



ROBOTICS

Technical reference manual

RAPID Instructions, Functions and Data types



Trace back information:
Workspace 25-3 version a26
Checked in 2025-11-11
Skribenta version 5.6.019

Technical reference manual
RAPID Instructions, Functions and Data types

RobotWare 7.20

Document ID: 3HAC065038-001

Revision: T

The information in this manual is subject to change without notice and should not be construed as a commitment by ABB. ABB assumes no responsibility for any errors that may appear in this manual.

Except as may be expressly stated anywhere in this manual, nothing herein shall be construed as any kind of guarantee or warranty by ABB for losses, damage to persons or property, fitness for a specific purpose or the like.

In no event shall ABB be liable for incidental or consequential damages arising from use of this manual and products described herein.

This manual and parts thereof must not be reproduced or copied without ABB's written permission.

Keep for future reference.

Additional copies of this manual may be obtained from ABB.

Original instructions.

Table of contents

Overview of this manual	17
1 Instructions	23
1.1 AccSet - Reduces the acceleration	23
1.2 ActEventBuffer - Activation of event buffer	26
1.3 ActUnit - Activates a mechanical unit	28
1.4 Add - Adds a numeric value	30
1.5 AliasCamera - Define camera device with alias name	32
1.6 AliasIO - Define I/O signal with alias name	34
1.7 AliasIOReset - Resetting I/O signal with alias name	37
1.8 ":= " - Assigns a value	39
1.9 BitClear - Clear a specified bit in a byte or dnum data	41
1.10 BitSet - Set a specified bit in a byte or dnum data	44
1.11 BookErrNo - Book a RAPID system error number	47
1.12 Break - Break a loop	49
1.13 DebugBreak - Break program execution	50
1.14 BytesReset - Set all elements in a byte array to zero (0)	51
1.15 CallByVar - Call a procedure by a variable	52
1.16 CamFlush - Removes the collection data for the camera	54
1.17 CamGetParameter - Get different named camera parameters	55
1.18 CamGetResult - Gets a camera target from the collection	57
1.19 CamLoadJob - Load a camera task into a camera	59
1.20 CamReqImage - Order the camera to acquire an image	61
1.21 CamSetExposure - Set camera specific data	63
1.22 CamSetParameter - Set different named camera parameters	65
1.23 CamSetProgramMode - Orders the camera to go to program mode	67
1.24 CamSetRunMode - Orders the camera to run mode	68
1.25 CamStartLoadJob - Start load of a camera task into a camera	69
1.26 CamStartSetParameter - Start the set-operation of a parameter setting	71
1.27 CamWaitLoadJob - Wait until a camera task is loaded	74
1.28 CamWaitSetParameter - Wait until a set-operation is ready	76
1.29 CancelLoad - Cancel loading of a module	78
1.30 CapAPTrSetupAI - Setup an At-Point-Tracker controlled by analog input signals	80
1.31 CapAPTrSetupAO - Setup an At-Point-Tracker controlled by analog output signals	83
1.32 CapAPTrSetupPERS - Setup an At-Point-Tracker controlled by persistent variables	86
1.33 CapC - Circular CAP movement instruction	89
1.34 CapEquiDist - Generate equidistant event	100
1.35 CapInitSupervision - Reset all supervision for CAP	102
1.36 CapL - Linear CAP movement instruction	103
1.37 CapNoProcess - Run CAP without process	113
1.38 CapRefresh - Refresh CAP data	115
1.39 CapRemoveSupervision - Remove condition for one signal	117
1.40 CapSetDOAtStop - Set a digital output signal at TCP stop	119
1.41 CapSetupSupervision - Setup conditions for signal supervision in CAP	121
1.42 CapWeaveSync - set up signals and levels for weave synchronization	124
1.43 CheckProgRef - Check program references	127
1.44 CirPathMode - Tool reorientation during circle path	129
1.45 Clear - Clears the value	135
1.46 ClearPath - Clear current path	136
1.47 ClearRawBytes - Clear the contents of rawbytes data	140
1.48 ClkReset - Resets a clock used for timing	142
1.49 ClkStart - Starts a clock used for timing	143
1.50 ClkStop - Stops a clock used for timing	145
1.51 Close - Closes a file or I/O device	146
1.52 CloseDir - Close a directory	147
1.53 Comment - Comment	148
1.54 Compact IF - If a condition is met, then... (one instruction)	149

1.55	ConfJ - Controls the configuration during joint movement	150
1.56	ConfL - Monitors the configuration during linear movement	152
1.57	CONNECT - Connects an interrupt to a trap routine	155
1.58	ContactL - Linear contact movement	157
1.59	Continue - Skip the rest of the loop	162
1.60	CopyFile - Copy a file	163
1.61	CopyRawBytes - Copy the contents of rawbytes data	165
1.62	CornerPathWarning - Show or hide corner path warnings	167
1.63	CorrClear - Removes all correction generators	169
1.64	CorrCon - Connects to a correction generator	170
1.65	CorrDiscon - Disconnects from a correction generator	175
1.66	CorrWrite - Writes to a correction generator	176
1.67	DeactEventBuffer - Deactivation of event buffer	178
1.68	DeactUnit - Deactivates a mechanical unit	180
1.69	Decr - Decrements by 1	182
1.70	DropWObj - Drop work object on conveyor	184
1.71	EOffsOff - Deactivates an offset for additional axes	185
1.72	EOffsOn - Activates an offset for additional axes	186
1.73	EOffsSet - Activates an offset for additional axes using known values	188
1.74	EraseModule - Erase a module	190
1.75	ErrLog - Write an error message	192
1.76	ErrRaise - Writes a warning and calls an error handler	196
1.77	ErrWrite - Write an error message	200
1.78	EXIT - Terminates program execution	203
1.79	ExitCycle - Break current cycle and start next	204
1.80	FitCircle - Fits a circle to 3D-points	206
1.81	FitLine - Fits a line to a set of points	210
1.82	FitPlane - Fits a plane to a set of points	212
1.83	FitSphere - Fit a sphere to a set of points	214
1.84	FOR - Repeats a given number of times	216
1.85	FricIdInit - Initiate friction identification	219
1.86	FricIdEvaluate - Evaluate friction identification	220
1.87	FricIdSetFricLevels - Set friction levels after friction identification	223
1.88	GetDataVal - Get the value of a data object	225
1.89	GetGroupSignalInfo - Read information about a digital group signal	228
1.90	GetJointData - Get joint specific data	230
1.91	GetSysData - Get system data	232
1.92	GetTrapData - Get interrupt data for current trap routine	235
1.93	GOTO - Goes to a new instruction	237
1.94	GripLoad - Defines the payload for a robot	239
1.95	HollowWristReset - Reset hollow wrist	241
1.96	ICap - connect CAP events to trap routines	243
1.97	ICapPathPos - Get center line robtarget when weaving	248
1.98	IDelete - Cancels an interrupt	250
1.99	IDisable - Disables interrupts	251
1.100	IEnable - Enables interrupts	252
1.101	IError - Orders an interrupt on errors	253
1.102	IF - If a condition is met, then ...; otherwise	256
1.103	Incr - Increments by 1	258
1.104	IndAMove - Independent absolute position movement	260
1.105	IndCMove - Independent continuous movement	264
1.106	IndDMove - Independent delta position movement	268
1.107	IndReset - Independent reset	271
1.108	IndRMove - Independent relative position movement	276
1.109	InvertDO - Inverts the value of a digital output signal	280
1.110	IOActivate - Activate an I/O device	282
1.111	IODeactivate - Deactivate an I/O device	285
1.112	IODeviceMute - Turn off I/O event messages from device	288
1.113	IPers - Interrupt at value change of a persistent variable	289

1.114	IRMQMessage - Orders RMQ interrupts for a data type	291
1.115	ISignalAI - Interrupts from analog input signal	295
1.116	ISignalAO - Interrupts from analog output signal	305
1.117	ISignalDI - Orders interrupts from a digital input signal	309
1.118	ISignalDO - Interrupts from a digital output signal	312
1.119	ISignalGI - Orders interrupts from a group of digital input signals	315
1.120	ISignalGO - Orders interrupts from a group of digital output signals	318
1.121	ISleep - Deactivates an interrupt	321
1.122	ITimer - Orders a timed interrupt	323
1.123	IVarValue - orders a variable value interrupt	326
1.124	IWatch - Activates an interrupt	329
1.125	Label - Line name	331
1.126	Load - Load a program module during execution	332
1.127	LoadId - Load identification of tool or payload	337
1.128	MakeDir - Create a new directory	343
1.129	ManLoadIdProc - Load identification of IRBP manipulators	344
1.130	MatrixAdd - Calculates the sum of two matrices	348
1.131	MatrixInverse - Inverse a matrix	351
1.132	MatrixMult - Multiply a matrix with a matrix, scalar, or vector	354
1.133	MatrixReset - Set all elements in a matrix to 0	360
1.134	MatrixSolve - Solve a linear equation system	362
1.135	MatrixSolveQR - Computes a QR-factorization	365
1.136	MatrixSub - Calculates the difference between two matrices	367
1.137	MatrixSVD - Computes a singular value decomposition	370
1.138	MatrixTranspose - Transpose a matrix	373
1.139	MechUnitLoad - Defines a payload for a mechanical unit	376
1.140	MotionProcessModeSet - Set motion process mode	381
1.141	MotionSup - Deactivates/Activates motion supervision	383
1.142	MoveAbsJ - Moves the robot to an absolute joint position	386
1.143	MoveAbsL - Moves the robot to an absolute joint position	393
1.144	MoveC - Moves the robot circularly	398
1.145	MoveCAO - Moves the robot circularly and sets analog output in the corner	407
1.146	MoveCDO - Moves the robot circularly and sets digital output in the corner	412
1.147	MoveCGO - Moves the robot circularly and set a group output signal in the corner	417
1.148	MoveCSync - Moves the robot circularly and executes a RAPID procedure	422
1.149	MoveExtJ - Move one or several mechanical units without TCP	427
1.150	MoveJ - Moves the robot by joint movement	431
1.151	MoveJAO - Moves the robot by joint movement and sets analog output in the corner	437
1.152	MoveJDO - Moves the robot by joint movement and sets digital output in the corner	442
1.153	MoveJGO - Moves the robot by joint movement and set a group output signal in the corner	447
1.154	MoveJSync - Moves the robot by joint movement and executes a RAPID procedure	452
1.155	MoveL - Moves the robot linearly	457
1.156	MoveLAO - Moves the robot linearly and sets analog output in the corner	464
1.157	MoveLDO - Moves the robot linearly and sets digital output in the corner	469
1.158	MoveLGO - Moves the robot linearly and sets group output signal in the corner	474
1.159	MoveLSync - Moves the robot linearly and executes a RAPID procedure	479
1.160	MovePnP - Moves the robot along a pick and place path	484
1.161	MToolRotCalib - Calibration of rotation for moving tool	494
1.162	MToolTCPCalib - Calibration of TCP for moving tool	497
1.163	Open - Opens a file or I/O device	500
1.164	OpenDir - Open a directory	504
1.165	PackDNHeader - Pack DeviceNet Header into rawbytes data	506
1.166	PackRawBytes - Pack data into rawbytes data	509
1.167	PathAccLim - Reduce TCP acceleration along the path	515
1.168	PathLengthReset - Resets the current path-length value of the counter	519
1.169	PathLengthStart - Activates the counter that monitors the path-length	521
1.170	PathLengthStop - Stops the counter that monitors the path-length	523
1.171	PathRecMoveBwd - Move path recorder backwards	525

1.172	PathRecMoveFwd - Move path recorder forward	531
1.173	PathRecStart - Start the path recorder	534
1.174	PathRecStop - Stop the path recorder	537
1.175	PathResol - Override path resolution	540
1.176	PDispOff - Deactivates program displacement	542
1.177	PDispOn - Activates program displacement	543
1.178	PDispSet - Activates program displacement using known frame	548
1.179	ProcCall - Calls a new procedure	550
1.180	ProcErrRecovery - Generate and recover from process-move error	552
1.181	PulseDO - Generates a pulse on a digital output signal	558
1.182	RAISE - Calls an error handler	561
1.183	RaiseToUser - Propagates an error to user level	564
1.184	ReadAnyBin - Read data from a binary I/O device or file	567
1.185	ReadCfgData - Reads attribute of a system parameter	569
1.186	ReadErrData - Gets information about an error	573
1.187	ReadRawBytes - Read rawbytes data	576
1.188	ReadVarArr - Read multiple variables from a sensor device	579
1.189	RemoveAllCyclicBool - Remove all Cyclic bool conditions	581
1.190	RemoveCyclicBool - Remove a Cyclic bool condition	583
1.191	RemoveDir - Delete a directory	585
1.192	RemoveFile - Delete a file	587
1.193	RenameFile - Rename a file	588
1.194	Reset - Resets a digital output signal	590
1.195	ResetAxisDistance - Reset the traversed distance information for the axis	592
1.196	ResetAxisMoveTime - Reset the move time counter of the axis	594
1.197	ResetData - Reset all elements to default values	596
1.198	ResetPPMoved - Reset state for the program pointer moved in manual mode	597
1.199	ResetRetryCount - Reset the number of retries	598
1.200	ResetTorqueMargin - Reset least torque margin	599
1.201	RestoPath - Restores the path after an interrupt	600
1.202	RETRY - Resume execution after an error	602
1.203	RETURN - Finishes execution of a routine	603
1.204	Rewind - Rewind file position	605
1.205	RMQEmptyQueue - Empty RAPID Message Queue	606
1.206	RMQFindSlot - Find a slot identity from the slot name	608
1.207	RMQGetMessage - Get an RMQ message	610
1.208	RMQGetMsgData - Get the data part from an RMQ message	613
1.209	RMQGetMsgHeader - Get header information from an RMQ message	616
1.210	RMQReadWait - Returns message from RMQ	619
1.211	RMQSendMessage - Send an RMQ data message	622
1.212	RMQSendWait - Send an RMQ data message and wait for a response	626
1.213	SafetyControllerSyncRequest - Initiation of hardware synchronization procedure	631
1.214	Save - Save a program module	632
1.215	SaveCfgData - Save system parameters to file	635
1.216	SearchC - Searches circularly using the robot	637
1.217	SearchExtJ - Search with one or several mechanical units without TCP	647
1.218	SearchL - Searches linearly using the robot	655
1.219	SenDevice - connect to a sensor device	666
1.220	Set - Sets a digital output signal	668
1.221	SetAllDataVal - Set a value to all data objects in a defined set	670
1.222	SetAO - Changes the value of an analog output signal	672
1.223	SetDataSearch - Define the symbol set in a search sequence	674
1.224	SetDataVal - Set the value of a data object	679
1.225	SetDO - Changes the value of a digital output signal	682
1.226	SetGO - Changes the value of a group of digital output signals	684
1.227	SetLeadThrough - Activate and deactivate lead-through	687
1.228	SetSysData - Set system data	690
1.229	SetupCyclicBool - Setup a Cyclic bool condition	692
1.230	SimCollision - Simulate a collision	695

1.231	SingArea - Defines interpolation around singular points	696
1.232	SkipWarn - Skip the latest warning	699
1.233	SocketAccept - Accept an incoming connection	700
1.234	SocketBind - Bind a socket to my IP-address and port	704
1.235	SocketClose - Close a socket	707
1.236	SocketConnect - Connect to a remote computer	709
1.237	SocketCreate - Create a new socket	712
1.238	SocketListen - Listen for incoming connections	715
1.239	SocketReceive - Receive data from remote computer	717
1.240	SocketReceiveFrom - Receive data from remote computer	723
1.241	SocketSend - Send data to remote computer	728
1.242	SocketSendTo - Send data to remote computer	733
1.243	SoftAct - Activating the soft servo	738
1.244	SoftDeact - Deactivating the soft servo	740
1.245	SoftElbow - Making the elbow flexible for external forces	741
1.246	SpeedLimAxis - Set speed limitation for an axis	743
1.247	SpeedLimCheckPoint - Set speed limitation for check points	747
1.248	SpeedRefresh - Update speed override for ongoing movement	752
1.249	SpyStart - Start recording of execution time data	755
1.250	SpyStop - Stop recording of time execution data	758
1.251	StartLoad - Load a program module during execution	759
1.252	StartMove - Restarts robot movement	763
1.253	StartMoveRetry - Restarts robot movement and execution	766
1.254	STCalib - Calibrate a Servo Tool	769
1.255	STClose - Close a Servo Tool	773
1.256	StepBwdPath - Move backwards one step on path	776
1.257	STIndGun - Sets the servo tool in independent mode	778
1.258	STIndGunReset - Resets the servo tool from independent mode	780
1.259	SToolRotCalib - Calibration of TCP and rotation for stationary tool	781
1.260	SToolTCPCalib - Calibration of TCP for stationary tool	784
1.261	Stop - Stops program execution	787
1.262	STOpen - Open a Servo Tool	790
1.263	StopMove - Stops robot movement	792
1.264	StopMoveReset - Reset the system stop move state	796
1.265	StorePath - Stores the path when an interrupt occurs	798
1.266	STTune - Tuning Servo Tool	800
1.267	STTuneReset - Resetting Servo tool tuning	804
1.268	SyncMoveOff - End coordinated synchronized movements	805
1.269	SyncMoveOn - Start coordinated synchronized movements	811
1.270	SyncMoveResume - Set synchronized coordinated movements	817
1.271	SyncMoveSuspend - Set independent-semicoordinated movements	819
1.272	SyncMoveUndo - Set independent movements	821
1.273	SystemStopAction - Stop the robot system	823
1.274	TEST - Depending on the value of an expression	825
1.275	TestSignDefine - Define test signal	827
1.276	TestSignReset - Reset all test signal definitions	829
1.277	TextTablInstall - Installing a text table	830
1.278	TPEraser - Erases text printed on the FlexPendant	832
1.279	TPReadDnum - Reads a number from the FlexPendant	833
1.280	TPReadFK - Reads function keys	837
1.281	TPReadNum - Reads a number from the FlexPendant	842
1.282	TPShow - Switch window on the FlexPendant	846
1.283	TPWrite - Writes on the FlexPendant	847
1.284	TriggAbsJ - Absolute joint robot movements with events	850
1.285	TriggC - Circular robot movement with events	858
1.286	TriggCheckIO - Defines I/O check at a fixed position	867
1.287	TriggDataCopy - Copy the content in a triggdata variable	873
1.288	TriggDataReset - Reset the content in a triggdata variable	875
1.289	TriggEquip - Define a fixed position and time I/O event on the path	877

1.290	TriggInt - Defines a position related interrupt	883
1.291	TriggIO - Define a fixed position or time I/O event near a stop point	888
1.292	TriggJ - Axis-wise robot movements with events	894
1.293	TriggL - Linear robot movements with events	902
1.294	TriggJIOs - Joint robot movements with I/O events	911
1.295	TriggLIOs - Linear robot movements with I/O events	919
1.296	TriggRampAO - Define a fixed position ramp AO event on the path	927
1.297	TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event	934
1.298	TriggStopProc - Generate restart data for trigg signals at stop	944
1.299	TryInt - Test if data object is a valid integer	950
1.300	TRYNEXT - Jumps over an instruction which has caused an error	952
1.301	TuneReset - Resetting servo tuning	953
1.302	TuneServo - Tuning servos	954
1.303	UIDisplay - user messages	961
1.304	UIMsgBox - User Message Dialog Box type basic	964
1.305	UIMsgWrite - User message dialog box type non-waiting	973
1.306	UIMsgWriteAbort - Abort user message dialog box type non-waiting	977
1.307	UnLoad - Unload a program module during execution	978
1.308	UnpackRawBytes - Unpack data from rawbytes data	981
1.309	VelSet - Changes the programmed velocity	987
1.310	WaitAI - Waits until an analog input signal value is set	989
1.311	WaitAO - Waits until an analog output signal value is set	996
1.312	WaitDI - Waits until a digital input signal is set	1003
1.313	WaitDO - Waits until a digital output signal is set	1009
1.314	WaitGI - Waits until a group of digital input signals are set	1015
1.315	WaitGO - Waits until a group of digital output signals are set	1023
1.316	WaitLoad - Connect the loaded module to the task	1031
1.317	WaitRob - Wait until stop point or zero speed	1035
1.318	WaitSyncTask - Wait at synchronization point for other program tasks	1037
1.319	WaitTestAndSet - Wait until variable becomes FALSE, then set	1041
1.320	WaitTime - Waits a given amount of time	1044
1.321	WaitUntil - Waits until a condition is met	1046
1.322	WaitWObj - Wait for work object on conveyor	1055
1.323	WarmStart - Restart the controller	1058
1.324	WHILE - Repeats as long as	1059
1.325	WorldAccLim - Control acceleration in world coordinate system	1061
1.326	WristOpt - Optimization of calibration for wrist axes	1063
1.327	Write - Writes to a character-based file or I/O device	1067
1.328	WriteAnyBin - Writes data to a binary file or I/O device	1070
1.329	WriteBin - Writes to a binary I/O device	1072
1.330	WriteCfgData - Writes attribute of a system parameter	1074
1.331	WriteRawBytes - Write rawbytes data	1078
1.332	WriteStrBin - Writes a string to a binary I/O device	1080
1.333	WriteVar - Write variable	1082
1.334	WriteVarArr - Write multiple variables to a sensor device	1084
1.335	WZBoxDef - Define a box-shaped world zone	1086
1.336	WZCylDef - Define a cylinder-shaped world zone	1088
1.337	WZDisable - Deactivate temporary world zone supervision	1091
1.338	WZDOSet - Activate world zone to set digital output	1093
1.339	WZEnable - Activate temporary world zone supervision	1098
1.340	WZFree - Erase temporary world zone supervision	1100
1.341	WZHomeJointDef - Define a world zone for home joints	1102
1.342	WZLimJointDef - Define a world zone for limitation in joints	1105
1.343	WZLimSup - Activate world zone limit supervision	1109
1.344	WZSphDef - Define a sphere-shaped world zone	1112
2	Functions	1115
2.1	Abs - Gets the absolute value	1115

2.2	AbsDnum - Gets the absolute value of a dnum	1117
2.3	ACos - Calculates the arc cosine value	1119
2.4	ACosDnum - Calculates the arc cosine value	1120
2.5	AINput - Reads the value of an analog input signal	1121
2.6	AND - Evaluates a logical value	1123
2.7	AOutput - Reads the value of an analog output signal	1125
2.8	ArgName - Gets argument name	1127
2.9	ASin - Calculates the arc sine value	1130
2.10	ASinDnum - Calculates the arc sine value	1131
2.11	ATan - Calculates the arc tangent value	1132
2.12	ATanDnum - Calculates the arc tangent value	1133
2.13	ATan2 - Calculates the arc tangent2 value	1134
2.14	ATan2Dnum - Calculates the arc tangent2 value	1135
2.15	BitAnd - Logical bitwise AND - operation on byte data	1136
2.16	BitAndDnum - Logical bitwise AND - operation on dnum data	1138
2.17	BitCheck - Check if a specified bit in a byte data is set	1140
2.18	BitCheckDnum - Check if a specified bit in a dnum data is set	1142
2.19	BitLSh - Logical bitwise LEFT SHIFT - operation on byte	1144
2.20	BitLShDnum - Logical bitwise LEFT SHIFT - operation on dnum	1146
2.21	BitNeg - Logical bitwise NEGATION - operation on byte data	1148
2.22	BitNegDnum - Logical bitwise NEGATION - operation on dnum data	1150
2.23	BitOr - Logical bitwise OR - operation on byte data	1152
2.24	BitOrDnum - Logical bitwise OR - operation on dnum data	1154
2.25	BitRSh - Logical bitwise RIGHT SHIFT - operation on byte	1156
2.26	BitRShDnum - Logical bitwise RIGHT SHIFT - operation on dnum	1158
2.27	BitXor - Logical bitwise XOR - operation on byte data	1160
2.28	BitXorDnum - Logical bitwise XOR - operation on dnum data	1162
2.29	ByteToStr - Converts a byte to a string data	1164
2.30	BytesToVal - Converts a byte array to a value	1166
2.31	CalcJointT - Calculates joint angles from robtarget	1169
2.32	CalcRobT - Calculates robtarget from jointtarget	1173
2.33	CalcRotAxFrmZ - Calculate a rotational axis frame	1175
2.34	CalcRotAxisFrame - Calculate a rotational axis frame	1180
2.35	CamGetExposure - Get camera specific data	1184
2.36	CamGetLoadedJob - Get name of the loaded camera task	1186
2.37	CamGetMode - Get current mode of camera	1188
2.38	CamGetName - Get the name of the used camera	1189
2.39	CamNumberOfResults - Get number of available results	1190
2.40	CDate - Reads the current date as a string	1192
2.41	CJointT - Reads the current joint angles	1193
2.42	ClkRead - Reads a clock used for timing	1195
2.43	Concat - Concatenates two strings to one	1197
2.44	CorrRead - Reads the current total offsets	1199
2.45	Cos - Calculates the cosine value	1200
2.46	CosDnum - Calculates the cosine value	1201
2.47	CPos - Reads the current position (pos) data	1202
2.48	CRobT - Reads the current position (robtarget) data	1204
2.49	CrossProd - Cross product of two pos vectors	1207
2.50	CSpeedOverride - Reads the current override speed	1210
2.51	CTime - Reads the current time as a string	1212
2.52	CTool - Reads the current tool data	1213
2.53	CWObj - Reads the current work object data	1215
2.54	DecToHex - Convert from decimal to hexadecimal	1217
2.55	DefAccFrame - Define an accurate frame	1218
2.56	DefDFrame - Define a displacement frame	1221
2.57	DefFrame - Define a frame	1224
2.58	Dim - Obtains the size of an array	1227
2.59	DInput - Reads the value of a digital input signal	1229
2.60	Distance - Distance between two points	1231

2.61	DIV - Evaluates an integer division	1233
2.62	DnumToNum - Converts dnum to num	1234
2.63	DnumToStr - Converts numeric value to string	1236
2.64	DotProd - Dot product of two pos vectors	1238
2.65	DOutput - Reads the value of a digital output signal	1240
2.66	EulerZYX - Gets euler angles from orient	1242
2.67	EventType - Get current event type inside any event routine	1244
2.68	ExecHandler - Get type of execution handler	1246
2.69	ExecLevel - Get execution level	1247
2.70	Exp - Calculates the exponential value	1248
2.71	FileSize - Retrieve the size of a file	1249
2.72	FileTimeDnum - Retrieve time information about a file	1252
2.73	FSSize - Retrieve the size of a file system	1255
2.74	GetAxisDistance - Get the traversed distance counter of the axis	1258
2.75	GetAxisMoveTime - Get the move time counter of the axis	1260
2.76	GetMaxNumberOfCyclicBool - Get the maximum number of Cyclic bool conditions	1262
2.77	GetMecUnitName - Get the name of the mechanical unit	1263
2.78	GetModalPayLoadMode - Get the ModalPayLoadMode value	1264
2.79	GetMotorTorque - Reads the current motor torque	1265
2.80	GetNextCyclicBool - Get the names of all Cyclic bools	1268
2.81	GetNextMechUnit - Get name and data for mechanical units	1270
2.82	GetNextOption - Get name of options installed	1273
2.83	GetNextProduct - Get name of products installed	1275
2.84	GetNextSym - Get next matching symbol	1277
2.85	GetNumberOfCyclicBool - Get the number of Cyclic bool conditions	1279
2.86	GetServiceInfo - Get service information from the system	1280
2.87	GetSignalOrigin - Get information about the origin of an I/O signal	1282
2.88	GetSysInfo - Get information about the system	1284
2.89	GetTaskName - Gets the name and number of current task	1287
2.90	GetTime - Reads the current time as a numeric value	1289
2.91	GetTorqueMargin - Reads the least torque margin	1291
2.92	GetTSPStatus - Get current task selection panel status	1293
2.93	GetUASUserName - Get user name of logged in user	1295
2.94	GInput - Read value of group input signal	1297
2.95	GInputDnum - Read value of group input signal	1299
2.96	GOutput - Reads the value of a group of digital output signals	1302
2.97	GOutputDnum - Read value of group output signal	1304
2.98	HexToDec - Convert from hexadecimal to decimal	1307
2.99	IndInpos - Independent axis in position status	1308
2.100	IndSpeed - Independent speed status	1310
2.101	IODeviceState - Get current state of I/O device	1312
2.102	IONetworkState - Get current state of I/O network	1315
2.103	IsBrakeCheckActive - Test if brake check is running	1318
2.104	IsCollFree - Checks if position would collide	1319
2.105	IsCyclicBool - Checks if a persistent variable is a Cyclic bool	1321
2.106	IsFile - Check the type of a file	1324
2.107	IsLeadThrough - Check lead-through status	1328
2.108	IsMechUnitActive - Is mechanical unit active	1330
2.109	IsPers - Is persistent	1331
2.110	IsStopMoveAct - Is stop move flags active	1333
2.111	IsStopStateEvent - Test whether moved program pointer	1335
2.112	IsSyncMoveOn - Test if in synchronized movement mode	1337
2.113	IsSysId - Test system identity	1339
2.114	IsVar - Is variable	1340
2.115	Max - Get the largest of two values	1342
2.116	MaxExtLinearSpeed - Maximum additional axis speed	1343
2.117	MaxExtReorientSpeed - Maximum additional axis rotational speed	1344
2.118	MaxRobReorientSpeed - Maximum reorient speed of robot	1345
2.119	MaxRobSpeed - Maximum robot speed	1346

2.120	Min - Get the smallest of two values	1347
2.121	MirPos - Mirroring of a position	1348
2.122	MOD - Evaluates an integer modulo	1350
2.123	ModExist - Check if program module exist	1351
2.124	ModTimeDnum - Get file modify time for the loaded module	1352
2.125	MotionPlannerNo - Get connected motion planner number	1354
2.126	NonMotionMode - Read the Non-Motion execution mode	1356
2.127	NOT - Inverts a logical value	1358
2.128	NOrient - Normalize orientation	1359
2.129	NumToDnum - Converts num to dnum	1361
2.130	NumToStr - Converts numeric value to string	1362
2.131	Offs - Displaces a robot position	1364
2.132	OpMode - Read the operating mode	1366
2.133	OR - Evaluates a logical value	1367
2.134	OrientZYX - Builds an orient from Euler angles	1368
2.135	ORobT - Removes the program displacement from a position	1370
2.136	ParldPosValid - Valid robot position for parameter identification	1372
2.137	ParldRobValid - Valid robot type for parameter identification	1375
2.138	PathLengthGet - Reads the current path-length value of the counter	1378
2.139	PathLevel - Get current path level	1380
2.140	PathRecValidBwd - Is there a valid backward path recorded	1382
2.141	PathRecValidFwd - Is there a valid forward path recorded	1385
2.142	PFRestart - Check interrupted path after power failure	1389
2.143	PosInv - Inverts pose data	1390
2.144	PoseMult - Multiplies pose data	1392
2.145	PoseVect - Applies a transformation to a vector	1394
2.146	Pow - Calculates the power of a value	1396
2.147	PowDnum - Calculates the power of a value	1397
2.148	PPMovedInManMode - Test whether the program pointer is moved in manual mode	1398
2.149	Present - Tests if an optional parameter is used	1399
2.150	ProgMemFree - Get the size of free program memory	1401
2.151	Rand - Generate a random number	1402
2.152	RawBytesLen - Get the length of rawbytes data	1404
2.153	ReadBin - Reads a byte from a file or I/O device	1406
2.154	ReadDir - Read next entry in a directory	1408
2.155	ReadDnum - Reads a number from a file or I/O device	1411
2.156	ReadMotor - Reads the current motor angles	1414
2.157	ReadNum - Reads a number from a file or I/O device	1416
2.158	ReadStr - Reads a string from a file or I/O device	1419
2.159	ReadStrBin - Reads a string from a binary I/O device or file	1424
2.160	ReadVar - Read variable from a device	1426
2.161	RelTool - Make a displacement relative to the tool	1428
2.162	RemainingRetries - Remaining retries left to do	1430
2.163	RMQGetSlotName - Get the name of an RMQ client	1431
2.164	RobName - Get the TCP robot name	1433
2.165	RobOS - Check if execution is on RC or VC	1435
2.166	Round - Round a numeric value	1436
2.167	RoundDnum - Round a numeric value	1438
2.168	RunMode - Read the running mode	1440
2.169	SafetyControllerGetChecksum - Get the checksum for the user configuration file	1442
2.170	SafetyControllerGetGroupChecksum - Get the protected group checksum	1443
2.171	SafetyControllerGetNextGroupName - Get the name of the next protected group	1444
2.172	SafetyControllerGetOpModePinCode - Get the operating mode pin code	1446
2.173	SafetyControllerGetSWVersion - Get the safety controller firmware version	1447
2.174	SafetyControllerGetUserChecksum - Get the checksum for protected parameters	1448
2.175	Sin - Calculates the sine value	1449
2.176	SinDnum - Calculates the sine value	1450
2.177	SocketGetStatus - Get current socket state	1451
2.178	SocketPeek - Test for the presence of data on a socket	1454

2.179	Sqrt - Calculates the square root value	1457
2.180	SqrtDnum - Calculates the square root value	1458
2.181	STCalcForce - Calculate the tip force for a Servo Tool	1459
2.182	STCalcTorque - Calculate the motor torque for a servo tool	1461
2.183	STIsCalib - Tests if a servo tool is calibrated	1463
2.184	STIsClosed - Tests if a servo tool is closed	1465
2.185	STIsIndGun - Tests if a servo tool is in independent mode	1467
2.186	STIsOpen - Tests if a servo tool is open	1468
2.187	StrFind - Searches for a character in a string	1470
2.188	StrFormat - Format a string	1472
2.189	StrLen - Gets the string length	1475
2.190	StrMap - Maps a string	1476
2.191	StrMatch - Search for pattern in string	1478
2.192	StrMemb - Checks if a character belongs to a set	1480
2.193	StrOrder - Checks if strings are ordered	1482
2.194	StrPart - Finds a part of a string	1484
2.195	StrSize - Gets the string size	1486
2.196	StrToByte - Converts a string to a byte data	1487
2.197	StrToVal - Converts a string to a value	1489
2.198	Tan - Calculates the tangent value	1491
2.199	TanDnum - Calculates the tangent value	1492
2.200	TaskRunMec - Check if task controls any mechanical unit	1493
2.201	TaskRunRob - Check if task controls some robot	1494
2.202	TasksInSync - Returns the number of synchronized tasks	1495
2.203	TasksActive - Check if a normal task is active	1497
2.204	TasksExecuting - Check if task is executing	1499
2.205	TestAndSet - Test variable and set if unset	1501
2.206	TestDI - Tests if a digital input is set	1504
2.207	TestSignRead - Read test signal value	1506
2.208	TextGet - Get text from system text tables	1508
2.209	TextTabFreeToUse - Test whether text table is free	1512
2.210	TextTabGet - Get text table number	1514
2.211	TriggDataValid - Check if the content in a triggdata variable is valid	1516
2.212	Trunc - Truncates a numeric value	1518
2.213	TruncDnum - Truncates a numeric value	1520
2.214	Type - Get the data type name for a variable	1522
2.215	UIAlphaEntry - User Alpha Entry	1524
2.216	UIClientExist - Exist User Client	1531
2.217	UIDnumEntry - User Number Entry	1532
2.218	UIDnumTune - User Number Tune	1540
2.219	UIListView - User List View	1547
2.220	UIMessageBox - User Message Box type advanced	1556
2.221	UINumEntry - User Number Entry	1565
2.222	UINumTune - User Number Tune	1573
2.223	ValidIO - Valid I/O signal to access	1580
2.224	ValToBytes - Converts a value to a byte array	1582
2.225	ValToStr - Converts a value to a string	1584
2.226	VectMagn - Magnitude of a pos vector	1586
2.227	XOR - Evaluates a logical value	1588
3	Data types	1589
3.1	aiotrigg - Analog I/O trigger condition	1589
3.2	ALIAS - Assigning an alias data type	1591
3.3	bool - Logical values	1592
3.4	btnres - Push button result data	1593
3.5	buttondata - Push button data	1595
3.6	byte - Integer values 0-255	1597
3.7	cameradev - camera device	1598
3.8	camerastatus - Camera communication status	1599

3.9	cameratarget - camera data	1601
3.10	capaptrreferencedata - Variable setup data for At-Point-Tracker	1603
3.11	capdata - CAP data	1605
3.12	capspeeddata - Speed data for CAP	1608
3.13	capweavedata - Weavedata for CAP	1609
3.14	cfgdomain - Configuration domain	1615
3.15	clock - Time measurement	1616
3.16	confdata - Robot configuration data	1617
3.17	corrdescr - Correction generator descriptor	1625
3.18	datapos - Enclosing block for a data object	1627
3.19	dionum - Digital values (0-1)	1628
3.20	dir - File directory structure	1629
3.21	dnum - Double numeric values	1630
3.22	errdomain - Error domain	1632
3.23	errnum - Error number	1634
3.24	errstr - Error string	1642
3.25	errtype - Error type	1643
3.26	event_type - Event routine type	1644
3.27	exec_level - Execution level	1645
3.28	extjoint - Position of external joints	1646
3.29	flypointdata - Data for flying start/end	1648
3.30	handler_type - Type of execution handler	1651
3.31	icondata - Icon display data	1652
3.32	identno - Identity for move instructions	1654
3.33	intnum - Interrupt identity	1656
3.34	iodev - I/O device	1658
3.35	iodevice_state - State of I/O device	1659
3.36	ionetwork_state - State of I/O network	1660
3.37	jointtarget - Joint position data	1661
3.38	listitem - List item data structure	1663
3.39	loaddata - Load data	1664
3.40	loadidnum - Type of load identification	1670
3.41	loadsession - Program load session	1671
3.42	mecunit - Mechanical unit	1672
3.43	motsetdata - Motion settings data	1674
3.44	num - Numeric values	1680
3.45	opnum - Comparison operator	1682
3.46	orient - Orientation	1683
3.47	paridnum - Type of parameter identification	1688
3.48	paridvalidnum - Result of ParIdRobValid	1690
3.49	pathrecid - Path recorder identifier	1692
3.50	pnpdata - Configure pick and place paths	1694
3.51	pos - Positions (only X, Y and Z)	1696
3.52	pose - Coordinate transformations	1698
3.53	processtimes - process times	1699
3.54	progdisp - Program displacement	1700
3.55	rawbytes - Raw data	1702
3.56	restartblkdata - blockdata for restart	1704
3.57	restartdata - Restart data for trigg signals	1706
3.58	rmqheader - RAPID Message Queue Message header	1710
3.59	rmqmessage - RAPID Message Queue message	1712
3.60	rmqslot - Identity number of an RMQ client	1713
3.61	robjoint - Joint position of robot axes	1714
3.62	robtarg - Position data	1715
3.63	sensorvardata - Multiple variable setup data for sensor interface	1719
3.64	shapedata - World zone shape data	1721
3.65	signalorigin - Describes the I/O signal origin	1723
3.66	signalxx - Digital and analog signals	1725
3.67	socketdev - Socket device	1727

Table of contents

3.68	socketstatus - Socket communication status	1728
3.69	speeddata - Speed data	1729
3.70	stoppointdata - Stop point data	1733
3.71	string - Strings	1739
3.72	supervtimeouts - Handshake supervision time outs	1741
3.73	switch - Optional parameters	1743
3.74	symnum - Symbolic number	1744
3.75	syncident - Identity for synchronization point	1745
3.76	System data - Current RAPID system data settings	1746
3.77	taskid - Task identification	1748
3.78	tasks - RAPID program tasks	1749
3.79	testsignal - Test signal	1751
3.80	tooldata - Tool data	1753
3.81	tpnum - FlexPendant window number	1759
3.82	trapdata - Interrupt data for current trap routine	1760
3.83	triggdata - Positioning events, trigg	1761
3.84	triggios - Positioning events, trigg	1762
3.85	triggiosdnum - Positioning events, trigg	1764
3.86	triggmode - Trigg action mode	1766
3.87	tsp_status - Task selection panel status	1769
3.88	tunetype - Servo tune type	1771
3.89	uidisplaynum - Instance ID for UIDisplay	1772
3.90	weavestartdata - weave start data	1773
3.91	wobjdata - Work object data	1775
3.92	wzstationary - Stationary world zone data	1779
3.93	wztemporary - Temporary world zone data	1781
3.94	zonedata - Zone data	1783
4	Programming type examples	1789
4.1	ERROR handler with movements	1789
4.2	Service routines with or without movements	1792
4.3	System I/O interrupts with or without movements	1795
4.4	Trap routines with movements	1798
Index		1801

Overview of this manual

About this manual

This is a technical reference manual intended for the RAPID programmer. The RAPID base instructions, functions and data types are detailed in this manual. This manual describes RobotWare 7.

Usage

This manual should be read during programming and when you need specific information about a RAPID instruction, function or data type.

Who should read this manual?

This manual is intended for someone with some previous experience in programming, for example, a robot programmer.

Prerequisites

The reader should have some programming experience and have studied

- *Technical reference manual - RAPID Overview*

Organization of chapters

The manual is organized in the following chapters:

Chapter	Contents
Instructions	Detailed descriptions of all RAPID base instructions, including examples of how to use them.
Functions	Detailed descriptions of all RAPID base functions, including examples of how to use them.
Data types	Detailed descriptions of all RAPID base data types, including examples of how to use them.
Programming type examples	A general view of how to write program code that contains different instructions/functions/data types. The chapter contains also programming tips and explanations.

References

Reference	Document ID
<i>Technical reference manual - RAPID Overview</i>	3HAC065040-001
<i>Technical reference manual - RAPID kernel</i>	3HAC065039-001
<i>Application manual - Controller software OmniCore</i>	3HAC066554-001

Revisions

Revision	Description
A	Released with RobotWare 7.0.

Continues on next page

Revision	Description
B	Released with RobotWare 7.1. - Added instructions: IsCollFree - Checks if position would collide on page 1319 SimCollision - Simulate a collision on page 695 StrFormat - Format a string on page 1472 - Added functions: CamGetMode - Get current mode of camera on page 1188 StrSize - Gets the string size on page 1486 - Added data types: camerastatus - Camera communication status on page 1599 - The instruction Break has changed name to DebugBreak. - Updated information for instructions SetAllDataVal and SetDataSearch. - Updated information for function TextGet. - New images for functions UIAlphaEntry, UIDnumEntry, UIDnumTune, UIListView, UIMessageBox, UINumEntry, UINumTune. - Image updated in UIMsgBox - User Message Dialog Box type basic on page 964. - New error recovery added for errnum ERR_CAM_NOT_ON_NETWORK. - Removed support for the the switch \Sync from the instruction SetDO - Changes the value of a digital output signal on page 682. - Removed support for .eng files in the function TextTabGet - Get text table number on page 1514. Use .xml format instead. - Added new arguments (Arg3 to Arg6) for StrFormat and TextGet. - Changed data type of the return value for the function ProgMemFree from num to dnum.
C	Released with RobotWare 7.2. - Added instructions: CamStartSetParameter - Start the set-operation of a parameter setting on page 71 CamWaitSetParameter - Wait until a set-operation is ready on page 76 - Added functions: Rand - Generate a random number on page 1402 Concat - Concatenates two strings to one on page 1197 - Added limitation for the instruction StartLoad, see StartLoad - Load a program module during execution on page 759. - Updates made in PackRawBytes - Pack data into rawbytes data on page 509 and UnpackRawBytes - Unpack data from rawbytes data on page 981. - Updated information about using the instruction Stop in event routines, see Stop - Stops program execution on page 787. - Updates made in strings regarding Unicode. - Updates made in signalxx - Digital and analog signals on page 1725. - Updates made in FSSize - Retrieve the size of a file system on page 1255.
D	Released with RobotWare 7.3. - New example in section WaitUntil - Waits until a condition is met on page 1046. - New images added for Wait instructions.

Continues on next page

Revision	Description
E	Released with RobotWare 7.4. - Added the argument ErrorNumber to the instructions WaitAI, WaitAO, WaitDI, WaitDO, WaitGI, and WaitGO. - Added prerequisites for GetAxisDistance - Get the traversed distance counter of the axis on page 1258.
F	Released with RobotWare 7.6. - Added the Resume switch on the instruction RaiseToUser - Propagates an error to user level on page 564. - Added the ISOLatin1Encoding switch on the instructions Open - Opens a file or I/O device on page 500 and SocketCreate - Create a new socket on page 712. - Updated descriptions for functions StrFind - Searches for a character in a string on page 1470, StrMatch - Search for pattern in string on page 1478, and StrMemb - Checks if a character belongs to a set on page 1480.
G	Released with RobotWare 7.7. Added the argument Compact to the functions DnumToStr and NumToStr.
H	Released with RobotWare 7.8. - Added the argument MSec to the function GetTime. - Added the optional argument ErrorNumber to WaitUntil. - Added the optional arguments TimeOutSignal, TimeOutGOSignal, and TimeOutGOValue to WaitUntil, WaitDI, WaitDO, WaitGI, WaitGO, WaitAI, and WaitAO. - Added the error ERR_GO_LIM to WaitUntil, WaitDI, WaitDO, WaitAI, and WaitAO. - Added the errors ERR_UI_NOACTION, ERR_UI_BUTTONS, and ERR_UI_ICON in errnum and the related instructions and functions. - Minor corrections.
J	Released with RobotWare 7.10. - The predefined speed data for orientation is changed from 500°/s to 1000°/s, see speeddata - Speed data on page 1729. - Added information about cfx for inverted SCARA robots, see confdata - Robot configuration data on page 1617. - Added instruction MovePnP and data type pnpdata. - New CAP instructions and data types added. - The following instructions are added: FitLine - Fits a line to a set of points on page 210 FitPlane - Fits a plane to a set of points on page 212 FitSphere - Fit a sphere to a set of points on page 214 - The following functions are added: SafetyControllerGetGroupChecksum - Get the protected group checksum on page 1443 - The instruction UIShow and the data type uishownum are removed from the manual as they do not work in RobotWare 7. - Updated information about the argument Signal for the instruction SetupCyclicBool - Setup a Cyclic bool condition on page 692.
K	Released with RobotWare 7.12. - The following instructions are added: Break - Break a loop on page 49 Continue - Skip the rest of the loop on page 162 TriggAbsJ - Absolute joint robot movements with events on page 850

Continues on next page

Revision	Description
	- UIDisplay - user messages on page 961 • The following functions are added: - GetNextOption - Get name of options installed on page 1273 - GetNextProduct - Get name of products installed on page 1275 - SafetyControllerGetNextGroupName - Get the name of the next protected group on page 1444 • The following data types are added: - uidisplaynum - Instance ID for UIDisplay on page 1772 • Updated limitations on string length from characters to bytes in various sections. • Corrected information about maximum length of messages on the FlexPendant in various sections. • Updated image size for UIMsgBox - User Message Dialog Box type basic on page 964 and UIMessageBox - User Message Box type advanced on page 1556. • Removed the error ERR_UI_NOACTION. • Added the error ERR_CAM_NOT_VALID_LOAD_JOB. • Removed the Continue switch on the instruction RaiseToUser - Propagates an error to user level on page 564. Use the switch Resume. • Updated TestSignDefine - Define test signal on page 827, Test-SignRead - Read test signal value on page 1506, and testsignal - Test signal on page 1751 with new names of symbolic constants. The signals dig_input1 and dig_input2 are removed. • Updated description for the data type stoppointdata - Stop point data on page 1733. • Minor corrections.
L	Released with RobotWare 7.13. • Added instructions: - IODeviceMute - Turn off I/O event messages from device on page 288 - MatrixAdd - Calculates the sum of two matrices on page 348 - MatrixInverse - Inverse a matrix on page 351 - MatrixMult - Multiply a matrix with a matrix, scalar, or vector on page 354 - MatrixReset - Set all elements in a matrix to 0 on page 360 - MatrixSub - Calculates the difference between two matrices on page 367 - MatrixTranspose - Transpose a matrix on page 373 - WristOpt - Optimization of calibration for wrist axes on page 1063 • Added optional argument Remaining on the functions StrFormat and TextGet. • Added the error handler ERR_SOCKET_EXEC_LEVEL, for SocketAccept, SocketBind, SocketConnect, SocketPeek, SocketReceive, SocketReceiveFrom. • Corrections done in example and arguments for the instruction CapAPTrSetupPERS - Setup an At-Point-Tracker controlled by persistent variables on page 86.
M	Released with RobotWare 7.14. • Added optional argument Deactivate on the instruction CapRemoveSupervision.
N	Released with RobotWare 7.15. • Updated the description of MatrixMult - Multiply a matrix with a matrix, scalar, or vector on page 354, and added the arguments Vector and ResultVector.

Continues on next page

Revision	Description
	- Added error handling for FitX instructions. - Added the new switch \FollowConveyor to the instructions MoveL and TriggL. - Removed all objects for and references to <i>Machine Synchronization</i>.
P	Released with RobotWare 7.16. - Added the new argument \SmartTruncate to StrFormat and TextGet. - Added the new argument \Status to ReadStr. - The following instructions are added: MoveAbsL - Moves the robot to an absolute joint position on page 393
Q	Released with RobotWare 7.17. - Updated the repetition accuracy for SearchC and SearchL. - Updated the limitation in Open and iodev. - Added information about <i>ReportNonActiveSingles</i> in jointtarget and robtarget. - Minor corrections.
R	Released with RobotWare 7.18. - The following instructions are added: BytesReset - Set all elements in a byte array to zero (0) on page 51 - The following functions are added: BytesToVal - Converts a byte array to a value on page 1166 ValToBytes - Converts a value to a byte array on page 1582 - Added support for Vietnamese in RobotWare UI, see GetSysInfo - Get information about the system on page 1284. - Minor improvements.
S	Released with RobotWare 7.19. - Added the function ReadDnum - Reads a number from a file or I/O device on page 1411. - Added the new optional argument Image to the functions UIAlphaEntry, UIDnumEntry, UIDnumTune, UINumEntry and UINumTune. - The allowed size is updated for <i>Rapid Message Queue</i> messages.
T	Released with RobotWare 7.20. - Added the instruction ResetData - Reset all elements to default values on page 596. - Updated UI instructions and functions regarding directory location of images. - Added a clarification for GoFa and PoWa robots in confdata - Robot configuration data on page 1617. - Updated the information regarding the maximum size of RAPID sockets. - Updated BytesToVal and ValToBytes due to changes in <i>MathLib-MemSize</i>. - Minor corrections. - Company name updated to reflect current legal entities.

This page is intentionally left blank

1 Instructions

1.1 AccSet - Reduces the acceleration

Usage

AccSet is used when handling fragile loads or in order to decrease vibrations and path errors. It allows slower acceleration and deceleration, which results in smoother robot movements.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Basic examples

The following examples illustrate the instruction AccSet:

Example 1

```
AccSet 50, 100;
```

The acceleration is limited to 50% of the normal value.

Example 2

```
AccSet 100, 50;
```

The acceleration ramp is limited to 50% of the normal value, which means that the time to reach the acceleration is increased by a factor of 2.

Example 3

```
AccSet 100, 100 \FinePointRamp:=50;
```

The deceleration ramp when decelerating towards a finepoint is limited to 50% of the normal value.

Arguments

```
AccSet Acc Ramp [\FinePointRamp]
```

ACC

Data type: num

Acceleration and deceleration as a percentage of the normal values. 100% corresponds to maximum acceleration. Input value < 20% gives 20% of maximum acceleration.

Ramp

Data type: num

The rate at which acceleration and deceleration increases as a percentage of the normal values. Jerking can be restricted by reducing this value. 100% corresponds to maximum rate. Input value < 10% gives 10% of maximum rate.

The figures show that reducing the acceleration results in smoother movements.

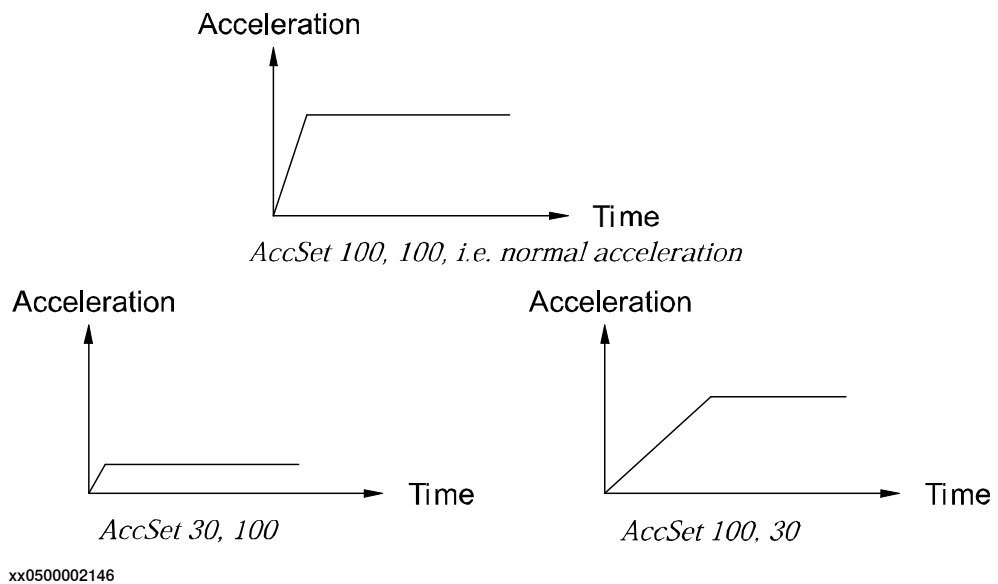
Continues on next page

1 Instructions

1.1 AccSet - Reduces the acceleration

RobotWare Base

Continued



[\FinePointRamp]

Data type: num

The rate at which deceleration decreases as a percentage of the normal values. The parameter only affects the ramp when the robot decelerates towards a finepoint. In a finepoint the deceleration ramp value is a combination of this parameter and the Ramp value, $\text{Ramp} * \text{FinePointRamp}$. The parameter must be greater than 0 and be in the interval 0 to 100%.

If this optional argument is not used, the FinePointRamp value is set to the default value, 100%.

Program execution

The acceleration applies for the next executed movement instruction, for both the robot and external axes, until a new AccSet instruction is executed.

The default values (AccSet 100, 100) are automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Syntax

```
AccSet
[ Acc ':=' ] < expression (IN) of num > ', '
[ Ramp ':=' ] < expression (IN) of num >
[ '\FinePointRamp ':=' < expression (IN) of num > ] ';' ;
```

Continues on next page

Related information

For information about	See
Motion settings data	motsetdata - Motion settings data on page 1674
Reduce TCP acceleration along the path	PathAccLim - Reduce TCP acceleration along the path on page 515
Definition of maximum velocity	VelSet - Changes the programmed velocity on page 987
Control acceleration in world coordinate system	WorldAccLim - Control acceleration in world coordinate system on page 1061
Positioning instructions	<i>Technical reference manual - RAPID Overview</i>

1 Instructions

1.2 ActEventBuffer - Activation of event buffer

RobotWare Base

1.2 ActEventBuffer - Activation of event buffer

Description

ActEventBuffer is used to activate the use of the event buffer in current motion program task.

The instructions ActEventBuffer and DeactEventBuffer should be used when combining an application using finepoints and a continuous application where signals needs to be set in advance due to slow process equipment.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Basic examples

The following example illustrates the instruction ActEventBuffer:

Example 1

```
...
DeactEventBuffer;
! Use an application that uses finepoints, such as SpotWelding
...
! Activate the event buffer again
ActEventBuffer;
! Now it is possible to use an application that needs
! to set signals in advance, such as Dispense
...
```

The DeactEventBuffer deactivates the configured event buffer. When using an application with finepoints, the start of the robot from the finepoint will be faster. When activating the event buffer with ActEventBuffer, it is possible to set signals in advance for an application with slow process equipment.

Program execution

The use of an event buffer applies for the next executed robot movement instruction of any type and is valid until a DeactEventBuffer instruction is executed.

The instruction will wait until the robot and external axes has reached the stop point (ToPoint of current move instruction) before the activation of the event buffer. Therefore it is recommended to program the movement instruction preceding ActEventBuffer with a fine point.

The default value (ActEventBuffer) is automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Continues on next page

Limitations

ActEventBuffer cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart or Step.

Syntax

ActEventBuffer ';' ;

Related information

For information about	See
Deactivation of event buffer	DeactEventBuffer - Deactivation of event buffer on page 178
Configuration of Event preset time	<i>Technical reference manual - System parameters</i>
Motion settings data	motsetdata - Motion settings data on page 1674

1 Instructions

1.3 ActUnit - Activates a mechanical unit

RobotWare Base

1.3 ActUnit - Activates a mechanical unit

Usage

ActUnit is used to activate a mechanical unit.

It can be used to determine which unit is to be active when, for example, common drive units are used.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Basic examples

The following example illustrates the instruction ActUnit:

Example 1

```
ActUnit orbit_a;
```

Activation of the orbit_a mechanical unit.

Arguments

ActUnit MechUnit

MechUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit to be activated.

Program execution

When the robot and the actual path of external axes are ready, the path on current path level is cleared and the specified mechanical unit is activated. This means that it is controlled and monitored by the robot.

If several mechanical units share a common drive unit, activation of one of these mechanical units will also connect that unit to the common drive unit.

Limitations

If this instruction is preceded by a move instruction, that move instruction must be programmed with a stop point (zonedata fine), not a fly-by point, otherwise restart after power failure will not be possible.

ActUnit cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

It is possible to use ActUnit - DeactUnit on StorePath level, but the same mechanical units must be active when doing RestoPath as when StorePath was done. Such operation on the Path Recorder and the path on the base level will be intact, but the path on the StorePath level will be cleared.

Syntax

```
ActUnit  
[ MechUnit ':' ] < variable (VAR) of mecunit> ';' ;
```

Continues on next page

Related information

For information about	See
Deactivating mechanical units	<i>DeactUnit - Deactivates a mechanical unit on page 180</i>
Mechanical units	<i>mecunit - Mechanical unit on page 1672</i>
More examples	<i>DeactUnit - Deactivates a mechanical unit on page 180</i>
Check if a mechanical unit is activated or not.	<i>IsMechUnitActive - Is mechanical unit active on page 1330</i>
Path Recorder	<i>PathRecMoveBwd - Move path recorder backwards on page 525</i>

1 Instructions

1.4 Add - Adds a numeric value

RobotWare Base

1.4 Add - Adds a numeric value

Usage

Add is used to add or subtract a value to or from a numeric variable or persistent.

Basic examples

The following examples illustrate the instruction Add:

Example 1

```
Add reg1, 3;
```

3 is added to reg1, that is, $\text{reg1} := \text{reg1} + 3$.

Example 2

```
Add reg1, -reg2;
```

The value of reg2 is subtracted from reg1, that is, $\text{reg1} := \text{reg1} - \text{reg2}$.

Example 3

```
VAR dnum mydnum:=5;  
Add mydnum, 500000000;
```

500000000 is added to mydnum, that is, $\text{mydnum} := \text{mydnum} + 500000000$.

Example 4

```
VAR dnum mydnum:=5000;  
VAR num mynum:=6000;  
Add mynum, DnumToNum(mydnum \Integer);
```

5000 is added to mynum, that is, $\text{mynum} := \text{mynum} + 5000$. You have to use DnumToNum to get a num numeric value that you can use together with the num variable mynum.

Arguments

Add Name | Dname AddValue | AddDvalue

Name

Data type: num

The name of the variable or persistent to be changed.

Dname

Data type: dnum

The name of the variable or persistent to be changed.

AddValue

Data type: num

The value to be added.

AddDvalue

Data type: dnum

The value to be added.

Continues on next page

Limitations

If the value to be added is of the type dnum, and the variable/persistent that should be changed is a num, a runtime error will be generated. The combination of arguments is not possible (see Example 4 above how to solve this).

Syntax

Add

```
[ Name ':=' ] < variable or persistent (INOUT) of num >
| [ Dname ':=' ] < variable or persistent (INOUT) of dnum > ', '
[ AddValue ':=' ] < expression (IN) of num >
| [ AddDvalue ':=' ] < expression (IN) of dnum > ';' ;
```

Related information

For information about	See
Incrementing a variable by 1	Incr - Increments by 1 on page 258
Decrementing a variable by 1	Decr - Decrements by 1 on page 182
Changing data using an arbitrary expression, for example, multiplication	":=" - Assigns a value on page 39

1 Instructions

1.5 AliasCamera - Define camera device with alias name

Integrated Vision

1.5 AliasCamera - Define camera device with alias name

Usage

AliasCamera is used to define a camera with an alias name or to use cameras in built-in task modules. Cameras with alias names can be used for predefined generic programs. The instruction AliasCamera must be run before any use of the actual camera.

Basic examples

The following examples illustrate the instruction AliasCamera.

Example 1

```
VAR cameradev mycamera;
...
PROC prog_start()
  AliasCamera "CAMERA1", mycamera;
  ...
  CamReqImage mycamera;
```

The routine prog_start is executed in the beginning of the RAPID program. Instruction AliasCamera searches for the predefined RAPID camera device variable named CAMERA1, and the content of it is copied to mycamera. From now, it is possible to access the camera with mycamera camera device.

Example 2

```
VAR cameradev mycamera;
PROC proc1()
  IF GetTaskName() = "T_ROB_L" THEN
    AliasCamera CAMERA_L, mycamera;
  ELSE
    AliasCamera CAMERA_R, mycamera;
  ENDIF
  ...
  CamReqImage mycamera;
```

The routine proc1 is connected to the START event in the system parameters. The program defining the camera device mycamera is connected to the configured camera CAMERA_L or CAMERA_R at program start.

Arguments

AliasCamera CameraName | FromCamera ToCamera

CameraName

Data type: string

The camera identifier according to the system parameter Communication configuration. The instruction AliasCamera searches for the predefined RAPID camera device variable (installed data) with the name used in CameraName, and copies the content of it.

FromCamera

Data type: cameradev

Continues on next page

The camera identifier in the system parameter Communication configuration from which the camera device is copied. The camera must be defined in the system parameters.

ToCamera

Data type: cameradev

The camera identifier according to the program to which the camera device is copied. The cameradev must be declared in the RAPID program.

Program execution

The camera device content is copied from the camera given in argument CameraName or FromCamera to the camera device given in argument ToCamera.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_ALIASCAM_DEF	The camera in argument CameraName or the cameradev used in argument FromCamera is not defined in the system parameter Communication configuration. Or the ToCamera is not declared in the RAPID program or is already defined in the system parameter Communication configuration.

Limitation

When starting the program, the alias camera cannot be used until the AliasCamera instruction is executed.

Instruction AliasCamera **must** be placed:

- either in the event routine executed at program start (event START).
- or in the program part executed after every program start (before use of the camera).

To prevent mistakes it is not recommended to use dynamic reconnection of an AliasCamera camera to different physical cameras.

Syntax

```
AliasCamera
[ CameraName ':' < expression (IN) of string >
| FromCamera ':' < variable (VAR) of cameradev > ', '
[ ToCamera ':' < variable (VAR) of cameradev > ] ';'

```

Related information

For information about	See
Definition of camera devices	cameradev - camera device on page 1598
Configuration of cameras	<i>Technical reference manual - System parameters</i>
Defining event routines	<i>Technical reference manual - System parameters</i>
Integrated Vision	<i>Application manual - Integrated Vision</i>

1 Instructions

1.6 AliasIO - Define I/O signal with alias name

RobotWare Base

1.6 AliasIO - Define I/O signal with alias name

Usage

AliasIO is used to define a signal of any type with an alias name or to use signals in built-in task modules.

Signals with alias names can be used for predefined generic programs, without any modification of the program before running in different robot installations.

The instruction AliasIO must be run before any use of the actual signal. See [Basic examples on page 34](#) for loaded modules, and [More examples on page 35](#) for installed modules.

Basic examples

The following example illustrates the instruction AliasIO:

See also [More examples on page 35](#).

Example 1

```
VAR signaldo alias_do;
PROC prog_start()
  AliasIO config_do, alias_do;
ENDPROC
```

The routine prog_start is connected to the START event in system parameters. The program defining digital output signal alias_do is connected to the configured digital output signal config_do at program start.

Arguments

AliasIO FromSignal ToSignal

FromSignal

Data type: signalxx or string

Loaded modules:

The signal identifier named according to the configuration (data type signalxx) from which the signal descriptor is copied. The signal must be defined in the I/O configuration.

Installed modules or loaded modules:

A reference (CONST, VAR or parameter of these) containing the name of the signal (data type string) from which the signal descriptor after search in the system is copied. The signal must be defined in the I/O configuration.

ToSignal

Data type: signalxx

The signal identifier according to the program (data type signalxx) to which the signal descriptor is copied. The signal must be declared in the RAPID program.

The same data type must be used (or found) for the arguments FromSignal and ToSignal and must be one of type signalxx (signalai, signalao, signaldi, signaldo, signalgi, or signalgo).

Continues on next page

Program execution

The signal descriptor value is copied from the signal given in argument `FromSignal` to the signal given in argument `ToSignal`.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_ALIASIO_DEF	The <code>FromSignal</code> is not defined in the I/O configuration, or the <code>ToSignal</code> is not declared in the RAPID program, or the <code>ToSignal</code> is not defined in the I/O configuration.
ERR_ALIASIO_TYPE	The data types for the arguments <code>FromSignal</code> and <code>ToSignal</code> is not the same type.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .

More examples

More examples of the instruction `AliasIO` are illustrated below.

Example 1

```
VAR signaldi alias_di;
PROC prog_start()
  CONST string config_string := "config_di";
  AliasIO config_string, alias_di;
ENDPROC
```

The routine `prog_start` is connected to the `START` event in system parameters. The program defined digital input signal `alias_di` is connected to the configured digital input signal `config_di` (via constant `config_string`) at program start.

Limitations

When starting the program, the alias signal cannot be used until the `AliasIO` instruction is executed.

The signal variable should be declared globally in the module. It must not be a part of a `RECORD` component or declared locally in a procedure (otherwise the refresh of the signal after power fail restart will not work as it should).

Instruction `AliasIO` **must** be placed

- either in the event routine executed at program start (event `START`)
- or in the program part executed after every program start (before use of the signal)

To prevent mistakes it is not recommended to use dynamic reconnection of an `AliasIO` signal to different physical signals.

Syntax

```
AliasIO
  [ FromSignal ':' ] < reference (REF) of anytype > ','
  [ ToSignal ':' ] < variable (VAR) of anytype > ';' ;
```

Continues on next page

1 Instructions

1.6 AliasIO - Define I/O signal with alias name

RobotWare Base

Continued

Related information

For information about	See
Reset I/O signal with alias name	AliasIOReset - Resetting I/O signal with alias name on page 37
Input/Output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Get information about the origin of an I/O signal	GetSignalOrigin - Get information about the origin of an I/O signal on page 1282
Configuration of I/O	<i>Technical reference manual - System parameters</i>
Defining event routines	<i>Technical reference manual - System parameters</i>
Loaded/Installed task modules	<i>Technical reference manual - System parameters</i>
<i>Advanced RAPID</i>	<i>Application manual - Controller software OmniCore</i>

1.7 AliasIOReset - Resetting I/O signal with alias name

Usage

AliasIOReset is used to reset a signal that has been used in a previous call to AliasIO.

Basic examples

The following example illustrates the instruction AliasIOReset:

Example 1

```

VAR signaldo alias_do;
PROC myproc()
  AliasIO config_do, alias_do;
  SetDO alias_do, 1;
  ..
  AliasIOReset alias_do;
ENDPROC

```

The program defined digital output signal alias_do is connected to the configured digital output signal config_do at the beginning of the procedure myproc. The signal config_do is defined in the I/O configuration. Later on, when alias_do should not be used anymore, the alias coupling is removed.

Arguments

AliasIOReset Signal

Signal

Data type: signalxx

The signal identifier according to the program (data type signalxx) that should be reset. The signal must be declared in the RAPID program.

Program execution

The entire alias coupling is removed. The signal cannot be used until a new alias coupling with AliasIO is done.

Limitation

Signals that are defined in the I/O configuration can not be reset. Only signals that have been used in an AliasIO instruction and are declared in the RAPID program can be used.

Syntax

```

AliasIOReset
  [ Signal ':' ] < variable (VAR) of anytype > ';'

```

Related information

For information about	See
Define I/O signal with alias name	AliasIO - Define I/O signal with alias name on page 34

Continues on next page

1 Instructions

1.7 AliasIOReset - Resetting I/O signal with alias name

RobotWare Base

Continued

For information about	See
Input/Output instructions	<i>Technical reference manual - RAPID Overview</i>
Get information about the origin of an IO signal	GetSignalOrigin - <i>Get information about the origin of an I/O signal on page 1282</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>
Defining event routines	<i>Technical reference manual - System parameters</i>
Loaded/Installed task modules	<i>Technical reference manual - System parameters</i>
<i>Advanced RAPID</i>	<i>Application manual - Controller software OmniCore</i>

1.8 " := " - Assigns a value

Usage

The " := " instruction is used to assign a new value to data. This value can be anything from a constant value to an arithmetic expression, for example, `reg1+5*reg3`.

Basic examples

The following examples illustrate the instruction " := ":

See also [More examples on page 39](#).

Example 1

```
reg1 := 5;
```

reg1 is assigned the value 5.

Example 2

```
reg1 := reg2 - reg3;
```

reg1 is assigned the value that the `reg2 - reg3` calculation returns.

Example 3

```
counter := counter + 1;
```

counter is incremented by one.

Arguments

`Data := Value`

Data

Data type: All

The data that is to be assigned a new value.

Value

Data type: Same as Data

The desired value.

More examples

More examples of the instruction " := " are illustrated below.

Example 1

```
tool1.tframe.trans.x := tool1.tframe.trans.x + 20;
```

The TCP for tool1 is shifted 20 mm in the X-direction.

Example 2

```
pallet{5,8} := Abs(value);
```

An element in the pallet matrix is assigned a value equal to the absolute value of the value variable.

Limitations

The data (whose value is to be changed) must not be

- a constant

Continues on next page

1 Instructions

1.8 ":=" - Assigns a value

RobotWare Base

Continued

- a non-value data type.

The data and value must have similar (the same or alias) data types.

Syntax

<assignment target> ':=' <expression> ';'

Related information

For information about	See
Expressions	<i>Technical reference manual - RAPID Overview</i>
Non-value data types	<i>Technical reference manual - RAPID Overview</i>
Assigning an initial value to data	<i>Operating manual - OmniCore</i>

1.9 BitClear - Clear a specified bit in a byte or dnum data

Usage

BitClear is used to clear (set to 0) a specified bit in a defined byte data or dnum data.

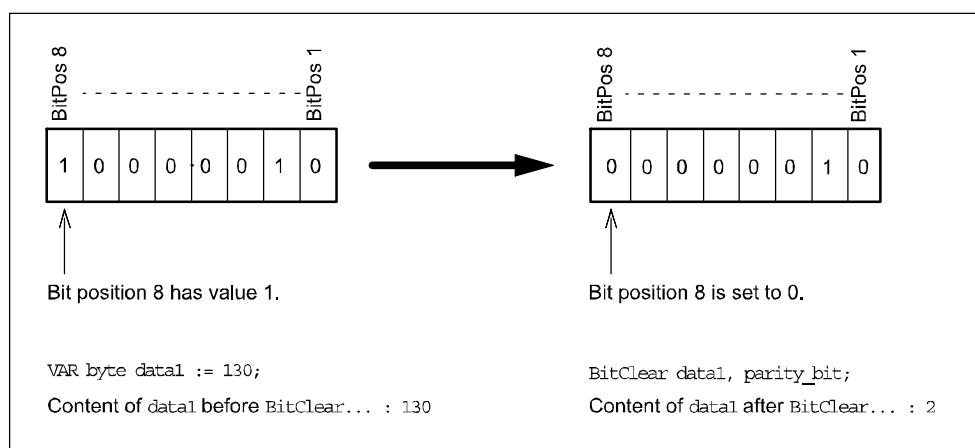
Basic examples

The following examples illustrate the instruction BitClear:

Example 1

```
CONST num parity_bit := 8;
VAR byte data1 := 130;
BitClear data1, parity_bit;
```

Bit number 8 (parity_bit) in the variable data1 will be set to 0, for example, the content of the variable data1 will be changed from 130 to 2 (integer representation). Bit manipulation of data type byte when using BitClear is illustrated in the following figure.



xx0500002147

Example 2

```
CONST num parity_bit := 52;
VAR dnum data2 := 2251799813685378;
BitClear data2, parity_bit;
```

Bit number 52 (parity_bit) in the variable data2 will be set to 0, e.g. the content of the variable data2 will be changed from 2251799813685378 to 130 (integer representation). Bit manipulation of data type dnum when using BitClear is illustrated in the figure below.

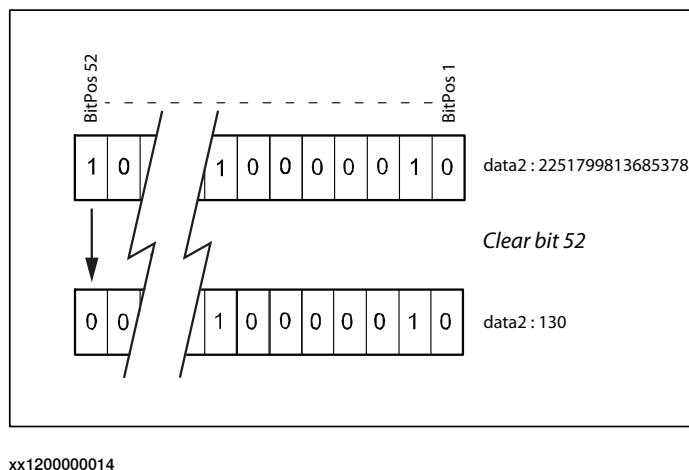
Continues on next page

1 Instructions

1.9 BitClear - Clear a specified bit in a byte or dnum data

RobotWare Base

Continued



Arguments

BitClear BitData | DnumData BitPos

BitData

Data type: byte

The bit data, in integer representation, to be changed.

DnumData

Data type: dnum

The dnum bit data, in integer representation, to be changed.

BitPos

Bit Position

Data type: num

The bit position (1-8) in the BitData, or bit position (1-52) in the DnumData, to be set to 0.

Limitations

The range for a data type byte is 0 - 255 decimal.

The bit position is valid from 1 - 8 for data type byte.

The range for a data type dnum is 0 - 4503599627370495 decimal.

The bit position is valid from 1 - 52 for data type dnum.

Syntax

```
BitClear
[ BitData ':' '=' ] < variable or persistent (INOUT) of byte >
| [ DnumData ':' '=' ] < variable or persistent (INOUT) of dnum >
','
[ BitPos ':' '=' ] < expression (IN) of num > ';' ;
```

Continues on next page

1.9 BitClear - Clear a specified bit in a byte or dnum data

RobotWare Base

Continued

Related information

For information about	See
Set a specified bit in a byte or dnum data	BitSet - Set a specified bit in a byte or dnum data on page 44
Check if a specified bit in a byte data is set	BitCheck - Check if a specified bit in a byte data is set on page 1140
Check if a specified bit in a dnum data is set	BitCheckDnum - Check if a specified bit in a dnum data is set on page 1142
Other bit functions	Technical reference manual - RAPID Overview
Advanced RAPID	Application manual - Controller software Omni-Core

1 Instructions

1.10 BitSet - Set a specified bit in a byte or dnum data

RobotWare Base

1.10 BitSet - Set a specified bit in a byte or dnum data

Usage

BitSet is used to set a specified bit to 1 in a defined byte data or dnum data.

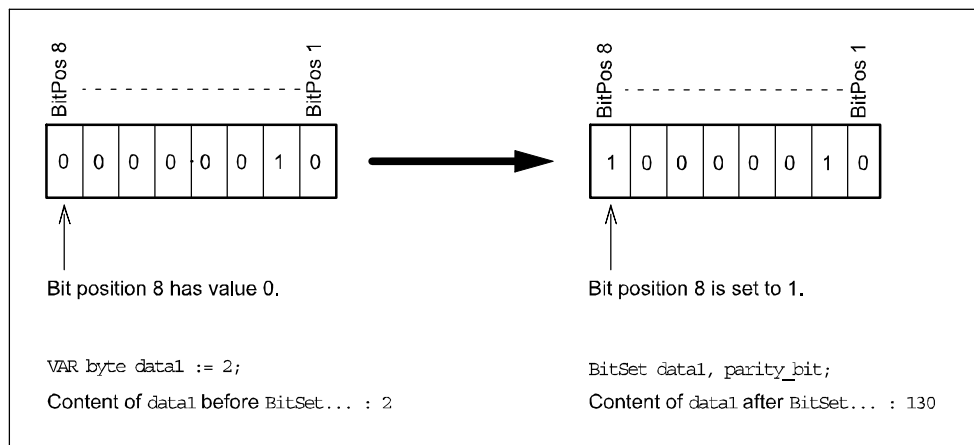
Basic examples

The following examples illustrate the instruction BitSet:

Example 1

```
CONST num parity_bit := 8;  
VAR byte data1 := 2;  
BitSet data1, parity_bit;
```

Bit number 8 (parity_bit) in the variable data1 will be set to 1, for example, the content of the variable data1 will be changed from 2 to 130 (integer representation). Bit manipulation of data type byte when using BitSet is illustrated in the figure below.



xx0500002148

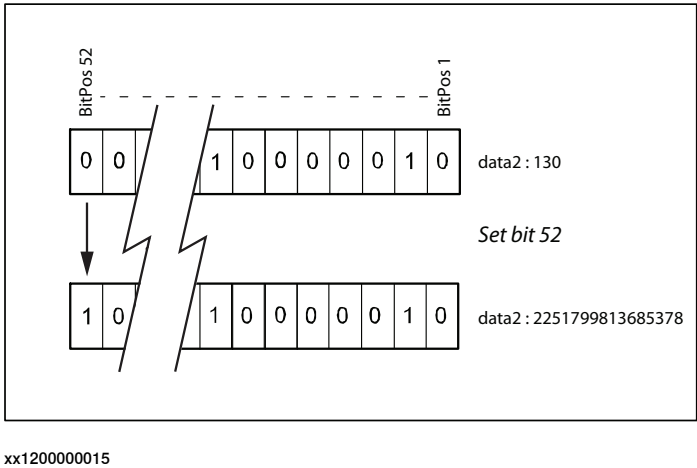
Example 2

```
CONST num parity_bit := 52;  
VAR dnum data2 := 130;  
BitSet data2, parity_bit;
```

Bit number 52 (parity_bit) in the variable data2 will be set to 1, e.g. the content of the variable data2 will be changed from 130 to 2251799813685378 (integer representation). Bit manipulation of data type dnum when using BitSet is illustrated in the figure below.

Continues on next page

1.10 BitSet - Set a specified bit in a byte or dnum data
RobotWare Base
Continued



Arguments

BitSet BitData | DnumData BitPos

BitData

Data type: byte
The bit data, in integer representation, to be changed.

DnumData

Data type: dnum
The bit data, in integer representation, to be changed.

BitPos

Bit Position
Data type: num
The bit position (1-8) in the BitData, or bit position (1-52) in the DnumData, to be set to 1.

Limitations

The range for a data type byte is integer 0 - 255.
The bit position is valid from 1 - 8 for data type byte.
The range for a data type dnum is integer 0 - 4503599627370495.
The bit position is valid from 1 - 52 for data type dnum.

Syntax

```
BitSet
[ BitData':=' ] < variable or persistent (INOUT) of byte >
| [ DnumData':=' ] < variable or persistent (INOUT) of dnum >
|
| [ BitPos':=' ] < expression (IN) of num > ';' ;
```

Continues on next page

1 Instructions

1.10 BitSet - Set a specified bit in a byte or dnum data

RobotWare Base

Continued

Related information

For information about	See
Clear a specified bit in a byte or dnum data	BitClear - Clear a specified bit in a byte or dnum data on page 41
Check if a specified bit in a byte data is set	BitCheck - Check if a specified bit in a byte data is set on page 1140
Check if a specified bit in a dnum data is set	BitCheckDnum - Check if a specified bit in a dnum data is set on page 1142
Other bit functions	<i>Technical reference manual - RAPID Overview</i>
<i>Advanced RAPID</i>	<i>Application manual - Controller software OmniCore</i>

1.11 BookErrNo - Book a RAPID system error number

Usage

BookErrNo is used to book a new RAPID system error number.

Basic examples

The following example illustrates the instruction BookErrNo:

Example 1

```

! Introduce a new error number in a glue system
! Note: The new error variable must be declared with the initial
      value -1
VAR errnum ERR_GLUEFLOW := -1;

```

```

! Book the new RAPID system error number
BookErrNo ERR_GLUEFLOW;

```

The variable ERR_GLUEFLOW will be assigned to a free system error number for use in the RAPID code.

```

! Use the new error number
IF di1 = 0 THEN
  RAISE ERR_GLUEFLOW;
ELSE
  ...
ENDIF

! Error handling
ERROR
  IF ERRNO = ERR_GLUEFLOW THEN
    ...
  ELSE
    ...
  ENDIF

```

If the digital input di1 is 0, the new booked error number will be raised and the system error variable ERRNO will be set to the new booked error number. The error handling of those user generated errors can then be handled in the error handler as usual.

Arguments

BookErrNo ErrorName

ErrorName

Data type: errnum

The new RAPID system error variable name.

Limitations

The new error variable must not be declared as a routine variable.

The new error variable must be declared with an initial value of -1, that gives the information that this error should be a RAPID system error.

Continues on next page

1 Instructions

1.11 BookErrNo - Book a RAPID system error number

RobotWare Base

Continued

Syntax

```
BookErrNo  
[ ErrorName ']:='] < variable (VAR) of errnum > ';' ;'
```

Related information

For information about	See
Error handling	<i>Technical reference manual - RAPID Overview</i>
Error number	errnum - Error number on page 1634
Call an error handler	RAISE - Calls an error handler on page 561
<i>Advanced RAPID</i>	<i>Application manual - Controller software OmniCore</i>

1.12 Break - Break a loop

Usage

Break is used to break a For or a While loop.

Basic examples

The following example illustrates the instruction Break.

Example 1

```
WHILE (TRUE) DO
  TPWrite "Start WHILE";
  Incr reg1;
  IF (reg1 > 2) THEN
    BREAK;
  ENDIF
ENDWHILE
```

Limitations

It is only possible to use Break in a While or a For loop.

Syntax

```
BREAK ';' ;'
```

Related information

For information about	See
WHILE	WHILE - Repeats as long as ... on page 1059
FOR	FOR - Repeats a given number of times on page 216

1 Instructions

1.13 DebugBreak - Break program execution

RobotWare Base

1.13 DebugBreak - Break program execution

Usage

DebugBreak is used to make an immediate break in program execution for RAPID program code debugging purposes. The robot movement is stopped at once.

Basic examples

The following example illustrates the instruction DebugBreak:

Example 1

```
...  
DebugBreak;  
...
```

Program execution stops and it is possible to analyze variables, values etc. for debugging purposes.

Program execution

The instruction stops program execution at once, without waiting for the robot and external axes to reach their programmed destination points for the movement being performed at the time. Program execution can then be restarted from the next instruction.

If there is a DebugBreak instruction in some routine event, the execution of the routine will be interrupted and no STOP routine event will be executed. The routine event will be executed from the beginning the next time the same event occurs.

Syntax

```
DebugBreak';'
```

Related information

For information about	See
Stopping for program actions	Stop - Stops program execution on page 787
Stopping after a fatal error	EXIT - Terminates program execution on page 203
Terminating program execution	EXIT - Terminates program execution on page 203
Only stopping robot movements	StopMove - Stops robot movement on page 792

1.14 BytesReset - Set all elements in a byte array to zero (0)

Usage

BytesReset is used to set all elements in a byte array to zero (0).

Basic examples

The following example illustrates the instruction BytesReset.

Example 1

```

VAR byte mybytes{500};
VAR num length;
..
BytesReset mybytes;
length := ValToBytes(myrobtarg, mybytes);

```

In the example above all elements in mybytes are set to 0. Then mybytes is used in ValToBytes when converting the value of myrobtarg to ACSII value representation and storing it in the mybytes variable.

Arguments

BytesReset ByteArr

ByteArr

Data type: array of byte

ByteArr is an array with the dimension n.

Program execution

BytesReset is used to set all elements in a byte array to 0.

Syntax

```

BytesReset
[ ByteArr '[:=' ] < variable or persistent (INOUT) array{*} of
byte > '];'

```

Related information

For information about	See
byte	byte - Integer values 0-255 on page 1597
BytesToVal	BytesToVal - Converts a byte array to a value on page 1166
ValToBytes	ValToBytes - Converts a value to a byte array on page 1582
Bit functions	Technical reference manual - RAPID Overview

1 Instructions

1.15 CallByVar - Call a procedure by a variable

RobotWare Base

1.15 CallByVar - Call a procedure by a variable

Usage

CallByVar (*Call By Variable*) can be used to call procedures with specific names, for example, proc_name1, proc_name2, proc_name3 ... proc_namex via a variable.

Basic examples

The following example illustrates the instruction CallByVar:

See also [More examples on page 52](#).

Example 1

```
reg1 := 2;  
CallByVar "proc", reg1;
```

The procedure proc2 is called.

Arguments

CallByVar Name Number

Name

Data type: string

The first part of the procedure name, for example, proc_name.

Number

Data type: num

The numeric value for the number of the procedure. This value will be converted to a string and gives the 2nd part of the procedure name, for example, 1. The value must be a positive integer.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_ARGVALERR	The argument Number is < 0 or is not an integer.
ERR_REFUNKPRC	The reference is to an unknown procedure.
ERR_CALLPROC	Procedure call error (not procedure).

More examples

More examples of how to make static and dynamic selection of procedure call.

Example 1 - Static selection of procedure call

```
TEST reg1  
CASE 1:  
  lf_door door_loc;  
CASE 2:  
  rf_door door_loc;  
CASE 3:
```

Continues on next page


```

        lr_door door_loc;
CASE 4:
        rr_door door_loc;
DEFAULT:
        EXIT;
ENDTEST

```

Depending on whether the value of register reg1 is 1, 2, 3, or 4, different procedures are called that perform the appropriate type of work for the selected door. The door location in argument door_loc.

Example 2 - Dynamic selection of procedure call with RAPID syntax

```

reg1 := 2;
%"proc"+NumToStr(reg1,0)% door_loc;

```

The procedure proc2 is called with argument door_loc.

Limitation: All procedures must have a specific name, for example, proc1, proc2, proc3.

Example 3 - Dynamic selection of procedure call with CallByVar

```

reg1 := 2;
CallByVar "proc", reg1;

```

The procedure proc2 is called.

Limitation: All procedures must have specific name, for example, proc1, proc2, proc3, and no arguments can be used.

Limitations

Can only be used to call procedures without parameters.

Cannot be used to call LOCAL procedures.

Execution of CallByVar takes a little more time than execution of a normal procedure call.

Syntax

```

CallByVar
[Name ':='] <expression (IN) of string>', '
[Number ':='] <expression (IN) of num>';'

```

Related information

For information about	See
Calling procedures	<i>Technical reference manual - RAPID Overview</i> <i>Operating manual - OmniCore</i>

1 Instructions

1.16 CamFlush - Removes the collection data for the camera

Integrated Vision

1.16 CamFlush - Removes the collection data for the camera

Usage

CamFlush is used to flush (remove) the cameratarget collection for the camera.

Basic examples

The following example illustrates the instruction CamFlush.

Example 1

```
CamFlush mycamera;
```

The collection data for camera mycamera is removed.

Arguments

CamFlush Camera

Camera

Data type: cameradev

The name of the camera.

Syntax

```
CamFlush  
[ Camera ':' ] < variable (VAR) of cameradev > ';' ;
```

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

1.17 CamGetParameter - Get different named camera parameters

Usage

CamGetParameter is used to get named parameters that the camera may expose. The user has to know the name of the parameter and its return type in order to retrieve its value.

Basic examples

The following example illustrates the instruction CamGetParameter.

Example 1

```
VAR bool mybool:=FALSE;
...
CamGetParameter mycamera, "Pattern_1.Tool_Enabled_Status"
  \BoolVar:=mybool;
TPWrite "The current value of Pattern_1.Tool_Enabled_Status is: "
  \Bool:=mybool;
```

Get the named boolean parameter Pattern_1.Tool_Enabled_Status and write the value on the FlexPendant.

Arguments

CamGetParameter Camera ParName [\NumVar] | [\BoolVar] | [\StrVar]

Camera

Data type: cameradev
The name of the camera.

ParName

Parameter Name
Data type: string
The name of the parameter in the camera.

[\NumVar]

Data type: num
Variable (VAR) to store the numeric value of the data object retrieved.

[\BoolVar]

Data type: bool
Variable (VAR) to store the boolean value of the data object retrieved.

[\StrVar]

Data type: string
Variable (VAR) to store the string value of the data object retrieved.

Program execution

The instruction reads the specified parameter directly when the instruction is executed and returns the value.

Continues on next page

1 Instructions

1.17 CamGetParameter - Get different named camera parameters

Integrated Vision

Continued

If the instruction is used to read a result from the image analysis, make sure that the camera has finished processing the image before getting the data.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CAM_BUSY	The camera is busy with some other request and cannot perform the current order.
ERR_CAM_COM_TIMEOUT	Communication error with camera. The camera is probably disconnected.
ERR_CAM_GET_MISMATCH	The parameter fetched from the camera with instruction CamGetParameter has the wrong data type.
ERR_CAM_NOT_ON_NETWORK	The camera is not connected.

Syntax

```
CamGetParameter
[ Camera ':' = ] < variable (VAR) of cameradev > ', '
[ ParName ':' = ] < expression (IN) of string >
[ '\NumVar ':' = ] < variable (VAR) of num > ]
| [ '\BoolVar ':' = ] < variable (VAR) of bool > ]
| [ '\StrVar ':' = ] < variable (VAR) of string > ] ';' ;
```

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

1.18 CamGetResult - Gets a camera target from the collection

Integrated Vision

1.18 CamGetResult - Gets a camera target from the collection

Usage

`CamGetResult` (*Camera Get Result*) is used to get a camera target from the vision result collection.

Basic examples

The following example illustrates the instruction `CamGetResult`.

Example 1

```
VAR num mysceneid;
VAR cameratarget mycamtarget;
...
CamReqImage mycamera \SceneId:= mysceneid;
CamGetResult mycamera, mycamtarget \SceneId:= mysceneid;
```

Order camera mycamera to acquire an image. Get a vision result originating from the image with SceneId.

Arguments

`CamGetResult Camera CamTarget [\SceneId] [\MaxTime]`

Camera

Data type: cameradev
The name of the camera.

CamTarget

Camera Target
Data type: cameratarget
The variable where the vision result will be stored.

[\SceneId]

Scene Identification
Data type: num
The SceneId is an identifier that specifies from which image the cameratarget has been generated.

[\MaxTime]

Maximum Time
Data type: num
The maximum amount of time in seconds that program execution waits. The maximum allowed value is 120 seconds.

Program execution

`CamGetResult` gets a camera target from the vision result collection. If no SceneId or MaxTime is used, and there is no result to fetch, the instruction will hang forever. If a SceneId is used in `CamGetResult` it should have been generated in a preceding `CamReqImage` instruction.

Continues on next page

1 Instructions

1.18 CamGetResult - Gets a camera target from the collection

Integrated Vision

Continued

The SceneId can only be used if the image has been ordered from instruction CamReqImage. If images are generated by an external I/O signal, the SceneId cannot be used in instruction CamGetResult.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CAM_BUSY	The camera is busy with some other request and cannot perform the current order.
ERR_CAM_MAXTIME	No result could be fetched within the time-out time.
ERR_CAM_NO_MORE_DATA	No more vision results can be fetched for used SceneId, or the result could not be fetched within the time-out time.

Syntax

```
CamGetResult
[ Camera ':=' ] < variable (VAR) of cameradev > ','
[ CamTarget ':=' ] < variable (VAR) of CameraTarget >
[ '\SceneId ':=' < expression (IN) of num > ]
[ '\MaxTime ':=' < expression (IN) of num > ] ';' ;
```

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

1.19 CamLoadJob - Load a camera task into a camera

Usage

CamLoadJob (*Camera Load Job*) loads a camera task, *job*, describing exposure parameters, calibration, and what vision tools to apply.

Basic examples

The following example illustrates the instruction CamLoadJob.

Example 1

```
CamSetProgramMode mycamera;  
CamLoadJob mycamera, "myjob.job";  
CamSetRunMode mycamera;
```

The job myjob is loaded into the camera named mycamera.

Arguments

CamLoadJob Camera JobName [\KeepTargets] [\MaxTime]

Camera

Data type: cameradev

The name of the camera.

Name

Data type: string

The name of the job to load into the camera.

[\KeepTargets]

Data type: switch

This argument is used to specify if any existing camera targets produced by the camera should be kept.

[\MaxTime]

Data type: num

The maximum amount of time in seconds that program execution waits. The maximum allowed value is 120 seconds.

Program execution

The execution of CamLoadJob will wait until the job is loaded or fail with a time-out error. If the optional argument KeepTargets is used, the old collection data for the specified camera is kept. The default behavior is to remove (flush) the old collection data.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CAM_BUSY	The camera is busy with some other request and cannot perform the current order.

Continues on next page

1 Instructions

1.19 CamLoadJob - Load a camera task into a camera

Integrated Vision

Continued

Name	Cause of error
ERR_CAM_COM_TIMEOUT	Communication error with camera. The camera is probably disconnected.
ERR_CAM_MAXTIME	The camera job was not loaded within the time-out time.
ERR_CAM_NOT_ON_NETWORK	The camera is not connected
ERR_CAM_NOT_VALID_LOAD_JOB	The loaded job is not a valid job, the name is too long or has invalid characters, or the camera is not in program mode
ERR_CAM_NO_PROGMode	The camera is not in program mode

Limitations

It is only possible to execute CamLoadJob when the camera is set in program mode. Use instruction CamSetProgramMode to set the camera in program mode. To be able to load the job, the job file must be stored on the camera flash disk.

Syntax

```
CamLoadJob
[ Camera ':' = ' ] < variable (VAR) of cameradev > ', '
[ JobName ':' = ' ] <expression (IN) of string >
[ '\\'KeepTargets ]
[ '\\'MaxTime ':' = ' <expression (IN) of num>]';'
```

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

1.20 CamReqImage - Order the camera to acquire an image

Usage

CamReqImage (*Camera Request Image*) orders the camera to acquire an image.

Basic examples

The following example illustrates the instruction CamReqImage.

Example 1

```
CamReqImage mycamera;
```

Order camera mycamera to acquire an image.

Arguments

```
CamReqImage Camera [\SceneId] [\KeepTargets] [\AwaitComplete]
```

Camera

Data type: cameradev

The name of the camera.

[\SceneId]

Scene Identification

Data type: num

The optional argument SceneId is an identifier for the acquired image. It is generated for each executed CamReqImage using the optional argument SceneId. The identifier is an integer between 1 and 8388608. If no SceneId is used, the identifier value is set to 0.

[\KeepTargets]

Data type: switch

This argument is used to specify if old collection data for a specified camera should be kept.

[\AwaitComplete]

Data type : switch

If the optional argument \AwaitComplete is specified the instruction waits until the results from the image have been received.

When \AwaitComplete is used, the camera trigger type has to be set to **External**.

Program execution

CamReqImage is ordering a specified camera to acquire an image. If the optional argument SceneId is used, the available vision results of an acquired image is marked with the unique number generated by the instruction.

If optional argument KeepTargets is used, the old collection data for the specified camera is kept. The default behavior is to remove (flush) any old collection data.

Continues on next page

1 Instructions

1.20 CamReqImage - Order the camera to acquire an image

Integrated Vision

Continued

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CAM_BUSY	The camera is busy with some other request and cannot perform the current order.
ERR_CAM_COM_TIMEOUT	Communication error with camera. The camera is probably disconnected.
ERR_CAM_NO_RUNMODE	The camera is not in running mode
ERR_CAM_NOT_ON_NETWORK	The camera is not connected.

Limitations

It is only possible to execute CamReqImage when the camera is set in running mode. Use instruction CamSetRunMode to set the camera in running mode.

Syntax

```
CamReqImage
[ Camera ':= ' ] < variable (VAR) of cameradev > ', '
[ '\\SceneId ':= ' < variable (VAR) of num > ]
[ '\\KeepTargets ]
[ '\\AwaitComplete ]';'
```

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

1.21 CamSetExposure - Set camera specific data

Usage

CamSetExposure (*Camera Set Exposure*) sets camera specific data and makes it possible to adapt image parameters depending on ambient lighting conditions.

Basic examples

The following example illustrates the instruction CamSetExposure.

Example 1

```
CamSetExposure mycamera \ExposureTime:=10;
```

Order the camera mycamera to change the exposure time to 10 ms.

Arguments

```
CamSetExposure Camera [\ExposureTime] [\Brightness] [\Contrast]
```

Camera

Data type: cameradev

The name of the camera.

[\ExposureTime]

Data type: num

If this optional argument is used, the exposure time of the camera is updated. The value is in milliseconds (ms).

[\Brightness]

Data type: num

If this optional argument is used, the brightness setting of the camera is updated. The value is normally expressed on a scale from 0 to 1.

[\Contrast]

Data type: num

If this optional argument is used, the contrast setting of the camera is updated. The value is normally expressed on a scale from 0 to 1.

Program execution

The instruction updates the exposure time, brightness and contrast if it is possible to update those for the specific camera. If a setting is not supported by the camera an error message will be presented to the user, and the program execution stops.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CAM_COM_TIMEOUT	Communication error with camera. The camera is probably disconnected.

Continues on next page

1 Instructions

1.21 CamSetExposure - Set camera specific data

Integrated Vision

Continued

Name	Cause of error
ERR_CAM_NOT_ON_NETWORK	The camera is not connected.

Syntax

```
CamSetExposure
[ Camera ':= ' ] < variable (VAR) of cameradev > ', '
[ '\\ExposureTime ':= ' < variable (IN) of num > ]
[ '\\Brightness ':= ' < variable (IN) of num > ]
[ '\\Contrast ':= ' < variable (IN) of num > ] ';' ;
```

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

1.22 CamSetParameter - Set different named camera parameters

Usage

CamSetParameter is used to set different named camera parameters that a camera may expose. With this instruction it is possible to change different parameters in the camera in runtime. The user has to know the name of the parameter and its type in order to set its value.

Basic examples

The following example illustrates the instruction CamSetParameter.

Example 1

```
CamSetParameter mycamera, "Pattern_1.Tool_Enabled" \BoolVal:=FALSE;
CamSetRunMode mycamera;
```

In this example the parameter named "Pattern_1.Tool_Enabled" is set to false, which means that the specified vision tool shall not execute when an image is acquired.

This will give a faster execution of the vision tool. However, the tool still produces results with the values from the latest active execution. In order to not use these targets, sort them out in the RAPID program.

Arguments

```
CamSetParameter Camera ParName [\NumVal] | [\BoolVal] | [\StrVal]
```

Camera

Data type: cameradev

The name of the camera.

ParName

Data type: string

The name of the parameter in the camera.

[\NumVal]

Data type: num

The numeric value to set for the camera parameter with the name set in argument ParName.

[\BoolVal]

Data type: bool

The boolean value to set for the camera parameter with the name set in argument ParName.

[\StrVal]

Data type: string

The string value to set for the camera parameter with the name set in argument ParName.

Continues on next page

1 Instructions

1.22 CamSetParameter - Set different named camera parameters

Integrated Vision

Continued

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CAM_BUSY	The camera is busy with some other request and cannot perform the current order.
ERR_CAM_COM_TIMEOUT	Communication error with camera. The camera is probably disconnected.
ERR_CAM_NOT_ON_NETWORK	The camera is not connected.
ERR_CAM_SET_MISMATCH	The parameter written to the camera with instruction CamSetParameter has the wrong data type, or the value is out of range.

Limitations

User created parameters can only be of type EditString, EditInt, or EditFloat.

Syntax

```
CamSetParameter
[ Camera ':' ] < variable (VAR) of cameradev > ','
[ ParName ':' ] < expression (IN) of string >
[ '\NumVal ':' < expression (IN) of num > ]
| [ '\BoolVal ':' < expression (IN) of bool > ]
| [ '\StrVal ':' < expression (IN) of string > ] ';'

```

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

1.23 CamSetProgramMode - Orders the camera to go to program mode

Integrated Vision

1.23 CamSetProgramMode - Orders the camera to go to program mode

Usage

CamSetProgramMode (*Camera Set Program Mode*) orders the camera to go to program mode (offline).

Basic examples

The following example illustrates the instruction CamSetProgramMode.

Example 1

```
CamSetProgramMode mycamera;
CamLoadJob mycamera, "myjob.job";
CamSetRunMode mycamera;
...
```

First, change the camera to programming mode. Then load myjob into the camera. Then, order the camera to go to running mode.

Arguments

CamSetProgramMode Camera

Camera

Data type: cameradev

The name of the camera.

Program execution

When ordering a camera to go to program mode with instruction CamSetProgramMode, it will be possible to change settings and load a job into the camera.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CAM_BUSY	The camera is busy with some other request and cannot perform the current order.
ERR_CAM_COM_TIMEOUT	Communication error with camera. The camera is probably disconnected.
ERR_CAM_NOT_ON_NETWORK	The camera is not connected.

Syntax

```
CamSetProgramMode
[ Camera ':= ' ] < variable (VAR) of cameradev > ';' ;
```

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

1 Instructions

1.24 CamSetRunMode - Orders the camera to run mode

Integrated Vision

1.24 CamSetRunMode - Orders the camera to run mode

Usage

CamSetRunMode (*Camera Set Running Mode*) orders the camera to go to run mode (online), and updates the controller on the current output to RAPID configuration.

Basic examples

The following example illustrates the instruction CamSetRunMode.

Example 1

```
CamSetProgramMode mycamera;  
CamLoadJob mycamera, "myjob.job";  
...  
CamSetRunMode mycamera;
```

First, change the camera to programming mode. Then load myjob into the camera. Then, order the camera to go to running mode with instruction CamSetRunMode.

Arguments

CamSetRunMode Camera

Camera

Data type: cameradev

The name of the camera.

Program execution

When ordering a camera to go to run mode with CamSetRunMode it is possible to start taking images.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CAM_BUSY	The camera is busy with some other request and cannot perform the current order.
ERR_CAM_COM_TIMEOUT	Communication error with camera. The camera is probably disconnected.
ERR_CAM_NOT_ON_NETWORK	The camera is not connected.

Syntax

```
CamSetRunMode  
[ Camera ':' = ' ] < variable (VAR) of cameradev > ';' ;
```

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

1.25 CamStartLoadJob - Start load of a camera task into a camera

Usage

CamStartLoadJob will start the loading of a job into a camera, and then the execution will continue on the next instruction. When loading is in progress other instructions can be executed in parallel.

Basic examples

The following example illustrates the instruction CamStartLoadJob.

Example 1

```
...
CamStartLoadJob mycamera, "myjob.job";
MoveL p1, v1000, fine, tool2;
CamWaitLoadJob mycamera;
CamSetRunMode mycamera;
CamReqImage mycamera;
...
```

First a job loading is started to the camera, and while the loading is proceeding, a movement to position p1 is done. When the movement is ready, and the loading has finished, an image is acquired.

Arguments

CamStartLoadJob Camera Name [\KeepTargets]

Camera

Data type: cameradev

The name of the camera.

Name

Data type: string

The name of the job to load into the camera.

[\KeepTargets]

Data type: switch

This argument is used to specify if old collection data for a specified camera should be kept.

Program execution

Execution of CamStartLoadJob will only order the loading and then proceed directly with the next instruction without waiting for the loading to be completed. If optional argument \KeepTargets is used, the old collection data for the specified camera is not removed. The default behavior is to remove (flush) old collection data.

The camera will be busy running the load operation and will not accept any new camera requests before the operation is completed with CamWaitLoadJob, with the exception that CamStartSetParameter requests can be queued.

Continues on next page

1 Instructions

1.25 CamStartLoadJob - Start load of a camera task into a camera

Integrated Vision

Continued

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CAM_BUSY	The camera is busy with some other request and cannot perform the current order.
ERR_CAM_NOT_ON_NETWORK	The camera is not connected

Limitations

It is only possible to execute CamStartLoadJob when the camera is set in program mode. Use instruction CamSetProgramMode to set the camera in program mode.

When an ongoing load of a job is executing, it is not possible to access that specific camera with any other instruction or function. The following camera instruction or function must be a CamWaitLoadJob instruction.

To be able to load the job, the job file must be stored on the camera flash disk.

Syntax

```
CamStartLoadJob
[ Camera ':'= ' ] < variable (VAR) of cameradev > ', '
[ Name ':'= ' ] <expression (IN) of string >
[ '\KeepTargets ]';'
```

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>
CamWaitLoadJob	CamWaitLoadJob – Wait until a camera task is loaded on page 74
CamStartSetParameter	CamStartSetParameter - Start the set-operation of a parameter setting on page 71

1.26 CamStartSetParameter - Start the set-operation of a parameter setting

Integrated Vision

1.26 CamStartSetParameter - Start the set-operation of a parameter setting

Usage

CamStartSetParameter is used to start the set-operation of a parameter setting in the camera. When the set-operation is in progress other RAPID instructions and functions can be executed in parallel. The camera will be busy running the set parameter-operation and will not perform any other request before this operation is completed with CamWaitSetParameter.

Basic examples

The following examples illustrate the instruction CamStartSetParameter.

Example 1

```
CamStartSetParameter mycamera, "Pattern_1.Tool_Enabled"
    \BoolVal:=FALSE;
MoveL p1, v1000, fine, tool2;
CamWaitSetParameter mycamera;
```

First a parameter setting is ordered, and while the setting is performed, a movement to position p1 is done. When the movement is ready, and the setting of the parameter is ready, the RAPID execution continues.

Example 2

```
CamStartSetParameter mycamera,
    "Pattern_1.Description"\StrVal:="mydescription";
CamStartSetParameter mycamera,
    "Pattern_1.Rotation_Tolerance"\NumVal:=15;
MoveL p1, v1000, fine, tool2;
CamWaitSetParameter mycamera;
CamWaitSetParameter mycamera;
```

Order two settings of parameters and during the time those are handled a movement is performed. The two CamStartSetParameter instructions must be matched with two CamWaitSetParameter instructions to be able to perform any other request against the camera.

Arguments

```
CamStartSetParameter Camera ParName [\NumVal] | [\BoolVal] |
    [\StrVal]
```

Camera

Data type: cameradev
The name of the camera.

ParName

Data type: string
The name of the parameter in the camera.

[\NumVal]

Data type: num

Continues on next page

1 Instructions

1.26 CamStartSetParameter - Start the set-operation of a parameter setting

Integrated Vision

Continued

The numeric value to set for the camera parameter with the name set in argument ParName.

[\BoolVal]

Data type: bool

The boolean value to set for the camera parameter with the name set in argument ParName.

[\StrVal]

Data type: string

The string value to set for the camera parameter with the name set in argument ParName.

Program execution

CamStartSetParameter will start the set-operation of a parameter in the camera. When the set operation is in progress, other RAPID instructions and functions can be executed in parallel.

The camera will be busy running the set parameter operation and will not perform any other request before this operation is completed with CamWaitSetParameter. Every CamStartSetParameter instruction must be matched with a corresponding CamWaitSetParameter instruction.

With multiple queued StartSetParameter requests, then the corresponding WaitSetParameter will reflect the same order as the for the request and thus return the status for that StartSetParameter.



Note

User defined parameters in the camera have to be associated with one of the following camera functions:

- EditFloat
- EditInt
- EditString

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_CAM_BUSY	The camera is busy with some other request and cannot perform the current order.
ERR_CAM_NOT_ON_NETWORK	The camera is not connected.
ERR_CAM_NO_PROGMODE	The camera is not in program mode.

Limitations

The controller can have 10 pending CamStartSetParameter operations. When the controller has 10 pending requests, all the requests have to be confirmed with CamWaitSetParameter instructions before any new CamStartSetParameter is ordered.

Continues on next page

1.26 CamStartSetParameter - Start the set-operation of a parameter setting

Integrated Vision
Continued

Syntax

```
CamStartSetParameter
[ Camera ':' ] < variable (VAR) of cameradev > ','
[ ParName ':' ] < expression (IN) of string >
[ '\NumVal ':' < expression (IN) of num > ]
| [ '\BoolVal ':' < expression (IN) of bool > ]
| [ '\StrVal ':' < expression (IN) of string > ] ';'

```

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>
CamWaitSetParameter	CamWaitSetParameter - Wait until a set-operation is ready on page 76
CamSetParameter	CamSetParameter - Set different named camera parameters on page 65

1 Instructions

1.27 CamWaitLoadJob – Wait until a camera task is loaded

Integrated Vision

1.27 CamWaitLoadJob – Wait until a camera task is loaded

Usage

CamWaitLoadJob (*Camera Wait Load Job*) will wait until the loading of a job into a camera is ready.

Basic examples

The following example illustrates the instruction CamWaitLoadJob.

Example 1

```
...
CamStartLoadJob mycamera, "myjob.job";
MoveL p1, v1000, fine, tool2;
CamWaitLoadJob mycamera;
CamSetRunMode mycamera;
CamReqImage mycamera;
...
```

First a job loading is started to the camera, and while the loading is proceeding, a movement to position p1 is done. When the movement is ready, and the loading has finished, an image is acquired.

Arguments

CamWaitLoadJob Camera

Camera

Data type: cameradev

The name of the camera.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CAM_COM_TIMEOUT	Communication error with camera. The camera is probably disconnected.
ERR_CAM_NOT_ON_NETWORK	The camera is not connected
ERR_CAM_NOT_VALID_LOAD_JOB	The loaded job is not a valid job, the name is too long or has invalid characters, or the camera is not in program mode

Limitations

It is only possible to execute CamWaitLoadJob when the camera is set in program mode. Use instruction CamSetProgramMode to set the camera in program mode. When an ongoing load of a job is executing, it is not possible to access that specific camera with any other instruction or function. The following camera instruction or function must be a CamWaitLoadJob instruction.

Continues on next page

1.27 CamWaitLoadJob – Wait until a camera task is loaded

Integrated Vision

Continued

Syntax

CamWaitLoadJob

[Camera ':= '] < variable (VAR) of cameradev > ';' ;

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>
CamStartLoadJob	CamStartLoadJob - Start load of a camera task into a camera on page 69

1 Instructions

1.28 CamWaitSetParameter - Wait until a set-operation is ready

Integrated Vision

1.28 CamWaitSetParameter - Wait until a set-operation is ready

Usage

CamWaitSetParameter will wait until the set-operation of the parameter is done in the camera and return with status.

Basic examples

The following example illustrates the instruction CamWaitSetParameter.

Example 1

```
CamStartSetParameter mycamera, "Pattern_1.Tool_Enabled"  
  \BoolVal:=FALSE;  
MoveL p1, v1000, fine, tool2;  
CamWaitSetParameter mycamera;
```

First a parameter setting is ordered, and while the setting is performed, a movement to position p1 is done. When the movement is ready, and the setting of the parameter is ready, the RAPID execution continues.

Arguments

CamWaitSetParameter Camera

Camera

Data type: cameradev

The name of the camera.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_CAM_BUSY	The camera is busy with some other request and cannot perform the current order.
ERR_CAM_COM_TIMEOUT	Communication error with camera. The camera is probably disconnected.
ERR_CAM_NOT_ON_NETWORK	The camera is not connected.
ERR_CAM_NO_START_SET_PARAMETER	There is no ongoing request to set a parameter to camera.
ERR_CAM_SET_MISMATCH	The parameter written to the camera with instruction CamSetParameter has the wrong datatype, or the value is out of range.
ERR_CAM_SET_PARAMETER_REJECTED	The preceding instruction failed and also caused the setting of parameter to fail for the camera.

Syntax

```
CamWaitSetParameter  
  [ Camera ':= ' ] < variable (VAR) of cameradev > ';' ;
```

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

Continues on next page

1.28 CamWaitSetParameter - Wait until a set-operation is ready

Integrated Vision

Continued

For information about	See
CamStartSetParameter	CamStartSetParameter - Start the set-operation of a parameter setting on page 71

1 Instructions

1.29 CancelLoad - Cancel loading of a module *RobotWare Base*

1.29 CancelLoad - Cancel loading of a module

Usage

CancelLoad can be used to cancel the loading operation generated from the instruction StartLoad.

CancelLoad can only be used between the instruction StartLoad and WaitLoad.

Basic examples

The following example illustrates the instruction CancelLoad:

See also [More examples on page 78](#).

Example1

```
CancelLoad load1;
```

The load session load1 is cancelled.

Arguments

CancelLoad LoadNo

LoadNo

Data type: loadsession

Reference to the load session, created by the instruction StartLoad.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_LOADNO_NOUSE	The variable specified in argument LoadNo is not in use, meaning that no load session is in use.

More examples

More examples of how to use the instruction CancelLoad are illustrated below.

Example 1

```
VAR loadsession load1;

StartLoad "HOME:"\File:="PART_B.modx", load1;
...
IF ...
    CancelLoad load1;
    StartLoad "HOME:"\File:="PART_C.modx", load1;
ENDIF
...
WaitLoad load1;
```

The instruction CancelLoad will cancel the ongoing loading of the module PART_B.modx and instead make it possible to load PART_C.modx.

Continues on next page

Limitation

CancelLoad can only be used in the sequence after that instruction StartLoad is ready and before instruction WaitLoad is started.

Syntax

```
CancelLoad
[ LoadNo ':= ' ] < variable (VAR) of loadsession >';'
```

Related information

For information about	See
Load a program module during execution	StartLoad - Load a program module during execution on page 759
Connect the loaded module to the task	WaitLoad - Connect the loaded module to the task on page 1031
Load session	loadsession - Program load session on page 1671
Load a program module	Load - Load a program module during execution on page 332
Unload a program module	UnLoad - Unload a program module during execution on page 978
Check program references	CheckProgRef - Check program references on page 127

1 Instructions

1.30 CapAPTrSetupAI - Setup an At-Point-Tracker controlled by analog input signals *Continuous Application Platform*

1.30 CapAPTrSetupAI - Setup an At-Point-Tracker controlled by analog input signals

Usage

CapAPTrSetupAI is used to setup an At-Point-Tracker controlled by analog input signals.

Basic examples

The following example illustrates the instruction CapAPTrSetupAI.

Example 1

```
TASK PERS capdata cData:=[.....];
TASK PERS weavestartdata wsData:=[.....];
TASK PERS capweavedata wData:=[.....];
TASK PERS captrackdata trackData:=["ANALOG_TRACKER",.....];

VAR capaptrreferencedata referenceData:=[2,2,1,1,0.1,0.1];
VAR signalai ai_y;
VAR signalai ai_z;

AliasIO realsignal_y, ai_y;
AliasIO realsignal_z, ai_z;
CapAPTrSetupAI ai_y, ai_z, referenceData;

CapL p1, v200, cData, wsData, wData , fine, tweldGun
  \Track:=trackData;
```

Arguments

```
CapAPTrSetupAI ai_y, ai_z, ReferenceData [\MaxIncrCorr]
[\WarnMaxCorr] [\Filter] [\SampleTime] [\Logfile] [\LogSize]
[\LatestCorr] [\AccCorr]
```

ai_y

Data type: signalai

Analog input signal used as process position for the y-direction.

ai_z

Data type: signalai

Analog input signal used as process position for the z-direction.

ReferenceData

Data type: capaptrreferencedata

Setup data used for the correction regulator loop.

MaxIncrCorr

Data type: num

Maximum incremental correction allowed (in mm).

If the incremental TCP correction is larger than \MaxIncrCorr and \WarnMaxCorr, the robot will continue its path but the applied incremental correction will not exceed

Continues on next page

1.30 CapAPTrSetupAI - Setup an At-Point-Tracker controlled by analog input signals

Continuous Application Platform
Continued

\MaxIncCorr. If \WarnMaxCorr is not specified, a track error is reported and the program execution is stopped.

WarnMaxCorr

Data type: switch

If this switch is present the program execution is not interrupted when the limit for maximum correction is exceeded, specified in \MaxIncCorr. Only a warning is sent.

Filter

Data type: num

Size of the reference sample data filter. A value between 1 and 15 is allowed, the default value is 1.

SampleTime

Data type: num

Sample time in milliseconds for the correction loop. The value is rounded to a multiple of 24. The minimum value allowed is 24, and the default value is 24.

LogFile

Data type: string

The name of the tracklog log file. The log file is placed in the HOME directory of the system.

LogSize

Data type: num

The size of the tracklog ring buffer that is the number of sensor measurements that can be buffered during tracking.

Default value: 1000.

LatestCorr

Data type: pos

Size of the latest added correction (in mm).

AccCorr

Data type: pos

Size of the total accumulated correction added (in mm).

Syntax

```
CapAPTrSetupAI
[aoi_y ':='] <expression (IN) of signalai> ',',
[ai_z ':='] <expression (IN) of signalai> ',',
[ReferenceData ':='] <expression (IN) of capaptrreferencedata>
',',
[\MaxIncrCorr ':='] <expression (IN) of num> ',',
[\WarnMaxCorr ':='] <expression (IN) of switch> ',',
[\Filter ':='] <expression (IN) of num> ',',
[\SampleTime ':='] <expression (IN) of num> ',',
[\LogFile ':='] <expression (IN) of string> ',',
```

Continues on next page

1 Instructions

1.30 CapAPTrSetupAI - Setup an At-Point-Tracker controlled by analog input signals

Continuous Application Platform

Continued

```
[\\LogSize ':='] <expression (IN) of num> ','  
[\\LatestCorr ':='] <expression (PERS) of pos> ','  
[\\AccCorr ':='] <expression (PERS) of pos> ';' ;
```

Related information

For information about	See
Instruction CapAPTrSetupAO	CapAPTrSetupAO - Setup an At-Point-Tracker controlled by analog output signals on page 83
Instruction CapAPTrSetupPERS	CapAPTrSetupPERS - Setup an At-Point-Tracker controlled by persistent variables on page 86
Data type capaptrreferencedata	capaptrreferencedata - Variable setup data for At-Point-Tracker on page 1603
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
<i>Sensor Interface</i>	<i>Application manual - Controller software Omni-Core</i>

1.31 CapAPTrSetupAO - Setup an At-Point-Tracker controlled by analog output signals

Continuous Application Platform

1.31 CapAPTrSetupAO - Setup an At-Point-Tracker controlled by analog output signals

Usage

CapAPTrSetupAO is used to setup an At-Point-Tracker controlled by analog output signals.

Basic examples

The following example illustrates the instruction CapAPTrSetupAO.

Example 1

```
TASK PERS capdata cData:=[.....];
TASK PERS weavestartdata wsData:=[.....];
TASK PERS capweavedata wData:=[.....];
TASK PERS captrackdata trackData:=["ANALOG_TRACKER",.....];

VAR capaptrreferencedata referenceData:=[2,2,1,1,0.1,0.1];
VAR signalao ao_y;
VAR signalao ao_z;

AliasIO realsignal_y, ao_y;
AliasIO realsignal_z, ao_z;
CapAPTrSetupAO ao_y, ao_z, referenceData;

CapL p1, v200, cData, wsData, wData , fine, tweldGun
\Track:=trackData;
```

Arguments

```
CapAPTrSetupAO ao_y, ao_z, ReferenceData [\MaxIncrCorr]
[\WarnMaxCorr] [\Filter] [\SampleTime] [\Logfile] [\LogSize]
[\LatestCorr] [\AccCorr]
```

ao_y

Data type: signalao

Analog output signal used as process position for the y-direction.

ao_z

Data type: signalao

Analog output signal used as process position for the z-direction.

ReferenceData

Data type: capaptrreferencedata

Setup data used for the correction regulator loop.

MaxIncrCorr

Data type: num

Maximum incremental correction allowed (in mm).

If the incremental TCP correction is larger than \MaxIncrCorr and \WarnMaxCorr, the robot will continue its path but the applied incremental correction will not exceed

Continues on next page

1 Instructions

1.31 CapAPTrSetupAO - Setup an At-Point-Tracker controlled by analog output signals

Continuous Application Platform

Continued

\MaxIncrCorr. If \WarnMaxCorr is not specified, a track error is reported and the program execution is stopped.

WarnMaxCorr

Data type: switch

If this switch is present the program execution is not interrupted when the limit for maximum correction is exceeded, specified in \MaxIncrCorr. Only a warning is sent.

Filter

Data type: num

Size of the reference sample data filter. A value between 1 and 15 is allowed, the default value is 1.

SampleTime

Data type: num

Sample time in milliseconds for the correction loop. The value is rounded to a multiple of 24. The minimum value allowed is 24, and the default value is 24.

LogFile

Data type: string

The name of the tracklog log file. The log file is placed in the HOME directory of the system.

LogSize

Data type: num

The size of the tracklog ring buffer that is the number of sensor measurements that can be buffered during tracking.

Default value: 1000.

LatestCorr

Data type: pos

Size of the latest added correction (in mm).

AccCorr

Data type: pos

Size of the total accumulated correction added (in mm).

Syntax

```
CapAPTrSetupAO
[ao_y ':='] <expression (IN) of signalao> ',',
[ao_z ':='] <expression (IN) of signalao> ',',
[ReferenceData ':='] <expression (IN) of capaptrreferencedata>
',',
[\MaxIncrCorr ':='] <expression (IN) of num> ',',
[\WarnMaxCorr ':='] <expression (IN) of switch> ',',
[\Filter ':='] <expression (IN) of num> ',',
[\SampleTime ':='] <expression (IN) of num> ',',
[\LogFile ':='] <expression (IN) of string> ',',
```

Continues on next page

1.31 CapAPTrSetupAO - Setup an At-Point-Tracker controlled by analog output signals

*Continuous Application Platform**Continued*

```

[\LogSize ':='] <expression (IN) of num> ', '
[\LatestCorr ':='] <expression (PERS) of pos> ', '
[\AccCorr ':='] <expression (PERS) of pos> '; '

```

Related information

For information about	See
Instruction CapAPTrSetupAI	CapAPTrSetupAI - Setup an At-Point-Tracker controlled by analog input signals on page 80
Instruction CapAPTrSetupPERS	CapAPTrSetupPERS - Setup an At-Point-Tracker controlled by persistent variables on page 86
Data type capaptrreferencedata	capaptrreferencedata - Variable setup data for At-Point-Tracker on page 1603
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
<i>Sensor Interface</i>	<i>Application manual - Controller software Omni-Core</i>

1 Instructions

1.32 CapAPTrSetupPERS - Setup an At-Point-Tracker controlled by persistent variables *Continuous Application Platform*

1.32 CapAPTrSetupPERS - Setup an At-Point-Tracker controlled by persistent variables

Usage

CapAPTrSetupPERS is used to setup an At-Point-Tracker controlled by persistent variables.

Basic examples

The following example illustrates the instruction CapAPTrSetupPERS.

Example 1

```
TASK PERS capdata cData:=[.....];
TASK PERS weavestartdata wsData:=[.....];
TASK PERS capweavedata wData:=[.....];
TASK PERS captrackdata trackData:=["ANALOG_TRACKER",.....];
PERS pos corr:=[0,-0.05,-0.025];

VAR capaptrreferencedata referenceData:=[2,2,1,1,0.1,0.1];

main()
IDelete intno1;
CONNECT intno1 WITH trOffset;
CapAPTRSetupPERS corr.y, corr.z, referenceData;

ITimer 1,intno1;
CapL p1, v200, cData, wsData, wData , fine,
      tWeldGun\Track:=trackData;
ENDPROC

TRAP trOffset
  corr.y := referenceData.reference_y +- .....;
  corr.z := referenceData.reference_z +- .....;
ENDTRAP
```

Arguments

CapAPTrSetupPERS var_y, var_z, ReferenceData [\ResetToReference]
[\MaxIncrCorr] [\WarnMaxCorr] [\Filter] [\SampleTime]
[\Logfile] [\LogSize] [\LatestCorr] [\AccCorr]

var_y

Data type: num

Persistent data used as process position for the y-direction.

var_z

Data type: signalai

Persistent data used as process position for the z-direction.

ReferenceData

Data type: capaptrreferencedata

Setup data used for the correction regulator loop.

Continues on next page

1.32 CapAPTrSetupPERS - Setup an At-Point-Tracker controlled by persistent variables
Continuous Application Platform
Continued

`[\ResetToReference]`

Data type: switch

This switch enables resetting the value of the persistent correction data `var_y` and `var_z` to the reference value. If `var_y` and `var_z` are updated at low frequency, for example, using RAPID code, this switch is used to avoid drifting of the path correction.

`MaxIncCorr`

Data type: num

Maximum incremental correction allowed (in mm).

If the incremental TCP correction is larger than `\MaxIncCorr` and `\WarnMaxCorr`, the robot will continue its path but the applied incremental correction will not exceed `\MaxIncCorr`. If `\WarnMaxCorr` is not specified, a track error is reported and the program execution is stopped.

`WarnMaxCorr`

Data type: switch

If this switch is present the program execution is not interrupted when the limit for maximum correction is exceeded, specified in `\MaxIncCorr`. Only a warning is sent.

`Filter`

Data type: num

Size of the reference sample data filter. A value between 1 and 15 is allowed, the default value is 1.

`SampleTime`

Data type: num

Sample time in milliseconds for the correction loop. The value is rounded to a multiple of 24. The minimum value allowed is 24, and the default value is 24.

`LogFile`

Data type: string

The name of the tracklog log file. The log file is placed in the HOME directory of the system.

`LogSize`

Data type: num

The size of the tracklog ring buffer that is the number of sensor measurements that can be buffered during tracking.

Default value: 1000.

`LatestCorr`

Data type: pos

Size of the latest added correction (in mm).

`AccCorr`

Data type: pos

Continues on next page

1 Instructions

1.32 CapAPTrSetupPERS - Setup an At-Point-Tracker controlled by persistent variables

Continuous Application Platform

Continued

Size of the total accumulated correction added (in mm).

Syntax

```
CapAPTrSetupPERS
[var_y ':='] <expression (PERS) of num> ',',
[var_z ':='] <expression (PERS) of vnum> ',',
[ReferenceData ':='] <expression (IN) of capaptrreferencedata>
', '
[\ResetToReference ':='] <expression (IN) of switch> ',',
[\MaxIncrCorr ':='] <expression (IN) of num> ',',
[\WarnMaxCorr ':='] <expression (IN) of switch> ',',
[\Filter ':='] <expression (IN) of num> ',',
[\SampleTime ':='] <expression (IN) of num> ',',
[\LogFile ':='] <expression (IN) of string> ',',
[\LogSize ':='] <expression (IN) of num> ',',
[\LatestCorr ':='] <expression (PERS) of pos> ',',
[\AccCorr ':='] <expression (PERS) of pos> ';'
```

Related information

For information about	See
Instruction CapAPTrSetupAI	CapAPTrSetupAI - Setup an At-Point-Tracker controlled by analog input signals on page 80
Instruction CapAPTrSetupAO	CapAPTrSetupAO - Setup an At-Point-Tracker controlled by analog output signals on page 83
Data type capaptrreferencedata	capaptrreferencedata - Variable setup data for At-Point-Tracker on page 1603
Continuous Application Platform	Application manual - Continuous Application Platform
Sensor Interface	Application manual - Controller software Omni-Core

1.33 CapC - Circular CAP movement instruction

Usage

CapC is used to move the tool center point (TCP) along a circular path to a given destination and at the same time control a continuous process. Furthermore it is possible to connect up to eight events to CapC. The events are defined using the instructions TriggRampAO, TriggIO, TriggEquip, TriggInt, TriggCheckIO, or TriggSpeed.

Basic examples

Example 1

Circular movements with CapC.

```
CapC cirp, p1, v100, cdata, weavestart, weave, fine, gun1;
```

The TCP of the tool, gun1, is moved circularly to the fine point p1 with speed defined in cdata.

Example 2

Circular movement with user event and CAP event.

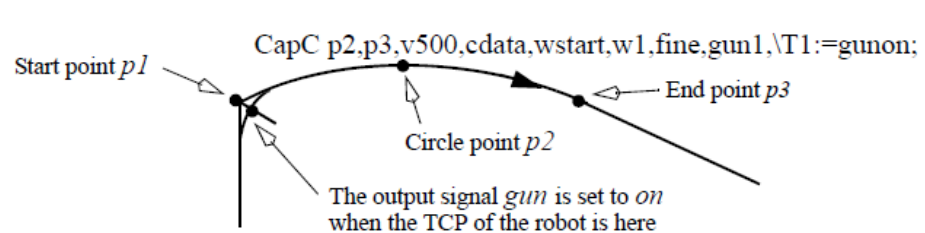
```
VAR intnum start_intno;
...
PROC main()
  VAR trigdata gunon;

  IDelete start_intno;
  CONNECT start_intno WITH start_trap;
  ICap start_intno, CAP_START;
  TriggIO gunon, 0 \Start \D0p:=gun, on;

  MoveJ p1, v500, z50, gun1;
  CapC p2,p3,v500,cdata,wstart,w1,fine,gun1,\T1:=gunon;
ENDPROC
```

```
TRAP start_trap
  ! This routine will be executed when the event CAP_START is
  reported
ENDTRAP
```

The digital output signal gun is set when the robot's TCP passes the midpoint of the corner path of the point p1. The trap routine start_trap is executed when the CAP process is starting.



xx1200000174

Continues on next page

1 Instructions

1.33 CapC - Circular CAP movement instruction

*C*ontinuous Application Platform

Continued

Arguments

CapC Cirpoint ToPoint [**Id] Speed Cdata [**MoveStartTimer] Weavestart
Weave Zone [**Inpos] Tool [**WObj] [**Corr] [**Time] [**T1]
[**TriggArray] [**T2] [**T3] [**T4] [**T5] [**T6] [**T7] [**T8]
[**TLoad]

CirPoint

Data type: robtarget

The circle point of the robot. The circle point is a position on the circle between the start point and the destination point. To obtain the best accuracy it should be placed about halfway between the start and destination points. If it is placed too close to the start or destination point, the robot may give a warning. The circle point is defined as a named position or stored directly in the instruction (marked with an * in the instruction). The position of the external axes are not used.

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[**ID]

Synchronization id

Data type: identno

The argument [**ID] is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

Cdata

(CAP process Data)

Data type: capdata

CAP process data, see [capdata - CAP data on page 1605](#) for a detailed description.

[**Movestart_timer]

(Time in s)

Data type: num

Upper limit for the time difference between the order of the process start and the actual start of the robot's TCP movement in a MultiMove system in synchronized mode.

Weavestart

(Weavestart Data)

Continues on next page

Data type: weavestartdata

Weave start data for the CAP process, see [weavestartdata - weave start data on page 1773](#) for a detailed description.

Weave

(Weave Data)

Data type: capweavedata

Weaving data for the CAP process, see [capweavedata - Weavedata for CAP on page 1609](#) for a detailed description.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Inpos]

In position

Data type: stoppoint data

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[\WObj]

Work Object

Data type: wobjdata

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used this argument must be specified in order for a circle relative to the work object to be executed.

[\Corr]

Correction

Data type: switch

Correction data written to a corrections entry by the instruction CorrWrite will be added to the path and destination position if this argument is present.

The RobotWare option *Path Corrections* is required when using this argument.

[\Time]

Data type: num

Continues on next page

1 Instructions

1.33 CapC - Circular CAP movement instruction

*C*ontinuous Application Platform

Continued

This argument is used to specify the total time in seconds during which the robot and additional axes move. It is then substituted for the corresponding speed data.

[\T1]

Trigg 1

Data type: trigndata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

TriggArray

Trigg Data Array Parameter

Data type: trigndata

Array variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggSpeed, TriggCheckIO, or TriggRampA0.

The limitation is 25 elements in the array and 1 to 25 defined trigger conditions must be defined.

It is not possible to use the optional arguments T2, T3, T4, T5, T6, T7, or T8 at the same time as the TriggArray argument is used.

[\T2]

Trigg 2

Data type: trigndata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T3]

Trigg 3

Data type: trigndata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T4]

Trigg 4

Data type: trigndata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T5]

Trigg 5

Data type: trigndata

Continues on next page

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T6]

Trigg 6

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T8]

Trigg 8

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T8]

Trigg 8

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.

Continues on next page

1 Instructions

1.33 CapC - Circular CAP movement instruction

CContinuous Application Platform

Continued



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See [MoveL - Moves the robot linearly on page 457](#) for information about linear movement.

See [TriggL - Linear robot movements with events on page 902](#) for information about linear movement with trigg events.

Error handling

There are several different types of errors that can be handled in the error handler for the CapC/CapL instructions:

- supervision errors
- sensor specific errors
- errors specific to a MultiMove system
- errors inherited from TriggX functionality
- other CAP errors

If one of the signals that is supposed to be supervised does not have the correct value, or if it changes value during supervision, the system variable ERRNO is set.

If no values can be read from the track sensor, the system variable ERRNO is set.

For a MultiMove system running in synchronized mode the error handler must take care of two other errors. One is used to report that some other application has detected a recoverable error. This enables recoverable error handling in synchronized RAPID tasks. The other error, CAP_MOV_WATCHDOG, is reported if the time between the order of the process start and the actual start of the robot's TCP movement in a MultiMove system in synchronized mode expires. The time used is specified in the optional parameter Movestart_timer in the CapC instruction.

If anything abnormal is detected, program execution will stop. If, however, an error handler is programmed, the errors defined below can be remedied without stopping production. However, a recommendation is that some of the errors (the errors with CAP_XX) these errors should not be presented for the end user. Map those errors to a application specific error. For the supervision errors the instruction CapGetFailSigs can be used to get which specific signal that failed.

Supervision errors

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

CAP_START_PRE_ERR	This error occurs when there is an error in the START_PRE supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in pre_cond time-out).

Continues on next page

1.33 CapC - Circular CAP movement instruction

*C*Ontinuous *A*pplication *P*latform
Continued

CAP_PRE_ERR	This error occurs when there is an error during the supervision of the PRE phase.
CAP_END_PRE_ERR	This event occurs when there is an error in the END_PRE supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in start_cond time-out).
CAP_START_MAIN_ERR	This event occurs when there is an error in the START_MAIN supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in start_cond time-out).
CAP_MAIN_ERR	This error occurs when there is an error during the supervision of the MAIN phase.
CAP_END_MAIN_ERR	This error occurs when there is an error in the END_MAIN supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in end_main_cond time-out).
CAP_START_POST1_ERR	This event occurs when there is an error in the START_POST1 supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in end_main_cond time-out).
CAP_POST1_ERR	This error occurs when there is an error during the supervision of the POST1 phase.
CAP_END_POST1_ERR	This error occurs when there is an error in the END_POST1 supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in end_main_cond time-out).
CAP_START_POST2_ERR	This event occurs when there is an error in the START_POST1 supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in end_main_cond time-out).
CAP_POST2_ERR	This error occurs when there is an error during the supervision of the POST2 phase.
CAP_END_POST2_ERR	This error occurs when there is an error in the END_POST2 supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in end_main_cond time-out). If supervision is done on two different signals in the same phase, and both of them fails, the first one that is setup with is the one that generates the error. If supervision is done on two different signals in the same phase, and both of them fails, the first one that is setup with CapSetupSupervision is the one that generates the error.

Sensor related errors

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

CAP_TRACK_ERR	Track error occurs when reading data from sensor and after a time no valid data are received. One reason for this could be that the sensor cannot indicate the seam.
CAP_TRACKSTA_ERR	Track start error occurs when no valid data has been read from the laser track sensor.
CAP_TRACKCOR_ERR	Track correction error occurs when something goes wrong in the calculation of the offset.

Continues on next page

1 Instructions

1.33 CapC - Circular CAP movement instruction

Continuous Application Platform

Continued

CAP_TRACKCOM_ERR	The communication between the robot controller and the sensor equipment is broken.
CAP_TRACKPFR_ERR	It is not possible to continue tracking, if a power failure occurred during tracking.
CAP_SEN_NO_MEAS	The controller did not get a valid measurement from sensor.
CAP_SEN_NOREADY	The sensor is not ready yet.
CAP_SEN_GENERRO	A general sensor error occurred.
CAP_SEN_BUSY	The sensor is busy and cannot answer the request.
CAP_SEN_UNKNOWN	The command sent to the sensor is unknown to sensor.
CAP_SEN_ILLEGAL	The variable or block number sent to the sensor is illegal.
CAP_SEN_EXALARM	An external alarm occurred in the sensor.
CAP_SEN_CAALARM	A camera alarm occurred in the sensor.
CAP_SEN_TEMP	The sensor temperature is out of range.
CAP_SEN_VALUE	The value sent to the sensor is out of range.
CAP_SEN_CAMCHECK	The camera check failed.
CAP_SEN_TIMEOUT	The sensor did not respond within the time out time.

Errors possible in MultiMove systems

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_PATH_STOP	When using synchronized motion this error is reported when an application controlling one mechanical unit detects a recoverable error and notifies other applications that something went wrong. If this error code is received from a CapC instruction, the error is a reaction on another error. All tasks using movement instructions in synchronized mode in a MultiMove system should have this ERRNO value defined in the error handler.

Errors inherited from TriggX

The instruction CapC is based on the instruction TriggC. As a consequence you can get and handle the errors ERR_AO_LIM and ERR_DIPLAG_LIM, as in TriggC.

The system variable ERRNO will be set to:

ERR_AO_LIM	If the programmed ScaleValue/SetValue argument for the specified analog output signal AOp/AOutput in some of the connected TriggSpeed/TriggRampAO instructions, results are out of limit for the analog signal together with the programmed Speed in this instruction. The system variable ERRNO is set to ERR_AO_LIM.
ERR_DIPLAG_LIM	If the programmed DipLag argument in some of the connected TriggSpeed instructions, is too big in relation to the used system parameter <i>Event Preset Time</i> , the system variable ERRNO is set to ERR_DIPLAG_LIM.

Continues on next page

Other CAP errors

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

<code>CAP_ATPROC_START</code>	This recoverable error is generated at the end of the first CapC/L instruction of a sequence if the optional argument <code>\PreProcessTracking</code> is used. It can be handled in the error handler to start the process.
<code>CAP_NOPROC_END</code>	This error occurs when the instruction <code>CapNoProcess</code> is used to run a certain distance without application process and the end of this distance is reached. This is not really an error, but it uses the mechanisms of error recovery.
<code>CAP_MOV_WATCHDOG</code>	This error occurs when the switch <code>\Movestart_timer</code> is specified and the time between the process start (<code>MAIN_STARTED</code>) and the start of the robot movement exceeds the time specified with the switch.

CAP process

During continuous execution in both Auto mode and Manual mode, the CAP process is running, unless it is blocked. That means, that all data controlling the CAP process (that is, `Cdata`, `Weavestart`, `Weave` and `Movestart_timer`), are used. In these modes all CAP trigger activities are carried out, see [ICap - connect CAP events to trap routines on page 243](#).

In all other execution modes the CAP process is not running, and the CapC instruction behaves like a MoveC instruction.

Trigger conditions `[T1]` to `[T8]` and `[TriggArray]`

As the trigger conditions are fulfilled when the robot is positioned closer and closer to the end point, the defined trigger activities are carried out. The trigger conditions are fulfilled either at a certain distance before the end point of the instruction, or at a certain distance after the start point of the instruction, or at a certain point in time (limited to a short time) before the end point of the instruction.

During stepping execution forwards, the I/O activities are carried out but the interrupt routines are not run. During stepping execution backwards, no trigger activities at all are carried out.

Continues on next page

1 Instructions

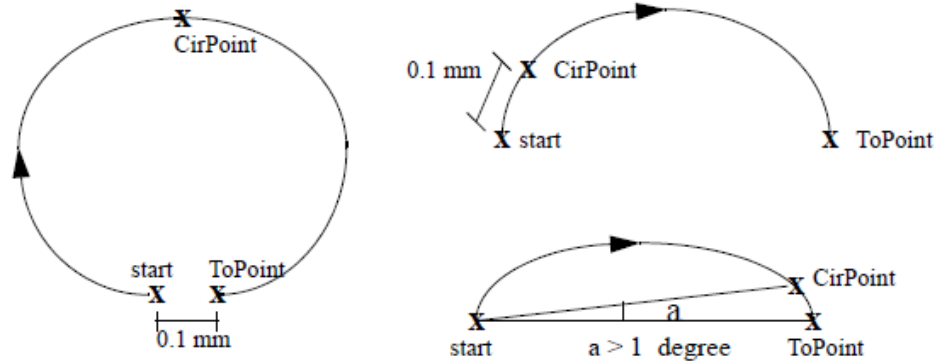
1.33 CapC - Circular CAP movement instruction

Continuous Application Platform

Continued

Limitations

There are some limitations in how the *CirPoint* and the *ToPoint* can be placed, as shown in the figure below.



xx1200000175

- Minimum distance between start and ToPoint is 0.1 mm.
- Minimum distance between start and CirPoint is 0.1 mm.
- Minimum angle between CirPoint and ToPoint from the start point is 1 degree.

The accuracy can be poor near the limits, for example, if the start point and the ToPoint on the circle are close to each other, the fault caused by the leaning of the circle can be much greater than the accuracy with which the points have been programmed.

A change of execution mode from forward to backward or vice versa, while the robot is stopped on a circular path, is not permitted and will result in an error message.

The instruction CapC (or any other instruction including circular movement) should never be started from the beginning, with TCP between the circle point and the end point. Otherwise the robot will not take the programmed path (positioning around the circular path in another direction compared with that programmed).

Make sure that the robot can reach the circle point during program execution and divide the circle segment if necessary.

If the current start point deviates from the usual, so that the total positioning length of the instruction CapC is shorter than usual, it may happen that several or all of the trigger conditions are fulfilled immediately and at the same position. In such cases, the sequence in which the trigger activities are carried out will be undefined. The program logic in the user program may not be based on a normal sequence of trigger activities for an "incomplete movement".

CapC cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

CapC

```
[CirPoint ':='] < expression (IN) of robtarg >  
[ToPoint ':='] < expression (IN) of robtarg >  
['\ ' Id ':=' < expression (IN) of identno > ] ', '  
[Speed ':='] < expression (IN) of speeddata >
```

Continues on next page

1.33 CapC - Circular CAP movement instruction

*C*ontinuous *A*pplication *P*latform
Continued

```
[Cdata ':='] < persistent (PERS) of capdata >
['\ ' Movestart_timer ':=' < expression (IN) of num > ] ', '
[Weavestart ':='] < persistent (PERS) of weavestartdata >
[Weave ':='] < persistent (PERS) of capweavedata >
[Zone ':='] < expression (IN) of zonedata >
['\ ' Inpos ':=' < expression (IN) of stoppointdata >] ', '
[Tool ':='] < persistent (PERS) of tooldata >
['\ ' WObj ':=' < persistent (PERS) of wobjdata > ]
|[ '\ ' Corr]
['\ ' Time ':=' < expression (IN) of num > ]
['\ ' T1 ':=' < variable (VAR) of triggdata > ]
['\ ' TriggArray ':=' < array variable {*} (VAR) of triggdata >
  ]
['\ ' T2 ':=' < variable (VAR) of triggdata > ]
['\ ' T3 ':=' < variable (VAR) of triggdata > ]
['\ ' T4 ':=' < variable (VAR) of triggdata > ]
['\ ' T5 ':=' < variable (VAR) of triggdata > ]
['\ ' T6 ':=' < variable (VAR) of triggdata > ]
['\ ' T7 ':=' < variable (VAR) of triggdata > ]
['\ ' T8 ':=' < variable (VAR) of triggdata > ]
['\ ' TLoad ':=' < persistent (PERS) of loaddata > ] ';'

```

Related information

For information about	See
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
Circular movement	MoveC - Moves the robot circularly on page 398
Circular movement with triggers	TriggC - Circular robot movement with events on page 858
Definition of CAP data	capdata - CAP data on page 1605
Definition of weave start data	weavestartdata - weave start data on page 1773
Definition of weave data	capweavedata - Weavedata for CAP on page 1609
<i>Path Offset</i>	<i>Application manual - Controller software OmniCore</i>

1 Instructions

1.34 CapEquiDist - Generate equidistant event *Continuous Application Platform*

1.34 CapEquiDist - Generate equidistant event

Usage

CapEquiDist is used to tell CAP to generate an equidistant RAPID event (EQUIDIST) on the CAP path. The first event is generated at the startpoint of the first CAP instruction in a sequence of CAP instructions. From RAPID it is possible to subscribe this event using ICap.

Basic example

```
VAR intnum intno_equi;

PROC main()
    .....
    IDelete intno_equi;
    Connect intno_equi equi_trp;
    ICap intno_equi, EQUIDIST
    .....
    CapEquiDist\Distance:=5.0;
    MoveL p60, v1000, fine, tWeldGun;
    CapL p_fig3_l_1, v500, cd, wsd, cwd, z10, tWeldGun;
    CapL p_fig3_l_2, v500, cd, wsd, cwd, fine, tWeldGun;
    .....
    CapEquiDist\Reset;
    MoveL p70, v1000, fine, tWeldGun;
    CapL p_fig3_l_3, v500, cd, wsd, cwd, fine, tWeldGun;
    .....

    ERROR
        Retry;
ENDPROC

TRAP equi_trp
    ! do whatever you want, but it must not take too long time
ENDTRAP
```

In this example, the event EQUIDIST will be generated on the first CAP path. It will be sent every 5 mm on the path over several CAP instructions with zones.

Arguments

CapEquiDist [\Distance] [\Reset]

[\Distance]

Distance in mm

Data type: num

The data provided with this optional argument defines the distance in mm between two consecutive equidistant events.

[\Reset]

Reset event generation

Continues on next page

1.34 CapEquiDist - Generate equidistant event *Continuous Application Platform* *Continued*

Data type: switch

If this switch is present, the event generation is reset, that is, the equidistant event will not be generated any longer on a CapL/CapC path. This switch has precedence before the \Distance switch.

Limitations

If the CAP path is long compared to the event distance, the system can run out of event resources, and the error message **50368 Too Short distance between equidistant events**.

Syntax

```
CapEquiDist  
  ['\ ' Distance ':=' < expression (IN) of num >]  
  ['\ ' Reset] ';' ;
```

Related information

For information about	See
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>

1 Instructions

1.35 CapInitSupervision - Reset all supervision for CAP *Continuous Application Platform*

1.35 CapInitSupervision - Reset all supervision for CAP

Usage

CapInitSupervision is used to initiate CAP supervision. This means that all supervision lists will be cleared and all I/O subscriptions will be removed.

Example

```
PROC main()  
  CapInitSupervision;  
  CapSetupSupervision diWR_EST, ACT,SUPERV_MAIN;  
  CapSetupSupervision diGA_EST, ACT,SUPERV_MAIN;  
  CapL p2, v100, cdata1, weavestart, weave,fine, tWeldGun;  
ENDPROC
```

CapInitSupervision is used to clear all supervision lists before setting up new supervision.

Limitations

The CapInitSupervision instruction should be executed only once, for example, from the startup shelf.

Syntax

```
CapInitSupervision ';' ;'
```

Related information

For information about	See
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
CapSetupSupervision instruction	CapSetupSupervision - Setup conditions for signal supervision in CAP on page 121
CapRemoveSupervision instruction	CapRemoveSupervision - Remove condition for one signal on page 117

1.36 CapL - Linear CAP movement instruction

Usage

CapL is used to move the tool center point (TCP) linearly to a given destination and at the same time control a continuous process. Furthermore it is possible to connect up to eight events to CapL. The events are defined using the instructions TriggRampAO, TriggIO, TriggEquip, TriggInt, TriggCheckIO, or TriggSpeed.

Basic examples

Example1

Linear movements with CapL.

```
CapL p1, v100, cdata, weavestart, weave, z50, gun1;
```

The TCP of the tool, gun1, is moved linearly to the position p1, with speed defined in cdata, and zone data z50.

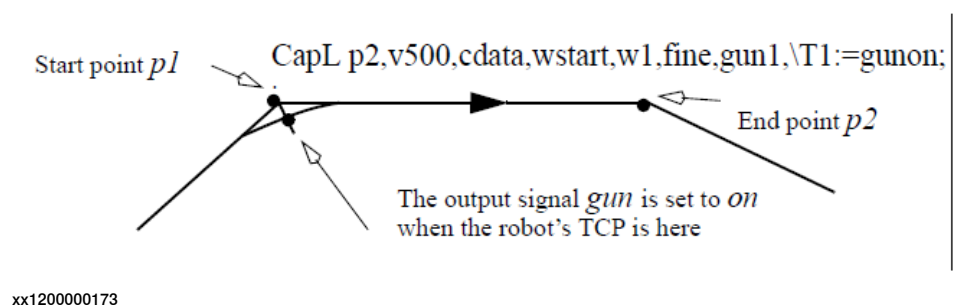
Example 2

Circular movement with user event and CAP event.

```
VAR intnum start_intno;
...
PROC main()
  VAR triggdata gunon;
  IDelete start_intno;
  CONNECT start_intno WITH start_trap;
  ICap start_intno, CAP_START;
  TriggIO gunon, 0 \Start \DOp:=gun, on;
  MoveJ p1, v500, z50, gun1;
  CapL p2, v500, cdata, wstart, w1, fine, gun1 \T1:=gunon;
ENDPROC

TRAP start_trap
  !This routine is executed when event CAP_START arrives
ENDTRAP
```

The digital output signal gun is set when the robot TCP passes the midpoint of the corner path of the point p1. The trap routine start_trap is executed when the CAP process is starting.



Continues on next page

1 Instructions

1.36 CapL - Linear CAP movement instruction

Continuous Application Platform

Continued

Arguments

CapL ToPoint [*\ID*] Speed Cdata [*\MoveStartTimer*] Weavestart Weave
Zone [*\Inpos*] Tool [*\WObj*] [*\Corr*] [*\Time*] [*\T1*] [*\TriggArray*]
[*\T2*] [*\T3*] [*\T4*] [*\T5*] [*\T6*] [*\T7*] [*\T8*] [*\TLoad*]

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[*\ID*]

Synchronization id

Data type: identno

The argument [*\ID*] is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

Cdata

(CAP process Data)

Data type: capdata

CAP process data, see [capdata - CAP data on page 1605](#) for a detailed description.

[*\Movestart_timer*]

(Time in s)

Data type: num

Upper limit for the time difference between the order of the process start and the actual start of the robot's TCP movement in a MultiMove system in synchronized mode.

Weavestart

(Weavestart Data)

Data type: weavestartdata

Weave start data for the CAP process, see [weavestartdata - weave start data on page 1773](#) for a detailed description.

Weave

(Weave Data)

Data type: capweavedata

Weaving data for the CAP process, see [capweavedata - Weavedata for CAP on page 1609](#) for a detailed description.

Continues on next page

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Inpos]

In position

Data type: stoppoint data

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[\Wobj]

Work Object

Data type: wobjdata

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used this argument must be specified in order for a circle relative to the work object to be executed.

[\Corr]

Correction

Data type: switch

Correction data written to a corrections entry by the instruction CorrWrite will be added to the path and destination position if this argument is present.

The RobotWare option *Path Corrections* is required when using this argument.

[\Time]

Data type: num

This argument is used to specify the total time in seconds during which the robot and additional axes move. It is then substituted for the corresponding speed data.

[\T1]

Trigg 1

Data type: trigdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

Continues on next page

1 Instructions

1.36 CapL - Linear CAP movement instruction

Continuous Application Platform

Continued

TriggArray

Trigg Data Array Parameter

Data type: trigndata

Array variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggSpeed, TriggCheckIO, or TriggRampA0.

The limitation is 25 elements in the array and 1 to 25 defined trigger conditions must be defined.

It is not possible to use the optional arguments T2, T3, T4, T5, T6, T7, or T8 at the same time as the TriggArray argument is used.

[\T2]

Trigg 2

Data type: trigndata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T3]

Trigg 3

Data type: trigndata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T4]

Trigg 4

Data type: trigndata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T5]

Trigg 5

Data type: trigndata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T6]

Trigg 6

Data type: trigndata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

Continues on next page

[\T8]

Trigg 8**Data type:** triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T8]

Trigg 8**Data type:** triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\TLoad]

Total load**Data type:** loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.

**Note**

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See [MoveL - Moves the robot linearly on page 457](#) for information about linear movement.

See [TriggL - Linear robot movements with events on page 902](#) for information about linear movement with trigg events.

Continues on next page

1 Instructions

1.36 CapL - Linear CAP movement instruction

Continuous Application Platform

Continued

Error handling

There are several different types of errors that can be handled in the error handler for the CapC/CapL instructions:

- supervision errors
- sensor specific errors
- errors specific to a MultiMove system
- errors inherited from TriggX functionality
- other CAP errors

If one of the signals that is supposed to be supervised does not have the correct value, or if it changes value during supervision, the system variable `ERRNO` is set.

If no values can be read from the track sensor, the system variable `ERRNO` is set.

For a MultiMove system running in synchronized mode the error handler must take care of two other errors. One is used to report that some other application has detected a recoverable error. This enables recoverable error handling in synchronized RAPID tasks. The other error, `CAP_MOV_WATCHDOG`, is reported if the time between the order of the process start and the actual start of the robot's TCP movement in a MultiMove system in synchronized mode expires. The time used is specified in the optional parameter `Movestart_timer` in the CapL instruction.

If anything abnormal is detected, program execution will stop. If, however, an error handler is programmed, the errors defined below can be remedied without stopping production. However, a recommendation is that some of the errors (the errors with `CAP_XX`) these errors should not be presented for the end user. Map those errors to a application specific error. For the supervision errors the instruction `CapGetFailSigs` can be used to get which specific signal that failed.

Supervision errors

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

<code>CAP_START_PRE_ERR</code>	This error occurs when there is an error in the <code>START_PRE</code> supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in <code>pre_cond</code> time-out).
<code>CAP_PRE_ERR</code>	This error occurs when there is an error during the supervision of the PRE phase.
<code>CAP_END_PRE_ERR</code>	This event occurs when there is an error in the <code>END_PRE</code> supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in <code>start_cond</code> time-out).
<code>CAP_START_MAIN_ERR</code>	This event occurs when there is an error in the <code>START_MAIN</code> supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in <code>start_cond</code> time-out).
<code>CAP_MAIN_ERR</code>	This error occurs when there is an error during the supervision of the MAIN phase.

Continues on next page

CAP_END_MAIN_ERR	This error occurs when there is an error in the END_MAIN supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in end_main_cond time-out).
CAP_START_POST1_ERR	This event occurs when there is an error in the START_POST1 supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in end_main_cond time-out).
CAP_POST1_ERR	This error occurs when there is an error during the supervision of the POST1 phase.
CAP_END_POST1_ERR	This error occurs when there is an error in the END_POST1 supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in end_main_cond time-out).
CAP_START_POST2_ERR	This event occurs when there is an error in the START_POST2 supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in end_main_cond time-out).
CAP_POST2_ERR	This error occurs when there is an error during the supervision of the POST2 phase.
CAP_END_POST2_ERR	This error occurs when there is an error in the END_POST2 supervision list, that is, when the conditions in the list are not met within the specified time frame (specified in end_main_cond time-out). If supervision is done on two different signals in the same phase, and both of them fails, the first one that is setup with CapSetupSupervision is the one that generates the error.

Sensor related errors

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

CAP_TRACK_ERR	Track error occurs when reading data from sensor and after a time no valid data are received. One reason for this could be that the sensor cannot indicate the seam.
CAP_TRACKSTA_ERR	Track start error occurs when no valid data has been read from the laser track sensor.
CAP_TRACKCOR_ERR	Track correction error occurs when something goes wrong in the calculation of the offset.
CAP_TRACKCOM_ERR	The communication between the robot controller and the sensor equipment is broken.
CAP_TRACKPFR_ERR	It is not possible to continue tracking, if a power failure occurred during tracking.
CAP_SEN_NO_MEAS	The controller did not get a valid measurement from sensor.
CAP_SEN_NOREADY	The sensor is not ready yet.
CAP_SEN_GENERRO	A general sensor error occurred.
CAP_SEN_BUSY	The sensor is busy and cannot answer the request.
CAP_SEN_UNKNOWN	The command sent to the sensor is unknown to sensor.
CAP_SEN_ILLEGAL	The variable or block number sent to the sensor is illegal.
CAP_SEN_EXALARM	An external alarm occurred in the sensor.
CAP_SEN_CAALARM	A camera alarm occurred in the sensor.

Continues on next page

1 Instructions

1.36 CapL - Linear CAP movement instruction

Continuous Application Platform

Continued

CAP_SEN_TEMP	The sensor temperature is out of range.
CAP_SEN_VALUE	The value sent to the sensor is out of range.
CAP_SEN_CAMCHECK	The camera check failed.
CAP_SEN_TIMEOUT	The sensor did not respond within the time out time.

Errors possible in MultiMove systems

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_PATH_STOP	When using synchronized motion this error is reported when an application controlling one mechanical unit detects a recoverable error and notifies other applications that something went wrong. If this error code is received from a CapL instruction, the error is a reaction on another error. All tasks using movement instructions in synchronized mode in a MultiMove system should have this ERRNO value defined in the error handler.

Errors inherited from TriggX

The instruction CapL is based on the instruction TriggL. As a consequence you can get and handle the errors ERR_AO_LIM and ERR_DIPLAG_LIM, as in TriggL.

The system variable ERRNO will be set to:

ERR_AO_LIM	If the programmed ScaleValue/SetValue argument for the specified analog output signal AO _p /AO _{output} in some of the connected TriggSpeed/TriggRampAO instructions, results are out of limit for the analog signal together with the programmed Speed in this instruction. The system variable ERRNO is set to ERR_AO_LIM.
ERR_DIPLAG_LIM	If the programmed DipLag argument in some of the connected TriggSpeed instructions, is too big in relation to the used system parameter <i>Event Preset Time</i> , the system variable ERRNO is set to ERR_DIPLAG_LIM.

Other CAP errors

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

CAP_ATPROC_START	This recoverable error is generated at the end of the first CapC/L instruction of a sequence if the optional argument \PreProcessTracking is used. It can be handled in the error handler to start the process.
CAP_NOPROC_END	This error occurs when the instruction CapNoProcess is used to run a certain distance without application process and the end of this distance is reached. This is not really an error, but it uses the mechanisms of error recovery.
CAP_MOV_WATCHDOG	This error occurs when the switch \Movestart_timer is specified and the time between the process start (MAIN_STARTED) and the start of the robot movement exceeds the time specified with the switch.

CAP process

During continuous execution in both Auto mode and Manual mode, the CAP process is running, unless it is blocked. That means, that all data controlling the CAP process (that is, Cdata, Weavestart, Weave and Movestart_timer), are used.

Continues on next page

In these modes all CAP trigger activities are carried out, see [ICap - connect CAP events to trap routines on page 243](#).

In all other execution modes the CAP process is not running, and the CapL instruction behaves like a MoveL instruction.

Trigger conditions [T1] to [T8] and [TriggArray]

As the trigger conditions are fulfilled when the robot is positioned closer and closer to the end point, the defined trigger activities are carried out. The trigger conditions are fulfilled either at a certain distance before the end point of the instruction, or at a certain distance after the start point of the instruction, or at a certain point in time (limited to a short time) before the end point of the instruction.

During stepping execution forwards, the I/O activities are carried out but the interrupt routines are not run. During stepping execution backwards, no trigger activities at all are carried out.

Limitations

If the current start point deviates from the usual, so that the total positioning length of the instruction CapL is shorter than usual (for example, at the start of CapL with the robot position at the end point), it may happen that several or all of the trigger conditions are fulfilled immediately and at the same position. In such cases, the sequence in which the trigger activities are carried out will be undefined. The program logic in the user program may not be based on a normal sequence of trigger activities for an "incomplete movement".

The behavior of the CAP process may be undefined if an error occurs during CapL or CapC instructions with extremely short TCP movements (< 1 mm).

CapL cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

CapL

```
[ToPoint ':='] < expression (IN) of robtarget >
['\ ' Id ':='] < expression (IN) of identno >] ', '
[Speed ':='] < expression (IN) of speeddata > ', '
[Cdata ':='] < persistent (PERS) of capdata >
['\ ' Movestart_timer ':='] < expression (IN) of num >] ', '
[Weavestart ':='] < persistent (PERS) of weavestartdata > ', '
[Weave ':='] < persistent (PERS) of capweavedata > ', '
[Zone ':='] < expression (IN) of zonedata >
['\ ' Inpos ':='] < expression (IN) of stoppointdata >] ', '
[Tool ':='] < persistent (PERS) of tooldata >
['\ ' Wobj ':='] < persistent (PERS) of wobjdata >]
|[ '\ ' Corr]
['\ ' Time ':='] < expression (IN) of num > ]
['\ ' T1 ':='] < variable (VAR) of triggdata > ]
['\ ' TriggArray ':='] < array variable {*} (VAR) of triggdata >
]
['\ ' T2 ':='] < variable (VAR) of triggdata > ]
['\ ' T3 ':='] < variable (VAR) of triggdata > ]
```

Continues on next page

1 Instructions

1.36 CapL - Linear CAP movement instruction

Continuous Application Platform

Continued

```
['\ ' T4 ':=' < variable (VAR) of triggdata >]  
['\ ' T5 ':=' < variable (VAR) of triggdata >]  
['\ ' T6 ':=' < variable (VAR) of triggdata >]  
['\ ' T7 ':=' < variable (VAR) of triggdata >]  
['\ ' T8 ':=' < variable (VAR) of triggdata >]  
['\ ' TLoad':=' < persistent (PERS) of loaddata >] ';' ;
```

Related information

For information about	See
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
Linear movement	MoveL - Moves the robot linearly on page 457
Linear movement with triggers	TriggL - Linear robot movements with events on page 902
Definition of CAP data	capdata - CAP data on page 1605
Definition of weave start data	weavestartdata - weave start data on page 1773
Definition of weave data	capweavedata - Weavedata for CAP on page 1609
<i>Path Offset</i>	<i>Application manual - Controller software OmniCore</i>

1.37 CapNoProcess - Run CAP without process

Usage

CapNoProcess is used to run CAP a certain distance without process.

With CapNoProcess, it is possible to tell CAP to execute a certain distance (in mm) without process. This is useful, if there was a recoverable process error, which in some way makes it impossible to restart the process at the error location.

In the beginning and at the end of the skip distance, backing on the path (restart_dist component in capdata) is suppressed.

At the end of the skip distance a error with errno CAP_NOPROC_END is generated.

Basic example

```

VAR num skip_dist := 0.0;
VAR bool cap_skip := FALSE;

PROC main()
    .....
    skip_dist := 25.0;
    CapL p_fig3_l_1, v500, cd, wsd, cwd, fine, tweldGun;
    .....
    skip_dist := 15.0;
    CapL p_fig3_l_3, v500, cd, wsd, cwd, fine, tweldGun;
    .....

    ERROR
    StorePath;
    TEST ERRNO
    CASE CAP_NOPROC_END:
        IF cap_skip THEN
            ! This is the end of the skip distance
            cap_skip := FALSE;
        ENDIF
    CASE CAP_MAIN_ERR:
        IF skip_dist > 0.0 THEN
            ! This is the start of the skip distance
            CapNoProcess skip_dist;
            cap_skip := TRUE;
        ENDIF
    DEFAULT:
    ENDTEST
    RestoPath;
    StartMoveRetry;
ENDPROC
ENDMODULE

```

In this example, the recoverable error CAP_MAIN_ERR is followed by 25 mm movement (at 10 mm/s) without process for the first CapL instruction and by 15

Continues on next page

1 Instructions

1.37 CapNoProcess - Run CAP without process

Continuous Application Platform

Continued

mm for the second. At the end of that distance, CAP_NOPROC_END is generated and the process is restarted.

Arguments

CapNoProcess skip_distance

skip_distance

Distance in mm

Data type: num

CapNoProcess has a num variable as input parameter, that defines the skip distance in mm.

Limitations

The speed of the TCP during skip is predefined with 10 mm/s. The shortest skip distance is predefined with 10 mm.

In synchronized MultiMove systems, the shortest distance of all skip distances defined for the different synchronized process robots will be the actual one.

If the skip distance is longer than the distance from the current TCP position to the end of the current sequence of CAP instructions, nothing special will happen: RAPID execution continues as usual, without stopping the robot.

Syntax

```
CapNoProcess  
[skip_dist ':='] < variable (IN) of num >;'
```

Related information

For information about	See
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
CapInitSupervision instruction	CapInitSupervision - Reset all supervision for CAP on page 102
CapSetupSupervision instruction	CapSetupSupervision - Setup conditions for signal supervision in CAP on page 121
CapRemoveSupervision instruction	CapRemoveSupervision - Remove condition for one signal on page 117

1.38 CapRefresh - Refresh CAP data

Usage

CapRefresh is used to tell the CAP process to refresh its process data. It can for example, be used to tune CAP process parameters during program execution.

Basic example

```

PROC PulseSpeed()
  ! Setup a 1 Hz timer interrupt
  CONNECT intno1 WITH TuneTrp;
  ITimer 1, intno1;
  CapL p1, v100, cdata, wstartdata, wdata, fine, gun1;
  IDelete intno1;
ENDPROC

TRAP TuneTrp
  ! Modify the main speed component of active cdata
  IF HighValueFlag = TRUE THEN
    cdata.speed_data.start := 10;
    HighValueFlag := FALSE;
  ELSE
    cdata.speed_data.start := 15;
    HighValueFlag := TRUE;
  ENDIF
  ! Order the process control to refresh process parameters
  CapRefresh;
ENDTRAP

```

In this example the speed will be switched between 10 and 15 mm/s at a rate of 1 Hz.

Arguments

CapRefresh [**\MainSpeed**] [**\MainWeave**] [**\StartWeave**] [**\RestartDist**]

Without optional argument the CAP data capdata, capweavedata, weavestartdata, captrackdata, and movestarttimer are - if present - re-read from the PERSISTENT RAPID variable specified in the currently active CAP instruction.

[MainSpeed]

Data type: switch

If this switch is present, CAP will reread the component capdata.speed_data.main of the currently active CAP instruction.

[MainWeave]

Data type: switch

If this switch is present, CAP will reread the components capweavedata.width, capweavedata.length, capweavedata.bias, and capweavedata.active of the currently active CAP instruction.

Continues on next page

1 Instructions

1.38 CapRefresh - Refresh CAP data

Continuous Application Platform

Continued

[StartWeave]

Data type: bool

If this switch is present, CAP will use its value instead of `weavestartdata.active` of the currently active CAP instruction. The data of the currently active CAP instruction remain untouched.

[RestartDist]

Data type: num

If this switch is present, CAP will use its value instead of `capdata.restart_dist` of the currently active CAP instruction. The data of the currently active CAP instruction remain untouched.

Syntax

```
CapRefresh
  ['\ ' MainSpeed]
  ['\ ' MainWeave]
  ['\ ' Startweave ':=' < expression (IN) of bool >]
  ['\ ' RestartDist ':=' < expression (IN) of num >] ';' ;'
```

Related information

For information about	See
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>

1.39 CapRemoveSupervision - Remove condition for one signal

Continuous Application Platform

1.39 CapRemoveSupervision - Remove condition for one signal

Usage

CapRemoveSupervision is used to remove conditions added by CapSetupSuperv from supervision.

Basic example

```
PROC main()
  CapInitSupervision;
  CapSetupSupervision diWR_EST, ACT, SUPERV_MAIN \ErrIndSig:=
    do_WR_Sup;
  CapSetupSupervision diGA_EST, ACT, SUPERV_MAIN;
  CapL p2, v100, cdata1, weavestart, weave,fine, tWeldGun;
  CapRemoveSupervision di_Arc_Sup, ACT, SUPERV_START_MAIN;
ENDPROC
```

Removes the signal *di_Arc_Sup* from the START list.

Arguments

CapRemoveSupervision Signal Condition Listtype [\Deactivate]

Signal

Data type: signal_{di}

Digital signal to remove from supervision list.

Condition

Data type: num

The name representing one of the following available conditions:

ACT:	Used for status supervision. Expected signal status during supervision: active. If the signal becomes passive, supervision triggers.
PAS:	Used for status supervision. Expected signal status during supervision: passive. If the signal becomes active, supervision triggers.
POS_EDGE:	Used for handshake supervision. Expected signal status at the end of supervision: active. If the signal does not become active within the chosen timeout, supervision triggers.
NEG_EDGE:	Used for handshake supervision. Expected signal status at the end of supervision: passive. If the signal does not become passive within the chosen timeout, supervision triggers.

Listtype

Data type: num

The name representing the number of the different lists (for example, phases in the process):

- SUPERV_START_PRE
- SUPERV_PRE
- SUPERV_END_PRE
- SUPERV_START_MAIN
- SUPERV_MAIN
- SUPERV_END_MAIN

Continues on next page

1 Instructions

1.39 CapRemoveSupervision - Remove condition for one signal

Continuous Application Platform

Continued

- SUPERV_START_POST1
- SUPERV_POST1
- SUPERV_END_POST1
- SUPERV_START_POST2
- SUPERV_POST2
- SUPERV_END_POST2

[Deactivate]

Data type: switch

If this switch is present, CAP will not only remove the specified supervision, it will also deactivate it immediately, if active.

Syntax

```
CapRemoveSupervision
[Signal ':='] < variable (VAR) of signaldi > ',', '
[Condition ':='] < variable (IN) of num > ',', '
[Listtype ':='] < variable (IN) of num >
['\ ' Deactivate] ';' ;'
```

Related information

For information about	See
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
CapInitSupervision instruction	CapInitSupervision - Reset all supervision for CAP on page 102
CapSetupSupervision instruction	CapSetupSupervision - Setup conditions for signal supervision in CAP on page 121

1.40 CapSetDOAtStop - Set a digital output signal at TCP stop

Continuous Application Platform

1.40 CapSetDOAtStop - Set a digital output signal at TCP stop

Usage

CapSetDOAtStop is used to define a digital output signal and its value, which will be set when the TCP of the robot that runs CAP, stops moving during a CAP instruction (CapL or CapC) before the CAP sequence is finished.

An existing definition of such signals, is cleared with the CAP instruction CapInitSupervision.

Basic example

```
CapSetDOAtStop do15, 1;
```

The signal do15 is set to 1 when the TCP stops.

```
CapSetDOAtStop weld, off;
```

The signal weld is set to off when the TCP stops.

Arguments

CapSetDOAtStop Signal Value

Signal

Data type: signaldo

The name of the signal to be changed.

Value

Data type: dionum

The desired value of the signal 0 or 1.

Specified Value	Set digital output to
0	0
Any value except 0	1

Limitations

The final value of the signal depends on the configuration of the signal. If the signal is inverted in the system parameters, the value of the physical channel is the opposite.

A maximum of 10 signals per RAPID task may be set up.

Syntax

```
CapSetDOAtStop
[Signal ':='] < variable (VAR) of signaldo > ',', '
[Value ':='] < expression (IN) of dionum > ';'
```

Related information

For information about	See
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
CapInitSupervision instruction	CapInitSupervision - Reset all supervision for CAP on page 102

Continues on next page

1 Instructions

1.40 CapSetDOAtStop - Set a digital output signal at TCP stop

Continuous Application Platform

Continued

For information about	See
CapSetupSupervision instruction	<i>CapSetupSupervision - Setup conditions for signal supervision in CAP on page 121</i>
CapRemoveSupervision instruction	<i>CapRemoveSupervision - Remove condition for one signal on page 117</i>

1.41 CapSetupSupervision - Setup conditions for signal supervision in CAP Continuous Application Platform

1.41 CapSetupSupervision - Setup conditions for signal supervision in CAP

Usage

CapSetupSupervision is used to set up conditions for I/O signals to be supervised. The conditions are collected in different lists:

- START_PRE
- PRE
- END_PRE
- START_MAIN
- MAIN
- END_MAIN
- START_POST1
- POST1
- END_POST1
- START_POST2
- POST2
- END_POST2

For more information about supervision lists see *Application manual - Continuous Application Platform*.

As an optional parameter an out signal can be specified. This out signal is set to high, if the given condition fails.

Basic example

```
PROC main()
  CapInitSupervision;
  CapSetupSupervision diWR_EST, ACT, SUPERV_MAIN \ErrIndSig:=
    do_WR_Sup;
  CapSetupSupervision diGA_EST, ACT, SUPERV_MAIN;
  CapL p2, v100, cdata1, weavestart, weave, fine, tweldGun;
ENDPROC
```

CapSetupSupervision is used to set up supervision on signals. If signal *diWR_EST* fails during SUPERV_MAIN phase, the digital output signal *do_WR_Sup* is set high.

The CapSetupSupervision instruction should be executed only if supervision data is changed. If the supervision data is never changed, it is a good idea to put it into a module, that is executed from the startup shelf.

Arguments

CapSetupSupervision Signal Condition Listtype [\ErrIndSig]

Signal

Data type: signaldi

Digital signal to be supervised.

Continues on next page

1 Instructions

1.41 CapSetupSupervision - Setup conditions for signal supervision in CAP

Continuous Application Platform

Continued

Condition

Data type: num

The name representing one of the following available conditions:

ACT:	Used for status supervision. Expected signal status during supervision: active. If the signal becomes passive, supervision triggers.
PAS:	Used for status supervision. Expected signal status during supervision: passive. If the signal becomes active, supervision triggers.
POS_EDGE:	Used for handshake supervision. Expected signal status at the end of supervision: active. If the signal does not become active within the chosen timeout, supervision triggers.
NEG_EDGE:	Used for handshake supervision. Expected signal status at the end of supervision: passive. If the signal does not become passive within the chosen timeout, supervision triggers.

Listtype

Data type: num

The name representing the number of the different lists (for example, phases in the process):

- SUPERV_START_PRE
- SUPERV_PRE
- SUPERV_END_PRE
- SUPERV_START_MAIN
- SUPERV_MAIN
- SUPERV_END_MAIN
- SUPERV_START_POST1
- SUPERV_POST1
- SUPERV_END_POST1
- SUPERV_START_POST2
- SUPERV_POST2
- SUPERV_END_POST2

[ErrIndSig]

Data type: signaldo

Used to indicate which condition that failed if a failure has occurred. When the failure occurs the value on this signal is set to 1. This is an optional parameter.

Program execution

The given signal and its condition is added to the selected list. If a signal fails, the CapL/CapC instruction will report that a supervision error occurred during the specified phase and which signal(s) failed.

Errors

CAP_SPV_LIM

The maximum number of supervisions set up is exceeded.

Continues on next page

1.41 CapSetupSupervision - Setup conditions for signal supervision in CAP Continuous Application Platform Continued

CAP_SPV_UNK_LST

The supervision list is unknown.

Limitations

Only digital input signals can be supervised.

Status supervision applies for a complete sequence of CAP instructions (see section *Supervision and process phases in Application manual - Continuous Application Platform*).

Syntax

```
CapSetupSupervision
[Signal ':='] < variable (VAR) of signaldi > ', '
[Condition ':='] < variable (IN) of num > ', '
[Listtype ':='] < variable (IN) of num >
[\ErrIndSig ':='] < variable (VAR) of signaldo >] ';'

```

Related information

For information about	See
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
CapInitSupervision instruction	CapInitSupervision - Reset all supervision for CAP on page 102
CapRemoveSupervision instruction	CapRemoveSupervision - Remove condition for one signal on page 117

1 Instructions

1.42 CapWeaveSync - set up signals and levels for weave synchronization

Continuous Application Platform

1.42 CapWeaveSync - set up signals and levels for weave synchronization

Usage

CapWeaveSync is used to setup weaving synchronization signals without sensors. The I/O signals must be defined in EIO.cfg.

Basic example

RAPID program:

```
PROC main()  
  ...  
  CapWeaveSync \DoLeft:=do_sync_left \LevelLeft:=80  
              \DoRight:=do_sync_right \LevelRight:=80;  
  ...  
ENDPROC
```

In this example the signals do_sync_left and do_sync_right are set up with weaving level 80%.

The CapWeaveSync instruction should be executed only once, for example, from the startup shelf.

Arguments

CapWeaveSync [\Reset] [\DoLeft] [\LevelLeft] [\DoRight]
 [\LevelRight]

[\Reset]

Data type: switch

Clear weave synchronization data.

[\DoLeft]

Data type: signaldo

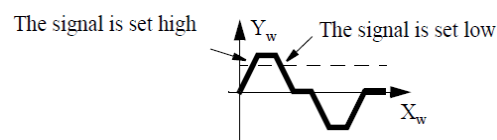
Digital output signal for weave synchronization on the left weave cycle.

[\LevelLeft]

Data type: num

The coordination position on the left side of the weaving pattern. The value specified is a percentage of the width on the left of the weaving centre. When weaving is carried out beyond this point, a digital output signal is automatically set high (if the signal is defined).

This type of coordination can be used for seam tracking using Through-the-Arc Tracker.



xx1200000176

[\LevelLeft]

Data type: num

Continues on next page

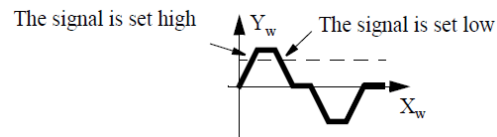
1.42 CapWeaveSync - set up signals and levels for weave synchronization

Continuous Application Platform

Continued

The coordination position on the left side of the weaving pattern. The value specified is a percentage of the width on the left of the weaving centre. When weaving is carried out beyond this point, a digital output signal is automatically set high (if the signal is defined).

This type of coordination can be used for seam tracking using Through-the-Arc Tracker.



xx1200000176

[\DoRight]

Data type: signaldo

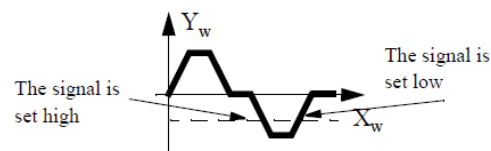
Digital output signal for weave synchronization on the right weave cycle.

[\LevelRight]

Data type: num

The coordination position on the right side of the weaving pattern. The value specified is a percentage of the width on the right of the weaving centre. When weaving is carried out beyond this point, a digital output signal is automatically set high (provided the signal is defined).

This type of coordination can be used for seam tracking using Through-the-Arc Tracker.



xx1200000177

Program execution

The defined signals are checked and set when running without a sensor.

Limitations

The signals must be defined in EIO.cfg.

It is not possible to use only either level or corresponding signal. It will not result in errors when loading the RAPID file, but it will result in RAPID run-time errors for the instruction CapWeaveSync.

Syntax

```
CapWeaveSync
['\ ' Reset]
[DoLeft ':=' < expression (IN) of signaldo >]
[LevelLeft ':=' < expression (IN) of num >]
[DoRight ':=' < expression (IN) of signaldo >]
[LevelRight ':=' < expression (IN) of num >] ';' ;'
```

Continues on next page

1 Instructions

1.42 CapWeaveSync - set up signals and levels for weave synchronization

Continuous Application Platform

Continued

Related information

For information about	See
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
capweavedata data type	capweavedata - Weavedata for CAP on page 1609

1.43 CheckProgRef - Check program references

Usage

CheckProgRef is used to check for unresolved references at any time during execution.

Basic examples

The following example illustrates the instruction CheckProgRef:

Example 1

```
Load \Dynamic, diskhome \File:="PART_B.modx" \CheckRef;
Unload "PART_A.modx";
CheckProgRef;
```

In this case the program contains a module called PART_A.modx. A new module PART_B.modx is loaded, which checks if all references are OK. Then PART_A.modx is unloaded. To check for unresolved references after unload, a call to CheckProgRef is done.

Program execution

Program execution forces a new link of the program task and checks for unresolved references.

If an error occurs during CheckProgRef, the program is not affected, it just tells you that an unresolved reference exists in the program task. Therefore, use CheckProgRef immediately after changing the number of modules in the program task (loading or unloading) to be able to know which module caused the link error. This instruction can also be used as a substitute for using the optional argument \CheckRef in instruction Load or WaitLoad.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_LINKREF	The program task contains unresolved references.

Syntax

```
CheckProgRef';'
```

Related information

For information about	See
Load of a program module	Load - Load a program module during execution on page 332
Unload of a program module	UnLoad - Unload a program module during execution on page 978
Start loading of a program module	StartLoad - Load a program module during execution on page 759

Continues on next page

1 Instructions

1.43 CheckProgRef - Check program references

RobotWare Base

Continued

For information about	See
Finish loading of a program module	WaitLoad - Connect the loaded module to the task on page 1031

1.44 CirPathMode - Tool reorientation during circle path

Usage

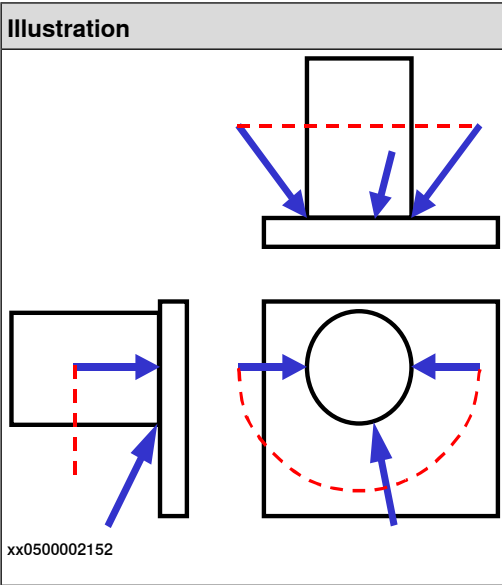
CirPathMode (*Circle Path Mode*) makes it possible to select different modes to reorientate the tool during circular movements.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system in Motion tasks.

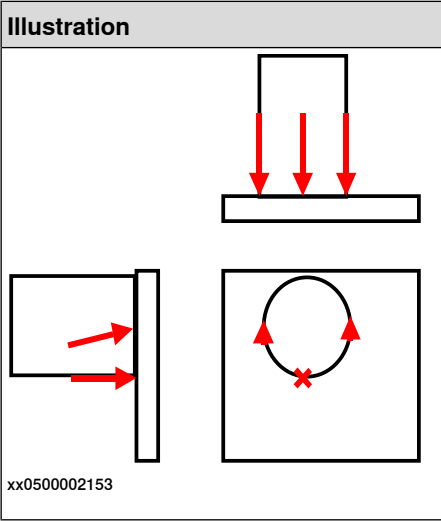
Description

PathFrame

The figure in the table shows the tool reorientation for the standard mode \PathFrame.

Illustration	Description
	The arrows shows the tool from wrist center point to tool center point for the programmed points. The path for the wrist center point is dotted in the figure. The \PathFrame mode makes it easy to get the same angle of the tool around the cylinder. The robot wrist will not go through the programmed orientation in the CirPoint

The figure in the table shows the use of standard mode \PathFrame with fixed tool orientation.

Illustration	Description
	This picture shows the obtained orientation of the tool in the middle of the circle using a leaning tool and \PathFrame mode. Compare with the figure below when \ObjectFrame mode is used.

Continues on next page

1 Instructions

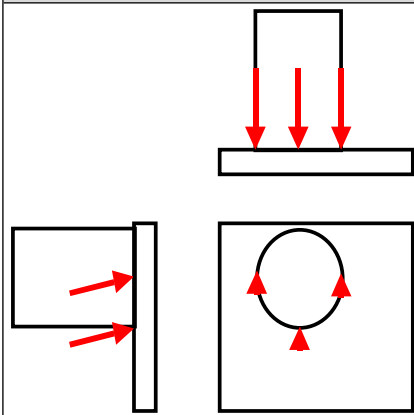
1.44 CirPathMode - Tool reorientation during circle path

RobotWare Base

Continued

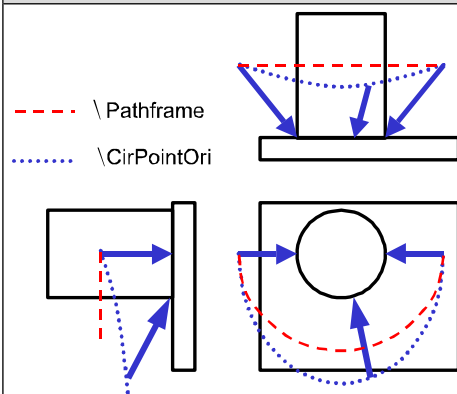
ObjectFrame

The figure in the table shows the use of modified mode \ObjectFrame with fixed tool orientation.

Illustration	Description
 xx0500002151	This figure shows the obtained orientation of the tool in the middle of the circle using a leaning tool and \ObjectFrame mode. This mode will make a linear reorientation of the tool in the same way as for MoveL. The robot wrist will not go through the programmed orientation in the CirPoint. Compare with the previous figure when \PathFrame mode is used.

CirPointOri

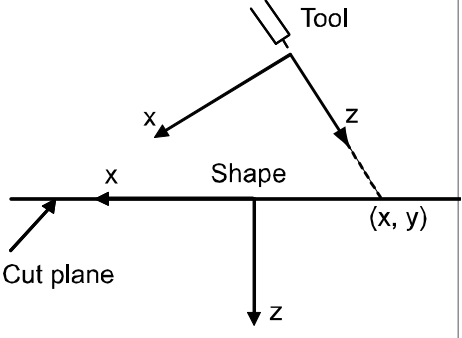
The figure in the table shows the different tool reorientation between the standard mode \PathFrame and the modified mode \CirPointOri.

Illustration	Description
 xx0500002150	The arrows show the tool from wrist center point to tool center point for the programmed points. The different paths for the wrist center point are dashed in the figure. The \CirPointOri mode will make the robot wrist to go through the programmed orientation in the CirPoint. The path is always the same in xyz but the orientation is different.

Continues on next page

Wrist45 / Wrist46 / Wrist56

The figure in the table shows the frames involved when cutting a shape using axes 4 and 5.

Illustration	Description
	It is assumed that the cutting beam is aligned with the tool's z axis. The coordinate frame of the cut plane is defined by the robot's starting position when executing the MoveC instruction.

Basic examples

The following examples illustrate the instruction CirPathMode:

Example 1

```
CirPathMode \PathFrame;
```

Standard mode for tool reorientation in the actual path frame from the start point to the ToPoint during all succeeding circular movements. This is default in the system.

Example 2

```
CirPathMode \ObjectFrame;
```

Modified mode for tool reorientation in actual object frame from the start point to the ToPoint during all succeeding circular movements.

Example 3

```
CirPathMode \CirPointOri;
```

Modified mode for tool reorientation from the start point via the programmed CirPoint orientation to the ToPoint during all succeeding circular movements.

Example 4

```
CirPathMode \Wrist45;
```

Modified mode such that the projection of the tool's z-axis onto the cut plane will follow the programmed circle movement order. Only wrist axes 4 and 5 are used. This mode should only be used when cutting thin objects.

Example 5

```
CirPathMode \Wrist46;
```

Modified mode such that the projection of the tool's z-axis onto the cut plane will follow the programmed circle movement order. Only wrist axes 4 and 6 are used. This mode should only be used for thin objects.

Example 6

```
CirPathMode \Wrist56;
```

Continues on next page

1 Instructions

1.44 CirPathMode - Tool reorientation during circle path

RobotWare Base

Continued

Modified mode such that the projection of the tool's z-axis onto the cut plane will follow the programmed circle movement order. Only wrist axes 5 and 6 are used. This mode should only be used for thin objects.

Arguments

CirPathMode [\PathFrame] | [\ObjectFrame] | [\CirPointOri] |
[\Wrist45] | [\Wrist46] | [\Wrist56]

[\PathFrame]

Data type: switch

During the circular movement the reorientation of the tool is done continuously from the start point orientation to the ToPoint orientation in the actual path frame. This is the standard mode in the system.



Note

Using CirPathMode without any switch gives the same result as CirPathMode \PathFrame.

[\ObjectFrame]

Data type: switch

During the circular movement the reorientation of the tool is done continuously from the start point orientation to the ToPoint orientation in the actual object frame.

[\CirPointOri]

Data type: switch

During the circular movement the reorientation of the tool is done continuously from the start point orientation to the programmed CirPoint orientation and further to the ToPoint orientation.

[\Wrist45]

Data type: switch

The robot will move axes 4 and 5 such that the projection of the tool's z-axis onto the cut plane will follow the programmed circle movement order. This mode should only be used for thin objects as only 2 wrist axes are used and thus give us increased accuracy but also less control.



Note

This switch requires the RobotWare option *WristMove*.

[\Wrist46]

Data type: switch

The robot will move axes 4 and 6 such that the projection of the tool's z-axis onto the cut plane will follow the programmed circle movement order. This mode should only be used for thin objects as only 2 wrist axes are used and thus give us increased accuracy but also less control.

Continues on next page

**Note**

This switch requires the RobotWare option *WristMove*.

[\\Wrist56]

Data type: switch

The robot will move axes 5 and 6 such that the projection of the tool's z-axis onto the cut plane will follow the programmed circle movement order. This mode should only be used for thin objects as only 2 wrist axes are used and thus give us increased accuracy but also less control.

**Note**

This switch requires the RobotWare option *WristMove*.

Program execution

The specified circular tool reorientation mode applies for the next executed circular movement instruction of any type (MoveC, SearchC, TriggC, MoveCDO, MoveCSync, ArcC, PaintC, etc.) and is valid until a new CirPathMode instruction is executed.

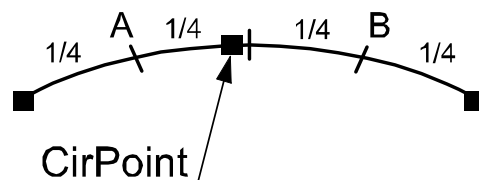
The standard circular reorientation mode (CirPathMode \\PathFrame) is automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Limitations

The instruction only affects circular movements.

When using the \\CirPointOri mode, the CirPoint must be between the points A and B according to the figure below to make the circle movement to go through the programmed orientation in the CirPoint.



xx0500002149

Continues on next page

1 Instructions

1.44 CirPathMode - Tool reorientation during circle path

RobotWare Base

Continued

\Wrist45, \Wrist46, and \Wrist56 mode should only be used for cutting thin objects as the ability to control the angle of the tool is lost when using only two wrist axes. Coordinated movements are not possible since the main axis is locked. If working in wrist singularity area and the instruction SingArea\Wrist has been executed, the instruction CirPathMode has no effect because the system then selects another tool reorientation mode for circular movements (joint interpolation).

Syntax

```
CirPathMode
  ['\PathFrame]
  | ['\ObjectFrame]
  | ['\CirPointOri]
  | ['\Wrist45]
  | ['\Wrist46]
  | ['\Wrist56] ';' ;'
```

Related information

For information about	See
Motion settings data	motsetdata - Motion settings data on page 1674
Circular move instruction	MoveC - Moves the robot circularly on page 398
Define interpolation around singular points	SingArea - Defines interpolation around singular points on page 696
Interpolation	<i>Technical reference manual - RAPID Overview</i>
Wrist movements	<i>Application manual - Controller software Omni-Core, section WristMove</i>

1.45 Clear - Clears the value

Usage

Clear is used to clear a numeric variable or persistent , that is, set it to 0.

Basic examples

The following examples illustrate the instruction Clear:

Example 1

```
Clear reg1;  
Reg1 is cleared, i.e. reg1:=0.
```

Example 2

```
VAR dnum mydnum:=5;  
Clear mydnum;  
mydnum is cleared, i.e. mydnum:=0.
```

Arguments

Clear Name | Dname

Name

Data type: num

The name of the variable or persistent to be cleared.

Dname

Data type: dnum

The name of the variable or persistent to be cleared.

Syntax

```
Clear  
[ Name ':=' ] < variable or persistent (INOUT) of num >  
| [ Dname ':=' ] < variable or persistent (INOUT) of dnum > ';' ;
```

Related information

For information about	See
Incrementing a variable by 1	Incr - Increments by 1 on page 258
Decrementing a variable by 1	Decr - Decrements by 1 on page 182
Adding any value to a variable	Add - Adds a numeric value on page 30
Changing data using arbitrary	":=" - Assigns a value on page 39

1 Instructions

1.46 ClearPath - Clear current path

RobotWare Base

1.46 ClearPath - Clear current path

Usage

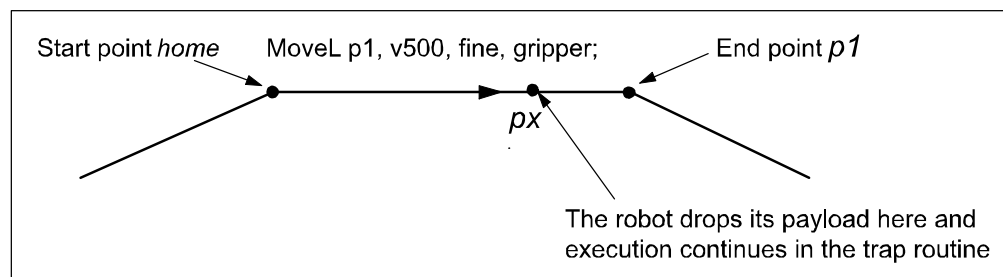
ClearPath (*Clear Path*) clears the whole motion path on the current motion path level (base level or StorePath level).

With motion path, meaning all the movement orders from any move instructions which have been executed in RAPID but not performed by the robot at the execution time of ClearPath.

The robot must be in a stop point position or must be stopped with StopMove before the instruction ClearPath can be executed.

Basic examples

The following example illustrates the instruction ClearPath:



xx0500002154

In the following program example, the robot moves from the position home to the position p1. At the point px the signal di1 will indicate that the payload has been dropped. The execution continues in the trap routine gohome. The robot will stop moving (start the braking) at px, the path will be cleared, the robot will move to position home. The error will be raised up to the calling routine minicycle and the whole user defined program cycle proc1 ... proc2 will be executed from the beginning one more time.

Example 1

```
VAR intnum drop_payload;
VAR errnum ERR_DROP_LOAD := -1;

PROC minicycle()
  BookErrNo ERR_DROP_LOAD;
  proc1;
  ...
  ERROR (ERR_DROP_LOAD)
    ! Restart the interrupted movement on motion base path level
    StartMove;
    RETRY;
ENDPROC

PROC proc1()
  ...
  proc2;
```

Continues on next page

```

...
ENDPROC

PROC proc2()
  CONNECT drop_payload WITH gohome;
  ISignalDI \Single, di1, 1, drop_payload;
  MoveL p1, v500, fine, gripper;
  .....
  IDelete drop_payload;
ENDPROC

TRAP gohome
  StopMove;
  ClearPath;
  IDelete drop_payload;
  StorePath;
  MoveL home, v500, fine, gripper;
  RestoPath;
  RAISE ERR_DROP_LOAD;
  ERROR
  RAISE;
ENDTRAP

```

If the same program is being run but **without** StopMove and ClearPath in the trap routine gohome, the robot will continue to position p1 before going back to position home.

Limitations

Limitation examples of the instruction ClearPath are illustrated below.

Example 1 - Limitation

```

VAR intnum int_move_stop;
...
PROC test_move_stop()
  CONNECT int_move_stop WITH trap_move_stop;
  ISignalDI di1, 1, int_move_stop;
  MoveJ p10, v200, z20, gripper;
  MoveL p20, v200, z20, gripper;
ENDPROC

TRAP trap_move_stop
  StopMove;
  ClearPath;
  StorePath;
  MoveJ p10, v200, z20, gripper;
  RestoPath;
  StartMove;
ENDTRAP

```

This is an example of ClearPath limitation. During the robot movement to p10 and p20, the ongoing movement is stopped and the motion path is cleared, but no action is done to break off the active instruction MoveJ p10 or MoveL p20 in the

Continues on next page

1 Instructions

1.46 ClearPath - Clear current path

RobotWare Base

Continued

PROC test_move_stop. So the ongoing movement will be interrupted and the robot will go to p10 in the routine TRAP trap_move_stop, but no further movement to p10 or p20 in the PROC test_move_stop will be done. The program execution will be hanging.

This problem can be solved with either error recovery with long jump as described in example 2 below or with asynchronously raised error with instruction ProcerrRecovery.

Example 2 - No limitations

```
VAR intnum int_move_stop;
VAR errnum err_move_stop := -1;
...
PROC test_move_stop()
  BookErrNo err_move_stop;
  CONNECT int_move_stop WITH trap_move_stop;
  ISignalDI di1, 1, int_move_stop;
  MoveJ p10, v200, z20, gripper;
  MoveL p20, v200, z20, gripper;
  ERROR (err_move_stop)
    StopMove;
    ClearPath;
    StorePath;
    MoveJ p10, v200, z20, gripper;
    RestoPath;
    ! Restart the interrupted movement on motion base path level
    StartMove;
    RETRY;
ENDPROC

TRAP trap_move_stop
  RAISE err_move_stop;
  ERROR
    RAISE;
ENDTRAP
```

This is an example of how to use error recovery with long jump together with ClearPath without any limitation. During the robot movement to p10 and p20, the ongoing movement is stopped. The motion path is cleared, and because of error recovery through execution level boundaries, break off is done of the active instruction MoveJ p10 or MoveL p20. So the ongoing movement will be interrupted and the robot will go to p10 in the error handler, and once more execute the interrupted instruction MoveJ p10 or MoveL p20 in the PROC test_move_stop.

Syntax

ClearPath ';' ;

Related information

For information about	See
Stop robot movements	StopMove - Stops robot movement on page 792

Continues on next page

For information about	See
Error recovery	<i>Technical reference manual - RAPID Overview</i> <i>Technical reference manual - RAPID kernel</i>
Asynchronously raised error	ProcerrRecovery - Generate and recover from process-move error on page 552

1 Instructions

1.47 ClearRawBytes - Clear the contents of rawbytes data

RobotWare Base

1.47 ClearRawBytes - Clear the contents of rawbytes data

Usage

ClearRawBytes is used to set all the contents of a rawbytes variable to 0.

Basic examples

The following example illustrates the instruction ClearRawBytes:

Example 1

```
VAR rawbytes raw_data;  
VAR num integer := 8  
VAR num float := 13.4;  
  
PackRawBytes integer, raw_data, 1 \IntX := DINT;  
PackRawBytes float, raw_data, (RawBytesLen(raw_data)+1) \Float4;  
  
ClearRawBytes raw_data \FromIndex := 5;
```

In the first 4 bytes the value of integer is placed (from index 1) and in the next 4 bytes starting from index 5 the value of float.

The last instruction in the example clears the contents of raw_data, starting at index 5, that is, float will be cleared, but integer is kept in raw_data.

Current length of valid bytes in raw_data is set to 4.

Arguments

ClearRawBytes RawData [\FromIndex]

RawData

Data type: rawbytes

RawData is the data container which will be cleared.

[\FromIndex]

Data type: num

With \FromIndex it is specified where to start clearing the contents of RawData. Everything is cleared to the end.

If \FromIndex is not specified, all data starting at index 1 is cleared.

Program execution

Data from index 1 (default) or from \FromIndex in the specified variable is reset to 0.

The current length of valid bytes in the specified variable is set to 0 (default) or to (FromIndex - 1) if \FromIndex is programmed.

Syntax

```
ClearRawBytes  
[RawData ':='] < variable (VAR) of rawbytes>  
['\FromIndex ':='] <expression (IN) of num>];'
```

Continues on next page

1.47 ClearRawBytes - Clear the contents of rawbytes data

RobotWare Base

Continued

Related information

For information about	See
rawbytes data	rawbytes - Raw data on page 1702
Get the length of rawbytes data	RawBytesLen - Get the length of rawbytes data on page 1404
Copy the contents of rawbytes data	CopyRawBytes - Copy the contents of rawbytes data on page 165
Pack DeviceNet header into rawbytes data	PackDNHeader - Pack DeviceNet Header into rawbytes data on page 506
Pack data into rawbytes data	PackRawBytes - Pack data into rawbytes data on page 509
Write rawbytes data	WriteRawBytes - Write rawbytes data on page 1078
Read rawbytes data	ReadRawBytes - Read rawbytes data on page 576
Unpack data from rawbytes data	UnpackRawBytes - Unpack data from rawbytes data on page 981
File and I/O device handling	Application manual - Controller software Omni-Core

1 Instructions

1.48 ClkReset - Resets a clock used for timing

RobotWare Base

1.48 ClkReset - Resets a clock used for timing

Usage

ClkReset is used to reset a clock that functions as a stop-watch used for timing. This instruction can be used before using a clock to make sure that it is set to 0.

Basic examples

The following example illustrates the instruction ClkReset:

Example 1

```
ClkReset clock1;
```

The clock `clock1` is reset.

Arguments

```
ClkReset Clock
```

Clock

Data type: `clock`

The name of the clock to reset.

Program execution

When a clock is reset, it is set to 0.

If a clock is running it will be stopped and then reset.

Syntax

```
ClkReset  
[ Clock ':= ' ] < variable (VAR) of clock > ';' ;
```

Related Information

For information about	See
Other clock instructions	<i>Technical reference manual - RAPID Overview</i>

1.49 ClkStart - Starts a clock used for timing

Usage

ClkStart is used to start a clock that functions as a stop-watch used for timing.

Basic examples

The following example illustrates the instruction ClkStart:

Example 1

```
ClkStart clock1;
```

The clock clock1 is started.

Arguments

ClkStart Clock

Clock

Data type: clock

The name of the clock to start.

Program execution

When a clock is started, it will run and continue counting seconds until it is stopped.

A clock continues to run when the program that started it is stopped. However, the event that you intended to time may no longer be valid. For example, if the program was measuring the waiting time for an input, the input may have been received while the program was stopped. In this case, the program will not be able to “see” the event that occurred while the program was stopped.

A clock continues to run when the robot is powered down as long as the battery back-up retains the program that contains the clock variable.

If a clock is running it can be read, stopped, or reset.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_OVERFLOW	The clock runs for 4,294,967 seconds (49 days 17 hours 2 minutes 47 seconds), then it is overflowed.

More examples

More examples of the instruction ClkStart are illustrated below.

Example 1

```

VAR clock clock2;
VAR num time;

ClkReset clock2;
ClkStart clock2;
WaitUntil di1 = 1;
ClkStop clock2;

```

Continues on next page

1 Instructions

1.49 ClkStart - Starts a clock used for timing

RobotWare Base

Continued

```
time:=ClkRead(clock2);
```

The waiting time for di1 to become 1 is measured.

Syntax

```
ClkStart  
[ Clock ':= ' ] < variable (VAR) of clock >';'
```

Related Information

For information about	See
Other clock instructions	<i>Technical reference manual - RAPID Overview</i>

1.50 ClkStop - Stops a clock used for timing

Usage

ClkStop is used to stop a clock that functions as a stop-watch used for timing.

Basic examples

The following example illustrates the instruction ClkStop:

```
ClkStop clock1;
```

The clock `clock1` is stopped.

Arguments

ClkStop Clock

Clock

Data type: `clock`

The name of the clock to stop.

Program execution

When a clock is stopped, it will stop running.

If a clock is stopped, it can be read, started again, or reset.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_OVERFLOW	The clock runs for 4,294,967 seconds (49 days 17 hours 2 minutes 47 seconds) it becomes overflowed.

Syntax

```
ClkStop
[ Clock ':' ] < variable (VAR) of clock >';'
```

Related Information

For information about	See
Other clock instructions	<i>Technical reference manual - RAPID Overview</i>
More examples	ClkStart - Starts a clock used for timing on page 143

1 Instructions

1.51 Close - Closes a file or I/O device

RobotWare Base

1.51 Close - Closes a file or I/O device

Usage

Close is used to close a file or I/O device.

Basic examples

The following example illustrates the instruction Close:

Example 1

```
Close channel2;
```

The I/O device referred to by channel2 is closed.

Arguments

Close IODevice

IODevice

Data type: iODEV

The name (reference) of the file or I/O device to be closed.

Program execution

The specified file or I/O device is closed and must be re-opened before reading or writing. If it is already closed the instruction is ignored.

Syntax

```
Close  
[IODevice ':='] <variable (VAR) of iODEV>;'
```

Related information

For information about	See
Opening a file or I/O device	<i>Technical reference manual - RAPID Overview</i>
File and I/O device handling	<i>Application manual - Controller software Omni-Core</i>

1.52 CloseDir - Close a directory

Usage

CloseDir is used to close a directory in balance with OpenDir.

Basic examples

The following example illustrates the instruction CloseDir:

Example 1

```

PROC lmdir(string dirname)
  VAR dir directory;
  VAR string filename;
  OpenDir directory, dirname;
  WHILE ReadDir(directory, filename) DO
    TPWrite filename;
  ENDWHILE
  CloseDir directory;
ENDPROC

```

This example prints out the names of all files or subdirectories under the specified directory.

Arguments

CloseDir Dev

Dev

Data type: dir

A variable with reference to the directory fetched with instruction OpenDir.

Syntax

```

CloseDir
[ Dev ':=' ] < variable (VAR) of dir>;'

```

Related information

For information about	See
Directory	dir - File directory structure on page 1629
Make a directory	MakeDir - Create a new directory on page 343
Open a directory	OpenDir - Open a directory on page 504
Read a directory	ReadDir - Read next entry in a directory on page 1408
Remove a directory	RemoveDir - Delete a directory on page 585
Remove a file	RemoveFile - Delete a file on page 587
Rename a file	RenameFile - Rename a file on page 588
File and I/O device handling	Application manual - Controller software OmniCore

1 Instructions

1.53 Comment - Comment

RobotWare Base

1.53 Comment - Comment

Usage

Comment is only used to make the program easier to understand. It has no effect on the execution of the program.

Basic examples

The following example illustrates the instruction Comment:

Example 1

```
! Goto the position above pallet
MoveL p100, v500, z20, tool1;
```

A comment is inserted into the program to make it easier to understand.

Arguments

! Comment

Comment

Text string
Any text.

Program execution

Nothing happens when you execute this instruction.

Limitations

Comments in a record

In a record definition, it is not allowed to have a comment in a separate line unless it is the last line.

```
RECORD my_rec
  ! DISALLOWED COMMENT
  num mynum; ! allowed comment (not separate line)
  string mystring;
  ! allowed comment on last line
ENDRECORD
```

Syntax

'!' {<character>} <newline>

Related information

For information about	See
Characters permitted in a comment	<i>Technical reference manual - RAPID Overview</i>
Comments within data and routine declarations	<i>Technical reference manual - RAPID Overview</i>

1.54 Compact IF - If a condition is met, then... (one instruction)

Usage

Compact IF is used when a single instruction is only to be executed if a given condition is met.

If different instructions are to be executed, depending on whether the specified condition is met or not, the IF instruction is used.

Basic examples

The following examples illustrate the instruction Compact IF:

Example 1

```
IF reg1 > 5 GOTO next;
```

If reg1 is greater than 5, program execution continues at the next label.

Example 2

```
IF counter > 10 Set do1;
```

The do1 signal is set if counter > 10.

Arguments

IF Condition ...

Condition

Data type: bool

The condition that must be satisfied for the instruction to be executed.

Syntax

```
IF <conditional expression> ( <instruction> | <SMT> ) ';' ;'
```

Related information

For information about	See
Conditions (logical expressions)	<i>Technical reference manual - RAPID Overview</i>
IF with several instructions	IF - If a condition is met, then ...; otherwise ... on page 256

1 Instructions

1.55 ConfJ - Controls the configuration during joint movement

RobotWare Base

1.55 ConfJ - Controls the configuration during joint movement

Usage

ConfJ (*Configuration Joint*) is used to specify whether or not the robot's configuration is to be controlled during joint movement. If it is not controlled, the robot can sometimes use a different configuration than that which was programmed. With ConfJ \Off, the robot cannot switch main axis configuration - it will search for a solution with the same main axis configuration as the current one, but it moves to the closest wrist configuration for axes 4 and 6.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.



Note

For IRB5400 and IRB5500, the robot monitoring is always off independent of what is specified in ConfJ.

Basic examples

The following examples illustrate the instruction ConfJ:

Example 1

```
ConfJ \Off;  
MoveJ *, v1000, fine, tool1;
```

The robot moves to the programmed position and orientation. If this position can be reached in several different ways, with different axis configurations, the closest possible position is chosen.

Example 2

```
ConfJ \On;  
MoveJ *, v1000, fine, tool1;
```

The robot moves to the programmed position, orientation and axis configuration.

Arguments

ConfJ [\On] | [\Off]

[\On]

Data type: switch

The robot moves to the programmed position with configuration parameters equal or close to the the given configuration parameters in the confdata.

If a program displacement or path correction is active, the risk for large movements is increased since the programmed configuration data is based on the original position.

The IRB 5400 robot will move to the programmed axis configuration or to an axis configuration close to the programmed one.

[\Off]

Data type: switch

The robot moves to the programmed position using the closest axis configuration.

Continues on next page

Program execution

The configuration applies for the next executed movement instruction until a new ConfJ instruction is executed.

If the argument \On (or no argument) is chosen, the robot moves to the programmed position with configuration parameters equal or close to the the given configuration parameters.

If a program displacement or path correction is active, the risk for large movements is increased since the programmed configuration data is based on the original position.

If the argument \Off is chosen, the robot always moves to the closest axis configuration. This may be different to the programmed one if the configuration has been incorrectly specified manually, or if a program displacement has been carried out.

Control of the configuration (ConfJ \On) is active by default. This is automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to `main`
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Syntax

```
ConfJ
[ '\ ' On ] | [ '\ ' Off ]';'
```

Related information

For information about	See
Handling different configurations	<i>Technical reference manual - RAPID Overview</i>
Robot configuration during linear movement	ConfL - Monitors the configuration during linear movement on page 152
Motion settings data	motsetdata - Motion settings data on page 1674
Robot configuration data	confdata - Robot configuration data on page 1617

1 Instructions

1.56 ConfL - Monitors the configuration during linear movement *RobotWare Base*

1.56 ConfL - Monitors the configuration during linear movement

Usage

ConfL (*Configuration Linear*) is used to specify whether or not the robot's configuration is to be monitored during linear or circular movement. If it is not monitored, the configuration at execution time may differ from that at programmed time. It may also result in unexpected sweeping robot movements when the mode is changed to joint movement.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.



Note

For IRB5400 and IRB5500, the robot monitoring is always off independent of what is specified in ConfL.

Basic examples

The following examples illustrate the instruction ConfL:

Example 1

```
ConfL \On;  
MoveL *, v1000, fine, tool1;
```

Program execution stops when the programmed configuration is not possible to reach from the current position.

Example 2

```
SingArea \Wrist;  
ConfL \On;  
MoveL *, v1000, fine, tool1;
```

The robot moves to the programmed position, orientation and wrist axis configuration. If this is not possible, program execution stops.

Example 3

```
ConfL \Off;  
MoveL *, v1000, fine, tool1;
```

The robot moves to the programmed position and orientation but to the closest possible axis configuration, which can be different from the programmed.

Arguments

ConfL [\On][\Off]

[\On]

Data type: switch

The robot configuration is monitored.

[\Off]

Data type: switch

The robot configuration is not monitored.

Continues on next page

Program execution

The configuration applies for the next executed movement instruction until a new ConfL instruction is executed.

During linear or circular movement, the robot always moves to the programmed position and orientation that has the closest possible axis configuration. If the argument \On (or no argument) is used, then the program execution stops as soon as there is a risk that the configuration of the programmed position will not be attained from the current position. The way that this is decided varies between robot types, see [confdata - Robot configuration data on page 1617](#).

Before an ordered movement is started, a verification is made to see if it is possible to achieve the programmed configuration. If it is not possible, the program is stopped. When the movement is finished (in a zone or in a finepoint), it is also verified that the robot has reached the programmed configuration.

If SingArea \Wrist is used, the robot always moves to the programmed wrist axis configuration.

If the argument \Off is used, there is no monitoring.

After a stop caused by a configuration error it is possible to restart the RAPID program in manual mode. Note that in this case, due to the reported error, the robot will most likely not move to the correct configuration.

If ConfL \Off is used with a big movement, it can cause stops directly or later in the program with error 50050 Position outside reach or 50080 Position not compatible.

Monitoring of the configuration (ConfL \On) is active by default. This is automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

**Tip**

A simple rule of thumb to avoid problems, both for ConfL\On and \Off, is to insert intermediate points to make the movement of each axis less than 180 degrees between points.

**Tip**

In a program with ConfL \Off it is recommended to have start points with known configurations points with "ConfJ \On and MoveJ" or "ConfL \On and SingArea \Wrist and MoveL" before movements in different program parts.

Continues on next page

1 Instructions

1.56 ConfL - Monitors the configuration during linear movement

RobotWare Base

Continued

Syntax

```
ConfL  
[ '\ ' On] | [ '\ ' Off]';'
```

Related information

For information about	See
Handling different configurations	<i>Technical reference manual - RAPID Overview</i>
Robot configuration during joint movement	ConfJ - Controls the configuration during joint movement on page 150
Define interpolation around singular points	SingArea - Defines interpolation around singular points on page 696
Motion settings data	motsetdata - Motion settings data on page 1674
Robot configuration data	confdata - Robot configuration data on page 1617

1.57 CONNECT - Connects an interrupt to a trap routine

Usage

CONNECT is used to find the identity of an interrupt and connect it to a trap routine. The interrupt is defined by ordering an interrupt event and specifying its identity. Thus, when that event occurs, the trap routine is automatically executed.

Basic examples

The following example illustrates the instruction CONNECT:

Example 1

```
VAR intnum feeder_low;
PROC main()
  CONNECT feeder_low WITH feeder_empty;
  ISignalDI di1, 1 , feeder_low;
  ...
```

An interrupt identity `feeder_low` is created which is connected to the trap routine `feeder_empty`. There will be an interrupt when input `di1` is getting high. In other words, when this signal becomes high, the `feeder_empty` trap routine is executed.

Arguments

CONNECT Interrupt WITH Trap routine

Interrupt

Data type: `intnum`

The variable that is to be assigned the identity of the interrupt. This must not be declared within a routine (routine data).

Trap routine

Identifier

The name of the trap routine.

Program execution

The variable is assigned an interrupt identity which shall be used when ordering or disabling interrupts. This identity is also connected to the specified trap routine.



Note

All interrupts in a task are cancelled when program pointer is set to main for that task and must be reconnected. The interrupts will not be affected by a power fail or a **Restart**.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_ALRDYCNT	The interrupt variable is already connected to a trap routine.

Continues on next page

1 Instructions

1.57 CONNECT - Connects an interrupt to a trap routine

RobotWare Base

Continued

Name	Cause of error
ERR_CNTNOTVAR	The interrupt variable is not a variable reference.
ERR_INOMAX	No more interrupt numbers are available.

Limitations

An interrupt (interrupt identity) cannot be connected to more than one trap routine. Different interrupts, however, can be connected to the same trap routine.

When an interrupt has been connected to a trap routine, it cannot be reconnected or transferred to another routine; it must first be deleted using the instruction `IDelete`.

Interrupts that come or have not been handled when program execution is stopped will be neglected. The interrupts are not considered when stopping the program. Interrupts that has been set as safe will not be neglected at program stop. They will be handled when the program is started again.

Syntax

```
CONNECT <connect target> WITH <trap>;'  
<connect target> ::= <variable>  
                    | <parameter>  
                    | <VAR>  
<trap> ::= <identifier>
```

Related information

For information about	See
Summary of interrupts	<i>Technical reference manual - RAPID Overview</i>
More information on interrupt management	<i>Technical reference manual - RAPID Overview</i>
Data type for interrupt	intnum - Interrupt identity on page 1656
Cancelling an interrupt	IDelete - Cancels an interrupt on page 250

1.58 ContactL - Linear contact movement

Usage

ContactL (*Contact Linear*) is used for the YuMi robot to obtain contact with an object at a desired position while moving the tool center point (TCP) linearly.

The collision detection level is raised to its maximum value, and during the movement the robot supervises the internal torque and compares it to a torque level given by the user. When the requested user torque level is reached, the robot performs a stiff stop and continues with the rest of the program.

This instruction can typically be used when the tool held by the robot has to press an object into place.

This instruction can only be used in the main task T_ROB1, or in Motion tasks when in a *MultiMove* system.

The maximum speed for a ContactL instruction is 1000 mm/s.

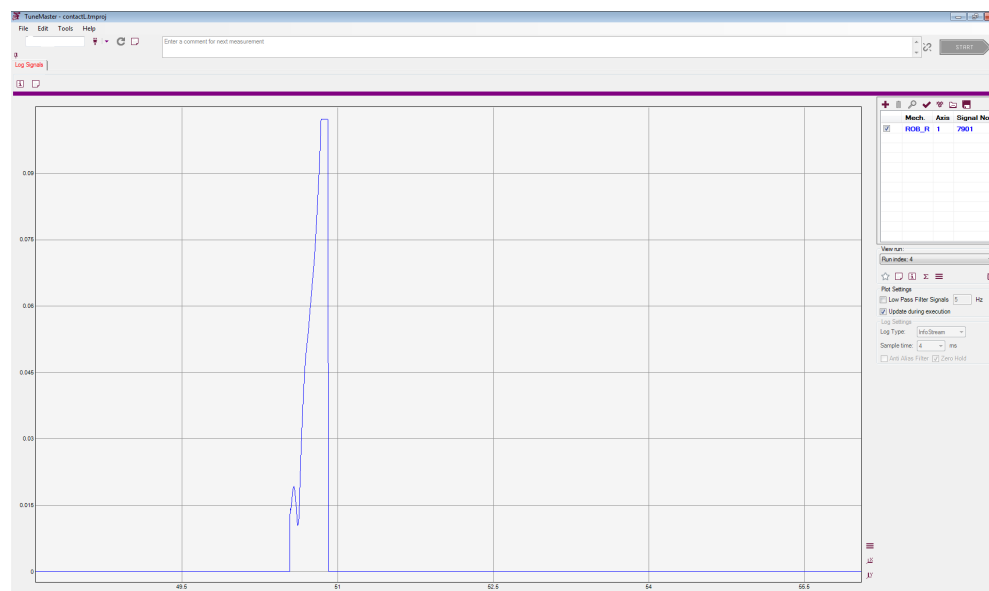


Note

During programming it is recommended to first test with a slow speed, <100 mm/s, and then gradually increase the speed to the desired value.

Description

To find out the value for the torque level `desiredTorque` it is necessary to test the application and to view an internal test signal, signal 7901, using TuneMaster.



xx150000649

For more information about TuneMaster, see the help section included in the application.

Basic examples

The following examples illustrate the instruction ContactL:

Continues on next page

1 Instructions

1.58 ContactL - Linear contact movement

YuMi

Continued

See also [More examples on page 160](#).

Example 1

```
desiredTorque := 0.1;
ContactL \DesiredTorque:=desiredTorque, p10, v100, tool1;
```

The TCP of tool1 is moved linearly towards the position p10 at a speed of v100. When the value of the internal torque level exceeds the desiredTorque level specified by the user, the robot will perform a stiff stop and then the program will continue from the position where the robot is stopped.

The argument DesiredTorque is optional. When DesiredTorque is omitted, the ContactL instruction will only raise the collision detection level to its maximum value, i.e. giving the opportunity to keep pressure on an object while moving the TCP.

If the desiredTorque is not reached when the robot reaches the desired position, there will be an execution error and the system stops with an event log. Therefore it is recommended to implement an error handler for such cases, see [Error handling on page 160](#).

Example 2

```
ContactL RelTool (CRobT(),5,5,0), v100, \Zone:=z10, tool1;
```

The robot is moved to a position that is 5 mm from its current position in the x direction and 5 mm from its current position in the y direction of the tool. If the Zone argument is omitted, the ContactL instruction will use a fine-point as default.

In the example the argument DesiredTorque is omitted. The instruction will only raise the collision detection level to its maximum value and the ContactL instruction will function similar to a MoveL instruction.

Example 3

```
desiredTorque := 0.9;
ContactL \DesiredTorque:=desiredTorque, p10, v100, tool1;
ContactL RelTool (CRobT(),5,5,0), v100, \Zone:=z10, tool1;
ContactL RelTool (CRobT(),5,5,-10), v100, \Zone:=z10, tool1;
MoveL ...
```

It is important to remember to use the ContactL instruction while in contact, but also when leaving contact. A normal move instruction will most probably trigger the motion supervision.

Arguments

ContactL [\DesiredTorque] ToPoint [\ID] Speed [\Zone] Tool [\WObj]

[\DesiredTorque]

Data type: num

User defined desired torque level.

ContactL will always use a fine-point as zone data for the destination if DesiredTorque is defined. When DesiredTorque is omitted the ContactL instruction will only raise the collision detection level and not supervise the internal torque level.

Continues on next page

ToPoint**Data type:** robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]***Synchronization id*****Data type:** identno

The argument [\ID] is mandatory in the MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed**Data type:** speeddata

The speed data that applies to movements. Speed data defines the velocity for the tool center point, the tool reorientation, and external axes.

[\Zone]**Data type:** zonedata

Zone data for the movement. Zone data describes the size of the generated corner path and is only used when DesiredTorque is omitted.

If the [\Zone] argument is omitted the ContactL instruction will use a fine-point as default.

Tool**Data type:** tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination position.

[\WObj]***Work Object*****Data type:** wobjdata

The work object (coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified for a linear movement relative to the work object to be performed.

Program execution

See the instruction MoveL for information about linear movement.

The robot movement stops when the internal torque level has exceeded the user defined torque level, assuming that the argument DesiredTorque is defined.

Otherwise the robot movement always continues to the programmed destination point.

Continues on next page

1 Instructions

1.58 ContactL - Linear contact movement

YuMi

Continued

If the argument `DesiredTorque` is omitted the collision detection level is raised to its maximum value and no supervision of the internal torque level is performed, i.e. giving the opportunity to keep pressure on an object while moving the TCP.

Error handling

An error is reported during a `ContactL` when:

- `ContactL` reaches the point specified in the argument `ToPoint` without reaching the `DesiredTorque` specified by the user. This generates the error `ERR_CONTACTL`.

Errors can be handled in different ways depending on the selected running mode:

- **Continuous forward/Instruction forward:**
No position is returned and the movement always continues to the programmed destination point. The system variable `ERRNO` is set to `ERR_CONTACTL` and the error can be handled in the error handler of the routine.
- **Instruction backward:**
During backward execution the instruction carries out the movement without any torque supervision.

Example

```
VAR num desiredTorque;
...
desiredTorque := 0.1;
MoveL p10, v100, fine, tool1;
ContactL \DesiredTorque:=desiredTorque, p20, v100, tool1;
...
ERROR
  IF ERRNO=ERR_CONTACTL THEN
    StorePath;
    MoveL p10, v100, fine, tool1;
    RestoPath;
    ClearPath;
    StartMove;
    RETRY;
  ELSE
    Stop;
  ENDIF
ENDPROC
```

The robot moves from position `p10` to `p20`. If the robot reaches `p20` without reaching the `DesiredTorque` specified by the user, then the robot moves back to `p10` and tries once more.

More examples

More examples of the instruction `ContactL` are illustrated below.

Example 1

```
ContactL p10, v100, \Zone:=z10, tool1;
```

Continues on next page

The TCP of tool1 is moved linearly towards the position p10 at a speed of v100 and a zone size of 10 mm.

Since the argument DesiredTorque is omitted, the ContactL instruction will only raise the collision detection level to its maximum value and not supervise the internal torque level.

Limitations

The instruction ContactL can only be used for YuMi robots.

Syntax

```

ContactL
['\ ' DesiredTorque ',']
[ToPoint ':=' ] <expression (IN) of robtarget>
['\ ' ID ':=' <expression (IN) of identno>'], '
[Speed ':=' ] <expression (IN) of speeddata>
['\ ' Zone ':=' <expression (IN) of zonedata>'], '
[Tool ':=' ] <persistent (PERS) of tooldata>
['\ ' WObj ':=' <persistent (PERS) of wobjdata>'];'
```

Related information

For information about	See
Writes to a corrections entry	CorrWrite - Writes to a correction generator on page 176
Moves the robot linearly	MoveL - Moves the robot linearly on page 457
Definition of load	loaddata - Load data on page 1664
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
Using error handlers	<i>Technical reference manual - RAPID Overview</i>
Linear movement	
Motion in general	
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayloadMode</i> for activating and deactivating payload.	

1 Instructions

1.59 Continue - Skip the rest of the loop

RobotWare Base

1.59 Continue - Skip the rest of the loop

Usage

Continue is used to skip the rest of the loop statement and starts the next iteration of the loop.

Basic examples

The following example illustrates the instruction Continue.

Example 1

```
FOR i FROM 1 TO 5 DO
  TPWrite "ABC"; ! will be run for i = 1, 2, 3, 4, 5
  IF ( i > 3) THEN
    CONTINUE;
  ENDIF
  TPWrite "DEF"; ! will only be run for i = 1, 2, 3
ENDFOR
```

Limitations

It is only possible to use Continue in a While or a For loop.

Syntax

```
CONTINUE ';' ;'
```

Related information

For information about	See
WHILE	WHILE - Repeats as long as ... on page 1059
FOR	FOR - Repeats a given number of times on page 216

1.60 CopyFile - Copy a file

Usage

CopyFile is used to make a copy of an existing file.

Basic examples

The following example illustrates the instruction CopyFile:

Example 1

```
CopyFile "HOME:/myfile", "HOME:/yourfile";
```

The file myfile is copied to yourfile. Both files are then identical.

```
CopyFile "HOME:/myfile", "HOME:/mydir/yourfile";
```

The file myfile is copied to yourfile in the existing directory mydir.

Arguments

CopyFile OldPath NewPath

OldPath

Data type: string

The complete path of the file to be copied from.

NewPath

Data type: string

The complete path where the file is to be copied to.

Program execution

The file specified in OldPath will be copied to the file specified in NewPath.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	The file specified in OldPath does not exist.
ERR_FILEEXIST	The file specified in NewPath already exists.

Syntax

```
CopyFile
[ OldPath ':' ] < expression (IN) of string > ','
[ NewPath ':' ] < expression (IN) of string > ';'

```

Related information

For information about	See
Make a directory	MakeDir - Create a new directory on page 343
Remove a directory	RemoveDir - Delete a directory on page 585
Rename a file	RenameFile - Rename a file on page 588

Continues on next page

1 Instructions

1.60 CopyFile - Copy a file

RobotWare Base

Continued

For information about	See
Remove a file	RemoveFile - Delete a file on page 587
Check file type	IsFile - Check the type of a file on page 1324
Check file size	FileSize - Retrieve the size of a file on page 1249
Check file system size	FSSize - Retrieve the size of a file system on page 1255
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

1.61 CopyRawBytes - Copy the contents of rawbytes data

Usage

CopyRawBytes is used to copy all or part of the contents from one rawbytes variable to another.

Basic examples

The following example illustrates the instruction CopyRawBytes:

Example 1

```

VAR rawbytes from_raw_data;
VAR rawbytes to_raw_data;
VAR num integer := 8
VAR num float := 13.4;

ClearRawBytes from_raw_data;
PackRawBytes integer, from_raw_data, 1 \IntX := DINT;
PackRawBytes float, from_raw_data, (RawBytesLen(from_raw_data)+1)
\Float4;
CopyRawBytes from_raw_data, 1, to_raw_data, 3,
RawBytesLen(from_raw_data);

```

In this example the variable `from_raw_data` of type `rawbytes` is first cleared, that is all bytes set to 0. Then in the first 4 bytes the value of `integer` is placed and in the next 4 bytes the value of `float`.

After having filled `from_raw_data` with data, the contents (8 bytes) is copied to `to_raw_data`, starting at position 3.

Arguments

CopyRawBytes FromRawData FromIndex ToRawData ToIndex[\NoOfBytes]

FromRawData

Data type: rawbytes

FromRawData is the data container from which the rawbytes data shall be copied.

FromIndex

Data type: num

FromIndex is the position in FromRawData where the data to be copied starts. Indexing starts at 1.

ToRawData

Data type: rawbytes

ToRawData is the data container to which the rawbytes data shall be copied.

ToIndex

Data type: num

ToIndex is the position in ToRawData where the data to be copied will be placed. Everything is copied to the end. Indexing starts at 1.

Continues on next page

1 Instructions

1.61 CopyRawBytes - Copy the contents of rawbytes data

RobotWare Base

Continued

[\NoOfBytes]

Data type: num

The value specified with \NoOfBytes is the number of bytes to be copied from FromRawData to ToRawData.

If \NoOfBytes is not specified, all bytes from FromIndex to the end of current length of valid bytes in FromRawData is copied.

Program execution

During program execution data is copied from one rawbytes variable to another.

The current length of valid bytes in the ToRawData variable is set to:

- (ToIndex + copied_number_of_bytes - 1)
- The current length of valid bytes in the ToRawData variable is not changed, if the complete copy operation is done inside the old current length of valid bytes in the ToRawData variable.

Limitations

CopyRawBytes cannot be used to copy some data from one rawbytes variable to other part of the same rawbytes variable.

Syntax

```
CopyRawBytes
[FromRawData ':='] < variable (VAR) of rawbytes> ', '
[FromIndex ':='] < expression (IN) of num> ', '
[ToRawData ':='] < variable (VAR) of rawbytes> ', '
[ToIndex ':='] < expression (IN) of num>
['\NoOfBytes ':='] < expression (IN) of num> '];'
```

Related information

For information about	See
rawbytes data	rawbytes - Raw data on page 1702
Get the length of rawbytes data	RawBytesLen - Get the length of rawbytes data on page 1404
Clear the contents of rawbytes data	ClearRawBytes - Clear the contents of rawbytes data on page 140
Pack DeviceNet header into rawbytes data	PackDNHeader - Pack DeviceNet Header into rawbytes data on page 506
Pack data into rawbytes data	PackRawBytes - Pack data into rawbytes data on page 509
Write rawbytes data	WriteRawBytes - Write rawbytes data on page 1078
Read rawbytes data	ReadRawBytes - Read rawbytes data on page 576
Unpack data from rawbytes data	UnpackRawBytes - Unpack data from rawbytes data on page 981
File and I/O device handling	Application manual - Controller software OmniCore

1.62 CornerPathWarning - Show or hide corner path warnings

Usage

CornerPathWarning is used to activate/deactivate corner path failure warnings (50024 event log) for all subsequent movement instructions.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Basic examples

The following examples illustrate the instruction CornerPathWarning.

Example 1

```
CornerPathWarning TRUE;
```

Activating corner path warnings.

Example 2

```
PROC main()
  ! Deactivate corner path warning on all
  ! subsequent movement instructions
  CornerPathWarning FALSE;
  ...
  ! Check if warning is suppressed
  IF C_MOTSET.corner_path_warn_suppress=TRUE THEN
    CornerPathWarning TRUE;
  ENDIF
  MyProcess;
```

Deactivate corner path warnings in start of program. Later on, check if the corner path warning is suppressed. If it is, activate corner path warning before calling MyProcess.

Arguments

CornerPathWarning Active

Active

Data type: bool

Specifies if the corner path warnings should be active.

Program execution

The setting applies for the next executed movement instruction, for both the robot and external axes, until a new CornerPathWarning instruction is executed.

A corner path failure occurs when the robot is executing a corner zone move instruction and the RAPID program execution does not provide a new move instruction in time. This forces the system to convert the programmed fly-by point to a fine point.

If set to true, any succeeding move instruction with a corner path failure will display a warning in the event log.

If set to false, corner path failures will still be executed as fine points but the warning will not be shown in the event log.

Continues on next page

1 Instructions

1.62 CornerPathWarning - Show or hide corner path warnings

RobotWare Base

Continued

To get the same behavior as in earlier versions of Robotware, where the warning could be removed in the configuration, the recommendation is to put `CornerPathWarning FALSE;` in the event routine executed at program start (event START).

The default value (report corner path error) is automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to `main`
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.



Note

The recommendation is to have the corner path warning activated. Turn off the corner path warning only in situations where a warning sometimes occur. Such situations can be when waiting for some input (from I/O, cameras, sensors or other external equipment). A corner path warning can result in bad process performance and will lead to worse cycle times. All those situations needs to be analyzed before removing the corner path warning.

Syntax

```
CornerPathWarning
  [Active ':='] <expression (IN) of bool>';'
```

Related information

For information about	See
Move instruction	MoveL - Moves the robot linearly on page 457
Corner path behavior	Section <i>Interpolation of corner paths</i> in <i>Technical reference manual - RAPID Overview</i>
Motion settings	motsetdata - Motion settings data on page 1674
Defining event routines	<i>Technical reference manual - System parameters</i>

1.63 CorrClear - Removes all correction generators

Descriptions

CorrClear is used to remove all connected correction generators. The instruction can be used to remove all offsets provided earlier by all correction generators.

Basic examples

The following example illustrates the instruction CorrClear:

Example 1

```
CorrClear;
```

The instruction removes all connected correction generators.



Note

An easy way to ensure that all correction generators (with corrections) are removed at program start, is to run CorrClear in a START event routine.
See *Technical reference manual - System parameters*, the topic *Controller*.

Syntax

```
CorrClear ';' ;
```

Related information

For information about	See
Connects to a correction generator	CorrCon - Connects to a correction generator on page 170
Disconnects from a correction generator	CorrDiscon - Disconnects from a correction generator on page 175
Writes to a correction generator	CorrWrite - Writes to a correction generator on page 176
Reads the current total offsets	CorrRead - Reads the current total offsets on page 1199
Correction descriptor	corrdescr - Correction generator descriptor on page 1625

1 Instructions

1.64 CorrCon - Connects to a correction generator

Path Corrections

1.64 CorrCon - Connects to a correction generator

Usage

CorrCon is used to connect to a correction generator.

Basic examples

The following example illustrates the instruction CorrCon:
See also [More examples on page 170](#).

Example1

```
VAR corrdescr id;  
...  
CorrCon id;
```

The correction generator reference corresponds to the variable `id` reservation.

Arguments

CorrCon Descr

Descr

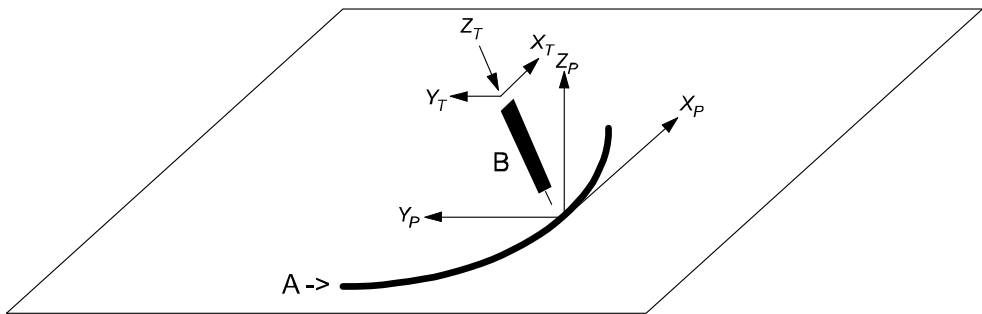
Data type: corrdescr
Descriptor of the correction generator.

More examples

More examples of the instruction CorrCon are illustrated below.

Path coordinate system

All path corrections (offsets on the path) are added in the path coordinate system.
The path coordinate system is defined as illustrated below:



xx0500002156

A	Path direction
B	Tool
P	Path coordinate system
T	Tool coordinate system

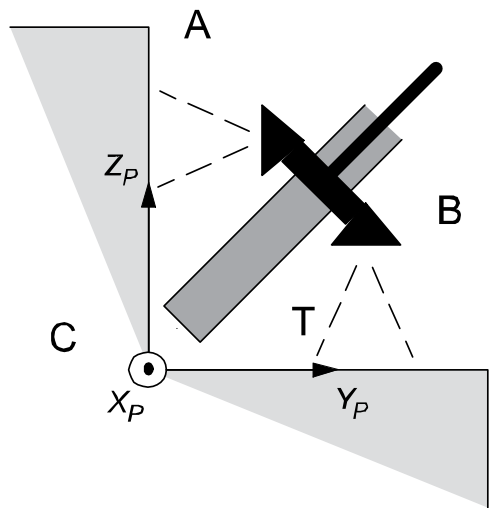
- Path coordinate axis X is given as the tangent of the path.
- Path coordinate axis Y is derived as the cross product of path coordinate axis X and tool coordinate axis Z.

Continues on next page

- Path coordinate axis Z is derived as the cross product of path coordinate axis X and path coordinate axis Y.

Application example

An example of an application using path corrections is a robot holding a tool with two sensors mounted on it to detect the vertical and horizontal distances to a work object. The figure below illustrates a path correction device.



xx0500002155

A	Sensor for horizontal correction
B	Sensor for vertical correction
C	Path coordinate system
T	Tool

Program example

**Note**

hori_sig and vert_sig are analog signals defined in system parameters.

```
CONST num TARGET_DIST := 5;  
CONST num SCALE_FACTOR := 0.5;  
VAR intnum intno1;  
VAR corrdescr hori_id;  
VAR corrdescr vert_id;  
VAR pos total_offset;  
VAR pos write_offset;  
VAR bool conFlag;  
PROC PathRoutine()  
  ! Connect to the correction generators for horizontal  
  ! and vertical correction.  
  CorrCon hori_id;  
  CorrCon vert_id;  
  conFlag := TRUE;
```

Continues on next page

1 Instructions

1.64 CorrCon - Connects to a correction generator

Path Corrections

Continued

```
! Setup a 5 Hz timer interrupt. The trap routine will read the
! sensor values and compute the path corrections.
CONNECT intno1 WITH ReadSensors;
ITimer\Single, 0.2, intno1;

! Position for start of contour tracking
MoveJ p10, v100, z10, tool1;
! Run MoveL with both vertical and horizontal correction.
MoveL p20, v100, z10, tool1 \Corr;

! Read the total corrections added by all connected
! correction generators.
total_offset := CorrRead();
! Write the total vertical correction on the FlexPendant.
TPWrite "The total vertical correction is:" \Num:=total_offset.z;

! Disconnect the correction generator for vertical correction.
! Horizontal corrections will be unaffected.
CorrDiscon vert_id;
conFlag := FALSE;

! Run MoveL with only horizontal interrupt correction.
MoveL p30, v100, fine, tool1 \Corr;
! Remove all outstanding connected correction generators.
! In this case, the only connected correction generator is
! the one for horizontal correction.
CorrClear;
! Remove the timer interrupt.
IDelete intno1;
ENDPROC
TRAP ReadSensors
VAR num horiSig;
VAR num vertSig;
! Compute the horizontal correction values and execute
! the correction.
horiSig := hori_sig;
write_offset.x := 0;
write_offset.y := (hori_sig - TARGET_DIST)*SCALE_FACTOR;
write_offset.z := 0;
CorrWrite hori_id, write_offset;

IF conFlag THEN
! Compute the vertical correction values and execute
! the correction.
write_offset.x := 0;
write_offset.y := 0;
write_offset.z := (vert_sig - TARGET_DIST)*SCALE_FACTOR;
CorrWrite vert_id, write_offset;
ENDIF
!Setup interrupt again
IDelete intnol;
```

Continues on next page


```

CONNECT intno1 WITH ReadSensors;
ITimer\single, 0.2, intno1;
ENDTRAP

```

Program explanation

Two correction generators are connected with the instruction CorrCon. Each correction generator is referenced by a unique descriptor (hori_id and vert_id) of the type corrdescr. The two sensors will use one correction generator each.

A timer interrupt is set up to call the trap routine ReadSensors with a frequency of 5 Hz. The offsets, needed for path correction, are computed in the trap routine and written to the corresponding correction generator (referenced by the descriptors hori_id and vert_id) by the instruction CorrWrite. All the corrections will have immediate effect on the path.

The MoveL instruction must be programmed with the switch argument Corr when path corrections are used. Otherwise, no corrections will be executed.

When the first MoveL instruction is ready, the function CorrRead is used to read the sum of all the corrections (the total path correction) given by all the connected correction generators. The result of the total vertical path correction is written to the FlexPendant with the instruction TPWrite.

CorrDiscon will then disconnect the correction generator for vertical correction (referenced by the descriptor vert_id). All corrections added by this correction generator will be removed from the total path correction. The corrections added by the correction generator for horizontal correction will still be preserved.

Finally, the function CorrClear will remove all remaining connected correction generators and their previously added corrections. In this case, it is only the correction generator for horizontal correction that will be removed. The timer interrupt will also be removed by the instruction IDelete.

The correction generators

The table below illustrates the correction generators.

X	Y	Z	Path coordinate axis
0	0	3	Vertical correction generator with the sum of all its own path corrections
0	1	0	Horizontal correction generator with the sum of all its own path corrections
-	-	-	Not connected correction generator
-	-	-	Not connected correction generator
-	-	-	Not connected correction generator
0	1	3	The sum of all corrections done by all connected correction generators

Limitations

- A maximum number of 5 correction generators can be connected simultaneously.
- Connected correction generators do not survive a controller restart.
- Sharp corners and backward execution should be avoided when using a correction generator, since correction is added in the path coordinate system.

Continues on next page

1 Instructions

1.64 CorrCon - Connects to a correction generator

Path Corrections

Continued

Syntax

```
CorrCon  
[ Descr ':= ' ] < variable (VAR) of corrdescr > ';' ;
```

Related information

For information about	See
Disconnects from a correction generator	<i>CorrDiscon - Disconnects from a correction generator on page 175</i>
Writes to a correction generator	<i>CorrWrite - Writes to a correction generator on page 176</i>
Reads the current total offsets	<i>CorrRead - Reads the current total offsets on page 1199</i>
Removes all correction generators	<i>CorrClear - Removes all correction generators on page 169</i>
Correction generator descriptor	<i>corrdescr - Correction generator descriptor on page 1625</i>

1.65 CorrDiscon - Disconnects from a correction generator

Description

CorrDiscon is used to disconnect from a previously connected correction generator. The instruction can be used to remove corrections given earlier.

Basic examples

The following example illustrates the instruction CorrDiscon:

See also [More examples on page 175](#).

Example 1

```
VAR corrdescr id;
...
CorrCon id;
...
CorrDiscon id;
```

CorrDiscon disconnects from the previously connected correction generator referenced by the descriptor id.

Arguments

CorrDiscon Descr

Descr

Data type: corrdescr

Descriptor of the correction generator.

More examples

For more examples of the instruction CorrDiscon, see [CorrCon - Connects to a correction generator on page 170](#).

Syntax

```
CorrDiscon
[ Descr ':= ' ] < variable (VAR) of corrdescr > ';' ;
```

Related information

For information about	See
Connects to a correction generator	CorrCon - Connects to a correction generator on page 170
Writes to a correction generator	CorrWrite - Writes to a correction generator on page 176
Reads the current total offsets	CorrRead - Reads the current total offsets on page 1199
Removes all correction generators	CorrClear - Removes all correction generators on page 169
Correction descriptor	corrdescr - Correction generator descriptor on page 1625

1 Instructions

1.66 CorrWrite - Writes to a correction generator

Path Corrections

1.66 CorrWrite - Writes to a correction generator

Description

CorrWrite is used to write offsets in the path coordinate system to a correction generator.

Basic examples

The following example illustrates the instruction CorrWrite:

Example 1

```
VAR corrdescr id;  
VAR pos offset;  
...  
CorrWrite id, offset;
```

The current offsets, stored in the variable offset, are written to the correction generator referenced by the descriptor id.

Arguments

CorrWrite Descr Data

Descr

Data type: corrdescr
Descriptor of the correction generator.

Data

Data type: pos
The offset to be written.

More examples

For more examples of the instruction CorrWrite, see [CorrCon - Connects to a correction generator on page 170](#).

Limitations

The best performance is achieved on straight paths. As the speed and angles between consecutive linear paths increase, the deviation from the expected path will also increase. The same applies to circles with decreasing circle radius.

Syntax

```
CorrWrite  
[ Descr ':' = ' ] < variable (VAR) of corrdescr > ' , '  
[ Data ':' = ' ] < expression (IN) of pos > ' ; '
```

Related information

For information about	See
Connects to a correction generator	CorrCon - Connects to a correction generator on page 170
Disconnects from a correction generator	CorrDiscon - Disconnects from a correction generator on page 175

Continues on next page

1.66 CorrWrite - Writes to a correction generator

Path Corrections

Continued

For information about	See
Reads the current total offsets	<i>CorrRead - Reads the current total offsets on page 1199</i>
Removes all correction generators	<i>CorrClear - Removes all correction generators on page 169</i>
Correction generator descriptor	<i>corrdescr - Correction generator descriptor on page 1625</i>

1 Instructions

1.67 DeactEventBuffer - Deactivation of event buffer

RobotWare Base

1.67 DeactEventBuffer - Deactivation of event buffer

Description

DeactEventBuffer is used to deactivate the use of the event buffer in current motion program task.

The instructions DeactEventBuffer and ActEventBuffer should be used when combining an application using finepoints and a continuous application where signals needs to be set in advance due to slow process equipment.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Basic examples

The following example illustrates the instruction DeactEventBuffer:

Example 1

```
..
DeactEventBuffer;
! Use an application that use finepoints, such as SpotWelding
..
! Activate the event buffer again
ActEventBuffer;
! Now it is possible to use an application that needs
! to set signals in advance, such as Dispense
..
```

The DeactEventBuffer deactivates the configured event buffer. When using an application with finepoints, the start of the robot from the finepoint will be faster. When activating the the event buffer with ActEventBuffer, it is possible to set signals in advance for an application with slow process equipment.

Program execution

The deactivation of an event buffer applies for the next executed robot movement instruction of any type and is valid until a ActEventBuffer instruction is executed.

The instruction will wait until the robot and external axes has reached the stop point (ToPoint of current move instruction) before the deactivation of the event buffer. Therefore it is recommended to program the movement instruction preceding DeactEventBuffer with a fine point.

The default value (ActEventBuffer) is automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Continues on next page

Limitations

DeactEventBuffer cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart or Step.

Syntax

DeactEventBuffer ';' ;

Related information

For information about	See
Activation of event buffer	ActEventBuffer - Activation of event buffer on page 26
Configuration of Event preset time	<i>Technical reference manual - System parameters</i>
Motion settings data	motsetdata - Motion settings data on page 1674

1 Instructions

1.68 DeactUnit - Deactivates a mechanical unit

RobotWare Base

1.68 DeactUnit - Deactivates a mechanical unit

Usage

DeactUnit is used to deactivate a mechanical unit.

It can be used to determine which unit is to be active when, for example, common drive units are used.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Examples

The following examples illustrate the instruction DeactUnit:

Example 1

```
DeactUnit orbit_a;
```

Deactivation of the orbit_a mechanical unit.

Example 2

```
MoveL p10, v100, fine, tool1;  
DeactUnit track_motion;  
MoveL p20, v100, z10, tool1;  
MoveL p30, v100, fine, tool1;  
ActUnit track_motion;  
MoveL p40, v100, z10, tool1;
```

The unit track_motion will be stationary when the robot moves to p20 and p30. After this, both the robot and track_motion will move to p40.

Example 3

```
MoveL p10, v100, fine, tool1;  
DeactUnit orbit1;  
ActUnit orbit2;  
MoveL p20, v100, z10, tool1;
```

The unit orbit1 is deactivated and orbit2 is activated.

Arguments

DeactUnit MechUnit

MechUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit that is to be deactivated.

Program execution

When the robot's and external axes' actual path is ready, the path on current path level is cleared and the specified mechanical unit is deactivated. This means that it will neither be controlled nor monitored until it is re-activated.

If several mechanical units share a common drive unit, deactivation of one of the mechanical units will also disconnect that unit from the common drive unit.

Continues on next page

Limitations

Instruction DeactUnit cannot be used when one of the mechanical unit is in independent mode.

If this instruction is preceded by a move instruction, that move instruction must be programmed with a stop point (zonedata fine), not a fly-by point, otherwise restart after power failure will not be possible.

DeactUnit cannot be executed in a RAPID routine connected to any of following special system events: PowerOn, Stop, QStop, Restart or Step.

It is possible to use ActUnit - DeactUnit on StorePath level, but the same mechanical units must be active when doing RestoPath as when StorePath was done. If such operation the Path Recorder and the path on the base level will be intact, but the path on the StorePath level will be cleared.

Syntax

```
DeactUnit
  [MechUnit ':='] < variable (VAR) of mecunit> ';'

```

Related information

For information about	See
Activating mechanical units	ActUnit - Activates a mechanical unit on page 28
Mechanical units	mecunit - Mechanical unit on page 1672
Check if a mechanical unit is activated or not.	IsMechUnitActive - Is mechanical unit active on page 1330
Path Recorder	PathRecMoveBwd - Move path recorder backwards on page 525 mecunit - Mechanical unit on page 1672

1 Instructions

1.69 Decr - Decrements by 1
RobotWare Base

1.69 Decr - Decrements by 1

Usage

Decr is used to subtract 1 from a numeric variable or persistent.

Basic examples

The following example illustrates the instruction Decr:

See also [More examples on page 182](#).

Example 1

```
Decr reg1;
```

1 is subtracted from reg1, that is `reg1:=reg1-1`.

Arguments

Decr Name | Dname

Name

Data type: num

The name of the variable or persistent to be decremented.

Dname

Data type: dnum

The name of the variable or persistent to be decremented.

More examples

More examples of the instruction Decr are illustrated below.

Example 1

```
VAR num no_of_parts:=0;
...
TPReadNum no_of_parts, "How many parts should be produced? ";
WHILE no_of_parts>0 DO
  produce_part;
  Decr no_of_parts;
ENDWHILE
```

The operator is asked to input the number of parts to be produced. The variable `no_of_parts` is used to count the number that still have to be produced.

Example 2

```
VAR dnum no_of_parts:=0;
...
TPReadDnum no_of_parts, "How many parts should be produced? ";
WHILE no_of_parts>0 DO
  produce_part;
  Decr no_of_parts;
ENDWHILE
```

The operator is asked to input the number of parts to be produced. The variable `no_of_parts` is used to count the number that still have to be produced.

Continues on next page

Syntax

Decr

```
[ Name ':=' ] < variable or persistent (INOUT) of num >
| [ Dname ':=' ] < variable or persistent (INOUT) of dnum > ' ;'
```

Related information

For information about	See
Incrementing a variable by 1	Incr - Increments by 1 on page 258
Subtracting any value from a variable	Add - Adds a numeric value on page 30
Changing data using an arbitrary expression, e.g. multiplication	":=" - Assigns a value on page 39

1 Instructions

1.70 DropWObj - Drop work object on conveyor *Conveyor Tracking*

1.70 DropWObj - Drop work object on conveyor

Usage

DropWObj (*Drop Work Object*) is used to disconnect from the current object and the program is ready for the next object on the conveyor.

Basic examples

The following example illustrates the instruction DropWObj:

Example 1

```
MoveL *, v1000, z10, tool, \WObj:=wobj_on_cnv1;  
MoveL *, v1000, fine, tool, \WObj:=wobj0;  
DropWObj wobj_on_cnv1;  
MoveL *, v1000, z10, tool, \WObj:=wobj0;
```

Arguments

DropWObj WObj

WObj

Work Object

Data type: wobjdata

The moving work object (coordinate system) to which the robot position in the instruction is related. The mechanical unit conveyor is to be specified by the `ufmec` in the work object.

Program execution

Dropping the work object means that the encoder unit no longer tracks the object. The object is removed from the object queue and cannot be recovered.

Limitations

If the instruction is issued while the robot is actively using the conveyor coordinated work object, then the motion stops.

The instruction may be issued only after a fixed work object has been used in the preceding motion instructions with either a fine point or several (>1) corner zones.

Syntax

```
DropWObj  
[ WObj '[:=' ] < persistent (PERS) of wobjdata>';'
```

Related information

For information about	See
Wait for work objects	WaitWObj - Wait for work object on conveyor on page 1055
Conveyor tracking	Application manual - Conveyor tracking

1.71 EOffsOff - Deactivates an offset for additional axes

Usage

EOffsOff (*External Offset Off*) is used to deactivate an offset for additional axes. The offset for additional axes is activated by the instruction EOffsSet or EOffsOn and applies to all movements until some other offset for additional axes is activated or until the offset for additional axes is deactivated.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Basic examples

The following examples illustrate the instruction EOffsOff:

Example 1

```
EOffsOff;
```

Deactivation of the offset for additional axes.

Example 2

```
MoveL p10, v500, z10, tool1;
EOffsOn \ExeP:=p10, p11;
MoveL p20, v500, z10, tool1;
MoveL p30, v500, z10, tool1;
EOffsOff;
MoveL p40, v500, z10, tool1;
```

An offset is defined as the difference between the position of each axis at p10 and p11. This displacement affects the movement to p20 and p30, but not to p40.

Program execution

Active offsets for additional axes are reset.

Syntax

```
EOffsOff ' ; '
```

Related information

For information about	See
Definition of offset using two positions	EOffsOn - Activates an offset for additional axes on page 186
Definition of offset using known values	EOffsSet - Activates an offset for additional axes using known values on page 188
Deactivation of the robot's program displacement	PDispOff - Deactivates program displacement on page 542

1 Instructions

1.72 EOffsOn - Activates an offset for additional axes

RobotWare Base

1.72 EOffsOn - Activates an offset for additional axes

Usage

EOffsOn (*External Offset On*) is used to define and activate an offset for additional axes using two positions.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Basic examples

The following examples illustrate the instruction EOffsOn:

See also [More examples on page 187](#).

Example 1

```
MoveL p10, v500, z10, tool1;  
EOffsOn \ExeP:=p10, p20;
```

Activation of an offset for additional axes. This is calculated for each axis based on the difference between positions p10 and p20.

Example 2

```
MoveL p10, v500, fine \Inpos := inpos50, tool1;  
EOffsOn *;
```

Activation of an offset for additional axes. Since a stop point that is accurately defined has been used in the previous instruction, the argument \ExeP does not have to be used. The displacement is calculated on the basis of the difference between the actual position of each axis and the programmed point (*) stored in the instruction.

Arguments

EOffsOn [\ExeP] ProgPoint

[\ExeP]

Executed Point

Data type: robtarget

The new position, used for calculation of the offset. If this argument is omitted, the current position of the axes at the time of the program execution is used.

ProgPoint

Programmed Point

Data type: robtarget

The original position of the axes at the time of programming.

Program execution

The offset is calculated as the difference between \ExeP and ProgPoint for each additional axis. If \ExeP has not been specified, the current position of the axes at the time of the program execution is used instead. Since it is the actual position of the axes that is used, the axes should not move when EOffsOn is executed.

Continues on next page

This offset is then used to displace the position of additional axes in subsequent positioning instructions and remains active until some other offset is activated (the instruction `EOffsSet` or `EOffsOn`) or until the offset for additional axes is deactivated (the instruction `EOffsOff`).

Only **one** offset for each individual additional axis can be activated at the same time. Several `EOffsOn`, on the other hand, can be programmed one after the other and, if they are, the different offsets will be added.

The additional axes offset is automatically reset:

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to `main`
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

More examples

More examples of how to use the instruction `EOffsOn` are illustrated below.

Example 1

```
SearchL sen1, psearch, p10, v100, tool1;
PDispOn \ExeP:=psearch, *, tool1;
EOffsOn \ExeP:=psearch, *;
```

A search is carried out in which the searched position of both the robot and the additional axes is stored in the position `psearch`. Any movement carried out after this starts from this position using a program displacement of both the robot and the additional axes. This is calculated based on the difference between the searched position and the programmed point (*) stored in the instruction.

Syntax

```
EOffsOn
[ '\ ' ExeP ':=' < expression (IN) of robtarget> ', ' ]
[ ProgPoint ':=' ] < expression (IN) of robtarget> ';' ;
```

Related information

For information about	See
Deactivation of offset for additional axes	EOffsOff - Deactivates an offset for additional axes on page 185
Definition of offset using known values	EOffsSet - Activates an offset for additional axes using known values on page 188
Displacement of the robot's movements	PDispOn - Activates program displacement on page 543
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>

1 Instructions

1.73 EOffsSet - Activates an offset for additional axes using known values

RobotWare Base

1.73 EOffsSet - Activates an offset for additional axes using known values

Usage

EOffsSet (*External Offset Set*) is used to define and activate an offset for additional axes using known values.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Basic examples

The following example illustrates the instruction EOffsSet:

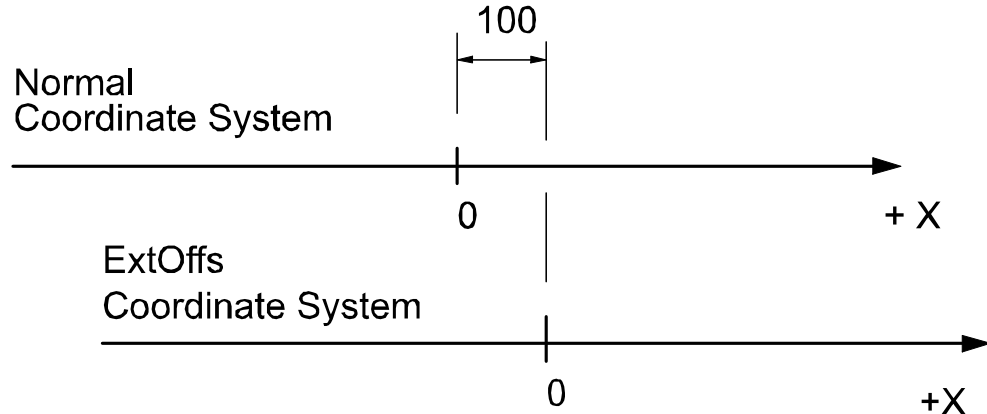
Example 1

```
VAR extjoint eax_a_p100 := [100, 0, 0, 0, 0, 0];  
...  
EOffsSet eax_a_p100;
```

Activation of an offset `eax_a_p100` for additional axes, meaning (provided that the logical additional axis "a" is linear) that:

- The ExtOffs coordinate system is displaced 100 mm for the logical axis "a" (see figure below).
- As long as this offset is active, all positions will be displaced 100 mm in the direction of the x-axis.

The following figure shows displacement of an additional axis.



xx0500002162

Arguments

EOffsSet EAxOffs

EAxOffs

External Axes Offset

Data type: `extjoint`

The offset for additional axes is defined as data of the type `extjoint`, expressed in:

- mm for linear axes
- degrees for rotating axes

Continues on next page

Program execution

The offset for additional axes is activated when the EOffsSet instruction is executed and remains active until some other offset is activated (the instruction EOffsSet or EOffsOn) or until the offset for additional axes is deactivated (the instruction EOffsOff).

Only one offset for additional axes can be activated at the same time. Offsets cannot be added to one another using EOffsSet.

The additional axes offset is automatically reset:

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Syntax

```
EOffsSet
  [ EAxOffs ':= ' ] < expression (IN) of extjoint> ';'

```

Related information

For information about	See
Activate an offset for additional axes	EOffsOn - Activates an offset for additional axes on page 186
Deactivation of offset for additional axes	EOffsOff - Deactivates an offset for additional axes on page 185
Displacement of the robot's movements	PDispOn - Activates program displacement on page 543
Definition of data of the type extjoint	extjoint - Position of external joints on page 1646
Coordinate systems	Technical reference manual - RAPID Overview

1 Instructions

1.74 EraseModule - Erase a module

RobotWare Base

1.74 EraseModule - Erase a module

Usage

EraseModule is used to remove a module from the program memory during execution.

There are no restrictions on how the module was loaded. It could have been loaded manually, from the configuration, or with a combination of the instructions Load, StartLoad, and WaitLoad.

The module cannot be defined as *Shared* in the configuration.

Basic examples

The following example illustrates the instruction EraseModule:

Example 1

```
EraseModule "PART_A";
```

Erase the program module PART_A from the program memory.

Arguments

```
EraseModule ModuleName
```

ModuleName

Data type: string

The name of the module that should be removed. Please note that this is the name of the module, not the name of the file.

Program execution

The program execution waits for the program module to finish the removal process before the execution proceeds with the next instruction.

When the program module is removed the rest of the program modules will be linked.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_MODULE	The file in the EraseModule instruction cannot be removed because it was not found.

Limitations

It is not allowed to remove a program module that is executing.

Trap routines, system I/O events, and other program tasks cannot execute during the removal process.

Avoid ongoing robot movements during the removal.

Program stop during execution of EraseModule instruction results in guard stop with motors off and error message "20025 Stop order timeout" on the FlexPendant.

Continues on next page

Syntax

```
EraseModule  
[ModuleName':=']<expression (IN) of string>;'
```

Related information

For information about	See
Unload a program module	UnLoad - Unload a program module during execution on page 978
Load a program module in parallel with another program execution	StartLoad - Load a program module during execution on page 759 WaitLoad - Connect the loaded module to the task on page 1031
Accept unresolved reference	<i>Technical reference manual - System parameters, section Controller</i>

1 Instructions

1.75 ErrLog - Write an error message *RobotWare Base*

1.75 ErrLog - Write an error message

Usage

ErrLog is used to display an error message on the FlexPendant and write it in the event log. Error number and five error arguments must be stated. The message is stored in the process domain in the robot log. ErrLog can also be used to display warnings and information messages.

Basic examples

The following examples illustrate the instruction ErrLog:

Example 1

In case you do not want to make your own .xml file, you can use ErrorId 4800 like in the example below:

```
VAR errstr my_title := "myerror";
VAR errstr str1 := "errortext1";
VAR errstr str2 := "errortext2";
VAR errstr str3 := "errortext3";
VAR errstr str4 := "errortext4";
ErrLog 4800, my_title, str1, str2, str3, str4;
```

On the FlexPendant the message will look like this:

Event Message: 4800

myerror

errortext1

errortext2

errortext3

errortext4

Example 2

An ErrorId must be declared in an .xml file. The number must be between 5000-9999. The error message is written in the .xml file and the arguments to the message is sent in by the ErrLog instruction. The ErrorId in the .xml file is the same stated in the ErrLog instruction.



Note

If using an ErrorId between 5000-9999 you have to install your own xml file.

Example of message in .xml file:

```
<Message number="5210" eDefine="ERR_INPAR_RDONLY">
  <Title>Parameter error</Title>
  <Description>Task:<arg format="%s" ordinal="1" />
    <p />Symbol <arg format="%s" ordinal="2" />is read-only
    <p />Context:<arg format="%s" ordinal="3" /><p />
  </Description>
</Message>
```

Continues on next page

Example of instruction:

```

MODULE MyModule
  PROC main()
    VAR num errorid := 5210;
    VAR errstr arg := "Symbol P1 is read-only.";
    ErrLog errorid, ERRSTR_TASK, arg, ERRSTR_CONTEXT, ERRSTR_UNUSED,
      ERRSTR_UNUSED;
    ErrLog errorid \W, ERRSTR_TASK, arg, ERRSTR_CONTEXT,
      ERRSTR_UNUSED, ERRSTR_UNUSED;
  ENDPROC
ENDMODULE

```

On the FlexPendant the message will look like this:

Event Message: 5210

Parameter error

Task: T_ROB1

Symbol P1 is read-only.

Context: MyModule/main/ErrLog/(line number)

The first ErrLog instruction generates an error message. The message is stored in the robot log in the process domain. It is also shown on the FlexPendant display.

The second instruction is a warning. A message is stored in the robot log only.

The program will in both cases continue its execution when the instruction is done.

Arguments

```

ErrLog ErrorID [\W] | [\I] Argument1 Argument2 Argument3 Argument4
      Argument5

```

ErrorId

Data type: num

The number of a specific error that is to be monitored. The error number must be in interval 4800-4814 if using the preinstalled xml file, and between 5000 - 9999 if using an own xml file.

[\W]

Warning

Data type: switch

Gives a warning that is stored in the robot event log only (not shown directly on the FlexPendant display).

[\I]

Information

Data type: switch

Gives an information message that is stored in the event log only (not shown directly on the FlexPendant display).

If none of the arguments \W or \I are specified then the instruction will generate an error message directly on the flexpendant and also store it in the event log.

Continues on next page

1 Instructions

1.75 ErrLog - Write an error message

RobotWare Base

Continued

Argument1

Data type: `errstr`

First argument in the error message. Any string or predefined data of type `errstr` can be used.

Argument2

Data type: `errstr`

Second argument in the error message. Any string or predefined data of type `errstr` can be used.

Argument3

Data type: `errstr`

Third argument in the error message. Any string or predefined data of type `errstr` can be used

Argument4

Data type: `errstr`

Fourth argument in the error message. Any string or predefined data of type `errstr` can be used.

Argument5

Data type: `errstr`

Fifth argument in the error message. Any string or predefined data of type `errstr` can be used.

Program execution



Note

ErrLog will produce an error, warning, or information message in the domain *Common*. If using the `IError` instruction and subscribing on messages in the `COMMON_ERR` domain, make sure not to flood the event log. There can be problems to handle all interrupts if using ErrLog with high frequency.

Add a small delay after the ErrLog to calm down the number of interrupts produced.

An error message (max 5 lines) is displayed on the FlexPendant and written in the event log.

If either of the optional arguments `\W` or `\I` are used, a warning or an information message is written in the event log.

ErrLog generates program errors between 4800-4814 if using the xml file that are installed by the system, and between 5000-9999 if installing an own xml file. The error generated depends on the `ErrorID` indicated.

The message is stored in the process domain in the event log.

How to install an own xml file is described in *Application manual - RobotWare add-ins*.

Continues on next page

Limitations

Total string length (Argument1-Argument5) is limited to 195 bytes.

Syntax

```
ErrLog
  [ErrorId ':'='] < expression (IN) of num> ','
  [ '\W ' ] | [ '\ I ' ] ','
  [Argument1 ':'='] < expression (IN) of errstr> ','
  [Argument2 ':'='] < expression (IN) of errstr> ','
  [Argument3 ':'='] < expression (IN) of errstr> ','
  [Argument4 ':'='] < expression (IN) of errstr> ','
  [Argument5 ':'='] < expression (IN) of errstr> ';'

```

Related information

For information about	See
Predefined data of type errstr	errstr - Error string on page 1642
Display message on the FlexPendant	TPWrite - Writes on the FlexPendant on page 847 UIMsgBox - User Message Dialog Box type basic on page 964
Event log	Operating manual - OmniCore
Event log messages, explanation of xml-file	Application manual - RobotWare add-ins
How to install XML files when using add-ins	Application manual - RobotWare add-ins

1 Instructions

1.76 ErrRaise - Writes a warning and calls an error handler

RobotWare Base

1.76 ErrRaise - Writes a warning and calls an error handler

Usage

ErrRaise is used to create an error in the program and then call the error handler of the routine. A warning is written in the event log. ErrRaise can also be used in the error handler to propagate the current error to the error handler of the calling routine.

Error name, error number, and five error arguments must be stated. The message is stored in the *Process* category in the event log.

Basic examples

The following examples illustrate the instruction ErrRaise:

Example 1

In case you do not want to make your own .xml file, you can use ErrorId 4800 like in the example below:

```
MODULE MyModule
  VAR errnum ERR_BATT:=-1;
  PROC main()
    VAR num errorid := 4800;
    VAR errstr my_title := "Backup battery status";
    VAR errstr str1 := "Bacup battery is fully charged";
    BookErrNo ERR_BATT;
    ErrRaise "ERR_BATT", errorid, my_title, ERRSTR_TASK, str1,
      ERRSTR_CONTEXT,ERRSTR_EMPTY;
  ERROR
  IF ERRNO = ERR_BATT THEN
    TRYNEXT;
  ENDIF
ENDPROC
ENDMODULE
```

On the FlexPendant the message will look like this (warning and/or an error):

Event Message: 4800

Backup battery status

Task: main

Backup battery is fully charged

Context: MyModule/main/ErrRaise

An error number must be booked with the instruction BookErrNo. Corresponding string is stated as the first argument, ErrorName, in the ErrRaise.

ErrRaise creates an error and then calls the error handler. If the error is taken care of, a warning is generated in the event log, in the process domain. Otherwise a fatal error is generated and the program stops.

ErrRaise can also be used in an error handler in a subroutine. In this case the execution continues in the error handler of the calling routine.

Continues on next page

Example 2

An ErrorId must be declared in an .xml file. The number must be between 5000 - 9999. The error message is written in the .xml file and the arguments to the message are sent in by the ErrRaise instruction. The ErrorId in the .xml file is the same stated in the ErrRaise instruction.

NOTE: If using an ErrorId between 5000-9999 you have to install your own xml file.

Example of message in .xml file:

```
<Message number="7055" eDefine="SYS_ERR_ARL_INPAR_RDONLY">
  <Title>Parameter error</Title>
  <Description>Task:<arg format="%s" ordinal="1" />
    <p />Symbol <arg format="%s" ordinal="2" />is read-only
    <p />Context:<arg format="%s" ordinal="3" /><p /></Description>
</Message>
```

Example of instruction:

```
MODULE MyModule
  VAR errnum ERR_BATT:=-1;
  PROC main()
    VAR num errorid := 7055;
    BookErrNo ERR_BATT;
    ErrRaise "ERR_BATT", errorid, ERRSTR_TASK,
      ERRSTR_CONTEXT,ERRSTR_UNUSED, ERRSTR_UNUSED,
      ERRSTR_UNUSED;

    ERROR
    IF ERRNO = ERR_BATT THEN
      TRYNEXT;
    ENDIF
  ENDPROC
ENDMODULE
```

On the FlexPendant the message will look like this (warning and/or an error):

Event Message: 7055

Backup battery status

Task: main

Backup battery is fully charged

Context: MyModule/main/ErrRaise

An error number must be booked with the instruction BookErrNo. Corresponding string is stated as the first argument, ErrorName, in the ErrRaise.

ErrRaise creates an error and then calls the error handler. If the error is taken care of, a warning is generated in the event log, in the process domain. Otherwise a fatal error is generated and the program stops.

ErrRaise can also be used in an error handler in a subroutine. In this case the execution continues in the error handler of the calling routine.

Arguments

```
ErrRaise ErrorName ErrorId Argument1 Argument2 Argument3 Argument4
Argument5
```

Continues on next page

1 Instructions

1.76 ErrRaise - Writes a warning and calls an error handler

RobotWare Base

Continued

ErrorName

Data type: string

An error number must be booked using the instruction BookErrNo. Corresponding variable is stated as ErrorName.

ErrorId

Data type: num

The number of a specific error that is to be monitored. The error number must be in interval 4800-4814 if using the preinstalled xml file, and between 5000 - 9999 if using an own xml file.

Argument1

Data type: errstr

First argument in the error message. Any string or predefined data of type errstr can be used.

Argument2

Data type: errstr

Second argument in the error message. Any string or predefined data of type errstr can be used.

Argument3

Data type: errstr

Third argument in the error message. Any string or predefined data of type errstr can be used

Argument4

Data type: errstr

Fourth argument in the error message. Any string or predefined data of type errstr can be used.

Argument5

Data type: errstr

Fifth argument in the error message. Any string or predefined data of type errstr can be used.

Program execution

ErrRaise generates program warnings between 4800-4814 if using the xml file that are installed by the system, and between 5000-9999 if installing an own xml file. The error generated depends on the ErrorID indicated. A warning is written in the robot message log in the domain process.

When the ErrRaise is executed the behavior depends on where it is executed:

- When executing instruction in the routine body, a warning is generated, and the execution continues in the error handler.
- When executing instruction in an error handler, the old warning is skipped, a new one is generated, and the control is raised to calling instruction.

Continues on next page

More examples

More examples of how to use the instruction ErrRaise are illustrated below.

Example 1

```

VAR errnum ERR_BATT:=-1;
VAR errnum ERR_NEW_ERR:=-1;

PROC main()
  testerrraise;
ENDPROC

PROC testerrraise()
  BookErrNo ERR_BATT;
  BookErrNo ERR_NEW_ERR;
  ErrRaise "ERR_BATT", 7055, ERRSTR_TASK, ERRSTR_CONTEXT,
    ERRSTR_UNUSED, ERRSTR_UNUSED, ERRSTR_UNUSED;
  ERROR
  IF ERRNO = ERR_BATT THEN
    ErrRaise "ERR_NEW_ERR", 7156, ERRSTR_TASK, ERRSTR_CONTEXT,
      ERRSTR_UNUSED, ERRSTR_UNUSED, ERRSTR_UNUSED;
  ENDIF
ENDPROC

```

Generate new warning 7156 from error handler. Raise control to calling routine and stop execution.

Limitations

Total string length (Argument1-Argument5) is limited to 195 bytes.

Syntax

```

ErrRaise
  [ErrorName ':' ] < expression (IN) of string> ','
  [ErrorId ':' ] < expression (IN) of num> ','
  [Argument1 ':' ] < expression (IN) of errstr> ','
  [Argument2 ':' ] < expression (IN) of errstr> ','
  [Argument3 ':' ] < expression (IN) of errstr> ','
  [Argument4 ':' ] < expression (IN) of errstr> ','
  [Argument5 ':' ] < expression (IN) of errstr> ';'

```

Related information

For information about	See
Predefined data of type errstr	errstr - Error string on page 1642
Booking error numbers	BookErrNo - Book a RAPID system error number on page 47
Error handling	<i>Technical reference manual - RAPID Overview</i>
<i>Advanced RAPID</i>	<i>Application manual - Controller software Omni-Core</i>

1 Instructions

1.77 ErrWrite - Write an error message

RobotWare Base

1.77 ErrWrite - Write an error message

Usage

ErrWrite (*Error Write*) is used to display an error message on the FlexPendant and write it in the event log. It can also be used to display warnings and information messages.

Basic examples

The following examples illustrate the instruction ErrWrite:

Example 1

```
ErrWrite "PLC error", "Fatal error in PLC" \RL2:="Call service";  
Stop;
```

A message is stored in the robot log. The message is also shown on the FlexPendant display.

Example 2

```
ErrWrite \W, "Search error", "No hit for the first search";  
RAISE try_search_again;
```

A message is stored in the robot log only. Program execution then continues.

Arguments

```
ErrWrite [ \W ] | [ \I ] Header Reason [ \RL2 ] [ \RL3 ] [ \RL4 ]
```

[\W]

Warning

Data type: switch

Gives a warning that is stored in the robot error message log only (not shown directly on the FlexPendant display).

[\I]

Information

Data type: switch

Gives an information message that is stored in the event log only (not shown directly on the FlexPendant display).

If none of the arguments \W or \I are specified then the instruction will generate an error message directly on the flexpendant and also store it in the event log.

Header

Data type: string

Error message heading (max. 46 characters).

Reason

Data type: string

Reason for error.

[\RL2]

Reason Line 2

Continues on next page

Data type: string

Reason for error.

[\RL3]

Reason Line 3

Data type: string

Reason for error.

[\RL4]

Reason Line 4

Data type: string

Reason for error.

Program execution



Note

ErrWrite will produce an error, warning, or information message in the domain *Common*. If using the IError instruction and subscribing on messages in the COMMON_ERR domain, make sure not to flood the event log. There can be problems to handle all interrupts if using ErrWrite with high frequency.

Add a small delay after the ErrWrite to calm down the number of interrupts produced.

An error message (max. 5 lines) is displayed on the FlexPendant and written in the robot message log.

If either of the optional arguments \W or \I are used, a warning or an information message is written in the event log.

ErrWrite generates the program error no. 80001 for an error, no. 80002 for a warning (\W), and no. 80003 for an information message (\I).

Limitations

Total string length (Header+Reason+\RL2+\RL3+\RL4) is limited to 195 bytes.

Syntax

```
ErrWrite
[ '\W' ] | [ '\I' ] ','
[ Header ':' ] < expression (IN) of string> ','
[ Reason ':' ] < expression (IN) of string>
[ '\RL2 ':' ] < expression (IN) of string> ]
[ '\RL3 ':' ] < expression (IN) of string> ]
[ '\RL4 ':' ] < expression (IN) of string> ] ';'

```

Related information

For information about	See
Predefined data of type errstr	errstr - Error string on page 1642

Continues on next page

1 Instructions

1.77 ErrWrite - Write an error message

RobotWare Base

Continued

For information about	See
Display message on the FlexPendant	TPWrite - Writes on the FlexPendant on page 847 UIMsgBox - User Message Dialog Box type basic on page 964
Event log	<i>Operating manual - OmniCore</i>
Write error message - Err Log	ErrLog - Write an error message on page 192

1.78 EXIT - Terminates program execution

Usage

EXIT is used to terminate program execution. Program restart will then be blocked, that is the program can only be restarted from the first instruction of the main routine.

The EXIT instruction should be used when fatal errors occur or when program execution is to be stopped permanently. The Stop instruction is used to temporarily stop program execution. After execution of the instruction EXIT the program pointer is gone. To continue program execution, the program pointer must be set.

Basic examples

The following example illustrates the instruction EXIT:

Example 1

```
ErrWrite "Fatal error","Illegal state";  
EXIT;
```

Program execution stops and cannot be restarted from that position in the program.

Syntax

```
EXIT ';' ;
```

Related information

For information about	See
Stopping program execution temporarily	Stop - Stops program execution on page 787

1 Instructions

1.79 ExitCycle - Break current cycle and start next *RobotWare Base*

1.79 ExitCycle - Break current cycle and start next

Usage

`ExitCycle` is used to break the current cycle and move the program pointer (PP) back to the first instruction in the main routine.

If the program is executed in continuous mode, it will start to execute the next cycle.

If the execution is in cycle mode, the execution will stop at the first instruction in the main routine.

Basic examples

The following example illustrates the instruction `ExitCycle`:

Example 1

```
VAR num cyclecount:=0;
VAR intnum error_intno;

PROC main()
  IF cyclecount = 0 THEN
    CONNECT error_intno WITH error_trap;
    ISignalDI di_error,1,error_intno;
  ENDIF
  cyclecount:=cyclecount+1;
  ! start to do something intelligent
  ...
ENDPROC

TRAP error_trap
  TPWrite "ERROR, I will start on the next item";
  ExitCycle;
ENDTRAP
```

This will start the next cycle if the signal `di_error` is set.

Program execution

Execution of the instruction `ExitCycle` in a program task controlling mechanical units results in the following in the actual task:

- On-going robot movements stops.
- All robot paths that are not performed at all path levels (both normal and StorePath level) are cleared.
- All instructions that are started but not finished at all execution levels (both normal and trap level) are interrupted.
- The program pointer is moved to the first instruction in the main routine.
- The program execution continues to execute the next cycle.

Continues on next page

1.79 ExitCycle - Break current cycle and start next
RobotWare Base
Continued

Execution of the instruction `ExitCycle` in some other program task, not controlling mechanical units, results in the following in the actual task:

- All instructions that are started but not finished on all execution levels (both normal and trap level) are interrupted.
- The program pointer is moved to the first instruction in the main routine.
- The program execution continues to execute the next cycle.

All other modal things in the program and system are **not** affected by `ExitCycle` such as:

- The actual value of variables or persistents.
- Any motion settings such as `StorePath-RestoPath` sequence, world zones, and so on.
- Open files, directories, and so on.
- Defined interrupts, and so on.

When using `ExitCycle` in routine calls and the entry routine is defined with “Move PP to Routine ...” or “Call Routine ...”, `ExitCycle` breaks the current cycle and moves the program pointer back to the first instruction in the entry routine (instead of the main routine as specified previously).

Syntax

`ExitCycle';'`

Related information

For information about	See
Stopping after a fatal error	EXIT - Terminates program execution on page 203
Terminating program execution	EXIT - Terminates program execution on page 203
Stopping for program actions	Stop - Stops program execution on page 787
Finishing execution of a routine	RETURN - Finishes execution of a routine on page 603

1 Instructions

1.80 FitCircle - Fits a circle to 3D-points

RobotWare Base

1.80 FitCircle - Fits a circle to 3D-points

Usage

FitCircle is used to fit a circle to a set of 3D-points.

Basic examples

The following examples illustrate the instruction FitCircle.

Example 1

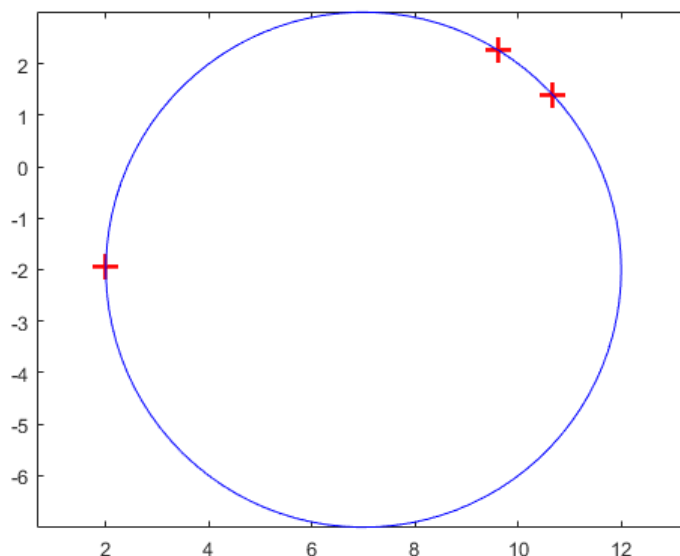
```
VAR pos points{3}:=[ [2.000264140454799, -1.948606082287765, 3],  
                    [10.666326255802462, 1.399713485871053, 3],  
                    [9.609499187363362, 2.265033879249959, 3]];  
VAR num radius;  
VAR pos center;  
VAR pos normal;  
FitCircle points, center, radius, normal;
```

With only three points specified, FitCircle calculates a circle that passes exactly through all the points. In this example, the resulting circle is:

```
center = [7, -2, 3]  
radius = 5  
normal = [0, 0, 1]
```

In this simple example, all the 3D-points have the same z-coordinate and therefore the identified circle must be in the xy-plane. In the general case, the method will identify the plane that contains the circle. The plane is described by the returned normal, which is a unit vector perpendicular to the circle.

The circle and the input points are shown in the figure below.



xx1700000731

Example 2

```
VAR pos points{10}:=[
```

Continues on next page

```

[-7.2, -5.254055558738700, 3.307061712883007],
[-7.2, -3.211963764808295, 3.090792209685409],
[-7.2, -5.650784519354138, 4.074184087507510],
[-7.2, -4.261241341238363, 3.549808031134106],
[-7.2, -3.780658372123544, 12.570750298513245],
[-7.2, 1.309442476421255, 11.013856026376601],
[-7.2, -4.649041803426594, 3.435039251520052],
[-7.2, 1.403058916454365, 6.576147932013719],
[-7.2, -7.546395053424201, 9.841667138860654],
[-7.2, -2.490309697793828, 2.788705869634919]];
VAR pos center;
VAR num radius;
VAR pos normal;
VAR num rms;
VAR num maxErr;
VAR num indexWorst;

FitCircle points, center, radius, normal \RMS:=rms \MaxErr:=maxErr
\IndexWorst:=indexWorst;

```

In this case a circle is fitted to ten points that do not lie on a circle. The result is a circle that fits the points in a least-squares sense. To simplify the example, the points are all in a plane parallel to the yz-plane.

The resulting circle is:

```

center = [-7.2, -2.92489, 7.96317]
radius = 4.88656
normal = [1, 0, 0]

```

The error parameters of the fit are:

```

rms = 0.2387
maxErr = 0.3418
indexWorst = 8

```

The circle and the input points are shown in the figure below.

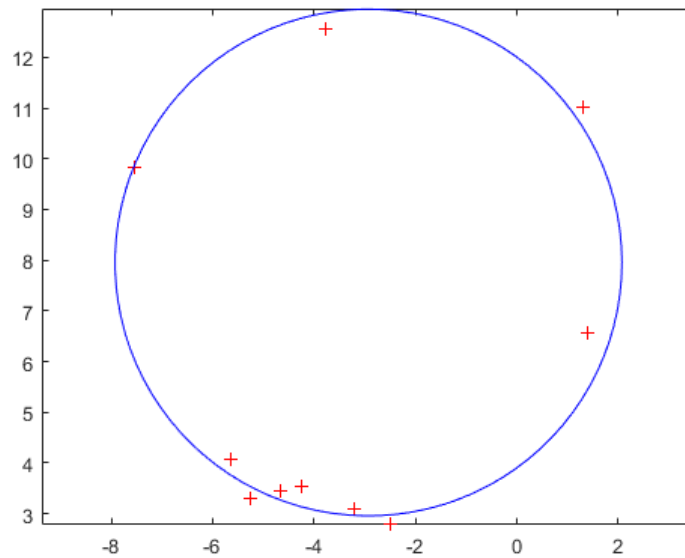
Continues on next page

1 Instructions

1.80 FitCircle - Fits a circle to 3D-points

RobotWare Base

Continued



xx1700000732

Arguments

FitCircle Points [\NumPoints] Center Radius Normal [\RMS] [\MaxErr]
[\IndexWorst]

Points

Data type: array of pos

Points is an array containing the 3D-points for the circle fit.

[\NumPoints]

Data type: num

With the optional argument NumPoints it is possible to specify how many of the points that shall be used. If omitted, then all points in the array Points are used.

Center

Data type: pos

The center of the resulting circle.

Radius

Data type: num

The radius of the resulting circle.

Normal

Data type: pos

A unit-length vector that is perpendicular to the plane of the identified circle.

[\RMS]

Data type: num

Optional argument that contains the root-mean-square error of the circle fit.

Continues on next page

[\MaxErr]

Data type: num

Optional argument that contains the maximum distance between the resulting circle and the input points.

[\IndexWorst]

Data type: num

Optional argument that contains the index of the point that has the maximum distance to the circle.

Program execution

FitCircle fits a circle to a set of 3D-points.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

ERR_FIT_NUMPOINTS	Parameter NumPoints larger than array Points.
ERR_FIT_TOO_FEW_POINTS	Too few points, $n < 3$.
ERR_FIT_TOO_MANY_POINTS	Too many points, $n > 100$.
ERR_FIT_POINTS_IN_LINE	Identical points or collinear points and $n = 3$.
ERR_FIT_NOT_PLANE	Points are not on a plane (linear or spherical distribution).

Limitations

If the input points are not possible to fit a circle, an event log is presented and the result cannot be used.

Syntax

```
FitCircle
[ Points ':=' ] <array {*} expression (IN) of dnum> ', '
[ '\ ' NumPoints ':=' <expression (IN) of num> ] ', '
[ Center ':=' ] <variable (VAR) of pos> ', '
[ Radius ':=' ] <variable (VAR) of num> ', '
[ Normal ':=' ] <variable (VAR) of pos>
[ '\ ' RMS ':=' <variable (VAR) of num> ]
[ '\ ' MaxErr ':=' <variable (VAR) of num> ]
[ '\ ' IndexWorst ':=' <variable (VAR) of num> ] ';'
```

Related information

For information about	See
Mathematical instructions and functions.	<i>Technical reference manual - RAPID Overview</i>

1 Instructions

1.81 FitLine - Fits a line to a set of points

RobotWare Base

1.81 FitLine - Fits a line to a set of points

Usage

FitLine is used to create a least squares fit of a line to a set of points.

Arguments

FitLine Points [\NumPoints] P V [\RMS] [\MaxErr] [\IndexWorst]

Points

Data type: array of pos

Points is an array of points for identifying the line.

[\NumPoints]

Data type: num

With the optional argument NumPoints it is possible to specify how many of the points that shall be used. If omitted, then all points in the array Points are used.

P

Data type: pos

A point in the identified line.

V

Data type: num

The unit-length direction vector for the line.

[\RMS]

Data type: num

Optional argument that contains the root-mean-square error of the line fit.

[\MaxErr]

Data type: num

Optional argument that contains the maximum distance between the points and identified line.

[\IndexWorst]

Data type: num

Optional argument that contains the index of the point that causes the largest error in the fit.

Program execution

FitLine creates a least squares fit of a line to a set of points. If the parameter NumPoints is omitted, all points in the array are used. The method requires at least two points to be able to identify a line. The returned line is represented as a point P and a unit-length direction vector V.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_FIT_NUMPOINTS	Parameter NumPoints larger than array Points.
ERR_FIT_T00_FEW_POINTS	Too few points, $n < 2$.
ERR_FIT_POINTS_T00_CLOSE	Identical points and $n = 2$.
ERR_FIT_POINTS_NOT_LINE	Points are not along a line (planar or spherical distribution).

Limitations

If the input points are not possible to fit a line, an event log is presented and the result cannot be used.

Syntax

```
FitLine
[ Points ':=' ] <array {*} expression (IN) of dnum> ', '
[ '\ ' NumPoints ':=' <expression (IN) of num> ] ', '
[ P ':=' ] <variable (VAR) of pos>
[ V ':=' <variable (VAR) of num> ]
[ '\ ' RMS ':=' <variable (VAR) of num> ]
[ '\ ' MaxErr ':=' <variable (VAR) of num> ]
[ '\ ' IndexWorst ':=' <variable (VAR) of num> ] ';'
```

Related information

For information about	See
Mathematical instructions and functions.	<i>Technical reference manual - RAPID Overview</i>

1 Instructions

1.82 FitPlane - Fits a plane to a set of points

RobotWare Base

1.82 FitPlane - Fits a plane to a set of points

Usage

FitPlane is used to create a least squares fit of a plane to a set of points.

Arguments

FitPlane Points [\NumPoints] P Normal [\RMS] [\MaxErr] [\IndexWorst]

Points

Data type: array of pos

Points is an array containing the points for the plane.

[\NumPoints]

Data type: num

With the optional argument NumPoints it is possible to specify how many of the points that shall be used. If omitted, then all points in the array Points are used.

P

Data type: pos

A point in the identified plane.

Normal

Data type: pos

A unit-length vector for the plane.

[\RMS]

Data type: num

Optional argument that contains the root-mean-square error of the plane.

[\MaxErr]

Data type: num

Optional argument that contains the maximum distance between the points and the identified plane.

[\IndexWorst]

Data type: num

Optional argument that contains the index of the point that causes the largest error in the fit.

Program execution

FitPlane creates a least squares fit of a plane to a set of points. If the parameter NumPoints is omitted, all points in the array are used. The method requires at least three points to be able to identify a plane. The returned plane is represented as a point P and a unit-length normal vector.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_FIT_NUMPOINTS	Parameter NumPoints larger than array Points.
ERR_FIT_TOO_FEW_POINTS	Too few points, $n < 3$.
ERR_FIT_POINTS_IN_LINE	Identical points or collinear points and $n = 3$.
ERR_FIT_NOT_PLANE	Points are not on a plane (linear or spherical distribution).

Limitations

If the input points are not possible to fit a plane, an event log is presented and the result cannot be used.

Syntax

```
FitPlane
[ Points ':=' ] <array {*} expression (IN) of dnum> ', '
[ '\ ' NumPoints ':=' <expression (IN) of num> ] ', '
[ P ':=' ] <variable (VAR) of pos> ', '
[ Normal ':=' ] <variable (VAR) of pos>
[ '\ ' RMS ':=' <variable (VAR) of num> ]
[ '\ ' MaxErr ':=' <variable (VAR) of num> ]
[ '\ ' IndexWorst ':=' <variable (VAR) of num> ] ';'
```

Related information

For information about	See
Mathematical instructions and functions.	<i>Technical reference manual - RAPID Overview</i>

1 Instructions

1.83 FitSphere - Fit a sphere to a set of points

RobotWare Base

1.83 FitSphere - Fit a sphere to a set of points

Usage

FitSphere is used to create a least squares fit of a sphere to a set of points.

Arguments

FitSphere Points [\NumPoints] Center Radius [\RMS] [\MaxErr]
[\IndexWorst]

Points

Data type: array of pos

Points is an array containing the 3D-points for the sphere.

[\NumPoints]

Data type: num

With the optional argument NumPoints it is possible to specify how many of the points that shall be used. If omitted, then all points in the array Points are used.

Center

Data type: pos

The center of the resulting sphere.

Radius

Data type: num

The radius of the resulting sphere.

[\RMS]

Data type: num

Optional argument that contains the root-mean-square error of the sphere fit.

[\MaxErr]

Data type: num

Optional argument that contains the maximum distance between the resulting sphere and the input points.

[\IndexWorst]

Data type: num

Optional argument that contains the index of the point that has the maximum distance to the sphere.

Program execution

FitSphere creates a least squares fit of a sphere to a set of points. If the parameter NumPoints is omitted, then all points in the array are used. The method requires at least four points to be able to identify a sphere.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_FIT_NUMPOINTS	Parameter NumPoints larger than array Points.
ERR_FIT_T00_FEW_POINTS	Too few points, $n < 3$.
ERR_FIT_T00_MANY_POINTS	Too many points, $n > 100$.
ERR_FIT_POINTS_IN_LINE	All points are on a line (bad input).

Limitations

If the input points are not possible to fit a sphere, an event log is presented and the result cannot be used.

Syntax

```
FitSphere
[ Points ':=' ] <array {*} expression (IN) of dnum> ', '
[ '\ ' NumPoints ':=' <expression (IN) of num> ] ', '
[ Center ':=' ] <variable (VAR) of pos> ', '
[ Radius ':=' ] <variable (VAR) of num> ', '
[ '\ ' RMS ':=' <variable (VAR) of num> ]
[ '\ ' MaxErr ':=' <variable (VAR) of num> ]
[ '\ ' IndexWorst ':=' <variable (VAR) of num> ] ';'
```

Related information

For information about	See
Mathematical instructions and functions.	<i>Technical reference manual - RAPID Overview</i>

1 Instructions

1.84 FOR - Repeats a given number of times

RobotWare Base

1.84 FOR - Repeats a given number of times

Usage

FOR is used when one or several instructions are to be repeated a number of times.

Basic examples

The following examples illustrate the instruction FOR:

See also [More examples on page 217](#).

Example 1

```
FOR i FROM 1 TO 10 DO
  routine1;
ENDFOR
```

Repeats the routine1 procedure 10 times.

Arguments

```
FOR Loop counter FROM Start value TO End value [STEP Step value]
DO ... ENDFOR
```

Loop counter

Identifier

The name of the data that will contain the value of the current loop counter. The data is declared automatically.

If the loop counter name is the same as any data that already exists in the actual scope, the existing data will be hidden in the FOR loop and not affected in any way.

Start value

Data type: Num

The desired start value of the loop counter. (usually integer values)

End value

Data type: Num

The desired end value of the loop counter. (usually integer values)

Step value

Data type: Num

The value by which the loop counter is to be incremented (or decremented) each loop. (usually integer values)

If this value is not specified, the step value will automatically be set to 1 (or -1 if the start value is greater than the end value).

Program execution

- 1 The expressions for the start, end, and step values are evaluated.
- 2 The loop counter is assigned the start value.
- 3 The value of the loop counter is checked to see whether its value lies between the start and end value, or whether it is equal to the start or end value. If the

Continues on next page

value of the loop counter is outside of this range, the FOR loop stops and program execution continues with the instruction following ENDFOR.

- 4 If a Break is executed in the FOR loop, the loop is interrupted and the execution continues after the FOR loop.
- 5 If a Continue is executed in the FOR loop, the rest of the statements in the loop are disregarded, and the execution continues in the beginning of the FOR loop.
- 6 The instructions in the FOR loop are executed.
- 7 The loop counter is incremented (or decremented) in accordance with the step value.
- 8 The FOR loop is repeated, starting from point 3.

More examples

More examples of how to use the instruction FOR are illustrated below.

Example 1

```
FOR i FROM 10 TO 2 STEP -2 DO
  a{i} := a{i-1};
ENDFOR
```

The values in an array are adjusted upwards so that a{10}:=a{9}, a{8}:=a{7} and so on.

Example 2

```
FOR i FROM 10 TO 2 STEP -2 DO
  a{i} := a{i-1};
  IF di_1 = 1 THEN
    BREAK; ! Leave the loop if di_1 is set
  ENDIF
ENDFOR
```

Example 3

```
FOR i FROM 10 TO 2 STEP -2 DO
  IF i = 6 THEN
    CONTINUE; ! Don't set value for a[6]. Continue with the next
    loop
  ENDIF
  a{i} := a{i-1};
ENDFOR
```

Limitations

The loop counter (of data type num) can only be accessed from within the FOR loop and consequently hides other data and routines that have the same name. It can only be read (not updated) by the instructions in the FOR loop.

Decimal values for start, end, or stop values, in combination with exact termination conditions for the FOR loop, cannot be used (undefined whether or not the last loop is running).

Continues on next page

1 Instructions

1.84 FOR - Repeats a given number of times

RobotWare Base

Continued

Remarks

If the number of repetitions is to be repeated as long as a given expression is evaluated to a TRUE value, the WHILE instructions should be used instead.

Syntax

```
FOR <loop variable> FROM <expression> TO <expression>
  [ STEP <expression> ] DO
  <statement list>
ENDFOR
```

Related information

For information about	See
Expressions	<i>Technical reference manual - RAPID Overview</i>
Repeats as long as...	<i>WHILE - Repeats as long as ... on page 1059</i>
Break the FOR loop	<i>Break - Break a loop on page 49</i>
Skip the rest of the FOR loop	<i>Continue - Skip the rest of the loop on page 162</i>
Identifiers	<i>Technical reference manual - RAPID Overview</i>

1.85 FricIdInit - Initiate friction identification

Usage

FricIdInit marks the starting point of a sequence of move instructions that will be repeated to calculate the robot's internal friction.

Example

Basic example where a circle movement is used to calculate the robot's internal friction for this movement.

```
PERS num friction_levels{6};

! Start of the friction calculation sequence
FricIdInit;

! Execute the move sequence
MoveC p10, p20, Speed, z0, Tool;
MoveC p30, p40, Speed, z0, Tool;

! Repeat the sequence and calculate the friction
FricIdEvaluate friction_levels;

! Activate compensation for the calculated friction levels
FricIdSetFricLevels friction_levels;
```

Prerequisites

The system parameter *Friction FFW On* must be set to TRUE. Otherwise the instruction FricIdInit will do nothing.

Limitations

- FricIdInit only works for TCP robots.
- Can only be executed from motion tasks.
- The robot must move on the basic path level.
- Friction tuning cannot be combined with synchronized movement. That is, SyncMoveOn is not allowed between FricIdInit and FricIdEvaluate.
- The movement sequence for which friction tuning is done must begin and end with a finepoint. If not, finepoints will automatically be inserted during the tuning process.

Syntax

```
FricIdInit ';' ;
```

Related information

For information about	See
Advanced robot motion	Application manual - Controller software OmniCore

1 Instructions

1.86 FricIdEvaluate - Evaluate friction identification

Advanced Shape Tuning

1.86 FricIdEvaluate - Evaluate friction identification

Usage

FricIdEvaluate makes the robot repeat the movement between the instructions **FricIdInit** and **FricIdEvaluate** while calculating the friction for each axis of the robot.

Example

Basic example where a circle movement is used to calculate the robot's internal friction for this movement.

```
PERS num friction_levels{6};

! Start of the friction calculation sequence
FricIdInit;

! Execute the move sequence
MoveC p10, p20, Speed, z0, Tool;
MoveC p30, p40, Speed, z0, Tool;

! Repeat the sequence and calculate the friction
FricIdEvaluate friction_levels;

! Activate compensation for the calculated friction levels
FricIdSetFricLevels friction_levels;
```

Arguments

```
FricIdEvaluate FricLevels [\MechUnit] [\BwdSpeed] [\NoPrint]
[\FricLevelMax] [\FricLevelMin] [\OptTolerance]
```

FricLevels

Friction levels

Data type: array of num

When **FricIdEvaluate** is finished, the array **FricLevels** will contain the tuned friction levels for all axes of the robot. This array must be declared to have as many elements as the robot has axes. Note that the instruction **FricIdSetFricLevels** must be called for these values to have effect.

[\MechUnit]

Mechanical unit

Data type: mecunit

The argument **MechUnit** is optional. If it is omitted, friction tuning will be done for the mechanical unit represented by the predefined RAPID variable **ROB_ID**, which is a reference to the TCP robot in the current program task. Friction compensation is only possible for TCP robots.

[\BwdSpeed]

Backward speed

Data type: speeddata

Continues on next page

After each iteration in the tuning process, the robot moves backward along the programmed path. By default the backward movement is done at the programmed speed. To speed up the process, the optional argument `BwdSpeed` can be used to specify a higher speed during the backward movement. This will *not* influence the tuning result.

`[\NoPrint]`

Data type: switch

If the argument `NoPrint` is used, no text is written on the FlexPendant about the progress of the iterations of the friction identification.

`[\FricLevelMax]`

Friction level max

Data type: num

Normally, the optimal friction value is found by trying values between 1% and 500% of the configured friction value. In rare cases this can generate an error message (Joint speed error). To avoid this, use the argument `FricLevelMax` and set it to a value lower than 500. For example, if `FricLevelMax` is set to 400, values between 1% and 400% are tested.

Allowed values are 101-500.

`[\FricLevelMin]`

Friction level min

Data type: num

Normally, the optimal friction value is found by trying values between 1% and 500% of the configured friction value. To set a higher starting value than 1% use the argument `FricLevelMin`. For example, if `FricLevelMin` is set to 80, values between 80% and 500% are tested.

Allowed values are 1-99.

`[\OptTolerance]`

Optimization tolerance

Data type: num

Normally, the optimal friction value is found by trying values until a small tolerance is achieved. To speed up the process this value can be increased. Increasing this value might give a less accurate result.

Allowed values are 1-10. Default value is 1.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_FRICTUNE_FATAL	An error occurs during the friction tuning.

Continues on next page

1 Instructions

1.86 FricIdEvaluate - Evaluate friction identification

Advanced Shape Tuning

Continued



Note

If the friction tuning has no effect at all, check that the system parameter *Friction FFW On* is set to TRUE.

Prerequisites

The system parameter *Friction FFW On* must be set to TRUE. Otherwise the instruction FricIdEvaluate will do nothing.

Limitations

- FricIdEvaluate only works for TCP robots.
- FricIdEvaluate can only be executed from motion tasks.
- The robot must move on the basic path level.
- For a MultiMove system, friction tuning can only be done for one robot at a time. Several robots can execute FricIdEvaluate simultaneously, but they will automatically stand still and wait for their turn as long as another robot is busy doing friction tuning.
- Friction tuning cannot be combined with synchronized movement. That is, SyncMoveOn is not allowed between FricIdInit and FricIdEvaluate.
- The movement sequence for which friction tuning is done must begin and end with a finepoint. If not, finepoints will automatically be inserted during the tuning process.

Syntax

```
FricIdEvaluate
[ FricLevels '[:]=' < persistent array {*} (PERS) of num >
['\' MechUnit '[:]=' < variable (VAR) of mecunit >]
['\' BwdSpeed '[:]=' < expression (IN) of speeddata >]
['\' NoPrint]
['\' FricLevelMax '[:]=' < expression (VAR) of num >]
['\' FricLevelMin '[:]=' < expression (VAR) of num >]
['\' OptTolerance '[:]=' < expression (VAR) of num >] ';' ;'
```

Related information

For information about	See
Advanced robot motion	Application manual - Controller software OmniCore

1.87 FricIdSetFricLevels - Set friction levels after friction identification

Advanced Shape Tuning

1.87 FricIdSetFricLevels - Set friction levels after friction identification

Usage

FricIdSetFricLevels is used for setting the friction level for each axis of a mechanical unit.

Example

Basic example where a circle movement is used to calculate the robot's internal friction for this movement.

```
PERS num friction_levels{6};

! Start of the friction calculation sequence
FricIdInit;

! Execute the move sequence
MoveC p10, p20, Speed, z0, Tool;
MoveC p30, p40, Speed, z0, Tool;

! Repeat the sequence and calculate the friction
FricIdEvaluate friction_levels;

! Activate compensation for the calculated friction levels
FricIdSetFricLevels friction_levels;
```

Arguments

FricIdSetFricLevels FricLevels [\MechUnit]

FricLevels

Friction levels

Data type: array of num

The array FricLevels specifies the friction level for each axis in percent of the default friction. The values must be in the interval 0-500.

[\MechUnit]

Mechanical unit

Data type: mecunit

The argument MechUnit is optional. If it is omitted, the friction levels will be set for the mechanical unit represented by the predefined RAPID variable ROB_ID. Friction compensation is only possible for TCP robots.

Program execution

The settings of the friction levels will remain active until:

- Program execution is started from the beginning (PP to Main)
- Another call to FricIdSetFricLevels is made
- A new program is loaded
- The controller is restarted using the restart mode **Reset system**.

Continues on next page

1 Instructions

1.87 FricIdSetFricLevels - Set friction levels after friction identification

Advanced Shape Tuning

Continued

Prerequisites

The system parameter *Friction FFW On* must be set to TRUE. Otherwise the instruction FricIdSetFricLevels will do nothing.

Limitations

- FricIdSetFricLevels only works for TCP robots.

Syntax

```
FricIdSetFricLevels
[ FricLevels ':=' ] < array {*} (IN) of num >
['\' MechUnit ':=' < variable (VAR) of mecunit >] ';' ;'
```

Related information

For information about	See
<i>Advanced robot motion</i>	<i>Application manual - Controller software OmniCore</i>

1.88 GetDataVal - Get the value of a data object

Usage

GetDataVal (*Get Data Value*) makes it possible to get a value from a data object that is specified with a string variable.

Basic examples

The following examples illustrate the instruction GetDataVal:

Example 1

```
VAR datapos block;
VAR string name;
VAR num valuevar;
...
SetDataSearch "num" \Object:="my.*" \InMod:="mymod";
WHILE GetNextSym(name,block) DO
  GetDataVal name\Block:=block,valuevar;
  TPWrite name+" "\Num:=valuevar;
ENDWHILE
```

This session will print out all num variables that begin with my in the module mymod with its value to the FlexPendant.

Example 2

```
VAR num NumArrConst_copy{2};
...
GetDataVal "NumArrConst", NumArrConst_copy;
TPWrite "Pos1 = " \Num:=NumArrConst_copy{1};
TPWrite "Pos2 = " \Num:=NumArrConst_copy{2};
```

This session will print out the num variables in the array NumArrConst.

Arguments

GetDataVal Object [\Block][\TaskRef][\TaskName] Value

Object

Data type: string

The name of the data object.

[\Block]

Data type: datapos

The enclosed block to the data object. This can only be fetched with the GetNextSym function.

If this argument is omitted, the value of the visible data object in the current program execution scope will be fetched.

[\TaskRef]

Task Reference

Data type: taskId

Continues on next page

1 Instructions

1.88 GetDataVal - Get the value of a data object

RobotWare Base

Continued

The program task identity in which to search for the data object specified. When using this argument, you may search for PERS or TASKPERS declarations in other tasks, any other declarations will result in an error.

For all program tasks in the system the predefined variables of the data type `taskId` will be available. The variable identity will be "taskname"+"Id", for example, for the T_ROB1 task the variable identity will be T_ROB1Id.

`[\TaskName]`

Data type: `string`

The program task name in which to search for the data object specified. When using this argument, you may search for PERS or TASKPERS declarations in other tasks, any other declarations will result in an error.

`Value`

Data type: `anytype`

Variable for storage of the get value. The data type must be the same as the data type for the data object to find. The get value can be fetched from a constant, variable, or persistent but must be stored in a variable.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_SYM_ACCESS	• The data object is non-existent. • The data object is routine data or routine parameter and is not located in the current active routine. • Searching in other tasks for other declarations than PERS or TASK PERS.
ERR_INVDIM	The data object and the variable used in argument <code>Value</code> have different dimensions.
ERR_SYMBOL_TYPE	The data object and the variable used in argument <code>Value</code> is of different types. If using ALIAS datatypes, you will also get this ERROR, even though the types might have the same base data type.
ERR_TASKNAME	If the program task name in argument <code>\TaskName</code> cannot be found in the system, the system variable <code>ERRNO</code> is set to <code>ERR_TASKNAME</code> .

When using the arguments `TaskRef` or `TaskName` you may search for PERS or TASK PERS declarations in other tasks, any other declarations will result in an error and the system variable `ERRNO` is set to `ERR_SYM_ACCESS`. Searching for a PERS declared as LOCAL in other tasks will also result in an error and the system variable `ERRNO` is set to `ERR_SYM_ACCESS`.

Limitations

For a semivalue data type, it is not possible to search for the associated value data type. For example, if searching for `dionum`, no search hit for signals `signalId` will be obtained and if searching for `num`, no search hit for signals `signalgi` or `signalai` will be obtained.

Continues on next page

It is not possible to get the value of a variable declared as LOCAL in a built in RAPID module.

Syntax

```
GetDataVal
[ Object ':' ] < expression (IN) of string >
['\Block' :='<variable (VAR) of datapos>]
|[ '\TaskRef' :=' <variable (VAR) of taskid>]
|[ '\TaskName' :=' <expression (IN) of string>] ',' ]
[ Value ':' ] <variable (VAR) of anytype>]';'
```

Related information

For information about	See
Define a symbol set in a search session	SetDataSearch - Define the symbol set in a search sequence on page 674
Get next matching symbol	GetNextSym - Get next matching symbol on page 1277
Set the value of a data object	SetDataVal - Set the value of a data object on page 679
Set the value of many data objects	SetAllDataVal - Set a value to all data objects in a defined set on page 670
The related data type datapos	datapos - Enclosing block for a data object on page 1627
<i>Advanced RAPID</i>	<i>Application manual - Controller software OmniCore</i>

1 Instructions

1.89 GetGroupSignalInfo - Read information about a digital group signal

RobotWare Base

1.89 GetGroupSignalInfo - Read information about a digital group signal

Usage

GetGroupSignalInfo is used to read out information about a digital group signal from I/O.

Basic examples

The following example illustrates the instruction GetGroupSignalInfo.

Example 1

```
VAR dnum DValue;  
VAR string label;  
VAR string devicename;  
  
GetGroupSignalInfo go1 \MaxDValue:=DValue \Label:=label  
                        \DeviceName:=devicename;
```

Read out maximum signal value that can be set to the signal go1, the signal identification label and the device name the signal is assigned to.

Arguments

GetGroupSignalInfo Signal [\MaxDValue] [\Label] [\DeviceName]

Signal

Data type: signalxx

The signal identifier according to the program (data type signalgo or signalgi) to get information about.

\MaxDValue

Data type: dnum

The MaxDValue is the maximum value that can be set to the signal. It is based on the device mapping of the signal.

\Label

Data type: string

The Label is the signal identification label specified.

\DeviceName

Data type: string

The DeviceName is the device the signal is assigned to.

Program execution

The instruction reads out information about a digital group signal from I/O.

Continues on next page

1.89 GetGroupSignalInfo - Read information about a digital group signal

*RobotWare Base**Continued***Error handling**

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.

Syntax

```
GetGroupSignalInfo
[ Signal ':' = ] < variable (VAR) of anytype >
[ '\\' MaxDvalue ':' = < variable (VAR) of dnum >]
[ '\\' Label ':' = < variable (VAR) of string >]
[ '\\' DeviceName ':' = < variable (VAR) of string >] ';' ;
```

Related information

For information about	See
Read attribute of a system parameter	ReadCfgData - Reads attribute of a system parameter on page 569
Configuration of I/O	<i>Technical reference manual - System parameters</i>

1 Instructions

1.90 GetJointData - Get joint specific data

RobotWare Base

1.90 GetJointData - Get joint specific data

Usage

GetJointData is used to read out joint specific data from a specified mechanical unit. The information that can be read for the specified axis is the position, speed, torque, and estimated external torque.

Basic examples

The following example illustrates the instruction GetJointData.

Example 1

```
VAR num position;  
VAR num speed;  
VAR num torque;  
VAR num exttorque;  
...  
GetJointData \MechUnit:=ROB_1, 1 \Position:=position \Speed:=speed  
          \Torque:=torque \ExtTorque:=exttorque;
```

The current position, speed, torque, and estimated external torque of the first axis of ROB_1 is read.

Arguments

```
GetJointData [\MechUnit] Axis [\Position] [\Speed] [\Torque]  
          [\ExtTorque]
```

[\MechUnit]

Mechanical Unit

Data type: mecunit

The name of the mechanical unit for which an axis is to be read. If this argument is omitted, the axis for the connected robot is read.

Axis

Data type: num

The number of the axis to be read (1 - 6).

[\Position]

Data type: num

The current position of the stated axis of the robot or external axis on the arm side. The value is in degrees for a rotating axis and mm for a linear axis.

At least one of the optional parameters \Position, \Speed, \Torque, or \ExtTorque must be used.

[\Speed]

Data type: num

The current speed of the stated axis of the robot or external axis on the arm side. The value is in degrees/second for a rotating axis and mm/second for a linear axis.

At least one of the optional parameters \Position, \Speed, \Torque, or \ExtTorque must be used.

Continues on next page

[\Torque]

Data type: num

The current torque in Nm of the of the stated axis of the robot or external axis on the arm side.

At least one of the optional parameters \Position, \Speed, \Torque, or \ExtTorque must be used.

[\ExtTorque]

Data type: num

The current estimated external torque in Nm of the of the stated axis of the robot or external axis on the arm side.

At least one of the optional parameters \Position, \Speed, \Torque, or \ExtTorque must be used.

Program execution

The instruction reads position, speed, torque, and estimated external torque of the robot and external axes.

The read values can also be seen when using *TuneMaster* using test signal numbers 4000, 4001, 4002, and 4003.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_AXIS_PAR	Parameter axis in instruction is wrong.
ERR_AXIS_ACT	The axis is not activated.

Syntax

```
GetJointData
[ '\ ' MechUnit ':' < variable (VAR) of mecunit> ', ' ]
[ Axis ':' < expression (IN) of num> ]
[ '\ ' Position ':' < variable (VAR) of num> ]
[ '\ ' Speed ':' < variable (VAR) of num> ]
[ '\ ' Torque ':' < variable (VAR) of num> ]
[ '\ ' ExtTorque ':' < variable (VAR) of num> ] ';'

```

1 Instructions

1.91 GetSysData - Get system data *RobotWare Base*

1.91 GetSysData - Get system data

Usage

GetSysData fetches the value and the optional symbol name for the current system data of specified data type.

With this instruction it is possible to fetch data and the name of the current active Tool, Work Object, PayLoad or Total Load for the robot in actual or connected motion task, or any named motion task.

Basic examples

The following examples illustrate the instruction GetSysData:

Example 1

```
PERS tooldata curtoolvalue := [TRUE, [[0, 0, 0], [1, 0, 0, 0]],  
    [2, [0, 0, 2], [1, 0, 0, 0], 0, 0, 0]];  
VAR string curtoolname;  
GetSysData curtoolvalue;
```

Copy current active tool data value to the persistent variable curtoolvalue.

Example 2

```
GetSysData curtoolvalue \ObjectName := curtoolname;
```

Also copy current active tool name to the variable curtoolname.

Example 3

```
PERS loaddata curload;  
PERS loaddata piece:=[2.8, [-38.2, -10.1, -73.6], [1, 0, 0, 0], 0, 0, 0];  
PERS loaddata  
    tool2piece:=[13.1, [104.5, 13.5, 115.9], [1, 0, 0, 0], 0, 0, 0.143];  
PERS tooldata tool2 := [TRUE, [[138.695, 150.023, 98.9783],  
    [0.709396, -0.704707, -0.00856676, 0.00851007]],  
    [10, [105.2, -3.8, 118.7], [1, 0, 0, 0], 0, 0, 0.123]];  
VAR string name;  
..  
IF GetModalPayloadMode() = 1 THEN  
    GripLoad piece;  
    MoveL p3, v1000, fine, tool2;  
    ..  
    ..  
    ! Get current payload  
    GetSysData curload \ObjectName := name;  
ELSE  
    MoveL p30, v1000, fine, tool2\TLoad:=tool2piece;  
    ..  
    ..  
    ! Get current total load  
    GetSysData curload \ObjectName := name;  
ENDIF
```

If ModalPayloadMode is 1, copy current active payload and name to the variable name.

If ModalPayloadMode is 0, copy current total load and name to the variable name.

Continues on next page

Arguments

GetSysData [\TaskRef] [\TaskName] DestObject [\ObjectName]

[\TaskRef]

Task Reference

Data type: taskid

The program task identity from which the data of the current active system data should be read.

For all program tasks in the system, predefined variables of the data type taskid will be available. The variable identity will be "taskname"+"Id", e.g. for the T_ROB1 task the variable identity will be T_ROB1Id.

[\TaskName]

Data type: string

The program task name from which the current active system data should be read.

If none of the arguments \TaskRef or \TaskName are specified then the current task is used.

DestObject

Data type: anytype

Persistent variable for storage of current active system data value.

The data type of this argument also specifies the type of system data (Tool, Work Object, or Payload/Total Load) to fetch. If using TLoad optional argument on movement instructions, the Total Load is fetched instead of the Payload, if a loaddata datatype is used.

Data type	Type of system data
tooldata	Tool
wobjdata	Work Object
loaddata	Payload/Total Load

Array or record component cannot be used.

[\ObjectName]

Data type:string

Optional argument (variable or persistent) to also fetch the current active system data name.

Program execution

When running the instruction GetSysData the current data value is stored in the specified persistent variable in argument DestObject.

If argument \ObjectName is used, the name of the current data is stored in the specified variable or persistent in argument ObjectName.

Current system data for Tool, Work Object or Total load is activated by execution of any move instruction. Payload is activated by execution of the instruction GripLoad.

Continues on next page

1 Instructions

1.91 GetSysData - Get system data

RobotWare Base

Continued

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NOT_MOVETASK	The arguments \TaskRef or \TaskName specifies a non-motion task.  Note No error will be generated if the arguments \TaskRef or \TaskName specify the non-motion task that executes this function GetSysData (reference to my own non-motion task). The current system data will then be fetched from the connected motion task.
ERR_TASKNAME	If the program task name in argument \TaskName cannot be found in the system, the system variable ERRNO is set to ERR_TASKNAME.

Syntax

```
GetSysData
['\' TaskRef' :=] <variable (VAR) of taskid>]
|['\' TaskName' :=] <expression (IN) of string>]
[ DestObject' :=] <persistent(PERS) of anytype>
['\'ObjectName' :=] <variable or persistent (INOUT) of string>]';'
```

Related information

For information about	See
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of payload	loaddata - Load data on page 1664
Set system data	SetSysData - Set system data on page 690
System parameter <i>ModalPayloadMode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457

1.92 GetTrapData - Get interrupt data for current trap routine

Usage

GetTrapData is used in a trap routine to obtain all information about the interrupt that caused the trap routine to be executed.

To be used in trap routines generated by instruction IError, before use of the instruction ReadErrData.

Basic examples

The following example illustrates the instruction GetTrapData:

See also [More examples on page 235](#).

Example 1

```
VAR trapdata err_data;  
GetTrapData err_data;
```

Store interrupt information in the non-value variable err_data.

Arguments

GetTrapData TrapEvent

TrapEvent

Data type: trapdata

Variable for storage of the information about what caused the trap to be executed.

More examples

More examples of the instruction GetTrapData are illustrated below.

Example 1

```
VAR errdomain err_domain;  
VAR num err_number;  
VAR errtype err_type;  
VAR trapdata err_data;  
...  
TRAP trap_err  
  GetTrapData err_data;  
  ReadErrData err_data, err_domain, err_number, err_type;  
ENDTRAP
```

When an error is trapped to the trap routine trap_err, the error domain, the error number, and the error type are saved into appropriate non-value variables of the type trapdata.

Limitation

This instruction can only be used in a trap routine.

Syntax

```
GetTrapData  
  [TrapEvent '[:='] <variable (VAR) of trapdata>'];'
```

Continues on next page

1 Instructions

1.92 GetTrapData - Get interrupt data for current trap routine

RobotWare Base

Continued

Related information

For information about	See
Summary of interrupts	<i>Technical reference manual - RAPID Overview</i>
More information on interrupt management	<i>Technical reference manual - RAPID Overview</i>
Interrupt data for the current trap	<i>trapdata - Interrupt data for current trap routine on page 1760</i>
Orders an interrupt on errors	<i>IError - Orders an interrupt on errors on page 253</i>
Gets information about an error	<i>ReadErrData - Gets information about an error on page 573</i>
<i>Advanced RAPID</i>	<i>Application manual - Controller software Omni-Core</i>

1.93 GOTO - Goes to a new instruction

Usage

GOTO is used to transfer program execution to another line (a label) within the same routine.

Basic examples

The following example illustrates the instruction GOTO:

Example 1

```
GOTO next;
...
next:
```

Program execution continues with the instruction following next.

Example 2

```
reg1 := 1;
next:
...
reg1 := reg1 + 1;
IF reg1<=5 GOTO next;
```

The execution will be transferred to next four times (for reg1= 2, 3, 4, 5).

Example 3

```
IF reg1>100 THEN
  GOTO highvalue
ELSE
  GOTO lowvalue
ENDIF
lowvalue:
...
GOTO ready;
highvalue:
...
ready:
```

If reg1 is greater than 100, the execution will be transferred to the label highvalue, otherwise the execution will be transferred to the label lowvalue.

Arguments

GOTO Label

Label

Identifier

The label from where program execution is to continue.

Limitations

It is only possible to transfer program execution to a label within the same routine.

Continues on next page

1 Instructions

1.93 GOTO - Goes to a new instruction

RobotWare Base

Continued

It is only possible to transfer program execution to a label within an IF or TEST instruction if the GOTO instruction is also located within the same branch of that instruction.

It is only possible to transfer program execution to a label within a FOR or WHILE instruction if the GOTO instruction is also located within that instruction.

Syntax

GOTO <identifier>';'

Related information

For information about	See
Label	Label - Line name on page 331
Other instructions that change the program flow	<i>Technical reference manual - RAPID Overview</i>

1.94 GripLoad - Defines the payload for a robot

Usage

GripLoad is used to define the payload which the robot holds in its gripper.

Description

GripLoad specifies which load the robot is carrying. Specified load is used by the control system so that the robot movements can be controlled in the best possible way.

The payload is connected/disconnected using the instruction GripLoad, which adds or subtracts the weight of the payload to the weight of the gripper.



WARNING

It is important to always define the actual tool load and, when used, the payload of the robot (for example, a gripped part). Incorrect definitions of load data can result in overloading of the robot mechanical structure. There is also a risk that the speed in manual reduced speed mode can be exceeded.

When incorrect load data is specified, it can often lead to the following consequences:

- The robot may not use its maximum capacity.
- Impaired path accuracy including a risk of overshooting.
- Risk of overloading the mechanical structure.

The controller continuously monitors the load and writes an event log if the load is higher than expected. This event log is saved and logged in the controller memory.

Basic examples

The following examples illustrate the instruction GripLoad.

Example 1

```
Set doGripper;
!wait to grip
WaitTime 0.3;
GripLoad piece1;
```

Connection of the payload, piece1, specified at the same time as the robot grips the load.

Example 2

```
Reset doGripper;
!wait to release
WaitTime 0.3;
GripLoad load0;
```

Disconnection of a payload, specified at the same time as the robot releases a payload.

Continues on next page

1 Instructions

1.94 GripLoad - Defines the payload for a robot

RobotWare Base

Continued

Arguments

GripLoad Load

Load

Data type: loaddata

The load data that describes the current payload.

It is possible to test run the program without any payload by using a digital input signal connected to the system input *SimMode* (Simulated Mode). If the digital input signal is set to 1, the *loaddata* in the *GripLoad* instruction is not considered, and only the *loaddata* in the current *tooldata* is used.

Program execution

The specified load applies for the next executed movement instruction until a new *GripLoad* instruction is executed.

The specified load affects the performance of the robot.

The default load (*load0*), 0 kg, is automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to *main*
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

The payload is updated for the mechanical unit that is controlled from current program task. If *GripLoad* is used from a non-motion task, the payload is updated for the mechanical unit controlled by the connected motion task.

Syntax

```
GripLoad  
[Load ':='] <persistent (PERS) of loaddata>;'
```

Related information

For information about	See
Load identification of tool load, payload or arm load	<i>Operating manual - OmniCore</i> , section <i>Programming and testing - Service routines</i>
Define payload for mechanical units	MechUnitLoad - Defines a payload for a mechanical unit on page 376
Definition of load data	loaddata - Load data on page 1664
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>

1.95 HollowWristReset - Reset hollow wrist

Usage

HollowWristReset (*Reset hollow wrist*) resets the position of the wrist joints on hollow wrist manipulators, such as IRB 5402 and IRB 5403.

The instruction makes it possible to avoid rewinding the wrist joints 4 and 5 after they have been wound up one or more revolutions. After executing a HollowWristReset instruction, the wrist joints may continue to wind up in the same direction.

Description

HollowWristReset makes it easier to make application programs. You do not have to ensure that the wrist position is within ± 2 revolutions at the time of programming, and it may save cycle time because the robot does not have to spend time rewinding the wrist. There is a limitation of ± 144 revolutions for winding up joints 4 and 5 before the wrist position is reset by HollowWristReset. The robot programmer must be aware of this limitation and take it into consideration when planning the robot programs. To ensure that the 144 revolution limit is not exceeded after running a *wrist-winding* program several times, you should always let the robot come to a complete stop and reset the absolute position in every program (or cycle/routine/module and so on as necessary). Note that all axes must remain stopped during the execution of the HollowWristReset instruction. As long as these limitations are taken into consideration, joints 4 and 5 can wind indefinitely and independently of joint 6 during program execution.

Use HollowWristReset instead of IndReset to reset the hollow wrist as this instruction preserves the joint limits for joint 6 to prevent too much twisting of the paint tubes/cables.

Basic examples

The following example illustrates the instruction HollowWristReset:

Example 1

```
MoveL p10,v800,fine,paintgun1\WObj:=workobject1;  
HollowWristReset;
```

All active axes are stopped by a stop point and the wrist is reset.

Limitations

All active axes must be stopped while the HollowWristReset instruction is executed.

The wrist joints must be reset before any of them reach the ± 144 revolution limit (51840degrees/904rad).

Whenever a program stop, emergency stop, power failure stop, and so on occurs, the controller retains the path context to be able to return to the path and let the robot continue program execution from the point on the path at which it was stopped. In manual mode, if the manipulator has been moved out of the path between a stop and a restart, the operator is informed by the following message

Continues on next page

1 Instructions

1.95 HollowWristReset - Reset hollow wrist

RobotWare Base

Continued

on the FlexPendant: **Not on path! Robot has been moved after program stop. Should the robot return to the path on Start? Yes/No/Cancel.** This provides an opportunity of returning to the path before restart. In automatic mode, the robot automatically returns to the path.

HollowWristReset removes the path context. This means that it is not possible to return to the path in case of a program restart if the HollowWristReset instruction has been executed in the meantime. If this instruction is executed manually (service routine) it should only be executed at a time when returning to the path is not required. That is, after a program is completely finished, or an instruction is completely finished in step-by-step execution and the manipulator is not moved out of the path by jogging, and so on.

Syntax

```
HollowWristReset ';' 
```

Related information

For information about	See
Related system parameters	<i>Technical reference manual - System parameters</i>
Return to path	<i>Technical reference manual - RAPID Overview</i>

1.96 ICap - connect CAP events to trap routines

Usage

ICap is used to connect an interrupt number (which is already connected to a trap routine) with a specific CAP Event, see Arguments below for a listing of available Events. When using ICap, an association between a specific process event and a user defined Trap routine is created. In other words, the Trap routine in question is executed when the associated CAP event occurs.

We recommend placing the traps in a background task.

Basic example

Below is an example where the CAP Event CAP_START is associated with the trap routine start_trap.

```
VAR intnum start_intno:=0;
...

TRAP start_trap
  ! This routine will be executed when the event CAP_START is
    reported from the core
  ! Do what you want to do
ENDTRAP

PROC main()
  IDelete start_intno;
  CONNECT start_intno WITH start_trap;
  ICap start_intno, CAP_START;
  CapL p1, v100, cdata, weavestart, weave, z50, gun1;
ENDPROC
```

Arguments

ICap Interrupt Event

Interrupt

Data type: intnum

The interrupt identity. This should have previously been connected to a trap routine by means of the instruction CONNECT.

Event

Data type: num

The CAP event number to be associated with the interrupt. These events are predefined constants.

Continues on next page

1 Instructions

1.96 ICap - connect CAP events to trap routines

Continuous Application Platform

Continued

Available CAP events

To see the events listed according to phases, see section *Coupling between phases and events* in *Application manual - Continuous Application Platform*.

Events	Phase	Event number	Description
AT_ERRORPOINT	MAIN	28	This event occurs after restart, when the TCP reaches the position of the supervision error.
AT_POINT	MAIN	13	This event occurs at every robtarget on the process path except the start and finish point.
AT_RESTARTPOINT	MAIN	14	This event occurs when the robot has jogged back, the restart distance, on the process path after a stop.
CAP_PF_RESTART	MAIN	26	This event occurs when restart is ordered.
CAP_START		0	This event occurs as soon as the CAP process is started.
CAP_STOP		25	This event is a required event. If any other event is used, this event must be defined too. The event/trap is executed as soon as possible after the controller is stopped due to an error or a program stop. An error can be a recoverable error detected in CAP, a fatal error detected in CAP or an internal error stopping the controller. The code executed in this trap should take all external equipment to a safe state, for example, reset all external I/O-signals. Keep in mind that TRAP execution is stopped when RAPID execution of a NORMAL task is stopped. Therefore the TRAP connected to CAP_STOP has to be placed in a STATIC or SEMISTATIC task.
END_MAIN	END_MAIN	17	This event occurs at the point on the process path where supervision of the end sequence is started, that is, when the robot reaches the end point of the process.
END_POST1	END_POST1	21	This event occurs when it is time to end the POST1 phase, that is, when it is time to change from the POST1 to the POST2-phase. If using a <i>flying end</i> no event is distributed.
END_POST2	END_POST2	23	This event occurs when the POST2 phase is at an end, that is, when it is time to finally finish the process. If using a <i>flying end</i> no event is distributed.
END_PRE	PRE	32	This event occurs when the supervision of the PRE-phase, if present, is activated. If using a <i>flying start</i> no event is distributed, because there is a TCP movement already. At a restart this event is distributed.
EQUIDIST	MAIN	27	This event is sent, if it is ordered with the instruction CapEquiDist.

Continues on next page

1.96 ICap - connect CAP events to trap routines
Continuous Application Platform
Continued

Events	Phase	Event number	Description
FLY_END	MAIN	30	This event occurs when using <i>flying end</i> . This event is only available with <i>flying end</i> .
FLY_START	MAIN	29	This event occurs when using <i>flying start</i> . This event is only available with <i>flying start</i> .
LAST_INSTR_ENDED	MAIN	31	This event occurs when RAPID execution of the last CAP instruction is finished during <i>flying end</i> . This event is only available with <i>flying end</i> .
LAST_SEGMENT	MAIN	15	This event occurs at the starting point of the last segment.
MAIN_ENDED	END_MAIN	18	This event occurs when all conditions of the END_MAIN supervision list are fulfilled, that is, when the main process is considered ended.
MAIN_MOTION	MAIN	9	This event occurs when main motion is activated with the process running.
MAIN_STARTED	START	4	This event occurs when all conditions of the START Supervision list are fulfilled, that is, when the MAIN-phase is started.
MOTION_DELAY	MAIN	7	This event occurs after the delay, if any, of motion start. If using a <i>flying start</i> no event is distributed, because there is a TCP movement already. At a restart this event is distributed.
MOVE_STARTED	MAIN	10	This event occurs as soon as the robot starts moving along the process path. If using a <i>flying start</i> no event is distributed, because there is a TCP movement already. At a restart this event is distributed.
NEW_INSTR	MAIN	12	This event occurs when a new CapL or CapC instruction is fetched from the RAPID program.
PATH_END_POINT		19	This event occurs when the robot reaches the end point of the path, that is, the fine point or the middle of the zone (for <i>flying end</i>) in the last CAP instruction.
POST1_ENDED	END_POST1	22	This event occurs when all the conditions of the END_POST1 supervision list are fulfilled, that is, when the POST1 phase is successfully ended and the POST2 phase is started. If using a <i>flying end</i> no event is distributed.
POST1_STARTED	POST1	35	This event occurs when the supervision of the POST1-phase, if present, is activated. If using a <i>flying start</i> no event is distributed, because there is a TCP movement already. At a restart this event is distributed.

Continues on next page

1 Instructions

1.96 ICap - connect CAP events to trap routines

Continuous Application Platform

Continued

Events	Phase	Event number	Description
POST2_ENDED	END_POST2	24	This event occurs when all the conditions of the END_POST2 supervision list are fulfilled, that is, when the POST2 phase, and thus the whole process, is successfully ended. If using a <i>flying end</i> no event is distributed.
POST2_STARTED	POST2	37	This event occurs when the supervision of the POST1-phase, if present, is activated. If using a <i>flying start</i> no event is distributed, because there is a TCP movement already. At a restart this event is distributed.
PRE_ENDED	PRE	33	This event occurs when the supervision of the PRE-phase, if present, is activated. If using a <i>flying start</i> no event is distributed, because there is a TCP movement already. At a restart this event is distributed.
PRE_STARTED	PRE	2	This event occurs when all the requirements of the PRE Supervision list are fulfilled, that is, when the PRE_START-phase is started. If using a <i>flying start</i> no event is distributed, because there is a TCP movement already. At a restart this event is distributed.
PROCESS_END_POINT	MAIN	16	This event occurs when the robot reaches the end point of the process, that is, where the process is supposed to be ended. If using a <i>flying end</i> no event is distributed.
PROCESS_ENDED		20	This event occurs only when both the process is ended at the fine point or the middle of the zone (for <i>flying end</i>) in the last CAP instruction.
RESTART	MAIN	11	This event occurs when restart is ordered.
START_MAIN	START	3	This event occurs when the PRE_START-phase is ended and the MAIN-phase is started.
START_POST1	POST1	34	This event occurs when the supervision of the POST1-phase, if present, is activated. If using a <i>flying start</i> no event is distributed, because there is a TCP movement already. At a restart this event is distributed.
START_POST2	POST2	36	This event occurs when the supervision of the POST1-phase, if present, is activated. If using a <i>flying start</i> no event is distributed, because there is a TCP movement already. At a restart this event is distributed.
START_PRE	PRE	1	This event occurs when the supervision of the PRE-phase, if present, is activated. If using a <i>flying start</i> no event is distributed, because there is a TCP movement already. At a restart this event is distributed.

Continues on next page

1.96 ICap - connect CAP events to trap routines

Continuous Application Platform

Continued

Events	Phase	Event number	Description
STARTSPEED_TIME	MAIN	8	This event occurs when the time to use <i>Start Speed</i> runs out and it is time to switch to main motion data.
STOP_WEAVESTART	MAIN	5	This event occurs, before each weave start - but only if weave start is ordered. If using a <i>flying start</i> no event is distributed, because there is a TCP movement already. At a restart this event is distributed.
WEAVESTART_REGAIN	MAIN	6	This event occurs when the robot has regained back to the path after a weave start. If using a <i>flying start</i> no event is distributed, because there is a TCP movement already. At a restart this event is distributed.

Limitations

The same variable for interrupt identity cannot be used more than once, without first deleting it. Interrupts should therefore be handled as shown in one of the alternatives below.

```
PROC setup_events ()
  VAR intnum start_intno;
  IDelete start_intno;
  CONNECT start_intno WITH start_trap;
  ICap start_intno, CAP_START;
ENDPROC
```

All activation of interrupts is done at the beginning of the program. These instructions are then kept outside the main flow of the program. The ICap instruction should be executed only once, for example, from the startup system event routine. A recommendation is that the traps should be placed in a background task.

Syntax

```
ICap
  [Interrupt '[:='] < variable (IN) of intnum > ','
  [Event '[:='] < variable (IN) of num > ';' ]
```

Related information

For information about	See
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
Connect an interrupt with a trap	CONNECT - Connects an interrupt to a trap routine on page 155
Cancel an interrupt connected to a trap	IDelete - Cancels an interrupt on page 250
Data type intnum	intnum - Interrupt identity on page 1656

1 Instructions

1.97 ICapPathPos - Get center line robtarget when weaving *Continuous Application Platform*

1.97 ICapPathPos - Get center line robtarget when weaving

Usage

ICapPathPos is used to retrieve the position of the center line during weaving with CAP.

This function is mainly used together with the tracking functionality. It is necessary to activate weaving and the synchronization signals on both the left side and the right side.

Basic example

```
connect intpt, TRP_ipathpos ICapPathPos p_robt, sen_pos, intpt;  
When p_robt gets a new calculated value, the interrupt intpt will be sent, and  
the trap routine TRP_ipathpos will be executed.
```

Arguments

```
ICapPathPos p_robt, sen_pos, intpt [\NoDispl] [\EOffs]
```

p_robt

Data type: robtarget

p_robt keeps the latest value of the calculated robtarget.

sen_pos

Data type: pos

sen_pos is not used.

intpt

Data type: intno

intpt specifies the interrupt that will be received each time a new value is assigned to p_robt.

[\NoDispl]

Data type: switch

If \NoDispl is specified, the value returned in the PERS p_robt will not include any displacement that might be specified using the RAPID instructions PDispSet and PDispOn.

[\EOffs]

Data type: switch

If [\EOffs] is specified, the value returned in the PERS p_robt will include any offset specified using the RAPID instruction EOffsSet.

Limitations

It is necessary to activate weaving and weave synchronization (with or without tracking).

Syntax

```
ICapPathPos  
[p_robt ':='] < persistent (PERS) of robtarget > ', '
```

Continues on next page

1.97 ICapPathPos - Get center line robtarget when weaving

*Continuous Application Platform**Continued*

```
[sen_pos ':='] < persistent (PERS) of pos > ', '
[Interrupt ':='] < variable (IN) of intnum >
['\ ' EOffs ]
['\ ' NoDispl ] ';'

```

Related information

For information about	See
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
CapWeaveSync instruction	CapWeaveSync - set up signals and levels for weave synchronization on page 124

1 Instructions

1.98 IDelete - Cancels an interrupt
RobotWare Base

1.98 IDelete - Cancels an interrupt

Usage

IDelete (*Interrupt Delete*) is used to cancel (delete) an interrupt subscription.
If the interrupt is to be only temporarily disabled, the instruction ISleep or IDisable should be used.

Basic examples

The following example illustrates the instruction IDelete:

Example 1

```
IDelete feeder_low;
```

The interrupt feeder_low is cancelled.

Arguments

IDelete Interrupt

Interrupt

Data type: intnum
The interrupt identity.

Program execution

The definition of the interrupt is completely erased. To define it again it must first be re-connected to the trap routine.

It is recommended to precede IDelete with a stop point. Otherwise the interrupt will be deactivated before the end point of the movement path is reached.

Interrupts do not have to be erased; this is done automatically when

- a new program is loaded
- the program is restarted from the beginning
- the program pointer is moved to the start of a routine

Syntax

```
IDelete [ Interrupt ':=' ] < variable (VAR) of intnum > ';' ;
```

Related information

For information about	See
Summary of interrupts	<i>Technical reference manual - RAPID Overview</i>
More information about interrupt management	<i>Technical reference manual - RAPID Overview</i>
Temporarily disabling an interrupt	ISleep - Deactivates an interrupt on page 321
Temporarily disabling all interrupts	IDisable - Disables interrupts on page 251

1.99 IDisable - Disables interrupts

Usage

IDisable(*Interrupt Disable*) is used to disable all interrupts temporarily. It may, for example, be used in a particularly sensitive part of the program where no interrupts may be permitted to take place if they disturb normal program execution.

Basic examples

The following example illustrates the instruction IDisable:

Example 1

```
IDisable;
FOR i FROM 1 TO 100 DO
  character[i]:=ReadBin(sensor);
ENDFOR
IEnable;
```

No interrupts are permitted while reading from the sensor. When it has finished reading, interrupts are once more permitted.

Program execution

Interrupts that occur during the time in which an IDisable instruction is in effect are placed in a queue. When interrupts are permitted once more, then the interrupt(s) immediately begin generating, executed in “first in - first out” order in the queue.

IEnable is active by default. IEnable is automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to `main`
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost
- after executing one cycle (passing `main`) or executing `ExitCycle`.

Syntax

```
IDisable';'
```

Related information

For information about	See
Summary of interrupts	<i>Technical reference manual - RAPID Overview</i>
More information about interrupt management	<i>Technical reference manual - RAPID Overview</i>
Permitting interrupts	IEnable - Enables interrupts on page 252

1 Instructions

1.100 IEnable - Enables interrupts *RobotWare Base*

1.100 IEnable - Enables interrupts

Usage

IEnable(*Interrupt Enable*) is used to enable interrupts during program execution.

Basic examples

The following example illustrates the instruction IEnable:

Example 1

```
IDisable;  
FOR i FROM 1 TO 100 DO  
    character[i]:=ReadBin(sensor);  
ENDFOR  
IEnable;
```

No interrupts are permitted while reading from the sensor. When it has finished reading, interrupts are once more permitted.

Program execution

Interrupts which occur during the time in which an IDisable instruction is in effect are placed in a queue. When interrupts are permitted once more (IEnable), the interrupt(s) then immediately begin generating, executed in “first in - first out” order in the queue. Program execution then continues in the ordinary program and interrupts which occur after this are dealt with as soon as they occur.

Interrupts are always permitted when a program is started from the beginning. Interrupts disabled by the ISleep instruction are not affected by the IEnable instruction.

Syntax

IEnable';'

Related information

For information about	See
Summary of interrupts	<i>Technical reference manual - RAPID Overview</i>
More information about interrupt management	<i>Technical reference manual - RAPID Overview</i>
Permitting no interrupts	IDisable - Disables interrupts on page 251

1.101 IError - Orders an interrupt on errors

Usage

IError (*Interrupt Errors*) is used to order and enable an interrupt when an error occurs.

Error, warning, or state change can be logged with IError.

Basic examples

The following example illustrates the instruction IError:

See also [More examples on page 254](#).

Example 1

```
VAR intnum err_int;
...
PROC main()
  CONNECT err_int WITH err_trap;
  IError COMMON_ERR, TYPE_ALL, err_int;
```

Orders an interrupt in **RAPID** and execution of the trap routine `err_trap` each time an error, warning, or state change is generated in the system.

Arguments

IError ErrorDomain [`\ErrorId`] ErrorType Interrupt

ErrorDomain

Data type: `errdomain`

The error domain that is to be monitored. See predefined data of type `errdomain`. To specify any domain use `COMMON_ERR`.

[\ErrorId]

Data type: `num`

Optionally, the number of a specific error that is to be monitored. The error number must be specified without the first digit (error domain) of the complete error number. For example, **10008 Program restarted**, must be specified as **0008** or only **8**.

ErrorType

Data type: `errtype`

The type of event such as error, warning, or state change that is to be monitored. See predefined data of type `errtype`. To specify any type use `TYPE_ALL`.

Interrupt

Data type: `intnum`

The interrupt identity. This should have been previously connected to a trap routine by means of the instruction `CONNECT`.

Continues on next page

1 Instructions

1.101 IError - Orders an interrupt on errors

RobotWare Base

Continued

Program execution



Note

If using ErrWrite or ErrLog from RAPID a lot, and subscribing on events from those domains with IError, there can be problems to handle all interrupts that are produced.

The corresponding trap routine is automatically called when an error occurs in the specified domain of the specified type and optionally with the specified error number. When this has been executed, program execution continues from where the interrupt occurred.

More examples

More examples of the instruction IError are illustrated below.

```
VAR intnum err_interrupt;  
VAR trapdata err_data;  
VAR errdomain err_domain;  
VAR num err_number;  
VAR errtype err_type;  
PROC main()  
  CONNECT err_interrupt WITH trap_err;  
  IError COMMON_ERR, TYPE_ERR, err_interrupt;  
  ...  
  IDelete err_interrupt;  
  ...  
ENDPROC  
TRAP trap_err  
  GetTrapData err_data;  
  ReadErrData err_data, err_domain, err_number, err_type;  
  ! Set domain no 1 ... 11  
  SetGO go_err1, err_domain;  
  ! Set error no 1 ...9999  
  SetGO go_err2, err_number;  
ENDTRAP
```

When an error occurs (only error, not warning or state change) the error number is retrieved in the trap routine, and its value is used to set 2 groups of digital output signals.

Limitation

It is not possible to order an interrupt on internal errors.

In a task of type normal, the event will be thrown away during a program stop, which means that not all events can be fetched in a normal task. To fetch all events the task must be of static or semi-static type.

The same variable for interrupt identity cannot be used more than once without first deleting it. Interrupts should therefore be handled as shown in one of the alternatives below.

```
VAR intnum err_interrupt;  
PROC main ( )
```

Continues on next page

```

CONNECT err_interrupt WITH err_trap;
IError COMMON_ERR, TYPE_ERR, err_interupt;
WHILE TRUE DO
:
:
ENDWHILE
ENDPROC

```

Interrupts are activated at the beginning of the program. These instructions in the beginning are then kept outside the main flow of the program.

```

VAR intnum err_interrupt;
PROC main ( )
CONNECT err_interrupt WITH err_trap;
IError COMMON_ERR, TYPE_ERR, err_interupt;
:
:
IDelete err_interrupt;
ENDPROC

```

The interrupt is deleted at the end of the program and is then reactivated. Note, in this case, that the interrupt is inactive for a short period.

Syntax

```

IError
[ErrorDomain ':='] <expression (IN) of errdomain>
['\\'ErrorId':=' <expression (IN) of num>', '
[ErrorType' :='] <expression (IN) of errtype> ', '
[Interrupt' :='] <variable (VAR) of intnum>;'

```

Related information

For information about	See
Summary of interrupts	<i>Technical reference manual - RAPID Overview</i>
More information on interrupt management	<i>Technical reference manual - RAPID Overview</i>
Error domains, predefined constants	errdomain - Error domain on page 1632
Error types, predefined constants	errtype - Error type on page 1643
Get interrupt data for current trap	GetTrapData - Get interrupt data for current trap routine on page 235
Gets information about an error	ReadErrData - Gets information about an error on page 573
<i>Advanced RAPID</i>	<i>Application manual - Controller software Omni-Core</i>

1 Instructions

1.102 IF - If a condition is met, then ...; otherwise ...

RobotWare Base

1.102 IF - If a condition is met, then ...; otherwise ...

Usage

IF is used when different instructions are to be executed depending on whether a condition is met or not.

Basic examples

Basic examples of the instruction IF are illustrated below.

See also [More examples on page 256](#).

Example 1

```
IF reg1 > 5 THEN
  Set do1;
  Set do2;
ENDIF
```

The signals do1 and do2 are set only if reg1 is greater than 5.

Example 2

```
IF reg1 > 5 THEN
  Set do1;
  Set do2;
ELSE
  Reset do1;
  Reset do2;
ENDIF
```

The signals do1 and do2 are set or reset depending on whether reg1 is greater than 5 or not.

Arguments

```
IF Condition THEN ...
  {ELSEIF Condition THEN ...}
[ELSE ...]
ENDIF
```

Condition

Data type: bool

The condition that must be satisfied for the instructions between THEN and ELSE/ELSEIF to be executed.

Program execution

The conditions are tested in sequential order, until one of them is satisfied. Program execution continues with the instructions associated with that condition. If none of the conditions are satisfied, program execution continues with the instructions following ELSE. If more than one condition is met, only the instructions associated with the first of those conditions are executed.

More examples

More examples of how to use the instruction IF are illustrated below.

Continues on next page

Example 1

```
IF counter > 100 THEN
  counter := 100;
ELSEIF counter < 0 THEN
  counter := 0;
ELSE
  counter := counter + 1;
ENDIF
```

counter is incremented by 1. However, if the value of counter is outside the limit 0-100, counter is assigned the corresponding limit value.

Syntax

```
IF <conditional expression> THEN
  <statement list>
{ ELSEIF <conditional expression> THEN
  <statement list> | <EIT> }
[ ELSE
  <statement list> ]
ENDIF
```

Related information

For information about	See
Conditions (logical expressions)	<i>Technical reference manual - RAPID Overview</i>

1 Instructions

1.103 Incr - Increments by 1

RobotWare Base

1.103 Incr - Increments by 1

Usage

Incr is used to add 1 to a numeric variable or persistent.

Basic examples

The following example illustrates the instruction Incr:

See also [More examples on page 258](#).

Example 1

```
Incr reg1;
```

1 is added to reg1, i.e. $\text{reg1} := \text{reg1} + 1$.

Arguments

Incr Name | Dname

Name

Data type: num

The name of the variable or persistent to be changed.

Dname

Data type: dnum

The name of the variable or persistent to be changed.

More examples

More examples of the instruction Incr are illustrated below.

Example 1

```
VAR num no_of_parts:=0;
...
WHILE stop_production=0 DO
  produce_part;
  Incr no_of_parts;
  TPWrite "No of produced parts= "\Num:=no_of_parts;
ENDWHILE
```

The number of parts produced is updated each cycle on the FlexPendant. Production continues to run as long as the input signal stop_production is not set.

Example 2

```
VAR dnum no_of_parts:=0;
...
WHILE stop_production=0 DO
  produce_part;
  Incr no_of_parts;
  TPWrite "No of produced parts= "\Dnum:=no_of_parts;
ENDWHILE
```

Continues on next page

The number of parts produced is updated each cycle on the FlexPendant.
Production continues to run as long as the input signal stop_production is not set.

Syntax

Incr

[Name ':' = '] < variable or persistent (**INOUT**) of num >

| [Dname' ':' = '] < variable or persistent (**INOUT**) of dnum > ' ;'

Related information

For information about	See
Decrementing a variable by 1	Decr - Decrements by 1 on page 182
Adding any value to a variable	Add - Adds a numeric value on page 30
Changing data using an arbitrary expression, for example, multiplication	":=" - Assigns a value on page 39

1 Instructions

1.104 IndAMove - Independent absolute position movement *Independent Axis*

1.104 IndAMove - Independent absolute position movement

Usage

IndAMove(*Independent Absolute Movement*) is used to change an axis to independent mode and move the axis to a specific position.

An independent axis is an axis moving independently of other axes in the robot system. As program execution immediately continues, it is possible to execute other instructions (including positioning instructions) during the time the independent axis is moving.

If the axis is to be moved within a revolution, the instruction IndRMove should be used instead. If the move is to occur a short distance from the current position, the instruction IndDMove must be used.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction IndAMove:

See also [More examples on page 262](#).

Example 1

```
IndAMove Station_A,2\ToAbsPos:=p4,20;
```

Axis 2 of Station_A is moved to the position p4 at the speed 20 degrees/s.

Arguments

```
IndAMove MecUnit Axis [\ToAbsPos] | [\ToAbsNum] Speed [\Ramp]
```

MecUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

Axis

Data type: num

The number of the current axis for the mechanical unit (1-6)

[\ToAbsPos]

To Absolute Position

Data type: robtarget

Axis position specified as a robtarget. Only the component for this specific Axis is used. The value is used as an absolute position value in degrees (mm for linear axes).

The axis position will be affected if the axis is displaced using the instruction EOffsSet or EOffsOn.

For robot axes the argument \ToAbsNum is to be used instead.

[\ToAbsNum]

To Absolute Numeric value

Continues on next page

1.104 IndAMove - Independent absolute position movement

*Independent Axis**Continued***Data type:** num

Axis position defined in degrees (mm for linear axis).

Using this argument, the position will NOT be affected by any displacement, for example, EOffsSet or PDispOn.

Same function as \ToAbsPos but the position is defined as a numeric value to make it easy to manually change the position.

Speed

Data type: num

Axis speed in degrees/s (mm/s for linear axis).

[\Ramp]

Data type: num

Decrease acceleration and deceleration from maximum performance (1-100%,100%=maximumperformance).

Program execution

When IndAMove is executed the specified axis moves with the programmed speed to the specified axis position. If \Ramp is programmed there will be a reduction of acceleration/deceleration.

To change the axis back to normal mode the IndReset instruction is used. In connection with this the logical position of the axis can be changed so that a number of revolutions are erased from the position, for example, to avoid rotating back for the next movement.

The speed can be altered by executing another IndAMove instruction (or another IndXMove instruction). If a speed in the opposite direction is selected the axis stops and then accelerates to the new speed and direction.

For stepwise execution of the instruction the axis is set in independent mode only. The axis begins its movement when the next instruction is executed and continues as long as program execution takes place. For more information see *RAPID reference manual - RAPID overview, section Motion and I/O principles - Positioning during program execution - Independent axes*.

When the program pointer is moved to the start of the program or to a new routine all axes are automatically set to normal, without changing the measurement system (equivalent to executing the instruction IndReset\Old).

**Note**

An IndAMove instruction after an IndCMove operation can result in the axis spinning back to the movement performed in the IndCMove instruction. To prevent this, use an IndReset instruction before the IndAMove, or use an IndRMove instruction.

Continues on next page

1 Instructions

1.104 IndAMove - Independent absolute position movement

Independent Axis

Continued

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AXIS_ACT	The axis is not activated.

More examples

More examples of the instruction IndAMove are illustrated below.

Example 1

```
ActUnit Station_A;  
weld_stationA;  
IndAMove Station_A,1\ToAbsNum:=90,20\Ramp:=50;  
ActUnit Station_B;  
weld_stationB_1;  
WaitUntil IndInpos(Station_A,1) = TRUE;  
WaitTime 0.2;  
DeactUnit Station_A;  
weld_stationB_2;
```

Station_A is activated and the welding is started in station A.

Station_A (axis 1) is then moved to the 90 degrees position while the robot is welding in station B. The speed of the axis is 20 degrees/s. The speed is changed with acceleration/deceleration reduced to 50% of max performance.

When station A reaches this position it is deactivated, and reloading can take place in the station at the same time as the robot continues to weld in station B.

Limitations

Axes in independent mode cannot be jogged. If an attempt is made to execute the axis manually, the axis will not move and an error message will be displayed. Execute an IndReset instruction or move the program pointer to main to leave independent mode.

If a power fail occurs when an axis is in independent mode the program cannot be restarted. An error message is displayed and the program must be started from the beginning.

The instruction is not advisable for coupled robot wrist axes (see *RAPID reference manual - RAPID overview*, section *Motion and I/O principles - Positioning during program execution - Independent axes*).

Syntax

```
IndAMove  
[MecUnit ':='] <variable (VAR) of mecunit>','  
[Axis ':='] <expression (IN) of num>  
['\ ' ToAbsPos ':=' <expression (IN) of robtarg>]  
|['\ ' ToAbsNum ':=' <expression (IN) of num>'],'  
[Speed ':='] <expression (IN) of num>  
['\ ' Ramp ':=' <expression (IN) of num>'];'
```

Continues on next page

Related information

For information about	See
Independent axes in general	<i>Technical reference manual - RAPID Overview</i>
<i>Independent Axis</i>	<i>Application manual - Controller software OmniCore</i>
Change back to normal mode	IndReset - Independent reset on page 271
Reset the measurement system	IndReset - Independent reset on page 271
Other independent axis movement	IndRMove - Independent relative position movement on page 276 IndDMove - Independent delta position movement on page 268 IndCMove - Independent continuous movement on page 264
Check the speed status for independent axes	IndSpeed - Independent speed status on page 1310
Check the position status for independent axes	IndInpos - Independent axis in position status on page 1308
Activating independent joints	<i>Technical reference manual - System parameters, topic Motion, type Arm</i>

1 Instructions

1.105 IndCMove - Independent continuous movement

Independent Axis

1.105 IndCMove - Independent continuous movement

Usage

IndCMove (*Independent Continuous Movement*) is used to change an axis to independent mode and start the axis moving continuously at a specific speed. An independent axis is an axis moving independently of other axes in the robot system. As program execution continues immediately it is possible to execute other instructions (including positioning instructions) during the time the independent axis is moving.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction IndCMove:

See also [More examples on page 265](#).

Example 1

```
IndCMove Station_A, 2, -30.5;
```

Axis 2 of Station_A starts to move in a negative direction at a speed of 30.5 degrees/s.

Arguments

```
IndCMove MecUnit Axis Speed [\Ramp]
```

MecUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

Axis

Data type: num

The number of the current axis for the mechanical unit (1-6).

Speed

Data type: num

Axis speed in degrees/s (mm/s for linear axis).

The direction of movement is specified with the sign of the speed argument.

[\Ramp]

Data type: num

Decrease acceleration and deceleration from maximum performance (1-100%, 100%=maximum performance).

Program execution

When IndCMove is executed the specified axis starts to move with the programmed speed. The direction of movement is specified as the sign of the speed argument. If \Ramp is programmed there will be a reduction of acceleration/deceleration.

Continues on next page

To change the axis back to normal mode the IndReset instruction is used. The logical position of the axis can be changed in connection with this - a number of full revolutions can be erased, for example, to avoid rotating back for the next movement.

The speed can be changed by executing a further IndCMove instruction. If a speed in the opposite direction is ordered the axis stops and then accelerates to the new speed and direction. To stop the axis, speed argument 0 can be used. It will then still be in independent mode.

During stepwise execution of the instruction the axis is set in independent mode only. The axis starts its movement when the next instruction is executed and continues as long as program execution continues. For more information see *RAPID reference manual - RAPID overview*, section *Motion and I/O principles - Positioning during program execution - Independent axes*.

When the program pointer is moved to the beginning of the program or to a new routine, all axes are set automatically to normal mode without changing the measurement system (equivalent to executing the instruction IndReset\0ld).

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AXIS_ACT	The axis is not activated.

More examples

More examples of the instruction IndCMove are illustrated below.

```
IndCMove Station_A,2,20;
WaitUntil IndSpeed(Station_A,2 \InSpeed) = TRUE;
WaitTime 0.2;
MoveL p10, v1000, fine, tool1;
IndCMove Station_A,2, -10\Ramp:=50;
MoveL p20, v1000, z50, tool1;
IndRMove Station_A,2 \ToRelPos:=p1 \Short,10;
MoveL p30, v1000, fine, tool1;
WaitUntil IndInpos(Station_A,2 ) = TRUE;
WaitTime 0.2;
IndReset Station_A,2 \RefPos:=p40\Short;
MoveL p40, v1000, fine, tool1;
```

Axis 2 of Station_A starts to move in a positive direction at a speed of 20 degrees/s. When this axis has reached the selected speed the robot axes start to move.

When the robot reaches position p10 the external axis changes direction and rotates at a speed of 10 degrees/s. The change of speed is performed with acceleration/deceleration reduced to 50% of maximum performance. At the same time, the robot executes towards p20.

Axis 2 of Station_A is then stopped as quickly as possible in position p1 within the current revolution.

Continues on next page

1 Instructions

1.105 IndCMove - Independent continuous movement

Independent Axis

Continued

When axis 2 has reached this position, and the robot has stopped in position p30, axis 2 returns to normal mode again. The measurement system offset for this axis is changes a whole number of axis revolutions so that the actual position is as close as possible to p40.

When the robot is then moved to position p40, axis 2 of Station_A will be moved by the instruction MoveL p40 via the shortest route to position p40 (max ± 180 degrees).

Limitations

The resolution of the axis position worsens the further it is moved from its logical zero position (usually the middle of the working area). To achieve high resolution again the logical working area can be set to zero with the instruction IndReset. For more information see *RAPID reference manual - RAPID overview*, section *Motion and I/O Principles - Positioning during program execution - Independent axes*.

Axes in independent mode cannot be jogged. If an attempt is made to execute the axis manually, the axis will not move, and an error message will be displayed. Execute an IndReset instruction or move the program pointer to main to leave independent mode.

If a power fail occurs when the axis is in independent mode the program cannot be restarted. An error message is displayed, and the program must be started from the beginning.

The instruction is not advisable for coupled robot wrist axes (see *RAPID Reference Manual- RAPID overview*, section *Motion and I/O principles - Positioning during program execution- Independent Axes*).

Syntax

```
IndCMove
[MecUnit ':=' ] <variable (VAR) of mecunit> ', '
[Axis ':=' ] <expression (IN) of num> ', '
[Speed ':=' ] <expression (IN) of num>
['\ ' Ramp ':=' <expression (IN) of num> ] ';' ;'
```

Related information

For information about	See
Independent axes in general	<i>Technical reference manual - RAPID Overview</i>
<i>Independent Axis</i>	<i>Application manual - Controller software Omni-Core</i>
Change back to normal mode	IndReset - Independent reset on page 271
Reset the measurement system	IndReset - Independent reset on page 271
Other independent axis movement	IndAMove - Independent absolute position movement on page 260 IndRMove - Independent relative position movement on page 276 IndDMove - Independent delta position movement on page 268

Continues on next page

1.105 IndCMove - Independent continuous movement

Independent Axis

Continued

For information about	See
Check the speed status for independent axes	IndSpeed - Independent speed status on page 1310
Check the position status for independent axes	IndInpos - Independent axis in position status on page 1308
Activating independent joints	<i>Technical reference manual - System parameters, topic Motion, type Arm</i>

1 Instructions

1.106 IndDMove - Independent delta position movement

Independent Axis

1.106 IndDMove - Independent delta position movement

Usage

IndDMove(*Independent Delta Movement*) is used to change an axis to independent mode and move the axis to a specific distance.

An independent axis is an axis moving independently of other axes in the robot system. As program execution continues immediately it is possible to execute other instructions (including positioning instructions) during the time the independent axis is moving.

If the axis is to be moved to a specific position, the instruction IndAMove or IndRMove must be used instead.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction IndDMove:

See also [More examples on page 269](#).

Example 1

```
IndDMove Station_A,2,-30,20;
```

Axis 2 of Station_A is moved 30 degrees in a negative direction at a speed of 20 degrees/s.

Arguments

```
IndDMove MecUnit Axis Delta Speed [\Ramp]
```

MecUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

Axis

Data type: num

The number of the current axis for the mechanical unit (1-6).

Delta

Data type: num

The distance which the current axis is to be moved, expressed in degrees (mm for linear axes). The sign specifies the direction of movement.

Speed

Data type: num

Axis speed in degrees/s (mm/s for linear axis).

[\Ramp]

Data type: num

Continues on next page

Decrease acceleration and deceleration from maximum performance
(1-100%,100%=maximumperformance).

Program execution

When IndDMove is executed the specified axis moves with the programmed speed to the specified distance. The direction of movement is specified as the sign of the Delta argument. If \Ramp is programmed there will be a reduction of acceleration/deceleration.

If the axis is moving the new position is calculated from the momentary position of the axis when the instruction IndDMove is executed. If an IndDMove instruction with distance 0 is executed and the axis is already moving position, the axis will stop and then move back to the position which the axis had when the instruction was executed.

To change the axis back to normal mode the IndReset instruction is used. The logical position of the axis can be changed in connection with this - a number of full revolutions can be erased from the position, for example, to avoid rotating back for the next movement.

The speed can be changed by running a further IndDMove instruction (or another IndXMove instruction). If a speed in the opposite direction is selected the axis stops and then accelerates to the new speed and direction.

During stepwise execution of the instruction the axis is set in independent mode only. The axis starts its movement when the next instruction is executed and continues as long as program execution continues. For more information see *RAPID reference manual - RAPID overview, section Motion and I/O principles - Positioning during program execution - Independent axes*.

When the program pointer is moved to the beginning of the program, or to a new routine, all axes are automatically set to normal mode without changing the measurement system (equivalent to running the instruction IndReset \Old).

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AXIS_ACT	The axis is not activated.

More examples

More examples of the instruction IndDMove are illustrated below.

Example 1

```
IndAMove ROB_1,6\ToAbsNum:=90,20;
WaitUntil IndInpos(ROB_1,6) = TRUE;
WaitTime 0.2;
IndDMove Station_A,2,-30,20;
WaitUntil IndInpos(ROB_1,6) = TRUE;
WaitTime 0.2;
IndDMove ROB_1,6,400,20;
```

Continues on next page

1 Instructions

1.106 IndDMove - Independent delta position movement

Independent Axis

Continued

Axis 6 of the robot is moved to the following positions:

- 90 degrees
- 60 degrees
- 460 degrees (1 revolution + 100 degrees)

Limitations

Axes in independent mode cannot be jogged. If an attempt is made to execute the axis manually the axis will not move, and an error message will be displayed. Execute an IndReset instruction or move the program pointer to main to leave independent mode.

If a loss of power fail occurs when the axis is in independent mode the program cannot be restarted. An error message is displayed, and the program must be started from the beginning.

The instruction is not advisable for coupled robot wrist axes (see *RAPID reference manual - RAPID overview*, section *Motion and I/O principles - Positioning during program execution - Independent axes*).

Syntax

```
IndDMove
[MecUnit ':='] <variable (VAR) of mecunit>', '
[Axis ':='] <expression (IN) of num>', '
[Delta ':='] <expression (IN) of num>', '
[Speed ':='] <expression (IN) of num>
['\ ' Ramp ':=' <expression (IN) of num>'];'
```

Related information

For information about	See
Independent axes in general	<i>Technical reference manual - RAPID Overview</i>
<i>Independent Axis</i>	<i>Application manual - Controller software Omni-Core</i>
Change back to normal mode	IndReset - Independent reset on page 271
Reset the measurement system	IndReset - Independent reset on page 271
Other independent axis movement	IndAMove - Independent absolute position movement on page 260 IndRMove - Independent relative position movement on page 276 IndCMove - Independent continuous movement on page 264
Check the speed status for independent axes	IndSpeed - Independent speed status on page 1310
Check the position status for independent axes	IndInpos - Independent axis in position status on page 1308
Activating independent joints	<i>Technical reference manual - System parameters, topic Motion, type Arm</i>

1.107 IndReset - Independent reset

Usage

IndReset (*Independent Reset*) is used to change an independent axis back to normal mode. At the same time, the measurement system for rotational axes can be moved a number of axis revolutions.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction IndReset:

See also [More examples on page 273](#).

```
IndCMove Station_A,2,5;
MoveL *,v1000,fine,tool1;
IndCMove Station_A,2,0;
WaitUntil IndSpeed(Station_A,2\ZeroSpeed);
WaitTime 0.2
IndReset Station_A,2;
```

Axis 2 of Station_A is first moved in independent mode and then changed back to normal mode. The axis will keep its position.



Note

The current independent axis and the normal axes should not move when the instruction IndReset is executed. That is why previous position is a stop point, and an IndCMove instruction is executed at zero speed. Furthermore, a pause of 0.2 seconds is used to ensure that the correct status has been achieved.

Arguments

```
IndReset MecUnit Axis [\RefPos] | [\RefNum] [\Short] | [\Fwd]
|[\Bwd] | \Old
```

MecUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

Axis

Data type: num

The number of the current axis for the mechanical unit (1-6).

[\RefPos]

Reference Position

Data type: robtarget

Reference axis position specified as a robtarget. Only the component for this specific Axis is used. The position must be inside the normal working range.

For robot axes, the argument \RefNum is to be used instead.

Continues on next page

1 Instructions

1.107 IndReset - Independent reset

Independent Axis

Continued

The argument is only to be defined together with the argument \Short, \Fwd or \Bwd. It is not allowed together with the argument \Old.

[\RefNum]

Reference Numeric value

Data type: num

Reference axis position defined in degrees (mm for linear axis). The position must be inside the normal working range.

The argument is only to be defined together with the argument \Short, \Fwd or \Bwd. It is not allowed together with the argument \Old.

Same function as \RefPos but the position is defined as a numeric value to make it easy to change the position manually.

[\Short]

Data type: switch

The measurement system will change a whole number of revolutions on the axis side so that the axis will be as close as possible to the specified \RefPos or \RefNum position. If a positioning instruction with the same position is executed after IndReset the axis will travel the shortest route, less than ± 180 degrees, to reach the position.

[\Fwd]

Forward

Data type: switch

The measurement system will change a whole number of revolutions on the axis side so that the reference position will be on the positive side of the specified \RefPos or \RefNum position. If a positioning instruction with the same position is executed after IndReset, the axis will turn in a positive direction less than 360 degrees to reach the position.

[\Bwd]

Backward

Data type: switch

The measurement system will change a whole number of revolutions on the axis side so that the reference position will be on the negative side of the specified \RefPos or \RefNum position. If a positioning instruction with the same position is executed after IndReset, the axis will turn in a negative direction less than 360 degrees to reach the position.

[\Old]

Data type: switch

Keeps the old position.

Continues on next page

**Note**

Resolution is decreased in positions far away from zero.

If no argument \Short, \Fwd, \Bwd or \Old is specified - \Old is used as default value.

Program execution

When IndReset is executed it changes the independent axis back to normal mode. At the same time the measurement system for the axis can be moved by a whole number of axis revolutions.

The instruction may also be used in normal mode to change the measurement system.

**Note**

The position is used only to adjust the measurement system - the axis will not move to the position.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AXIS_ACT	The axis is not activated.
ERR_AXIS_MOVING	The axis is moving.

More examples

More examples of the instruction IndReset are illustrated below.

Example 1

```
IndAMove Station_A,1\ToAbsNum:=750,50;
WaitUntil IndInpos(Station_A,1);
WaitTime 0.2;
IndReset Station_A,1 \RefNum:=0 \Short;
IndAMove Station_A,1\ToAbsNum:=750,50;
WaitUntil IndInpos(Station_A,1);
WaitTime 0.2;
IndReset Station_A,1 \RefNum:=300 \Short;
```

Axis 1 in Station_A is first moved independently to the 750 degrees position (2 revolutions and 30 degrees). At the same time as it changes to normal mode the logical position is set to 30 degrees.

Axis 1 in Station_A is subsequently moved to the 750 degrees position (2 revolutions and 30 degrees). At the same time as it changes to normal mode the logical position is set to 390degrees (1 revolution and 30 degrees).

Continues on next page

1 Instructions

1.107 IndReset - Independent reset

Independent Axis

Continued

Limitations

The instruction may only be executed when all active axes running in normal mode are standing still. All active axes in every mechanical unit connected to the same motion planner need to stand still. The independent mode axis which is going to be changed to normal mode must also be stationary. For axes in normal mode this is achieved by executing a move instruction with the argument *fine*. The independent axis is stopped by an IndCMove with Speed:=0 (followed by a wait period of 0.2 seconds), IndRMove, IndAMove, or IndDMove instruction.

The resolution of positions is decreased when moving away from logical position 0. An axis which progressively rotates further and further from the position 0 should thus be set to zero using the instruction IndReset with an argument other than \Old.

The measurement system cannot be changed for linear axes.

To ensure a proper start after IndReset of an axis with a relative measured measurement system (synchronization switches) an extra time delay of 0.12 seconds must be added after the IndReset instruction.

Only robot axis 6 can be used as independent axis. The IndReset instruction can also be used for axis 4 on IRB 1600, 2600 and 4600 models (not for ID version). If IndReset is used on robot axis 4 then axis 6 must not be in the independent mode.

If this instruction is preceded by a move instruction, that move instruction must be programmed with a stop point (zonedata *fine*), not a fly-by point. Otherwise restart after power failure will not be possible.

IndReset cannot be executed in a RAPID routine connected to any of following special system events: PowerOn, Stop, QStop, Restart or Step.

IndReset only switches the independent state for an axis. It cannot be used to stop an independent movement. To stop an independent movement it has to reach a stop condition or the user has to for example move PP to main.

The option *Independent Axis* cannot be combined with *Tool Change*.

Syntax

```
IndReset
[MecUnit ':='] <variable (VAR) of mecunit>','
[Axis ':='] <expression (IN) of num>
['\ ' RefPos ':=' <expression (IN) of robtarget>]|
['\ ' RefNum ':=' <expression (IN) of num>]
['\ ' Short] | ['\ ' Fwd] | ['\ ' Bwd] | ['\ ' Old]';'
```

Related information

For information about	See
Independent axes in general	<i>Technical reference manual - RAPID Overview</i>
<i>Independent Axis</i>	<i>Application manual - Controller software Omni-Core</i>

Continues on next page

1.107 IndReset - Independent reset Independent Axis Continued

For information about	See
Change an axis to independent mode	IndAMove - Independent absolute position movement on page 260 IndCMove - Independent continuous movement on page 264 IndDMove - Independent delta position movement on page 268 IndRMove - Independent relative position movement on page 276
Check the speed status for independent axes	IndSpeed - Independent speed status on page 1310
Check the position status for independent axes	IndInpos - Independent axis in position status on page 1308
Activating independent joints	<i>Technical reference manual - System parameters, topic Motion, type Arm</i>

1 Instructions

1.108 IndRMove - Independent relative position movement

Independent Axis

1.108 IndRMove - Independent relative position movement

Usage

IndRMove (*Independent Relative Movement*) is used to change a rotational axis to independent mode and move the axis to a specific position within one revolution. An independent axis is an axis moving independently of other axes in the robot system. As program execution continues immediately it is possible to execute other instructions (including positioning instructions) during the time the independent axis is moving.

If the axis is to be moved to an absolute position (several revolutions) or if the axis is linear, the instruction IndAMove is used instead. If the movement is to take place a certain distance from the current position the instruction IndDMove must be used.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction IndRMove:

See also [More examples on page 278](#).

Example 1

```
IndRMove Station_A,2\ToRelPos:=p5 \Short,20;
```

Axis 2 of Station_A is moved the shortest route to position p5 within one revolution (maximum rotation ± 180 degrees) at a speed of 20 degrees/s.

Arguments

```
IndRMove MecUnit Axis [\ToRelPos] | [\ToRelNum] [\Short] | [\Fwd]  
          | [\Bwd] Speed [\Ramp]
```

MecUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

Axis

Data type: num

The number of the current axis for the mechanical unit (1-6).

[\ToRelPos]

To Relative Position

Data type: robtarget

Axis position specified as a robtarget. Only the component for this specific Axis is used. The value is used as a position value in degrees within one axis revolution. This means that the axis moves less than one revolution.

The axis position will be affected if the axis is displaced using the instruction EOffsSet or EOffsOn.

Continues on next page

For robot axes the argument `\ToRelNum` is to be used instead.

[`\ToRelNum`]

To Relative Numeric value

Data type: num

Axis position defined in degrees.

Using this argument the position will NOT be affected by any displacement, e.g. `EOffsSet` or `PDispOn`.

Same function as `\ToRelPos` but the position is defined as a numeric value to make it easy to change the position manually.

[`\Short`]

Data type: switch

The axis is moved the shortest route to the new position. This means that the maximum rotation will be 180 degrees in any direction. The direction of movement therefore depends on the current location of the axis.

[`\Fwd`]

Forward

Data type: switch

The axis is moved in a positive direction to the new position. This means that the maximum rotation will be 360 degrees and always in a positive direction (increased position value).

[`\Bwd`]

Backward

Data type: switch

The axis is moved in a negative direction to the new position. This means that the maximum rotation will be 360 degrees and always in a negative direction (decreased position value).

If `\Short`, `\Fwd` or `\Bwd` argument is omitted, `\Short` is used as default value.

Speed

Data type: num

Axis speed in degrees/s.

[`\Ramp`]

Data type: num

Decrease acceleration and deceleration from maximum performance (1-100%, 100%=maximum performance).

Program execution

When `IndRMove` is executed the specified axis moves with the programmed speed to the specified axis position, but only a maximum of one revolution. If `\Ramp` is programmed there will be a reduction of acceleration/deceleration.

To change the axis back to normal mode the `IndReset` instruction is used. The logical position of the axis can be changed in connection with this - a number of

Continues on next page

1 Instructions

1.108 IndRMove - Independent relative position movement

Independent Axis

Continued

full revolutions can be erased from the position, for example, to avoid rotating back for the next movement.

The speed can be changed by running a further IndRMove instruction (or another IndXMove instruction). If a speed in the opposite direction is selected the axis stops and then accelerates to the new speed and direction.

During stepwise execution of the instruction the axis is set in independent mode only. The axis starts its movement when the next instruction is executed and continues as long as program execution continues. For more information see *RAPID reference manual - RAPID overview*, section *Motion and I/O principles - Positioning during program execution- Independent axes*.

When the program pointer is moved to the beginning of the program or to a new routine, all axes are automatically set to normal mode without changing the measurement system (equivalent to running the instruction IndReset \Old).

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AXIS_ACT	The axis is not activated.

More examples

More examples of the instruction IndRMove are illustrated below.

Example 1

```
IndRMove Station_A,1\ToRelPos:=p5 \Fwd,20\Ramp:=50;
```

Axis 1 of Station_A starts to move in a positive direction to the position p5 within one revolution (maximum rotation 360 degrees) at a speed of 20 degrees/s. The speed is changed with acceleration/deceleration reduced to 50% of maximum performance.

```
IndAMove Station_A,1\ToAbsNum:=90,20;  
WaitUntil IndInpos(Station_A,1 ) = TRUE;  
IndRMove Station_A,1\ToRelNum:=80 \Fwd,20;  
WaitTime 0.2;  
WaitUntil IndInpos(Station_A,1 ) = TRUE;  
WaitTime 0.2;  
IndRMove Station_A,1\ToRelNum:=50 \Bwd,20;  
WaitUntil IndInpos(Station_A,1 ) = TRUE;  
WaitTime 0.2;  
IndRMove Station_A,1\ToRelNum:=150 \Short,20;  
WaitUntil IndInpos(Station_A,1 ) = TRUE;  
WaitTime 0.2;  
IndAMove Station_A,1\ToAbsNum:=10,20;
```

Axis 1 of Station_A is moved to the following positions:

- 90 degrees
- 440 degrees (1 revolution + 80 degrees)
- 410 degrees (1 revolution + 50 degrees)

Continues on next page

- 510 degrees (1 revolution + 150 degrees)
- 10 degrees

Limitations

Axes in independent mode cannot be jogged. If an attempt is made to execute the axis manually the axis will not move, and an error message will be displayed. Execute an IndReset instruction or move the program pointer to main to leave independent mode.

If a power fail occurs when the axis is in independent mode the program cannot be restarted. An error message is displayed, and the program must be started from the beginning.

The instruction is not advisable for coupled robot wrist axes (see *RAPID reference manual- RAPID overview*, section *Motion and I/O principles - Positioning during program execution- Independent axes*).

Syntax

```
IndRMove
[MecUnit ':='] <variable (VAR) of mecunit>', '
[Axis ':='] <expression (IN) of num>
['\ ' ToRelPos ':=' <expression (IN) of robtargets>]
| ['\ ' ToRelNum ':=' <expression (IN) of num>]
['\ ' Short] | ['\ ' Fwd] | ['\ ' Bwd]', '
[Speed ':='] <expression (IN) of num>
['\ ' Ramp ':=' <expression (IN) of num>'];'
```

Related information

For information about	See
Independent axes in general	<i>Technical reference manual - RAPID Overview</i>
<i>Independent Axis</i>	<i>Application manual - Controller software Omni-Core</i>
Change back to normal mode	IndReset - Independent reset on page 271
Reset the measurement system	IndReset - Independent reset on page 271
Other independent axis movement	IndAMove - Independent absolute position movement on page 260 IndDMove - Independent delta position movement on page 268 IndCMove - Independent continuous movement on page 264
Check the speed status for independent axes	IndSpeed - Independent speed status on page 1310
Check the position status for independent axes	IndInpos - Independent axis in position status on page 1308
Activating independent joints	<i>Technical reference manual - System parameters, topic Motion, type Arm</i>

1 Instructions

1.109 InvertDO - Inverts the value of a digital output signal

RobotWare Base

1.109 InvertDO - Inverts the value of a digital output signal

Usage

InvertDO (*Invert Digital Output*) inverts the value of a digital output signal (0 -> 1 and 1 -> 0).

Basic examples

The following example illustrates the instruction InvertDO:

Example 1

```
InvertDO do15;
```

The current value of the signal do15 is inverted .

Arguments

InvertDO Signal

Signal

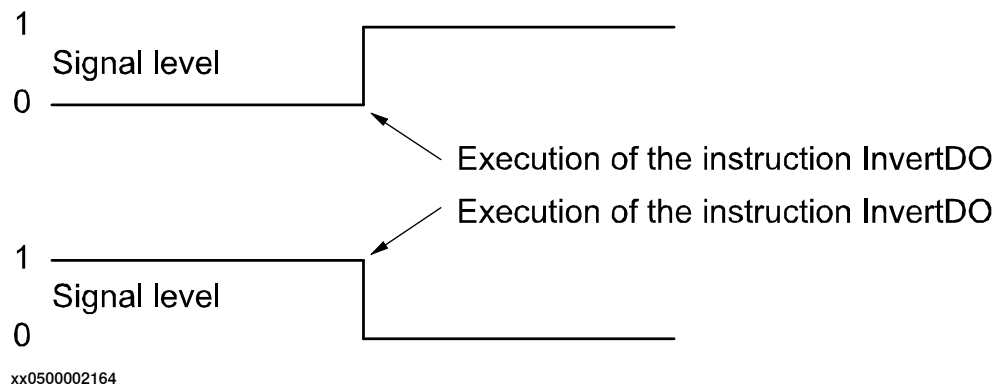
Data type: signaldo

The name of the signal to be inverted.

Program execution

The current value of the signal is inverted (see figure below).

The figure below shows inversion of digital output signal.



Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed (only valid for ICI field bus).

Continues on next page

1.109 InvertDO - Inverts the value of a digital output signal

RobotWare Base

Continued

Syntax

```
InvertDO  
[Signal ':='] <variable (VAR) of signaldo>;'
```

Related information

For information about	See
Input/Output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

1 Instructions

1.110 IOActivate - Activate an I/O device

RobotWare Base

1.110 IOActivate - Activate an I/O device

Usage

IOActivate is used to activate an I/O device during program execution.

I/O devices are automatically activated after start-up if they are defined in the system parameters. When required for some reason I/O devices can be deactivated or activated during program execution.

The controller action when activating an I/O device depends on the defined Device Trust Level in the system parameters.

Basic examples

The following example illustrates the instruction IOActivate:

See also [More examples on page 283](#).

Example 1

```
CONST string board1:="board1";  
IOActivate board1, 5;
```

Activate an I/O device with name board1. Wait max. 5 s.

Arguments

IOActivate DeviceName MaxTime

DeviceName

Data type: string

A name of an I/O device (the I/O device name must be present in the system parameters).

MaxTime

Data type: num

The maximum period of waiting time permitted, expressed in seconds. If this time runs out before the I/O device has finished the activation steps the error handler will be called, if there is one, with the error code ERR_IOACTIVATE. If there is no error handler the execution will be stopped. The I/O device activation steps will always continue regardless of MaxTime or error.

To activate an I/O device takes about 2-5 s.

Program execution

The specified I/O device starts the activation steps. The instruction is ready when the activation steps are finished. If the MaxTime runs out before the I/O device has finished the activation steps a recoverable error will be generated.

After a sequence of IODeactivate - IOActivate, all outputs on the current I/O device will be set to the old values (before IODeactivate).

Continues on next page

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_IOACTIVATE	The time out time runs out before the I/O device is activated.
ERR_NAME_INVALID	The I/O device name does not exist
ERR_NETWORKSTATE	An IOActivate is done, but the I/O network is in error state or enters error state before the I/O device is activated.

More examples

IOActivate can also be used to check whether some I/O device is disconnected for some reason.

More examples of how to use the instruction IOActivate are illustrated below.

Example 1

```

VAR num max_retry:=0;
...
IOActivate "board1", 0;
SetDO board1_sig3, 1;
...
ERROR
  IF ERRNO = ERR_IOACTIVATE THEN
    IF RemaningRetries() > 0 THEN
      WaitTime 1;
      RETRY;
    ELSE
      RAISE;
    ENDIF
  ELSE
    ErrWrite "IOActivate error", "Not possible to activate I/O
      device board1";
    Stop;
  ENDIF

```

Before using signals on the I/O device board1, a test is done by trying to activate the I/O device with time-out after 0 sec. If the test fails a jump is made to the error handler. In the error handler the program execution waits for 1 sec. and a new retry is made. After 4 retry attempts the error ERR_IOACTIVATE is propagated to the caller of this routine.

Syntax

```

IOActivate
  [DeviceName ':='] <expression (IN) of string>','
  [MaxTime' :='] <expression (IN) of num>;'

```

Related information

For information about	See
Deactivating an I/O device	IODeactivate - Deactivate an I/O device on page 285

Continues on next page

1 Instructions

1.110 IOActivate - Activate an I/O device

RobotWare Base

Continued

For information about	See
Input/Output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

1.111 IODeactivate - Deactivate an I/O device

Usage

IODeactivate is used to deactivate an I/O device during program execution. I/O devices are automatically activated after start-up if they are defined in the system parameters. When required for some reason, I/O devices can be deactivated or activated during program execution.



Note

It is not possible to deactivate an I/O device with Device Trust Level set to Deny Deactivate.

Basic examples

The following example illustrates the instruction IODeactivate:

See also [More examples on page 286](#).

Example 1

```
CONST string board1:="board1";
IODeactivate board1, 5;
```

Deactivate an I/O device with name board1. Wait maximum 5 seconds.

Arguments

IODeactivate DeviceName MaxTime

DeviceName

Data type: string

A name of an I/O device (the device name must be present in the system parameters).

MaxTime

Data type: num

The maximum period of waiting time permitted expressed in seconds. If this time runs out before the I/O device has finished the deactivation steps the error handler will be called, if there is one, with the error code ERR_IODEACTIVATE. If there is no error handler the program execution will be stopped. The I/O device deactivation steps will always continue regardless of the MaxTime or error.

To deactivate an I/O device takes about 0-5 s.

Program execution

The specified I/O device starts the deactivation steps. The instruction is ready when the deactivation steps are finished. If the MaxTime runs out before the I/O device has finished the deactivation steps, a recoverable error will be generated. After deactivation of an I/O device, any setting of outputs on this unit will result in an error.

Continues on next page

1 Instructions

1.111 IODeactivate - Deactivate an I/O device

RobotWare Base

Continued

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_IODEACTIVATE	The waiting time expires before the I/O device is deactivated.
ERR_NAME_INVALID	The I/O device name does not exist.
ERR_TRUSTLEVEL	The I/O device cannot be deactivated if the Device Trust Level is set to Deny Deactivate.

More examples

More examples of the instruction IODeactivate are illustrated below.

Example 1

```
PROC go_home()  
  VAR num recover_flag :=0;  
  ...  
  ! Start to deactivate I/O device board1  
  recover_flag := 1;  
  IODeactivate "board1", 0;  
  ! Move to home position  
  MoveJ home, v1000,fine,tool1;  
  ! Wait until deactivation of I/O device board1 is ready  
  recover_flag := 2;  
  IODeactivate "board1", 5;  
  ...  
  ERROR  
  IF ERRNO = ERR_IODEACTIVATE THEN  
    IF recover_flag = 1 THEN  
      TRYNEXT;  
    ELSEIF recover_flag = 2 THEN  
      IF RemaningRetries() > 0 THEN  
        RETRY;  
      ELSE  
        RAISE;  
      ENDIF  
    ENDIF  
  ELSE  
    ErrWrite "IODeactivate error", "Not possible to deactivate  
      I/O device board1";  
    Stop;  
  ENDIF  
ENDPROC
```

To save cycle time the I/O device board1 is deactivated during robot movement to the home position. With the robot at the home position a test is done to establish whether or not the I/O device board1 is fully deactivated. After the max. number of retries (4 with a waiting time of 5 s), the robot execution will stop with an error message.

Continues on next page

The same principle can be used with IOActivate (this will save more cycle time compared with IODeactivate).

Syntax

```
IODeactivate
  [DeviceName ':='] <expression (IN) of string>', '
  [MaxTime ':='] <expression (IN) of num>;'
```

Related information

For information about	See
Activating an I/O device	IOActivate - Activate an I/O device on page 282
Input/Output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/Output function in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

1 Instructions

1.112 IODeviceMute - Turn off I/O event messages from device

RobotWare Base

1.112 IODeviceMute - Turn off I/O event messages from device

Usage

IODeviceMute is used to define if I/O event messages should be sent from the I/O device.

This can typically be used for a planned power cycle or disconnection of the I/O device, for example during tool change with FastDeviceStartup. For more information regarding FastDeviceStartup, see *Application manual - PROFINET Controller/Device*.

Basic examples

The following example illustrates the instruction IODeviceMute:

Example

```
IF muted = TRUE THEN
  IODeviceMute \On, "device_name";
ENDIF
IF muted = FALSE THEN
  IODeviceMute \Off, "device_name";
ENDIF
```

Arguments

IODeviceMute [\On] | [\Off] device_name

[\On]

Data type: switch

Mute I/O event messages from the device.

[\Off]

Data type: switch

Send I/O event messages from the device.

Syntax

```
IODeviceMute
[ '\ ' On] | [ '\ ' Off]
[ device_name ' :=' ] < expression (IN) of string > ';' ;
```

Related information

For information about	See
Fast Device Startup	<i>Application manual - PROFINET Controller/Device</i>

1.113 IPers - Interrupt at value change of a persistent variable

Usage

IPers (*Interrupt Persistent*) is used to order and enable interrupts to be generated when the value of a persistent variable is changed.

Basic examples

The following examples illustrates the instruction IPers:

Example 1

```

VAR intnum pers1int;
PERS num counter := 0;

PROC main()
  CONNECT pers1int WITH iroutine1;
  IPers counter, pers1int;
  ...
  IDelete pers1int;
ENDPROC

TRAP iroutine1
  TPWrite "Current value of counter = " \Num:=counter;
ENDTRAP

```

Orders an interrupt which is to occur each time the persistent variable counter is changed. A call is then made to the iroutine1 trap routine.

Arguments

IPers [\Single] | [\SingleSafe] Name Interrupt

[\Single]

Data type: switch

Specifies whether the interrupt is to occur once or cyclically.

If the argument Single is set, the interrupt occurs once at the most. If the Single and SingleSafe arguments is omitted, an interrupt will occur each time its condition is satisfied.

[\SingleSafe]

Data type: switch

Specifies that the interrupt is single and safe. For definition of single, see description of Single argument. A safe interrupt cannot be put in sleep with instruction ISleep. The safe interrupt event will be queued at program stop and stepwise execution, and when starting in continuous mode again, the interrupt will be executed. The only time a safe interrupt will be thrown is when the interrupt queue is full. Then an error will be reported. The interrupt will not survive program reset, e.g. PP to main.

Name

Data type: anytype

Continues on next page

1 Instructions

1.113 IPers - Interrupt at value change of a persistent variable

RobotWare Base

Continued

The persistent variable that is to generate interrupts.

All type of data could be used such as atomic, record, record component, array, or array element.

Interrupt

Data type: `intnum`

The interrupt identity. This should have previously been connected to a trap routine by means of the instruction `CONNECT`.

Program execution

When the persistent variable changes value a call is made to the corresponding trap routine. When this routine has been executed program execution continues from where the interrupt occurred.

If the persistent variable changes value during a program stop no interrupt will occur when the program starts again.

Limitations

The same variable for interrupt identity cannot be used more than once without first deleting it. See Instructions - `ISignalDI`.

If subscribed on data such as record component or array element specified in parameter `Name`, the interrupt will occur every time any part of the data is changed.

When executing the trap routine and reading the value of the persistent, there is no guarantee that the value read is the one that triggered the interrupt.

Syntax

```
IPers
[ '\ ' Single ] | [ '\ ' SingleSafe ] ','
[ Name ':=' ] < persistent (PERS) of anytype > ','
[ Interrupt' :=' ] < variable (VAR) of intnum > ';'

```

Related information

For information about	See
Summary of interrupts and interrupt management	<i>Technical reference manual - RAPID Overview</i>
Interrupt from an input signal	ISignalDI - Orders interrupts from a digital input signal on page 309
Interrupt identity	intnum - Interrupt identity on page 1656
<i>Advanced RAPID</i>	<i>Application manual - Controller software OmniCore</i>

1.114 IRMQMessage - Orders RMQ interrupts for a data type

Usage

IRMQMessage (*Interrupt RAPID Message Queue Message*) is used to order and enable interrupts for a specific data type when using RMQ function.

Basic examples

The following example illustrates the instruction IRMQMessage:

See also [IRMQMessage - Orders RMQ interrupts for a data type on page 291](#).

Example 1

```
VAR intnum rmqint;
VAR string dummy;
...
PROC main()
  CONNECT rmqint WITH iroutine1;
  IRMQMessage dummy, rmqint;
```

Orders an interrupt which is to occur each time a new rmqmessage containing the data type string is received. A call is then made to the trap routine iroutine1.

Arguments

IRMQMessage InterruptDataType Interrupt

InterruptDataType

Data type: anytype

A reference to a variable, persistent or constant of a data type that will generate an interrupt when a rmqmessage with the specified data type is received.

Interrupt

Data type: intnum

The interrupt identity. This should have previously been connected to a trap routine by the instruction CONNECT.

Program execution

When the RMQ message with the specified data type is received, a call is made to the corresponding trap routine. When this has been executed, program execution continues from where the interrupt occurred.

All messages containing data of the same data type regardless of number of dimensions will be handled by the same interrupt. If using different dimensions, use RMQGetMsgHeader to adapt for this.

Any message containing data of a data type that no interrupt is connected to, will generate a warning.

The RMQSendWait instruction has the highest priority if a message is received and it fits the description for both the expected answer and a message connected to a trap routine with instruction IRMQMessage.

Not all data types can be used in argument InterruptDataType (see limitations).

Continues on next page

1 Instructions

1.114 IRMQMessage - Orders RMQ interrupts for a data type

RobotStudio Connect or Multitasking

Continued

The interrupt is considered to be a safe interrupt. A safe interrupt cannot be put in sleep with instruction ISleep. The safe interrupt event will be queued at program stop and stepwise execution, and when starting in continuous mode again, the interrupt will be executed. The only time a safe interrupt will be thrown is when the interrupt queue is full. Then an error will be reported. The interrupt will not survive program reset, e.g. PP to main.

More examples

More examples of how to use the instruction IRMQMessage are illustrated below.

Example 1

```
MODULE ReceiverMod
  VAR intnum intno1;
  VAR rmqheader rmqheader1;
  VAR rmqslot rmqslot1;
  VAR rmqmessage rmqmessage1;

  PROC main()
    VAR string interrupt_on_str := stEmpty;
    CONNECT intno1 WITH RecMsgs;
    ! Set up interrupts for data type string
    IRMQMessage interrupt_on_str, intno1;

    ! Perform cycle
    WHILE TRUE DO
      ...
    ENDWHILE
  ENDPROC
  TRAP RecMsgs
    VAR string receivestr;
    VAR string client_name;
    VAR num userdef;

    ! Get the message from the RMQ
    RMQGetMessage rmqmessage1;
    ! Get information about the message
    RMQGetMsgHeader rmqmessage1 \Header:=rmqheader1
      \SenderId:=rmqslot1 \UserDef:=userdef;

    IF rmqheader1.datatype = "string" AND rmqheader1.ndim = 0 THEN
      ! Get the data received in rmqmessage1
      RMQGetMsgData rmqmessage1, receivestr;
      client_name := RMQGetSlotName(rmqslot1);
      TPWrite "Rec string: " + receivestr;
      TPWrite "User Def: " + ValToStr(userdef);
      TPWrite "From: " + client_name;
    ELSE
      TPWrite "Faulty data received!"
    ENDIF
```

Continues on next page

1.114 IRMQMessage - Orders RMQ interrupts for a data type *RobotStudio Connect or Multitasking* *Continued*

```
ENDTRAP
ENDMODULE
```

The example show how to set up interrupts for a specific data type. When a message is received, the trap routine RecMsgs is executed and the received data in the message is sent to the FlexPendant. If the data type received or the dimension of the data is different from the expected, this is sent to the FlexPendant.

Limitations

It is not allowed to execute IRMQMessage in synchronous mode. That will cause a fatal runtime error.

It is not possible to setup interrupts, send or receive data instances of data types that are of non-value, semi-value types, or data type motsetdata.

The same variable for interrupt identity cannot be used more than once without first deleting it. Interrupts should therefore be handled as shown in one of the alternatives below.

```
VAR intnum rmqint;
PROC main ( )
  VAR mytype dummy;
  CONNECT rmqint WITH iroutine1;
  IRMQMessage dummy, rmqint;
  WHILE TRUE DO
    ...
  ENDWHILE
ENDPROC
```

All activation of interrupts is done at the beginning of the program. These beginning instructions are then kept outside the main flow of the program.

```
VAR intnum rmqint;
PROC main ( )
  VAR mytype dummy;
  CONNECT rmqint WITH iroutine1;
  IRMQMessage dummy, rmqint;
  ...
  IDelete rmqint;
ENDPROC
```

The interrupt is deleted at the end of the program, and is then reactivated. Note, in this case, the interrupt is inactive for a short period.

Syntax

```
IRMQMessage
[ InterruptDataType ':= ' ] < reference (REF) of anytype >
[ Interrupt ':= ' ] < variable (VAR) of intnum >';'
```

Related information

For information about	See
Description of the RAPID Message Queue functionality	<i>Application manual - Controller software OmniCore</i>
Send data to the queue of a RAPID task or Robot Application Builder client.	RMQFindSlot - Find a slot identity from the slot name on page 608

Continues on next page

1 Instructions

1.114 IRMQMessage - Orders RMQ interrupts for a data type

RobotStudio Connect or Multitasking

Continued

For information about	See
Get the first message from a RAPID Message Queue.	RMQGetMessage - Get an RMQ message on page 610
Send data to the queue of a RAPID task or Robot Application Builder client, and wait for an answer from the client.	RMQSendWait - Send an RMQ data message and wait for a response on page 626
Extract the header data from a rmqmessage.	RMQGetMsgHeader - Get header information from an RMQ message on page 616
Send data to the queue of a RAPID task or Robot Application Builder client.	RMQSendMessage - Send an RMQ data message on page 622
Extract the data from a rmqmessage.	RMQGetMsgData - Get the data part from an RMQ message on page 613
Get the slot name from a specified slot identity.	RMQGetSlotName - Get the name of an RMQ client on page 1431

1.115 ISignalAI - Interrupts from analog input signal

Usage

ISignalAI (*Interrupt Signal Analog Input*) is used to order and enable interrupts from an analog input signal.

Basic examples

The following examples illustrate the instruction ISignalAI:

Example 1

```
VAR intnum sig1int;
PROC main()
  CONNECT sig1int WITH iroutine1;
  ISignalAI \Single, ai1, AIO_BETWEEN, 1.5, 0.5, 0, sig1int;
```

Orders an interrupt which is to occur the first time the logical value of the analog input signal ai1 is between 0.5 and 1.5. A call is then made to the iroutine1 trap routine.

Example 2

```
ISignalAI ai1, AIO_BETWEEN, 1.5, 0.5, 0.1, sig1int;
```

Orders an interrupt which is to occur each time the logical value of the analog input signal ai1 is between 0.5 and 1.5, and the absolute signal difference compared to the stored reference value is bigger than 0.1.

Example 3

```
ISignalAI ai1, AIO_OUTSIDE, 1.5, 0.5, 0.1, sig1int;
```

Orders an interrupt which is to occur each time the logical value of the analog input signal ai1 is lower than 0.5 or higher than 1.5, and the absolute signal difference compared to the stored reference value is bigger than 0.1.

Arguments

```
ISignalAI [\Single] | [\SingleSafe] Signal Condition HighValue
LowValue DeltaValue [\DPos] | [\DNeg] Interrupt
```

[\Single]

Data type: switch

Specifies whether the interrupt is to occur once or cyclically. If the argument Single is set, the interrupt occurs once at the most. If the Single and SingleSafe arguments is omitted, an interrupt will occur each time its condition is satisfied.

[\SingleSafe]

Data type: switch

Specifies that the interrupt is single and safe. For definition of single, see description of Single argument. A safe interrupt cannot be put in sleep with instruction ISleep. The safe interrupt event will be queued at program stop and stepwise execution, and when starting in continuous mode again, the interrupt will be executed. The only time a safe interrupt will be thrown is when the interrupt queue is full. Then an error will be reported. The interrupt will not survive program reset, e.g. PP to main.

Continues on next page

1 Instructions

1.115 ISignalAI - Interrupts from analog input signal

RobotWare Base

Continued

Signal

Data type: signalai

The name of the signal that is to generate interrupts.

Condition

Data type: aiotrigger

Specifies how HighValue and LowValue define the condition to be satisfied:

Value	Symbolic constant	Comment
1	AIO_ABOVE_HIGH	Signal will generate interrupts if above specified high value
2	AIO_BELOW_HIGH	Signal will generate interrupts if below specified high value
3	AIO_ABOVE_LOW	Signal will generate interrupts if above specified low value
4	AIO_BELOW_LOW	Signal will generate interrupts if below specified low value
5	AIO_BETWEEN	Signal will generate interrupts if between specified low and high values
6	AIO_OUTSIDE	Signal will generate interrupts if below specified low value or above specified high value
7	AIO_ALWAYS	Signal will always generate interrupts

HighValue

Data type: num

High logical value to define the condition.

LowValue

Data type: num

Low logical value to define the condition.

DeltaValue

Data type: num

Defines the minimum logical signal difference before generation of a new interrupt. The current signal value compared to the stored reference value must be greater than the specified DeltaValue before generation of a new interrupt.

[\DPos]

Data type: switch

Specifies that only positive logical signal differences will give new interrupts.

[\DNeg]

Data type: switch

Specifies that only negative logical signal differences will give new interrupts.

If none of \DPos and \DNeg argument is used, both positive and negative differences will generate new interrupts.

Interrupt

Data type: intnum

The interrupt identity. This interrupt should have previously been connected to a trap routine by means of the instruction CONNECT.

Continues on next page

Program execution

When the signal fulfils the specified conditions (both `Condition` and `DeltaValue`) a call is made to the corresponding trap routine. When this has been executed, program execution continues from where the interrupt occurred.

Conditions for interrupt generation

Before the interrupt subscription is ordered, each time the signal is sampled, the value of the signal is read, saved, and later used as a reference value for the `DeltaValue` condition.

At the interrupt subscription time if specified `DeltaValue` = 0 and after the interrupt subscription time, the signal is sampled. The signal value is then compared to `HighValue` and `LowValue` according to `Condition` and with consideration to `DeltaValue` to decide if an interrupt should be generated or not. If the new read value satisfies the specified `HighValue` and `LowValueCondition`, but its difference compared to the last stored reference value is less or equal to the `DeltaValue` argument, no interrupt occurs. If the signal difference is not in the specified direction no interrupts will occur (argument `\DPos` or `\DNeg`).

The stored reference value for the `DeltaValue` condition is updated with a newly read value for later use at any sample if the following conditions are satisfied:

- `Argument Condition` with specified `HighValue` and `LowValue` (within limits)
- `Argument DeltaValue` (sufficient signal change in any direction independently of specified switch `\DPos` or `\DNeg`)

The reference value is only updated at the sample time, not at the interrupt subscription time.

An interrupt is also generated at the sample for update of the reference value if the direction of the signal difference is in accordance with the specified argument (any direction, `\DPos0`, or `\DNeg`).

When the `\Single` switch is used only one interrupt at the most will be generated. If the switch `\Single` (cyclic interrupt) is not used a new test of the specified conditions (both `Condition` and `DeltaValue`) is made at every sample of the signal value. A comparison is made between the current signal value and the last stored reference value to decide if an interrupt should be generated or not.

Continues on next page

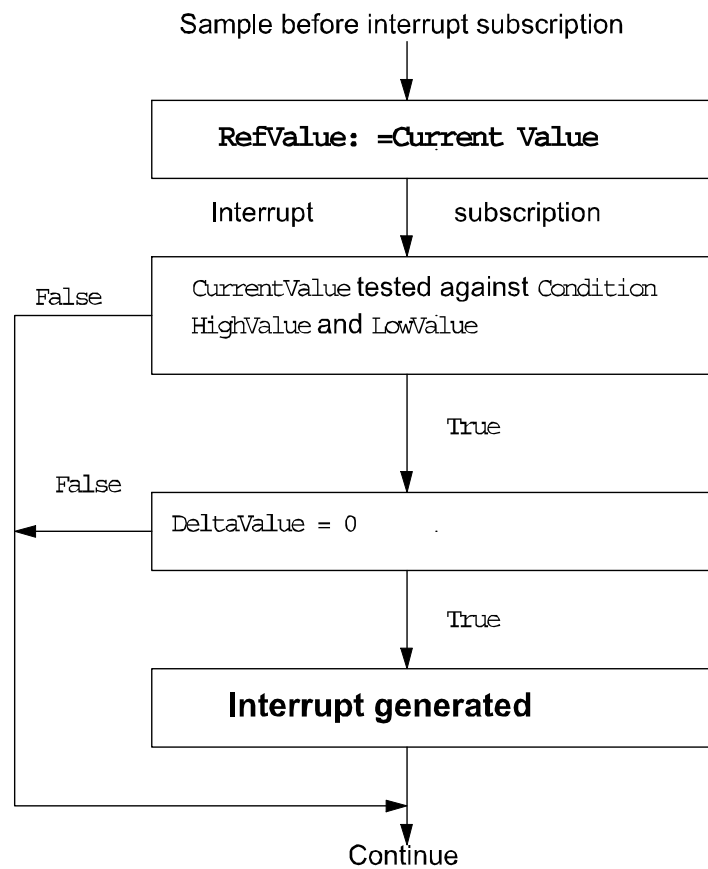
1 Instructions

1.115 ISignalAI - Interrupts from analog input signal

RobotWare Base

Continued

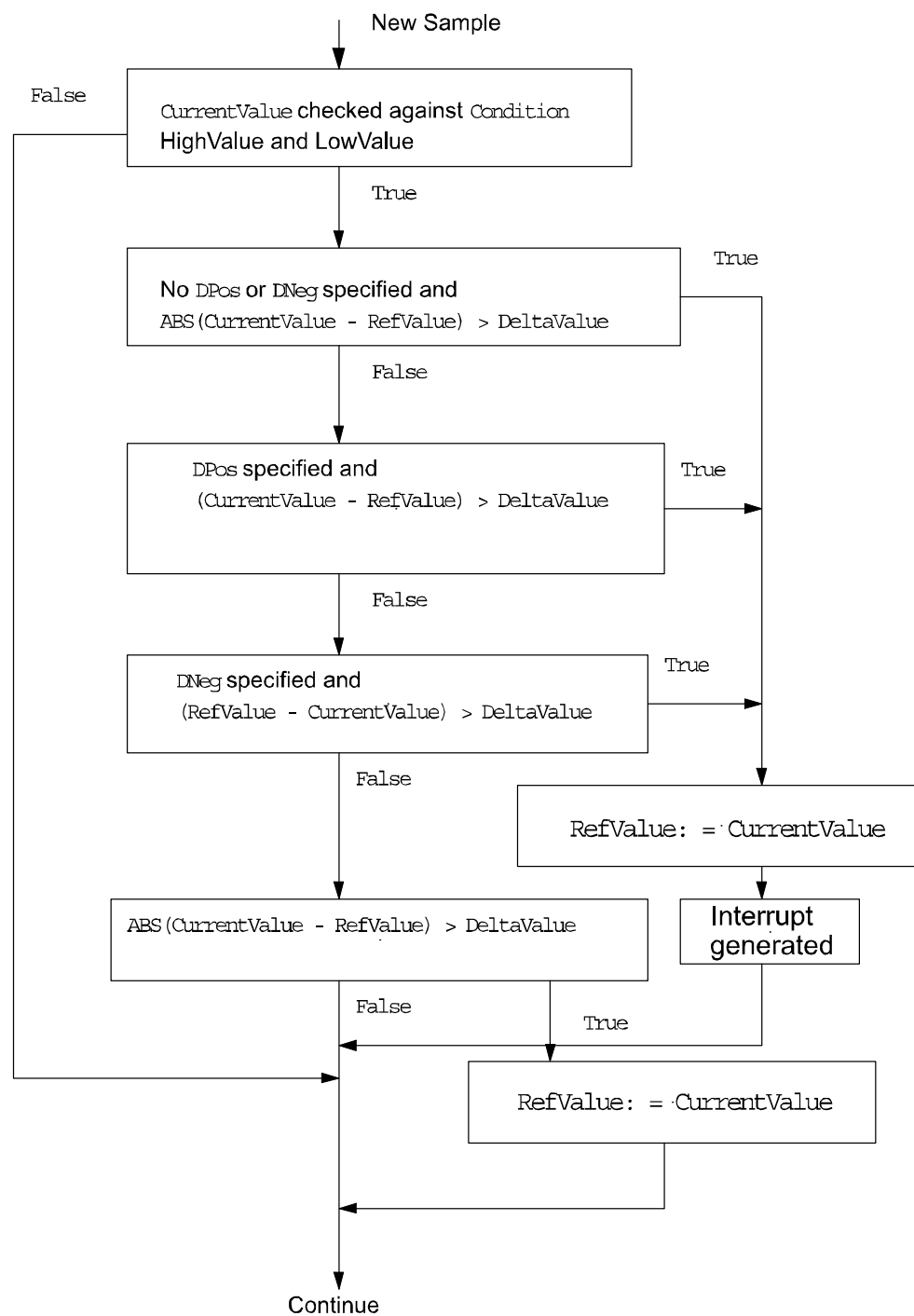
Condition for interrupt generation at interrupt subscription time



xx0500002165

Continues on next page

Condition for interrupt generation at each sample after interrupt subscription



xx0500002166

Continues on next page

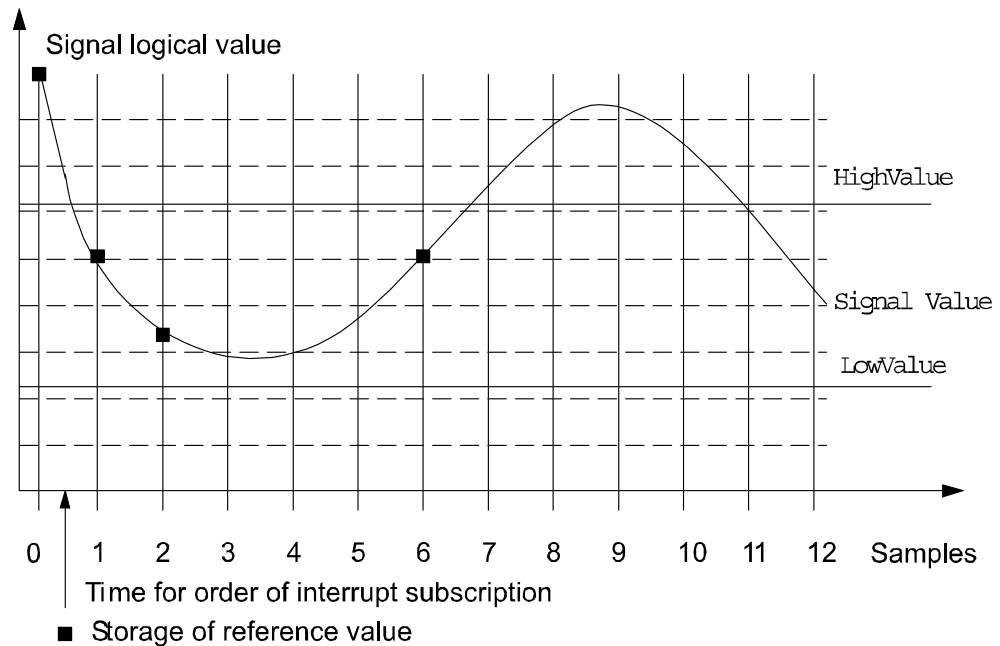
1 Instructions

1.115 ISignalAI - Interrupts from analog input signal

RobotWare Base

Continued

Example 1 of interrupt generation



xx0500002167

Assuming the interrupt is ordered between sample 0 and 1, the following instruction will give the following results:

```
ISignalAI ai1, AIO_BETWEEN, 6.1, 2.2, 1.0, sig1int;
```

Sample 1 will generate an interrupt because the signal value is between HighValue and LowValue and the signal difference compared to Sample 0 is more than DeltaValue.

Sample 2 will generate an interrupt because the signal value is between HighValue and LowValue and the signal difference compared to Sample 1 is more than DeltaValue.

Samples 3, 4, 5 will not generate any interrupt because the signal difference is less than DeltaValue.

Sample 6 will generate an interrupt.

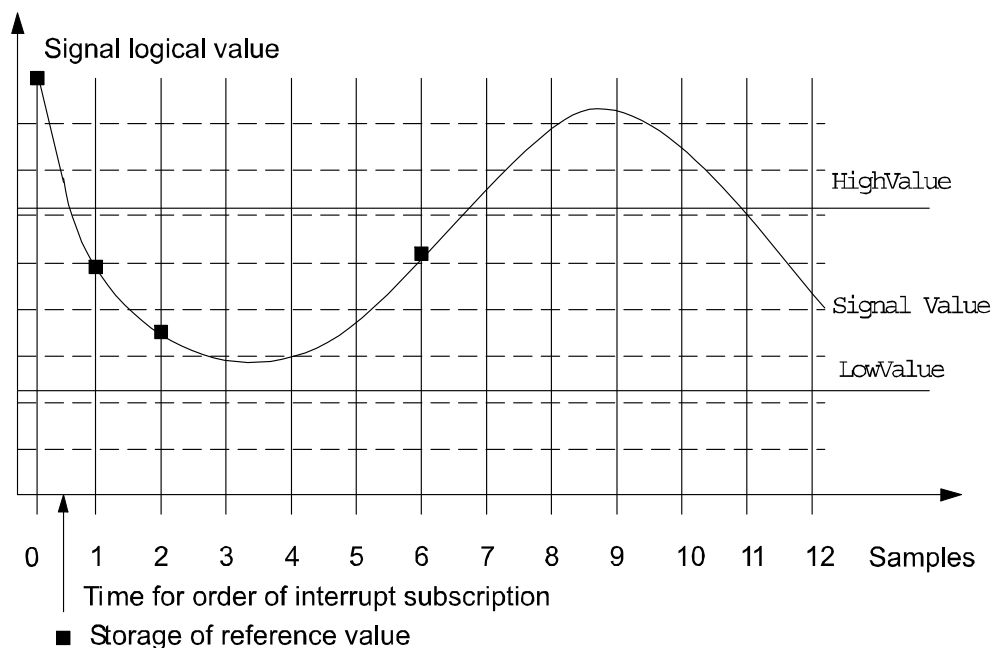
Samples 7 to 10 will not generate any interrupt because the signal is above HighValue.

Sample 11 will not generate any interrupt because the signal difference compared to Sample 6 is equal to DeltaValue.

Sample 12 will not generate any interrupt because the signal difference compared to Sample 6 is less than DeltaValue.

Continues on next page

Example 2 of interrupt generation



xx0500002168

Assuming the interrupt is ordered between sample 0 and 1, the following instruction will give the following results:

```
ISignalAI ai1, AIO_BETWEEN, 6.1, 2.2, 1.0 \DPos, siglint;
```

A new reference value is stored at sample 1 and 2 because the signal is within limits and the absolute signal difference between the current value and the last stored reference value is greater than 1.0. No interrupt will be generated because the signal changes are in the negative direction.

Sample 6 will generate an interrupt because the signal value is between HighValue and LowValue, and the signal difference in the positive direction compared to sample 2 is more than DeltaValue.

Continues on next page

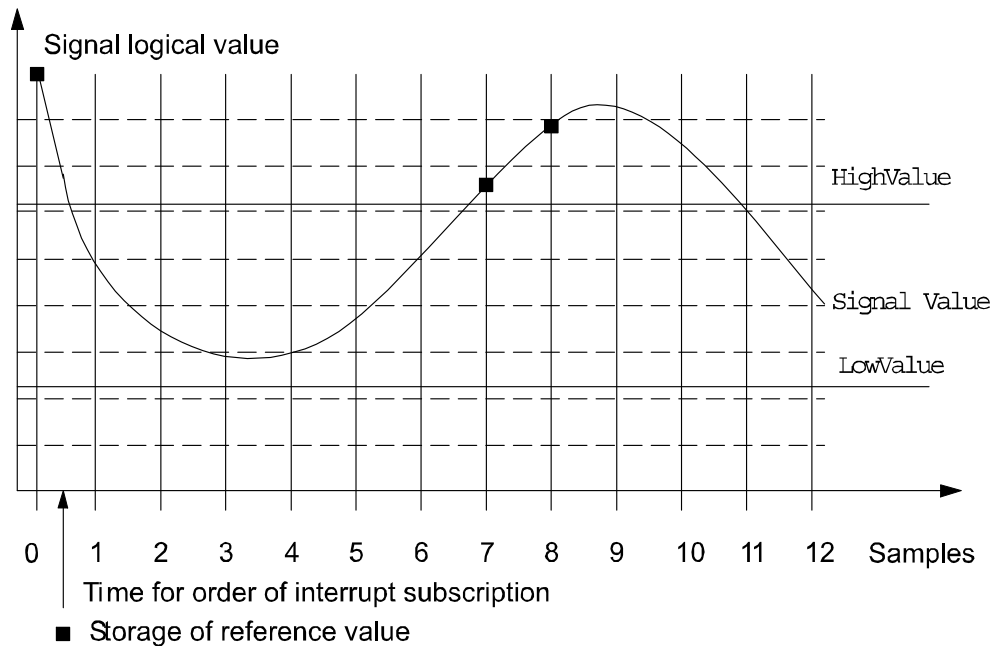
1 Instructions

1.115 ISignalAI - Interrupts from analog input signal

RobotWare Base

Continued

Example 3 of interrupt generation



xx0500002169

Assuming the interrupt is ordered between sample 0 and 1, the following instruction will give the following results:

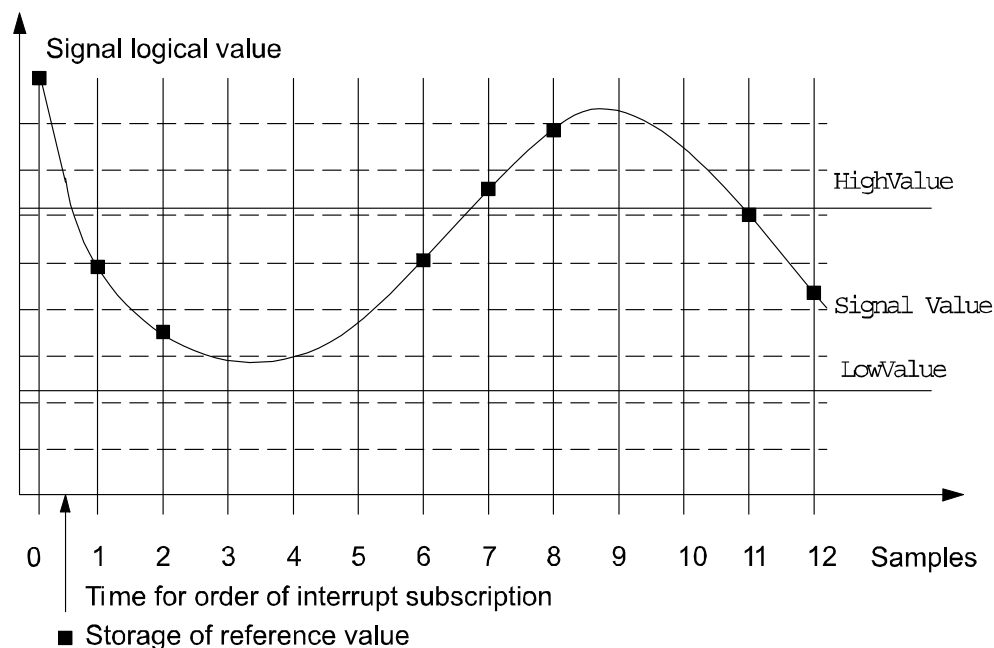
```
ISignalAI \Single, ai1, AIO_OUTSIDE, 6.1, 2.2, 1.0 \DPos, sig1int;
```

A new reference value is stored at sample 7 because the signal is within limits and the absolute signal difference between the current value and the last stored reference value is greater than 1.0

sample 8 will generate an interrupt because the signal value is above HighValue, and the signal difference in the positive direction compared to sample 7 is more than DeltaValue.

Continues on next page

Example 4 of interrupt generation



xx0500002170

Assuming the interrupt is ordered between sample 0 and 1, the following instruction will give the following results:

```
ISignalAI ai1, AI0_ALWAYS, 6.1, 2.2, 1.0 \DPos, sig1int;
```

A new reference value is stored at sample 1 and 2 because the signal is within limits and the absolute signal difference between the current value and the last stored reference value is greater than 1.0

Sample 6 will generate an interrupt because the signal difference in the positive direction compared to sample 2 is more than DeltaValue.

Sample 7 and 8 will generate an interrupt because the signal difference in the positive direction compared to previous sample is more than DeltaValue.

A new reference value is stored at sample 11 and 12 because the signal is within limits, and the absolute signal difference between the current value and the last stored reference value is greater than 1.0

Error handling

If there is a subscription of interrupt on an analog input signal, an interrupt will be given for every change in the analog value that satisfies the condition specified when ordering the interrupt subscription. If the analog value is noisy many interrupts can be generated even if only one or two bits in the analog value are changed.

To avoid generating interrupts for small changes of the analog input value, set the DeltaValue to a level greater than 0. Then no interrupts will be generated until a change of the analog value is greater than the specified DeltaValue.

Continues on next page

1 Instructions

1.115 ISignalAI - Interrupts from analog input signal

RobotWare Base

Continued

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID and it has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_AO_LIM	The programmed HighValue or LowValue argument for the specified analog input signal Signal is outside limits.
ERR_NORUNUNIT	There is no contact with the I/O device.

Limitations

The HighValue and LowValue arguments should be in the range: logical maximum value, logical minimum value defined for the signal.

HighValue must be above LowValue.

DeltaValue must be 0 or positive.

The limitations for the interrupt identity are the same as for ISignalDI.

Syntax

```
ISignalAI
[ '\ ' Single ] | [ '\ ' SingleSafe ] ', '
[ Signal ':' = ] <variable (VAR) of signalai> ', '
[ Condition ':' = ] <expression (IN) of aiotrigg> ', '
[ HighValue ':' = ] <expression (IN) of num> ', '
[ LowValue ':' = ] <expression (IN) of num> ', '
[ DeltaValue ':' = ] <expression (IN) of num>
[ ['\ ' DPos] | [ '\ ' DNeg] ', ' ]
[ Interrupt ':' = ] <variable (VAR) of intnum> ';'
```

Related information

For information about	See
Summary of interrupts and interrupt management	<i>Technical reference manual - RAPID Overview</i>
Definition of constants	aiotrigg - Analog I/O trigger condition on page 1589
Interrupt from analog output signal	ISignalAO - Interrupts from analog output signal on page 305
Interrupt from digital input signal	ISignalDI - Orders interrupts from a digital input signal on page 309
Interrupt from digital output signal	ISignalDO - Interrupts from a digital output signal on page 312
Interrupt identity	intnum - Interrupt identity on page 1656
Related system parameters (filter)	<i>Technical reference manual - System parameters</i>

1.116 ISignalAO - Interrupts from analog output signal

Usage

ISignalAO (*Interrupt Signal Analog Output*) is used to order and enable interrupts from an analog output signal.

Basic examples

The following examples illustrate the instruction ISignalAO:

Example 1

```
VAR intnum sig1int;
PROC main()
  CONNECT sig1int WITH iroutine1;
  ISignalAO \Single, ao1, AIO_BETWEEN, 1.5, 0.5, 0, sig1int;
```

Orders an interrupt which is to occur the first time the logical value of the analog output signal ao1 is between 0.5 and 1.5. A call is then made to the iroutine1 trap routine.

Example 2

```
ISignalAO ao1, AIO_BETWEEN, 1.5, 0.5, 0.1, sig1int;
```

Orders an interrupt which is to occur each time the logical value of the analog output signal ao1 is between 0.5 and 1.5, and the absolute signal difference compared to the previous stored reference value is bigger than 0.1.

Example 3

```
ISignalAO ao1, AIO_OUTSIDE, 1.5, 0.5, 0.1, sig1int;
```

Orders an interrupt which is to occur each time the logical value of the analog output signal ao1 is lower than 0.5 or higher than 1.5, and the absolute signal difference compared to the previous stored reference value is bigger than 0.1.

Arguments

```
ISignalAO [\Single] | [\SingleSafe] Signal Condition HighValue
LowValue DeltaValue [\DPos] | [\DNeg] Interrupt
```

[\Single]

Data type: switch

Specifies whether the interrupt is to occur once or cyclically. If the argument Single is set the interrupt occurs once at the most. If the Single and SingleSafe argument is omitted an interrupt will occur each time its condition is satisfied.

[\SingleSafe]

Data type: switch

Specifies that the interrupt is single and safe. For definition of single, see description of Single argument. A safe interrupt cannot be put in sleep with instruction ISleep. The safe interrupt event will be queued at program stop and stepwise execution, and when starting in continuous mode again, the interrupt will be executed. The only time a safe interrupt will be thrown is when the interrupt queue is full. Then an error will be reported. The interrupt will not survive program reset, e.g. PP to main.

Continues on next page

1 Instructions

1.116 ISignalAO - Interrupts from analog output signal

RobotWare Base

Continued

Signal

Data type: `signalao`

The name of the signal that is to generate interrupts.

Condition

Data type: `aiotrigg`

Specifies how HighValue and LowValue define the condition to be satisfied:

Value	Symbolic constant	Comment
1	AIO_ABOVE_HIGH	Signal will generate interrupts if above specified high value
2	AIO_BELOW_HIGH	Signal will generate interrupts if below specified high value
3	AIO_ABOVE_LOW	Signal will generate interrupts if above specified low value
4	AIO_BELOW_LOW	Signal will generate interrupts if below specified low value
5	AIO_BETWEEN	Signal will generate interrupts if between specified low and high values
6	AIO_OUTSIDE	Signal will generate interrupts if below specified low value or above specified high value
7	AIO_ALWAYS	Signal will always generate interrupts

HighValue

Data type: `num`

High logical value to define the condition.

LowValue

Data type: `num`

Low logical value to define the condition.

DeltaValue

Data type: `num`

Defines the minimum logical signal difference before generation of a new interrupt. The current signal value compared to the previous stored reference value must be greater than the specified DeltaValue before generation of a new interrupt.

[\DPos]

Data type: `switch`

Specifies that only positive logical signal differences will give new interrupts.

[\DNeg]

Data type: `switch`

Specifies that only negative logical signal differences will give new interrupts.

If neither of the \DPos and \DNeg arguments are used, both positive and negative differences will generate new interrupts.

Interrupt

Data type: `intnum`

The interrupt identity. This interrupt should have previously been connected to a trap routine by means of the instruction CONNECT.

Continues on next page

Program execution

See instruction ISignalAI for information about:

- Program execution
- Condition for interrupt generation
- More examples

Same principles are valid for ISignalAO as for ISignalAI.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID and it has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_AO_LIM	The programmed HighValue or LowValue argument for the specified analog input signal Signal is outside limits.
ERR_NORUNUNIT	There is no contact with the I/O device.

Limitations

The HighValue and LowValue arguments should be in the range: logical maximum value, logical minimum value, defined for the signal.

HighValue must be above LowValue.

DeltaValue must be 0 or positive.

The limitations for the interrupt identity are the same as for ISignalDO.

Syntax

```
ISignalAO
[ '\ ' Single ] | [ '\ ' SingleSafe ] ', '
[ Signal':=' ]<variable (VAR) of signalao>', '
[ Condition':=' ]<expression (IN) of aiotrigg>', '
[ HighValue':=' ]<expression (IN) of num>', '
[ LowValue':=' ]<expression (IN) of num>', '
[ DeltaValue':=' ]<expression (IN) of num>
[[ '\ ' DPos ] | [ '\ ' DNeg ] ', '
[ Interrupt':=' ]<variable (VAR) of intnum>;'
```

Related information

For information about	See
Summary of interrupts and interrupt management	<i>Technical reference manual - RAPID Overview</i>
Definition of constants	aiotrigg - Analog I/O trigger condition on page 1589
Interrupt from analog input signal	ISignalAI - Interrupts from analog input signal on page 295
Interrupt from digital input signal	ISignalDI - Orders interrupts from a digital input signal on page 309

Continues on next page

1 Instructions

1.116 ISignalAO - Interrupts from analog output signal

RobotWare Base

Continued

For information about	See
Interrupt from digital output signal	<i>ISignalDO - Interrupts from a digital output signal on page 312</i>
Interrupt identity	<i>intnum - Interrupt identity on page 1656</i>
Related system parameters (filter)	<i>Technical reference manual - System parameters</i>

1.117 ISignalDI - Orders interrupts from a digital input signal

Usage

ISignalDI (*Interrupt Signal Digital In*) is used to order and enable interrupts from a digital input signal.

Basic examples

The following examples illustrate the instruction ISignalDI:

Example 1

```
VAR intnum sig1int;
PROC main()
  CONNECT sig1int WITH iroutine1;
  ISignalDI di1,1,sig1int;
```

Orders an interrupt which is to occur each time the digital input signal di1 is set to 1. A call is then made to the iroutine1 trap routine.

Example 2

```
ISignalDI di1,0,sig1int;
```

Orders an interrupt which is to occur each time the digital input signal di1 is set to 0.

Example 3

```
ISignalDI \Single, di1,1,sig1int;
```

Orders an interrupt which is to occur only the first time the digital input signal di1 is set to 1.

Arguments

ISignalDI [\Single] | [\SingleSafe] Signal TriggValue Interrupt

[\Single]

Data type: switch

Specifies whether the interrupt is to occur once or cyclically.

If the argument Single is set, the interrupt occurs once at the most. If the Single and SingleSafe arguments is omitted, an interrupt will occur each time its condition is satisfied.

[\SingleSafe]

Data type: switch

Specifies that the interrupt is single and safe. For definition of single, see description of Single argument. A safe interrupt cannot be put in sleep with instruction ISleep. The safe interrupt event will be queued at program stop and stepwise execution, and when starting in continuous mode again, the interrupt will be executed. The only time a safe interrupt will be thrown is when the interrupt queue is full. Then an error will be reported. The interrupt will not survive program reset, e.g. PP to main.

Signal

Data type: signaldi

Continues on next page

1 Instructions

1.117 ISignalDI - Orders interrupts from a digital input signal

RobotWare Base

Continued

The name of the signal that is to generate interrupts.

TriggValue

Data type: `dionum`

The value to which the signal must change for an interrupt to occur.

The value is specified as 0 or 1 or as a symbolic value (e.g. high/low). The signal is edge-triggered upon changeover to 0 or 1.

TriggValue 2 or symbolic value edge can be used for generation of interrupts on both positive flank (0 -> 1) and negative flank (1 -> 0).

Interrupt

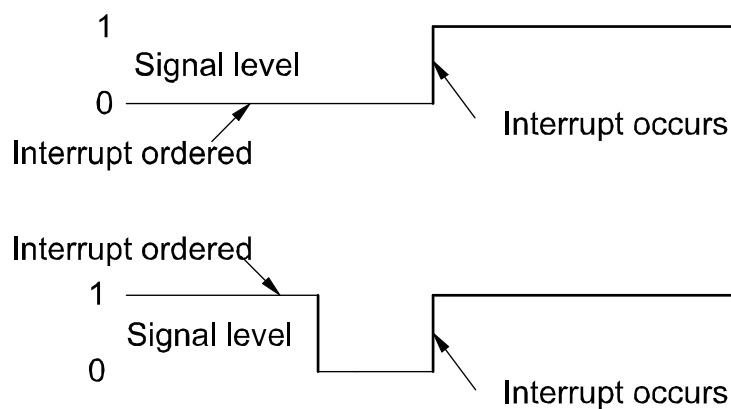
Data type: `intnum`

The interrupt identity. This should have previously been connected to a trap routine by means of the instruction `CONNECT`.

Program execution

When the signal assumes the specified value a call is made to the corresponding trap routine. When this has been executed, program execution continues from where the interrupt occurred.

If the signal changes to the specified value before the interrupt is ordered no interrupt occurs. Interrupts from a digital input signal at signal level 1 is illustrated in the figure below.



xx0500002189

Error handling

The following recoverable errors can be generated. The errors can be handled in an `ERROR` handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_NO_ALIASIO_DEF</code>	The signal variable is a variable declared in <code>RAPID</code> and it has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
<code>ERR_NORUNUNIT</code>	There is no contact with the I/O device.

Continues on next page

Limitations

The same variable for interrupt identity cannot be used more than once without first deleting it. Interrupts should therefore be handled as shown in one of the alternatives below.

```
VAR intnum sig1int;
PROC main ()
  CONNECT sig1int WITH iroutine1;
  ISignalDI di1, 1, sig1int;
  WHILE TRUE DO
    ...
  ENDWHILE
ENDPROC
```

All activation of interrupts is done at the beginning of the program. These beginning instructions are then kept outside the main flow of the program.

```
VAR intnum sig1int;
PROC main ()
  CONNECT sig1int WITH iroutine1;
  ISignalDI di1, 1, sig1int;
  ...
  IDelete sig1int;
ENDPROC
```

The interrupt is deleted at the end of the program and is then reactivated. Note, in this case, that the interrupt is inactive for a short period.

Syntax

```
ISignalDI
[ '\ ' Single ] | [ '\ ' SingleSafe ] ', '
[ Signal ' := ' ] < variable (VAR) of signaldi > ', '
[ TriggValue ' := ' ] < expression (IN) of dionum > ', '
[ Interrupt ' := ' ] < variable (VAR) of intnum > ';'
```

Related information

For information about	See
Summary of interrupts and interrupt management	<i>Technical reference manual - RAPID Overview</i>
Interrupt from an output signal	ISignalDO - Interrupts from a digital output signal on page 312
Interrupt identity	intnum - Interrupt identity on page 1656

1 Instructions

1.118 ISignalDO - Interrupts from a digital output signal *RobotWare Base*

1.118 ISignalDO - Interrupts from a digital output signal

Usage

ISignalDO (*Interrupt Signal Digital Out*) is used to order and enable interrupts from a digital output signal.

Basic examples

The following examples illustrate the instruction ISignalDO:

Example 1

```
VAR intnum sig1int;  
PROC main()  
  CONNECT sig1int WITH iroutine1;  
  ISignalDO do1,1,sig1int;
```

Orders an interrupt which is to occur each time the digital output signal do1 is set to 1. A call is then made to the iroutine1 trap routine.

Example 2

```
ISignalDO do1,0,sig1int;
```

Orders an interrupt which is to occur each time the digital output signal do1 is set to 0.

Example 3

```
ISignalDO\Single, do1,1,sig1int;
```

Orders an interrupt which is to occur only the first time the digital output signal do1 is set to 1.

Arguments

ISignalDO [\Single] | [\SingleSafe] Signal TriggValue Interrupt

[\Single]

Data type: switch

Specifies whether the interrupt is to occur once or cyclically.

If the argument Single is set, the interrupt occurs once at the most. If the Single and SingleSafe arguments is omitted, an interrupt will occur each time its condition is satisfied.

[\SingleSafe]

Data type: switch

Specifies that the interrupt is single and safe. For definition of single, see description of Single argument. A safe interrupt cannot be put in sleep with instruction ISleep. The safe interrupt event will be queued at program stop and stepwise execution, and when starting in continuous mode again, the interrupt will be executed. The only time a safe interrupt will be thrown is when the interrupt queue is full. Then an error will be reported. The interrupt will not survive program reset, e.g. PP to main.

Signal

Data type: signaldo

Continues on next page

The name of the signal that is to generate interrupts.

TriggValue

Data type: dionum

The value to which the signal must change for an interrupt to occur.

The value is specified as 0 or 1 or as a symbolic value (e.g. high/low). The signal is edge-triggered upon changeover to 0 or 1.

TriggValue 2 or symbolic value edge can be used for generation of interrupts on both positive flank (0 -> 1) and negative flank (1 -> 0).

Interrupt

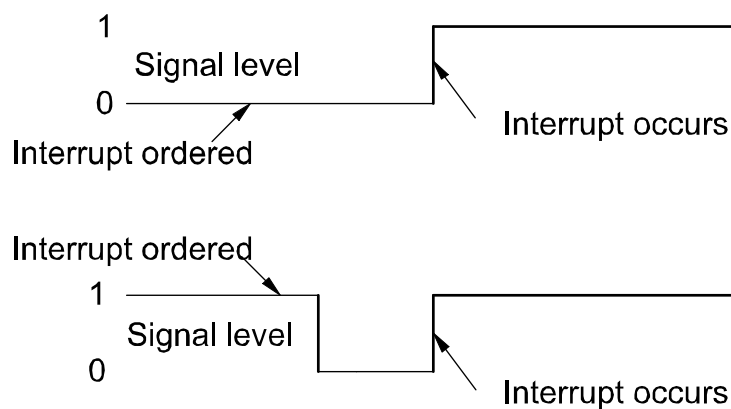
Data type: intnum

The interrupt identity. This should have previously been connected to a trap routine by means of the instruction CONNECT.

Program execution

When the signal assumes the specified value 0 or 1, a call is made to the corresponding trap routine. When this has been executed program execution continues from where the interrupt occurred.

If the signal changes to the specified value before the interrupt is ordered no interrupt occurs. Interrupts from a digital output signal at signal level 1 is illustrated in the figure below.



xx0500002190

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID and it has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.

Continues on next page

1 Instructions

1.118 ISignalDO - Interrupts from a digital output signal

RobotWare Base

Continued

Limitations

The same variable for interrupt identity cannot be used more than once without first deleting it. Interrupts should therefore be handled as shown in one of the alternatives below.

```
VAR intnum sig1int;  
PROC main ()  
  CONNECT sig1int WITH iroutine1;  
  ISignalDO do1, 1, sig1int;  
  WHILE TRUE DO  
    ...  
  ENDWHILE  
ENDPROC
```

All activation of interrupts is done at the beginning of the program. These beginning instructions are then kept outside the main flow of the program.

```
VAR intnum sig1int;  
PROC main ()  
  CONNECT sig1int WITH iroutine1;  
  ISignalDO do1, 1, sig1int;  
  ...  
  IDelete sig1int;  
ENDPROC
```

The interrupt is deleted at the end of the program and is then reactivated. Note, in this case, that the interrupt is inactive for a short period.

Syntax

```
ISignalDO  
  [ '\' Single ] | [ '\' SingleSafe ] ', '  
  [ Signal ':= ' ] < variable (VAR) of signaldo > ', '  
  [ TriggValue ':= ' ] < expression (IN) of dionum > ', '  
  [ Interrupt ':= ' ] < variable (VAR) of intnum > ';'
```

Related information

For information about	See
Summary of interrupts and interrupt management	<i>Technical reference manual - RAPID Overview</i>
Interrupt from an input signal	ISignalDI - Orders interrupts from a digital input signal on page 309
Interrupt identity	intnum - Interrupt identity on page 1656

1.119 ISignalGI - Orders interrupts from a group of digital input signals

Usage

ISignalGI (*Interrupt Signal Group Digital In*) is used to order and enable interrupts from a group of digital input signals.

Basic examples

The following example illustrates the instruction ISignalGI:

Example 1

```
VAR intnum sig1int;  
PROC main()  
  CONNECT sig1int WITH iroutine1;  
  ISignalGI gi1,sig1int;
```

Orders an interrupt when a digital input group signal changes value.

Arguments

ISignalGI [\Single] | [\SingleSafe] Signal Interrupt

[\Single]

Data type: switch

Specifies whether the interrupt is to occur once or cyclically.

If the argument Single is set, the interrupt occurs once at the most. If the Single and SingleSafe arguments is omitted, an interrupt will occur each time its condition is satisfied.

[\SingleSafe]

Data type: switch

Specifies that the interrupt is single and safe. For definition of single, see description of Single argument. A safe interrupt cannot be put in sleep with instruction ISleep. The safe interrupt event will be queued at program stop and stepwise execution, and when starting in continuous mode again, the interrupt will be executed. The only time a safe interrupt will be thrown is when the interrupt queue is full. Then an error will be reported. The interrupt will not survive program reset, e.g. PP to main.

Signal

Data type: signalgi

The name of the group input signal that generates interrupts.

Interrupt

Data type: intnum

The interrupt identity. This should have previously been connected to a trap routine by means of the instruction CONNECT.

Continues on next page

1 Instructions

1.119 ISignalGI - Orders interrupts from a group of digital input signals

RobotWare Base

Continued

Program execution

When the group signal changes value a call is made to the corresponding trap routine. When this has been executed program execution continues from where the interrupt occurred.

If the signal changes before the interrupt is ordered no interrupt occurs.

When a digital group input signal is set to a value, this can generate several interrupts. The reason for this is that changes of the individual bits included in the group signal is not detected at the same time of the robot system. To avoid multiple interrupts for one group signal change, a filter time can be defined for the signal.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID and it has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.

Limitations

Maximum number of signals that can be used for a group is 32.

Numeric value condition cannot be used in the instruction to specify that an interrupt should occur on changes to that specific value. This must be handled in the user program by reading the group signal value at execution of the trap routine.

The interrupts are generated as bit interrupts, e.g. interrupts on single digital input signal change within the group. If the bits in the group signal change value with a delay between settings, several interrupts will be generated. Knowledge about how the I/O board works is necessary to get right function when using ISignalGI. If several interrupts are generated at group input settings, use instead ISignalDI on a strobe signal that are set when all bits in the group signal have been set.

The same variable for interrupt identity cannot be used more than once without first deleting it. Interrupts should therefore be handled as shown in one of the alternatives below.

```
VAR intnum sig1int;  
PROC main ()  
  CONNECT sig1int WITH iroutine1;  
  ISignalGI gi1, sig1int;  
  WHILE TRUE DO  
    ...  
  ENDWHILE  
ENDPROC
```

All activation of interrupts is done at the beginning of the program. These beginning instructions are then kept outside the main flow of the program.

```
VAR intnum sig1int;  
PROC main ()  
  CONNECT sig1int WITH iroutine1;
```

Continues on next page

1.119 ISignalGI - Orders interrupts from a group of digital input signals

RobotWare Base

Continued

```
ISignalGI gi1, sig1int;
...
IDelete sig1int;
ENDPROC
```

The interrupt is deleted at the end of the program and is then reactivated. It should be noted, in this case, that the interrupt is inactive for a short period.

Syntax

```
ISignalGI
['\ ' Single] | ['\ ' SingleSafe]', '
[Signal ':= ' ] < variable (VAR) of signalgi>', '
[Interrupt ':= ' ] <variable (VAR) of intnum>';'
```

Related information

For information about	See
Summary of interrupts and interrupt management	<i>Technical reference manual - RAPID Overview</i>
Interrupt from an input signal	ISignalDI - Orders interrupts from a digital input signal on page 309
Interrupt from group output signals	ISignalGO - Orders interrupts from a group of digital output signals on page 318
Interrupt identity	intnum - Interrupt identity on page 1656
Filter time	<i>Technical reference manual - System parameters</i>

1 Instructions

1.120 ISignalGO - Orders interrupts from a group of digital output signals *RobotWare Base*

1.120 ISignalGO - Orders interrupts from a group of digital output signals

Usage

ISignalGO (*Interrupt Signal Group Digital Out*) is used to order and enable interrupts from a group of digital output signals.

Basic examples

The following example illustrates the instruction ISignalGO:

Example 1

```
VAR intnum sig1int;  
PROC main()  
  CONNECT sig1int WITH iroutine1;  
  ISignalGO go1,sig1int;
```

Orders an interrupt when a digital output group signal change value.

Arguments

ISignalGO [\Single] | [\SingleSafe] Signal Interrupt

[\Single]

Data type: switch

Specifies whether the interrupt is to occur once or cyclically.

If the argument \Single is set, the interrupt occurs once at the most. If the Single and SingleSafe arguments is omitted, an interrupt will occur each time its condition is satisfied.

[\SingleSafe]

Data type: switch

Specifies that the interrupt is single and safe. For definition of single, see description of Single argument. A safe interrupt cannot be put in sleep with instruction ISleep. The safe interrupt event will be queued at program stop and stepwise execution, and when starting in continuous mode again, the interrupt will be executed. The only time a safe interrupt will be thrown is when the interrupt queue is full. Then an error will be reported. The interrupt will not survive program reset, e.g. PP to main.

Signal

Data type: signalgo

The name of the group output signal that generates interrupts.

Interrupt

Data type: intnum

The interrupt identity. This should have previously been connected to a trap routine by means of the instruction CONNECT.

Continues on next page

Program execution

When the group signal changes value a call is made to the corresponding trap routine. When this has been executed program execution continues from where the interrupt occurred.

If the signal changes before the interrupt is ordered no interrupt occurs.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID and it has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.

Limitations

Maximum number of signals that can be used for a group is 32.

Numeric value condition cannot be used in the instruction to specify that an interrupt should occur on changes to that specific value. This must be handled in the user program by reading the group signal value at execution of the trap routine.

The same variable for interrupt identity cannot be used more than once without first deleting it. Interrupts should therefore be handled as shown in one of the alternatives below.

```
VAR intnum sig1int;
PROC main ()
  CONNECT sig1int WITH iroutine1;
  ISignalGO go1, sig1int;
  WHILE TRUE DO
    ...
  ENDWHILE
ENDPROC
```

All activation of interrupts is done at the beginning of the program. These beginning instructions are then kept outside the main flow of the program.

```
VAR intnum sig1int;
PROC main ()
  CONNECT sig1int WITH iroutine1;
  ISignalGO go1, sig1int;
  ...
  IDelete sig1int;
ENDPROC
```

The interrupt is deleted at the end of the program and is then reactivated. Note, in this case, that the interrupt is inactive for a short period.

Syntax

```
ISignalGO
[ '\ ' Single ] | [ '\ ' SingleSafe ] ', '
[ Signal ' := ' ] < variable (VAR) of signalgo > ', '
```

Continues on next page

1 Instructions

1.120 ISignalGO - Orders interrupts from a group of digital output signals

RobotWare Base

Continued

```
[ Interrupt':=' ] < variable (VAR) of intnum > ';'
```

Related information

For information about	See
Summary of interrupts and interrupt management	<i>Technical reference manual - RAPID Overview</i>
Interrupt from an output signal	<i>ISignalDO - Interrupts from a digital output signal on page 312</i>
Interrupt from group input signals	<i>ISignalGI - Orders interrupts from a group of digital input signals on page 315</i>
Interrupt identity	<i>intnum - Interrupt identity on page 1656</i>

1.121 ISleep - Deactivates an interrupt

Usage

ISleep(*Interrupt Sleep*) is used to deactivate an individual interrupt temporarily. During the deactivation time any generated interrupts of the specified type are discarded without any trap execution.

Basic examples

The following example illustrates the instruction ISleep.
See also [More examples on page 321](#).

Example 1

```
ISleep sig1int;
```

The interrupt sig1int is deactivated.

Arguments

ISleep Interrupt

Interrupt

Data type: intnum
The variable (interrupt identity) of the interrupt.

Program execution

Any generated interrupts of the specified type are discarded without any trap execution until the interrupt has been re-activated by means of the instruction IWatch. Interrupts which are generated while ISleep is in effect are ignored.

More examples

More examples of the instruction ISleep are illustrated below.

Example 1

```
VAR intnum timeint;
VAR iodev binfile;

PROC ISleep_example()
  CONNECT timeint WITH write_binfile;
  ITimer 6, timeint;
  !...
  ISleep timeint;
  WriteBin binfile, buffer, 30;
  WriteBin binfile, buffer2, 30;
  IWatch timeint;
  !...
ENDPROC

TRAP write_binfile
  WriteBin binfile, buffer3, 1;
ENDTRAP
```

Continues on next page

1 Instructions

1.121 ISleep - Deactivates an interrupt

RobotWare Base

Continued

Writing to the `binfile` file is done every 6 seconds. The interrupts are not permitted when the communication from main is in progress.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_UNKINO	The interrupt number is unknown. Interrupts which have neither been ordered nor enabled are not permitted.
ERR_INOISSAFE	If trying to deactivate a safe interrupt temporarily with <code>ISleep</code> .

Syntax

```
ISleep  
[ Interrupt ':= ' ] < variable (VAR) of intnum > ';'
```

Related information

For information about	See
Summary of interrupts	<i>Technical reference manual - RAPID Overview</i>
Enabling an interrupt	<i>IWatch - Activates an interrupt on page 329</i>
Disabling all interrupts	<i>IDisable - Disables interrupts on page 251</i>
Cancelling an interrupt	<i>IDelete - Cancels an interrupt on page 250</i>

1.122 ITimer - Orders a timed interrupt

Usage

ITimer (*Interrupt Timer*) is used to order and enable a timed interrupt. This instruction can be used, for example, to check the status of peripheral equipment once every minute.

Basic examples

The following examples illustrate the instruction ITimer:

See also [More examples on page 324](#).

Example 1

```
VAR intnum timeint;
PROC main()
  CONNECT timeint WITH iroutine1;
  ITimer 60, timeint;
```

Orders an interrupt that is to occur cyclically every 60 seconds. A call is then made to the trap routine iroutine1.

Example 2

```
ITimer \Single, 60, timeint;
```

Orders an interrupt that is to occur once, after 60 seconds.

Arguments

ITimer [\Single] | [\SingleSafe] Time Interrupt

[\Single]

Data type: switch

Specifies whether the interrupt is to occur once or cyclically.

If the argument Single is set, the interrupt occurs only once. If the Single and SingleSafe arguments is omitted, an interrupt will occur each time at the specified time.

[\SingleSafe]

Data type: switch

Specifies that the interrupt is single and safe. For definition of single, see description of Single argument. A safe interrupt cannot be put in sleep with instruction ISleep. The safe interrupt event will be queued at program stop and stepwise execution, and when starting in continuous mode again, the interrupt will be executed.

Time

Data type: num

The amount of time that must lapse before the interrupt occurs.

The value is specified in seconds. If Single or SingleSafe is set this time may not be less than 0.01 seconds. The corresponding time for cyclical interrupts is 0.1 seconds.

Continues on next page

1 Instructions

1.122 ITimer - Orders a timed interrupt

RobotWare Base

Continued

Interrupt

Data type: intnum

The variable (interrupt identity) of the interrupt. This should have previously been connected to a trap routine by means of the instruction CONNECT.

Program execution

The corresponding trap routine is automatically called at a given time following the interrupt order. When this has been executed program execution continues from where the interrupt occurred.

If the interrupt occurs cyclically a new computation of time is started from when the interrupt occurs.

More examples

More examples of the instruction ITimer are illustrated below.

Example 1

```
VAR intnum timeint;  
VAR iodev binfile;  
  
PROC ISleep_example()  
  CONNECT timeint WITH write_binfile;  
  ITimer 6, timeint;  
  !...  
  ISleep timeint;  
  WriteBin binfile, buffer, 30;  
  WriteBin binfile, buffer2, 30;  
  IWatch timeint;  
  !...  
ENDPROC  
  
TRAP write_binfile  
  WriteBin binfile, buffer3, 1;  
ENDTRAP
```

Writing to the binfile file is done every 6 seconds. The interrupts are not permitted when the communication from main is in progress.

Limitations

The same variable for interrupt identity cannot be used more than once without being first deleted. See Instructions - ISignalDI.

Syntax

```
ITimer  
[ '\ ' Single ] | [ '\ ' SingleSafe ] ',''  
[ Time ':=' ] < expression (IN) of num >',''  
[ Interrupt' ':=' ] < variable (VAR) of intnum > ';' ;'
```

Continues on next page

Related information

For information about	See
Summary of interrupts and interrupt management	<i>Technical reference manual - RAPID Overview</i>

1 Instructions

1.123 IVarValue - orders a variable value interrupt

Optical Tracking

1.123 IVarValue - orders a variable value interrupt

Usage

IVarValue (*Interrupt Variable Value*) is used to order and enable an interrupt when the value of a variable accessed via the sensor interface has been changed. This instruction can be used, for example, to get seam volume or gap values from a seam tracker.

Basic examples

The following example illustrates the instruction IVarValue:

Example 1

```
LOCAL PERS num
    adptVlt{25}:=[1,1.2,1.4,1.6,1.8,2,2.16667,2.33333,2.5,...];
LOCAL PERS num
    adptWfd{25}:=[2,2.2,2.4,2.6,2.8,3,3.16667,3.33333,3.5,...];
LOCAL PERS num
    adptSpd{25}:=[10,12,14,16,18,20,21.6667,23.3333,25[,...];
LOCAL CONST num GAP_VARIABLE_NO:=11;
PERS num gap_value;
VAR intnum IntAdap;

PROC main()
    ! Setup the interrupt. The trap routine AdapTrp will be called
    ! when the gap variable with number 'GAP_VARIABLE_NO' in the
    ! sensor interface has been changed. The new value will be
    ! available in the PERS gp_value variable.
    ! Connect to the sensor device "sen1:" (defined in sio.cfg).
    SenDevice "sen1:";

    CONNECT IntAdap WITH AdapTrp;
    IVarValue "sen1:", GAP_VARIABLE_NO, gap_value, IntAdap;

    ! Start welding
    ArcL\On,*,v100,adaptSm,adaptWd,adaptWv,z10,tool\j\Track:=track;
    ArcL\On,*,v100,adaptSm,adaptWd,adaptWv,z10,tool\j\Track:=track;

ENDPROC

TRAP AdapTrap
    VAR num ArrInd;
    !Scale the raw gap value received
    ArrInd:=ArrIndx(gap_value);

    ! Update active welddata PERS variable 'adaptWd' with new data
    ! from the arrays of predefined parameter arrays. The scaled gap
    ! value is used as index in the voltage, wirefeed and
    ! speed arrays.
    adaptWd.weld_voltage:=adptVlt{ArrInd};
    adaptWd.weld_wirefeed:=adptWfd{ArrInd};
```

Continues on next page

1.123 IVarValue - orders a variable value interrupt

Optical Tracking

Continued

```
adaptWd.weld_speed:=adptSpd{ArrInd};
```

```
!Request a refresh of AW parameters using the new data i adaptWd  
ArcRefresh;
```

```
ENDTRAP
```

Arguments

```
IVarValue device VarNo Value Interrupt [\Unit] [\DeadBand]  
[\ReportAtTool] [\SpeedAdapt] [\APTR]
```

device

Data type: string

The I/O device name configured in sio.cfg for the sensor used.

VarNo

Data type: num

The number of the variable to be supervised.

Value

Data type: num

A PERS variable which will hold the new value of VarNo.

Interrupt

Data type: intnum

The variable (interrupt identity) of the interrupt. This should have previously been connected to a trap routine by means of the instruction CONNECT.

[\Unit]

Data type: num

Scale factor with which the sensor value for VarNo is multiplied before check and before it is saved in Value.

[\DeadBand]

Data type: num

If the value for VarNo, returned by the sensor, is within +/- DeadBand no interrupt is generated.

[\ReportAtTool]

Data type: switch

This optional argument is only available for sensors of look-ahead type, for example optical tracking sensors. The argument specifies that the value of the variable shall not be evaluated at once but when the robot TCP reaches the position, i.e. the look-ahead is compensated.

[\SpeedAdapt]

Data type: num

\SpeedAdapt is a scale factor used to change the process speed in Arc and Cap instructions. It is multiplied with the sensor value for VarNo according to:

Continues on next page

1 Instructions

1.123 IVarValue - orders a variable value interrupt

Optical Tracking

Continued

process speed = \SpeedAdapt * value(VarNo)

[\APTR]

Data type: switch

Specifies that the subscription of the variable should be coupled to the at-point tracker, for example WeldGuide, specified in the argument device.

Program execution

The corresponding trap routine is automatically called at a given time following the interrupt order. When this has been executed program execution continues from where the interrupt occurred.

Limitations

- The same variable for interrupt identity cannot be used more than five times without first being deleted.
- All interrupts that are setup with IVarValue must be setup again after a controller restart.



CAUTION

Too high interrupt frequency will stall the whole RAPID execution.

Syntax

```
IVarValue
[ device ':= ' ] < expression (IN) of string> ', '
[ VarNo ':= ' ] < expression (IN) of num > ', '
[ Value ':= ' ] < persistent (PERS) of num > ', '
[ Interrupt ':= ' ] < variable (VAR) of intnum > ', '
[ '\ ' Unit ':= ' ] < expression (IN) of num > ', '
[ '\ ' DeadBand ':= ' ] < expression (IN) of num > ', '
[ '\ ' ReportAtTool ] ', '
[ '\ ' SpeedAdapt ':= ' ] < expression (IN) of num > ', '
[ '\ ' APTR ] ';'
```

Related information

For information about	See
Connect to a sensor device	SenDevice - connect to a sensor device on page 666
Summary of interrupts and interrupt management	<i>Technical reference manual - RAPID Overview</i>
Optical Tracking	<i>Application manual - Continuous Application Platform</i>
Optical Tracking Arc	<i>Application manual - ArcWare for OmniCore</i>

1.124 IWatch - Activates an interrupt

Usage

IWatch(*Interrupt Watch*) is used to activate an interrupt which was previously ordered but was deactivated with ISleep.

Basic examples

The following example illustrates the instruction IWatch:

See also [More examples on page 329](#).

Example 1

```
IWatch sig1int;
```

The interrupt sig1int that was previously deactivated is activated.

Arguments

IWatch Interrupt

Interrupt

Data type: intnum

Variable (interrupt identity) of the interrupt.

Program execution

Re-activates interrupts of the specified type. Interrupts generated during the time the ISleep instruction was in effect are ignored.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_UNKINO	The interrupt number is unknown. Interrupts which have neither been ordered nor enabled are not permitted.

More examples

More examples of the instruction IWatch are illustrated below.

Example 1

```

VAR intnum sig1int;
PROC main()
  CONNECT sig1int WITH iroutine1;
  ISignalDI di1,1,sig1int;
  ...
  ISleep sig1int;
  weldpart1;
  IWatch sig1int;

```

During execution of the weldpart1 routine no interrupts are permitted from the signal di1.

Continues on next page

1 Instructions

1.124 IWatch - Activates an interrupt

RobotWare Base

Continued

Syntax

IWatch

[Interrupt ':= '] < variable (**VAR**) of intnum > ';' ;

Related information

For information about	See
Summary of interrupts	<i>Technical reference manual - RAPID Overview</i>
Deactivating an interrupt	<i>ISleep - Deactivates an interrupt on page 321</i>

1.125 Label - Line name

Usage

Label is used to name a line in the program. Using the GOTO instruction, this name can then be used to move program execution within the same routine.

Basic examples

The following example illustrates the instruction Label:

Example 1

```
GOTO next;  
...  
next:
```

Program execution continues with the instruction following next.

Arguments

Label:

Label

Identifier

The name you wish to give the line.

Program execution

Nothing happens when you execute this instruction.

Limitations

The label must not be the same as

- any other label within the same routine.
- any data name within the same routine.

A label hides global data and routines with the same name within the routine it is located in.

Syntax

<identifier>':'

Related information

For information about	See
Identifiers	<i>Technical reference manual - RAPID Overview</i>
Moving program execution to a label	GOTO - Goes to a new instruction on page 237

1 Instructions

1.126 Load - Load a program module during execution

RobotWare Base

1.126 Load - Load a program module during execution

Usage

Load is used to load a program module into the program memory during execution. The loaded program module will be added to the already existing modules in the program memory.

A program or system module can be loaded in static (default) or dynamic mode.

Both static and dynamic loaded modules can be unloaded by the instruction UnLoad.

Static mode

The following table describes how different operations affect static loaded program or system modules.

Type of module	Set PP to main from FlexPendant	Open new RAPID program
Program Module	Not affected	Unloaded
System Module	Not affected	Not affected

Dynamic mode

The following table describes how different operations affect dynamic loaded program or system modules.

Type of module	Set PP to main from FlexPendant	Open new RAPID program
Program Module	Unloaded	Unloaded
System Module	Unloaded	Unloaded

Basic examples

The following examples illustrate the instruction Load:

See also [More examples on page 334](#).

Example 1

```
Load \Dynamic, diskhome \File:="PART_A.modx";
```

Loads the program module PART_A.modx from the diskhome into the program memory. diskhome is a predefined string constant "HOME:". Load the program module in the dynamic mode.

Example 2

```
Load \Dynamic, diskhome \File:="PART_A.modx";  
Load \Dynamic, diskhome \File:="PART_B.modx" \CheckRef;
```

Loads the program module PART_A.modx into the program memory, then PART_B.modx is loaded. If PART_A.modx contains references to PART_B.modx, then \CheckRef can be used to check for unresolved references only when the last module is loaded. If \CheckRef is used on PART_A.modx, a link error will occur and the module will not be loaded.

Arguments

```
Load [\Dynamic] FilePath [\File] [\CheckRef]
```

Continues on next page

`[\Dynamic]`

Data type: switch

The switch enables load of a module in dynamic mode. Otherwise the load is in static mode.

`FilePath`

Data type: string

The file path and the file name to the file that will be loaded into the program memory. The file name shall be excluded when the argument `\File` is used.

`[\File]`

Data type: string

When the file name is excluded in the argument `FilePath` then it must be defined with this argument.

`[\CheckRef]`

Data type: switch

Check after loading of the module for unsolved references in the program task. If not used no check for unsolved references are done.

Program execution

Program execution waits for the program module to finish loading before proceeding with the next instruction.

Unresolved references will always be accepted for the loading operation, if parameter `\CheckRef` is not used, but it will be a run time error on execution of an unresolved reference.

After the program module is loaded it will be linked and initialized. The initialization of the loaded module sets all variables at module level to their unit values.

If any error from the loading operation, including unresolved references if use of switch `\CheckRef`, the loaded module will not be available any more in the program memory.

To obtain a good program structure that is easy to understand and maintain, all loading and unloading of program modules should be done from the main module which is always present in the program memory during execution.

For loading of program that contains a main procedure to a main program (with another main procedure), see example in [More examples on page 334](#) below.



Note

Be aware of that `Load`, `UnLoad`, and `WaitLoad` can affect both the motion execution and other RAPID execution and shall therefore be called with caution.

Continues on next page

1 Instructions

1.126 Load - Load a program module during execution

RobotWare Base

Continued

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILNOTFND	The file specified in the Load instruction cannot be found.
ERR_IOERROR	There is a problem reading the file in the Load instruction.
ERR_PRGMEMFULL	The module cannot be loaded because the program memory is full.
ERR_LOADED	The module is already loaded into the program memory.
ERR_SYNTAX	The loaded module contains syntax errors.
ERR_LINKREF	• The loaded module result in fatal link errors. • If Load is used with the switch \CheckRef to check for any reference error, and the program memory contains unresolved references.

If some of these error occurs the actual module will be unloaded and will not be available in the ERROR handler.

More examples

More examples of how to use the instruction Load are illustrated below.

More general examples

```
Load \Dynamic, "HOME:/DOORDIR/DOOR1.modx";
```

Loads the program module DOOR1.modx from HOME: at the directory DOORDIR into the program memory. The program module is loaded in the dynamic mode.

```
Load "HOME:" \File:="DOORDIR/DOOR1.modx";
```

Same as above but another syntax, and the module is loaded in the static mode.

```
Load\Dynamic, "HOME:/DOORDIR/DOOR1.modx";
```

```
%"routine_x"%;
```

```
UnLoad "HOME:/DOORDIR/DOOR1.modx";
```

Procedure routine_x, will be bound during execution (late binding).

Loaded module contains a main procedure

car.modx:

```
MODULE car
PROC main()
...
TEST part
CASE door_part:
  Load \Dynamic, "HOME:/door.modx";
  %"door:main"%;
  Unload "HOME:/door.modx";
CASE window_part:
  Load \Dynamic, "HOME:/window.modx";
  %"window:main"%;
  Unload \Save "HOME:/window.modx";
ENDTEST
```

Continues on next page

```
ENDPROC
ENDMODULE
```

door.modx:

```
MODULE door
  PROC main()
    ...
  ENDPROC
ENDMODULE
```

window.modx:

```
MODULE window
  PROC main()
    ...
  ENDPROC
ENDMODULE
```

The above example shows how you can load a module which includes a main procedure. This module can have been developed and tested separately and later loaded with `Load` or `StartLoad... WaitLoad` into the system using some type of main program framework. In this example `car.modx`, which loads other modules `door.modx` or `window.modx`.

In the module `car.modx` you load `door.modx` or `window.modx` located at `"HOME:"`. Because the main procedures in `door.modx` and `window.modx` after the loading are considered **LOCAL** in the module by the system, the procedure calls are made in the following way: `%"door:main"%` or `%"window: main"%`. This syntax is used when you want to get access to **LOCAL** procedures in other modules in this example procedure `main` in module `door` or module `window`.

Unloading the modules with `\Save` argument will again make the main procedures global in the saved program.

If you, when the module `car` or `window` are loaded in the system, set program pointer to `main` from any part of the program, the program pointer will always be set to the global main procedure in the main module, `car.modx` in this example.

Limitations

Avoid ongoing robot movements during the loading.

Syntax

```
Load
  ['\Dynamic',']
  [FilePath':=']<expression (IN) of string>
  ['\File':=' <expression (IN) of string>]
  ['\CheckRef']';'
```

Continues on next page

1 Instructions

1.126 Load - Load a program module during execution

RobotWare Base

Continued

Related information

For information about	See
Unload a program module	UnLoad - Unload a program module during execution on page 978
Load a program module in parallel with another program execution	StartLoad - Load a program module during execution on page 759 WaitLoad - Connect the loaded module to the task on page 1031
Check program references	CheckProgRef - Check program references on page 127
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

1.127 LoadId - Load identification of tool or payload

Usage

LoadId (*Load Identification*) can be used for load identification of tool (also gripper tool if roomfix TCP) or payload (activates with instruction GripLoad) by executing a user defined RAPID program.



Note

An alternative way to identify the tool load or payload is to use the service routine LoadIdentify. See *Operating manual - OmniCore*, section *Service routines*.



Note

When using LoadId or LoadIdentification to identify the load of a tool or payload with unknown mass, the mass is estimated using the manipulator and the result can deviate from the actual mass. This is due to tolerances and variations between mechanical units. This does not necessarily mean that the identified payload or tool will cause issues with motion performance. If a very accurate value for the mass is required, it is recommended to weigh the tool or payload and use known mass in the identification.

Basic examples

The following example illustrates the instruction LoadId:

See also [More examples on page 341](#).

Example 1

```
VAR bool invalid_pos := TRUE;
VAR jointtarget joints;
VAR bool valid_joints{12};
CONST speeddata low_ori_speed := [20, 5, 20, 5];
VAR bool slow_test_flag := TRUE;
PERS tooldata grip3 := [ TRUE, [[97.4, 0, 223.1], [0.924, 0, 0.383
,0]], [0, [0, 0, 0], [1, 0, 0, 0], 0, 0, 0]];
! Check if valid robot type
IF ParIdRobValid(TOOL_LOAD_ID) <> ROB_LOAD_VAL THEN
  EXIT;
ENDIF
! Check if valid robot position
WHILE invalid_pos = TRUE DO
  joints := CJointT();
  IF ParIdPosValid (TOOL_LOAD_ID, joints, valid_joints) = TRUE THEN
    ! Valid position
    invalid_pos := FALSE;
  ELSE
    ! Invalid position
    ! Adjust the position by program movements (horizontal tilt
    house)
    MoveAbsJ joints, low_ori_speed, fine, tool0;
```

Continues on next page

1 Instructions

1.127 LoadId - Load identification of tool or payload

RobotWare Base

Continued

```
ENDIF
ENDWHILE
! Do slow test for check of free working area
! Load modules into the system
Load \Dynamic, "RELEASE:/system/mockit.sysx";
Load \Dynamic, "RELEASE:/system/mockit1.sysx";
IF slow_test_flag = TRUE THEN
  %"LoadId"% TOOL_LOAD_ID, MASS_WITH_AX3, grip3 \SlowTest;
ENDIF
! Do measurement and update all load data in grip3
%"LoadID"% TOOL_LOAD_ID, MASS_WITH_AX3, grip3;
! Unload modules
Unload "RELEASE:/system/mockit.sysx";
Unload "RELEASE:/system/mockit1.sysx";
Load identification of tool grip3.
```

Condition

The following conditions should be fulfilled before load measurements with LoadId:

- Ensure that all loads are correctly mounted on the robot
- Check whether valid robot type with ParIdRobValid
- Check whether valid position with ParIdPosValid:
 - Axes 3, 5, and 6 not close to their corresponding working range
 - Tilthousing almost horizontal, i.e. that axis 4 is in zero position
- The following data should be defined in system parameters and in arguments to LoadId before running LoadId

The table below illustrates the load identification of tool.

Load identification modes / Defined data before LoadId	Moving TCP Mass Known	Moving TCP Mass Un-known	Roomfix TCP Mass Known	Roomfix TCP Mass Un-known
Upper arm load (System parameters)		Defined		Defined
Mass in tool	Defined		Defined	

The table below illustrates the load identification of payload.

Load identification modes / Defined data before LoadId	Moving TCP Mass Known	Moving TCP Mass Un-known	Roomfix TCP Mass Known	Roomfix TCP Mass Un-known
Upper arm load (System parameters)		Defined		Defined
Load data in tool	Defined	Defined	Defined	Defined
Mass in payload	Defined		Defined	
Tool frame in tool	Defined	Defined		
User frame in work object			Defined	Defined
Object frame in work object			Defined	Defined

Continues on next page

- Operating mode and speed override:
 - Slow test in manual mode reduced speed
 - Load measurements in automatic mode (or manual mode full speed) with speed override 100%

Arguments

LoadId ParIdType LoadIdType Tool [\PayLoad] [\WObj] [\ConfAngle]
[\SlowTest] [\Accuracy]

ParIdType

Data type: paridnum

Type of load identification as defined in the table below.

Value	Symbolic constant	Comment
1	TOOL_LOAD_ID	Identify tool load
2	PAY_LOAD_ID	Identify payload (ref. instruction GripLoad)

LoadIdType

Data type: loadidnum

Type of load identification as defined in the table below.

Value	Symbolic constant	Comment
1	MASS_KNOWN	Known mass in tool or payload respectively. (Mass in specified Tool or PayLoad must be specified)
2	MASS_WITH_AX3	Unknown mass in tool or payload respectively. Identification of mass in tool or payload will be done with movements of axis 3

Tool

Data type: tooldata

Persistent variable for the tool to be identified. If argument \PayLoad is specified, the persistent variable for the tool in use.

For load identification of tool, the following arguments \PayLoad and \WObj should not be specified.

[\ PayLoad]

Data type: loaddata

Persistent variable for the payload to be identified.

This optional argument must always be specified for load identification of payload.

[\ WObj]

Data type: wobjdata

Persistent variable for the work object in use.

This optional argument must always be specified for load identification of payload with roomfix TCP.

Continues on next page

1 Instructions

1.127 LoadId - Load identification of tool or payload

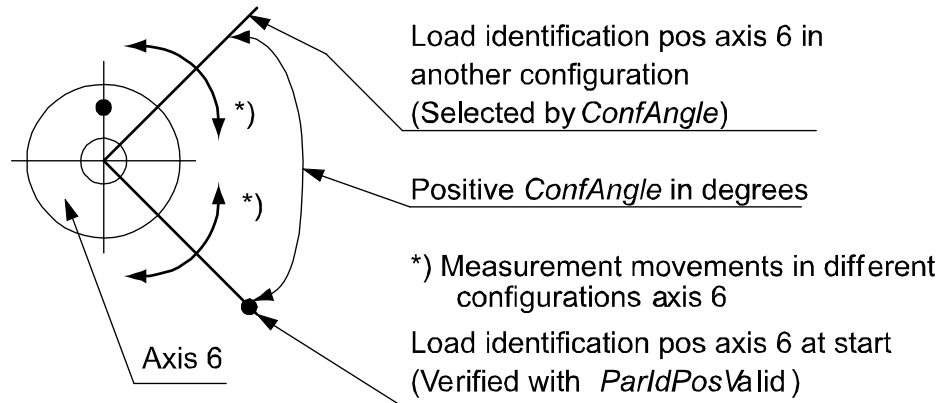
RobotWare Base

Continued

[\ ConfAngle]

Data type: num

Optional argument for specification of a specific configuration angle $\pm$ degrees to be used for the parameter identification.



xx0500002198

Default is +90 degrees if this argument is not specified. Minimum ± 30 degrees. Optimum ± 90 degrees.

For 5-axis delta manipulators the configuration axis is axis 5. The configuration angle will give a delta movement of ± 45 degrees from the standard input of 90 degrees.

[\ SlowTest]

Data type: switch

Optional argument to specify whether only slow test for checking of free working area should be done. See table below:

LoadId ... \SlowTest	Run only slow test
LoadId ...	Run only measurement and update tool or payload

[\ Accuracy]

Data type: num

Variable for output of calculated measurement accuracy in % for the whole load identification calculation (100% means maximum accuracy).

Program execution

The robot will carry out a large number of relative small transport and measurement movements on axes 5 and 6. For identification of mass, movements will also be made with axis 3.

After all measurements, movements, and load calculations the load data is returned in argument Tool or PayLoad. The following load data is calculated:

- Mass in kg (if mass is unknown otherwise not affected)
- Center of gravity x, y, z, and axes of moment
- Inertia ix, iy, iz in kgm

Continues on next page

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_PID_MOVESTOP	At any error during the execution of the RAPID NOSTEPIN routine LoadId. The program pointer is raised to the user call of LoadId.
ERR_PID_RAISE_PP	
ERR_LOADID_FATAL	

More examples

More examples of the instruction LoadId are illustrated below.

Example 1

```

PERS tooldata grip3 := [ FALSE, [[97.4, 0, 223.1], [0.924, 0, 0.383
,0]], [6, [10, 10, 100], [0.5, 0.5, 0.5, 0.5], 1.2, 2.7,
0.5]];
PERS loaddata piece5 := [ 5, [0, 0, 0], [1, 0, 0, 0], 0, 0, 0];
PERS wobjdata wobj2 := [ TRUE, TRUE, "", [ [34, 0, -45], [0.5,
-0.5, 0.5, -0.5] ], [ [0.56, 10, 68], [0.5, 0.5, 0.5, 0.5] ]
];
VAR num load_accuracy;
! Load modules into the system
Load \Dynamic, "RELEASE:/system/mockit.sysx";
Load \Dynamic, "RELEASE:/system/mockit1.sysx";
! Do measurement and update all payload data except mass in piece5
%"LoadId"% PAY_LOAD_ID, MASS_KNOWN, grip3 \Payload:=piece5
\Wobj:=wobj2 \Accuracy:=load_accuracy;
TPWrite " Load accuracy for piece5 (%) = " \Num:=load_accuracy;
! Unload modules
Unload "RELEASE:/system/mockit.sysx";
Unload "RELEASE:/system/mockit1.sysx";

```

Load identification of payload piece5 with known mass in installation with roomfix TCP.

Limitations

Usually load identification of tool or payload for the robot is done with the service routine LoadIdentify. It is also possible to do this identification with this RAPID instruction LoadId. Before loading or executing the program with LoadId following modules must be loaded to the system:

```

Load \Dynamic, "RELEASE:/system/mockit.sysx";
Load \Dynamic, "RELEASE:/system/mockit1.sysx";

```

Then it is possible to call LoadId with a late binding call (see example 1 above).

It is not possible to restart the load identification movements after any type of stop such as program stop, emergency stop, or power failure. The load identification movements must then be started from the beginning.

Syntax

```

LoadId
[ ParIdType ':' '=' ] <expression (IN) of paridnum> ' ,

```

Continues on next page

1 Instructions

1.127 LoadId - Load identification of tool or payload

RobotWare Base

Continued

```
[ LoadIdType ':'=' ] <expression (IN) of loadidnum> ','  
[ Tool ':'=' ] <persistent (PERS) of tooldata>  
[ '\\' PayLoad ':'=' <persistent (PERS) of loaddata> ]  
[ '\\' WObj ':'=' <persistent (PERS) of wobjdata> ]  
[ '\\' ConfAngle ':'=' <expression (IN) of num> ]  
[ '\\' SlowTest ]  
[ '\\' Accuracy ':'=' <variable (VAR) of num> ] ';' }
```

Related information

For information about	See
Predefined program Load Identify	<i>Operating manual - OmniCore</i>
Type of parameter identification	paridnum - Type of parameter identification on page 1688
Result of ParIdRobValid	paridvalidnum - Result of ParIdRobValid on page 1690
Type of load identification	loadidnum - Type of load identification on page 1670
Valid robot type	ParIdRobValid - Valid robot type for parameter identification on page 1375
Valid robot position	ParIdPosValid - Valid robot position for parameter identification on page 1372

1.128 MakeDir - Create a new directory

Usage

MakeDir is used to create a new directory. The user must have write and execute permission for the parent directory under which the new directory is created.

Basic examples

The following example illustrates the instruction MakeDir:

Example 1

```
MakeDir "HOME:/newdir";
```

This example creates a new directory, called newdir, under HOME:

Arguments

MakeDir Path

Path

Data type:string

The name of the new directory specified with full or relative path.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	The directory cannot be created.

Syntax

```
MakeDir
[ Path':=' ] < expression (IN) of string>';'
```

Related information

For information about	See
Remove a directory	RemoveDir - Delete a directory on page 585
Rename a file	RenameFile - Rename a file on page 588
Remove a file	RemoveFile - Delete a file on page 587
Copy a file	CopyFile - Copy a file on page 163
Check file type	IsFile - Check the type of a file on page 1324
Check file size	FileSize - Retrieve the size of a file on page 1249
Check file system size	FSSize - Retrieve the size of a file system on page 1255
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

1 Instructions

1.129 ManLoadIdProc - Load identification of IRBP manipulators

RobotWare Base

1.129 ManLoadIdProc - Load identification of IRBP manipulators

Usage

ManLoadIdProc (*Manipulator Load Identification Procedure*) is used for load identification of payload for external manipulators by executing a user defined RAPID program.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.



Note

An easier way to identify the payload is to use the service routine ManLoadIdentify. This service routine can be started from the menu **Program Editor, Debug, Call Routine, ManLoadIdentify**.

Basic examples

The following examples illustrate the instruction ManLoadIdProc:

```
PERS loaddata myload := [6, [0, 0, 0], [1, 0, 0, 0], 0, 0, 0];
VAR bool defined;
ActUnit STN1;
ManLoadIdProc \ParIdType := IRBP_L
  \MechUnit := STN1
  \PayLoad := myload
  \ConfigAngle := 60
  \AlreadyActive
  \DefinedFlag := defined;
DeactUnit STN1;
```

Load identification of payload myload mounted on the mechanical unit STN1. The external manipulator is of type IRBP-L. The configuration angle is set to 60 degrees. The manipulator is activated before the load identification and deactivated after. After the identification myload has been updated and defined it is set to TRUE.

Arguments

```
ManLoadIdProc [\ParIdType] [\MechUnit] | [\MechUnitName]
               [\AxisNumber] [\PayLoad] [\ConfigAngle] [\DeactAll] |
               [\AlreadyActive] [DefinedFlag] [DoExit]
```

[\ ParIdType]

Data type: paridnum

Type of parameter identification. Predefined constants are found under the datatype paridnum.

[\ MechUnit]

Data type: mecunit

Mechanical unit used for the load identification. Cannot be used together with argument \MechUnitName.

Continues on next page

[\ MechUnitName]

Data type: string

Mechanical unit used for the load identification given as a string. Cannot be used together with argument \MechUnit.

[\ AxisNumber]

Data type: num

Axis number within the mechanical unit, which holds the load to be identified.

[\ PayLoad]

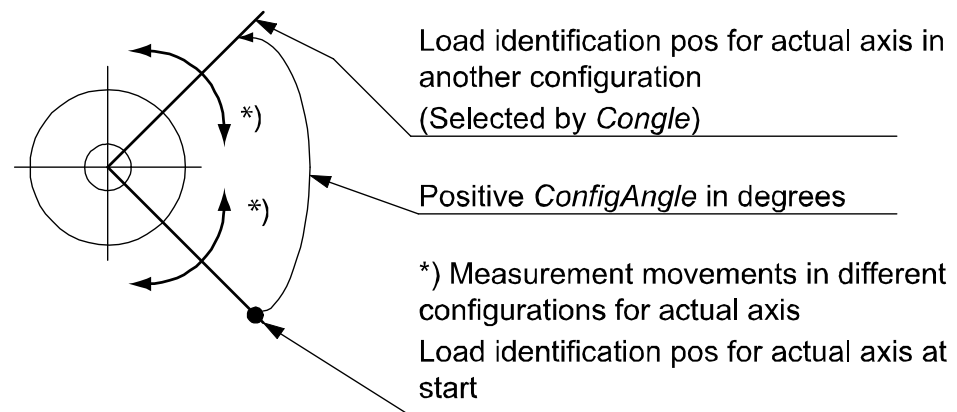
Data type: loaddata

Variable for the payload to be identified. The component mass must be specified. This variable will be updated after the identification is done.

[\ ConfigAngle]

Data type: num

Specification of a specific configuration angle $\pm$ degrees to be used for the parameter identification.



xx0500002197

Min. + or - 30 degrees. Optimum + or - 90 degrees.

[\ DeactAll]

Data type: switch

If this switch is used all mechanical units in the system will be deactivated before identification is done. The mechanical unit to identify will then be activated. It cannot be used together with argument \AlreadyActive.

[\ AlreadyActive]

Data type: switch

This switch is used if the mechanical unit to identify is active. It cannot be used together with argument \DeactAll.

[\ DefinedFlag]

Data type: bool

Continues on next page

1 Instructions

1.129 ManLoadIdProc - Load identification of IRBP manipulators

RobotWare Base

Continued

This argument will be set to TRUE if the identification has been made, FALSE otherwise.

[\ DoExit]

Data type: bool

If set to TRUE the load identification will end up with an EXIT command to force the user to set PP to main before continuing the execution. If not present or set to FALSE no EXIT will be done. Note that ManLoadIdProc always clears the current path.

Program execution

All arguments are optional. If an argument is not given the user will be asked for the value from the FlexPendant (except for \DoExit).

The user will always be asked to give the mass and if the manipulator is of type IRBP R, z in mm.

The mechanical unit will carry out a large number of relative small transport and measurement movements.

After all measurements, movements, and load calculations the load data is returned in argument PayLoad if used. The following load data is calculated.

Manipulator type/ Calculated load data	IRBP-K	IRBP-L IRBP-C IRBP_T	IRBP-R	IRBP-A IRBP-B IRBP-D
Parameter PayLoad - cog.x, cog.y, cog.z in loaddata in mm	cog.x cog.y	cog.x cog.y	cog.x cog.y	cog.x cog.y cog.z
Parameter PayLoad - ix, iy, iz in loaddata in kgm ²	iz	iz	ix iy iz	ix iy iz

The calculated data will be displayed on the FlexPendant.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_PID_MOVESTOP	At any error during the execution of the RAPID NOSTEPIN routine ManLoadIdProc. The program pointer is raised to the user call of ManLoadIdProc.
ERR_PID_RAISE_PP	
ERR_LOADID_FATAL	

Limitations

Usually load identification of load for the external manipulator is done with the service routine ManLoadIdentify. It is also possible to do this identification with this RAPID instruction ManLoadIdProc.

Any path in progress will be cleared before the load identification. The program pointer will be lost after the load identification if argument \DoExit:=TRUE is used.

Continues on next page

It is not possible to restart the load identification movements after any type of stop, such as program stop, emergency stop, or power failure. The load identification movements must be again restarted from the beginning.

Syntax

```
ManLoadIdProc
[ '\\'ParIdType ':=' <expression (IN) of paridnum>]
[ '\\'MechUnit ':=' <variable (VAR) of mecunit> ]
| [ '\\' MechUnitName ':=' <expression (IN) of string>]
[ '\\' AxisNumber ':=' <expression (IN) of num> ]
[ '\\' PayLoad ':=' <variable or persistent (INOUT) of loaddata>
[ '\\' ConfigAngle ':=' <expression (IN) of num>]
[ '\\' DeactAll] | [ '\\' AlreadyActive]
[ '\\' DefinedFlag ':=' <variable (VAR) of bool> ]
[ '\\' DoExit ':=' <expression (IN) of bool> ] ';'

```

Related information

For information about	See
Type of parameter identification	paridnum - Type of parameter identification on page 1688
Mechanical unit	mecunit - Mechanical unit on page 1672
Payload	loaddata - Load data on page 1664

1 Instructions

1.130 MatrixAdd - Calculates the sum of two matrices

RobotWare Base

1.130 MatrixAdd - Calculates the sum of two matrices

Usage

MatrixAdd is used to calculate the sum of two matrices.

Basic examples

The following examples illustrate the instruction MatrixAdd.

Example 1

```
VAR dnum A1{2, 2}:=[[1, 5], [-4, 3]];
VAR dnum B1{2, 2}:=[[2, -1], [4, -1]];
VAR dnum Result1{2, 2};
..
MatrixAdd A1, B1, Result1;
FOR i FROM 1 TO Dim(Result1,1) DO
  FOR j FROM 1 TO Dim(Result1,2) DO
    Write output, ValToStr(Result1{i,j})+" " \NoNewLine;
  ENDFOR
  Write output, "";
ENDFOR
```

In the example above matrix A1 and matrix B1 are added, and the result is stored in matrix Result1. The content of Result1 is then written to a file. The output will be:

```
3 4
0 2
```

Example 2

```
VAR dnum A2{3, 3}:=[[1, 5, 0], [-4, 3, 9], [4, -3, 2]];
VAR dnum B2{3, 3}:=[[2, -1, -2], [4, -1, 2], [5, 8, 6]];
VAR dnum Result2{2, 2};
..
MatrixReset Result2;
MatrixAdd A2 \A_m:=2 \A_n:=2, B2, Result2;
FOR i FROM 1 TO Dim(Result2,1) DO
  FOR j FROM 1 TO Dim(Result2,2) DO
    Write output, ValToStr(Result2{i,j})+" " \NoNewLine;
  ENDFOR
  Write output, "";
ENDFOR
```

In the example above matrix A2 and matrix B2 are added, and the result is stored in matrix Result2. Only 2 rows and 2 columns in the A2 and B2 matrices will be considered. The result matrix will be a 2*2 matrix and can be stored in the Result2 matrix. The content of Result2 is then written to a file. The output will be:

```
3 4
0 2
```

Arguments

MatrixAdd A [\A_m] [\A_n] B Result

Continues on next page

A

Data type: array of dnum

A is a matrix with the dimensions $m \times n$, where m is the number of rows, and n is the number of columns.

[\A_m]

Data type: num

With the optional argument A_m it is possible to specify how many of the rows (m) in the matrix A (and matrix B) that should be used.

[\A_n]

Data type: num

With the optional argument A_n it is possible to specify how many of the columns (n) in the matrix A (and matrix B) that should be used.

B

Data type: array of dnum

B is a matrix with the dimensions $m \times n$, where m is the number of rows, and n is the number of columns. The rows and columns of B must be at least as big as rows and columns in A, or the values used in optional arguments A_m and A_n.

Result

Data type: array of dnum

This is an array variable where the result of the calculation is stored, with the dimensions $m \times n$, where m is the number of rows, and n is the number of columns of the matrix. The rows and columns of Result must be at least as big as rows and columns in A, or the values used in optional arguments A_m and A_n.

Program execution

MatrixAdd is used to add one matrix to another matrix. A matrix can only be added to another matrix if the two matrices have the same dimensions, and the result will be a matrix with same dimensions as A.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_ARRAY_SIZE	Wrong dimensions or wrong values on optional arguments are used.

Syntax

MatrixAdd

```
[ A ':' '=' ] < array {*}{*} expression (IN) of dnum >
[ '\ ' A_m ':' '=' < expression (IN) of num > ]
[ '\ ' A_n ':' '=' < expression (IN) of num > ] ', '
[ B ':' '=' ] < array {*}{*} expression (IN) of dnum > ', '
[ Result ':' '=' ] < array variable {*}{*} (VAR) of dnum > ';'
```

Continues on next page

1 Instructions

1.130 MatrixAdd - Calculates the sum of two matrices

RobotWare Base

Continued

Related information

For information about	See
MatrixInverse	MatrixInverse - Inverse a matrix on page 351
MatrixMult	MatrixMult - Multiply a matrix with a matrix, scalar, or vector on page 354
MatrixReset	MatrixReset - Set all elements in a matrix to 0 on page 360
MatrixSub	MatrixSub - Calculates the difference between two matrices on page 367
MatrixTranspose	MatrixTranspose - Transpose a matrix on page 373
Mathematical instructions and functions.	Technical reference manual - RAPID Overview

1.131 MatrixInverse - Inverse a matrix

Usage

MatrixInverse is used to calculate the inverse a matrix. For non-square matrices, the instruction calculates the so called pseudo-inverse to the matrix.

Basic examples

The following examples illustrate the instruction MatrixInverse.

Example 1

```
VAR dnum A1{2,2}:=[[4, 7],
  [2, 6]];
VAR dnum Result1{2,2};
..
MatrixInverse A1, Result1;
FOR i FROM 1 TO Dim(Result1,1) DO
  FOR j FROM 1 TO Dim(Result1,2) DO
    Write output, ValToStr(Result1{i,j})+" " \NoNewLine;
  ENDFOR
  Write output, "";
ENDFOR
Write output, "";
```

In the example above the inverse of matrix A1 is calculated and stored in matrix Result1. The content of Result1 is then written to a file. The output will be:

```
0.6 -0.7
-0.2 0.4
```

Example 2

```
VAR dnum A3{7,4}:=[ [ 50, -72, 85, 66],
  [-49, -70, -30, 17],
  [ 1, -48, -60, 10],
  [ 40, 68, -50, 83],
  [ 78, -49, 23, -43],
  [ 91, 63, -5, 51],
  [ 9, -51, -30, 50]];
VAR dnum Result3{10,10};
VAR num ResM;
VAR num ResN;
..
MatrixInverse A3, Result3 \Result_m:=ResM \Result_n:=ResN;
TPWrite "Number of valid rows in Result3= "+ValToStr(ResM);
TPWrite "Number of valid columns in Result3= "+ValToStr(ResN);
FOR i FROM 1 TO ResM DO
  FOR j FROM 1 TO ResN DO
    Write output, ValToStr(RoundDnum(Result3{i,j} \Dec:=6)) + " "
      \NoNewLine;
  ENDFOR
  Write output, "";
ENDFOR
```

Continues on next page

1 Instructions

1.131 MatrixInverse - Inverse a matrix

RobotWare Base

Continued

In the example above the inverse of matrix A3 is calculated and stored in matrix Result3.

The dimensions of the Result3 matrix are bigger than it must be, so we use optional arguments Result_m and Result_n to get resulting rows and columns, which can be used in the writing to the file. The output to the file will be:

Number of valid rows in Result3=4

Number of valid columns in Result3=7

-8.1E-5 -0.002044 0.002093 0.000785 0.006486 0.003943 0.000635

-0.002159 -0.002835 -0.003043 0.001814 -0.002848 0.001601 -0.002671

0.005524 -0.001825 -0.005426 -0.002353 -0.002046 -0.000923 -0.002497

0.004527 0.001812 -0.000683 0.00365 -0.004902 0.000855 0.002398

Arguments

MatrixInverse A [\A_m] [\A_n] Result [\Result_m] [\Result_n]
[\Tolerance]

A

Data type: array of dnum

A is a matrix with the dimensions $m \times n$, where m is the number of rows, and n is the number of columns of the matrix.

[\A_m]

Data type: num

With the optional argument A_m it is possible to specify how many of the rows (m) in the matrix A that should be used.

[\A_n]

Data type: num

With the optional argument A_n it is possible to specify how many of the columns (n) in the matrix A that should be used.

Result

Data type: array of dnum

This is an array variable where the result of the calculation is stored. If A is a $m \times n$ matrix, the Result matrix must be at least a $n \times m$ matrix.

[\Result_m]

Data type: num

The number of valid rows in the Result matrix.

[\Result_n]

Data type: num

The number of valid columns in the Result matrix.

[\Tolerance]

Data type: dnum

The default tolerance value without using this optional argument is $1.0e-6$.

Continues on next page

If using this optional argument, the value can be set between 0 and 1. The value sets the tolerance against a singular matrix. More specifically, the instruction will return `ERR_MATRIX_SINGULAR` if the reciprocal condition number of the input matrix is less than the provided tolerance. Lowering the tolerance can eliminate the error message. Be aware though that lowering the tolerance too much can cause the instruction to return a result with bad numerical accuracy.

Program execution

`MatrixInverse` is used to calculate the inverse of a matrix.

It is possible to specify that only parts of the matrix `A` should be used with the optional arguments `A_m` and `A_n`. If `A` is a $m \times n$ matrix, the `Result` matrix (inverted matrix) will be a $n \times m$ matrix.

For non-square matrices, the instruction calculates the so called pseudo-inverse to the matrix.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

<code>ERR_ARRAY_SIZE</code>	Wrong values on optional arguments are used, or incorrect dimensions of used matrices.
<code>ERR_MATRIX_SINGULAR</code>	The input matrix is singular.

Syntax

```
MatrixInverse
[ A ':' ] < array {*}{*} expression (IN) of dnum >
[ '\\' A_m ':' < expression (IN) of num > ]
[ '\\' A_n ':' < expression (IN) of num > ] ', '
[ Result ':' ] < array variable {*}{*} (VAR) of dnum >
[ '\\' Result_m ':' < variable (VAR) of num > ]
[ '\\' Result_n ':' < variable (VAR) of num > ]
[ '\\' Tolerance ':' < expression (IN) of dnum > ] ';'

```

Related information

For information about	See
<code>MatrixAdd</code>	MatrixAdd - Calculates the sum of two matrices on page 348
<code>MatrixMult</code>	MatrixMult - Multiply a matrix with a matrix, scalar, or vector on page 354
<code>MatrixReset</code>	MatrixReset - Set all elements in a matrix to 0 on page 360
<code>MatrixSub</code>	MatrixSub - Calculates the difference between two matrices on page 367
<code>MatrixTranspose</code>	MatrixTranspose - Transpose a matrix on page 373
Mathematical instructions and functions.	Technical reference manual - RAPID Overview

1 Instructions

1.132 MatrixMult - Multiply a matrix with a matrix, scalar, or vector

RobotWare Base

1.132 MatrixMult - Multiply a matrix with a matrix, scalar, or vector

Usage

`MatrixMult` is used to multiply two matrices, or to multiply a matrix with a scalar, or a matrix with a vector.

Basic examples

The following examples illustrate the instruction `MatrixMult`.

See also [More examples on page 357](#).

Example 1

```
VAR dnum A1{3,2}:=[ [1, 3],
  [4, -1],
  [-5, 10]];
VAR dnum B1{2,2}:=[ [2, 1],
  [-8, 6]];
VAR dnum Result1{3,2};
..
MatrixMult A1, B1, Result1;
FOR i FROM 1 TO Dim(Result1,1) DO
  FOR j FROM 1 TO Dim(Result1,2) DO
    Write output, ValToStr(Result1{i,j})+" " \NoNewLine;
  ENDFOR
  Write output, "";
ENDFOR
```

In the example above matrix A1 is multiplied with matrix B1 and the result is stored in matrix Result1. The content of Result1 is then written to a file. The output will be:

```
-22 19
16 -2
-90 55
```

Example 2

```
VAR dnum A1{3,2}:=[ [1, 3],
  [4, -1],
  [-5, 10]];
VAR dnum Result1{3,2};
..
MatrixMult A1, 2, Result1;
```

In the example above matrix A1 is multiplied with a scalar 2. The result is stored in matrix Result1. The content of Result1 is:

```
[[2,6],
[8,-2],
[-10,20]];
```

Example 3

```
VAR dnum A1{2,3}:=[ [1, -1, 2], [0, -3, 1]];
VAR dnum x{3}:=[2, 1, 0];
```

Continues on next page

1.132 MatrixMult - Multiply a matrix with a matrix, scalar, or vector

RobotWare Base

Continued

```
VAR dnum Ax{2};
..
MatrixMult A1, x, Ax;
```

In the example above matrix A1 is multiplied with a vector x. The result is stored in the vector Ax. The content of Ax is:

```
[1, -3]
```

Arguments

```
MatrixMult A [\A_m] [\A_n] Scalar | Vector | B [\B_m] [\B_n]
           ResultVector | Result [\Result_m] [\Result_n]
```

A

Data type: array of dnum

A is a matrix with the dimensions $p \times q$, where p is the number of rows, and q is the number of columns.

[\A_m]

Data type: num

With the optional argument A_m it is possible to specify how many of the rows (m) in the matrix A that should be used.

[\A_n]

Data type: num

With the optional argument A_n it is possible to specify how many of the columns (n) in the matrix A that should be used.

Scalar

Data type: dnum

The numeric value used to multiply each element in the matrix A.

Vector

Data type: array of dnum

Vector is a vector with dimension n where n is at least equal to the number of columns specified for the matrix used in argument A. If n is bigger than the number of columns in matrix A, only the required elements are used.

B

Data type: array of dnum

B is a matrix with the dimensions $q \times r$, where q is the number of rows, and r is the number of columns.

The requirement on the matrix B is that its number of rows must be equal or more than the number of columns in the matrix A.

[\B_m]

Data type: num

With the optional argument B_m it is possible to specify how many of the rows (m) in the matrix B that should be used.

Continues on next page

1 Instructions

1.132 MatrixMult - Multiply a matrix with a matrix, scalar, or vector

RobotWare Base

Continued

`[\B_n]`

Data type: num

With the optional argument `B_n` it is possible to specify how many of the columns (`n`) in the matrix `B` that should be used.

`ResultVector`

Data type: array of dnum

`ResultVector` is a vector with dimension `m` where `m` is at least equal to the number of rows specified for the matrix used in argument `A`. If `m` is bigger than the number of rows in `A`, the number of updated elements is the same as the rows in `A`.

Multiply a matrix with a vector:

$$A * x = b$$

`A` is an `m x n` matrix:

- The vector `x` needs to have dimension `n` (columns in `A`).
- The result vector `b` needs to have dimension `m` (rows in `A`).

`Result`

Data type: array of dnum

This is an array variable where the result of the calculation is stored. The requirements on dimensions of the matrix `Result` are:

- Multiplication with a scalar: the `Result` matrix must be equal or bigger than the dimensions of matrix `A`.
- Multiplication between a matrix `A` and matrix `B`: `A` is a `p*q` matrix, `B` is a `q*r` matrix, then `Result` must be at least a `p*r` matrix.

Example:

$$A1\{3,2\} \times B1\{2,2\} \Rightarrow Result1\{3,2\}$$

$$A2\{7,5\} \times B2\{5,2\} \Rightarrow Result2\{7,2\}$$

`[\Result_m]`

Data type: num

The number of valid rows in the `Result` matrix.

`[\Result_n]`

Data type: num

The number of valid columns in the `Result` matrix.

Program execution

`MatrixMult` is used to multiply one matrix with a scalar, or a matrix with another matrix, or a matrix with a vector.

It is possible to specify that only parts of the matrices should be used with the optional arguments `A_m`, `A_n`, `B_m`, and `B_n`, and you will get required dimensions of the result matrix in optional arguments `Result_m` and `Result_n`. See example 2 in [More examples on page 357](#) how parts of two matrices are used.

Continues on next page

1.132 MatrixMult - Multiply a matrix with a matrix, scalar, or vector

*RobotWare Base**Continued*

When multiplying with a vector, the dimension of the vector used in argument Vector needs to be at least as big as the columns of the matrix used in argument A. The vector used in argument ResultVector needs to have at least the dimension as the rows in matrix used as argument in A. The ResultVector will only be updated with the same number of elements as the number of rows in the matrix A.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_ARRAY_SIZE	Wrong dimensions or wrong values on optional arguments are used.

More examples**Example 1**

```

VAR dnum A2{7,5}:=[ [1, 3, 1, 2, 3],
  [4, -1, 1, 2, 3],
  [-5, 10, 1, 2, 3],
  [1, 2, 3, 4, 5],
  [1, 2, 3, 4, 5],
  [1, 2, 3, 4, 5],
  [1, 2, 3, 4, 5]];
VAR dnum B2{5,2}:=[ [2, 2],
  [2, 2],
  [2, 2],
  [2, 2],
  [2, 2]];
VAR dnum Result2{10,10};
VAR num Res_m;
VAR num Res_n;
..
MatrixReset Result2;
MatrixMult A2, B2, Result2 \Result_m:=Res_m \Result_n:=Res_n;
FOR i FROM 1 TO Res_m DO
  FOR j FROM 1 TO Res_n DO
    Write output, ValToStr(Result2{i,j})+" " \NoNewLine;
  ENDFOR
  Write output, "";
ENDFOR

```

In the example above matrix A2 is multiplied with matrix B2 and the result is stored in matrix Result2. The dimensions of matrix Result2 are bigger than it needs to be. In Res_m and Res_n, the number of valid rows and columns in the Result2 matrix is returned and can be used when logging to file.

The output in the file will be:

20 20

18 18

22 22

Continues on next page

1 Instructions

1.132 MatrixMult - Multiply a matrix with a matrix, scalar, or vector

RobotWare Base

Continued

30 30

30 30

30 30

30 30

Example 2

```
VAR dnum A1{5,5}:=[ 1, 3, -7, 4, 3.5],
    [4, -1, 1, 5, 3],
    [-5, 10, 0.5, 4, -3],
    [-5, 8, -2, 8, 0],
    [1.5, 3, 7, 4, -1]];
VAR dnum B1{4,4}:=[ [2, 1, -1, 0.5],
    [-8, 6, 3, -2],
    [3, -5, 2, -4],
    [1, 2, -2, 7]];
VAR dnum Result1{5,5};
VAR num Res_m;
VAR num Res_n;
..
MatrixReset Result1;
MatrixMult A1 \A_m:=3 \A_n:=2, B1 \B_m:=2 \B_n:=2, Result1
    \Result_m:=Res_m \Result_n:=Res_n;
Write output, "Res_m = "+ ValToStr(Res_m);
Write output, "Res_n = "+ ValToStr(Res_n);
FOR i FROM 1 TO Res_m DO
    FOR j FROM 1 TO Res_n DO
        Write output, ValToStr(Result1{i,j})+" " \NoNewLine;
    ENDFOR
    Write output, "";
ENDFOR
```

In the example above matrix A1 is multiplied with matrix B1 and the result is stored in matrix Result1. In matrix A1 we use the first 3 rows and 2 columns (bold numbers) in the calculations, in matrix B1 we use the first 2 rows and 2 columns in the calculation (bold numbers), and the valid data is stored in a 3*2 matrix in the Result1 matrix.

The output in the file will be:

Res_m = 3

Res_n = 2

-22 19

16 -2

-90 55

Syntax

```
MatrixMult
[ A ':' '=' ] < array {*}{*} expression (IN) of dnum >
[ '\ ' A_m ':' '=' < expression (IN) of num > ]
[ '\ ' A_n ':' '=' < expression (IN) of num > ] ', '
[ Scalar ':' '=' ] < expression (IN) of dnum >
```

Continues on next page

1.132 MatrixMult - Multiply a matrix with a matrix, scalar, or vector

RobotWare Base

Continued

```

| [Vector ':=' ] < array {*} expression (IN) of dnum >
| [B ':=' ] < array {*}{*} expression (IN) of dnum >
[ '\\' B_m ':=' < expression (IN) of num > ]
[ '\\' B_n ':=' < expression (IN) of num > ] ', '
[ ResultVector ':=' ] < array variable {*} (VAR) of dnum >
| [ Result ':=' ] < array variable {*}{*} (VAR) of dnum >
[ '\\' Result_m ':=' < variable (VAR) of num > ]
[ '\\' Result_n ':=' < variable (VAR) of num > ] ';'

```

Related information

For information about	See
MatrixAdd	MatrixAdd - Calculates the sum of two matrices on page 348
MatrixInverse	MatrixInverse - Inverse a matrix on page 351
MatrixReset	MatrixReset - Set all elements in a matrix to 0 on page 360
MatrixSub	MatrixSub - Calculates the difference between two matrices on page 367
MatrixTranspose	MatrixTranspose - Transpose a matrix on page 373
Mathematical instructions and functions.	Technical reference manual - RAPID Overview

1 Instructions

1.133 MatrixReset - Set all elements in a matrix to 0

RobotWare Base

1.133 MatrixReset - Set all elements in a matrix to 0

Usage

`MatrixReset` is used to set all elements in a matrix to zero (0).

Basic examples

The following examples illustrate the instruction `MatrixReset`.

Example 1

```
VAR dnum A1{7,5}
..
MatrixReset A1;
```

In the example above all elements in A1 are set to 0.

Example 2

```
VAR dnum A1{7,5}
..
MatrixReset A1 \A_m:=3 \A_n:=4;
```

In the example above 3 rows and 4 columns of the A1 matrix are set to 0.

Arguments

`MatrixReset A [\A_m] [\A_n]`

A

Data type: array of dnum

A is a matrix with the dimensions $m \times n$, where m is the number of rows, and n is the number of columns.

[\A_m]

Data type: num

With the optional argument A_m it is possible to specify how many of the rows (m) in the matrix A that should be used.

[\A_n]

Data type: num

With the optional argument A_n it is possible to specify how many of the columns (n) in the matrix A that should be used.

Program execution

`MatrixReset` is used to set all or some elements in a matrix to 0.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

ERR_ARRAY_SIZE	Wrong values on optional arguments are used.

Syntax

`MatrixReset`

Continues on next page

1.133 MatrixReset - Set all elements in a matrix to 0

RobotWare Base

Continued

```
[ A ':' '=' ] < array {*}{*} (VAR) of dnum >
[ '\\' A_m ':' '=' < expression (IN) of num > ]
[ '\\' A_n ':' '=' < expression (IN) of num > ] ';'

```

Related information

For information about	See
MatrixAdd	MatrixAdd - Calculates the sum of two matrices on page 348
MatrixInverse	MatrixInverse - Inverse a matrix on page 351
MatrixMult	MatrixMult - Multiply a matrix with a matrix, scalar, or vector on page 354
MatrixSub	MatrixSub - Calculates the difference between two matrices on page 367
MatrixTranspose	MatrixTranspose - Transpose a matrix on page 373
Mathematical instructions and functions.	Technical reference manual - RAPID Overview

1 Instructions

1.134 MatrixSolve - Solve a linear equation system

RobotWare Base

1.134 MatrixSolve - Solve a linear equation system

Usage

MatrixSolve is used to solve linear equation systems on the form $A \cdot x = b$.

Basic examples

The following examples illustrate the instruction MatrixSolve.

See also [More examples on page 363](#).

Example 1

```
VAR dnum A1{3,3}:=[ [5, 2, 7], [-3, 1, 1], [1, 10, -3] ];
VAR dnum b1{3}:=[ -22, 39, 54 ];
VAR dnum x1{3};
...
MatrixSolve A1, b1, x1;
```

The example above solves the linear equation system. The x1 array will have the value [-10, 7, 2].

Example 2

```
VAR dnum A2{1,1} := [ [5] ];
VAR dnum b2{1}:=[ 35 ];
VAR dnum x2{1};
...
MatrixSolve A2, b2, x2;
```

The example above solves the trivial equation $5x = 35$. The answer is 7.

Arguments

MatrixSolve A [$\backslash A_m$] [$\backslash A_n$] b x

A

Data type: array of dnum

A is a matrix with the dimensions $m * n$, where $m \geq n$. The letter m describes the number of rows, and letter n describes the number of columns of the matrix. If $m > n$, then the system of equations is overdetermined and a least-squares solution is returned.

[$\backslash A_m$]

Data type: num

With the optional argument A_m it is possible to specify how many of the rows (m) in the matrix A that should be used.

[$\backslash A_n$]

Data type: num

With the optional argument A_n it is possible to specify how many of the columns (n) in the matrix A that should be used.

b

Data type: array of dnum

Continues on next page

b is an array with the same dimension as the rows (m) of the matrix A . If using an array with bigger dimension than the rows (m) of matrix A , the components above m will be set to 0.

x

Data type: array of dnum

x is an array with the same dimension as the columns (n) of the matrix A . This is an array variable where the result of the calculation is stored. If using an array with bigger dimension than the columns (n) of matrix A , the components above n will be set to 0.

Program execution

MatrixSolve is used to solve linear equation systems on the form $A \cdot x = b$. If the system is overdetermined, then a least-squares solution is returned.

If using the optional arguments A_m and A_n it is possible to use the same matrix for many different calculations that use different sizes of the matrix.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_ARRAY_SIZE	Wrong dimensions or wrong values on optional arguments are used.
ERR_MATRIX_SINGULAR	The input matrix is singular.

More examples

More examples of the instruction MatrixSolve are illustrated below.

Example 1

```
VAR dnum A1{5,5}:=[ [5,2,7,0,0], [-3,1,1,0,0], [1,10,-3,0,0] ];
VAR dnum b1{8}:=[ -22,39,54,0,0,0,0,0 ];
VAR dnum x1{8};
```

```
MatrixSolve A1 \A_m:=3 \A_n:=3, b1, x1;
```

The example above solves the linear equation system. The $x1$ array will have the value $[-10, 7, 2, 0, 0, 0, 0, 0]$. This example is the same as [Example 1 on page 362](#). The only difference is that in this example it is illustrated how to use the optional arguments A_m and A_n and that bigger arrays than m and n can be used for arguments b and x . A_m and A_n can be used to limit the size of the matrix, so a big general matrix can be used to solve many different equation systems.

Limitations

When solving large matrixes the allocated memory may not be enough to complete the current calculation and an event log is reported. The allocated memory size is fixed and cannot be changed. Try solving smaller sizes of the matrix.

Syntax

MatrixSolve

Continues on next page

1 Instructions

1.134 MatrixSolve - Solve a linear equation system

RobotWare Base

Continued

```
[ A ':' '=' ] < array {*}{*} expression (IN) of dnum >
[ '\ ' A_m ':' '=' < expression (IN) of num > ]
[ '\ ' A_n ':' '=' < expression (IN) of num > ] ', '
[ b ':' '=' ] < array {*} expression (IN) of dnum > ', '
[ x ':' '=' ] < array variable {*} (VAR) of dnum > '; '
```

Related information

For information about	See
Compute a QR-factorization.	MatrixSolveQR - Computes a QR-factorization on page 365
Compute a singular value decomposition.	MatrixSVD - Computes a singular value decomposition on page 370
Mathematical instructions and functions.	<i>Technical reference manual - RAPID Overview</i>

1.135 MatrixSolveQR - Computes a QR-factorization

Usage

MatrixSolveQR is used to compute a QR-factorization of an (m x n) matrix A.

Basic examples

The following example illustrates the instruction MatrixSolveQR.

Example 1

```

VAR dnum A4{3,3}:=[12, -51, 4], [6, 167, -68], [-4, 24, -41]];
VAR dnum Q4{3,3};
VAR dnum R4{3,3};
MatrixSolveQR A4, Q4, R4;

```

Instruction MatrixSolveQR is used to compute a QR-factorization of an (m x n) matrix A4. The result of the calculation is:

```

Q4 := [[-0.857142857142857, 0.394285714285714, 0.331428571428571],
        [-0.428571428571429, -0.902857142857143, -0.0342857142857143],
        [0.285714285714286, -0.171428571428571, 0.942857142857143]];

R4 := [[-14, -21, 14], [0, -175, 70], [0, 0, -35]];

```

Arguments

MatrixSolveQR A [$\backslash A_m$] [$\backslash A_n$] Q R

A

Data type: array of dnum

A is a matrix with the dimensions m * n, where m is the number of rows, and n is the number of columns.

[$\backslash A_m$]

Data type: num

With the optional argument A_m it is possible to specify how many of the rows m in the matrix A that shall be used.

[$\backslash A_n$]

Data type: num

With the optional argument A_n it is possible to specify how many of the columns n in the matrix A that shall be used.

Q

Data type: array of dnum

Orthogonal (m x m) matrix. This is a matrix variable where the result of the calculation is stored.

R

Data type: array of dnum

(m x n) upper-triangular matrix. This is a matrix variable where the result of the calculation is stored.

Continues on next page

1 Instructions

1.135 MatrixSolveQR - Computes a QR-factorization

RobotWare Base

Continued

Program execution

MatrixSolveQR computes a QR-factorization of an (m x n) matrix A so that $A=Q \cdot R$, where Q is an (m x m) orthogonal matrix and R is an (m x n) upper triangular matrix.

If using the optional arguments A_m and A_n it is possible to use the same matrix for many different calculations that use different sizes of the matrix.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

ERR_ARRAY_SIZE	Wrong dimensions or wrong values on optional arguments are used.

Limitations

When solving large matrixes the allocated memory may not be enough to complete the current calculation and an event log is reported. The allocated memory size is fixed and cannot be changed. Try solving smaller sizes of the matrix.

Syntax

```
MatrixSolveQR
[ A ':' ] < array {*}{*} expression (IN) of dnum >
[ '\ ' A_m ':' ] < expression (IN) of num > ]
[ '\ ' A_n ':' ] < expression (IN) of num > ] ', '
[ Q ':' ] < array variable {*}{*} (VAR) of dnum > ', '
[ R ':' ] < array variable {*}{*} (VAR) of dnum > ';' ;
```

Related information

For information about	See
Solve a linear equation system.	MatrixSolve - Solve a linear equation system on page 362
Compute a singular value decomposition.	MatrixSVD - Computes a singular value decomposition on page 370
Mathematical instructions and functions.	Technical reference manual - RAPID Overview

1.136 MatrixSub - Calculates the difference between two matrices

Usage

MatrixSub is used to calculate the difference of two matrices.

Basic examples

The following examples illustrate the instruction MatrixSub.

Example 1

```

VAR dnum A1{2, 2}:=[[1, 5], [-4, 3]];
VAR dnum B1{2, 2}:=[[2, -1], [4, -1]];
VAR dnum Result1{2, 2};
..
MatrixSub A1, B1, Result1;
FOR i FROM 1 TO Dim(Result1,1) DO
  FOR j FROM 1 TO Dim(Result1,2) DO
    Write output, ValToStr(Result1{i,j})+" " \NoNewLine;
  ENDFOR
  Write output, "";
ENDFOR

```

In the example above values in B1 matrix is subtracted from the values in A1 matrix and the result is stored in matrix Result1. The content of Result1 is then written to a file. The output will be:

```

-1 6
-8 4

```

Example 2

```

VAR dnum A2{3, 3}:=[[1, 5, 0], [-4, 3, 9], [4, -3, 2]];
VAR dnum B2{3, 3}:=[[2, -1, -2], [4, -1, 2], [5, 8, 6]];
VAR dnum Result2{2, 2};
..
MatrixReset Result2;
MatrixSub A2 \A_m:=2 \A_n:=2, B2, Result2;
FOR i FROM 1 TO Dim(Result2,1) DO
  FOR j FROM 1 TO Dim(Result2,2) DO
    Write output, ValToStr(Result2{i,j})+" " \NoNewLine;
  ENDFOR
  Write output, "";
ENDFOR

```

In the example above values in B1 matrix is subtracted from the values in A1 matrix and the result is stored in matrix Result2. Only 2 rows and 2 columns in the A2 and B2 matrices will be considered. The result matrix will be a 2*2 matrix and can be stored in the Result2 matrix. The content of Result2 is then written to a file. The output will be:

```

-1 6
-8 4

```

Continues on next page

1 Instructions

1.136 MatrixSub - Calculates the difference between two matrices

RobotWare Base

Continued

Arguments

MatrixSub A [$\backslash$ A_m] [$\backslash$ A_n] B Result

A

Data type: array of dnum

A is a matrix with the dimensions $m \times n$, where m is the number of rows, and n is the number of columns of the matrix.

[$\backslash$ A_m]

Data type: num

With the optional argument A_m it is possible to specify how many of the rows (m) in the matrix A (and matrix B) that should be used.

[$\backslash$ A_n]

Data type: num

With the optional argument A_n it is possible to specify how many of the columns (n) in the matrix A (and matrix B) that should be used.

B

Data type: array of dnum

B is a matrix with the dimensions $m \times n$, where m is the number of rows, and n is the number of columns of the matrix. The rows and columns of B must be at least as big as rows and columns in A, or the values used in optional arguments A_m and A_n.

Result

Data type: array of dnum

This is an array variable where the result of the calculation is stored, with the dimensions $m \times n$, where m is the number of rows, and n is the number of columns of the matrix. The rows and columns of Result must be at least as big as rows and columns in A, or the values used in optional arguments A_m and A_n.

Program execution

MatrixSub is used to subtract a matrix from another matrix. A matrix can only be subtracted from another matrix if the two matrices have the same dimensions, and the result will be a matrix with same dimensions as A.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_ARRAY_SIZE	Wrong dimensions or wrong values on optional arguments are used.

Syntax

```
MatrixSub
[ A ':=' ] < array {*}{*} expression (IN) of dnum >
[ '\ ' A_m ':=' < expression (IN) of num > ]
[ '\ ' A_n ':=' < expression (IN) of num > ] ', '
```

Continues on next page

1.136 MatrixSub - Calculates the difference between two matrices

RobotWare Base

Continued

```
[ B ':' ] < array {*} expression (IN) of dnum >
[ Result ':' ] < array variable {*} (VAR) of dnum > ';'

```

Related information

For information about	See
MatrixAdd	MatrixAdd - Calculates the sum of two matrices on page 348
MatrixInverse	MatrixInverse - Inverse a matrix on page 351
MatrixMult	MatrixMult - Multiply a matrix with a matrix, scalar, or vector on page 354
MatrixReset	MatrixReset - Set all elements in a matrix to 0 on page 360
MatrixTranspose	MatrixTranspose - Transpose a matrix on page 373
Mathematical instructions and functions.	Technical reference manual - RAPID Overview

1 Instructions

1.137 MatrixSVD - Computes a singular value decomposition

RobotWare Base

1.137 MatrixSVD - Computes a singular value decomposition

Usage

MatrixSVD is used to compute a singular value decomposition (SVD).

The singular value decomposition (SVD) is a factorization of a real matrix, with many useful applications in signal processing and statistics.

Basic examples

The following example illustrates the instruction MatrixSVD.

Example 1

```
VAR dnum A3{7,5}:=[ [32,5,30,-47,16], [41,46,-36,35,-33],  
  [-38,47,-8,44,21], [42,-35,42,18,-47], [13,48,30,26,-23],  
  [-41,46,46,25,-46], [-22,-1,16,-11,-41]];
```

```
VAR dnum U3{7,7};
```

```
VAR dnum S3{5};
```

```
VAR dnum V3{5,5};
```

```
MatrixSVD A3, U3, S3, V3;
```

Instruction MatrixSVD is used to compute a singular value decomposition. The result of the calculation is:

```
U3 := [ [-0.24489453114765, -0.241308890179438, -0.0602284681243788,  
  -0.835993641906923, -0.0767894261551876, 0.240015157740137,  
  0.340264541994411], [0.36884312087718, -0.011165754164993,  
  0.807113814553714, -0.0174513269190971, -0.383355889416929,  
  0.231289898525022, 0.107870591684966], [0.421298684810973,  
  0.496825721418653, -0.0754892815524551, -0.0380766666594926,  
  0.433352499740395, 0.0439085586237023, 0.615467956914505],  
  [0.026022505267863, -0.748510046516493, 0.145750281133738,  
  0.297910761636627, 0.491463032720705, 0.125969427524946,  
  0.267688931284032], [0.44990665677733, -0.194363365765786,  
  0.11415708386435, -0.406351234561054, 0.210650943912061,  
  -0.684691075563818, -0.261683066861719], [0.634107267122289,  
  -0.191796131356257, -0.458818389285907, -0.058536500937226,  
  -0.126605540694026, 0.499569153226195, -0.285627519159172],  
  [0.145957672500732, -0.24490688904148, -0.307330264960591,  
  0.205089199291144, -0.597836567476733, -0.390807165865741,  
  0.521598216836665]];
```

```
S3 := [128.223078192708, 106.345877681972, 86.7728210622664,  
  62.5176992467654, 42.2777876032412];
```

```
V3 := [ [-0.241697068016687, -0.449209801318353, 0.774566517264602,  
  -0.334347996967586, 0.16748495146732], [0.664865161158152,  
  0.281358669789186, 0.148180746944642, -0.633450002424302,  
  -0.235743880251818], [0.172346698575578, -0.571920245958167,  
  -0.538598865014224, -0.371678506044732, 0.463648787880432],  
  [0.541008847671309, 0.114564782377902, 0.291104463782398,  
  0.449207178575608, 0.638479004558623], [-0.420883460142759,  
  0.61549167032206, -0.0570844141501356, -0.383432536716582,  
  0.541985217686462]];
```

Continues on next page

Arguments

MatrixSVD A [\A_m] [\A_n] U S V [\Econ]

A

Data type: array of dnum

A is a matrix with the dimensions $m \times n$, where m is the number of rows, and n is the number of columns.

[\A_m]

Data type: num

With the optional argument A_m it is possible to specify how many of the rows m in the matrix A that shall be used.

[\A_n]

Data type: num

With the optional argument A_n it is possible to specify how many of the columns n in the matrix A that shall be used.

U

Data type: array of dnum

U is the left singular vectors of A, stored as an $m \times kk$ matrix, where kk is equal to the columns of the A matrix (or A_n) if the \Econ switch is used, otherwise it is the same as the rows of the A matrix (or A_m). This is a matrix variable where the result of the calculation is stored. If using a matrix with bigger dimension than the rows (m) and columns (n) of matrix A, the components above m and n will be set to 0.

S

Data type: array of dnum

S is an array with the dimension $\text{MIN}(A\_m, A\_n)$ with values ≥ 0 . This is an array variable where the result of the calculation is stored. If using an array with bigger dimension than needed, the components above n will be set to 0.

V

Data type: array of dnum

V is the right singular vectors of A stored as a $n \times n$ matrix.

[\Econ]

(Economy size)

Data type: switch

If \Econ is used and $m > n$, then only the n first singular vectors of U are calculated.

Program execution

MatrixSVD is used to compute a singular value decomposition (SVD) of the $(m \times n)$ input matrix A.

An SVD of a matrix A can be written as $A=U \cdot S \cdot V^T$, where U is $(m \times m)$ (left singular vectors), V is $(n \times n)$ (right singular vectors) and S is an $(m \times n)$ diagonal matrix with non-negative elements. The diagonal elements are the singular values of A.

Continues on next page

1 Instructions

1.137 MatrixSVD - Computes a singular value decomposition

RobotWare Base

Continued

To save space, only the singular values of S are returned, and not the complete matrix. So S is represented as an array of length MIN(m, n). The singular values are always returned in decreasing order.

With $m > n$, further space can be saved by only computing the n first singular vectors of U. This is controlled by using the switch \Econ. Hence, if $m > n$ and \Econ is used, then U is (m x n), otherwise U is (m x m).

If using the optional arguments A_m and A_n it is possible to use the same matrix for many different calculations that use different sizes of the matrix.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_ARRAY_SIZE	Wrong dimensions or wrong values on optional arguments are used.

Limitations

When solving large matrixes the allocated memory may not be enough to complete the current calculation and an event log is reported. The allocated memory size is fixed and cannot be changed. Try solving smaller sizes of the matrix.

Syntax

MatrixSVD

```
[ A ':=' ] < array {*}{*} expression (IN) of dnum >
[ '\ ' A_m ':=' < expression (IN) of num > ]
[ '\ ' A_n ':=' < expression (IN) of num > ] ', '
[ U ':=' ] < array variable {*}{*} (VAR) of dnum > ', '
[ S ':=' ] < array variable {*} (VAR) of dnum > ', '
[ V ':=' ] < array variable {*}{*} (VAR) of dnum >
[ '\ ' Econ ] ';' ;
```

Related information

For information about	See
Solve a linear equation system.	MatrixSolve - Solve a linear equation system on page 362
Compute a QR-factorization	MatrixSolveQR - Computes a QR-factorization on page 365
Mathematical instructions and functions.	Technical reference manual - RAPID Overview

1.138 MatrixTranspose - Transpose a matrix

Usage

MatrixTranspose calculates the transpose of a matrix.

Basic examples

The following examples illustrate the instruction MatrixTranspose.

Example 1

```

VAR dnum A1{3,2}:=[[1, 2], [3, 4], [5, 6]];
VAR dnum Result1{2,3};
..
MatrixTranspose A1, Result1;
FOR i FROM 1 TO Dim(Result1,1) DO
  FOR j FROM 1 TO Dim(Result1,2) DO
    Write output, ValToStr(Result1{i,j})+" " \NoNewLine;
  ENDFOR
  Write output, "";
ENDFOR

```

In the example above a transpose of matrix A1 is done and the result is stored in matrix Result1. The content of Result1 is then written to a file. The output will be:

```

1 3 5
2 4 6

```

Example 2

```

VAR dnum A3{4,3}:=[[1, 2, -1], [3, 4, -2], [5, 6, -3], [7, 8, -4]];
VAR dnum Result3{10,10};
VAR num ResM;
VAR num ResN;
MatrixTranspose A3 \A_m:=3 \A_n:=2, Result3 \Result_m:=ResM
\Result_n:=ResN;
FOR i FROM 1 TO ResM DO
  FOR j FROM 1 TO ResN DO
    Write output, ValToStr(Result3{i,j})+" " \NoNewLine;
  ENDFOR
  Write output, "";
ENDFOR

```

In the example above a transpose of matrix A3 is done and the result is stored in matrix Result3. Only the 3 first rows and 2 first columns in the A3 matrix should be considered. In ResM and ResN, the number of valid rows and columns in the Result3 matrix is returned and can be used when logging to file. The content of Result3 is then written to a file. The output will be:

```

1 3 5
2 4 6

```

Arguments

MatrixTranspose A [\A_m] [\A_n] Result [\Result_m] [\Result_n]

Continues on next page

1 Instructions

1.138 MatrixTranspose - Transpose a matrix

RobotWare Base

Continued

A

Data type: array of dnum

A is a matrix with the dimensions $m \times n$, where m is the number of rows, and n is the number of columns of the matrix.

[\A_m]

Data type: num

With the optional argument A_m it is possible to specify how many of the rows (m) in the matrix A that should be used.

[\A_n]

Data type: num

With the optional argument A_n it is possible to specify how many of the columns (n) in the matrix A that should be used.

Result

Data type: array of dnum

This is an array variable where the result of the calculation is stored. This matrix is often called A^T . If A is a $m \times n$ matrix, the Result matrix must be at least a $n \times m$ matrix.

[\Result_m]

Data type: num

The number of valid rows in the Result matrix.

[\Result_n]

Data type: num

The number of valid columns in the Result matrix.

Program execution

MatrixTranspose is used to transpose a matrix. This function flips the matrix over its diagonal, it switches the row and column indices of the matrix A by producing another matrix, often denoted by A^T .

It is possible to specify that only parts of the matrix A should be used with the optional arguments A_m and A_n.

If A is a $m \times n$ matrix, the Result matrix (transpose matrix) will be a $n \times m$ matrix.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_ARRAY_SIZE	Wrong values on optional arguments are used, or incorrect dimensions of used matrices.

Syntax

MatrixTranspose

[A ':' = '] < array {*}{*} expression (**IN**) of dnum >

['\ ' A_m ':' = ' < expression (**IN**) of num >]

Continues on next page

```
[ '\ ' A_n ':=' < expression (IN) of num > ] ', '
[ Result ':=' ] < array variable {*}{*} (VAR) of dnum >
[ '\ ' Result_m ':=' < variable (VAR) of num > ]
[ '\ ' Result_n ':=' < variable (VAR) of num > ] ';'

```

Related information

For information about	See
MatrixAdd	MatrixAdd - Calculates the sum of two matrices on page 348
MatrixInverse	MatrixInverse - Inverse a matrix on page 351
MatrixMult	MatrixMult - Multiply a matrix with a matrix, scalar, or vector on page 354
MatrixReset	MatrixReset - Set all elements in a matrix to 0 on page 360
MatrixSub	MatrixSub - Calculates the difference between two matrices on page 367
Mathematical instructions and functions.	Technical reference manual - RAPID Overview

1 Instructions

1.139 MechUnitLoad - Defines a payload for a mechanical unit
RobotWare Base

1.139 MechUnitLoad - Defines a payload for a mechanical unit

Usage

MechUnitLoad is used to define a payload for an external mechanical unit, for example positioners. The payload for a robot is defined with the instruction GripLoad.

This instruction should be used for all mechanical units with dynamic model (ABB positioners and track motions) to achieve the best motion performance.

The MechUnitLoad instruction should always be executed after execution of the instruction ActUnit.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Description

MechUnitLoad specifies which loads the mechanical unit are carrying. Specified loads are used in the control system so that the movements of the mechanical unit can be controlled in the best possible way.

The payload is connected/disconnected using the instruction MechUnitLoad, which adds or subtracts the weight of the payload to the weight of the mechanical unit.



WARNING

It is important to always define the actual tool load and, when used, the payload of the robot (for example, a gripped part). Incorrect definitions of load data can result in overloading of the robot mechanical structure. There is also a risk that the speed in manual reduced speed mode can be exceeded.

When incorrect load data is specified, it can often lead to the following consequences:

- The robot may not use its maximum capacity.
- Impaired path accuracy including a risk of overshooting.
- Risk of overloading the mechanical structure.

The controller continuously monitors the load and writes an event log if the load is higher than expected. This event log is saved and logged in the controller memory.



WARNING

The above warning also applies when defining payloads for an external mechanical unit.

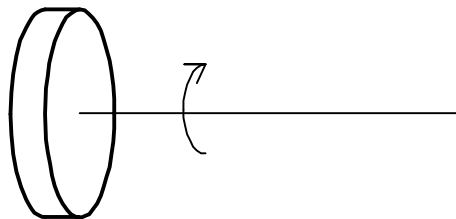
Basic examples

The following examples illustrate the instruction MechUnitLoad:

Continues on next page

Illustration

The following figure shows axis 1 on a mechanical unit named STN1 of type IRBP L.



xx0500002142

Example 1

```
ActUnit STN1;
MechUnitLoad STN1, 1, load0;
```

Activate mechanical unit STN1 and define the payload load0 corresponding to no load (at all) mounted on axis 1.

Example 2

```
ActUnit STN1;
MechUnitLoad STN1, 1, fixture1;
```

Activate mechanical unit STN1 and define the payload fixture1 corresponding to the fixture mounted on axis 1.

Example 3

```
ActUnit STN1;
MechUnitLoad STN1, 1, workpiece1;
```

Activate mechanical unit STN1 and define the payload workpiece1 corresponding to fixture and work piece mounted on axis 1.

Arguments

```
MechUnitLoad MechUnit AxisNo Load
```

MechUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

AxisNo

Axis Number

Data type: num

The axis number within the mechanical unit that holds the load. Axis numbering starts from 1.

Load

Data type: loaddata

The load data that describes the current payload to be defined, that is, the fixture or the fixture together with work piece depending on if the work piece is mounted on the mechanical unit or not.

Continues on next page

1 Instructions

1.139 MechUnitLoad - Defines a payload for a mechanical unit

RobotWare Base

Continued

Program execution

The specified load applies for the next executed movement instruction until a new MechUnitLoad instruction is executed.

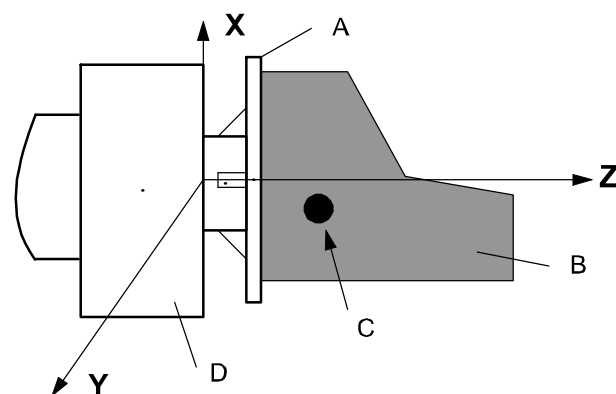
After execution of MechUnitLoad, when the robot and additional axes have come to a standstill, the specified load is defined for the specified mechanical unit and axis. This means that the payload is controlled and monitored by the control system.

The default payload when using the restart mode **Reset system** for a certain mechanical unit type, is the predefined maximal payload for this mechanical unit type.

When another payload is used, the actual payload for the mechanical unit and axis should be redefined with this instruction. This should always be done after activation of the mechanical unit.

The defined payload will survive a restart. The defined payload will also survive a restart of the program after manual activation of other mechanical units from the jogging window.

The following graphic shows a payload mounted on the end-effector of a mechanical unit (end-effector coordinate system for the mechanical unit).



xx0500002143

A	End-effector
B	Fixture and work piece
C	Center of gravity for the payload (fixture + work piece)
D	Mechanical unit

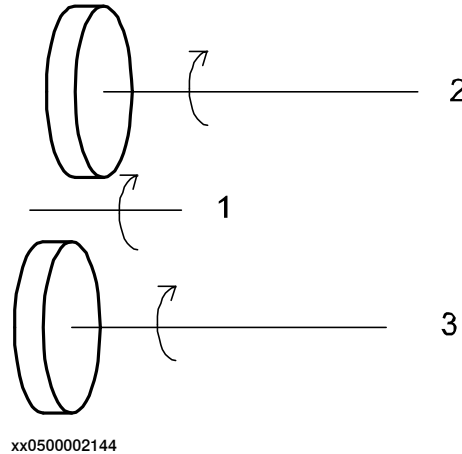
More examples

More examples of how to use the instruction MechUnitLoad are illustrated below.

Continues on next page

Illustration

The following figure shows a mechanical unit named INTERCH of type IRBP K with three axes (1, 2, and 3).



Example 1

```
MoveL homeside1, v1000, fine, gun1;
...
ActUnit INTERCH;
```

The whole mechanical unit INTERCH is activated.

Example 2

```
MechUnitLoad INTERCH, 2, workpiece1;
```

Defines payload workpiece1 on the mechanical unit INTERCH axis 2.

Example 3

```
MechUnitLoad INTERCH, 3, workpiece2;
```

Defines payload workpiece2 on the mechanical unit INTERCH axis 3.

Example 4

```
MoveL homeside2, v1000, fine, gun1;
```

The axes of the mechanical unit INTERCH move to the switch position homeside2 with mounted payload on both axes 2 and 3.

Example 5

```
ActUnit STN1;
MechUnitLoad STN1, 1, workpiece1;
```

The mechanical unit STN1 is activated. Defines payload workpiece1 on the mechanical unit STN1 axis 1.

Limitations

If this instruction is preceded by a move instruction, that move instruction must be programmed with a stop point (zonedata fine), not a fly-by point. Otherwise restart after power failure will not be possible.

MechUnitLoad cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart or Step.

Continues on next page

1 Instructions

1.139 MechUnitLoad - Defines a payload for a mechanical unit

RobotWare Base

Continued

Syntax

```
MechUnitLoad
  [MechUnit ':= ' ] <variable (VAR) of mecunit> ', '
  [AxisNo ':= ' ] <expression (IN) of num> ', '
  [Load ':= ' ] <persistent (PERS) of loaddata> ';' ;
```

Related information

For information about	See
Identification of payload for external mechanical units	<i>Product manual - Product.ProductName /D2009</i>
Definition of mechanical unit data	<i>mecunit - Mechanical unit on page 1672</i>
Definition of load data	<i>loaddata - Load data on page 1664</i>
Define payload for the robot	<i>GripLoad - Defines the payload for a robot on page 239</i>

1.140 MotionProcessModeSet - Set motion process mode

Usage

MotionProcessModeSet is used to set the motion process mode (*Motion Process Mode*) for a TCP robot.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in any motion tasks.

Basic examples

The following example illustrates the instruction MotionProcessModeSet:

```
MotionProcessModeSet OPTIMAL_CYCLE_TIME_MODE;
! Do cycle-time critical movement
..
MotionProcessModeSet ACCURACY_MODE;
! Do cutting with high accuracy
..
```

Changing the motion process mode used for the TCP robot in run time.

Arguments

MotionProcessModeSet Mode

Mode

Data type: motionprocessmode

The motion process mode to be used. It is an integer constant of data type motionprocessmode.

Program execution

The motion process mode applies for the TCP robot until a new MotionProcessModeSet instruction is executed, see [Related information on page 382](#).

The default configured value for motion process mode is automatically set:

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Continues on next page

1 Instructions

1.140 MotionProcessModeSet - Set motion process mode

Advanced Robot Motion

Continued

Predefined data

The following symbolic constants of the data type `motionprocessmode` are predefined and can be used to specify the integer in argument `Mode`.

The default mode is defined by the system parameter *Use Motion Process Mode* in type *Robot*, topic *Motion*.

Symbolic constant	Constant value	Description
OPTIMAL_CYCLE_TIME_MODE	1	This mode gives the shortest possible cycle time.
LOW_SPEED_ACCURACY_MODE	2	This mode improves path accuracy mainly for large robots.
LOW_SPEED_STIFF_MODE	3	This mode is recommended for low speed contact applications where maximum servo stiffness is important.
ACCURACY_MODE	4	This mode improves path accuracy mainly for small robots.
MPM_USER_MODE_1	5	User defined modes.
MPM_USER_MODE_2	6	
MPM_USER_MODE_3	7	
MPM_USER_MODE_4	8	
PRESS_TENDING_MODE	9	Primarily intended for flexible grippers in press tending applications.
COLLABORATIVE_MODE	10	Intended for GoFa robots

Limitations

The mode can only be changed when the robot is standing still, otherwise a fine point is enforced.

Syntax

```
MotionProcessModeSet  
[Mode ':='] <expression (IN) of motionprocessmode>;'
```

Related information

For information about	See
Advanced robot motion	<i>Application manual - Controller software Omni-Core</i>
Configuration of <i>Motion Process Mode</i> parameters.	<i>Technical reference manual - System parameters</i>
Tuning servos.	TuneServo - Tuning servos on page 954

1.141 MotionSup - Deactivates/Activates motion supervision

Usage

MotionSup (*Motion Supervision*) is used to deactivate or activate the motion supervision function for robot movements during program execution.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Description

Motion supervision is the name of a collection of functions for high sensitivity, model-based supervision of the robot. It contains the function for joint load supervision, joint collision supervision, and collision detection. Because the supervision is designed to be very sensitive it may trigger if there are large process forces acting on the robot.

If the load is not correctly defined, use the load identification service routine to specify it. If large external process forces are present in most parts of the application, such as during deburring, then use the system parameters to raise the supervision level of the motion supervision until it no longer triggers. If, the external forces are only temporary, such as during the closing of a large spotweld gun, then the MotionSup instruction should be used to raise the supervision level (or turn the function off) for those parts of the application where the disturbance acts.

Basic examples

The following example illustrates the instruction MotionSup:

Example 1

```

! If the motion supervision is active in the system parameters,
! then it is active by default during program execution
...
! If motion supervision is deactivated in the system parameters
! then it cannot be activated using the MotionSup instruction
...
! Deactivate motion supervision during program execution
MotionSup \Off;
...
! Activate motion supervision again during program execution
MotionSup \On;
...
! Tune the supervision level to 200% (makes the function less
! sensitive) of the level in
! the system parameters
MotionSup \On \TuneValue:= 200;
...
! Activate motion supervision again.
! No back off at a motion collision
MotionSup \On \NoBackoff;

```

Continues on next page

1 Instructions

1.141 MotionSup - Deactivates/Activates motion supervision

Collision Detection

Continued

Arguments

MotionSup[\On] | [\Off] [\TuneValue] [\NoBackoff]

[\On]

Data type: switch

Activate the motion supervision function during program execution (if it has already been activated in system parameters).

[\Off]

Data type: switch

Deactivate the motion supervision function during program execution.

One of the arguments \On or \Off must be specified.

[\TuneValue]

Data type: num

Tuning the motion supervision sensitivity level in percent (1 - 300%) of system parameter level. A higher level gives more robust sensitivity. This argument can only be combined with argument \On.

[\NoBackoff]

Data type: switch

If this switch is used, the robot does not back off at a motion collision. This argument can only be combined with argument \On.

Program execution

The specified motion supervision applies for the next executed movement instruction until a new MotionSup instruction is executed.

If the motion supervision function is active both in the system parameters and in the RAPID program, and the motion supervision is triggered because of a collision, then

- the robot will stop as quickly as possible
- the robot will back up to remove any residual forces (if \NoBackoff switch has not been used on last MotionSup instruction)
- the program execution will stop with an error message

If motion supervision is active in system parameters it is then active by default during program execution (TuneValue: =100, and back up to remove any residual forces). These values are set automatically

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Continues on next page

Limitations

- Motion supervision is never active for external axes or when one or more joints are run in independent joint mode. When using the robot in the soft servo mode it may be necessary to turn the motion supervision off to avoid accidental tripping.
- If motion supervision is deactivated in the system parameters, then it cannot be activated using the MotionSup instruction.

Syntax

```

MotionSup
[ '\ ' On ] | [ '\ ' Off ]
[ '\ ' Tunevalue':='< expression (IN) of num> ]
[ '\ ' NoBackoff ] ';'

```

Related information

For information about	See
Motion settings data	motsetdata - Motion settings data on page 1674
General description of the function	<i>Technical reference manual - RAPID Overview</i>
Tuning using system parameters	<i>Technical reference manual - System parameters</i>
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>

1 Instructions

1.142 MoveAbsJ - Moves the robot to an absolute joint position *RobotWare Base*

1.142 MoveAbsJ - Moves the robot to an absolute joint position

Usage

MoveAbsJ (*Move Absolute Joint*) is used to move the robot and external axes to an absolute position defined in axes positions. For example, if the end point is a singular point

The final position of the robot during a movement with MoveAbsJ is neither affected by the given tool and work object nor by active program displacement. The robot uses this data to calculate the load, TCP velocity, and the corner path. The same tools can be used in adjacent movement instructions.

The robot and external axes move to the destination position along a non-linear path. All axes reach the destination position at the same time.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following examples illustrate the instruction MoveAbsJ:

See also [More examples on page 390](#).

Example 1

```
MoveAbsJ p50, v1000, z50, tool2;
```

The robot with the tool `tool2` is moved along a non-linear path to the absolute axis position, `p50`, with velocity data `v1000` and zone data `z50`.

Example 2

```
MoveAbsJ *, v1000\T:=5, fine, grip3;
```

The robot with the tool `grip3` is moved along a non-linear path to a stop point which is stored as an absolute axis position in the instruction (marked with an `*`). The entire movement takes 5 seconds.

Arguments

```
MoveAbsJ [\Conc] ToJointPos [\ID] [\NoEOffs] Speed [\V] | [\T]  
[\KeepStartPath] [\KeepEndPath] Zone [\Z] [\Inpos] Tool  
[\WObj] [\TLoad]
```

[\Conc]

Concurrent

Data type: switch

Subsequent instructions are executed while the robot is moving. The argument is usually not used but can be used to avoid unwanted stops caused by overloaded CPU when using fly-by points. This is useful when the programmed points are very close together at high speeds. The argument is also useful when, for example, communicating with external equipment and synchronization between the external equipment and robot movement is not required.

Using the argument `\Conc`, the number of movement instructions in succession is limited to 5. In a program section that includes `StorePath-RestoPath`, movement instructions with the argument `\Conc` are not permitted.

Continues on next page

1.142 MoveAbsJ - Moves the robot to an absolute joint position

RobotWare Base

Continued

If this argument is omitted and the ToPoint is not a stop point then the subsequent instruction is executed some time before the robot has reached the programmed zone.

This argument cannot be used in coordinated synchronized movement in a MultiMove system.

ToJointPos

Data type: jointtarget

The destination absolute joint position of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

[\NoEOffs]

No External Offsets

Data type: switch

If the argument \NoEOffs is set then the movement with TriggAbsJ is not affected by active offsets for external axes.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

[\V]

Velocity

Data type: num

This argument is used to specify the velocity of the TCP in mm/s directly in the instruction. It is then substituted for the corresponding velocity specified in the speed data.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when

Continues on next page

1 Instructions

1.142 MoveAbsJ - Moves the robot to an absolute joint position

RobotWare Base

Continued

the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

`\KeepStartPath`

Data type: num

If the move instruction starts from a fine point, `\KeepStartPath` defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, `\KeepStartPath` is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

`\KeepEndPath`

Data type: num

If the move instruction ends in a fine point, `\KeepEndPath` defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, `\KeepEndPath` is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[`\Z`]

Zone

Data type: num

This argument is used to specify the position accuracy of the robot TCP directly in the instruction. The length of the corner path is given in mm, which is substituted for the corresponding zone specified in the zone data.

[`\Inpos`]

In position

Data type: stoppoint data

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[`\WObj`]

Work Object

Data type: wobjdata

Continues on next page

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used this argument must be specified in order for a circle relative to the work object to be executed.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

A movement with MoveAbsJ is not affected by active program displacement and if executed with switch \NoEOFFs there will be no offset for external axes. Without switch \NoEOFFs the external axes in the destination target are affected by active offset for external axes.

The tool is moved to the destination absolute joint position with interpolation of the axis angles. This means that each axis is moved with constant axis velocity and that all axes reach the destination joint position at the same time, which results in a non-linear path.

Generally speaking, the TCP is moved at approximate programmed velocity. The tool is reoriented and the external axes are moved at the same time as the TCP moves. If the programmed velocity for reorientation or for the external axes cannot be attained, the velocity of the TCP will be reduced.

Continues on next page

1 Instructions

1.142 MoveAbsJ - Moves the robot to an absolute joint position

RobotWare Base

Continued

A corner path is usually generated when movement is transferred to the next section of the path. If a stop point is specified in the zone data program execution only continues when the robot and external axes have reached the appropriate joint position.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CONC_MAX	The number of movement instructions in succession using argument \Conc has been exceeded.

More examples

More examples of how to use the instruction MoveAbsJ are illustrated below.

Example 1

```
MoveAbsJ *, v2000\V:=2200, z40 \Z:=45, grip3;
```

The tool, grip3, is moved along a non-linear path to an absolute joint position stored in the instruction. The movement is carried out with data set to v2000 and z40. The velocity and zone size of the TCP are 2200 mm/s and 45 mm respectively.

Example 2

```
MoveAbsJ p5, v2000, fine \Inpos := inpos50, grip3;
```

The tool, grip3, is moved along a non-linear path to an absolute joint position p5. The robot considers it to be in the point when 50% of the position condition and 50% of the speed condition for a stop point fine are satisfied. It waits at most for 2 seconds for the conditions to be satisfied. See predefined data inpos50 of data type stoppointdata.

Example 3

```
MoveAbsJ \Conc, *, v2000, z40, grip3;
```

The tool, grip3, is moved along a non-linear path to an absolute joint position stored in the instruction. Subsequent logical instructions are executed while the robot moves.

Example 4

```
MoveAbsJ \Conc, * \NoEOffs, v2000, z40, grip3;
```

Same movement as above but the movement is not affected by active offsets for external axes.

Example 5

```
GripLoad obj_mass;  
MoveAbsJ start, v2000, z40, grip3 \Wobj:= obj;
```

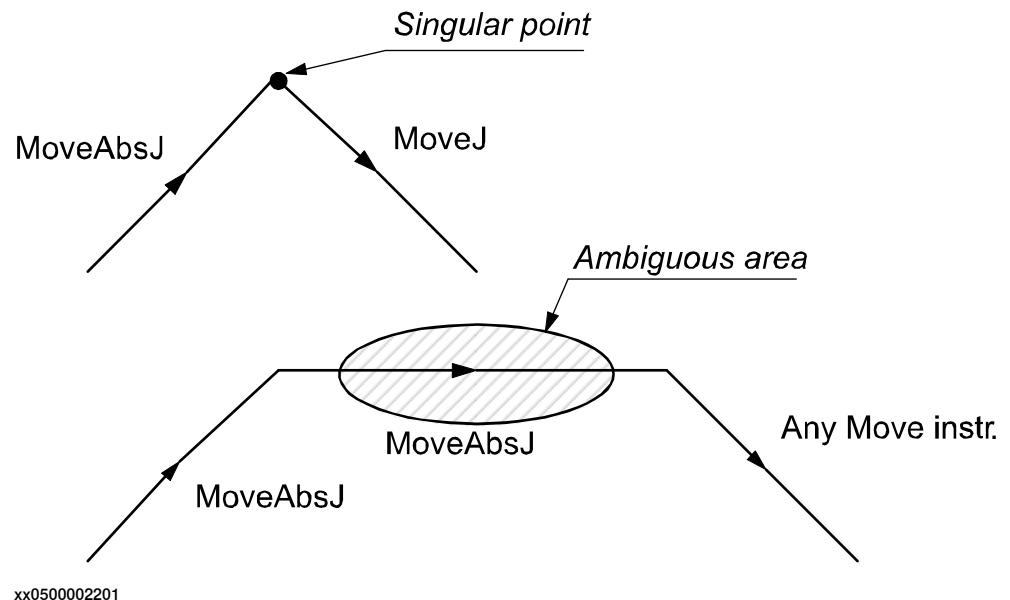
The robot moves the work object obj in relation to the fixed tool grip3 along a non-linear path to an absolute axis position start.

Continues on next page

Limitations

To run backwards with the instruction MoveAbsJ involved and avoiding problems with singular points or ambiguous areas, it is essential that the subsequent instructions fulfil certain requirements as follows (see figure below).

The figure shows limitation for backward execution with MoveAbsJ.



MoveAbsJ cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```

MoveAbsJ
['\ ' Conc ',']
[ToJointPos ':=' ] <expression (IN) of jointtarget>
['\ ' ID ':=' ] <expression (IN) of identno>
['\ ' NoEoffs'],'
[Speed ':=' ] <expression (IN) of speeddata>
['\ ' V ':=' ] <expression (IN) of num>
|['\ ' T ':=' ] <expression (IN) of num>
['\ ' KeepStartPath ':=' ] <expression (IN) of num>
['\ ' KeepEndPath ':=' ] <expression (IN) of num>','
[Zone ':=' ] <expression (IN) of zonedata>
['\ ' Z ':=' ] <expression (IN) of num >
['\ ' Inpos ':=' ] <expression (IN) of stoppointdata>','
[Tool ':=' ] <persistent (PERS) of tooldata>
['\ ' WObj ':=' ] <persistent (PERS) of wobjdata>
['\ ' TLoad ':=' ] <persistent (PERS) of loaddata>';'

```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>

Continues on next page

1 Instructions

1.142 MoveAbsJ - Moves the robot to an absolute joint position

RobotWare Base

Continued

For information about	See
Definition of jointtarget	jointtarget - Joint position data on page 1661
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of stop point data	stoppointdata - Stop point data on page 1733
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	Technical reference manual - RAPID Overview
Concurrent program execution	Technical reference manual - RAPID Overview
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	Operating manual - OmniCore
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	Technical reference manual - System parameters
System parameter <i>ModalPayloadMode</i> for activating and deactivating payload.	Technical reference manual - System parameters

1.143 MoveAbsL - Moves the robot to an absolute joint position

Usage

MoveAbsL is an encapsulation of the MoveL instruction, but the destination point is a `jointtarget` instead of a `robtarg`. It is used to move the tool center point (TCP) linearly to a given destination.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following examples illustrate the instruction MoveAbsL:

```
MoveAbsL jpos10, v1000, z30, tool2;
```

The TCP of the tool, `tool2`, is moved linearly to the absolute axis position, `jpos10`, with speed data `v1000` and zone data `z30`.

Arguments

```
MoveAbsL [\Conc] ToJointPos [\ID] Speed [\V] | [ \T]
[\KeepStartPath] [\KeepEndPath] Zone [\Z] [\Inpos] Tool
[\WObj] [\Corr] [\TLoad] [\FollowConveyor]
```

[\Conc]

Concurrent

Data type: switch

Subsequent instructions are executed while the robot is moving. The argument is usually not used but can be used to avoid unwanted stops caused by overloaded CPU when using fly-by points. This is useful when the programmed points are very close together at high speeds. The argument is also useful when, for example, communicating with external equipment and synchronization between the external equipment and robot movement is not required.

Using the argument `\Conc`, the number of movement instructions in succession is limited to 5. In a program section that includes `StorePath-RestoPath`, movement instructions with the argument `\Conc` are not permitted.

If this argument is omitted and the `ToPoint` is not a stop point then the subsequent instruction is executed some time before the robot has reached the programmed zone.

This argument cannot be used in coordinated synchronized movement in a *MultiMove* system.

ToJointPos

Data type: `jointtarget`

The destination absolute joint position of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Continues on next page

1 Instructions

1.143 MoveAbsL - Moves the robot to an absolute joint position

RobotWare Base

Continued

Data type: identno

The argument [\ID] is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

[\V]

Velocity

Data type: num

This argument is used to specify the velocity of the TCP in mm/s directly in the instruction. It is then substituted for the corresponding velocity specified in the speed data.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Continues on next page

1.143 MoveAbsL - Moves the robot to an absolute joint position

RobotWare Base

Continued

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Z]

Zone

Data type: num

This argument is used to specify the position accuracy of the robot TCP directly in the instruction. The length of the corner path is given in mm, which is substituted for the corresponding zone specified in the zone data.

[\Inpos]

In position

Data type: stoppoint data

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[\WObj]

Work Object

Data type: wobjdata

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used this argument must be specified in order for a circle relative to the work object to be executed.

[\Corr]

Correction

Data type: switch

Correction data written to a corrections entry by the instruction CorrWrite will be added to the path and destination position if this argument is present.

The RobotWare option *Path Corrections* is required when using this argument.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

Continues on next page

1 Instructions

1.143 MoveAbsL - Moves the robot to an absolute joint position

RobotWare Base

Continued

To be able to use the `\TLoad` argument it is necessary to set the value of the system parameter `ModalPayloadMode` to 0. If `ModalPayloadMode` is set to 0, it is no longer possible to use the instruction `GripLoad`.

The total load can be identified with the service routine `LoadIdentify`. If the system parameter `ModalPayloadMode` is set to 0, the operator has the possibility to copy the `loaddata` from the tool to an existing or new `loaddata` persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input `SimMode` (Simulated Mode). If the digital input signal is set to 1, the `loaddata` in the optional argument `\TLoad` is not considered, and the `loaddata` in the current `tooldata` is used instead.



Note

The default functionality to handle payload is to use the instruction `GripLoad`. Therefore the default value of the system parameter `ModalPayloadMode` is 1.

[`\FollowConveyor`]

Data type: switch

If running coordinated movement with conveyor and there is an unexpected fine point (corner path executed as stop point, event logs 50024 or 50124), this switch parameter will specify that the robot will use a coordinated fine point instead of a stationary fine point. As a result, the robot will not stop and will follow the conveyor.

Program execution

The robot and external units are moved to the destination position as follows:

- The TCP of the tool is moved linearly at constant programmed velocity.
- The tool is reoriented at equal intervals along the path.
- Uncoordinated external axes are executed at a constant velocity in order for them to arrive at the destination point at the same time as the robot axes.

If it is not possible to attain the programmed velocity for the reorientation or for the external axes, then the velocity of the TCP will be reduced.

A corner path is usually generated when movement is transferred to the next section of a path. If a stop point is specified in the zone data, then program execution only continues when the robot and external axes have reached the appropriate position.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_CONC_MAX</code>	The number of movement instructions in succession using argument <code>\Conc</code> has been exceeded.

Syntax

MoveAbsL

Continues on next page

1.143 MoveAbsL - Moves the robot to an absolute joint position

RobotWare Base

Continued

```

[ '\\' Conc ',' ]
[ ToJointPos ':' < expression (IN) of jointtarget >
[ '\\' ID ':' < expression (IN) of identno > ] ','
[ Speed ':' < expression (IN) of speeddata >
[ '\\' V ':' < expression (IN) of num > ]
| [ '\\' T ':' < expression (IN) of num > ]
[ '\\' KeepStartPath ':' < expression (IN) of num > ]
[ '\\' KeepEndPath ':' < expression (IN) of num > ] ','
[Zone ':' < expression (IN) of zonedata >
[ '\\' Z ':' < expression (IN) of num > ]
[ '\\' Inpos ':' < expression (IN) of stoppointdata > ] ','
[ Tool ':' < persistent (PERS) of tooldata >
[ '\\' WObj ':' < persistent (PERS) of wobjdata > ]
[ '\\' Corr ]
[ '\\' TLoad ':' < persistent (PERS) of loaddata > ]
[ '\\' FollowConveyor ] ';'

```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
MoveL	MoveL - Moves the robot linearly on page 457
MoveAbsJ	MoveAbsJ - Moves the robot to an absolute joint position on page 386

1 Instructions

1.144 MoveC - Moves the robot circularly *RobotWare Base*

1.144 MoveC - Moves the robot circularly

Usage

MoveC is used to move the tool center point (TCP) circularly to a given destination. During the movement the orientation normally remains unchanged relative to the circle.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following examples illustrate the instruction MoveC:

See also [More examples on page 403](#).

Example 1

```
MoveC p1, p2, v500, z30, tool2;
```

The TCP of the tool, `tool2`, is moved circularly to the position `p2` with speed data `v500` and zone data `z30`. The circle is defined from the start position, the circle point `p1`, and the destination point `p2`.

Example 2

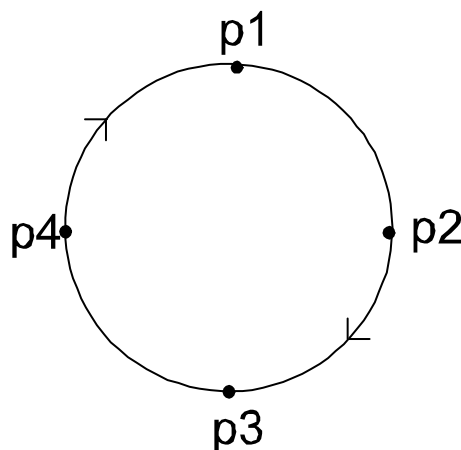
```
MoveC *, *, v500 \T:=5, fine, grip3;
```

The TCP of the tool, `grip3`, is moved circularly to a fine point stored in the instruction (marked by the second `*`). The circle point is also stored in the instruction (marked by the first `*`). The complete movement takes 5 seconds.

Example 3

```
MoveL p1, v500, fine, tool1;  
MoveC p2, p3, v500, z20, tool1;  
MoveC p4, p1, v500, fine, tool1;
```

The figure shows how a complete circle is performed by two MoveC instructions.



xx0500002212

Continues on next page

Arguments

MoveC [\Conc] CirPoint ToPoint [\ID] Speed [\V] | [\T]
 [\KeepStartPath] [\KeepEndPath] Zone [\Z] [\Inpos] Tool
 [\WObj] [\Corr] [\TLoad]

[\Conc]

Concurrent

Data type: switch

Subsequent instructions are executed while the robot is moving. The argument is usually not used but can be used to avoid unwanted stops caused by overloaded CPU when using fly-by points. This is useful when the programmed points are very close together at high speeds. The argument is also useful when, for example, communicating with external equipment and synchronization between the external equipment and robot movement is not required.

Using the argument \Conc, the number of movement instructions in succession is limited to 5. In a program section that includes StorePath-RestPath, movement instructions with the argument \Conc are not permitted.

If this argument is omitted and the ToPoint is not a stop point then the subsequent instruction is executed some time before the robot has reached the programmed zone.

This argument cannot be used in coordinated synchronized movement in a MultiMove system.

CirPoint

Data type: robtarget

The circle point of the robot. The circle point is a position on the circle between the start point and the destination point. To obtain the best accuracy it should be placed about halfway between the start and destination points. If it is placed too close to the start or destination point, the robot may give a warning. The circle point is defined as a named position or stored directly in the instruction (marked with an * in the instruction). The position of the external axes are not used.

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

Continues on next page

1 Instructions

1.144 MoveC - Moves the robot circularly

RobotWare Base

Continued

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

[\V]

Velocity

Data type: num

This argument is used to specify the velocity of the TCP in mm/s directly in the instruction. It is then substituted for the corresponding velocity specified in the speed data.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Z]

Zone

Data type: num

This argument is used to specify the position accuracy of the robot TCP directly in the instruction. The length of the corner path is given in mm, which is substituted for the corresponding zone specified in the zone data.

Continues on next page

[\Inpos]

In position

Data type: stoppoint data

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[\Wobj]

Work Object

Data type: wobjdata

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used this argument must be specified in order for a circle relative to the work object to be executed.

[\Corr]

Correction

Data type: switch

Correction data written to a corrections entry by the instruction CorrWrite will be added to the path and destination position if this argument is present.

The RobotWare option *Path Corrections* is required when using this argument.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

Continues on next page

1 Instructions

1.144 MoveC - Moves the robot circularly

RobotWare Base

Continued

It is possible to test run the program without any payload by using a digital input signal connected to the system input `SimMode` (Simulated Mode). If the digital input signal is set to 1, the `loaddata` in the optional argument `\TLoad` is not considered, and the `loaddata` in the current `tooldata` is used instead.



Note

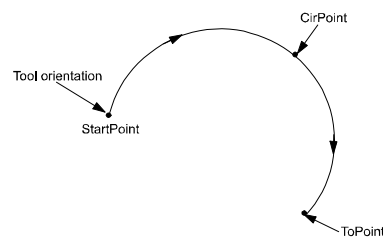
The default functionality to handle payload is to use the instruction `GripLoad`. Therefore the default value of the system parameter `ModalPayloadMode` is 1.

Program execution

The robot and external units are moved to the destination point as follows:

- The TCP of the tool is moved circularly at a constant programmed velocity.
- The tool is reoriented at a constant velocity from the orientation at the start position to the orientation at the destination point.
- The reorientation is performed relative to the circular path. Thus, if the orientation relative to the path is the same at the start and the destination points, the relative orientation remains unchanged during the movement (see figure below).

The figure shows tool orientation during circular movement.



xx0500002214

The orientation in the circle point is not reached. It is only used to distinguish between two possible directions of reorientation. The accuracy of the reorientation along the path depends only on the orientation at the start and destination points. Different modes for tool orientation during circle path are described in instruction `CirPathMode`.

Uncoordinated external axes are executed at constant velocity in order for them to arrive at the destination point at the same time as the robot axes. The position in the circle position is not used.

If it is not possible to attain the programmed velocity for the reorientation or for the external axes, the velocity of the TCP will be reduced.

A corner path is usually generated when movement is transferred to the next section of a path. If a stop point is specified in the zone data, program execution only continues when the robot and external axes have reached the appropriate position.

If the starting point, circle point, and the destination point are collinear, then the `MoveC` instruction will result in a linear movement.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CONC_MAX	The number of movement instructions in succession using argument \Conc has been exceeded.

More examples

More examples of how to use the instruction MoveC are illustrated below.

Example 1

```
MoveC *, *, v500 \V:=550, z40 \Z:=45, grip3;
```

The TCP of the tool, grip3, is moved circularly to a position stored in the instruction. The movement is carried out with data set to v500 and z40; the velocity and zone size of the TCP are 550 mm/s and 45 mm respectively.

Example 2

```
MoveC p5, p6, v2000, fine \Inpos := inpos50, grip3;
```

The TCP of the tool, grip3, is moved circularly to a stop point p6. The robot considers it to be in the point when 50% of the position condition and 50% of the speed condition for a stop point fine are satisfied. It waits at most for 2 seconds for the conditions to be satisfied. See predefined data inpos50 of data type stoppointdata.

Example 3

```
MoveC \Conc, *, *, v500, z40, grip3;
```

The TCP of the tool, grip3, is moved circularly to a position stored in the instruction. The circle point is also stored in the instruction. Subsequent logical instructions are executed while the robot moves.

Example 4

```
MoveC cir1, p15, v500, z40, grip3 \Wobj:=fixture;
```

The TCP of the tool, grip3, is moved circularly to a position, p15 via the circle point cir1. These positions are specified in the object coordinate system for fixture.

Continues on next page

1 Instructions

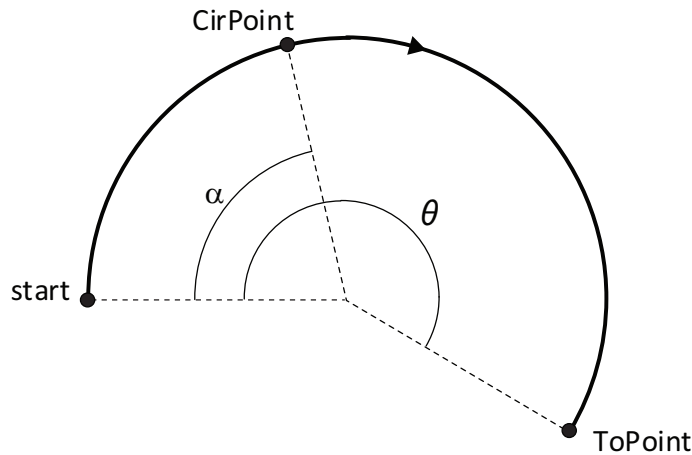
1.144 MoveC - Moves the robot circularly

RobotWare Base

Continued

Limitations

There are some limitations in how the CirPoint and the ToPoint can be placed.



xx1700001575

- Minimum distance between start and ToPoint is 0.1 mm
- Minimum distance between start and CirPoint is 0.1 mm
- Minimum distance between CirPoint and ToPoint is 0.1 mm
- If the system parameter *Restrict placing of circle points* is set to Yes, then the following additional limitations are active:
 - The angle of the circular path (θ in the picture above) may not be larger than 240° .
 - The circle point must be in the middle part of the circular path (α must be 25-75% of θ , according to the picture above).

The accuracy can be poor near the limits, e.g. if the start point and the ToPoint on the circle are close to each other then the fault caused by the leaning of the circle can be much greater than the accuracy with which the points have been programmed.

Ensure that the robot can reach the circle point during program execution and divide the circle movement order if necessary.

A change of execution mode from forward to backward or vice versa while the robot is stopped on a circular path is not permitted and will result in an error message.



WARNING

The instruction MoveC (or any other instruction including circular movement) should never be started from the beginning with TCP between the circle point and the end point. Otherwise the robot will not take the programmed path (positioning around the circular path in another direction compared with that which is programmed).

To minimize the risk, set the system parameter *Restrict placing of circlepoints* to Yes (type *Motion Planner*, topic *Motion*).

Continues on next page

MoveC cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
MoveC
['\ ' Conc ',']
[CirPoint ':='] <expression (IN) of robtarget>', '
[ToPoint ':='] <expression (IN) of robtarget>', '
['\ ' ID ':=' <expression (IN) of identno>'],' '
[Speed ':='] <expression (IN) of speeddata>
['\ ' V ':=' <expression (IN) of num>]
['\ ' T ':=' <expression (IN) of num>]
['\ ' KeepStartPath ':=' <expression (IN) of num>]
['\ ' KeepEndPath ':=' <expression (IN) of num>'],' '
[Zone ':='] <expression (IN) of zonedata>
['\ ' Z ':=' <expression (IN) of num>]
['\ ' Inpos ':=' <expression (IN) of stoppointdata>'],' '
[Tool ':='] <persistent (PERS) of tooldata>
['\ ' WObj ':=' <persistent (PERS) of wobjdata>]
['\ ' Corr]
['\ ' TLoad ':=' <persistent (PERS) of loaddata>'];'
```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of stop point data	stoppointdata - Stop point data on page 1733
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Writes to a corrections entry	CorrWrite - Writes to a correction generator on page 176
Tool reorientation during circle path	CirPathMode - Tool reorientation during circle path on page 129
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Concurrent program execution	<i>Technical reference manual - RAPID Overview</i>
System parameters	<i>Technical reference manual - System parameters</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>

Continues on next page

1 Instructions

1.144 MoveC - Moves the robot circularly

RobotWare Base

Continued

For information about	See
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayloadMode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>
<i>Path Corrections</i>	<i>Application manual - Controller software OmniCore</i>

1.145 MoveCAO - Moves the robot circularly and sets analog output in the corner

RobotWare Base

1.145 MoveCAO - Moves the robot circularly and sets analog output in the corner

Usage

MoveCAO (*Move Circular Analog Output*) is used to move the tool center point (TCP) circularly to a given destination. The specified analog output is set in the middle of the corner path at the destination point. During the movement the orientation normally remains unchanged relative to the circle.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction MoveCAO:

Example 1

```
MoveCAO p1, p2, v500, z30, tool2, ao1, 1.1;
```

The TCP of the tool, tool2, is moved circularly to the position p2 with speed data v500 and zone data z30. The circle is defined from the start position, the circle point p1, and the destination point p2. Output ao1 is set in the middle of the corner path at p2.

Arguments

```
MoveCAO CirPoint ToPoint [\ID] Speed [\T] [\KeepStartPath]
        [\KeepEndPath] Zone Tool [\WObj] Signal Value [\TLoad]
```

CirPoint

Data type: robtarget

The circle point of the robot. The circle point is a position on the circle between the start point and the destination point. To obtain the best accuracy it should be placed about halfway between the start and destination points. If it is placed too close to the start or destination point the robot may give a warning. The circle point is defined as a named position or stored directly in the instruction (marked with an * in the instruction). The position of the external axes are not used.

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Continues on next page

1 Instructions

1.145 MoveCAO - Moves the robot circularly and sets analog output in the corner

RobotWare Base

Continued

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[\Wobj]

Work Object

Data type: wobjdata

The work object (object coordinate system) to which the robot position in the instruction is related.

Continues on next page

1.145 MoveCAO - Moves the robot circularly and sets analog output in the corner

RobotWare Base
Continued

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified in order for a circle relative to the work object to be executed.

Signal

Data type: signalao

The name of the analog output signal to be changed.

Value

Data type: num

The desired value of signal.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See the instruction MoveC for more information about circular movement, [MoveC - Moves the robot circularly on page 398](#).

The analog output signal is set in the middle of the corner path for flying points, as shown in figure below.

The figure shows set of analog output signal in the corner path with MoveCA0.

```
MoveCA0 p2, p2, v500, z30, tool2, ao1, 1.1;
```

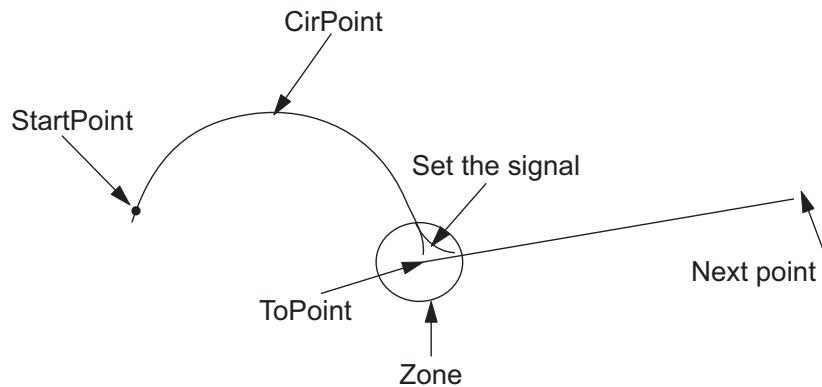
Continues on next page

1 Instructions

1.145 MoveCAO - Moves the robot circularly and sets analog output in the corner

RobotWare Base

Continued



xx1400001116

For stop points we recommend the use of "normal" programming sequence with MoveC and SetA0. But when using stop point in instruction MoveCA0 the analog output signal is set when the robot reaches the stop point.

The specified I/O signal is set in execution mode continuously and stepwise forward, but not in stepwise backward.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_A0_LIM	The programmed Value argument for the specified analog output signal Signal is outside limits.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Limitations

General limitations according to instruction MoveC, see [MoveC - Moves the robot circularly on page 398](#).

MoveCA0 cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
MoveCA0
[CirPoint ':='] <expression (IN) of robtarg>','
[ToPoint ':='] <expression (IN) of robtarg>','
['\ ' ID ':=' <expression (IN) of identno>'],'
[Speed ':='] <expression (IN) of speeddata>
['\ ' T ':=' <expression (IN) of num>]
['\ ' KeepStartPath ':=' <expression (IN) of num>]
```

Continues on next page

1.145 MoveCAO - Moves the robot circularly and sets analog output in the corner

RobotWare Base

Continued

```
[ '\ ' KeepEndPath ':=' <expression (IN) of num> ], '
[ Zone ':=' ] <expression (IN) of zonedata> ', '
[ Tool ':=' ] <persistent (PERS) of tooldata>
[ '\ ' WObj ':=' <persistent (PERS) of wobjdata> ], '
[ Signal ':=' ] <variable (VAR) of signalao> ', '
[ Value ':=' ] <expression (IN) of num>
[ '\ ' TLoad ':=' <persistent (PERS) of loaddata> ]; '
```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Move the robot circularly	MoveC - Moves the robot circularly on page 398
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Movements with I/O settings	<i>Technical reference manual - RAPID Overview</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayLoad-Mode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>

1 Instructions

1.146 MoveCDO - Moves the robot circularly and sets digital output in the corner
RobotWare Base

1.146 MoveCDO - Moves the robot circularly and sets digital output in the corner

Usage

MoveCDO (*Move Circular Digital Output*) is used to move the tool center point (TCP) circularly to a given destination. The specified digital output is set/reset in the middle of the corner path at the destination point. During the movement the orientation normally remains unchanged relative to the circle.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction MoveCDO:

Example 1

```
MoveCDO p1, p2, v500, z30, tool2, do1,1;
```

The TCP of the tool, `tool2`, is moved circularly to the position `p2` with speed data `v500` and zone data `z30`. The circle is defined from the start position, the circle point `p1`, and the destination point `p2`. Output `do1` is set in the middle of the corner path at `p2`.

Arguments

```
MoveCDO CirPoint ToPoint [\ID] Speed [\T] [\KeepStartPath]  
[\KeepEndPath] Zone Tool [\WObj] Signal Value [\TLoad]
```

CirPoint

Data type: robtarget

The circle point of the robot. The circle point is a position on the circle between the start point and the destination point. To obtain the best accuracy it should be placed about halfway between the start and destination points. If it is placed too close to the start or destination point the robot may give a warning. The circle point is defined as a named position or stored directly in the instruction (marked with an * in the instruction). The position of the external axes are not used.

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Continues on next page

1.146 MoveCDO - Moves the robot circularly and sets digital output in the corner *RobotWare Base* *Continued*

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[\Wobj]

Work Object

Data type: wobjdata

The work object (object coordinate system) to which the robot position in the instruction is related.

Continues on next page

1 Instructions

1.146 MoveCDO - Moves the robot circularly and sets digital output in the corner

RobotWare Base

Continued

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified in order for a circle relative to the work object to be executed.

Signal

Data type: signaldo

The name of the digital output signal to be changed.

Value

Data type: dionum

The desired value of signal (0 or 1).

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See the instruction MoveC for more information about circular movement.

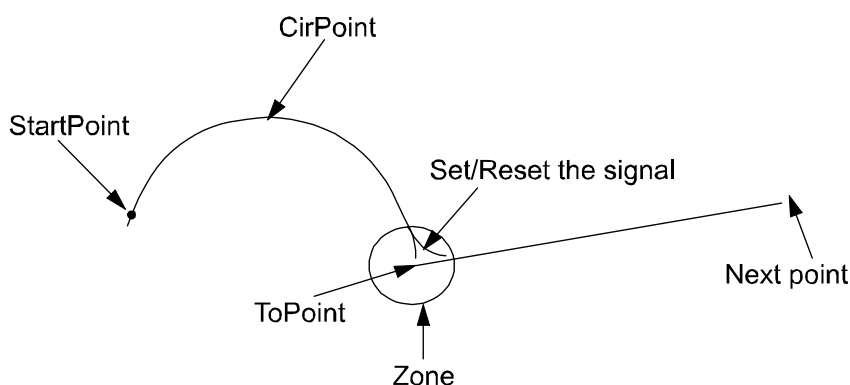
The digital output signal is set/reset in the middle of the corner path for flying points, as shown in figure below.

The figure shows set/reset of digital output signal in the corner path with MoveCDO.

Continues on next page

1.146 MoveCDO - Moves the robot circularly and sets digital output in the corner

RobotWare Base
Continued



xx0500002215

For stop points we recommend the use of “normal” programming sequence with MoveC + SetDO. But when using stop point in instruction MoveCDO the digital output signal is set/reset when the robot reaches the stop point.

The specified I/O signal is set/reset in execution mode continuously and stepwise forward, but not in stepwise backward.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Limitations

General limitations according to instruction MoveC.

MoveCDO cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
MoveCDO
[CirPoint ':='] <expression (IN) of robtarget>', '
[ToPoint ':='] <expression (IN) of robtarget>', '
['\ ' ID ':=' <expression (IN) of identno>'],'
[Speed ':='] <expression (IN) of speeddata>
|['\ ' T ':=' <expression (IN) of num>]
['\ ' KeepStartPath ':=' <expression (IN) of num>]
['\ ' KeepEndPath ':=' <expression (IN) of num>'],'
[Zone ':='] <expression (IN) of zonedata>', '
[Tool ':='] <persistent (PERS) of tooldata>
```

Continues on next page

1 Instructions

1.146 MoveCDO - Moves the robot circularly and sets digital output in the corner

RobotWare Base

Continued

```
['\' wObj ':'] <persistent (PERS) of wobjdata>'],''  
[Signal ':'] <variable (VAR) of signaldo>'],''  
[Value ':'] <expression (IN) of dionum>]  
['\' TLoad ':'] <persistent (PERS) of loaddata>'],';
```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Move the robot circularly	MoveC - Moves the robot circularly on page 398
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Movements with I/O settings	<i>Technical reference manual - RAPID Overview</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayload-Mode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>

1.147 MoveCGO - Moves the robot circularly and set a group output signal in the corner

RobotWare Base

1.147 MoveCGO - Moves the robot circularly and set a group output signal in the corner

Usage

MoveCGO (*Move Circular Group Output*) is used to move the tool center point (TCP) circularly to a given destination. The specified group output signal is set in the middle of the corner path at the destination point. During the movement the orientation normally remains unchanged relative to the circle.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction MoveCGO:

Example 1

```
MoveCGO p1, p2, v500, z30, tool2, go1 \Value:=5;
```

The TCP of the tool, tool2, is moved circularly to the position p2 with speed data v500 and zone data z30. The circle is defined from the start position, the circle point p1, and the destination point p2. Group output signal go1 is set in the middle of the corner path at p2.

Arguments

```
MoveCGO CirPoint ToPoint [\ID] Speed [\T] [\KeepStartPath]
        [\KeepEndPath] Zone Tool [\WObj] Signal [\Value] | [\DValue]
        [\TLoad]
```

CirPoint

Data type: robtarget

The circle point of the robot. The circle point is a position on the circle between the start point and the destination point. To obtain the best accuracy it should be placed about halfway between the start and destination points. If it is placed too close to the start or destination point the robot may give a warning. The circle point is defined as a named position or stored directly in the instruction (marked with an * in the instruction). The position of the external axes are not used.

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Continues on next page

1 Instructions

1.147 MoveCGO - Moves the robot circularly and set a group output signal in the corner

RobotWare Base

Continued

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[\Wobj]

Work Object

Data type: wobjdata

The work object (object coordinate system) to which the robot position in the instruction is related.

Continues on next page

1.147 MoveCGO - Moves the robot circularly and set a group output signal in the corner

RobotWare Base
Continued

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified in order for a circle relative to the work object to be executed.

Signal

Data type: signalgo

The name of the group output signal to be changed.

[\Value]

Data type: num

The desired value of signal.

[\DValue]

Data type: dnum

The desired value of signal.

If none of the arguments \Value or \DValue is entered, an error message will be displayed.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered. If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Continues on next page

1 Instructions

1.147 MoveCGO - Moves the robot circularly and set a group output signal in the corner

RobotWare Base

Continued

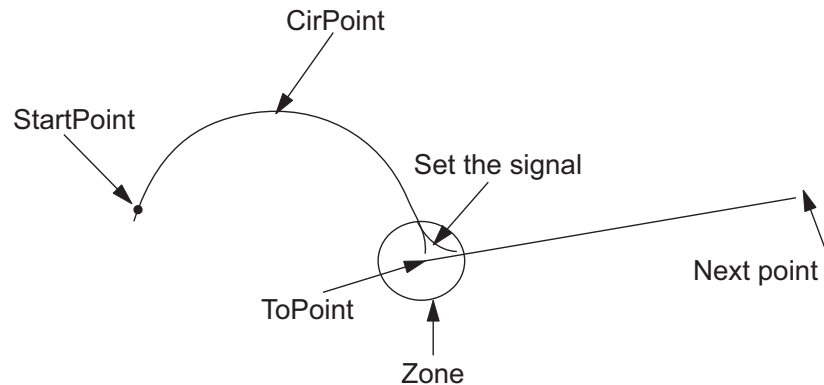
Program execution

See the instruction MoveC for more information about circular movement, [MoveC - Moves the robot circularly on page 398](#).

The group output signal is set in the middle of the corner path for flying points, as shown in figure below.

The figure shows set of group output signal in the corner path with MoveCGO.

```
MoveCGO p2, p2, v500, z30, tool2, go1 \Value:=5;
```



xx1400001116

For stop points we recommend the use of "normal" programming sequence with MoveC and SetGO. But when using stop point in instruction MoveCGO the group output signal is set when the robot reaches the stop point.

The specified I/O signal is set in execution mode continuously and stepwise forward, but not in stepwise backward.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_GO_LIM	Value or DValue argument for the specified group output signal is outside limits.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Limitations

General limitations according to instruction MoveC, see [MoveC - Moves the robot circularly on page 398](#).

MoveCGO cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Continues on next page

1.147 MoveCGO - Moves the robot circularly and set a group output signal in the corner

RobotWare Base
Continued

Syntax

MoveCGO

```
[CirPoint ':='] <expression (IN) of robtarget>', '
[ToPoint ':='] <expression (IN) of robtarget>', '
['\ ' ID ':=' <expression (IN) of identno>'],'
[Speed ':='] <expression (IN) of speeddata>
|['\ ' T ':=' <expression (IN) of num>]
['\ ' KeepStartPath ':=' <expression (IN) of num>]
['\ ' KeepEndPath ':=' <expression (IN) of num>'],'
[Zone ':='] <expression (IN) of zonedata>', '
[Tool ':='] <persistent (PERS) of tooldata>
['\ ' WObj ':=' <persistent (PERS) of wobjdata>'],'
[Signal ':='] <variable (VAR) of signalgo>', '
['\ ' Value ':='] <expression (IN) of num>]
|['\ ' Dvalue ':='] <expression (IN) of dnum>
['\ ' TLoad ':=' <persistent (PERS) of loaddata>'];'
```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Move the robot circularly	MoveC - Moves the robot circularly on page 398
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Movements with I/O settings	<i>Technical reference manual - RAPID Overview</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayLoad-Mode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>

1 Instructions

1.148 MoveCSync - Moves the robot circularly and executes a RAPID procedure *RobotWare Base*

1.148 MoveCSync - Moves the robot circularly and executes a RAPID procedure

Usage

MoveCSync (*Move Circular Synchronously*) is used to move the tool center point (TCP) circularly to a given destination. The specified RAPID procedure is ordered to execute at the middle of the corner path in the destination point. During the movement the orientation normally remains unchanged relative to the circle.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following examples illustrate the instruction MoveCSync:

Example 1

```
MoveCSync p1, p2, v500, z30, tool2, "proc1";
```

The TCP of the tool, tool2, is moved circularly to the position p2 with speed data v500 and zone data z30. The circle is defined from the start position, the circle point p1, and the destination point p2. Procedure proc1 is executed in the middle of the corner path at p2.

Example 2

```
MoveCSync p1, p2, v500, z30, tool2, "MyModule:proc1";
```

The same as in example 1 above, but here the locally declared procedure proc1 in module MyModule will be called in the middle of the corner path.

Arguments

```
MoveCSync CirPoint ToPoint [\ID] Speed [\T] [\KeepStartPath]  
[\KeepEndPath] Zone Tool [\WObj] ProcName [\TLoad]
```

CirPoint

Data type: robtarget

The circle point of the robot. The circle point is a position on the circle between the start point and the destination point. To obtain the best accuracy it should be placed about halfway between the start and destination points. If it is placed too close to the start or destination point, the robot may give a warning. The circle point is defined as a named position or stored directly in the instruction (marked with an * in the instruction). The position of the external axes are not used.

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any

Continues on next page

1.148 MoveCSync - Moves the robot circularly and executes a RAPID procedure RobotWare Base Continued

other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[\WObj]

Work Object

Data type: wobjdata

Continues on next page

1 Instructions

1.148 MoveCSync - Moves the robot circularly and executes a RAPID procedure

RobotWare Base

Continued

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used this argument must be specified in order for a circle relative to the work object to be executed.

ProcName

Procedure Name

Data type: string

Name of the RAPID procedure to be executed at the middle of the corner path in the destination point.

The procedure will execute on trap level (see description of program execution).

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See the instruction MoveC for more information about circular movements.

The specified RAPID procedure is ordered to execute when the TCP reaches the middle of the corner path in the destination point of the MoveCSync instruction, as shown in the figure below.

Continues on next page

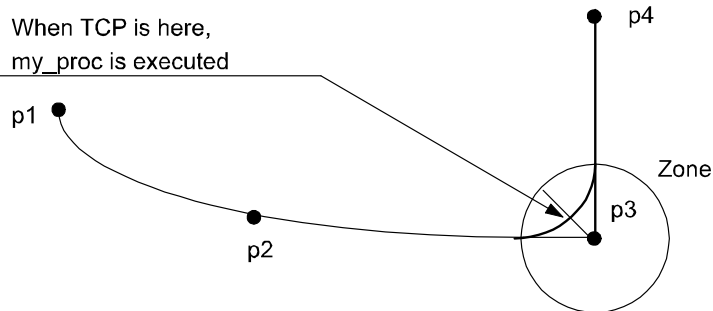
1.148 MoveCSync - Moves the robot circularly and executes a RAPID procedure

RobotWare Base
Continued

The figure shows that the order to execute the user defined RAPID procedure is done at the middle of the corner path.

```
MoveCSync p2, p3, v1000, z30, tool2, "my_proc";
```

When TCP is here,
my_proc is executed



xx0500002216

For stop points we recommend the use of normal programming sequence with MoveC + and other RAPID instructions in sequence.

The table describes execution of the specified RAPID procedure in different execution modes:

Execution mode	Execution of RAPID procedure
Continuously or Cycle	According to this description
Forward step	In the stop point
Backward step	Not at all

MoveCSync is an encapsulation of the instructions TriggInt and TriggC. The procedure call is executed on trap level.

If the middle of the corner path in the destination point is reached during the deceleration after a program stop, the procedure will not be called (program execution is stopped). The procedure call will be executed at next program start.

Limitations

General limitations according to the instruction MoveC.

When the robot reaches the middle of the corner path there is normally a delay of 2-30 ms until the specified RAPID routine is executed depending on what type of movement is being performed at the time.

Switching execution mode after program stop from continuously or cycle to stepwise forward or backward results in an error. This error tells the user that the mode switch can result in missed execution of the RAPID procedure in the queue for execution on the path.

Instruction MoveCSync cannot be used on trap level. The specified RAPID procedure cannot be tested with stepwise execution.

MoveCSync cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Continues on next page

1 Instructions

1.148 MoveCSync - Moves the robot circularly and executes a RAPID procedure

RobotWare Base

Continued

Syntax

```
MoveCSync
[CirPoint ':='] <expression (IN) of robtarget>', '
[ToPoint ':='] <expression (IN) of robtarget>', '
['\ ' ID ':=' <expression (IN) of identno>'],'
[Speed ':='] <expression (IN) of speeddata>
|['\ ' T ':=' <expression (IN) of num>]
['\ ' KeepStartPath ':=' <expression (IN) of num>]
['\ ' KeepEndPath ':=' <expression (IN) of num>'],'
[Zone ':='] <expression (IN) of zonedata>', '
[Tool ':='] <persistent (PERS) of tooldata>
['\ ' WObj ':=' <persistent (PERS) of wobjdata>'],'
[ProcName ':='] <expression (IN) of string>
['\ ' TLoad ':=' <persistent (PERS) of loaddata>'];'
```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Moves the robot circularly	MoveC - Moves the robot circularly on page 398
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Defines a position related interrupt	TriggInt - Defines a position related interrupt on page 883
Circular robot movement with events	TriggC - Circular robot movement with events on page 858
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayLoadMode</i> for activating and deactivating payload.	

1.149 MoveExtJ - Move one or several mechanical units without TCP

Usage

MoveExtJ (*Move External Joints*) is used to move linear or rotating external axes. The external axes can belong to one or several mechanical units without TCP. This instruction can only be used with an actual program task defined as a Motion Task and if the task controls one or several mechanical units without TCP.

Basic examples

The following examples illustrate the instruction MoveExtJ:

See also [More examples on page 429](#).

Example 1

```
MoveExtJ jpos10, vrot10, z50;
```

Move rotational external axes to joint position jpos10 with speed 10 degrees/s with zone data z50.

Example 2

```
MoveExtJ \Conc, jpos20, vrot10 \T:=5, fine \InPos:=inpos20;
```

Move external axes to joint position jpos20 in 5. The program execution goes forward at once but the external axes stops in the position jpos20 until the convergence criteria in inpos20 are fulfilled.

Arguments

```
MoveExtJ [\Conc] ToJointPos [\ID] [\UseEOffs] Speed [\T] Zone
[\Inpos]
```

[\Conc]

Concurrent

Data type: switch

Subsequent instructions are executed while the robot is moving. The argument is usually not used but can be used to avoid unwanted stops caused by overloaded CPU when using fly-by points. This is useful when the programmed points are very close together at high speeds. The argument is also useful when, for example, communicating with external equipment and synchronization between the external equipment and robot movement is not required.

Using the argument \Conc, the number of movement instructions in succession is limited to 5. In a program section that includes StorePath-RestoPath, movement instructions with the argument \Conc are not permitted.

If this argument is omitted and the ToPoint is not a stop point then the subsequent instruction is executed some time before the robot has reached the programmed zone.

This argument cannot be used in coordinated synchronized movement in a MultiMove system.

ToJointPos

To Joint Position

Continues on next page

1 Instructions

1.149 MoveExtJ - Move one or several mechanical units without TCP

RobotWare Base

Continued

Data type: jointtarget

The destination absolute joint position of the external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

[\UseEOffs]

Use External Offset

Data type: switch

The offset for external axes, setup by instruction EOffsSet, is activated for MoveExtJ instruction when the argument UseEOffs is used. See instruction EOffsSet for more information about external offset.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Inpos]

In position

Data type: stoppoint data

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Continues on next page

Program execution

The linear or rotating external axes are moved to the programmed point with the programmed velocity.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CONC_MAX	The number of movement instructions in succession using argument \Conc has been exceeded.

More examples

```

CONST jointtarget j1 :=
  [[9E9,9E9,9E9,9E9,9E9,9E9],[0,9E9,9E9,9E9,9E9,9E9]];
CONST jointtarget j2 :=
  [[9E9,9E9,9E9,9E9,9E9,9E9],[30,9E9,9E9,9E9,9E9,9E9]];
CONST jointtarget j3 :=
  [[9E9,9E9,9E9,9E9,9E9,9E9],[60,9E9,9E9,9E9,9E9,9E9]];
CONST jointtarget j4 :=
  [[9E9,9E9,9E9,9E9,9E9,9E9],[90,9E9,9E9,9E9,9E9,9E9]];
CONST speeddata rot_ax_speed := [0, 0, 0, 45];

```

```

MoveExtJ j1, rot_ax_speed, fine;
MoveExtJ j2, rot_ax_speed, z20;
MoveExtJ j3, rot_ax_speed, z20;
MoveExtJ j4, rot_ax_speed, fine;

```

In this example the rotating single axis is moved to joint position 0, 30, 60, and 90 degrees with the speed of 45 degrees/s.

Limitations

MoveExtJ cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```

MoveExtJ
  [ '\ ' Conc ', ' ]
  [ ToJointPos ':=' ] < expression (IN) of jointtarget >
  [ '\ ' ID ':=' < expression (IN) of identno > ], '
  [ '\ ' UseEOffs ', ' ]
  [ Speed ':=' ] < expression (IN) of speeddata >
  [ '\ ' T ':=' < expression (IN) of num > ] ', '
  [ Zone ':=' ] < expression (IN) of zonedata >
  [ '\ ' Inpos ':=' < expression (IN) of stoppointdata > ] '; '

```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>

Continues on next page

1 Instructions

1.149 MoveExtJ - Move one or several mechanical units without TCP

RobotWare Base

Continued

For information about	See
Definition of jointtarget	jointtarget - Joint position data on page 1661
Definition of velocity	speeddata - Speed data on page 1729
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Concurrent program execution	<i>Technical reference manual - RAPID Overview</i>

1.150 MoveJ - Moves the robot by joint movement

Usage

MoveJ is used to move the robot quickly from one point to another when that movement does not have to be in a straight line.

The robot and external axes move to the destination position along a non-linear path. All axes reach the destination position at the same time.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following examples illustrate the instruction MoveJ:

See also [More examples on page 434](#).

Example 1

```
MoveJ p1, vmax, z30, tool2;
```

The tool center point (TCP) of the tool, tool2, is moved along a non-linear path to the position, p1, with speed data vmax and zone data z30.

Example 2

```
MoveJ *, vmax \T:=5, fine, grip3;
```

The TCP of the tool, grip3, is moved along a non-linear path to a stop point stored in the instruction (marked with an *). The entire movement takes 5 seconds.

Arguments

```
MoveJ [\Conc] ToPoint [\ID] Speed [\V] | [\T] [\KeepStartPath]
      [\KeepEndPath] Zone [\Z] [\Inpos] Tool [\WObj] [\TLoad]
```

[\Conc]

Concurrent

Data type: switch

Subsequent instructions are executed while the robot is moving. The argument is usually not used but can be used to avoid unwanted stops caused by overloaded CPU when using fly-by points. This is useful when the programmed points are very close together at high speeds. The argument is also useful when, for example, communicating with external equipment and synchronization between the external equipment and robot movement is not required.

Using the argument \Conc, the number of movement instructions in succession is limited to 5. In a program section that includes StorePath-RestoPath movement instructions with the argument \Conc are not permitted.

If this argument is omitted and the ToPoint is not a stop point, the subsequent instruction is executed some time before the robot has reached the programmed zone.

This argument cannot be used in coordinated synchronized movement in a MultiMove system.

Continues on next page

1 Instructions

1.150 MoveJ - Moves the robot by joint movement

RobotWare Base

Continued

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

This argument must be used in a MultiMove system, if coordinated synchronized movement, and is not allowed in any other cases.

The specified id number must be the same in all cooperating program tasks. The id number gives a guarantee that the movements are not mixed up at runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the tool center point, the tool reorientation, and external axes.

[\V]

Velocity

Data type: num

This argument is used to specify the velocity of the TCP in mm/s directly in the instruction. It is then substituted for the corresponding velocity specified in the speed data.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

Continues on next page

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Z]

Zone

Data type: num

This argument is used to specify the position accuracy of the robot TCP directly in the instruction. The length of the corner path is given in mm, which is substituted for the corresponding zone specified in the zone data.

[\Inpos]

In position

Data type: stoppointdata

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point moved to the specified destination point.

[\Wobj]

Work Object

Data type: wobjdata

The work object (coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

Continues on next page

1 Instructions

1.150 MoveJ - Moves the robot by joint movement

RobotWare Base

Continued

To be able to use the `\TLoad` argument it is necessary to set the value of the system parameter `ModalPayloadMode` to 0. If `ModalPayloadMode` is set to 0, it is no longer possible to use the instruction `GripLoad`.

The total load can be identified with the service routine `LoadIdentify`. If the system parameter `ModalPayloadMode` is set to 0, the operator has the possibility to copy the `loaddata` from the tool to an existing or new `loaddata` persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input `SimMode` (Simulated Mode). If the digital input signal is set to 1, the `loaddata` in the optional argument `\TLoad` is not considered, and the `loaddata` in the current `tooldata` is used instead.



Note

The default functionality to handle payload is to use the instruction `GripLoad`. Therefore the default value of the system parameter `ModalPayloadMode` is 1.

Program execution

The tool center point is moved to the destination point with interpolation of the axis angles. This means that each axis is moved with constant axis velocity and that all axes reach the destination point at the same time, which results in a non-linear path.

Generally speaking, the TCP is moved at the approximate programmed velocity (regardless of whether or not the external axes are coordinated). The tool is reoriented and the external axes are moved at the same time that the TCP moves. If the programmed velocity for reorientation or for the external axes cannot be attained then the velocity of the TCP will be reduced.

A corner path is usually generated when movement is transferred to the next section of the path. If a stop point is specified in the zone data the program execution only continues when the robot and external axes have reached the appropriate position.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_CONC_MAX</code>	The number of movement instructions in succession using argument <code>\Conc</code> has been exceeded.

More examples

More examples of how to use the instruction `MoveJ` are illustrated below.

Example 1

```
MoveJ *, v2000\V:=2200, z40 \Z:=45, grip3;
```

Continues on next page

The TCP of the tool, grip3, is moved along a non-linear path to a position stored in the instruction. The movement is carried out with data set to v2000 and z40; the velocity and zone size of the TCP are 2200 mm/s and 45 mm respectively.

Example 2

```
MoveJ p5, v2000, fine \Inpos := inpos50, grip3;
```

The TCP of the tool, grip3, is moved in a non-linear path to a stop point p5. The robot considers it to be in the point when 50% of the position condition and 50% of the speed condition for a stop point fine are satisfied. It waits at most for 2 seconds for the conditions to be satisfied. See predefined data inpos50 of data type stoppointdata.

Example 3

```
MoveJ \Conc, *, v2000, z40, grip3;
```

The TCP of the tool, grip3, is moved along a non-linear path to a position stored in the instruction. Subsequent logical instructions are executed while the robot moves.

Example 4

```
MoveJ start, v2000, z40, grip3 \Wobj:=fixture;
```

The TCP of the tool, grip3, is moved along a non-linear path to a position, start. This position is specified in the object coordinate system for fixture.

Limitations

MoveJ cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
MoveJ
[ '\ ' Conc ', ' ]
[ ToPoint ':=' ] < expression (IN) of robtarg >
[ '\ ' ID ':=' < expression (IN) of identno > ], '
[ Speed ':=' ] < expression (IN) of speeddata >
[ '\ ' V ':=' < expression (IN) of num > ]
[ '\ ' T ':=' < expression (IN) of num > ]
[ '\ ' KeepStartPath ':=' < expression (IN) of num > ]
[ '\ ' KeepEndPath ':=' < expression (IN) of num > ], '
[ Zone ':=' ] < expression (IN) of zonedata >
[ '\ ' Z ':=' < expression (IN) of num > ]
[ '\ ' Inpos ':=' < expression (IN) of stoppointdata > ], '
[ Tool ':=' ] < persistent (PERS) of tooldata >
[ '\ ' WObj ':=' < persistent (PERS) of wobjdata > ]
[ '\ ' TLoad ':=' < persistent (PERS) of loaddata > ]; '
```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Definition of load	loaddata - Load data on page 1664

Continues on next page

1 Instructions

1.150 MoveJ - Moves the robot by joint movement

RobotWare Base

Continued

For information about	See
Definition of velocity	speeddata - Speed data on page 1729
Definition of stop point data	stoppointdata - Stop point data on page 1733
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Concurrent program execution	<i>Technical reference manual - RAPID Overview</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayLoad-Mode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>

1.151 MoveJAO - Moves the robot by joint movement and sets analog output in the corner

RobotWare Base

1.151 MoveJAO - Moves the robot by joint movement and sets analog output in the corner

Usage

MoveJAO (*Move Joint Analog Output*) is used to move the robot quickly from one point to another when that movement does not have to be in a straight line. The specified analog output signal is set at the middle of the corner path.

The robot and external axes move to the destination position along a non-linear path. All axes reach the destination position at the same time.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction MoveJAO:

Example 1

```
MoveJAO p1, vmax, z30, tool2, ao1, 1.1;
```

The tool center point (TCP) of the tool, tool2, is moved along a non-linear path to the position, p1, with speed data vmax and zone data z30. Output ao1 is set in the middle of the corner path at p1.

Arguments

```
MoveJAO ToPoint [\ID] Speed [\T] [\KeepStartPath] [\KeepEndPath]
      Zone Tool [\WObj] Signal Value [\TLoad]
```

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in the MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the tool center point, the tool reorientation, and external axes.

[\T]

Time

Data type: num

Continues on next page

1 Instructions

1.151 MoveJAO - Moves the robot by joint movement and sets analog output in the corner

RobotWare Base

Continued

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

`\KeepStartPath`

Data type: num

If the move instruction starts from a fine point, `\KeepStartPath` defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, `\KeepStartPath` is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

`\KeepEndPath`

Data type: num

If the move instruction ends in a fine point, `\KeepEndPath` defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, `\KeepEndPath` is ignored.

`Zone`

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

`Tool`

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point moved to the specified destination point.

`[ \Wobj ]`

Work Object

Data type: wobjdata

The work object (coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified.

`Signal`

Data type: signalao

The name of the analog output signal to be changed.

`Value`

Data type: num

Continues on next page

1.151 MoveJAO - Moves the robot by joint movement and sets analog output in the corner

RobotWare Base
Continued

The desired value of signal.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered. If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

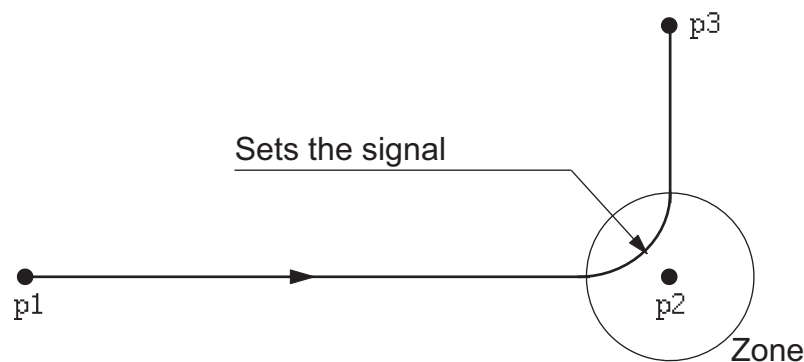
Program execution

See the instruction MoveJ for more information about joint movement, [MoveJ - Moves the robot by joint movement on page 431](#).

The analog output signal is set in the middle of the corner path for flying points, as shown in figure below.

The figure shows set of analog output signal in the corner path with MoveJAO.

```
MoveJAO p2, vmax, z30, tool2, ao1, 1.1;
```



Continues on next page

1 Instructions

1.151 MoveJAO - Moves the robot by joint movement and sets analog output in the corner

RobotWare Base

Continued

For stop points we recommend the use of "normal" programming sequence with MoveJ and SetAO. But when using stop point in instruction MoveJAO, the analog output signal is set when the robot reaches the stop point.

The specified I/O signal is set in execution mode continuously and stepwise forward, but not in stepwise backward.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AO_LIM	The programmed Value argument for the specified analog output signal Signal is outside limits.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Limitations

MoveJAO cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
MoveJAO
[ToPoint ':=' ] <expression (IN) of robtarget>
['\ ' ID ':=' <expression (IN) of identno>'], '
[Speed ':=' ] <expression (IN) of speeddata>
['\ ' T ':=' <expression (IN) of num>]
['\ ' KeepStartPath ':=' <expression (IN) of num>]
['\ ' KeepEndPath ':=' <expression (IN) of num>'], '
[Zone ':=' ] <expression (IN) of zonedata> ', '
[Tool ':=' ] <persistent (PERS) of tooldata>
['\ ' WObj ':=' <persistent (PERS) of wobjdata>'], '
[Signal ':=' ] <variable (VAR) of signalao> ', '
[Value ':=' ] <expression (IN) of num>]
['\ ' TLoad ':=' <persistent (PERS) of loaddata>'];'
```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Moves the robot by joint movement	MoveJ - Moves the robot by joint movement on page 431
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729

Continues on next page

1.151 MoveJAO - Moves the robot by joint movement and sets analog output in the corner

RobotWare Base

Continued

For information about	See
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Movements with I/O settings	<i>Technical reference manual - RAPID Overview</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayLoad-Mode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>

1 Instructions

1.152 MoveJDO - Moves the robot by joint movement and sets digital output in the corner
RobotWare Base

1.152 MoveJDO - Moves the robot by joint movement and sets digital output in the corner

Usage

MoveJDO (*Move Joint Digital Output*) is used to move the robot quickly from one point to another when that movement does not have to be in a straight line. The specified digital output signal is set/reset at the middle of the corner path.

The robot and external axes move to the destination position along a non-linear path. All axes reach the destination position at the same time.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction MoveJDO:

Example 1

```
MoveJDO p1, vmax, z30, tool2, do1, 1;
```

The tool center point (TCP) of the tool, tool2, is moved along a non-linear path to the position, p1, with speed data vmax and zone data z30. Output do1 is set in the middle of the corner path at p1.

Arguments

```
MoveJDO ToPoint [\ID] Speed [\T] [\KeepStartPath] [\KeepEndPath]  
Zone Tool [\WObj] Signal Value [\TLoad]
```

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in the MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the tool center point, the tool reorientation, and external axes.

[\T]

Time

Data type: num

Continues on next page

1.152 MoveJDO - Moves the robot by joint movement and sets digital output in the corner RobotWare Base Continued

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

`\KeepStartPath`

Data type: num

If the move instruction starts from a fine point, `\KeepStartPath` defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, `\KeepStartPath` is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

`\KeepEndPath`

Data type: num

If the move instruction ends in a fine point, `\KeepEndPath` defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, `\KeepEndPath` is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point moved to the specified destination point.

[`\wobj`]

Work Object

Data type: wobjdata

The work object (coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified.

Signal

Data type: signaldo

The name of the digital output signal to be changed.

Value

Data type: dionum

Continues on next page

1 Instructions

1.152 MoveJDO - Moves the robot by joint movement and sets digital output in the corner

RobotWare Base

Continued

The desired value of signal (0 or 1).

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered. If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

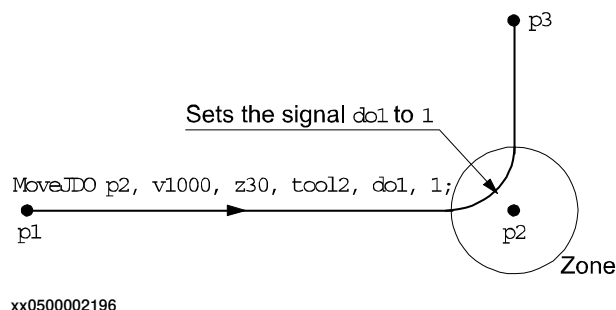
The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See the instruction MoveJ for more information about joint movement.

The digital output signal is set/reset in the middle of the corner path for flying points, as shown in figure below.

The figure shows set/reset of digital output signal in the corner path with MoveJDO.



For stop points we recommend the use of “normal” programming sequence with MoveJ + SetDO. But when using stop point in instruction MoveJDO, the digital output signal is set/reset when the robot reaches the stop point.

Continues on next page

1.152 MoveJDO - Moves the robot by joint movement and sets digital output in the corner

RobotWare Base

Continued

The specified I/O signal is set/reset in execution mode continuously and stepwise forward, but not in stepwise backward.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Limitations

MoveJDO cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```

MoveJDO
[ ToPoint ':' = ' ] < expression (IN) of robtarget >
[ '\\' ID ':' = ' < expression (IN) of identno > ] ', '
[ Speed ':' = ' ] < expression (IN) of speeddata >
| [ '\\' T ':' = ' < expression (IN) of num > ]
[ '\\' KeepStartPath ':' = ' < expression (IN) of num > ]
[ '\\' KeepEndPath ':' = ' < expression (IN) of num > ] ', '
[ Zone ':' = ' ] < expression (IN) of zonedata > ', '
[ Tool ':' = ' ] < persistent (PERS) of tooldata >
[ '\\' WObj ':' = ' < persistent (PERS) of wobjdata > ] ', '
[ Signal ':' = ' ] < variable (VAR) of signaldo > ] ', '
[ Value ':' = ' ] < expression (IN) of dionum > ]
[ '\\' TLoad ':' = ' < persistent (PERS) of loaddata > ] '; '

```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Moves the robot by joint movement	MoveJ - Moves the robot by joint movement on page 431
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>

Continues on next page

1 Instructions

1.152 MoveJDO - Moves the robot by joint movement and sets digital output in the corner

RobotWare Base

Continued

For information about	See
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Movements with I/O settings	<i>Technical reference manual - RAPID Overview</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayLoad-Mode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>

1.153 MoveJGO - Moves the robot by joint movement and set a group output signal in the corner

RobotWare Base

1.153 MoveJGO - Moves the robot by joint movement and set a group output signal in the corner

Usage

MoveJGO (*Move Joint Group Output*) is used to move the robot quickly from one point to another when that movement does not have to be in a straight line. The specified group output signal is set at the middle of the corner path.

The robot and external axes move to the destination position along a non-linear path. All axes reach the destination position at the same time.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction MoveJGO:

Example 1

```
MoveJGO p1, vmax, z30, tool2, go1 \Value:=5;
```

The tool center point (TCP) of the tool, tool2, is moved along a non-linear path to the position, p1, with speed data vmax and zone data z30. Group output signal go1 is set in the middle of the corner path at p1.

Arguments

```
MoveJGO ToPoint [\ID] Speed [\T] [\KeepStartPath] [\KeepEndPath]
      Zone Tool [\WObj] Signal [\Value] | [\DValue] [\TLoad]
```

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in the MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the tool center point, the tool reorientation, and external axes.

[\T]

Time

Data type: num

Continues on next page

1 Instructions

1.153 MoveJGO - Moves the robot by joint movement and set a group output signal in the corner

RobotWare Base

Continued

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

`\KeepStartPath`

Data type: num

If the move instruction starts from a fine point, `\KeepStartPath` defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, `\KeepStartPath` is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

`\KeepEndPath`

Data type: num

If the move instruction ends in a fine point, `\KeepEndPath` defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, `\KeepEndPath` is ignored.

`Zone`

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

`Tool`

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point moved to the specified destination point.

`[ \Wobj ]`

Work Object

Data type: wobjdata

The work object (coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified.

`Signal`

Data type: signalgo

The name of the group output signal to be changed.

`[ \Value ]`

Data type: num

Continues on next page

1.153 MoveJGO - Moves the robot by joint movement and set a group output signal in the corner

RobotWare Base
Continued

The desired value of signal.

[\DValue]

Data type: dnum

The desired value of signal.

If none of the arguments \Value or \DValue is entered, an error message will be displayed.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See the instruction MoveJ for more information about joint movement.

The group output signal is set in the middle of the corner path for flying points, as shown in figure below.

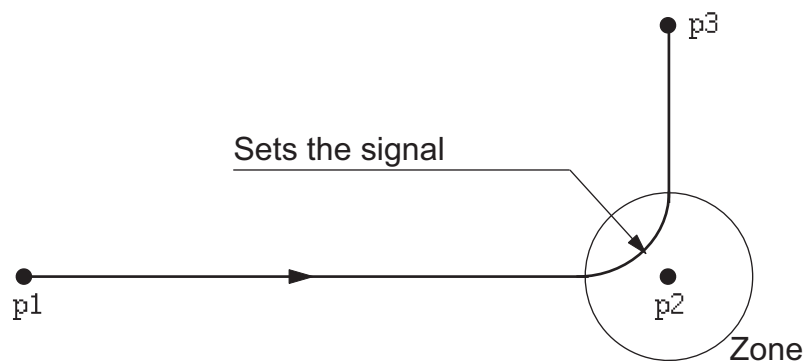
The figure shows set of group output signal in the corner path with MoveJGO.

```
MoveJGO p2, vmax, z30, tool2, go1 \Value:=5;
```

Continues on next page

1 Instructions

1.153 MoveJGO - Moves the robot by joint movement and set a group output signal in the corner
RobotWare Base
Continued



For stop points we recommend the use of "normal" programming sequence with MoveJ + SetGO. But when using stop point in instruction MoveJGO, the group output signal is set when the robot reaches the stop point.

The specified I/O signal is set in execution mode continuously and stepwise forward, but not in stepwise backward.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_GO_LIM	Value or DValue argument for the specified group output signal is outside limits.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	there is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Limitations

MoveJGO cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
MoveJGO
[ ToPoint ':' '=' ] < expression (IN) of robtarget >
[ '\ ' ID ':' '=' < expression (IN) of identno > ] ', '
[ Speed ':' '=' ] < expression (IN) of speeddata >
| [ '\ ' T ':' '=' < expression (IN) of num > ]
[ '\ ' KeepStartPath ':' '=' < expression (IN) of num > ]
[ '\ ' KeepEndPath ':' '=' < expression (IN) of num > ] ', '
[ Zone ':' '=' ] < expression (IN) of zonedata > ', '
[ Tool ':' '=' ] < persistent (PERS) of tooldata >
[ '\ ' wObj ':' '=' < persistent (PERS) of wobjdata > ] ', '
```

Continues on next page

1.153 MoveJGO - Moves the robot by joint movement and set a group output signal in the corner

RobotWare Base

Continued

```
[ Signal ':= ' ] < variable (VAR) of signalgo>] ', '
[ '\ ' Value ':= ' ] < expression (IN) of num > ]
| [ '\ ' Dvalue ':= ' ] < expression (IN) of dnum >
[ '\ ' TLoad ':= ' < persistent (PERS) of loaddata > ] ';'

```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Moves the robot by joint movement	MoveJ - Moves the robot by joint movement on page 431
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Movements with I/O settings	<i>Technical reference manual - RAPID Overview</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayLoad-Mode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>

1 Instructions

1.154 MoveJSync - Moves the robot by joint movement and executes a RAPID procedure
RobotWare Base

1.154 MoveJSync - Moves the robot by joint movement and executes a RAPID procedure

Usage

MoveJSync (*Move Joint Synchronously*) is used to move the robot quickly from one point to another when that movement does not have to be in a straight line. The specified RAPID procedure is ordered to execute at the middle of the corner path in the destination point.

The robot and external axes move to the destination position along a non-linear path. All axes reach the destination position at the same time.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following examples illustrate the instruction MoveJSync:

Example 1

```
MoveJSync p1, vmax, z30, tool2, "proc1";
```

The tool center point (TCP) of the tool, tool2, is moved along a non-linear path to the position, p1, with speed data vmax and zone data z30. Procedure proc1 is executed in the middle of the corner path at p1.

Example 2

```
MoveJSync p1, vmax, z30, tool2, "MyModule:proc1";
```

The same as in example 1 above, but here the locally declared procedure proc1 in module MyModule will be called in the middle of the corner path.

Arguments

```
MoveJSync ToPoint [\ID] Speed [\T] [\KeepStartPath] [\KeepEndPath]  
Zone Tool [\WObj] ProcName [\TLoad]
```

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

Continues on next page

1.154 MoveJSync - Moves the robot by joint movement and executes a RAPID procedure

RobotWare Base

Continued

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[\wobj]

Work Object

Data type: wobjdata

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external

Continues on next page

1 Instructions

1.154 MoveJSync - Moves the robot by joint movement and executes a RAPID procedure

RobotWare Base

Continued

axes are used this argument must be specified in order for a circle relative to the work object to be executed.

ProcName

Procedure Name

Data type: string

Name of the RAPID procedure to be executed at the middle of the corner path in the destination point. The procedure call is a late binding call, and therefore inherits its properties.

The procedure will execute on trap level (see [Program execution on page 454](#)).

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See the instruction MoveJ for more information about joint movements.

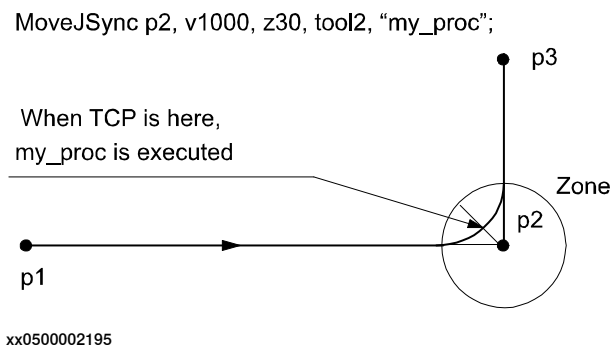
The specified RAPID procedure is ordered to execute when the TCP reaches the middle of the corner path in the destination point of the MoveJSync instruction, as shown in the figure below.

Continues on next page

1.154 MoveJSync - Moves the robot by joint movement and executes a RAPID procedure

RobotWare Base

Continued



For stop points we recommend the use of "normal" programming sequence with MoveJ + other RAPID instructions in sequence.

The table describes execution of the specified RAPID procedure in different execution modes:

Execution mode	Execution of RAPID procedure
Continuously or Cycle	According to this description
Forward step	In the stop point
Backward step	Not at all

MoveJSync is an encapsulation of the instructions TriggInt and TriggJ. The procedure call is executed on trap level.

If the middle of the corner path in the destination point is reached during the deceleration after a program stop, the procedure will not be called (program execution is stopped). The procedure call will be executed at next program start.

Limitations

When the robot reaches the middle of the corner path there is normally a delay of 2-30 ms until the specified RAPID routine is executed, depending on what type of movement is being performed at the time.

Switching execution mode after program stop from continuously or cycle to stepwise forward or backward results in an error. This error tells the user that the mode switch can result in missed execution of the RAPID procedure in the queue for execution on the path.

Instruction MoveJSync cannot be used on trap level. The specified RAPID procedure cannot be tested with stepwise execution.

MoveJSync cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
MoveJSync
[ ToPoint ':' '=' ] < expression (IN) of robtarget >
[ '\\' ID ':' '=' < expression (IN) of identno > ] ', '
[ Speed ':' '=' ] < expression (IN) of speeddata >
| [ '\\' T ':' '=' < expression (IN) of num > ]
[ '\\' KeepStartPath ':' '=' < expression (IN) of num > ]
[ '\\' KeepEndPath ':' '=' < expression (IN) of num > ] ', '
```

Continues on next page

1 Instructions

1.154 MoveJSync - Moves the robot by joint movement and executes a RAPID procedure

RobotWare Base

Continued

```
[ Zone ':=' ] < expression (IN) of zonedata > ', '  
[ Tool ':=' ] < persistent (PERS) of tooldata >  
[ '\ ' wObj '=' < persistent (PERS) of wobjdata > ] ', '  
[ ProcName '=' ] < expression (IN) of string > ]  
[ '\ ' TLoad ':=' < persistent (PERS) of loaddata > ] ';' ;
```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Moves the robot by joint movement	MoveJ - Moves the robot by joint movement on page 431
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Defines a position related interrupt	TriggInt - Defines a position related interrupt on page 883
Axis-wise robot movements with events	TriggJ - Axis-wise robot movements with events on page 894
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayLoad-Mode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>

1.155 MoveL - Moves the robot linearly

Usage

MoveL is used to move the tool center point (TCP) linearly to a given destination. When the TCP is to remain stationary then this instruction can also be used to reorientate the tool.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove System, in Motion tasks.

Basic examples

The following examples illustrate the instruction MoveL:

See also [More examples on page 461](#).

Example 1

```
MoveL p1, v1000, z30, tool2;
```

The TCP of the tool, tool2, is moved linearly to the position p1, with speed data v1000 and zone data z30.

Example 2

```
MoveL *, v1000\T:=5, fine, grip3;
```

The TCP of the tool, grip3, is moved linearly to a stop point stored in the instruction (marked with an *). The complete movement takes 5 seconds.

Arguments

```
MoveL [\Conc] ToPoint [\ID] Speed [\V] | [ \T] [\KeepStartPath]
[\KeepEndPath] Zone [\Z] [\Inpos] Tool [\WObj] [\Corr]
[\TLoad] [ \FollowConveyor ]
```

[\Conc]

Concurrent

Data type: switch

Subsequent instructions are executed while the robot is moving. The argument is usually not used but can be used to avoid unwanted stops caused by overloaded CPU when using fly-by points. This is useful when the programmed points are very close together at high speeds. The argument is also useful when, for example, communicating with external equipment and synchronization between the external equipment and robot movement is not required.

Using the argument \Conc, the number of movement instructions in succession is limited to 5. In a program section that includes StorePath-RestPath, movement instructions with the argument \Conc are not permitted.

If this argument is omitted and the ToPoint is not a stop point then the subsequent instruction is executed some time before the robot has reached the programmed zone.

This argument cannot be used in coordinated synchronized movement in a MultiMove System.

Continues on next page

1 Instructions

1.155 MoveL - Moves the robot linearly

RobotWare Base

Continued

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in the MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity for the tool center point, the tool reorientation, and external axes.

[\V]

Velocity

Data type: num

This argument is used to specify the velocity of the TCP in mm/s directly in the instruction. It is then substituted for the corresponding velocity specified in the speed data.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

Continues on next page

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Z]

Zone

Data type: num

This argument is used to specify the position accuracy of the robot TCP directly in the instruction. The length of the corner path is given in mm, which is substituted for the corresponding zone specified in the zone data.

[\Inpos]

In position

Data type: stoppointdata

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point moved to the specified destination position.

[\Wobj]

Work Object

Data type: wobjdata

The work object (coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary tool or coordinated external axes are used then this argument must be specified to perform a linear movement relative to the work object.

[\Corr]

Correction

Data type: switch

Correction data written to a corrections entry by the instruction CorrWrite will be added to the path and destination position if this argument is present.

The RobotWare option *Path Corrections* is required when using this argument.

Continues on next page

1 Instructions

1.155 MoveL - Moves the robot linearly

RobotWare Base

Continued

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

[\FollowConveyor]

Data type: switch

If running coordinated movement with conveyor and there is an unexpected fine point (corner path executed as stop point, event logs 50024 or 50124), this switch parameter will specify that the robot will use a coordinated fine point instead of a stationary fine point. As a result, the robot will not stop and will follow the conveyor.

Program execution

The robot and external units are moved to the destination position as follows:

- The TCP of the tool is moved linearly at constant programmed velocity.
- The tool is reoriented at equal intervals along the path.
- Uncoordinated external axes are executed at a constant velocity in order for them to arrive at the destination point at the same time as the robot axes.

If it is not possible to attain the programmed velocity for the reorientation or for the external axes then the velocity of the TCP will be reduced.

A corner path is usually generated when movement is transferred to the next section of a path. If a stop point is specified in the zone data then program execution only continues when the robot and external axes have reached the appropriate position.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CONC_MAX	The number of movement instructions in succession using argument \Conc has been exceeded.

More examples

More examples of how to use the instruction MoveL are illustrated below.

Example 1

```
MoveL *, v2000 \V:=2200, z40 \Z:=45, grip3;
```

The TCP of the tool, grip3, is moved linearly to a position stored in the instruction. The movement is carried out with data set to v2000 and z40. The velocity and zone size of the TCP are 2200 mm/s and 45 mm respectively.

Example 2

```
MoveL p5, v2000, fine \Inpos := inpos50, grip3;
```

The TCP of the tool, grip3, is moved linearly to a stop point p5. The robot considers it to be in the point when 50% of the position condition and 50% of the speed condition for a stop point fine are satisfied. It waits at most for 2 seconds for the conditions to be satisfied. See predefined data inpos50 of data type stoppointdata.

Example 3

```
MoveL \Conc, *, v2000, z40, grip3;
```

The TCP of the tool, grip3, is moved linearly to a position stored in the instruction. Subsequent logical instructions are executed while the robot moves.

Example 4

```
MoveL start, v2000, z40, grip3 \Wobj:=fixture;
```

The TCP of the tool, grip3, is moved linearly to a position, start. This position is specified in the object coordinate system for fixture.

Example with TLoad

```
MoveL p1, v1000, fine, tool2;
! Pick up the payload
Set gripperdo;
MoveL p2, v1000, z30, tool2 \TLoad:=tool2piece;
MoveL p3, v1000, fine, tool2 \TLoad:=tool2piece;
! Release the payload
Reset gripperdo;
MoveL p4, v1000, fine, tool2;
```

The TCP of the tool, tool2, is moved linearly to position p1 where a payload is picked up. From that position the TCP is moved to position p2 and p3 using the total load tool2piece. The loaddata in the current tooldata is not considered. The payload is released, and when moving to position p4 the load of the tool is considered again.

Continues on next page

1 Instructions

1.155 MoveL - Moves the robot linearly

RobotWare Base

Continued

Limitations

MoveL cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
MoveL
[ '\ ' Conc ' , ' ]
[ ToPoint ':' '=' ] < expression (IN) of robtarget >
[ '\ ' ID ':' '=' < expression (IN) of identno > ] ' , '
[ Speed ':' '=' ] < expression (IN) of speeddata >
[ '\ ' V ':' '=' < expression (IN) of num > ]
| [ '\ ' T ':' '=' < expression (IN) of num > ]
[ '\ ' KeepStartPath ':' '=' < expression (IN) of num > ]
[ '\ ' KeepEndPath ':' '=' < expression (IN) of num > ] ' , '
[ Zone ':' '=' ] < expression (IN) of zonedata >
[ '\ ' Z ':' '=' < expression (IN) of num > ]
[ '\ ' Inpos ':' '=' < expression (IN) of stoppointdata > ] ' , '
[ Tool ':' '=' ] < persistent (PERS) of tooldata >
[ '\ ' WObj ':' '=' < persistent (PERS) of wobjdata > ]
[ '\ ' Corr ]
[ '\ ' TLoad ':' '=' < persistent (PERS) of loaddata > ]
[ '\ ' FollowConveyor ] ' ; '
```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of stop point data	stoppointdata - Stop point data on page 1733
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Writes to a corrections entry	CorrWrite - Writes to a correction generator on page 176
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Concurrent program execution	<i>Technical reference manual - RAPID Overview</i>
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>

Continues on next page

1.155 MoveL - Moves the robot linearly

RobotWare Base

Continued

For information about	See
System parameter <i>ModalPayload-Mode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>
<i>Path Corrections</i>	<i>Application manual - Controller software OmniCore</i>

1 Instructions

1.156 MoveLAO - Moves the robot linearly and sets analog output in the corner
RobotWare Base

1.156 MoveLAO - Moves the robot linearly and sets analog output in the corner

Usage

MoveLAO (*Move Linearly Analog Output*) is used to move the tool center point (TCP) linearly to a given destination. The specified analog output signal is set at the middle of the corner path.

When the TCP is to remain stationary then this instruction can also be used to reorient the tool.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction MoveLAO:

Example 1

```
MoveLAO p1, v1000, z30, tool2, ao1, 1.1;
```

The TCP of the tool, tool2, is moved linearly to the position p1 with speed data v1000 and zone data z30. Output ao1 is set in the middle of the corner path at p1.

Arguments

```
MoveLAO ToPoint [\ID] Speed [\T][\KeepStartPath] [\KeepEndPath]  
Zone Tool [\WObj] Signal Value [\TLoad]
```

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in the MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity for the tool center point, the tool reorientation, and external axes.

[\T]

Time

Data type: num

Continues on next page

1.156 MoveLAO - Moves the robot linearly and sets analog output in the corner

RobotWare Base
Continued

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

`\KeepStartPath`

Data type: num

If the move instruction starts from a fine point, `\KeepStartPath` defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, `\KeepStartPath` is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

`\KeepEndPath`

Data type: num

If the move instruction ends in a fine point, `\KeepEndPath` defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, `\KeepEndPath` is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point moved to the specified destination position.

[`\wobj`]

Work Object

Data type: wobjdata

The work object (coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified.

Signal

Data type: signalao

The name of the analog output signal to be changed.

Value

Data type: num

Continues on next page

1 Instructions

1.156 MoveLAO - Moves the robot linearly and sets analog output in the corner

RobotWare Base

Continued

The desired value of signal.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

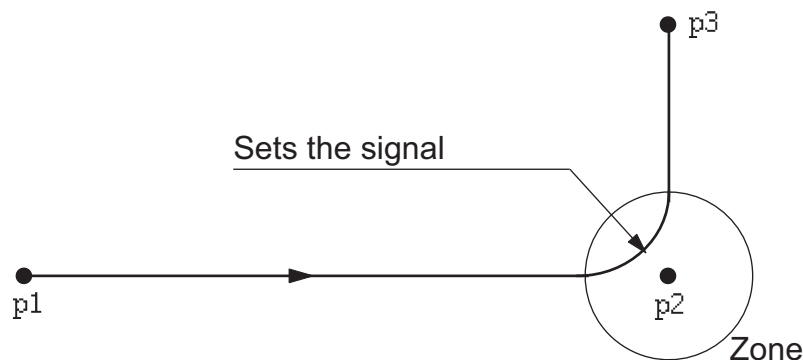
Program execution

See the instruction MoveL for more information about linear movements.

The analog output signal is set in the middle of the corner path for flying points, as shown in the figure below.

The figure shows set of analog output signal in the corner path with MoveLAO.

```
MoveLAO p2, v1000, z30, tool2, ao1, 1.1;
```



xx1400001118

Continues on next page

1.156 MoveLAO - Moves the robot linearly and sets analog output in the corner

RobotWare Base
Continued

For stop points we recommend the use of "normal" programming sequence with MoveL and SetAO. But when using stop point in instruction MoveLAO, the analog output signal is set when the robot reaches the stop point.

The specified I/O signal is set in execution mode continuously and stepwise forward, but not in stepwise backward.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AO_LIM	The programmed Value argument for the specified analog output signal Signal is outside limits.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Limitations

MoveLAO cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
MoveLAO
[ ToPoint ':' '=' ] < expression (IN) of robtarget >
[ '\\' ID ':' '=' < expression (IN) of identno > ] ', '
[ Speed ':' '=' ] < expression (IN) of speeddata >
| [ '\\' T ':' '=' < expression (IN) of num > ]
[ '\\' KeepStartPath ':' '=' < expression (IN) of num > ]
[ '\\' KeepEndPath ':' '=' < expression (IN) of num > ] ', '
[ Zone ':' '=' ] < expression (IN) of zonedata > ', '
[ Tool ':' '=' ] < persistent (PERS) of tooldata >
[ '\\' WObj ':' '=' ] < persistent (PERS) of wobjdata > ', '
[ Signal ':' '=' ] < variable (VAR) of signalao > ', '
[ Value ':' '=' ] < expression (IN) of num > ]
[ '\\' TLoad ':' '=' < persistent (PERS) of loaddata > ] ';'
```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Moves the robot linearly	MoveL - Moves the robot linearly on page 457
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729

Continues on next page

1 Instructions

1.156 MoveLAO - Moves the robot linearly and sets analog output in the corner

RobotWare Base

Continued

For information about	See
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Movements with I/O settings	<i>Technical reference manual - RAPID Overview</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayLoad-Mode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>

1.157 MoveLDO - Moves the robot linearly and sets digital output in the corner RobotWare Base

1.157 MoveLDO - Moves the robot linearly and sets digital output in the corner

Usage

MoveLDO (*Move Linearly Digital Output*) is used to move the tool center point (TCP) linearly to a given destination. The specified digital output signal is set/reset at the middle of the corner path.

When the TCP is to remain stationary then this instruction can also be used to reorient the tool.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction MoveLDO:

Example 1

```
MoveLDO p1, v1000, z30, tool2, do1,1;
```

The TCP of the tool, tool2, is moved linearly to the position p1 with speed data v1000 and zone data z30. Output do1 is set in the middle of the corner path at p1.

Arguments

```
MoveLDO ToPoint [\ID] Speed [\T] [\KeepStartPath] [\KeepEndPath]
      Zone Tool [\WObj] Signal Value [\TLoad]
```

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in the MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity for the tool center point, the tool reorientation, and external axes.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is

Continues on next page

1 Instructions

1.157 MoveLDO - Moves the robot linearly and sets digital output in the corner

RobotWare Base

Continued

computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

`\KeepStartPath`

Data type: num

If the move instruction starts from a fine point, `\KeepStartPath` defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, `\KeepStartPath` is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

`\KeepEndPath`

Data type: num

If the move instruction ends in a fine point, `\KeepEndPath` defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, `\KeepEndPath` is ignored.

`Zone`

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

`Tool`

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point moved to the specified destination position.

`[ \WObj ]`

Work Object

Data type: wobjdata

The work object (coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified.

`Signal`

Data type: signaldo

The name of the digital output signal to be changed.

`Value`

Data type: dionum

The desired value of signal (0 or 1).

Continues on next page

1.157 MoveLDO - Moves the robot linearly and sets digital output in the corner

RobotWare Base

Continued

[\TLoad]

Total load**Data type:** loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.

**Note**

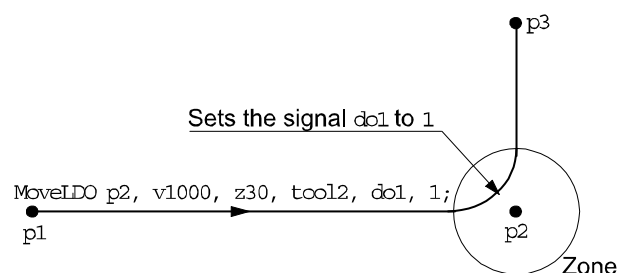
The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See the instruction MoveL for more information about linear movements.

The digital output signal is set/reset in the middle of the corner path for flying points, as shown in the figure below.

The figure shows set/reset of digital output signal in the corner path with MoveLDO.



xx0500002193

For stop points we recommend the use of "normal" programming sequence with MoveL and SetDO. But when using stop point in instruction MoveLDO, the digital output signal is set/reset when the robot reaches the stop point.

The specified I/O signal is set/reset in execution mode continuously and stepwise forward, but not in stepwise backward.

Continues on next page

1 Instructions

1.157 MoveLDO - Moves the robot linearly and sets digital output in the corner

RobotWare Base

Continued

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Limitations

MoveLDO cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
MoveLDO
[ ToPoint ':' '=' ] < expression (IN) of robtarget >
[ '\ ' ID ':' '=' < expression (IN) of identno > ] ', '
[ Speed ':' '=' ] < expression (IN) of speeddata >
| [ '\ ' T ':' '=' < expression (IN) of num > ]
[ '\ ' KeepStartPath ':' '=' < expression (IN) of num > ]
[ '\ ' KeepEndPath ':' '=' < expression (IN) of num > ] ', '
[ Zone ':' '=' ] < expression (IN) of zonedata > ', '
[ Tool ':' '=' ] < persistent (PERS) of tooldata >
[ '\ ' WObj ':' '=' ] < persistent (PERS) of wobjdata > ', '
[ Signal ':' '=' ] < variable (VAR) of signaldo > ] ', '
[ Value ':' '=' ] < expression (IN) of dionum > ]
[ '\ ' TLoad ':' '=' < persistent (PERS) of loaddata > ] ';'
```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Moves the robot linearly	MoveL - Moves the robot linearly on page 457
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Movements with I/O settings	<i>Technical reference manual - RAPID Overview</i>

Continues on next page

1.157 MoveLDO - Moves the robot linearly and sets digital output in the corner

RobotWare Base

Continued

For information about	See
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayloadMode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>

1 Instructions

1.158 MoveLGO - Moves the robot linearly and sets group output signal in the corner
RobotWare Base

1.158 MoveLGO - Moves the robot linearly and sets group output signal in the corner

Usage

MoveLGO (*Move Linearly Group Output*) is used to move the tool center point (TCP) linearly to a given destination. The specified group output signal is set at the middle of the corner path.

When the TCP is to remain stationary then this instruction can also be used to reorient the tool.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction MoveLGO:

Example 1

```
MoveLGO p1, v1000, z30, tool2, go1 \Value:=5;
```

The TCP of the tool, tool2, is moved linearly to the position p1 with speed data v1000 and zone data z30. Group output signal go1 is set in the middle of the corner path at p1.

Arguments

```
MoveLGO ToPoint [\ID] Speed [\T][\KeepStartPath] [\KeepEndPath]  
Zone Tool [\WObj] Signal [\Value] | [\DValue] [\TLoad]
```

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in the MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity for the tool center point, the tool reorientation, and external axes.

[\T]

Time

Data type: num

Continues on next page

1.158 MoveLGO - Moves the robot linearly and sets group output signal in the corner

RobotWare Base
Continued

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

`\KeepStartPath`

Data type: num

If the move instruction starts from a fine point, `\KeepStartPath` defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, `\KeepStartPath` is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

`\KeepEndPath`

Data type: num

If the move instruction ends in a fine point, `\KeepEndPath` defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, `\KeepEndPath` is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point moved to the specified destination position.

[`\wobj`]

Work Object

Data type: wobjdata

The work object (coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified.

Signal

Data type: signalgo

The name of the group output signal to be changed.

[`\Value`]

Data type: num

Continues on next page

1 Instructions

1.158 MoveLGO - Moves the robot linearly and sets group output signal in the corner

RobotWare Base

Continued

The desired value of signal.

[\DValue]

Data type: dnum

The desired value of signal.

If none of the arguments \Value or \DValue is entered, an error message will be displayed.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See the instruction MoveL for more information about linear movements.

The specified group output signal is set in the middle of the corner path for flying points, as shown in the figure below.

The figure shows set of group output signal in the corner path with MoveLGO.

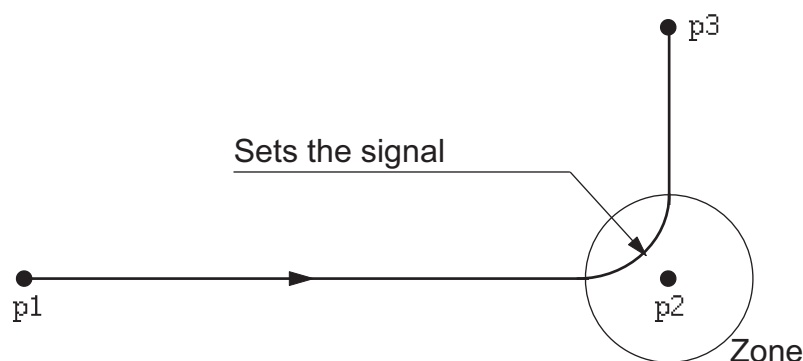
```
MoveLGO p2, v1000, z30, tool2, go1 \Value:=5;
```

Continues on next page

1.158 MoveLGO - Moves the robot linearly and sets group output signal in the corner

RobotWare Base

Continued



xx1400001118

For stop points we recommend the use of “normal” programming sequence with MoveL + SetGO. But when using stop point in instruction MoveLGO, the group output signal is set when the robot reaches the stop point.

The specified I/O signal is set in execution mode continuously and stepwise forward, but not in stepwise backward.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Limitations

MoveLGO cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```

MoveLGO
[ ToPoint ':' '=' ] < expression (IN) of robtarget >
[ '\\' ID ':' '=' < expression (IN) of identno > ], '
[ Speed ':' '=' ] < expression (IN) of speeddata >
| [ '\\' T ':' '=' < expression (IN) of num > ]
[ '\\' KeepStartPath ':' '=' < expression (IN) of num > ]
[ '\\' KeepEndPath ':' '=' < expression (IN) of num > ] ', '
[ Zone ':' '=' ] < expression (IN) of zonedata > ', '
[ Tool ':' '=' ] < persistent (PERS) of tooldata >
[ '\\' WObj ':' '=' ] < persistent (PERS) of wobjdata > ', '
[ Signal ':' '=' ] < variable (VAR) of signaldo > ', '
[ '\\' Value ':' '=' ] < expression (IN) of num > ]

```

Continues on next page

1 Instructions

1.158 MoveLGO - Moves the robot linearly and sets group output signal in the corner

RobotWare Base

Continued

```
| [ '\\' Dvalue' :=' ] < expression (IN) of dnum >  
[ '\\' TLoad ':= ' < persistent (PERS) of loaddata > ] ';' ;
```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Moves the robot linearly	MoveL - Moves the robot linearly on page 457
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Movements with I/O settings	<i>Technical reference manual - RAPID Overview</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayLoad-Mode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>

1.159 MoveLSync - Moves the robot linearly and executes a RAPID procedure

RobotWare Base

1.159 MoveLSync - Moves the robot linearly and executes a RAPID procedure

Usage

MoveLSync (*Move Linearly Synchronously*) is used to move the tool center point (TCP) linearly to a given destination. The specified RAPID procedure is ordered to execute at the middle of the corner path in the destination point.

When the TCP is to remain stationary then this instruction can also be used to reorient the tool.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following examples illustrate the instruction MoveLSync:

Example 1

```
MoveLSync p1, v1000, z30, tool2, "proc1";
```

The TCP of the tool, tool2, is moved linearly to the position p1 with speed data v1000 and zone data z30. Procedure proc1 is executed in the middle of the corner path at p1.

Example 2

```
MoveLSync p1, v1000, z30, tool2, "proc1";
```

The same as in example 1 above, but here the locally declared procedure proc1 in module MyModule will be called in the middle of the corner path.

Arguments

```
MoveLSync ToPoint [\ID] Speed [\T] [\KeepStartPath] [\KeepEndPath]
          Zone Tool [\WObj] ProcName [\TLoad]
```

ToPoint

Data type: robtargget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

Continues on next page

1 Instructions

1.159 MoveLSync - Moves the robot linearly and executes a RAPID procedure

RobotWare Base

Continued

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[\WObj]

Work Object

Data type: wobjdata

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used this argument must be specified in order for a circle relative to the work object to be executed.

Continues on next page

1.159 MoveLSync - Moves the robot linearly and executes a RAPID procedure

RobotWare Base
Continued

ProcName

Procedure Name

Data type: string

Name of the RAPID procedure to be executed at the middle of the corner path in the destination point.

The procedure will execute on trap level (see description of program execution).

ProcName

Procedure Name

Data type: string

Name of the RAPID procedure to be executed at the middle of the corner path in the destination point. The procedure call is a late binding call, and therefore inherits its properties.

The procedure will execute on trap level (see [Program execution on page 481](#)).

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.

**Note**

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See the instruction MoveL for more information about linear movements.

The specified RAPID procedure is ordered to execute when the TCP reaches the middle of the corner path in the destination point of the MoveLSync instruction, as shown in the figure below.

Continues on next page

1 Instructions

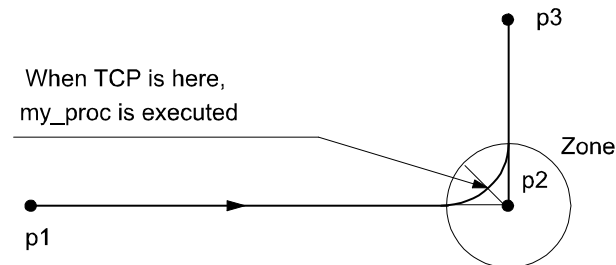
1.159 MoveLSync - Moves the robot linearly and executes a RAPID procedure

RobotWare Base

Continued

The figure shows that the order to execute the user defined RAPID procedure is done in the middle of the corner path.

```
MoveLSync p2, v1000, z30, tool2, "my_proc";
```



xx0500002194

For stop points we recommend the use of normal programming sequence with MoveL + other RAPID instructions in sequence.

The table describes execution of the specified RAPID procedure in different execution modes:

Execution mode:	Execution of RAPID procedure:
Continuously or Cycle	According to this description
Forward step	In the stop point
Backward step	Not at all

MoveLSync is an encapsulation of the instructions TriggInt and TriggL. The procedure call is executed on trap level.

If the middle of the corner path in the destination point is reached during the deceleration after a program stop, the procedure will not be called (program execution is stopped). The procedure call will be executed at next program start.

Limitations

When the robot reaches the middle of the corner path there is normally a delay of 2-30 ms until the specified RAPID routine is executed, depending on what type of movement is being performed at the time.

Switching execution mode after program stop from continuously or cycle to stepwise forward or backward results in an error. This error tells the user that the mode switch can result in missed execution of the RAPID procedure in the queue for execution on the path.

Instruction MoveLSync cannot be used on trap level. The specified RAPID procedure cannot be tested with stepwise execution.

MoveLSync cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
MoveLSync
[ ToPoint ':' '=' ] < expression (IN) of robtarget >
[ '\ ' ID ':' '=' < expression (IN) of identno > ], '
[ Speed ':' '=' ] < expression (IN) of speeddata >
```

Continues on next page

1.159 MoveLSync - Moves the robot linearly and executes a RAPID procedure

RobotWare Base

Continued

```

| [ '\\' T ':=' < expression (IN) of num > ]
[ '\\' KeepStartPath ':=' < expression (IN) of num > ]
[ '\\' KeepEndPath ':=' < expression (IN) of num > ] ', '
[ Zone ':=' ] < expression (IN) of zonedata > ', '
[ Tool ':=' ] < persistent (PERS) of tooldata >
[ '\\' WObj ':=' < persistent (PERS) of wobjdata > ] ', '
[ ProcName ':=' ] < expression (IN) of string > ]
[ '\\' TLoad ':=' < persistent (PERS) of loaddata > ] ';'

```

Related information

For information about	See
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Moves the robot linearly	MoveL - Moves the robot linearly on page 457
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Defines a position related interrupt	TriggInt - Defines a position related interrupt on page 883
Linear robot movements with events	TriggL - Linear robot movements with events on page 902
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayloadMode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>

1 Instructions

1.160 MovePnP - Moves the robot along a pick and place path SCARA robots

1.160 MovePnP - Moves the robot along a pick and place path

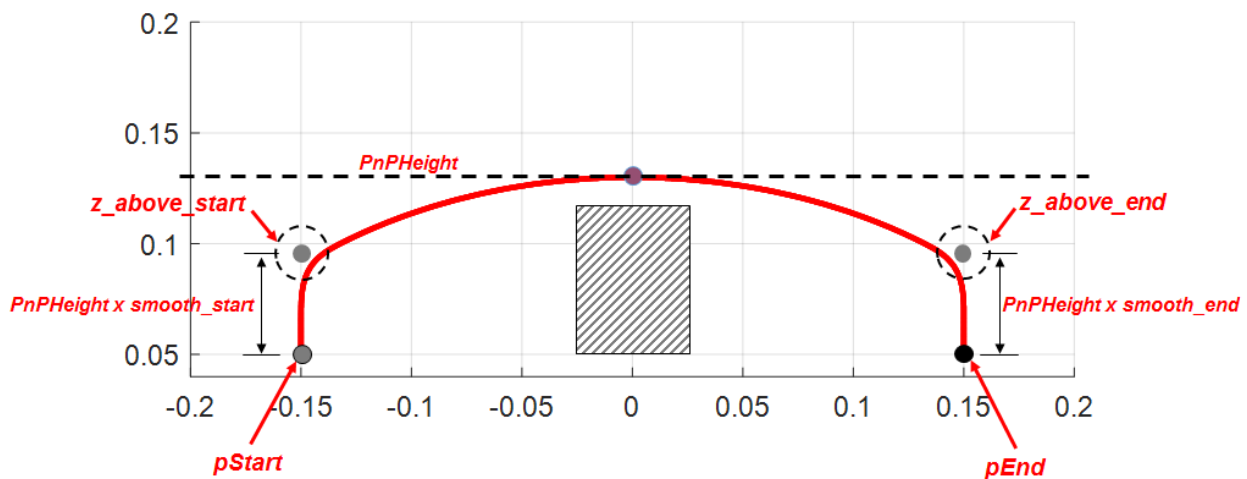
Usage

MovePnP is used to move the tool center point (TCP) quickly along a pick and place path as illustrated in the below picture.

The path includes two vertical movements connected by a top point. The height of the top point as well as the heights of the vertical movements are configurable to make the path assuming different shapes.

The different shape types are:

- Five points shape, as seen in the below picture.
- Four points shape, square like.
- Three points shape, arc like.
- Unsymmetrical, any of the above combinations.



xx1700001194

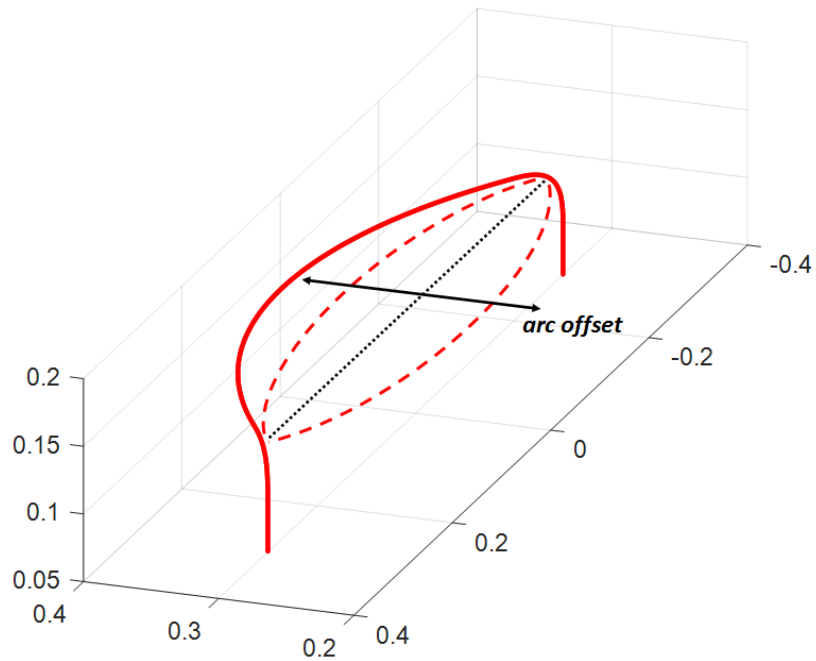
The path on the horizontal plane looks like an arc which curvature departs from a linear motion by an offset parameter that cannot be explicitly specified. This parameter is computed internally with the specific aim to minimize the cycle time.

Continues on next page

1.160 MovePnP - Moves the robot along a pick and place path

SCARA robots

Continued



xx1800002597

Basic examples

The following example illustrates the instruction MovePnP.

See also [More examples on page 490](#).

Example 1

```
VAR num my_pnp_height := 130;
VAR pnpdata my_pnpdata;

my_pnpdata.smooth_start := 50;
my_pnpdata.smooth_end := 50;
MoveL pStart, v300, fine, tool2;
MovePnP pEnd, v300, \PnPHeight:=my_pnp_height, fine, tool2
      \PnPDataIN:=my_pnpdata;
```

Five points shape path. It is configured by setting the optional parameters smooth_start and smooth_end to a value between 0 and 100.

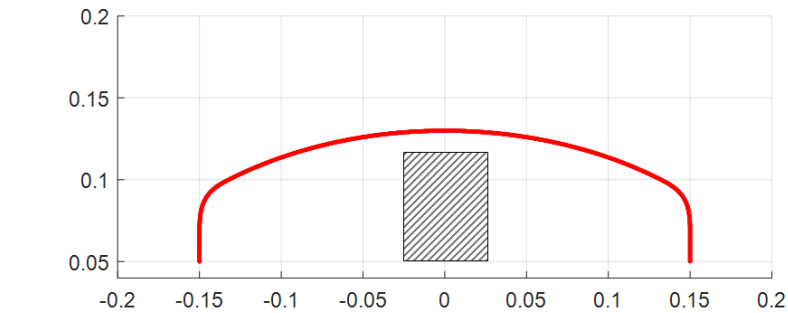
Continues on next page

1 Instructions

1.160 MovePnP - Moves the robot along a pick and place path

SCARA robots

Continued



xx1700001195

Arguments

```
MovePnP ToPoint [\ID] Speed [\PnPHeight] Zone [\Inpos] Tool [\WObj]
      [\TLoad] [\PnPDataIN] [\SignalIN] [\Value] [\MaxTime]
      [\TimeFlag] [\PnPTrigg] [\PnPTriggOption]
```

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in the MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the tool center point, the tool reorientation, and additional axes. The speed data not used to generate the optimal path. The path executed using the MovePnP instruction is optimized for the maximum speed of the robot.

[\PnPHeight]

Data type: num

The height of the top point specified in mm in absolute coordinates (not relative to the start point or to the end point) in the ToPoint reference frame. If the value is not specified, the height will correspond to the top (zero) position of axis 3.

Continues on next page

**Note**

The way to use PnPHeight is evident in case of different pick and place heights (see [Example 4 on page 491](#)), since PnPHeight needs to be independent from both the start and the end height, that is, not specified relative to either on them. For IRB 910INV, if the path is specified in base coordinates, PnPHeight will be negative.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Inpos]

In position

Data type: stoppointdata

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point moved to the specified destination point.

[\Wobj]

Work Object

Data type: wobjdata

The work object (coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

Continues on next page

1 Instructions

1.160 MovePnP - Moves the robot along a pick and place path

SCARA robots

Continued

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

[\PnPDataIN]

Data type: pnpdata

pnpdata is a data structure used to configure pick and place paths. If not specified, the path will be configured using the default values.



Note

If the structure is declared but not all the fields are assigned, the non-assigned fields will have default zero values.

[\SignalIN]

Data type: signaldi

The name of the signal.

[\Value]

Data type: dionum

The desired value of the signal.

[\MaxTime]

Data type: num

The maximum period of waiting time permitted, expressed in seconds. If this time runs out before the condition is met then the error handler will be called, if there is one, with the error code ERR_WAIT_MAXTIME. If there is no error handler then the execution will be stopped.

[\TimeFlag]

Data type: bool

The output parameter contains the value TRUE if the maximum permitted waiting time runs out before the condition is met. If this parameter is included in the instruction then it is not considered to be an error if the MaxTime runs out. This argument is ignored if the MaxTime argument is not included in the instruction.

[\PnPTrigg]

Data type: trigdata

Continues on next page

1.160 MovePnP - Moves the robot along a pick and place path

SCARA robots

Continued

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed or TriggRampA0.

**Note**

The triggering condition is set when the robot's TCP is at a point along the path according to the parameter PnPTriggOption.

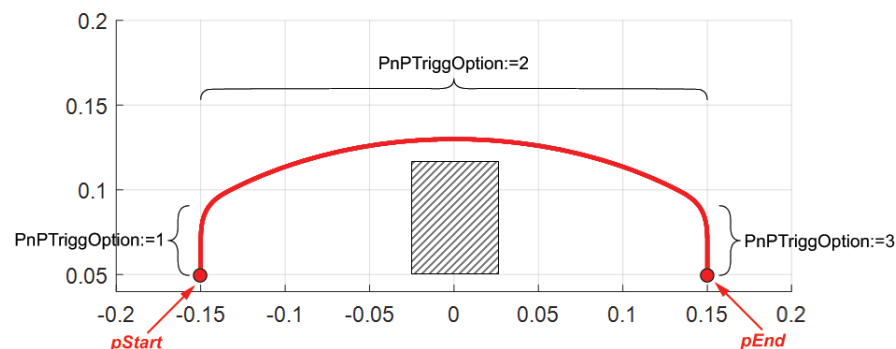
[\PnPTriggOption]

Data type: num

Specifies which part of the movement is associated with the triggering conditions specified by PnPTrigg.

The valid options are:

Value	Description
1	The first vertical movement, from the start point.
2	The horizontal movement.
3	The second vertical movement, towards the end point.



xx1800001532

Figure 1.1:

Default value is 2 (i.e. if \PnPTriggOption is omitted, the triggering will be specified along the horizontal movement).

Program execution

The robot TCP is moved to the destination position as follows:

- 1 The TCP moves vertically above the current robot position by a distance specified by a percentage of the path height.
- 2 The TCP reaches the top point computed as the middle point of the path with a path height specified by the PnPHeight parameter.
- 3 The TCP continues to move to a point above the end position described by a distance specified by a percentage of the path height.
- 4 The TCP moves vertically to the end position.

Continues on next page

1 Instructions

1.160 MovePnP - Moves the robot along a pick and place path

SCARA robots

Continued

(The optional parameter SignalIN can be used to wait for a digital input signal before starting the motion to the end position).

- 5 The optional argument PnPTrigg can be used to synchronize the movement with an external device while the TCP travels along the horizontal path or the vertical movement (depending on the optional argument PnPTriggOption).

More examples

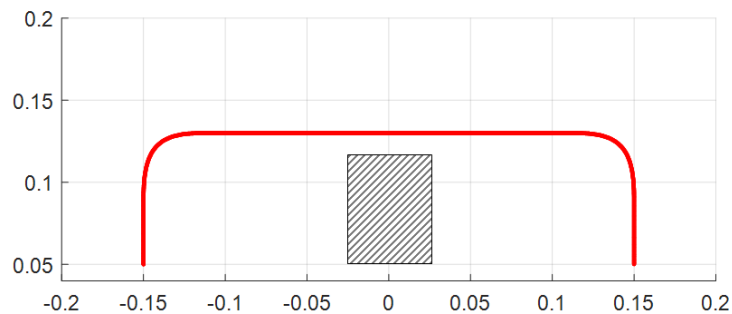
More examples of the instruction MovePnP are illustrated below.

Example 1

```
VAR num my_pnp_height := 130;
VAR pnpdata my_pnpdata;

my_pnpdata.smooth_start := 100;
my_pnpdata.smooth_end := 100;
MoveL pStart, v300, fine, tool2;
MovePnP pEnd, v300, \PnPHeight:=my_pnp_height, fine, tool2
      \PnPDataIN:=my_pnpdata;
```

Four points shape, square like. It is configured by setting the optional parameters smooth_start and smooth_end to 100.



xx1700001196

Example 2

```
VAR num my_pnp_height := 130;
VAR pnpdata my_pnpdata;

my_pnpdata.smooth_start := 0;
my_pnpdata.smooth_end := 0;
MoveL pStart, v300, fine, tool2;
MovePnP pEnd, v300, \PnPHeight:=my_pnp_height, fine, tool2
      \PnPDataIN:=my_pnpdata;
```

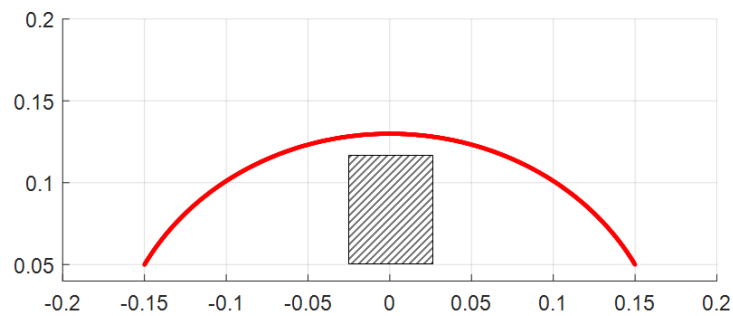
Three points shape, arc like. It is configured by setting the optional parameters smooth_start and smooth_end to 0.

Continues on next page

1.160 MovePnP - Moves the robot along a pick and place path

SCARA robots

Continued



xx1700001197

Example 3

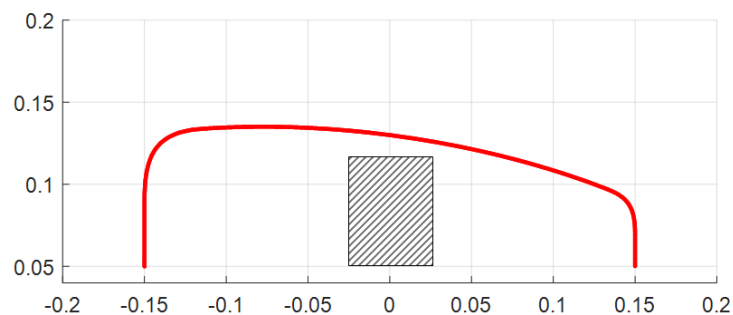
```

VAR num my_pnp_height := 130;
VAR pnpdata my_pnpdata

my_pnpdata.smooth_start := 100;
my_pnpdata.smooth_end := 50;
MoveL pStart, v300, fine, tool2;
MovePnP pEnd, v300, \PnPHeight:=my_pnp_height, fine, tool2
      \PnPDataIN:=my_pnpdata;

```

Four points unsymmetrical shape. It is configured by setting the optional parameters smooth_start and smooth_end to different values.



xx1800000951

Example 4

```

VAR num my_pnp_height := 130;
VAR pnpdata my_pnpdata

my_pnpdata.smooth_start := 100;
my_pnpdata.smooth_end := 100;
MoveL pStart, v300, fine, tool2;
MovePnP pEnd, v300, \PnPHeight:=my_pnp_height, fine, tool2
      \PnPDataIN:=my_pnpdata;

```

Four points shape with different pick and place levels. It is configured by setting the optional parameters smooth_start and smooth_end to 100 (no difference from pick and place on the same level).

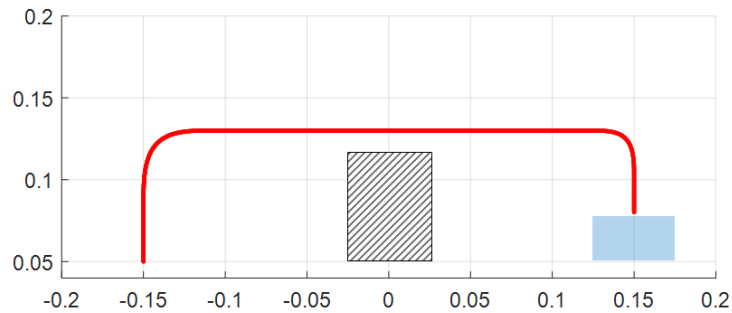
Continues on next page

1 Instructions

1.160 MovePnP - Moves the robot along a pick and place path

SCARA robots

Continued

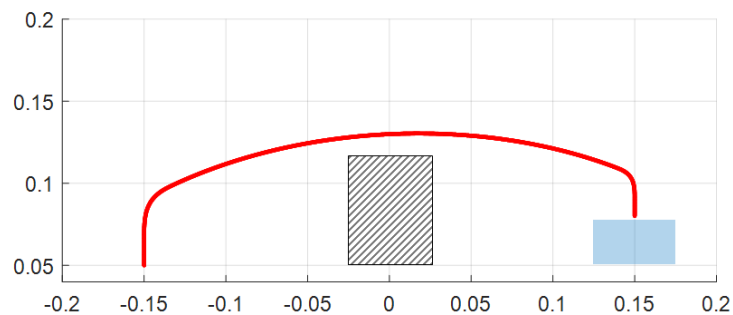


xx1800000952

Example 5

```
VAR num my_pnp_height := 130;  
VAR pnpdata my_pnpdata  
  
my_pnpdata.smooth_start := 50;  
my_pnpdata.smooth_end := 50;  
MoveL pStart, v300, fine, tool2;  
MovePnP pEnd, v300, \PnPHeight:=my_pnp_height, fine, tool2  
      \PnPDataIN:=my_pnpdata;
```

Five points shape with different pick and place levels. Note that the shape will be unsymmetrical even if the optional parameters `smooth_start` and `smooth_end` are set to the same value.



xx1800000953

Example 6

```
VAR num my_pnp_height := 130;  
VAR pnpdata my_pnpdata  
VAR trigdata open_gripper;  
  
my_pnpdata.smooth_start := 50;  
my_pnpdata.smooth_end := 50;  
TriggIO open_gripper, 25 \DOP:=doGripper, 0;  
MoveL pStart, v300, fine, tool2;  
MovePnP pEnd, v300, \PnPHeight:=my_pnp_height, fine, tool2  
      \PnPDataIN:=my_pnpdata \PnPTrigg:=open_gripper  
      \PnPTriggOption:=3;
```

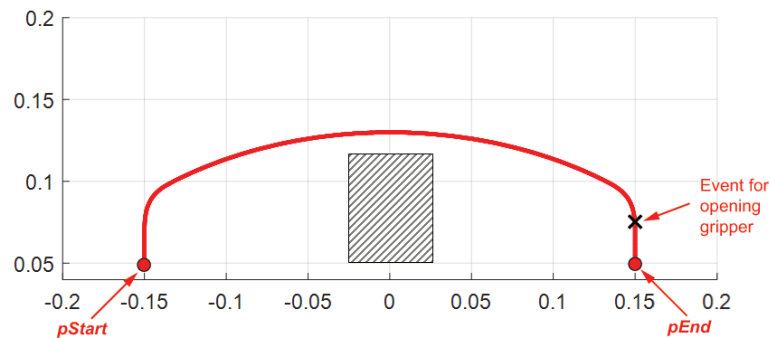
Continues on next page

1.160 MovePnP - Moves the robot along a pick and place path

SCARA robots

Continued

The digital output signal doGripper is set to the value 0 when the TCP is at a position where the vertical distance to pEnd is 25 mm.



xx1800001531

Limitations

The instruction MovePnP does not support backwards execution.

The instruction MovePnP is only available for SCARA robots.

Syntax

MovePnP

```
[ToPoint ':='] <expression (IN) of robtarget>
['\ ' ID ':='] <expression (IN) of identno>','
[Speed ':='] <expression (IN) of speeddata>
['\ ' PnPHeight ':='] <expression (IN) of num>','
[Zone ':='] <expression (IN) of zonedata>
['\ ' Inpos ':='] <expression (IN) of stoppointdata>','
[Tool ':='] <persistent (PERS) of tooldata>
['\ ' WObj ':='] <persistent (PERS) of wobjdata>
['\ ' TLoad ':='] <persistent (PERS) of loaddata>
['\ ' PnPDataIN ':='] <expression (IN) of pnpdata>
['\ ' SignalIN ':='] <variable (VAR) of signaldi>
['\ ' Value ':='] <expression (IN) of dionum>
['\ ' MaxTime ':='] <expression (IN) of num>
['\ ' TimeFlag ':='] <variable (VAR) of bool>
['\ ' PnPTrigg ':='] <variable (VAR) of triggdata>
['\ ' PnPTriggOption ':='] <variable (VAR) of num>;'
```

Related information

For information about	See
Configuring pick and place paths	pnpdata - Configure pick and place paths on page 1694

1 Instructions

1.161 MToolRotCalib - Calibration of rotation for moving tool

RobotWare Base

1.161 MToolRotCalib - Calibration of rotation for moving tool

Usage

MToolRotCalib (*Moving Tool Rotation Calibration*) is used to calibrate the rotation of a moving tool.

The position of the robot and its movements are always related to its tool coordinate system, that is, the TCP and tool orientation. To get the best accuracy it is important to define the tool coordinate system as correctly as possible.

The calibration can also be done with a manual method using the FlexPendant, see *Operating manual - OmniCore*.

Description

To define the tool orientation, you need a world fixed tip within the robot's working space.

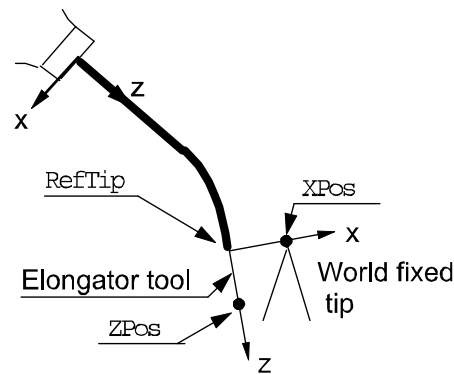
Before using the instruction MToolRotCalib some preconditions must be fulfilled:

- The tool that is to be calibrated must be mounted on the robot and defined with correct component robhold(TRUE).
- If using the robot with absolute accuracy then the load and center of gravity for the tool should already be defined. LoadIdentify can be used for the load definition.
- The TCP value of the tool must already be defined. The calibration can be done with the instruction MToolTCPCalib.
- tool0, wobj0, and PDispOff must be activated before jogging the robot.
- Jog the TCP of the actual tool as close as possible to the world fixed tip (origin of the tool coordinate system) and define a jointtarget for the reference point RefTip.
- Jog the robot without changing the tool orientation so the world fixed tip is pointing at some point on the positive z-axis of the tool coordinate system, and define a jointtarget for point ZPos.
- Optionally jog the robot without changing the tool orientation so the world fixed tip is pointing at some point on the positive x-axis of the tool coordinate system, and define a jointtarget for point XPos.

As a help for pointing out the positive z-axis and x-axis, some type of elongator tool can be used.

See the figure below for a definition of jointtarget for RefTip, ZPos, and optional XPos.

Continues on next page



xx0500002192

**Note**

It is not recommended to modify the positions RefTip, ZPos, and XPos in the instruction MToolRotCalib.

Basic examples

The following examples illustrate the instruction MToolRotCalib:

Example 1

```
! Created with the world fixed tip pointing at origin, positive
! z-axis, and positive x-axis of the wanted tool coordinate
! system.
CONST jointtarget pos_tip := [...];
CONST jointtarget pos_z := [...];
CONST jointtarget pos_x := [...];

PERS tooldata tool1:= [ TRUE, [[20, 30, 100], [1, 0, 0, 0]], [0.001,
    [0, 0, 0.001], [1, 0, 0, 0], 0, 0, 0]];

! Instructions for creating or ModPos of pos_tip, pos_z, and pos_x
MoveAbsJ pos_tip, v10, fine, tool0;
MoveAbsJ pos_z, v10, fine, tool0;
MoveAbsJ pos_x, v10, fine, tool0;

! Only tool calibration in the z direction
MToolRotCalib pos_tip, pos_z, tool1;
```

The tool orientation (tframe.rot) in the z direction of tool1 is calculated. The x and y directions of the tool orientation are calculated to coincide with the wrist coordinate system.

Example 2

```
! Calibration with complete tool orientation
MToolRotCalib pos_tip, pos_z \XPos:=pos_x, tool1;
```

The complete tool orientation (tframe.rot) of tool1 is calculated.

Continues on next page

1 Instructions

1.161 MToolRotCalib - Calibration of rotation for moving tool

RobotWare Base

Continued

Arguments

MToolRotCalib RefTip ZPos [\XPos]Tool

RefTip

Data type: jointtarget

The point where the TCP of the tool is pointing at the world fixed tip.

ZPos

Data type: jointtarget

The elongator point that defines the positive z direction.

[\XPos]

Data type: jointtarget

The elongator point that defines the x positive direction. If this point is omitted then the x and y directions of the tool will coincide with the corresponding axes in the wrist coordinate system.

Tool

Data type: tooldata

The persistent variable of the tool that is to be calibrated.

Program execution

The system calculates and updates the tool orientation (`tframe.rot`) in the specified tooldata. The calculation is based on the specified 2 or 3 jointtarget. The remaining data in tooldata such as TCP (`tframe.trans`) is not changed.

Syntax

```
MToolRotCalib
  [RefTip ':='] <expression (IN) of jointtarget>','
  [ZPos ':='] <expression (IN) of jointtarget>
  ['\ ' XPos ':=' <expression (IN) of jointtarget>'],'
  [Tool ':='] <persistent (PERS) of tooldata>;'
```

Related information

For information about	See
Calibration of TCP for a moving tool	MToolTCPCalib - Calibration of TCP for moving tool on page 497
Calibration of TCP for a stationary tool	SToolTCPCalib - Calibration of TCP for stationary tool on page 784
Calibration of TCP and rotation for a stationary tool	SToolRotCalib - Calibration of TCP and rotation for stationary tool on page 781

1.162 MToolTCPCalib - Calibration of TCP for moving tool

Usage

MToolTCPCalib (*Moving Tool TCP Calibration*) is used to calibrate Tool Center Point - TCP for a moving tool.

The position of the robot and its movements are always related to its tool coordinate system, that is, the TCP and tool orientation. To get the best accuracy it is important to define the tool coordinate system as correctly as possible.

The calibration can also be done with a manual method using the FlexPendant, see *Operating manual - OmniCore*.

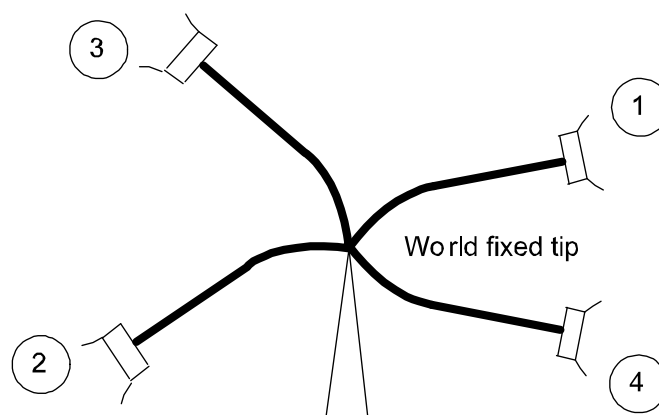
Description

To define the TCP of a tool you need a world fixed tip within the robot's working space.

Before using the instruction MToolTCPCalib some preconditions must be fulfilled:

- The tool that is to be calibrated must be mounted on the robot and defined with correct component robhold(TRUE).
- If using the robot with absolute accuracy then the load and center of gravity for the tool should already be defined. LoadIdentify can be used for the load definition.
- tool0, wobj0, and PDispOff must be activated before jogging the robot.
- Jog the TCP of the actual tool as close as possible to the world fixed tip (origin of the tool coordinate system) and define a jointtarget for the reference point RefTip.
- Define the further three positions (p2, p3, and p4) all with different orientations.

Definition of 4 jointtargets p1....p4, see figure below.



xx0500002191

Continues on next page

1 Instructions

1.162 MToolTCPCalib - Calibration of TCP for moving tool

RobotWare Base

Continued



Note

It is not recommended to modify the positions Pos1 to Pos4 in the instruction MToolTCPCalib.

The reorientation between the 4 positions should be as big as possible, putting the robot in different configurations. Its also good practice to check the quality of the TCP after a calibration. Which can be performed by reorientation of the tool to check if the TCP is standing still.

Basic examples

The following example illustrates the instruction MToolTCPCalib:

Example 1

```
! Created with actual TCP pointing at the world fixed tip
CONST jointtarget p1 := [...];
CONST jointtarget p2 := [...];
CONST jointtarget p3 := [...];
CONST jointtarget p4 := [...];

PERS tooldata tool1:= [TRUE, [[0, 0, 0], [1, 0, 0, 0]], [0.001,
    [0, 0, 0.001], [1, 0, 0, 0], 0, 0, 0]];
VAR num max_err;
VAR num mean_err;
...
! Instructions for createing or ModPos of p1 - p4
MoveAbsJ p1, v10, fine, tool0;
MoveAbsJ p2, v10, fine, tool0;
MoveAbsJ p3, v10, fine, tool0;
MoveAbsJ p4, v10, fine, tool0;
...
MToolTCPCalib p1, p2, p3, p4, tool1, max_err, mean_err;
```

The TCP value (tframe.trans) of tool1 will be calibrated and updated. max_err and mean_err will hold the max. error in mm from the calculated TCP and the mean error in mm from the calculated TCP, respectively.

Arguments

MToolTCPCalib Pos1 Pos2 Pos3 Pos4 Tool MaxErr MeanErr

Pos1

Data type: jointtarget

The first approach point.

Pos2

Data type: jointtarget

The second approach point.

Pos3

Data type: jointtarget

The third approach point.

Continues on next page

Pos4

Data type: jointtarget

The fourth approach point.

Tool

Data type: tooldata

The persistent variable of the tool that is to be calibrated.

MaxErr

Data type: num

The maximum error in mm for one approach point.

MeanErr

Data type: num

The average distance that the approach points are from the calculated TCP, that is, how accurately the robot was positioned relative to the tip.

Program execution

The system calculates and updates the TCP value in the wrist coordinate system (tfame.trans) in the specified tooldata. The calculation is based on the specified 4 jointtarget. The remaining data in tooldata, such as tool orientation (tfame.rot), is not changed.

Syntax

```
MToolTCPCalib
  [Pos1 ':='] <expression (IN) of jointtarget>', '
  [Pos2 ':='] <expression (IN) of jointtarget>', '
  [Pos3 ':='] <expression (IN) of jointtarget>', '
  [Pos4 ':='] <expression (IN) of jointtarget>', '
  [Tool ':='] <persistent (PERS) of tooldata>', '
  [MaxErr ':='] <variable (VAR) of num>', '
  [MeanErr ':='] <variable (VAR) of num>';'
```

Related information

For information about	See
Calibration of rotation for a moving tool	MToolRotCalib - Calibration of rotation for moving tool on page 494
Calibration of TCP for a stationary tool	SToolTCPCalib - Calibration of TCP for stationary tool on page 784
Calibration of TCP and rotation for a stationary tool	SToolRotCalib - Calibration of TCP and rotation for stationary tool on page 781

1 Instructions

1.163 Open - Opens a file or I/O device
RobotWare Base

1.163 Open - Opens a file or I/O device

Usage

Open is used to open a file or I/O device for reading or writing.

Basic examples

The following examples illustrate the instruction Open:

See also [More examples on page 502](#).

Example 1

```
VAR iodev logfile;  
...  
Open "HOME:" \File:= "LOGFILE1.DOC", logfile \Write;
```

The file LOGFILE1.DOC in unit HOME: is opened for writing. The reference name logfile is used later in the program when writing to the file.

Example 2

```
VAR iodev logfile;  
...  
Open "LOGFILE1.DOC", logfile \Write;
```

Same result as example 1. The default directory is HOME:.

Arguments

Open Object [\File] IODevice [\Read] | [\Write] | [\Append] [\Bin]
[\ISOLatin1Encoding]

Object

Data type: string

The I/O object (I/O device) that is to be opened, e.g. "HOME:", "TEMP:" or "pc:" (option).

The table describes different I/O devices on the robot controller.

I/O device name	Type of I/O device
"HOME:" or diskhome ⁱ	SD-card
"TEMP:" or disktemp ⁱ	SD-card
"pc:" ⁱⁱ	Mounted disk
"RAMDISK:" or diskram ^{i, iii}	RAM disk memory

ⁱ RAPID string defining a device name.

ⁱⁱ Application protocol, server path defined in the system parameters.

ⁱⁱⁱ The RAM disk memory is not for permanent storage of any data. The size is around 100 Mb and it is cleared at each shut down.

The following table describes different I/O devices on the virtual controller.

I/O device name	Type of I/O device
"HOME:" or diskhome ⁱ	
"TEMP:" or disktemp	Hard Drive

Continues on next page

I/O device name	Type of I/O device
"RAMDISK:" or diskram ⁱ	Hard Drive ..TEMP (points to the TEMP folder which is located in the same folder as your virtual system)

ⁱ RAPID string defining a device name.

[\File]

Data type: string

The name of the file to be opened, e.g. "LOGFILE1.DOC" or "LOGDIR/LOGFILE1.DOC"

The complete path can also be specified in the argument Object, "HOME:/LOGDIR/LOGFILE.DOC".

IODevice

Data type: iodev

A reference to the file or I/O device to open. This reference is then used for reading from and writing to the file or I/O device.

[\Read]

Data type: switch

Opens a file or I/O device for reading. When reading from a file the reading is started from the beginning of the file.

[\Write]

Data type: switch

Opens a file or I/O device for writing. If the selected file already exists then its contents are deleted. Anything subsequently written is written at the start of the file.

[\Append]

Data type: switch

Opens a file or I/O device for writing. If the selected file already exists then anything subsequently written is written at the end of the file.

Open a file or I/O device with \Append and without the \Bin arguments. The instruction opens a character-based file or I/O device for writing.

Open a file or I/O device with \Append and \Bin arguments. The instruction opens a binary file or I/O device for both reading and writing. The arguments \Read, \Write, \Append are mutually exclusive. If none of these are specified then the instruction acts in the same way as the \Write argument for character-based files or a I/O device (instruction without \Bin argument) and in the same way as the \Append argument for binary files or a I/O device (instruction with \Bin argument).

[\Bin]

Data type: switch

Continues on next page

1 Instructions

1.163 Open - Opens a file or I/O device

RobotWare Base

Continued

The file or I/O device is opened in a binary mode. If none of the arguments \Read, \Write or \Append are specified then the instruction opens a binary file or I/O device for both reading and writing, with the file pointer at the end of the file.

The Rewind instruction can be used to set the file pointer to the beginning of the file if desirable.

The set of instructions to access a binary file or I/O device is different from the set of instructions to access a character-based file.

[\ISOLatin1Encoding]

Data type: switch

If using this switch the data is converted to/from ISO 8859-1 (Latin-1) encoding before writing/reading the data.

If this switch is used in Open, then it is not needed in the instructions Write, WriteStrBin, ReadNum, ReadStr, and ReadStrBin.

More examples

More examples of how to use the instruction Open are illustrated below.

Example 1

```
VAR iODEV io_device;
VAR rawbytes raw_data_out;
VAR rawbytes raw_data_in;
VAR num float := 0.2;
VAR string answer;

ClearRawBytes raw_data_out;
PackDNHeader "10", "20 1D 24 01 30 64", raw_data_out;
PackRawBytes float, raw_data_out, (RawBytesLen(raw_data_out)+1)
    \Float4;

Open "/FCI1:/dsqc328_1", io_device \Bin;
WriteRawBytes io_device, raw_data_out;
ReadRawBytes io_device, raw_data_in \Time:=1;
Close io_device;

UnpackRawBytes raw_data_in, 1, answer \ISOLatin1Encoding:=10;
```

In this example raw_data_out is cleared and then packed with DeviceNet header and a float with value 0.2.

A device, "/FCI1:/dsqc328_1", is opened and the current valid data in raw_data_out is written to the device. Then the program waits for at most 1 second to read from the device, which is stored in the raw_data_in.

After having closed the device "/FCI1:/dsqc328_1", then the read data is unpacked as a string of 10 characters and stored in the string named answer.

Program execution

The specified file or I/O device is opened so that it is possible to read from or write to it.

Continues on next page

It is possible to open the same physical file several times at the same time but each invocation of the Open instruction will return a different reference to the file (data type `iodev`). For example, it is possible to have one write pointer and one different read pointer to the same file at the same time.

The `iodev` variable used when opening a file or I/O device must be free from use. If it has been used previously to open a file then this file must be closed before issuing a new Open instruction with the same `iodev` variable.

At Program Stop and moved PP to Main, any open file or I/O device in the program task will be closed and the I/O descriptor in the variable of type `iodev` will be reset. An exception to the rule is variables that are installed shared in the system of type global VAR or LOCAL VAR. Such file or I/O device belonging to the whole system will still be open.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type `iodev` will be reset.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_FILEOPEN</code>	A file cannot be opened.

Limitations

Any number of I/O devices (`iodev`) can be declared but it is only possible to have 12 open I/O devices and files at the same time.

Syntax

```

Open
[ Object '[:='] <expression (IN) of string>
[ '\\' File '[:=' <expression (IN) of string>] ', '
[ IODevice '[:=' <variable (VAR) of iodev>
[ '\\' Read] |
[ '\\' Write] |
[ '\\' Append]
[ '\\' Bin]
[ '\\' ISOLatin1Encoding]';'
```

Related information

For information about	See
Writing to, reading from and closing files or I/O devices	<i>Technical reference manual - RAPID Overview</i>
Fieldbus Command Interface File and I/O device handling	<i>Application manual - Controller software Omni-Core</i>

1 Instructions

1.164 OpenDir - Open a directory *RobotWare Base*

1.164 OpenDir - Open a directory

Usage

OpenDir is used to open a directory for further investigation.

Basic examples

The following example illustrates the instruction OpenDir:

Example 1

```
PROC lsdire(string dirname)
  VAR dir directory;
  VAR string filename;
  OpenDir directory, dirname;
  WHILE ReadDir(directory, filename) DO
    TPWrite filename;
  ENDWHILE
  CloseDir directory;
ENDPROC
```

This example prints out the names of all files or subdirectories under the specified directory.

Arguments

OpenDir Dev Path

Dev

Data type: dir

A variable with reference to the directory, fetched by OpenDir. This variable is then used for reading from the directory.

Path

Data type: string

Path to the directory.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	The path points to a non-existing directory or there are too many directories open at the same time.

Limitations

Open directories should always be closed by the user after reading (instruction CloseDir).

Syntax

```
OpenDir
  [ Dev ':= ' ] < variable (VAR) of dir> ','
  [ Path ':= ' ] < expression (IN) of string> ';'

```

Continues on next page

Related information

For information about	See
Directory	dir - File directory structure on page 1629
Make a directory	MakeDir - Create a new directory on page 343
Remove a directory	RemoveDir - Delete a directory on page 585
Read a directory	ReadDir - Read next entry in a directory on page 1408
Close a directory	CloseDir - Close a directory on page 147
Remove a file	RemoveFile - Delete a file on page 587
Rename a file	RenameFile - Rename a file on page 588
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

1 Instructions

1.165 PackDNHeader - Pack DeviceNet Header into rawbytes data

RobotWare Base

1.165 PackDNHeader - Pack DeviceNet Header into rawbytes data

Usage

PackDNHeader is used to pack the header of a DeviceNet explicit message into a container of type rawbytes.

The data part of the DeviceNet message can afterwards be set with the instruction PackRawBytes.

Basic examples

The following examples illustrate the instruction PackDNHeader:

Example 1

```
VAR rawbytes raw_data;
```

```
PackDNHeader "0E", "6,20 01 24 01 30 06,9,4", raw_data;
```

Pack the header for DeviceNet explicit message with service code "0E" and path string "6,2001 24 01 30 06,9,4" into raw_data corresponding to get the serial number from some I/O device.

This message is ready to send without filling the message with additional data.

Example 2

```
VAR rawbytes raw_data;
```

```
PackDNHeader "10", "20 1D 24 01 30 64", raw_data;
```

Pack the header for DeviceNet explicit message with service code "10" and path string "201D 24 01 30 64" into raw_data corresponding to set the filter time for the rising edge on insignal 1 for some I/O device.

This message must be increased with data for the filter time. This can be done with instruction PackRawBytes starting at index RawBytesLen(raw_data)+1 (done after PackDNHeader).

Arguments

PackDNHeader Service Path RawData

Service

Data type: string

The service to be done such as get or set attribute. To be specified with a hexadecimal code in a string e.g. "IF".

String length	2 characters
Format	'0' - '9', 'a' - 'f', 'A' - 'F'
Range	"00" - "FF"

The values for the Service is found in the EDS file. For more descriptions, see the Open DeviceNet Vendor Association *ODVA DeviceNet Specification revision 2.0*.

Path

Data type: string

Continues on next page

1.165 PackDNHeader - Pack DeviceNet Header into rawbytes data

RobotWare Base

Continued

The values for the Path is found in the EDS file. For more descriptions, see the Open DeviceNet Vendor Association *ODVA DeviceNet Specification revision 2.0*. Support for both long string format (e.g. "6, 20 1D 24 01 30 64, 8, 1") and short string format (e.g. "20 1D 24 01 30 64").

RawData

Data type: rawbytes

Variable container to be packed with message header data starting at index 1 in RawData.

Program execution

During program execution the DeviceNet message RawData container is:

- first completely cleared
- and then the header part is packed with data

Format DeviceNet Header

The instruction PackDNHeader will create a DeviceNet message header with following format:

RawData Header-Format	No of bytes	Note
Format	1	Internal robot controller code for DeviceNet
Service	1	Hex code for service
Size of Path	1	In bytes
Path	x	ASCII chars

The data part of the DeviceNet message can afterwards be set with the instruction PackRawBytes starting at index fetched with (RawBytesLen(my_rawdata)+1).

Syntax

```
PackDNHeader
[Service ':='] <expression (IN) of string>', '
[Path ':='] <expression (IN) of string>', '
[RawData ':='] <variable (VAR) of rawbytes>;'
```

Related information

For information about	See
rawbytes data	rawbytes - Raw data on page 1702
Get the length of rawbytes data	RawBytesLen - Get the length of rawbytes data on page 1404
Clear the contents of rawbytes data	ClearRawBytes - Clear the contents of rawbytes data on page 140
Copy the contents of rawbytes data	CopyRawBytes - Copy the contents of rawbytes data on page 165
Pack data to rawbytes data	PackRawBytes - Pack data into rawbytes data on page 509
Write rawbytes data	WriteRawBytes - Write rawbytes data on page 1078

Continues on next page

1 Instructions

1.165 PackDNHeader - Pack DeviceNet Header into rawbytes data

RobotWare Base

Continued

For information about	See
Read rawbytes data	ReadRawBytes - Read rawbytes data on page 576
Unpack data from rawbytes data	UnpackRawBytes - Unpack data from rawbytes data on page 981
Bit/Byte Functions	<i>Technical reference manual - RAPID Overview</i>
String functions	<i>Technical reference manual - RAPID Overview</i>
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>

1.166 PackRawBytes - Pack data into rawbytes data

Usage

PackRawBytes is used to pack the contents of variables of type num, dnum, byte, or string into a container of type rawbytes.

Basic examples

The following examples illustrate the instruction PackRawBytes.

See also [More examples on page 512](#).

```

VAR rawbytes raw_data;
VAR num integer := 8;
VAR dnum bigInt := 4294967295;
VAR num float := 13.4;
VAR byte data1 := 122;
VAR byte byte1;
VAR string string1:="ABCDEFGH";
PackDNHeader "10", "20 1D 24 01 30 64", raw_data;

```

Pack the header for DeviceNet into raw_data.

Then pack requested fieldbus data in raw_data with PackRawBytes. The examples below show how different data can be added.

Example 1

```

PackRawBytes integer, raw_data, (RawBytesLen(raw_data)+1) \IntX :=
  DINT;

```

The contents of the next 4 bytes after the header in raw_data will be 8 decimal.

Example 2

```

PackRawBytes bigInt, raw_data, (RawBytesLen(raw_data)+1) \IntX :=
  UDINT;

```

The contents of the next 4 bytes after the header in raw_data will be 4294967295 decimal.

Example 3

```

PackRawBytes bigInt, raw_data, (RawBytesLen(raw_data)+1) \IntX :=
  LINT;

```

The contents of the next 8 bytes after the header in raw_data will be 4294967295 decimal.

Example 4

```

PackRawBytes float, raw_data, RawBytesLen(raw_data)+1) \Float4;

```

The contents of the next 4 bytes in raw_data will be 13.4 decimal.

Example 5

```

PackRawBytes data1, raw_data, (RawBytesLen(raw_data)+1) \Hex1;

```

The contents of the next byte in raw_data will be 122, the ASCII code for "z".

Example 6

```

PackRawBytes string1, raw_data, (RawBytesLen(raw_data)+1)
  \ISOLatin1Encoding;

```

Continues on next page

1 Instructions

1.166 PackRawBytes - Pack data into rawbytes data

RobotWare Base

Continued

The contents of next 7 bytes in raw_data will be "abcdefg", coded in ISO 8859-1 (Latin-1).

Example 7

```
byte1 := StrToByte("1F" \Hex);  
PackRawBytes byte1, raw_data, (RawBytesLen(raw_data)+1) \Hex1;
```

The contents of the next byte in raw_data will be "1F", hexadecimal.

Arguments

PackRawBytes Value RawData [\Network] StartIndex [\Hex1] | [\IntX] | [\Float4] | [\UTF8Encoding] | [\ISOLatin1Encoding]

See [Combining the arguments on page 511](#).

Value

Data type: anytype

Data to be packed into RawData.

Allowed data types are: num, dnum, byte, or string. Array cannot be used.

RawData

Data type: rawbytes

Variable container to be packed with data.

[\Network]

Data type: switch

Indicates that integer and float shall be packed in big-endian (network order) representation in RawData. ProfiBus and InterBus use big-endian.

Without this switch, integer and float will be packed in little-endian (not network order) representation in RawData. DeviceNet uses little-endian.

Only relevant together with optional parameter \IntX - UINT, UDINT, ULINT, INT, DINT, LINT, and \Float4.

StartIndex

Data type: num

StartIndex between 1 and 65536 indicates where the first byte contained in Value shall be placed in RawData.

[\Hex1]

Data type: switch

The Value to be packed has byte format and shall be converted to hexadecimal format and stored in 1 byte in RawData.

[\IntX]

Data type: inttypes

The Value to be packed has num or dnum format. It is an integer and shall be stored in RawData according to this specified constant of data type inttypes.

See [Predefined data on page 512](#).

Continues on next page

[\Float4]

Data type: switch

The Value to be packed has num format and shall be stored as float, 4 bytes, in RawData.

[\UTF8Encoding]

Data type: switch

If using this switch the data used in the argument Value is copied as it is represented in RAPID (UTF8 encoded data) in the rawbytes variable.

This switch is only valid if using a variable of the data type string in the argument Value.

**Note**

One character will be 1-4 bytes in the rawbytes variable.

[\ISOLatin1Encoding]

Data type: switch

If using this switch the PackRawBytes instruction converts the data used in the argument Value to ISO 8859-1 (Latin-1) encoding, before it is stored in the rawbytes variable.

This switch is only valid if using a variable of the data type string in the argument Value.

**Note**

One character will be 1 byte in the rawbytes variable.

Combining the arguments

One of the arguments \Hex1, \IntX, \Float4, \UTF8Encoding, \ISOLatin1Encoding must be used.

The following combinations are allowed:

Data type of Value:	Allowed optional parameters:
num ⁱ	\IntX
dnum ⁱⁱ	\IntX
num	\Float4
string	\UTF8Encoding (1-80 bytes) or \ISOLatin1Encoding (1-80 characters)
byte	\Hex1

ⁱ Must be an integer within the value range of selected symbolic constant USINT, UINT, UDINT, SINT, INT or DINT.

ⁱⁱ Must be an integer within the value range of selected symbolic constant USINT, UINT, UDINT, ULINT, SINT, INT, DINT or LINT.

Continues on next page

1 Instructions

1.166 PackRawBytes - Pack data into rawbytes data

RobotWare Base

Continued

Program execution

During program execution the data is packed from the variable of type anytype into a container of type rawbytes.

The current length of valid bytes in the RawData variable is set to:

- (StartIndex + packed_number_of_bytes - 1)
- The current length of valid bytes in the RawData variable is not changed if the complete pack operation is done inside the old current length of valid bytes in the RawData variable.

Predefined data

The following symbolic constants of the data type inttypes are predefined and can be used to specify the integer in parameter \IntX.

Symbolic constant	Constant value	Integer format	Integer value range
USINT	1	Unsigned 1 byte integer	0 ... 255
UINT	2	Unsigned 2 byte integer	0 ... 65 535
UDINT	4	Unsigned 4 byte integer	0 ... 8 388 608 ⁱ 0 ... 4 294 967 295 ⁱⁱ
ULINT	8	Unsigned 8 byte integer	0 ... 4 503 599 627 370 496 ⁱⁱⁱ
SINT	- 1	Signed 1 byte integer	- 128... 127
INT	- 2	Signed 2 byte integer	- 32 768 ... 32 767
DINT	- 4	Signed 4 byte integer	- 8 388 607 ... 8 388 608 ⁱ -2 147 483 648 ... 2 147 483 647 ^{iv}
LINT	- 8	Signed 8 byte integer	- 4 503 599 627 370 496... 4 503 599 627 370 496 ⁱⁱⁱ

ⁱ Limitation in RAPID for storage of integer in data type num.

ⁱⁱ Range when using a dnum variable and inttype UDINT.

ⁱⁱⁱ Limitation in RAPID for storage of integer in data type dnum.

^{iv} Range when using a dnum variable and inttype DINT.

More examples

More examples of how to use the instructions PackRawBytes and UnPackRawBytes are illustrated below.

According to the protocol that is known to the programmer, the content of the rawbytes variable will be like this for the following examples.

Example 1

Byte number:	Contents:
1-4	An integer, the length of the RAPID string
5-39	The actual RAPID string in UTF8 encoding
40-43	An decimal value

```
VAR rawbytes raw_data;  
VAR num integer;
```

Continues on next page

```

VAR num float := 13.4;
VAR string multibyte_str:="å, ä, ö is multi-byte characters";
..
! Get the number of bytes of the multibyte_str RAPID string
integer:=StrSize(multibyte_str);
! Set the length of multibyte_str in the first 4 bytes
PackRawBytes integer, raw_data, (RawBytesLen(raw_data)+1)
\IntX:=DINT;
! The contents of next 35 bytes in raw_data will the content of
multibyte_str
PackRawBytes multibyte_str, raw_data, (RawBytesLen(raw_data)+1)
\UTF8Encoding;
! The contents of the next 4 bytes in raw_data will be 13.4 decimal.
PackRawBytes float, raw_data, (RawBytesLen(raw_data)+1) \Float4;
..

```

Pack the size of the string to send, the actual RAPID string (UTF8 encoded string), and a decimal value in the rawbytes container.

Example 2

```

VAR rawbytes raw_data;
VAR num read_int;
VAR string read_str;
VAR num read_float;
..
! Get the number of bytes the RAPID string contains
UnpackRawBytes raw_data, 1, read_int \IntX:=DINT;
! Get the actual RAPID string. read_int specifies number of bytes
to read
UnpackRawBytes raw_data, 5, read_str \UTF8Encoding:=read_int;
! Get the decimal value. Use read string length to get right byte
position
UnpackRawBytes raw_data, 5+read_int, read_float \Float4;
..

```

Unpack the size of the RAPID string, the actual RAPID string (UTF8 encoded string), and a decimal value from the rawbytes container.

Syntax

```

PackRawBytes
[Value ':='] <expression (IN) of anytype> ', '
[RawData ':='] <variable (VAR) of rawbytes>
['\ ' Network] ', '
[StartIndex ':='] <expression (IN) of num>
['\ ' Hex1]
|['\ ' IntX ':='] <expression (IN) of inttypes>
|['\ ' Float4]
|['\ ' UTF8Encoding]
|['\ ' ISOLatin1Encoding]';'

```

Continues on next page

1 Instructions

1.166 PackRawBytes - Pack data into rawbytes data

RobotWare Base

Continued

Related information

For information about	See
rawbytes data	rawbytes - Raw data on page 1702
Get the length of rawbytes data	RawBytesLen - Get the length of rawbytes data on page 1404
Clear the contents of rawbytes data	ClearRawBytes - Clear the contents of rawbytes data on page 140
Copy the contents of rawbytes data	CopyRawBytes - Copy the contents of rawbytes data on page 165
Pack DeviceNet header into rawbytes data	PackDNHeader - Pack DeviceNet Header into rawbytes data on page 506
Write rawbytes data	WriteRawBytes - Write rawbytes data on page 1078
Read rawbytes data	ReadRawBytes - Read rawbytes data on page 576
Unpack data from rawbytes data	UnpackRawBytes - Unpack data from rawbytes data on page 981
Bit/Byte Functions	<i>Technical reference manual - RAPID Overview</i>
String functions	<i>Technical reference manual - RAPID Overview</i>
File and I/O device handling	<i>Application manual - Controller software Omni-Core</i>

1.167 PathAccLim - Reduce TCP acceleration along the path

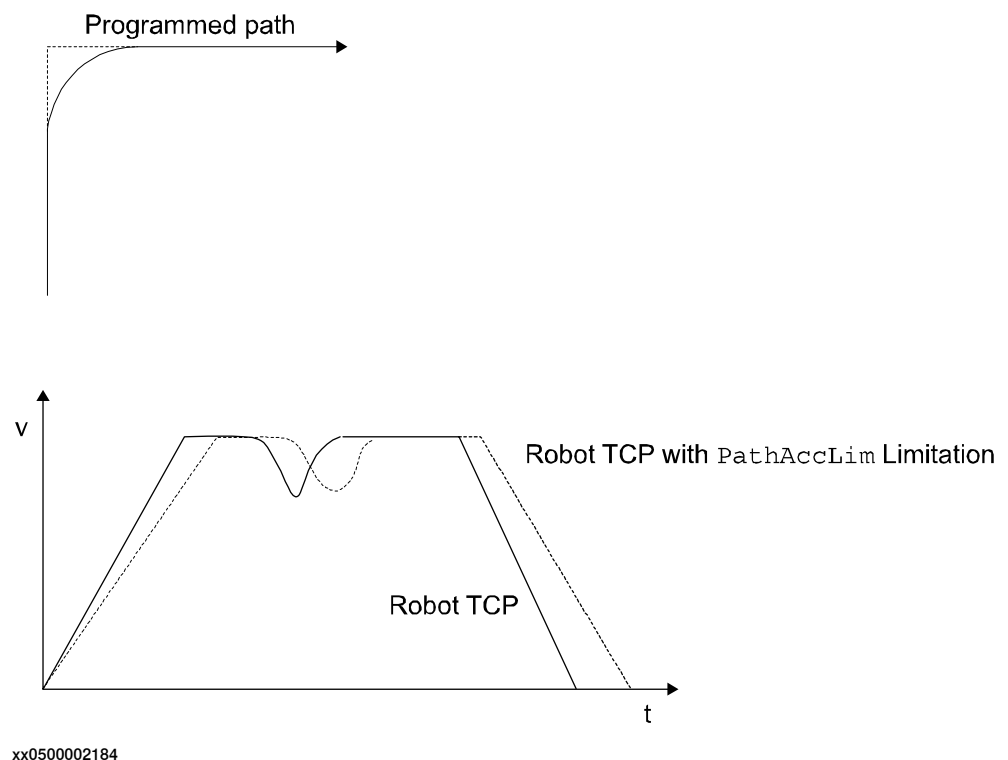
Usage

PathAccLim (*Path Acceleration Limitation*) is used to set or reset limitations on TCP acceleration and/or TCP deceleration along the movement path.

The limitation will be performed along the movement path, that is, the acceleration in the path frame. It is the tangential acceleration/deceleration in the path direction that will be limited.

The instruction does not limit the total acceleration of the equipment, that is, the acceleration in world frame, so it cannot be directly used to protect the equipment from large accelerations.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.



Basic examples

The following examples illustrate the instruction PathAccLim:

See also [More examples on page 517](#).

Example 1

```
PathAccLim TRUE \AccMax := 4, TRUE \DecelMax := 4;
```

TCP acceleration and TCP deceleration are limited to 4 m/s².

Example 2

```
PathAccLim FALSE, FALSE;
```

The TCP acceleration and deceleration is reset to maximum (default).

Continues on next page

1 Instructions

1.167 PathAccLim - Reduce TCP acceleration along the path

RobotWare Base

Continued

Arguments

PathAccLim AccLim [\AccMax] DecelLim [\DecelMax]

AccLim

Data type: bool

TRUE if there is to be a limitation of the acceleration, FALSE otherwise.

[\AccMax]

Data type: num

The absolute value of the acceleration limitation in m/s^2 . Only to be used when AccLim is TRUE.

DecelLim

Data type: bool

TRUE if there is to be a limitation of the deceleration, FALSE otherwise.

[\DecelMax]

Data type: num

The absolute value of the deceleration limitation in m/s^2 . Only to be used when DecelLim is TRUE.

Program execution

The acceleration/deceleration limitations applies for the next executed movement instruction until a new PathAccLim instruction is executed.

The maximum acceleration/deceleration (PathAccLim FALSE, FALSE) are automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

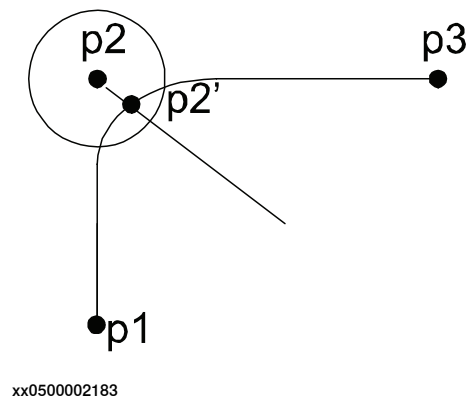
If there is a combination of instructions AccSet and PathAccLim the system reduces the acceleration/deceleration in the following order:

- according AccSet
- according PathAccLim

Continues on next page

More examples

More examples of how to use the instruction PathAccLim are illustrated below.

**Example 1**

```
MoveL p1, v1000, fine, tool0;
PathAccLim TRUE\AccMax := 4, FALSE;
MoveL p2, v1000, z30, tool0;
MoveL p3, v1000, fine, tool0;
PathAccLim FALSE, FALSE;
```

TCP acceleration is limited to 4 m/s^2 between p1 and p3.

Example 2

```
MoveL p1, v1000, fine, tool0;
MoveL p2, v1000, z30, tool0;
PathAccLim TRUE\AccMax :=3, TRUE\DecelMax := 4;
MoveL p3, v1000, fine, tool0;
PathAccLim FALSE, FALSE;
```

TCP acceleration is limited to 3 m/s^2 between p2' and p3.

TCP deceleration is limited to 4 m/s^2 between p2' and p3.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_ACC_TOO_LOW	The parameter \AccMax or \DecelMax is set too low.

Limitations

The minimum acceleration/deceleration allowed is 0.1 m/s^2 . The recommendation is to have the acceleration and deceleration limit symmetrical, that is to have the same value on AccMax and DecelMax.

Syntax

```
PathAccLim
[ AccLim ':' ] < expression (IN) of bool >
[ '\ ' AccMax ':' ] < expression (IN) of num > ] ', '
[ DecelLim ':' ] < expression (IN) of bool >
```

Continues on next page

1 Instructions

1.167 PathAccLim - Reduce TCP acceleration along the path

RobotWare Base

Continued

```
[ '\ ' DecelMax ' := ' <expression (IN) of num > ] ';' 
```

Related information

For information about	See
Reduction of acceleration	AccSet - Reduces the acceleration on page 23
Motion settings data	motsetdata - Motion settings data on page 1674
Control acceleration in world coordinate system	WorldAccLim - Control acceleration in world coordinate system on page 1061
Positioning instructions	<i>Technical reference manual - RAPID Overview, section RAPID summary - Motion</i>

1.168 PathLengthReset - Resets the current path-length value of the counter

RobotWare Base

1.168 PathLengthReset - Resets the current path-length value of the counter

Usage

PathLengthReset is used to reset the counter that monitors the path-length travelled by the robot's TCP.

This instruction can be called at any time, but it is advisable that it is called when the robot is standing still to get a predictable behavior for the counter.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Basic examples

The following example illustrates the instruction PathLengthReset.

Example 1

```
PathLengthStart;
MoveJ p10, v1000, z50, L10tip;
...
MoveL p40, v1000, fine, L10tip;
PathLengthStop;
TPWrite "PathLengthGet: "+ValToStr(PathLengthGet());
PathLengthReset;
```

This example read out the value of the counter that measures the path-length travelled by the robot's TCP. The value is then written to the FlexPendant.

Program execution

The path-length measurement applies for the next executed robot movement instruction of any type and is valid until a PathLengthStop instruction is executed. Path-length measurement is set to off, and the path-length measurement counter is set to zero when a PathLengthReset instruction is executed. The default value, path-length measurement off is automatically set:

- when using the restart mode *Reset RAPID*.
- when loading a new program or a new module.
- when starting program execution from the beginning.
- when moving the program pointer to Main routine.
- when moving the program pointer to a routine.
- when moving the program pointer in such a way that the execution order is lost.

Limitations

Path-length measurements are only applicable for TCP-robots.

Syntax

```
PathLengthReset';'
```

Continues on next page

1 Instructions

1.168 PathLengthReset - Resets the current path-length value of the counter

RobotWare Base

Continued

Related information

For information about	See
PathLengthGet	<i>PathLengthGet - Reads the current path-length value of the counter on page 1378</i>
PathLengthStart	<i>PathLengthStart - Activates the counter that monitors the path-length on page 521</i>
PathLengthStop	<i>PathLengthStop - Stops the counter that monitors the path-length on page 523</i>

1.169 PathLengthStart - Activates the counter that monitors the path-length RobotWare Base

1.169 PathLengthStart - Activates the counter that monitors the path-length

Usage

PathLengthStart is used to activate the counter that monitors the path-length travelled by the robot's TCP, starting from the next Move-instruction. The path length is always measured in the work object. Note that the internal counter for the TCP-length is not reset by this instruction. To reset the counter, use the instruction PathLengthReset.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Basic examples

The following example illustrates the instruction PathLengthStart.

Example 1

```
PathLengthStart;
MoveJ p10, v1000, z50, L10tip;
...
MoveL p40, v1000, fine, L10tip;
PathLengthStop;
TPWrite "PathLengthGet: "+ValToStr(PathLengthGet());
PathLengthReset;
```

This example read out the value of the counter that measures the path-length travelled by the robot's TCP. The value is then written to the FlexPendant.

Program execution

The path-length measurement applies for the next executed robot movement instruction of any type and is valid until a PathLengthStop instruction is executed. Path-length measurement is set to off, and the path-length measurement counter is set to zero when a PathLengthReset instruction is executed. The default value, path-length measurement off is automatically set:

- when using the restart mode *Reset RAPID*.
- when loading a new program or a new module.
- when starting program execution from the beginning.
- when moving the program pointer to Main routine.
- when moving the program pointer to a routine.
- when moving the program pointer in such a way that the execution order is lost.

Limitations

Path-length measurements are only applicable for TCP-robots.

Syntax

```
PathLengthStart';'
```

Continues on next page

1 Instructions

1.169 PathLengthStart - Activates the counter that monitors the path-length

RobotWare Base

Continued

Related information

For information about	See
PathLengthReset	<i>PathLengthReset - Resets the current path-length value of the counter on page 519</i>
PathLengthGet	<i>PathLengthGet - Reads the current path-length value of the counter on page 1378</i>
PathLengthStop	<i>PathLengthStop - Stops the counter that monitors the path-length on page 523</i>

1.170 PathLengthStop - Stops the counter that monitors the path-length

Usage

PathLengthStop is used to stop the counter that monitors the path-length travelled by the robot's TCP, starting from the next Move-instruction.

The path length is always measured in the work object. Note that the internal counter for the TCP-length is not reset by this instruction. To reset the counter, use the instruction PathLengthReset.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Basic examples

The following example illustrates the instruction PathLengthStop.

Example 1

```
PathLengthStart;
MoveJ p10, v1000, z50, L10tip;
...
MoveL p40, v1000, fine, L10tip;
PathLengthStop;
TPWrite "PathLengthGet: "+ValToStr(PathLengthGet());
PathLengthReset;
```

This example read out the value of the counter that measures the path-length travelled by the robot's TCP. The value is then written to the FlexPendant.

Program execution

The path-length measurement applies for the next executed robot movement instruction of any type and is valid until a PathLengthStop instruction is executed.

Path-length measurement is set to off, and the path-length measurement counter is set to zero when a PathLengthReset instruction is executed. The default value, path-length measurement off is automatically set:

- when using the restart mode *Reset RAPID*.
- when loading a new program or a new module.
- when starting program execution from the beginning.
- when moving the program pointer to Main routine.
- when moving the program pointer to a routine.
- when moving the program pointer in such a way that the execution order is lost.

Limitations

Path-length measurements are only applicable for TCP-robots.

Syntax

```
PathLengthStop';'
```

Continues on next page

1 Instructions

1.170 PathLengthStop - Stops the counter that monitors the path-length

RobotWare Base

Continued

Related information

For information about	See
PathLengthReset	<i>PathLengthReset - Resets the current path-length value of the counter on page 519</i>
PathLengthGet	<i>PathLengthGet - Reads the current path-length value of the counter on page 1378</i>
PathLengthStart	<i>PathLengthStart - Activates the counter that monitors the path-length on page 521</i>

1.171 PathRecMoveBwd - Move path recorder backwards

Usage

PathRecMoveBwd is used to move the robot backwards along a recorded path.

Basic examples

The following example illustrates the instruction PathRecMoveBwd:

See also [More examples on page 526](#).

Example 1

```
VAR pathrecid fixture_id;
PathRecMoveBwd \ID:=fixture_id \ToolOffs:=[0, 0, 10] \Speed:=v500;
```

The robot is moved backwards to the position in the program where the instruction PathRecStart planted the fixture_id identifier. The TCP offset is 10 mm in Z direction and the speed is set to 500 mm/s.

Arguments

PathRecMoveBwd [\ID] [\ToolOffs] [\Speed]

[\ID]

Identifier

Data type: pathrecid

Variable that specifies the ID position to move backward to. Data type pathrecid is a non-value type, only used as an identifier for naming the recording position.

If no ID position is specified then the backward movement is in a single system done to the closest recorded ID position. But in a MultiMove Synchronized Mode, the backward movements is done to the closest of the following positions:

- Back to the position where the synchronized movement started
- Back to the closest recorded ID position

[\ToolOffs]

Tool Offset

Data type: pos

Provides clearance offset for TCP during motion. A cartesian offset coordinate is applied to the TCP coordinates. Positive Z offset value indicates clearance. This is useful when the robot runs a process adding material. If running synchronized motion then all or none of the mechanical units needs to use the argument. If no offset is desired for some of the mechanical units then a zero offset can be applied. Even non TCP mechanical units need to use the argument if a TCP robot in a different task is used.

[\Speed]

Data type: speeddata

Speed replaces the speed original used during forward motion. Speeddata defines the velocity for the tool center point, the tool reorientation, and the external axis. If present, this speed will be used throughout the backward movement. If omitted, the backward motion will execute with the speed in the original motion instructions.

Continues on next page

1 Instructions

1.171 PathRecMoveBwd - Move path recorder backwards

Path Recovery

Continued

Program execution

The path recorder is activated with the PathRecStart instruction. After the recorder has been started then all move instructions will be recorded and the robot can be moved backwards along its recorded path at any point by executing PathRecMoveBwd.

Synchronized motion

Running the path recorder in synchronization motion adds a few considerations.

- All tasks involved in the synchronization recorded motion must order PathRecMoveBwd before any of the robots start to move.
- All synchronization handling is recorded and executed in reverse. For example, if PathRecMoveBwd is ordered from within a synchronization block to an independent position then the path recorder will automatically change state to independent at the SyncMoveOn instruction.
- SyncMoveOn is considered as a breakpoint without path identifier. That is, if the path recorder has been started by means of PathRecStart and PathRecMoveBwd without the optional argument \ID is executed within a synchronized motion block, then the robot will move backwards to the position the robot was at when SyncMoveOn was executed. Since the backward movement stops before SyncMoveOn, the state will be changed to independent.
- WaitSyncTask is considered as a breakpoint without path identifier. That is, if the path recorder has been started by the means of PathRecStart and PathRecMoveBwd is executed then the robot will move back no longer than to the position the robot was at when WaitSyncTask was executed.

More examples

More examples of how to use the instruction PathRecMoveBwd are illustrated below.

Example 1 - Independent motion

```
VAR pathrecid safe_id;
CONST robtarg p0 := [...];
...
CONST robtarg p4 := [...];
VAR num choice;

MoveJ p0, vmax, z50, tool1;
PathRecStart safe_id;
MoveJ p1, vmax, z50, tool1;
MoveL p2, vmax, z50, tool1;
MoveL p3, vmax, z50, tool1;
MoveL p4, vmax, z50, tool1;

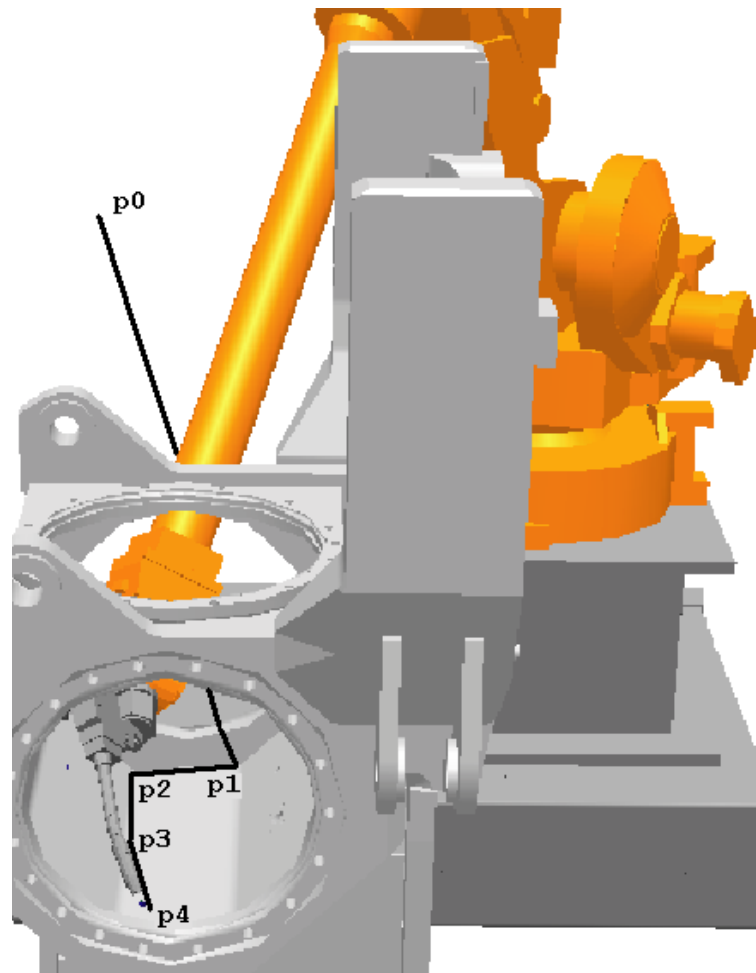
ERROR:
TPReadFK choice, "Go to safe?", stEmpty, stEmpty, stEmpty, stEmpty, "Yes";
IF choice=5 THEN
  IF PathRecValidBwd(\ID:=safe_id) THEN
```

Continues on next page

```

StorePath;
PathRecMoveBwd \ID:=safe_id \ToolOffs:=[0, 0 , 10];
Stop;
!Fix problem
PathRecMoveFwd;
RestoPath;
StartMove;
RETRY;
ENDIF
ENDIF

```



xx0500002135

This example shows how the path recorder can be utilized to extract the robot from narrow spaces upon error without programming a designated path.

A part is being manufactured. At the approach point, p0, the path recorder is started and given the path recorder identifier safe_id. Assume that when the robot moves from p3 to p4 that a recoverable error arises. At that point the path is stored by executing StorePath. By storing the path the error handler can start a new movement and later on restart the original movement. When the path has been stored the path recorder is used to move the robot out to the safe position, p0, by executing PathRecMoveBwd.

Continues on next page

1 Instructions

1.171 PathRecMoveBwd - Move path recorder backwards

Path Recovery

Continued

Note that a tool offset is applied to provide clearance from, for example, a newly added weld. When the robot has been moved out the operator can do what is necessary to fix the error (for example clean the torch of welding). Then the robot is moved back to the error location by the means of PathRecMoveFwd. At the error location the path level is switched back to base level by RestoPath and a retry attempt is made.

Example 2 - Synchronized motion

T_ROB1

```
VAR pathrecid HomerOB1;
CONST robtarget pR1_10:=[...];
...
CONST robtarget pR1_60:=[...];

PathRecStart HomerOB1;
MoveJ pR1_10, v1000, z50, tGun;
MoveJ pR1_20, v1000, z50, tGun;
MoveJ pR1_30, v1000, z50, tGun;
SyncMoveOn sync1, tasklist;
MoveL pR1_40 \ID:=1, v1000, z50, tGun\wobj:=pos1;
MoveL pR1_50 \ID:=2, v1000, z50, tGun\wobj:=pos1;
MoveL pR1_60 \ID:=3, v1000, z50, tGun\wobj:=pos1;
SyncMoveOff sync2;

ERROR
  StorePath \KeepSync;
  TEST ERRNO
  CASE ERR_PATH_STOP:
    PathRecMoveBwd \ID:= HomerOB1\ToolOffs:=[0,0,10];
  ENDTEST
  !Perform service action
  PathRecMoveFwd \ToolOffs:=[0,0,10];
  RestoPath;
  StartMove;
```

T_ROB2

```
VAR pathrecid HomerOB2;
CONST robtarget pR2_10:=[...];
...
CONST robtarget pR2_50:=[...];

PathRecStart HomerOB2;
MoveJ pR2_10, v1000, z50, tGun;
MoveJ pR2_20, v1000, z50, tGun;
SyncMoveOn sync1, tasklist;
MoveL pR2_30 \ID:=1, v1000, z50, tGun\wobj:=pos1;
MoveL pR2_40 \ID:=2, v1000, z50, tGun\wobj:=pos1;
MoveL pR2_50 \ID:=3, v1000, z50, tGun\wobj:=pos1;
SyncMoveOff sync2;

ERROR
```

Continues on next page

1.171 PathRecMoveBwd - Move path recorder backwards

*Path Recovery**Continued*

```

StorePath \KeepSync;
TEST ERRNO
CASE ERR_PATH_STOP:
    PathRecMoveBwd \ToolOffs:=[0,0,10];
ENDTEST
!Perform service action
PathRecMoveFwd \ToolOffs:=[0,0,10];
RestoPath;
StartMove;

```

T_ROB3

```

VAR pathrecid HomePOS1;
CONST jointtarget jP1_10:=[...];
...
CONST jointtarget jP1_40:=[...];

PathRecStart HomePOS1;
MoveExtJ jP1_10, v1000, z50;
SyncMoveOn sync1, tasklist;
MoveExtJ jP1_20 \ID:=1, v1000, z50;
MoveExtJ jP1_30 \ID:=2, v1000, z50;
MoveExtJ jP1_40 \ID:=3, v1000, z50;
SyncMoveOff sync2;

ERROR
StorePath \KeepSync;
TEST ERRNO
CASE ERR_PATH_STOP:
    PathRecMoveBwd \ToolOffs:=[0,0,0];
DEFAULT:
    PathRecMoveBwd \ID:=HomePOS1\ToolOffs:=[0,0,0];
ENDTEST
!Perform service action
PathRecMoveFwd \ToolOffs:=[0,0,0];
RestoPath;
StartMove;

```

A system is consisting of three manipulators that all run in separate tasks. Assume that T_ROB1 experiences an error ERR_PATH_STOP within the synchronized block, sync1. Upon error it is desired to move back to the home position marked with the path recorder identifier HomeROB1 to perform service of the robot's external equipment. This is done by using PathRecMoveBwd and supplying the pathrecid identifier.

Since the error occurred during synchronized motion it is necessary that the second TCP robot T_ROB2 and the external axis T_POS1 also orders PathRecMoveBwd. These manipulators do not have to move back further than before the synchronized motion started. By not supplying PathRecMoveBwd at ERR_PATH_STOP with a path recorder identifier the path recorder ability to stop after SyncMoveOn is utilized. Note that the external axis that does not have a TCP still adds a zero tool offset to enable the possibility for the TCP robots to do so.

Continues on next page

1 Instructions

1.171 PathRecMoveBwd - Move path recorder backwards

Path Recovery

Continued

The **DEFAULT** behavior in the **ERROR** handler in this example is that all manipulators first do the synchronized movements backwards and then the independent movements backwards to the start point of the recorded path. This is obtained by specifying **\ID** in **PathRecMoveBwd** for all manipulators.

Limitations

Movements using the path recorder cannot be performed on base level, that is, **StorePath** has to be executed before **PathRecMoveBwd**.

It is never possible to move backwards through a **SynchMoveOff** statement.

It is never possible to move backwards through a **WaitSyncTask** statement.

SyncMoveOn must be preceded by at least one independent movement if it is desired to move back to the position where the synchronized movement started.

If it is not desired to return to the point where **PathRecMoveBwd** was executed (by executing **PathRecMoveFwd**) then the **PathRecorder** has to be stopped by the means of **PathRecStop**. **PathRecStop\Clear** also clears the recorded path.

PathRecMoveBwd cannot be executed in a **RAPID** routine connected to any of the following special system events: **PowerOn**, **Stop**, **QStop**, **Restart**, **Reset** or **Step**.

Syntax

```
PathRecMoveBwd
[ '\ ' ID ':' < variable (VAR) of pathrecid > ]
[ '\ ' ToolOffs ':' < expression (IN) of pos > ]
[ '\ ' Speed ':' < expression (IN) of speeddata > ]';'
```

Related information

For information about	See
Path recorder	<i>Application manual - Controller software Omni-Core</i>
Path Recorder Identifier	pathrecid - Path recorder identifier on page 1692
Start - stop the path recorder	PathRecStart - Start the path recorder on page 534 PathRecStop - Stop the path recorder on page 537
Check for valid recorded path	PathRecValidBwd - Is there a valid backward path recorded on page 1382 PathRecValidFwd - Is there a valid forward path recorded on page 1385
Move path recorder forward	PathRecMoveFwd - Move path recorder forward on page 531
Store - restore paths	StorePath - Stores the path when an interrupt occurs on page 798 RestoPath - Restores the path after an interrupt on page 600
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Error Recovery	<i>Technical reference manual - RAPID Overview</i>

1.172 PathRecMoveFwd - Move path recorder forward

Usage

PathRecMoveFwd is used to move the robot back to the position where PathRecMoveBwd was executed. It is also possible to move the robot partly forward by supplying an identifier that has been passed during the backward movement.

Basic examples

The following example illustrates the instruction PathRecMoveFwd:
See also [More examples on page 532](#).

Example 1

```
PathRecMoveFwd;
```

The robot is moved back to the position where the path recorder started the backward movement.

Arguments

```
PathRecMoveFwd [\ID] [\ToolOffs] [\Speed]
```

[\ID]

Identifier

Data type: pathrecid

Variable that specifies the ID position to move forward to. Data type pathrecid is a non-value type only used as an identifier for naming the recording position.

If no ID position is specified then the forward movement will always be done to interrupt position on the original path.

[\ToolOffs]

Tool Offset

Data type: pos

Provides clearance offset for TCP during motion. A cartesian coordinate is applied to the TCP coordinates. This is useful when the robot runs a process adding material.

[\Speed]

Data type: speeddata

Speed overrides the original speed used during forward motion. Speeddata defines the velocity for the tool center point, the tool reorientation, and the external axis. If present, this speed will be used throughout the forward movement. If omitted, the forward motion will execute with the speed in the original motion instructions.

Program execution

The path recorder is activated with the PathRecStart instruction. After the recorder has been started the robot can be moved backwards along its executed path by executing PathRecMoveBwd. The robot can thereafter be ordered back to the position where the backward execution started by calling PathRecMoveFwd. It is

Continues on next page

1 Instructions

1.172 PathRecMoveFwd - Move path recorder forward

Path Recovery

Continued

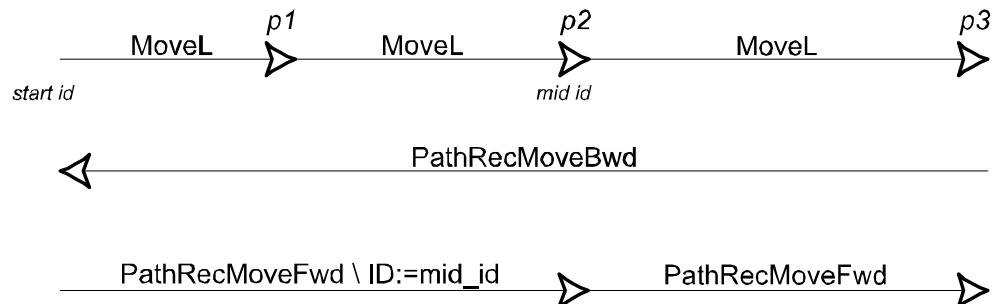
also possible to move the robot partly forward by supplying an identifier that has been passed during the backward movement.

More examples

More examples of how to use the instruction PathRecMoveFwd are illustrated below.

```
VAR pathrecid start_id;  
VAR pathrecid mid_id;  
CONST robtarget p1 := [...];  
CONST robtarget p2 := [...];  
CONST robtarget p3 := [...];
```

```
PathRecStart start_id;  
MoveL p1, vmax, z50, tool1;  
MoveL p2, vmax, z50, tool1;  
PathRecStart mid_id;  
MoveL p3, vmax, z50, tool1;  
StorePath;  
PathRecMoveBwd \ID:=start_id;  
PathRecMoveFwd \ID:=mid_id;  
PathRecMoveFwd;  
RestoPath;
```



xx0500002133

The example above will start the path recorder and the starting point will be tagged with the path identifier start_id. Thereafter the robot will move forward with traditional move instructions and then move back to the path recorder identifier start_id using the recorded path. Finally it will move forward again in two steps by the means of PathRecMoveFwd.

Limitations

Movements using the path recorder have to be performed on trap-level, i.e. StorePath must execute prior to PathRecMoveFwd.

To be able to execute PathRecMoveFwd a PathRecMoveBwd must have been executed before.

If it is not desired to return to the point where PathRecMoveBwd was executed (by executing PathRecMoveFwd) then the PathRecorder has to be stopped by the means of PathRecStop. PathRecStop\Clear also clears recorded path.

Continues on next page

1.172 PathRecMoveFwd - Move path recorder forward

*Path Recovery**Continued*

PathRecMoveFwd cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
PathRecMoveFwd '('
  [ '\\' ID ':=' < variable (VAR) of pathid > ]
  [ '\\' ToolOffs ':=' <expression (IN) of pos> ]
  [ '\\' Speed ':=' <expression (IN) of speeddata> ]';'
```

Related information

For information about	See
Path recorder	<i>Application manual - Controller software OmniCore</i>
Path Recorder Identifiers	pathrecid - Path recorder identifier on page 1692
Start - stop the path recorder	PathRecStart - Start the path recorder on page 534 PathRecStop - Stop the path recorder on page 537
Check for valid recorded path	PathRecValidBwd - Is there a valid backward path recorded on page 1382 PathRecValidFwd - Is there a valid forward path recorded on page 1385
Move path recorder backward	PathRecMoveBwd - Move path recorder backwards on page 525
Store - restore paths	StorePath - Stores the path when an interrupt occurs on page 798 RestoPath - Restores the path after an interrupt on page 600
Other positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Error Recovery	<i>Technical reference manual - RAPID Overview</i>

1 Instructions

1.173 PathRecStart - Start the path recorder

Path Recovery

1.173 PathRecStart - Start the path recorder

Usage

PathRecStart is used to start recording the robot's path. The path recorder will store path information during execution of the RAPID program.

Basic examples

The following example illustrates the instruction PathRecStart:

Example 1

```
VAR pathrecid fixture_id;
```

```
PathRecStart fixture_id;
```

The path recorder is started and the starting point (the instruction's position in the RAPID program) is tagged with the identifier `fixture_id`.

Arguments

PathRecStart ID

ID

Identifier

Data type: pathrecid

Variable that specifies the name of the recording start position. Data type pathrecid is a non-value type only used as an identifier for naming the recording position.

Program execution

When the path recorder is ordered to start the robot path will be recorded internally in the robot controller. The recorded sequence of program positions can be traversed backwards by means of PathRecMoveBwd causing the robot to move backwards along its executed path.

More examples

More examples of how to use the instruction PathRecStart are illustrated below.

Example 1

```
VAR pathrecid origin_id;
VAR pathrecid corner_id;
VAR num choice;
MoveJ p1, vmax, z50, tool1;
PathRecStart origin_id;
MoveJ p2, vmax, z50, tool1;
PathRecStart corner_id;
MoveL p3, vmax, z50, tool1;
MoveAbsJ jt4, vmax, fine, tool1;
ERROR
  TPreadFK choice, "Extract
    to:", stEmpty, stEmpty, stEmpty, "Origin", "Corner";
  IF choice=4 OR choice=5 THEN
```

Continues on next page

```

StorePath;
IF choice=4 THEN
    PathRecMoveBwd \ID:=origin_id;
ELSE
    PathRecMoveBwd \ID:=corner_id;
ENDIF
Stop;
!Fix problem
PathRecMoveFwd;
RestoPath;
StartMove;
RETRY;
ENDIF

```

In the example above the path recorder is used for moving the robot to a service position if an error during normal execution occurs.

The robot is executing along a path. After the position p1 the path recorder is started. After the point p2 another path identifier is inserted. Assume that a recoverable error occurs while moving from position p3 to position j t4. The error handler will now be invoked, and the user can choose between extracting the robot to position Origin (point p1) or Corner (point p2). Then the path level is switched with StorePath to be able to restart at the error location later on. When the robot has backed out from the error location it is up to the user to solve the error (usually fixing the robot's surrounding equipment).

Then the robot is ordered back to the error location. The path level is switched back to normal, and a retry attempt is made.

Limitations

The path recorder can only be started and will only record the path in the base path level, i.e. movements at StorePath level are not recorded.

Syntax

```

PathRecStart
[ ID ':=' ] < variable (VAR) of pathrecid> ';'

```

Related information

For information about	See
Path recorder	<i>Application manual - Controller software Omni-Core</i>
Path Recorder Identifiers	pathrecid - Path recorder identifier on page 1692
Stop the path recorder	PathRecStop - Stop the path recorder on page 537
Check for valid recorded path	PathRecValidBwd - Is there a valid backward path recorded on page 1382 PathRecValidFwd - Is there a valid forward path recorded on page 1385
Play the path recorder backward	PathRecMoveBwd - Move path recorder backwards on page 525

Continues on next page

1 Instructions

1.173 PathRecStart - Start the path recorder

Path Recovery

Continued

For information about	See
Play the path recorder forward	PathRecMoveFwd - Move path recorder forward on page 531
Motion in general	<i>Technical reference manual - RAPID Overview</i>

1.174 PathRecStop - Stop the path recorder

Usage

PathRecStop is used to stop recording the robot's path.

Basic examples

The following example illustrates the instruction PathRecStop:

See also *More examples* below.

Example 1

```
PathRecStop \Clear;
```

The path recorder is stopped and the buffer of stored path information is cleared.

Arguments

PathRecStop [\Clear]

[\Clear]

Data type: switch

Clear the recorded path.

Program execution

When the path recorder is ordered to stop the recording of the path will stop. The optional argument \Clear will clear the buffer of stored path information preventing the recorded path to be executed by mistake.

After the recorder has been stopped with PathRecStop, earlier recorded paths cannot be used for back-up movements (PathRecMoveBwd). It is possible to use earlier recorded paths if PathRecStart is ordered again from the same position that the path recorder was stopped in. See the following example.

More examples

More examples of how to use the instruction PathRecStop are illustrated below.

```
LOCAL VAR pathrecid id1;
LOCAL VAR pathrecid id2;
LOCAL CONST robtarget p0:= [...];
.....
LOCAL CONST robtarget p6 := [...];
PROC example1()
  MoveL p0, vmax, z50, tool1;
  PathRecStart id1;
  MoveL p1, vmax, z50, tool1;
  MoveL p2, vmax, z50, tool1;
  PathRecStop;
  MoveL p3, vmax, z50, tool1;
  MoveL p4, vmax, z50, tool1;
  MoveL p2, vmax, z50, tool1;
  PathRecStart id2;
  MoveL p5, vmax, z50, tool1;
  MoveL p6, vmax, z50, tool1;
```

Continues on next page

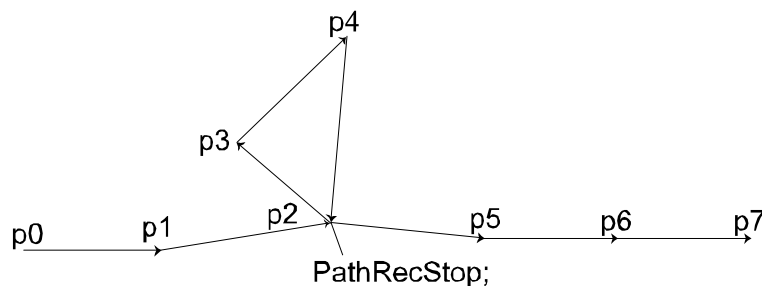
1 Instructions

1.174 PathRecStop - Stop the path recorder

Path Recovery

Continued

```
StorePath;  
PathRecMoveBwd \ID:=id1;  
PathRecMoveFwd;  
RestoPath;  
StartMove;  
MoveL p7, vmax, z50, tool1;  
ENDPROC  
PROC example2()  
MoveL p0, vmax, z50, tool1;  
PathRecStart id1;  
MoveL p1, vmax, z50, tool1;  
MoveL p2, vmax, z50, tool1;  
PathRecStop;  
MoveL p3, vmax, z50, tool1;  
MoveL p4, vmax, z50, tool1;  
PathRecStart id2;  
MoveL p2, vmax, z50, tool1;  
MoveL p5, vmax, z50, tool1;  
MoveL p6, vmax, z50, tool1;  
StorePath;  
PathRecMoveBwd \ID:=id1;  
PathRecMoveFwd;  
RestoPath;  
StartMove;  
MoveL p7, vmax, z50, tool1;  
ENDPROC
```



PathRecStop_

The above examples describe recording of the robot path when the recording is stopped in the middle of the sequence. In example1 the PathRecMoveBwd \ID:=id1; order is valid and the robot will execute the following path: p6 -> p5 -> p2 -> p1 -> p0

The reason that the order is valid is because of the recorder being stopped and started in the exact same robot position. If this behavior isn't desirable the stop order should include the optional argument \Clear. In that way the recorded path will be cleared and it will never be possible to back-up to previous path recorder identifiers.

The only difference in example2 is where the recorder was started the second time. In this case PathRecMoveBwd \ID:=id1 will cause an error. This is because no recorded path exists between p4, p3 and p2. It is possible to execute PathRecMoveBwd \ID:=id2.

Continues on next page

Syntax

```
PathRecStop
[ '\switch Clear ] ';'

```

Related information

For information about	See
Path recorder	<i>Application manual - Controller software OmniCore</i>
Path Recorder Identifiers	pathrecid - Path recorder identifier on page 1692
Start the path recorder	PathRecStart - Start the path recorder on page 534
Check for valid recorded path	PathRecValidBwd - Is there a valid backward path recorded on page 1382 PathRecValidFwd - Is there a valid forward path recorded on page 1385
Play the recorder backward	PathRecMoveBwd - Move path recorder backwards on page 525
Play the recorder forwards	PathRecMoveFwd - Move path recorder forward on page 531
Motion in general	<i>Technical reference manual - RAPID Overview</i>

1 Instructions

1.175 PathResol - Override path resolution *RobotWare Base*

1.175 PathResol - Override path resolution

Usage

PathResol (*Path Resolution*) is used to override the configured geometric path sample time defined in the system parameters for the mechanical units that are controlled from current program task.

The geometric path sample time is used in applications with sensor inputs. Observe that it is not used for defining the geometric path in normal application, a legacy functionality.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in any motion tasks.

Description

Example of when to use PathResol:

- Using coordinated interpolation.
- Using *Weldguide*.
- Using the option *Conveyor Tracking*.

Basic examples

The following example illustrates the instruction PathResol:

```
MoveJ p1,v1000,fine,tool1;  
PathResol 150;
```

With the robot at a stop point the path sample time is increased to 150 % of the configured value.

Arguments

PathResol PathSampleTime

PathSampleTime

Data type: num

Override as a percent of the configured path sample time. 100% corresponds to the configured path sample time. Within the range 25-400%.

Program execution

The path resolutions of all subsequent positioning instructions are affected until a new PathResol instruction is executed. This will affect the path resolution during all program execution of movements (default path level and path level after StorePath) and also during jogging.

In a MultiMove system at synchronized coordinated mode the following points are valid:

- All mechanical units involved in synchronized coordinated mode will run with the current path resolution for actual (used) motion planner.
- New path resolution order against actual motion planner affects the synchronized coordinated movement and future independent movement in that motion planner.

Continues on next page

- New path resolution order against another motion planner only affects future independent movement in that motion planner.

About connection between program task and motion planner see *Application manual - MultiMove*.

The default value for override of path sample time is 100%. This value is automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to `main`
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

The current override of path sample time can be read from the variable `C_MOTSET` (data type `motsetdata`) in the component `pathresol`.

Limitation

If this instruction is preceded by a move instruction then that move instruction must be programmed with a stop point (zonedata `fine`), not a fly-by point.

Otherwise restart after power failure will not be possible.

`PathResol` cannot be executed in a RAPID routine connected to any of following special system events: `PowerOn`, `Stop`, `QStop`, `Restart`, or `Step`.

Syntax

```
PathResol
  [PathSampleTime ':='] <expression (IN) of num>';'
```

Related information

For information about	See
Positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Motion settings	<i>Technical reference manual - RAPID Overview</i>
Configuration of path resolution	<i>Technical reference manual - System parameters</i>
Motion settings data	motsetdata - Motion settings data on page 1674

1 Instructions

1.176 PDispOff - Deactivates program displacement

RobotWare Base

1.176 PDispOff - Deactivates program displacement

Usage

PDispOff (*Program Displacement Off*) is used to deactivate a program displacement.

Program displacement is activated by the instruction PDispSet or PDispOn and applies to all movements until some other program displacement is activated or until program displacement is deactivated.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following examples illustrate the instruction PDispOff:

Example 1

```
PDispOff;
```

Deactivation of a program displacement.

Example 2

```
MoveL p10, v500, z10, tool1;  
PDispOn \ExeP:=p10, p11, tool1;  
MoveL p20, v500, z10, tool1;  
MoveL p30, v500, z10, tool1;  
PDispOff;  
MoveL p40, v500, z10, tool1;
```

A program displacement is defined as the difference between the positions p10 and p11. This displacement affects the movement to p20 and p30 but not to p40.

Program execution

Active program displacement is reset. This means that the program displacement coordinate system is the same as the object coordinate system, and thus all programmed positions will be related to the latter.

Syntax

```
PDispOff ';' ;
```

Related information

For information about	See
Definition of program displacement using two positions	PDispOn - Activates program displacement on page 543
Definition of program displacement using known frame	PDispSet - Activates program displacement using known frame on page 548

1.177 PDispOn - Activates program displacement

Usage

PDispOn (*Program Displacement On*) is used to define and activate a program displacement using two robot positions.

Program displacement is used, for example, after a search has been carried out or when similar motion patterns are repeated at several different places in the program.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following examples illustrate the instruction PDispOn:

See also [More examples on page 545](#).

Example 1

```
MoveL p10, v500, z10, tool1;  
PDispOn \ExeP:=p10, p20, tool1;
```

Activation of a program displacement (parallel displacement). This is calculated based on the difference between positions p10 and p20.

Example 2

```
MoveL p10, v500, fine \Inpos := inpos50, tool1;  
PDispOn *, tool1;
```

Activation of a program displacement (parallel displacement). Since a stop point that is accurately defined has been used in the previous instruction the argument \ExeP does not have to be used. The displacement is calculated on the basis of the difference between the robot's actual position and the programmed point (*) stored in the instruction.

Example 3

```
PDispOn \Rot \ExeP:=p10, p20, tool1;
```

Activation of a program displacement including a rotation. This is calculated based on the difference between positions p10 and p20.

Arguments

```
PDispOn [\Rot] [\ExeP] ProgPoint Tool [\WObj]
```

[\Rot]

Rotation

Data type: switch

The difference in the tool orientation is taken into consideration and this involves a rotation of the program.

[\ExeP]

Executed Point

Data type: robtarget

Continues on next page

1 Instructions

1.177 PDispOn - Activates program displacement

RobotWare Base

Continued

The new robot position used for calculation of the displacement. If this argument is omitted then the robot's current position at the time of the program execution is used.

ProgPoint

Programmed Point

Data type: robtarget

The robot's original position at the time of programming.

Tool

Data type: tooldata

The tool used during programming, i.e. the TCP to which the ProgPoint position is related.

[\WObj]

Work Object

Data type: wobjdata

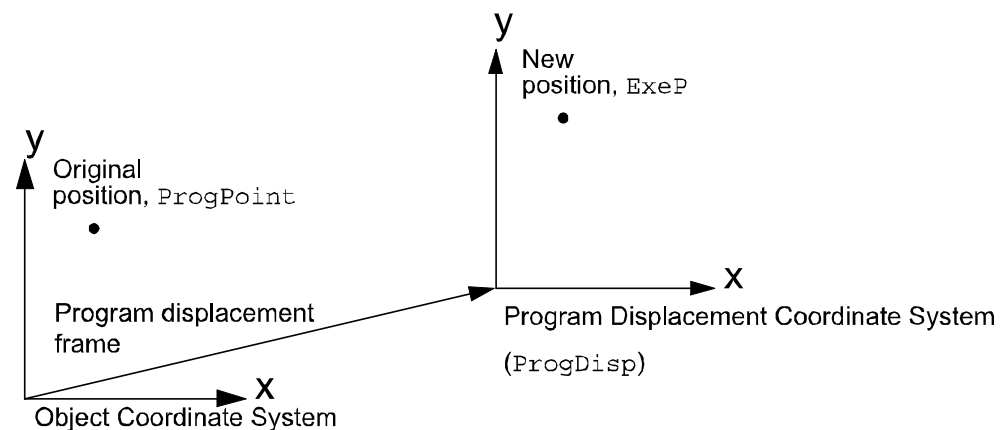
The work object (coordinate system) to which the ProgPoint position is related.

This argument can be omitted and if so then the position is related to the world coordinate system. If a stationary TCP or coordinated external axes are used then this argument must be specified.

The arguments **Tool** and **\WObj** are used both to calculate the ProgPoint during programming and to calculate the current position during program execution if no **\ExeP** argument is programmed.

Program execution

Program displacement means that the ProgDisp coordinate system is translated in relation to the object coordinate system. Since all positions are related to the ProgDisp coordinate system, all programmed positions will also be displaced. See figure below, which shows parallel displacement of a programmed position using program displacement.



Program displacement is activated when the instruction PDispOn is executed and remains active until some other program displacement is activated (the instruction

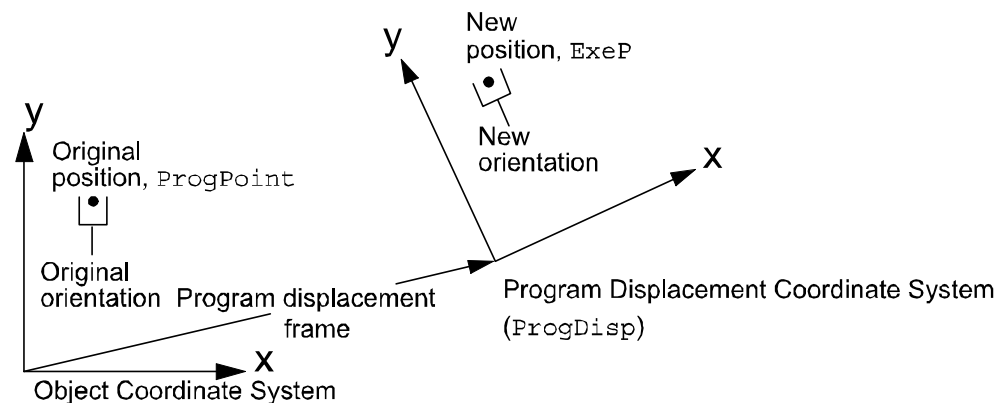
Continues on next page

PDispSet or PDispOn) or until program displacement is deactivated (the instruction PDispOff).

Only one program displacement can be active at the same time. Several PDispOn instructions, on the other hand, can be programmed one after the other and in this case the different program displacements will be added.

Program displacement is calculated as the difference between ExeP and ProgPoint. If ExeP has not been specified then the current position of the robot at the time of the program execution is used instead. Since it is the actual position of the robot that is used, the robot should not move when PDispOn is executed.

If the argument \Rot is used then the rotation is also calculated based on the tool orientation at the two positions. The displacement will be calculated in such a way that the new position (ExeP) will have the same position and orientation in relation to the displaced coordinate system, ProgDisp, as the old position (ProgPoint) had in relation to the original object coordinate system. See the figure below, which shows translation and rotation of a programmed position.



xx0500002187

The program displacement is automatically reset

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

More examples

More examples of how to use the instruction PDispOn are illustrated below.

Example 1

```
PROC draw_square()
  PDispOn *, tool1;
  MoveL *, v500, z10, tool1;
  MoveL *, v500, z10, tool1;
  MoveL *, v500, z10, tool1;
```

Continues on next page

1 Instructions

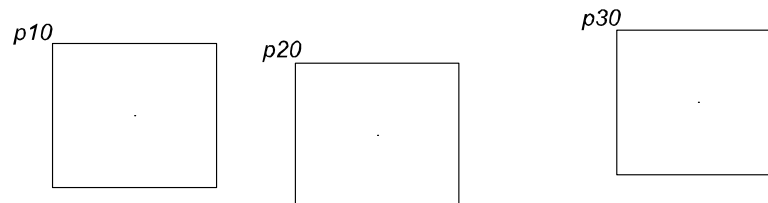
1.177 PDispOn - Activates program displacement

RobotWare Base

Continued

```
MoveL *, v500, z10, tool1;
PDispOff;
ENDPROC
...
MoveL p10, v500, fine \Inpos := inpos50, tool1;
draw_square;
MoveL p20, v500, fine \Inpos := inpos50, tool1;
draw_square;
MoveL p30, v500, fine \Inpos := inpos50, tool1;
draw_square;
```

The routine `draw_square` is used to execute the same motion pattern at three different positions based on the positions `p10`, `p20`, and `p30`. See the figure below, which shows that when using program displacement the motion patterns can be reused.



xx0500002185

Example 2

```
SearchL sen1, psearch, p10, v100, tool1\Wobj:=fixture1;
PDispOn \ExeP:=psearch, *, tool1 \Wobj:=fixture1;
```

A search is carried out in which the robot's searched position is stored in the position `psearch`. Any movement carried out after this starts from this position using a program displacement (parallel displacement). The latter is calculated based on the difference between the searched position and the programmed point (*) stored in the instruction. All positions are based on the `fixture1` object coordinate system.

Syntax

```
PDispOn
[ ['\' Rot ]
[ ['\' ExeP ':' <expression (IN) of robtarget>'],']
[ ProgPoint ':' <expression (IN) of robtarget>'],'
[ Tool ':' <persistent (PERS) of tooldata>
[ ['\' Wobj ':' <persistent (PERS) of wobjdata>'];'
```

Related information

For information about	See
Deactivation of program displacement	PDispOff - Deactivates program displacement on page 542
Definition of program displacement using known frame	PDispSet - Activates program displacement using known frame on page 548
Coordinate systems	<i>Technical reference manual - System parameters</i>

Continues on next page

1.177 PDispOn - Activates program displacement

RobotWare Base

Continued

For information about	See
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775

1 Instructions

1.178 PDispSet - Activates program displacement using known frame *RobotWare Base*

1.178 PDispSet - Activates program displacement using known frame

Usage

PDispSet (*Program Displacement Set*) is used to define and activate a program displacement using known frame.

Program displacement is used, for example, when similar motion patterns are repeated at several different places in the program.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction PDispSet:

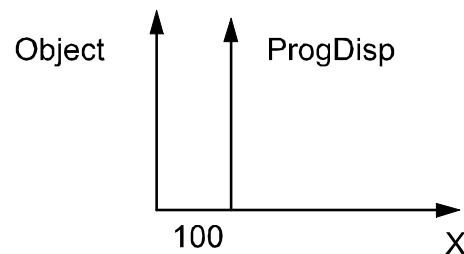
Example 1

```
VAR pose xp100 := [ [100, 0, 0], [1, 0, 0, 0] ];  
...  
PDispSet xp100;
```

Activation of the xp100 program displacement meaning that:

- The ProgDisp coordinate system is displaced 100 mm from the object coordinate system in the direction of the positive x-axis (see figure below).
- As long as this program displacement is active all positions will be displaced 100 mm in the direction of the x-axis.

The figure shows a 100 mm program displacement along the x-axis.



xx0500002199

Arguments

PDispSet DispFrame

DispFrame

Displacement Frame

Datatype: pose

The program displacement is defined as data of the type pose.

Program execution

Program displacement involves translating and/or rotating the ProgDisp coordinate system relative to the object coordinate system. Since all positions are related to the ProgDisp coordinate system, all programmed positions will also be displaced.

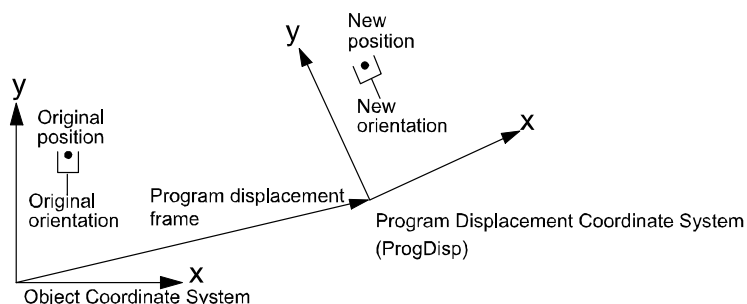
Continues on next page

1.178 PDispSet - Activates program displacement using known frame

RobotWare Base

Continued

See the figure below, which shows translation and rotation of a programmed position.



xx0500002204

Program displacement is activated when the instruction PDispSet is executed and remains active until some other program displacement is activated (the instruction PDispSet or PDispOn) or until program displacement is deactivated (the instruction PDispOff).

Only one program displacement can be active at the same time. Program displacements cannot be added to one another using PDispSet.

The program displacement is automatically reset

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Syntax

```
PDispSet
  [ DispFrame ':' ] < expression (IN) of pose> ';' ;
```

Related information

For information about	See
Deactivation of program displacement	PDispOff - Deactivates program displacement on page 542
Definition of program displacement using two positions	PDispOn - Activates program displacement on page 543
Definition of data of the type pose	pose - Coordinate transformations on page 1698
Coordinate systems	Technical reference manual - RAPID Overview
Examples of how program displacement can be used	PDispOn - Activates program displacement on page 543

1 Instructions

1.179 ProcCall - Calls a new procedure
RobotWare Base

1.179 ProcCall - Calls a new procedure

Usage

A procedure call is used to transfer program execution to another procedure. When the procedure has been fully executed the program execution continues with the instruction following the procedure call.

It is usually possible to send a number of arguments to the new procedure. These control the behavior of the procedure and make it possible for the same procedure to be used for different things.

Basic examples

The following examples illustrate the instruction ProcCall:

Example 1

```
weldpipe1;
```

Calls the weldpipe1 procedure.

Example 2

```
errormessage;  
Set do1;  
...  
PROC errormessage()  
  TPWrite "ERROR";  
ENDPROC
```

The errormessage procedure is called. When this procedure is ready the program execution returns to the instruction following the procedure call, Set do1.

Arguments

Procedure { Argument }

Procedure

Identifier

The name of the procedure to be called.

Argument

Data type: In accordance with the procedure declaration.

The procedure arguments (in accordance with the parameters of the procedure).

Basic examples

Basic examples of the instruction ProcCall are illustrated below.

Example 1

```
weldpipe2 10, lowspeed;
```

Calls the weldpipe2 procedure including two arguments.

Example 2

```
weldpipe3 10 \speed:=20;
```

Calls the weldpipe3 procedure including one mandatory and one optional argument.

Continues on next page

Limitations

The procedure's arguments must agree with its parameters:

- All mandatory arguments must be included.
- They must be placed in the same order.
- They must be of the same data type.
- They must be of the correct type with respect to the access-mode (input, variable, or persistent).

A routine can call a routine which, in turn, calls another routine. A routine can also call itself, that is, a recursive call. The number of routine levels permitted depends on the number of parameters. More than 10 levels are usually permitted.

Syntax

<procedure> [<argument list>] ';'

Related information

For information about	See
Arguments, parameters	<i>Technical reference manual - RAPID Overview</i>

1 Instructions

1.180 ProcerrRecovery - Generate and recover from process-move error *RobotWare Base*

1.180 ProcerrRecovery - Generate and recover from process-move error

Usage

ProcerrRecovery can be used to generate process error during robot movement and get the possibility to handle the error and restart the process and the movement from an ERROR handler.

Basic examples

The following examples illustrate the instruction ProcerrRecovery:

See also [More examples on page 554](#).

The examples below are not realistic but are shown for pedagogic reasons.

Example 1

```
MoveL p1, v50, z30, tool2;
ProcerrRecovery \SyncOrgMoveInst;
MoveL p2, v50, z30, tool2;
ERROR
  IF ERRNO = ERR_PATH_STOP THEN
    StartMove;
    RETRY;
  ENDIF
```

The robot movement stops on its way to p1 and the program execution transfers to the ERROR handler in the routine that created the actual path on which the error occurred, in this case the path to MoveL p1. The movement is restarted with StartMove and the execution is continued with RETRY.

Example 2

```
MoveL p1, v50, fine, tool2;
ProcerrRecovery \SyncLastMoveInst;
MoveL p2, v50, z30, tool2;
ERROR
  IF ERRNO = ERR_PATH_STOP THEN
    StartMove;
    RETRY;
  ENDIF
```

The robot movement stops at once on its way to p2. The program execution transfers to the ERROR handler in the routine where the program is currently executing or is going to execute a move instruction when the error occurred, in this case MoveL p2. The movement is restarted with StartMove and the execution is continued with RETRY.

Arguments

ProcerrRecovery[\SyncOrgMoveInst] | [\SyncLastMoveInst]
[\ProcSignal]

[\SyncOrgMoveInst]

Data type: switch

Continues on next page

The error can be handled in the routine that created the actual path on which the error occurred.

[SyncLastMoveInst]

Data type: switch

The error can be handled in the routine where the program is currently executing a move instruction when the error occurred.

If the program is currently not executing a move instruction when the error occurred then the transfer of the execution to the ERROR handler will be delayed until the program executes the next move instruction. This means that the transfer to the ERROR handler will be delayed if the robot is in a stop point or between the prefetch point and the middle of the corner path. The error can be handled in that routine.

[ProcSignal]

Data type: signaldo

Optional parameter that let the user turn on/off the use of the instruction. If this parameter is used and the signal value is 0, an recoverable error will be thrown, and no process error will be generated.

Program execution

Execution of ProcerrRecovery in continuous mode results in the following:

- At once the robot is stopped on its path.
- The variable ERRNO is set to ERR_PATH_STOP.
- The execution is transferred to some ERROR handler according the rules for asynchronously raised errors.

This instruction does nothing in any step mode.

For description of asynchronously raised errors that are generated with ProcerrRecovery, see *Technical reference manual - RAPID kernel*.

ProcerrRecovery can also be used in MultiMove system to transfer the execution to the ERROR handler in several program tasks if running in synchronized mode.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_PATH_STOP	Execution of ProcerrRecovery in continuous mode.
ERR_PROCSIGNAL_OFF	The optional parameter \ProcSignal is used and the signal is off when the instruction is executed.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Continues on next page

1 Instructions

1.180 ProcerrRecovery - Generate and recover from process-move error

RobotWare Base

Continued

More examples

More examples of how to use the instruction ProcerrRecovery are illustrated below.

Example with ProcerrRecovery\SyncOrgMoveInst

```
MODULE user_module
  VAR intnum proc_sup_int;

  PROC main()
    ...
    MoveL p1, v1000, fine, tool1;
    do_process;
    ...
  ENDPROC
  PROC do_process()
    my_proc_on;
    MoveL p2, v200, z10, tool1;
    MoveL p3, v200, fine, tool1;
    my_proc_off;
  ERROR
    IF ERRNO = ERR_PATH_STOP THEN
      my_proc_on;
      StartMove;
      RETRY;
    ENDIF
  ENDPROC

  TRAP iprocfail
    my_proc_off;
    ProcerrRecovery \SyncOrgMoveInst;
  ENDTRAP

  PROC my_proc_on()
    SetDO do_myproc, 1;
    CONNECT proc_sup_int WITH iprocfail;
    ISignalDI di_proc_sup, 1, proc_sup_int;
  ENDPROC

  PROC my_proc_off()
    SetDO do_myproc, 0;
    IDelete proc_sup_int;
  ENDPROC
ENDMODULE
```

Asynchronously raised errors generated by ProcerrRecovery with switch \SyncOrgMoveInst can, in this example, be treated in the routine do_process because the path on which the error occurred is always created in the routine do_process.

A process flow is started by setting the signal do_myproc to 1. The signal di_proc_sup supervise the process, and an asynchronous error is raised if

Continues on next page

1.180 ProcerrRecovery - Generate and recover from process-move error

*RobotWare Base**Continued*

di_proc_sup becomes 1. In this simple example the error is resolved by setting do_myproc to 1 again before resuming the movement.

Example with ProcerrRecovery\SyncLastMoveInst

```

MODULE user_module
  PROC main()
    ...
    MoveL p1, v1000, fine, tool1;
    do_process;
    ...
  ENDPROC
  PROC do_process()
    proc_on;
    proc_move p2, v200, z10, tool1;
    proc_move p3, v200, fine, tool1;
    proc_off;
  ERROR
    IF ERRNO = ERR_PATH_STOP THEN
      StorePath;
      p4 := CRobT(\Tool:=tool1);
      ! Move to service station and fix the problem
      MoveL p4, v200, fine, tool1;
      RestoPath;
      proc_on;
      StartMoveRetry;
    ENDIF
  ENDPROC
ENDMODULE

MODULE proc_module (SYSMODULE, NOSTEPIN)
  VAR intnum proc_sup_int;
  VAR num try_no := 0;

  TRAP iprocfail
    proc_off;
    ProcerrRecovery \SyncLastMoveInst;
  ENDTRAP

  PROC proc_on()
    SetDO do_proc, 1;
    CONNECT proc_sup_int WITH iprocfail;
    ISignalDI di_proc_sup, 1, proc_sup_int;
  ENDPROC

  PROC proc_off()
    SetDO do_proc, 0;
    IDelete proc_sup_int;
  ENDPROC

  PROC proc_move (robtarg ToPoint, speeddata Speed, zonedata Zone,
    PERS tooldata Tool)

```

Continues on next page

1 Instructions

1.180 ProcerrRecovery - Generate and recover from process-move error

RobotWare Base

Continued

```
MoveL ToPoint, Speed, Zone, Tool;  
ERROR  
  IF ERRNO = ERR_PATH_STOP THEN  
    try_no := try_no + 1;  
    IF try_no < 4 THEN  
      proc_on;  
      StartMoveRetry;  
    ELSE  
      RaiseToUser \Resume;  
    ENDIF  
  ENDPROC  
ENDMODULE
```

Asynchronously raised errors generated by ProcerrRecovery with switch \SyncLastMoveInst can in this example be treated in the routine proc_move because all move instructions are always created in the routine proc_move. When program pointer is in routine do_process the transfer to ERROR handler will be delayed until running the next MoveL in routine proc_move. Note that the movements are always stopped at once.

A process flow is started by setting the signal do_myproc to 1. The signal di_proc_sup supervise the process, and an asynchronous error is raised if di_proc_sup becomes 1. In this simple example the error is resolved by setting do_myproc to 1 again before resuming the movement.

When using predefined NOSTEPIN routine we recommend using the option switch parameter \SyncLastMoveInst because then the predefined routine can make the decision to handle some error situation within the routine while others must be handled by the end user.

Limitations

Error recovery from asynchronously raised process errors can only be done if the motion task with the process move instruction is executing on base level when the process error occurs. So error recovery cannot be done if the program task with the process instruction executes in:

- any event routine
- any routine handler (ERROR, BACKWARD or UNDO)
- user execution level (service routine)

See *Technical reference manual - RAPID kernel, Error recovery, Asynchronously raised errors*.

If no error handler with a StartMove + RETRY or a StartMoveRetry is used, the program execution will hang. The only way to reset this is to do a PP to main.

Syntax

```
ProcerrRecovery  
  [ '\ ' SyncOrgMoveInst ] | [ ' \ ' SyncLastMoveInst ]  
  [ '\ ' ProcSignal' := ' ] < variable (VAR) of signaldo > ';' ;
```

Continues on next page

Related information

For information about	See
Error handlers	<i>Technical reference manual - RAPID Overview</i>
Asynchronously raised errors	<i>Technical reference manual - RAPID kernel, Error recover</i>
Propagates an error to user level	<i>RaiseToUser - Propagates an error to user level on page 564</i>
Resume movement and program execution	<i>StartMoveRetry - Restarts robot movement and execution on page 766</i>

1 Instructions

1.181 PulseDO - Generates a pulse on a digital output signal
RobotWare Base

1.181 PulseDO - Generates a pulse on a digital output signal

Usage

PulseDO is used to generate a pulse on a digital output signal.

Basic examples

The following examples illustrate the instruction PulseDO:

Example 1

```
PulseDO do15;
```

A pulse with a pulse length of 0.2 s is generated on the output signal do15.

Example 2

```
PulseDO \PLength:=1.0, ignition;
```

A pulse of length 1.0 s is generated on the signal ignition.

Example 3

```
! Program task MAIN  
PulseDO \High, do3;  
! At almost the same time in program task BCK1  
PulseDO \High, do3;
```

Positive pulse (value 1) is generated on the signal do3 from two program tasks at almost the same time. It will result in one positive pulse with a pulse length longer than the default 0.2 s or two positive pulses after each other with a pulse length of 0.2 s.

Arguments

PulseDO [\High] [\PLength] Signal

[\High]

High level

Data type: switch

Specifies that the signal value should always be set to high (value 1) when the instruction is executed independently of its current state.

[\PLength]

Pulse Length

Data type: num

The length of the pulse in seconds (0.001 - 2000 s). If the argument is omitted a 0.2 second pulse is generated.

Signal

Data type: signaldo

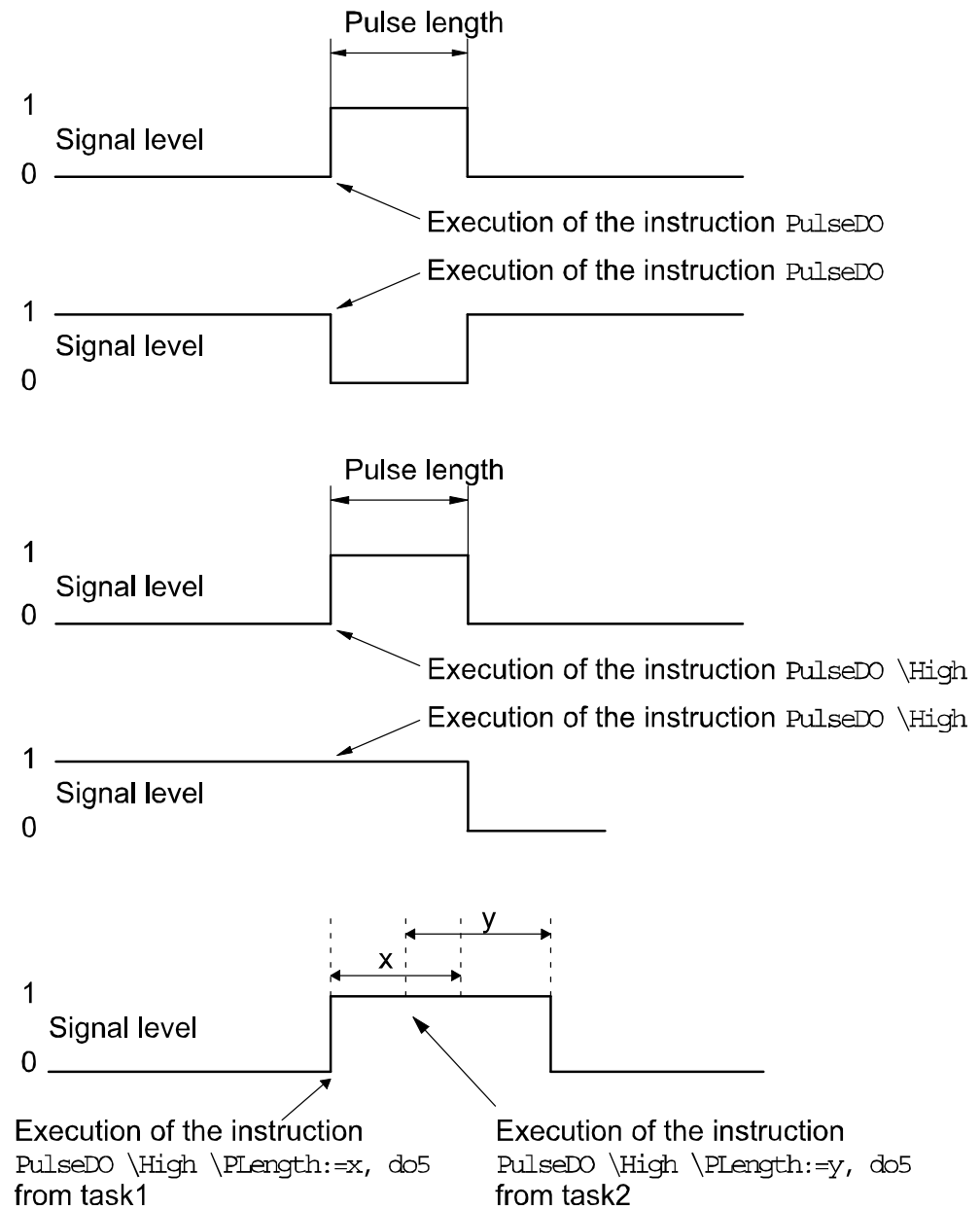
The name of the signal on which a pulse is to be generated.

Continues on next page

Program execution

The next instruction after `PulseDO` is executed directly after the pulse starts. The pulse can then be set/reset without affecting the rest of the program execution.

The figure below shows examples of generation of pulses on a digital output signal.



xx0500002217

The next instruction is executed directly after the pulse starts. The pulse can then be set/reset without affecting the rest of the program execution.

Limitations

The length of the pulse has a resolution off 0.001 seconds. Programmed values that differ from this are rounded off.

Continues on next page

1 Instructions

1.181 PulseDO - Generates a pulse on a digital output signal

RobotWare Base

Continued

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Syntax

```
PulseDO
  ['\' High]
  ['\' PLength ':' <expression (IN) of num>'],'
  [Signal ':' <variable (VAR) of signaldo>'];'
```

Related information

For information about	See
Input/Output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

1.182 RAISE - Calls an error handler

Usage

RAISE is used to create an error in the program and then to call the error handler of the routine.

RAISE can also be used in the error handler to propagate the current error to the error handler of the calling routine.

This instruction can, for example, be used to jump back to a higher level in the structure of the program, e.g. to the error handler in the main routine if an error occurs at a lower level.

Basic examples

The following example illustrates the instruction RAISE:

See also [More examples on page 562](#).

Example 1

```
MODULE MainModule .
VAR errnum ERR_MY_ERR := -1;

PROC main()
  BookErrNo ERR_MY_ERR;

  IF di1 = 0 THEN
    RAISE ERR_MY_ERR;
  ENDIF

ERROR
  IF ERRNO = ERR_MY_ERR THEN
    TPWrite "di1 equals 0";
  ENDIF

ENDPROC

ENDMODULE
```

For this implementation di1 equals 0 is regarded as an error. RAISE will force the execution to the error handler. In this example the user has created his own error number to handle the specific error.

Arguments

RAISE [Error no.]

Error no.

Data type: errnum

Error number: Any number between 1 and 90 which the error handler can use to locate the error that has occurred (the ERRNO system variable).

It is also possible to book an error number outside the range 1-90 with the instruction BookErrNo.

Continues on next page

1 Instructions

1.182 RAISE - Calls an error handler

RobotWare Base

Continued

The error number must be specified outside the error handler in a RAISE instruction to transfer execution to the error handler of that routine.

If the instruction is present in a routine's error handler then the error is propagated to the error handler of the calling routine. In this case the error number does not have to be specified.

Program execution

Program execution continues in the routine's error handler. After the error handler has been executed the program execution can continue with:

- the routine that called the routine in question (RETURN).
- the error handler of the routine that called the routine in question (RAISE).

A RAISE instruction in a routine's error handler also has another feature. It can be used for long jump (see "Error Recovery With Long Jump"). With a long jump it is possible to propagate an error from an error handler from a deep nested call chain to a higher level in one step.

If the RAISE instruction is present in a trap routine, the error is dealt with by the system's error handler.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_ILLRAISE	Error number in RAISE is out of range.

More examples

More examples of the instruction RAISE are illustrated below.

Example 1

```
MODULE MainModule
VAR num value1 := 10;
VAR num value2 := 0;

PROC main()
    routine1;

ERROR
    IF ERRNO = ERR_DIVZERO THEN
        value2 := 1;
        RETRY;
    ENDIF
ENDPROC

PROC routine1()
    value1 := 5/value2; !This will lead to an error when value2 is
                        equal to 0.
ERROR
    RAISE;
ENDPROC
```

Continues on next page

ENDMODULE

In this example the division with zero will result in an error. In the ERROR-handler RAISE will propagate the error to the ERROR-handler in the calling routine "main". The same error number remains active. RETRY will re-run the whole routine "routine1".

Syntax

RAISE [<error number>] ';' ;'

Related information

For information about	See
Error handling	<i>Technical reference manual - System parameters</i>
Error recovery with long jump	<i>Technical reference manual - RAPID kernel</i>
Booking error numbers	BookErrNo - Book a RAPID system error number on page 47

1 Instructions

1.183 RaiseToUser - Propagates an error to user level

RobotWare Base

1.183 RaiseToUser - Propagates an error to user level

Usage

`RaiseToUser` is used in an error handler in nostepin routines to propagate the current error or any other defined error to the error handler at user level. User level is in this case the first routine in a call chain above a nostepin routine.

Basic examples

The following example illustrates the instruction `RaiseToUser`:

Example 1

```
MODULE MyModule
  VAR errnum ERR_MYDIVZERO:= -1;
  PROC main()
    BookErrNo ERR_MYDIVZERO;
    ...
    routine1;
    ...
    ERROR
    IF ERRNO = ERR_MYDIVZERO THEN
      TRYNEXT;
    ELSE
      RETRY;
    ENDIF
  ENDPROC
ENDMODULE

MODULE MySysModule (SYSMODULE, NOSTEPIN, VIEWONLY)
  PROC routine1()
    ...
    routine2;
    ...
  UNDO
  ! Free allocated resources
  ENDPROC
  PROC routine2()
    VAR num n:=0;
    ...
    reg1:=reg2/n;
    ...
    ERROR
    IF ERRNO = ERR_DIVZERO THEN
      RaiseToUser \Resume \ErrorNumber:=ERR_MYDIVZERO;
    ELSE
      RaiseToUser \BreakOff;
    ENDIF
  ENDPROC
ENDMODULE
```

The division by zero in routine2 will propagate up to the error handler in main routine with the `errno` set to `ERR_MYDIVZERO`. The `TRYNEXT` instruction in main

Continues on next page

error handler will then cause the program execution to continue with the instruction after the division by zero in routine2. The \Resume switch controls this behavior.

If any other errors occur in routine2 then the \BreakOff switch forces the execution to continue from the error handler in the main routine. In this case the undo handler in routine1 will be executed while raising it to user level. The RETRY instruction in the error handler in the main routine will execute routine1 from the beginning once again.

The undo handler in routine1 will also be executed in the \Resume case if a following RAISE or RETURN is done on the user level.

Arguments

RaiseToUser [\Resume] | [\BreakOff] [\ErrorNumber]

[\Resume]

Data type: switch

Continue the execution in the routine that caused the error.

[\BreakOff]

Data type: switch

Break off the call chain and continue the execution at the user level. Any undo handler in the call chain will be executed apart from the undo handler in the routine that raised the error.

One of the arguments \Resume or \BreakOff must be programmed to avoid an execution error.

[\ErrorNumber]

Data type: errnum

Any number between 1 and 90 that the error handler can use to locate the error that has occurred (the ERRNO system variable).

It is also possible to book an error number outside the range 1-90 with the instruction BookErrNo.

If the argument \ErrorNumber is not specified then the original error number propagates to the error handler in the routine at user level.

Program execution

RaiseToUser can only be used in an error handler in a nostepin routine.

The program execution continues in the error handler of the routine at user level. The error number remains active if the optional parameter \ErrorNumber is not present. The system error handler deals with the error if there is no error handler on user level. The system error handler is called if none of the arguments \Resume or \BreakOff are specified.

There are two different behaviors after the error handler has been executed. The program execution continues in the routine with RaiseToUser if the \Resume switch is on. The program execution continues at the user level if the \BreakOff switch is on.

Continues on next page

1 Instructions

1.183 RaiseToUser - Propagates an error to user level

RobotWare Base

Continued

Program execution can continue with:

- the instruction that caused the error (RETRY)
- the following instruction (TRYNEXT)
- the error handler of the routine that called the routine at user level (RAISE)
- the routine that called the routine at user level (RETURN)

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_ILLRAISE	Error number in RAISE is out of range.

Syntax

```
RaiseToUser
[ '\ ' Resume ]
'|' [ '\ ' BreakOff ]
[ '\ ' ErrorNumber ':=' ] < expression (IN) of errnum> ';' 
```

Related information

For information about	See
Error handling	<i>Technical reference manual - RAPID Overview</i>
Undo handling	<i>Technical reference manual - RAPID Overview</i>
Booking error numbers	BookErrNo - Book a RAPID system error number on page 47

1.184 ReadAnyBin - Read data from a binary I/O device or file

Usage

ReadAnyBin (*Read Any Binary*) is used to read any type of data from a binary I/O device or file.

Basic examples

The following example illustrates the instruction ReadAnyBin:

Example 1

```
VAR iODEV file1;
VAR robtarget next_target;
...
Open "HOME:" \File:= "bin_file.txt", file1 \Read \Bin;
ReadAnyBin file1, next_target;
```

The next robot target to be executed, next_target, is read from the file file1.

Arguments

ReadAnyBin IODEV Data [\Time]

IODEV

Data type: iODEV

The name (reference) of the binary I/O device or file to be read.

Data

Data type: anytype

The VAR or PERS to which the read data will be stored.

[\Time]

Data type: num

The max. time for the reading operation (timeout) in seconds. If this argument is not specified then the max. time is set to 60 seconds. To wait forever, use the predefined constant WAIT_MAX.

If this time runs out before the read operation is finished then the error handler will be called with the error code ERR_DEV_MAXTIME. If there is no error handler then the execution will be stopped.

The timeout function is also in use during program stop and will be noticed by the RAPID program at program start.

Program execution

As many bytes as are required for the specified data are read from the specified binary I/O device or file.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type iODEV will be reset.

Continues on next page

1 Instructions

1.184 ReadAnyBin - Read data from a binary I/O device or file

RobotWare Base

Continued

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_FILEACC</code>	The path points to a non-existing directory or there are too many directories open at the same time.
<code>ERR_DEV_MAXTIME</code>	Timeout when executing a <code>ReadBin</code> , <code>ReadNum</code> , <code>ReadStr</code> , <code>ReadStrBinReadAnyBin</code> , or a <code>ReadRawBytes</code> instruction.
<code>ERR_RANYBIN_CHK</code>	Check sum error detected at data transfer with instruction <code>ReadAnyBin</code> .
<code>ERR_RANYBIN_EOF</code>	End of file is detected before all bytes are read in instruction <code>ReadAnyBin</code> .

Limitations

This instruction can only be used for I/O devices or files that have been opened for binary reading.

The data to be read by this instruction `ReadAnyBin` must be a value data type such as `num`, `bool`, or `string`. Record, record component, array, or array element of these value data types can also be used. Entire data or partial data with semi-value or non-value data types cannot be used.



Note

The VAR or PERS variable, for storage of the read data, can be updated in several steps. Therefore, always wait until the whole data structure is updated before using read data from a trap routine or another program task.

Because `WriteAnyBin`-`ReadAnyBin` are designed to only handle internal binary controller data with I/O device or files between or within the robot controller, no data protocol is released and the data cannot be interpreted on any PC.

Control software development can break the compatibility, and therefore it might not be possible to use `WriteAnyBin`-`ReadAnyBin` between different software versions of RobotWare.

Syntax

```
ReadAnyBin
  [IODevice ':='] <variable (VAR) of iodev>','
  [Data ':='] <variable or persistent (INOUT) of anytype>
  ['\ ' Time ':='] <expression (IN) of num>]';'
```

Related information

For information about	See
Opening of I/O devices or files	<i>Technical reference manual - RAPID Overview</i>
Write data to a binary I/O device or file	WriteAnyBin - Writes data to a binary file or I/O device on page 1070
File and I/O device handling	<i>Application manual - Controller software Omni-Core</i>

1.185 ReadCfgData - Reads attribute of a system parameter

Usage

ReadCfgData is used to read one attribute of a system parameter (configuration data).

Besides to reading named parameters it is also possible to search for unnamed parameters.

Basic examples

The following example illustrates the instruction ReadCfgData. Both of these examples show how to read named parameters.

Example 1

```
VAR num offset1;
...
ReadCfgData "/MOC/MOTOR_CALIB/rob1_1", "cal_offset", offset1;
```

Reads the value of the calibration offset for axis 1 for rob_1 into the num variable offset1.

Example 2

```
VAR string io_device;
...
ReadCfgData "/EIO/EIO_SIGNAL/process_error", "Device", io_device;
```

Reads the name of the I/O device where the signal process_error is defined into the string variable io_device.

Arguments

ReadCfgData InstancePath Attribute CfgData [\ListNo]

InstancePath

Data type: string

Specifies a path to the parameter to be accessed.

For named parameters the format of this string is /DOMAIN/TYPE/ParameterName.

For unnamed parameters the format of this string is /DOMAIN/TYPE/Attribute/AttributeValue.

Attribute

Data type: string

The name of the attribute of the parameter to be read.

CfgData

Data type: anytype

The variable where the attribute value will be stored. Depending on the attribute type the valid types are bool, num, dnum, or string.

[\ListNo]

Data type: num

Continues on next page

1 Instructions

1.185 ReadCfgData - Reads attribute of a system parameter

RobotWare Base

Continued

Variable holding the instance number of the Attribute + AttributeValue to be found.

First occurrence of the Attribute + AttributeValue has an instance number 0. If more instances are searched for then the returned value in \ListNo will be incremented with 1. Otherwise, if there are no more instances then the returned value will be -1. The predefined constant END_OF_LIST can be used to check if more instances are to be search for.

Program execution

The value of the attribute specified by the Attribute argument is stored in the variable specified by the CfgData argument.

If using format /DOMAIN/TYPE/ParameterName in InstancePath, only named parameters can be accessed, i.e. parameters where the first attribute is name, Name, or NAME.

For unnamed parameters use the optional parameter \ListNo to selects from which instance to read the attribute value. It is updated after each successful read to the next available instance.

Predefined data

The predefined constant END_OF_LIST with value -1 can be used to stop reading when no more instances can be found.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CFG_NOTFND	It is not possible to find the data specified with "InstancePath + Attribute" in the configuration database.
ERR_CFG_ILLTYPE	The data type for parameter CfgData is not equal to the real data type for the found data specified with "InstancePath + Attribute" in the configuration database.
ERR_CFG_INTERNAL	Not allowed to read internal parameter
ERR_CFG_OUTOFBOUNDS	The variable in argument \ListNo has a value outside range of available instances (0 ... n) when executing the instruction.

More examples

More examples of the instruction ReadCfgdata are illustrated below. Both these examples show how to read unnamed parameters.

Example 1

```
VAR num list_index;  
VAR string read_str;  
...  
list_index:=0;
```

Continues on next page

1.185 ReadCfgData - Reads attribute of a system parameter

*RobotWare Base**Continued*

```

ReadCfgData "/EIO/EIO_CROSS/Act1/do_13", "Res", read_str,
  \ListNo:=list_index;
IF read_str <> "" THEN
  TPWrite "Resultant signal for signal do_13 is: " + read_str;
ENDIF

```

Reads the resultant signal for the unnamed digital actor signal di_13 and places the name in the string variable read_str.

In this example domain EIO has the following cfg code:

EIO_CROSS:

```

-Name "Cross_di_1_do_2" -Res "di_1" -Act1 "do_2"
-Name "Cross_di_2_do_2" -Res "di_2" -Act1 "do_2"
-Name "Cross_di_13_do_13" -Res "di_13" -Act1 "do_13"

```

Example 2

```

VAR num list_index;
VAR string read_str;
...
list_index:=0;
WHILE list_index <> END_OF_LIST DO
  read_str:="";
  ReadCfgData "/EIO/EIO_SIGNAL/Device/USERIO", "Name", read_str,
    \ListNo:=list_index;
  IF read_str <> "" THEN
    TPWrite "Signal: " + read_str;
  ENDIF
ENDWHILE
..
ERROR
  TRYNEXT;

```

Read the names of all signals defined for the I/O device USERIO.

In this example domain EIO has the following cfg code:

```

EIO_SIGNAL:
-Name "USERD01" -SignalType "D0" -Device "USERIO" -DeviceMap "0"
-Name "USERD02" -SignalType "D0" -Device "USERIO" -DeviceMap "1"
-Name "USERD03" -SignalType "D0" -Device "USERIO" -DeviceMap "2"

```

Example 3

```

VAR num list_index;
VAR string read_str;
...
list_index:=0;
WHILE list_index <> END_OF_LIST DO
  read_str:="";
  ReadCfgData "/EIO/DEVICENET_DEVICE/Network/DeviceNet", "Name",
    read_str, \ListNo:=list_index;
  IF read_str <> "" THEN
    TPWrite read_str;
  ENDIF
ENDWHILE
..

```

Continues on next page

1 Instructions

1.185 ReadCfgData - Reads attribute of a system parameter

RobotWare Base

Continued

```
ERROR  
    TRYNEXT;
```

Read the names of all DeviceNet devices.

In this example domain EIO has the following cfg code:

```
DEVICENET_DEVICE:  
  -Name PANEL -Network "DeviceNet" -Simulated  
  -Name DRV_1 -Network "DeviceNet" -Simulated  
  -Name DEVICE1 -Network "DeviceNet" -Simulated  
  -Name DEVICE2 -Network "DeviceNet" -Simulated
```

Limitations

The conversion from system parameter units (m, radian, second, and so on.) to RAPID program units (mm, degree, second, and so on.) for CfgData of data type num and dnum must be done by the user in the RAPID program.

If using format /DOMAIN/TYPE/ParameterName in InstancePath then only named parameters can be accessed, i.e. parameters where the first attribute is name, Name, or NAME.

RAPID strings are limited to 80 characters. In some cases this can be in theory too small for the definition InstancePath, Attribute or CfgData.

Syntax

```
ReadCfgData  
  [ InstancePath ':' ] < expression (IN) of string > ','  
  [ Attribute ':' ] < expression (IN) of string > ','  
  [ CfgData ':' ] < variable (VAR) of anytype >  
  [ '\\' ListNo ':' < variable (VAR) of num > ] ';' ;
```

Related information

For information about	See
Definition of string	string - Strings on page 1739
Write attribute of a system parameter	WriteCfgData - Writes attribute of a system parameter on page 1074
Get robot name in current task	RobName - Get the TCP robot name on page 1433
Configuration	<i>Technical reference manual - System parameters</i>
<i>Advanced RAPID</i>	<i>Application manual - Controller software OmniCore</i>

1.186 ReadErrData - Gets information about an error

Usage

ReadErrData is to be used in a trap routine, to get information (domain, type, number and intermixed strings %s) about an error, a state change, or a warning that caused the trap routine to be executed.

Basic examples

The following example illustrates the instruction ReadErrData:

See chapter [More examples on page 574](#).

Example 1

```

VAR errdomain err_domain;
VAR num err_number;
VAR errtype err_type;
VAR trapdata err_data;
VAR string titlestr;
VAR string string1;
VAR string string2;
...
TRAP trap_err
  GetTrapData err_data;
  ReadErrData err_data, err_domain, err_number,
    err_type \Title:=titlestr \Str1:=string1 \Str2:=string2;
ENDTRAP

```

When an error is trapped to the trap routine trap_err the error domain, the error number, the error type, and the two first intermixed strings in the error message are saved into appropriate variables.

Arguments

```

ReadErrData TrapEvent ErrorDomain ErrorId ErrorType [\Title] [\Str1]
[\Str2] [\Str3] [\Str4] [\Str5]

```

TrapEvent

Data type: trapdata

Variable containing the information about what caused the trap to be executed.

ErrorDomain

Data type: errdomain

Variable to store the error domain to which the error, state change, or warning that occurred belongs. Ref. to predefined data of type errdomain.

ErrorId

Data type: num

Variable to store the number of the error that occurred. The error number is returned without the first digit (error domain) and without the initial zeros of the complete error number.

E.g. 10008 Program restarted is returned as 8.

Continues on next page

1 Instructions

1.186 ReadErrData - Gets information about an error

RobotWare Base

Continued

ErrorType

Data type: errtype

Variable to store the type of event such as error, state change, or warning that occurred. Ref. to predefined data of type errtype.

[\Title]

Data type: string

Variable to store the title in the error message. The title is in UTF8 format and all characters will not be displayed correctly for all languages on the FlexPendant.

[\Str1] ... [\Str5]

Data type: string

Update the specified string variable with argument that is intermixed in the error message. There could be up to five arguments in a message of type %s, %f, %d or %ld, which always will be converted to a string at execution of this instruction. Str1 will hold the first argument, Str2 will hold the second argument, and so on. Information about how many arguments there are in a message is found in *Operating manual - Trouble shooting*. The intermixed arguments is marked as arg in that document.

Program execution

The ErrorDomain, ErrorId, ErrorType, Title and Str1 ... Str5 variables are updated according to the contents of TrapEvent.

If different events are connected to the same trap routine then the program must ensure that the event is related to error monitoring. This can be done by testing that INTNO matches the interrupt number used in the instruction IError;

More examples

More examples of the instruction ReadErrData are illustrated below.

Example 1

```
VAR intnum err_interrupt;
VAR trapdata err_data;
VAR errdomain err_domain;
VAR num err_number;
VAR errtype err_type;
...
PROC main()
  CONNECT err_interrupt WITH trap_err;
  IError COMMON_ERR, TYPE_ERR, err_interrupt;
  ...
  IDelete err_interrupt;
  ...
TRAP trap_err
  GetTrapData err_data;
  ReadErrData err_data, err_domain, err_number, err_type;
  ! Set domain no 1 ... 11
  SetGO go_err1, err_domain;
  ! Set error no 1 ...9999
```

Continues on next page

1.186 ReadErrData - Gets information about an error

RobotWare Base

Continued

```
SetGO go_err2, err_number;
ENDTRAP
```

When an error occurs (only errors, not warning or state change) the error number is retrieved in the trap routine and its value is used to set 2 groups of digital output signals.

Limitation

It is not possible obtain information about internal errors.

Syntax

```
ReadErrData
[TrapEvent ':='] <variable (VAR) of trapdata>', '
[ErrorDomain' :='] <variable (VAR) of errdomain>', '
[ErrorId' :='] <variable (VAR) of num>', '
[ErrorType' :='] <variable (VAR) of errtype>
['\'Title ' :='] <variable (VAR) of string>]
['\'Str1 ' :='] <variable (VAR) of string>]
['\'Str2 ' :='] <variable (VAR) of string>]
['\'Str3 ' :='] <variable (VAR) of string>]
['\'Str4 ' :='] <variable (VAR) of string>]
['\'Str5 ' :='] <variable (VAR) of string>]';'
```

Related information

For information about	See
Summary of interrupts	<i>Technical reference manual - RAPID Overview</i>
More information on interrupt management	<i>Technical reference manual - RAPID Overview</i>
Error domains, predefined constants	errdomain - Error domain on page 1632
Error types, predefined constants	errtype - Error type on page 1643
Orders an interrupt on errors	IError - Orders an interrupt on errors on page 253
Get interrupt data for current trap	GetTrapData - Get interrupt data for current trap routine on page 235
<i>Advanced RAPID</i>	<i>Application manual - Controller software OmniCore</i>

1 Instructions

1.187 ReadRawBytes - Read rawbytes data

RobotWare Base

1.187 ReadRawBytes - Read rawbytes data

Usage

ReadRawBytes is used to read data of type rawbytes from a device opened with Open \Bin.

Basic examples

The following example illustrates the instruction ReadRawBytes:

Example 1

```
VAR iODEV io_device;
VAR rawbytes raw_data_out;
VAR rawbytes raw_data_in;
VAR num float := 0.2;
VAR string answer;

ClearRawBytes raw_data_out;
PackDNHeader "10", "20 1D 24 01 30 64", raw_data_out;
PackRawBytes float, raw_data_out, (RawBytesLen(raw_data_out)+1)
    \Float4;

Open "/FC1:/dsqc328_1", io_device \Bin;
WriteRawBytes io_device, raw_data_out;
ReadRawBytes io_device, raw_data_in \Time:=1;
Close io_device;
UnpackRawBytes raw_data_in, 1, answer \ISOLatin1Encoding=10;
```

In this example raw_data_out is cleared and then packed with DeviceNet header and a float with value 0.2.

A device, "/FC1:/dsqc328_1", is opened and the current valid data in raw_data_out is written to the device. Then the program waits for at most 1 second to read from the device, which is stored in the raw_data_in.

After having closed the device "/FC1:/dsqc328_1", the read data is unpacked as a string of characters and stored in answer.

Arguments

ReadRawBytes IODEV RawData [\Time]

IODEV

Data type: iODEV

IODEV is the identifier of the device from which data shall be read.

RawData

Data type: rawbytes

RawData is the data container that stores read data from IODEV starting at index 1.

[\Time]

Data type: num

Continues on next page

The max. time for the reading operation (timeout) in seconds (resolution 0,001s). If this argument is not specified then the max. time is set to 60 seconds. To wait forever, use the predefined constant `WAIT_MAX`.

If this time runs out before the reading operation is finished then the error handler will be called with the error code `ERR_DEV_MAXTIME`. If there is no error handler then the execution will be stopped.

The timeout function is also in use during program stop and will be noticed by the RAPID program at program start.

Program execution

During program execution the data is read from the device indicated by `IIODevice`. If using `WriteRawBytes` for field bus commands such as `DeviceNet` then the field bus always sends an answer. The answer must be handled in RAPID with the `ReadRawBytes` instruction.

The current length of valid bytes in the `RawData` variable is set to the read number of bytes. The data starts at index 1 in `RawData`.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type `iodev` will be reset.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_FILEACC</code>	A file is accessed incorrectly
<code>ERR_DEV_MAXTIME</code>	Time-out when executing the instruction.
<code>ERR_RANYBIN_EOF</code>	End of file is detected before all bytes are read in instruction <code>ReadRawBytes</code> .

Syntax

```
ReadRawBytes
  [IODevice ':= ' ] < variable (VAR) of iodev> ' , '
  [RawData ':= ' ] < variable (VAR) of rawbytes> ' , '
  [ '\ ' Time ':= ' < expression (IN) of num> ] ' ; '
```

Related information

For information about	See
rawbytes data	rawbytes - Raw data on page 1702
Get the length of rawbytes data	RawBytesLen - Get the length of rawbytes data on page 1404
Clear the contents of rawbytes data	ClearRawBytes - Clear the contents of rawbytes data on page 140
Copy the contents of rawbytes data	CopyRawBytes - Copy the contents of rawbytes data on page 165
Pack DeviceNet header into rawbytes data	PackDNHeader - Pack DeviceNet Header into rawbytes data on page 506

Continues on next page

1 Instructions

1.187 ReadRawBytes - Read rawbytes data

RobotWare Base

Continued

For information about	See
Pack data into rawbytes data	PackRawBytes - Pack data into rawbytes data on page 509
Write rawbytes data	WriteRawBytes - Write rawbytes data on page 1078
Unpack data from rawbytes data	UnpackRawBytes - Unpack data from rawbytes data on page 981
File and I/O device handling	<i>Application manual - Controller software Omni-Core</i>

1.188 ReadVarArr - Read multiple variables from a sensor device**Usage**

ReadVarArr is used to read up to six variables at the same time from a sensor device. The result is from the same sample.

The sensor must be configured and communicating via the RobotWare option *Sensor Interface*.

Basic examples

The following example illustrates the instruction ReadVarArr.

Example 1

```

CONST num xcoord := 8;
CONST num ycoord := 9;
CONST num zcoord := 10;
VAR pos sensorpos;
VAR sensorvardata readdata{4};

! Connect to the sensor device "sen1:" (defined in sio.cfg).
SenDevice "sen1:";

! Read a cartesian position from the sensor.
readdata{1} := [xcoord, 2, false, 1, 0];
readdata{2} := [ycoord, 2, false, 1, 0];
readdata{3} := [zcoord, 2, false, 1, 0];
! A varNumber of -1 will be ignored
readdata{4} := [-1, 2, false, 1, 0];

ReadVarArr "sen1", readdata;
sensorpos.x := DnumToNum(readdata{1}.value);
sensorpos.y := DnumToNum(readdata{2}.value);
sensorpos.z := DnumToNum(readdata{3}.value);

```

The example shows a reading of three variables at the same time. The reading is done at the same time and is from the same sample from the sensor.

Arguments

ReadVarArr Device, Data, [\TaskName]

Device

Data type: string

The I/O device name configured in sio.cfg for the sensor used.

Data

Data type: sensorvardata

An array variable that refers to a data definition of the variables to be read. The result value of the reading is also returned within this definition.

[\TaskName]

Data type: string

Continues on next page

1 Instructions

1.188 ReadVarArr - Read multiple variables from a sensor device

Sensor Interface

Continued

The argument TaskName makes it possible to access devices in other RAPID tasks.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
SEN_NO_MEAS	Measurement failure
SEN_NOREADY	Sensor unable to handle command
SEN_GENERRO	General sensor error
SEN_BUSY	Sensor busy
SEN_UNKNOWN	Unknown sensor
SEN_EXALARM	External sensor error
SEN_CAALARM	Internal sensor error
SEN_TEMP	Sensor temperature error
SEN_VALUE	Illegal communication value
SEN_CAMCHECK	Sensor check failure
SEN_TIMEOUT	Communication error

Syntax

```
ReadVarArr
[Device ':='] <expression(IN) of string>', '
[Data ':='] <array variable {*} (INOUT) of sensorvardata>', '
['\ ' TaskName ':=' <expression (IN) of string>'];'
```

Related information

For information about	See
Connect to a sensor device	SenDevice - connect to a sensor device on page 666
Write multiple variables to a device	WriteVarArr - Write multiple variables to a sensor device on page 1084
Write a sensor variable	WriteVar - Write variable on page 1082
Read a sensor variable	ReadVar - Read variable from a device on page 1426
Multiple variable setup data for sensor interface	sensorvardata - Multiple variable setup data for sensor interface on page 1719
Configuration of sensor communication	Technical reference manual - RAPID Overview

1.189 RemoveAllCyclicBool - Remove all Cyclic bool conditions

Usage

RemoveAllCyclicBool is used to remove the cyclic evaluation of all Cyclic bool conditions in the task executing the instruction.

Basic examples

The following example illustrates the instruction RemoveAllCyclicBool.

Example 1

```

PERS bool cyclicflag1;
TASK PERS bool cyclicflag2;
PERS bool mypersbool:=FALSE;

PROC main()
  SetupCyclicBool cyclicflag1, di1=1 AND do2=1;
  SetupCyclicBool cyclicflag2, di3 AND di4 AND mypersbool=FALSE;
  ...
  RemoveAllCyclicBool;
  ...

```

First two cyclic evaluations are setup, then later on both are removed.

Example 2

```

PERS bool cyclicflag1;

PROC main()
  SetupCyclicBool cyclicflag1, di1=1 AND do2=1;
  ...
  RemoveAllCyclicBool;
UNDO
  RemoveAllCyclicBool;
ENDPROC

```

All cyclic evaluations are removed when the program pointer is set to main.

The same behavior can be configured in the system parameters without using an UNDO handler, see *Technical reference manual - System parameters*.

Arguments

RemoveAllCyclicBool [\AllTasks]

[\AllTasks]

Data type: switch

This argument is used to remove the cyclic evaluation for all tasks.

Program execution

The behavior of the Cyclic bool functionality can be configured. For more information see *Application manual - Controller software OmniCore* and *Technical reference manual - System parameters*.

Continues on next page

1 Instructions

1.189 RemoveAllCyclicBool - Remove all Cyclic bool conditions

RobotWare Base

Continued

Syntax

```
RemoveAllCyclicBool  
['\'AllTasks] ';''
```

Related information

For information about	See
Setup a Cyclic bool condition	SetupCyclicBool - Setup a Cyclic bool condition on page 692
Remove a Cyclic bool condition	RemoveCyclicBool - Remove a Cyclic bool condition on page 583
Cyclically evaluated logical conditions, <i>Cyclic bool</i>	<i>Application manual - Controller software Omni-Core</i>
Configuring <i>Cyclic bool</i>	<i>Technical reference manual - System parameters</i>

1.190 RemoveCyclicBool - Remove a Cyclic bool condition

Usage

RemoveCyclicBool is used to remove the cyclic evaluation of a Cyclic bool condition.

Basic examples

The following examples illustrates the instruction RemoveCyclicBool.

Example 1

```

PERS bool cyclicflag1;

PROC main()
  SetupCyclicBool cyclicflag1, di1=1 AND do2=1;
  ...
  RemoveCyclicBool cyclicflag1;
  ...

```

First a cyclic evaluation is setup, then later on it is removed.

Example 2

```

PERS bool cyclicflag1;

PROC main()
  SetupCyclicBool cyclicflag1, di1=1 AND do2=1;
  ...
  RemoveCyclicBool "cyclicflag1";
  ...

```

First a cyclic evaluation is setup, then later on it is removed by using the name of the persistent boolean variable.

Arguments

RemoveCyclicBool Flag | Name

Flag

Data type: bool

The persistent boolean variable that stores the value of the logical condition.

Name

Data type: string

The name of the persistent boolean variable that stores the value of the logical condition.

Program execution

The behavior of the Cyclic bool functionality can be configured. For more information see *Application manual - Controller software OmniCore* and *Technical reference manual - System parameters*.

Syntax

RemoveCyclicBool

Continues on next page

1 Instructions

1.190 RemoveCyclicBool - Remove a Cyclic bool condition

RobotWare Base

Continued

```
[ Flag ':= ' ] <persistent (PERS) of bool>  
| [ Name ':= ' ] <expression (IN) of string> ';' ;
```

Related information

For information about	See
Check if a persistent variable is a Cyclic bool	IsCyclicBool - Checks if a persistent variable is a Cyclic bool on page 1321
Setup a Cyclic bool condition	SetupCyclicBool - Setup a Cyclic bool condition on page 692
Remove all Cyclic bool conditions	RemoveAllCyclicBool - Remove all Cyclic bool conditions on page 581
Cyclically evaluated logical conditions, <i>Cyclic bool</i>	<i>Application manual - Controller software Omni-Core</i>
Configuring <i>Cyclic bool</i>	<i>Technical reference manual - System parameters</i>

1.191 RemoveDir - Delete a directory

Usage

RemoveDir is used to remove a directory.

The user must have write and execute permission for the directory and the directory must be empty.

Basic examples

The following example illustrates the instruction RemoveDir:

Example 1

```
RemoveDir "HOME:/mydir";
```

In this example the mydir directory under HOME: is deleted.

Arguments

RemoveDir Path

Path

Data type: string

The name of the directory to be removed, specified with full or relative path.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	The directory does not exist, or the directory is not empty, or the user does not have write and execute permission to the library.

Syntax

```
RemoveDir
[ Path':=' ] < expression (IN) of string>';'
```

Related information

For information about	See
Directory	dir - File directory structure on page 1629
Open a directory	OpenDir - Open a directory on page 504
Read a directory	ReadDir - Read next entry in a directory on page 1408
Close a directory	CloseDir - Close a directory on page 147
Make a directory	MakeDir - Create a new directory on page 343
Rename a file	RenameFile - Rename a file on page 588
Remove a file	RemoveFile - Delete a file on page 587
Copy a file	CopyFile - Copy a file on page 163
Check file type	IsFile - Check the type of a file on page 1324

Continues on next page

1 Instructions

1.191 RemoveDir - Delete a directory

RobotWare Base

Continued

For information about	See
Check file size	FileSize - Retrieve the size of a file on page 1249
Check file system size	FSSize - Retrieve the size of a file system on page 1255
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

1.192 RemoveFile - Delete a file

Usage

RemoveFile is used to remove a file. The user must have write and execute permission for the directory where the file resides and the user must have write permission for the file itself.

Basic examples

The following example illustrates the instruction RemoveFile:

Example 1

```
RemoveFile "HOME:/mydir/myfile.log";
```

In this example the file myfile.log in directory mydir on disk HOME: is deleted.

Arguments

RemoveFile Path

Path

Data type: string

The name of the file to be deleted, specified with full or relative path.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	A file is accessed incorrectly.

Syntax

```
RemoveFile  
[ Path':=' ] < expression (IN) of string>';'
```

Related information

For information about	See
Make a directory	MakeDir - Create a new directory on page 343
Remove a directory	RemoveDir - Delete a directory on page 585
Rename a file	RenameFile - Rename a file on page 588
Copy a file	CopyFile - Copy a file on page 163
Check file type	IsFile - Check the type of a file on page 1324
Check file size	FileSize - Retrieve the size of a file on page 1249
Check file system size	FSSize - Retrieve the size of a file system on page 1255
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

1 Instructions

1.193 RenameFile - Rename a file

RobotWare Base

1.193 RenameFile - Rename a file

Usage

RenameFile is used to give a new name to an existing file. It can also be used to move a file from one place to another in the directory structure.

Basic examples

The following example illustrates the instruction RenameFile:

Example 1

```
RenameFile "HOME:/myfile", "HOME:/yourfile";
```

The file myfile is given the name yourfile.

```
RenameFile "HOME:/myfile", "HOME:/mydir/yourfile";
```

The file myfile is given the name yourfile and is moved to the directory mydir.

Arguments

```
RenameFile OldPath NewPath
```

OldPath

Data type:string

The complete path of the file to be renamed.

NewPath

Data type:string

The complete path of the renamed file.

Program execution

The file specified in OldPath will be given the name specified in NewPath. If the path in NewPath is different from the path in OldPath then the file will also be moved to the new location.

Error Handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	The file specified in OldPath does not exist.
ERR_FILEEXIST	The file specified in NewPath already exists.

Syntax

```
RenameFile  
[ OldPath' :=' ] < expression (IN) of string > ','  
[ NewPath' :=' ] < expression (IN) of string >';'
```

Related information

For information about	See
Make a directory	MakeDir - Create a new directory on page 343

Continues on next page

For information about	See
Remove a directory	RemoveDir - Delete a directory on page 585
Remove a file	RemoveFile - Delete a file on page 587
Copy a file	CopyFile - Copy a file on page 163
Check file type	IsFile - Check the type of a file on page 1324
Check file size	FileSize - Retrieve the size of a file on page 1249
Check file system size	FSSize - Retrieve the size of a file system on page 1255
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

1 Instructions

1.194 Reset - Resets a digital output signal

RobotWare Base

1.194 Reset - Resets a digital output signal

Usage

Reset is used to reset the value of a digital output signal to zero.

Basic examples

The following examples illustrate the instruction Reset:

Example 1

```
Reset do15;
```

The signal do15 is set to 0.

Example 2

```
Reset weld;
```

The signal weld is set to 0.

Arguments

Reset Signal

Signal

Data type: signaldo

The name of the signal to be reset to zero.

Program execution

The true value depends on the configuration of the signal. If the signal is inverted in the system parameters then this instruction causes the physical channel to be set to 1.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Syntax

```
Reset  
[Signal ':='] <variable (VAR) of signaldo>;'
```

Related information

For information about	See
Setting a digital output signal	Set - Sets a digital output signal on page 668

Continues on next page

1.194 Reset - Resets a digital output signal

RobotWare Base
Continued

For information about	See
Input/Output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

1 Instructions

1.195 ResetAxisDistance - Reset the traversed distance information for the axis

RobotWare Base

1.195 ResetAxisDistance - Reset the traversed distance information for the axis

Usage

ResetAxisDistance is used to reset the traversed distance information for the axis.

Basic examples

The following examples illustrate the instruction ResetAxisDistance.

Example 1

```
ResetAxisDistance Track,1;
```

The traversed distance information for axis 1 on mechanical unit Track will be reset.

Example 2

```
PERS dnum distanceLimit := 1000;

PROC main()
  IF GetAxisDistance(Track,1) > distanceLimit THEN
    ErrWrite \I, "Distance counter limit reached", "Distance counter
      limit for Track has been reached.";
    DoMaintenance();
  ENDIF
ENDPROC

PROC DoMaintenance()
  ...
  ResetAxisDistance Track, 1;
  ErrWrite \I, "Distance counter reset", "Distance counter for
    Track has been reset.";
ENDPROC
```

The example describes how ResetAxisDistance can be used together with GetAxisDistance to check if it is time for maintenance of an axis.

Arguments

ResetAxisDistance MechUnit AxisNo

MechUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

AxisNo

Data type: num

The number of the axis for which the traversed distance is to be reset.

Program execution

Resets the traversed distance information for the selected axis.

Continues on next page

1.195 ResetAxisDistance - Reset the traversed distance information for the axis

RobotWare Base
Continued

Syntax

```
ResetAxisDistance
  [MechUnit ':='] < variable (VAR) of mecunit > ','
  [AxisNo ':='] < variable (VAR) of num > ';'

```

Related information

For information about	See
ResetAxisMoveTime	ResetAxisMoveTime - Reset the move time counter of the axis on page 594
GetAxisDistance	GetAxisDistance - Get the traversed distance counter of the axis on page 1258
GetAxisMoveTime	GetAxisMoveTime - Get the move time counter of the axis on page 1260

1 Instructions

1.196 ResetAxisMoveTime - Reset the move time counter of the axis
RobotWare Base

1.196 ResetAxisMoveTime - Reset the move time counter of the axis

Usage

ResetAxisMoveTime is used to reset the move time information for the axis.

Basic examples

The following examples illustrate the instruction ResetAxisMoveTime.

Example 1

```
ResetAxisMoveTime Track,1;
```

The move time information for axis 1 on mechanical unit Track will be reset.

Example 2

```
PERS dnum timeLimit := 1000;

PROC main()
  IF GetAxisMoveTime(Track,1) > timeLimit THEN
    ErrWrite \I, "Time counter limit reached", "Time counter limit
      for Track has been reached.";
    DoMaintenance();
  ENDIF
ENDPROC

PROC DoMaintenance()
  ...
  ResetAxisMoveTime Track, 1;
  ErrWrite \I, "Time counter reset", "Time counter for Track has
    been reset.";
ENDPROC
```

The example describes how ResetAxisMoveTime can be used together with GetAxisMoveTime to check if it is time for maintenance of an axis.

Arguments

ResetAxisMoveTime MechUnit AxisNo

MechUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

AxisNo

Data type: num

The number of the axis for which the move time is to be reset.

Program execution

Resets the move time information for the selected axis.

Syntax

ResetAxisMoveTime

Continues on next page

1.196 ResetAxisMoveTime - Reset the move time counter of the axis

RobotWare Base

Continued

```
[MechUnit ':='] < variable (VAR) of mecunit > ','
[AxisNo ':='] < variable (VAR) of num > ';'

```

Related information

For information about	See
ResetAxisDistance	ResetAxisDistance - Reset the traversed distance information for the axis on page 592
GetAxisDistance	GetAxisDistance - Get the traversed distance counter of the axis on page 1258
GetAxisMoveTime	GetAxisMoveTime - Get the move time counter of the axis on page 1260

1 Instructions

1.197 ResetData - Reset all elements to default values

RobotWare Base

1.197 ResetData - Reset all elements to default values

Usage

ResetData is used to set all elements in an object to its initial value.

Basic examples

The following examples illustrate the instruction ResetData.

Example 1

```
PERS num matrix1{3,3}:=[[5, 2, 7],[-3, 1, 1],[1, 10, -3]];
PROC main()
..
ResetData matrix1;
```

matrix1 is set to its initial value, that is, all elements in matrix1 are set to 0.

Example 2

```
PROC main()
VAR bool myboolarr{10}:=[TRUE, FALSE, TRUE, FALSE, TRUE, FALSE,
TRUE, FALSE, TRUE, FALSE];
..
ResetData myboolarr;
```

ResetData is used to set all elements in the array to FALSE.

Arguments

ResetData Object

Object

Data type: anytype

The object that should be set to its initial value.

Limitations

ResetData can only be used on value data types. Semi-value data types, non-value data types, or variables that are write-protected cannot be used in the ResetData instruction.

Syntax

```
ResetData
[ Object ':= ' ] < reference (REF) of anytype > ';' ;
```

Related information

For information about	See
MatrixReset	MatrixReset - Set all elements in a matrix to 0 on page 360
BytesReset	BytesReset - Set all elements in a byte array to zero (0) on page 51

1.198 ResetPPMoved - Reset state for the program pointer moved in manual mode

RobotWare Base

1.198 ResetPPMoved - Reset state for the program pointer moved in manual mode

Usage

ResetPPMoved reset state for the program pointer moved in manual mode. PPMovedInManMode returns TRUE if the user has moved the program pointer while the controller is in manual mode - that is, the operator key is at Man Reduced Speed or Man Full Speed. The program pointer moved state is reset when the key is switched from Auto to Man, or when using the instruction ResetPPMoved.

Basic examples

The following example illustrates the instruction ResetPPMoved:

Example 1

```
IF PPMovedInManMode() THEN
  WarnUserOfPPMovement;
  ! DO THIS ONLY ONCE
  ResetPPMoved;
  DoJob;
ELSE
  DoJob;
ENDIF
```

Program execution

Resets state for the program pointer moved in manual mode for current program task.

Syntax

```
ResetPPMoved';'
```

Related information

For information about	See
Test whether program pointer has been moved in manual mode	PPMovedInManMode - Test whether the program pointer is moved in manual mode on page 1398

1 Instructions

1.199 ResetRetryCount - Reset the number of retries

RobotWare Base

1.199 ResetRetryCount - Reset the number of retries

Usage

ResetRetryCount is used to reset the number of retries that has been done from an error handler. The maximum number of retries that can be done is defined in the configuration.

Basic examples

The following example illustrates the instruction ResetRetryCount:

Example 1

```
VAR num myretries := 0;
...
ERROR
  IF myretries > 2 THEN
    ResetRetryCount;
    myretries := 0;
    TRYNEXT;
  ENDIF
  myretries:= myretries + 1;
  RETRY;
...
```

This program will retry the faulty instruction 3 times and then try the next instruction. The internal system retry counter is reset before trying the next instruction (even if this is done by the system at TRYNEXT).

Program execution

For every RETRY made from an error handler an internal system counter will check that the maximum number of retries, specified in the configuration, isn't exceeded. Executing the instruction ResetRetryCount will reset the counter and make it possible to redo a maximum number of retries again.

Syntax

ResetRetryCount ';' ;'

Related information

For information about	See
Error handlers	<i>Technical reference manual - RAPID Overview</i>
Resume execution after an error	RETRY - Resume execution after an error on page 602
Configure maximum number of retries	<i>Technical reference manual - System parameters</i>
Number of remaining retries	RemainingRetries - Remaining retries left to do on page 1430

1.200 ResetTorqueMargin - Reset least torque margin

Usage

ResetTorqueMargin is used to reset the least torque margin to be able to start a new measurement.

Basic examples

The following example illustrates the instruction ResetTorqueMargin.

Example 1

```
ResetTorqueMargin \AxisNo:=3;  
! starts a new measurement for axis 3;
```

Arguments

ResetTorqueMargin [\MecUnit] [\AxisNo]

[\MecUnit]

Data type: mecunit

The name of the mechanical unit for which an axis is to be reset. If this argument is omitted, the axis for the connected robot is reset.

[\AxisNo]

Data type: num

The number of the axis to be reset (1–6).

If no axis is specified, all axes for the mechanical unit are reset.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_AXIS_PAR	Parameter axis in function is wrong.

Syntax

```
ResetTorqueMargin '('  
  [ '\ ' MechUnit ':=' ] < variable (VAR) of mecunit > ','  
  [ '\ ' AxisNo ':=' < expression (IN) of num > ] ')'
```

Related information

For information about	See
Get torque margin	GetTorqueMargin - Reads the least torque margin on page 1291

1 Instructions

1.201 RestoPath - Restores the path after an interrupt

Path Recovery

1.201 RestoPath - Restores the path after an interrupt

Usage

RestoPath is used to restore a path that was stored at a previous stage using the instruction StorePath.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Basic examples

The following example illustrates the instruction RestoPath:

See also *More examples* below.

Example 1

```
RestoPath;
```

Restores the path that was stored earlier using StorePath.

Program execution

The current movement path of the robot and the external axes are deleted and the path stored earlier using StorePath is restored. Note that nothing moves until the instruction StartMove is executed or a return is made using RETRY from an error handler.

More examples

More examples of how to use the instruction RestoPath are illustrated below.

Example 1

```
ArcL p100, v100, seam1, weld5 \Weave:=weave1, z10, gun1;
...
ERROR
  IF ERRNO=AW_WELD_ERR THEN
    gun_cleaning;
    StartMoveRetry;
  ENDIF
...
PROC gun_cleaning()
  VAR robtarget p1;
  StorePath;
  p1 := CRobT();
  MoveL pclean, v100, fine, gun1;
  ...
  MoveL p1, v100, fine, gun1;
  RestoPath;
ENDPROC
```

In the event of a welding error the program execution continues in the error handler of the routine which in turn calls gun_cleaning. The movement path being executed at the time is then stored and the robot moves to the position pclean where the error is rectified. When this has been done, the robot returns to the position where the error occurred, p1, and stores the original movement once

Continues on next page

1.201 RestoPath - Restores the path after an interrupt

*Path Recovery**Continued*

again. The weld then automatically restarts, meaning that the robot is first reversed along the path before welding starts and ordinary program execution can continue.

Limitations

Only the movement path data is stored with the instruction StorePath. If the user wants to order movements on the new path level then the actual stop position must be stored directly after StorePath and before RestoPath make a movement to the stored stop position on the path.

If this instruction is preceded by a move instruction then that move instruction must be programmed with a stop point (zonedata fine), not a fly-by point, otherwise restart after power failure will not be possible.

RestoPath cannot be executed in a RAPID routine connected to any of following special system events: PowerOn, Stop, QStop, Restart or Step.

Syntax

```
RestoPath';'
```

Related information

For information about	See
Storing paths	StorePath - Stores the path when an interrupt occurs on page 798
More examples	StorePath - Stores the path when an interrupt occurs on page 798 PathRecStart - Start the path recorder on page 534 SyncMoveSuspend - Set independent-semicoordinated movements on page 819

1 Instructions

1.202 RETRY - Resume execution after an error

RobotWare Base

1.202 RETRY - Resume execution after an error

Usage

The RETRY instruction is used to resume program execution after an error starting with (re-executing) the instruction that caused the error.

Basic examples

The following example illustrates the instruction RETRY:

Example 1

```
reg2 := reg3/reg4;  
...  
ERROR  
  IF ERRNO = ERR_DIVZERO THEN  
    reg4 :=1;  
    RETRY;  
  ENDIF
```

An attempt is made to divide reg3 by reg4. If reg4 is equal to 0 (division by zero) then a jump is made to the error handler, which initializes reg4. The RETRY instruction is then used to jump from the error handler and another attempt is made to complete the division.

Program execution

Program execution continues with (re-executes) the instruction that caused the error.

Error handling

If the maximum number of retries (4 retries) is exceeded then the program execution stops with an error message. The maximum number of retries can be configured in System Parameters (type *General RAPID*).

Limitations

The instruction can only exist in a routine's error handler. If the error was created using a RAISE instruction then program execution cannot be restarted with a RETRY instruction. Then the instruction TRYNEXT should be used.

Syntax

```
RETRY ' ; '
```

Related information

For information about	See
Error handlers	<i>Technical reference manual - RAPID Overview</i>
Configure maximum number of retries	<i>Technical reference manual - System parameters</i>
Continue with the next instruction	TRYNEXT - Jumps over an instruction which has caused an error on page 952

1.203 RETURN - Finishes execution of a routine

Usage

RETURN is used to finish the execution of a routine. If the routine is a function then the function value is also returned.

Basic examples

The following examples illustrate the instruction RETURN:

Example 1

```
errormessage;
Set do1;
...
PROC errormessage()
  IF di1=1 THEN
    RETURN;
  ENDIF
  TPWrite "Error";
ENDPROC
```

The errormessage procedure is called. If the procedure arrives at the RETURN instruction then program execution returns to the instruction following the procedure call, Set do 1.

Example 2

```
FUNC num abs_value(num value)
  IF value<0 THEN
    RETURN -value;
  ELSE
    RETURN value;
  ENDIF
ENDFUNC
```

The function returns the absolute value of a number.

Arguments

RETURN [Return value]

Return value

Data type: According to the function declaration.

The return value of a function.

The return value must be specified in a RETURN instruction present in a function.

If the instruction is present in a procedure or trap routine then a return value shall not be specified.

Continues on next page

1 Instructions

1.203 RETURN - Finishes execution of a routine

RobotWare Base

Continued

Program execution

The result of the RETURN instruction may vary depending on the type of routine it is used in:

- Main routine: If a program has run mode single cycle then the program stops. Otherwise, program execution continues with the first instruction of the main routine.
- Procedure: Program execution continues with the instruction following the procedure call.
- Function: Returns the value of the function.
- Trap routine: Program execution continues from where the interrupt occurred.
- Error handler in a procedure: Program execution continues with the routine that called the routine with the error handler (with the instruction following the procedure call).
- Error handler in a function: The function value is returned.

Syntax

```
RETURN [ <expression> ]';'
```

Related information

For information about	See
Functions and Procedures	<i>Technical reference manual - RAPID Overview</i>
Trap routines	<i>Technical reference manual - RAPID Overview</i>
Error handlers	<i>Technical reference manual - RAPID Overview</i>

1.204 Rewind - Rewind file position

Usage

Rewind sets the file position to the beginning of the file.

Basic examples

The following example illustrates the instruction Rewind:

Example 1

```
Rewind iODEV1;
```

The file referred to by `iODEV1` will have the file position set to the beginning of the file.

Arguments

Rewind IODEVice

IODEVice

Data type: `iodev`

Name (reference) of the file to be rewound.

Program execution

The specified file is rewound to the beginning.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type `iodev` will be reset.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_FILEACC</code>	A file is accessed incorrectly.

Limitations

If the used file has been opened with a `\Bin` or `\Bin \Append` switch, a Rewind before any type of a Write instruction will be ineffective. The writing will be done at the end of the file.

Syntax

```
Rewind [IODEVice ':='] <variable (VAR) of iodev>;'
```

Related information

For information about	See
Opening, etc. of files	<i>Technical reference manual - RAPID Overview</i>
File and I/O device handling	<i>Application manual - Controller software Omni-Core</i>

1 Instructions

1.205 RMQEmptyQueue - Empty RAPID Message Queue *RobotStudio Connect or Multitasking*

1.205 RMQEmptyQueue - Empty RAPID Message Queue

Usage

RMQEmptyQueue empties the RAPID Message Queue (RMQ) in the task that is executing the instruction.

Basic examples

The following example illustrates the instruction RMQEmptyQueue:

Example

```
RMQEmptyQueue;
```

The RMQEmptyQueue instruction removes all messages from RMQ in the executing task.

Program execution

The RAPID Message Queue owned by the executing task is emptied. The instruction can be used on all execution levels.

Limitations

RMQEmptyQueue only empties the RAPID Message Queue in the task that is executing the instruction. All other RAPID Message Queues are left as is.

Syntax

```
RMQEmptyQueue ';' ;'
```

Related information

For information about	See
Description of the RAPID Message Queue functionality	<i>Application manual - Controller software OmniCore</i> , section <i>RAPID Message Queue</i> .
rmqmessage data type	rmqmessage - RAPID Message Queue message on page 1712 .
Send data to the queue of a RAPID task	RMQSendMessage - Send an RMQ data message on page 622 .
Send data to the queue of a RAPID task and wait for an answer from the client	RMQSendWait - Send an RMQ data message and wait for a response on page 626 .
Find the identity number of a RAPID Message Queue task	RMQFindSlot - Find a slot identity from the slot name on page 608 .
Extract the header data from an rmqmessage	RMQGetMsgHeader - Get header information from an RMQ message on page 616 .
Extract the data from an rmqmessage	RMQGetMsgData - Get the data part from an RMQ message on page 613 .
Order and enable interrupts for a specific data type	IRMQMessage - Orders RMQ interrupts for a data type on page 291 .
Get the slot name from a specified slot identity	RMQGetSlotName - Get the name of an RMQ client on page 1431 .

Continues on next page

1.205 RMQEmptyQueue - Empty RAPID Message Queue

RobotStudio Connect or Multitasking
Continued

For information about	See
Receive message from RMQ	<i>RMQReadWait - Returns message from RMQ on page 619.</i>
Get the first message from a RAPID Message Queue	<i>RMQGetMessage - Get an RMQ message on page 610.</i>

1 Instructions

1.206 RMQFindSlot - Find a slot identity from the slot name

RobotStudio Connect or Multitasking

1.206 RMQFindSlot - Find a slot identity from the slot name

Usage

RMQFindSlot (*RAPID Message Queue Find Slot*) is used to find the slot identity to an RMQ configured for a RAPID task, or the slot identity to a Robot Application Builder client.

Basic examples

The following example illustrates the instruction RMQFindSlot:

Example 1

```
VAR rmqslot myrmqslot;  
RMQFindSlot myrmqslot, "RMQ_T_ROB2";
```

Get the identity number for the RMQ "RMQ_T_ROB2" configured for the RAPID task "T_ROB2".

Arguments

RMQFindSlot Slot Name

Slot

Data type: rmqslot

The variable in which the numeric identifier is returned.

Name

Data type: string

The name of the client to find the identity number for. The name must be right regarding small and big letters. If the RAPID task is named T_ROB1, and using the name RMQ_t_rob1 for the RMQ, this will end up in a error (see error handling chapter below.)

Program execution

The RMQFindSlot instruction is used to find the slot identity for a named RMQ or Robot Application Builder client.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_RMQ_NAME	The given slot name is not valid or not found.

Syntax

```
RMQFindSlot  
[ Slot ':' ] < variable (VAR) of rmqslot > ','  
[ Name ':' ] < expression (IN) of string > ';' ;
```

Continues on next page

1.206 RMQFindSlot - Find a slot identity from the slot name
RobotStudio Connect or Multitasking
Continued

Related information

For information about	See
Description of the RAPID Message Queue functionality	<i>Application manual - Controller software OmniCore</i> , section <i>RAPID Message Queue</i> .
Send data to the queue of a RAPID task	RMQSendMessage - Send an RMQ data message on page 622
Get the first message from a RAPID Message Queue.	RMQGetMessage - Get an RMQ message on page 610
Send data to the queue of a RAPID task and wait for an answer from the client	RMQSendWait - Send an RMQ data message and wait for a response on page 626
Extract the header data from a rmqmessage	RMQGetMsgHeader - Get header information from an RMQ message on page 616
Order and enable interrupts for a specific data type	IRMQMessage - Orders RMQ interrupts for a data type on page 291
Extract the data from a rmqmessage	RMQGetMsgData - Get the data part from an RMQ message on page 613
Get the slot name from a specified slot identity	RMQGetSlotName - Get the name of an RMQ client on page 1431
RMQ Slot	rmqslot - Identity number of an RMQ client on page 1713

1 Instructions

1.207 RMQGetMessage - Get an RMQ message

RobotStudio Connect or Multitasking

1.207 RMQGetMessage - Get an RMQ message

Usage

RMQGetMessage (*RAPID Message Queue Get Message*) is used to fetch the first RMQ message from the queue for the actual program task.

Basic examples

The following example illustrates the instruction RMQGetMessage:

See also [More examples on page 611](#).

Example 1

```
TRAP msghandler
  VAR rmqmessage myrmqmsg;
  RMQGetMessage myrmqmsg;
  . . .
ENDTRAP
```

In the trap routine msghandler the rmqmessage is fetched from the RMQ and copied to the variable myrmqmsg.

Arguments

RMQGetMessage Message

Message

Data type: rmqmessage

Variable for storage of the RMQ message.

The maximum size of the data that can be received in a rmqmessage is about 5000 bytes.

Program execution

The instruction RMQGetMessage is used to get the first message from the queue of the task executing the instruction. If there is a message, it will be copied to the Message variable, and then removed from the queue to make room for new messages. The instruction is only supported on the trap level.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_RMQ_NOMSG	There is no message in the queue at the moment. If executing RMQGetMessage twice in a trap routine, this can happen. The error can also be generated if there is a power failure between the trap routine being ordered and the instruction RMQGetMessage being executed. The messages in the RMQ will be lost at power fail.
ERR_RMQ_INVMSG	Invalid message, likely sent from other client than a RAPID task. This may for instance happen if a PC application sends a corrupt message.

Continues on next page

More examples

More examples of how to use the instruction RMQGetMessage are illustrated below.

Example 1

```
RECORD mydatatype
  int x;
  int y;
ENDRECORD

VAR intnum msgreceive;
VAR mydatatype mydata;

PROC main()
  ! Setup interrupt
  CONNECT msgreceive WITH msghandler;
  ! Order cyclic interrupt to occur for data type mydatatype
  IRMQMessage mydata, msgreceive;
  WHILE TRUE DO
    ! Performing cycle
    ...
  ENDWHILE
ENDPROC

TRAP msghandler
  VAR rmqmessage message;
  VAR rmqheader header;

  ! Get the RMQ message
  RMQGetMessage message;
  ! Copy RMQ header information
  RMQGetMsgHeader message \Header:=header;

  IF header.datatype = "mydatatype" AND header.ndim = 0 THEN
    ! Copy the data from the message
    RMQGetMsgData message, mydata;
  ELSE
    TPWrite "Received a type not handled or with wrong dimension";
  ENDIF
ENDTRAP
```

When a new message is received, the trap routine msghandler is executed and the new message is copied to the variable message (instruction RMQGetMessage). Then the RMQ header data is copied (instruction RMQGetMsgHeader). If the message is of the expected data type and has the right dimension, the data is copied to the variable mydata (instruction RMQGetMsgData).

Limitations

RMQGetMessage is not supported on the user execution level (i.e. in service routines) or normal execution level.

Continues on next page

1 Instructions

1.207 RMQGetMessage - Get an RMQ message

RobotStudio Connect or Multitasking

Continued

The maximum size of the data that can be received in a `rmqmessage` is about 5000 bytes.

A recommendation is to reuse a variable of the data type `rmqmessage` as much as possible to save RAPID memory.

Syntax

```
RMQGetMessage  
[ Message ':' = ' ] < variable (VAR) of rmqmessage > ';' ;'
```

Related information

For information about	See
Description of the RAPID Message Queue functionality	Application manual - Controller software OmniCore, section RAPID Message Queue.
Find the identity number of a RAPID Message Queue task	RMQFindSlot - Find a slot identity from the slot name on page 608
Send data to the queue of a RAPID task	RMQSendMessage - Send an RMQ data message on page 622
Send data to the queue of a RAPID task and wait for an answer from the client	RMQSendWait - Send an RMQ data message and wait for a response on page 626
Extract the header data from an <code>rmqmessage</code>	RMQGetMsgHeader - Get header information from an RMQ message on page 616
Extract the data from an <code>rmqmessage</code>	RMQGetMsgData - Get the data part from an RMQ message on page 613
Order and enable interrupts for a specific data type	IRMQMessage - Orders RMQ interrupts for a data type on page 291
Get the slot name from a specified slot identity	RMQGetSlotName - Get the name of an RMQ client on page 1431
RMQ Message	rmqmessage - RAPID Message Queue message on page 1712

1.208 RMQGetMsgData - Get the data part from an RMQ message

RobotStudio Connect or Multitasking

1.208 RMQGetMsgData - Get the data part from an RMQ message

Usage

RMQGetMsgData (*RAPID Message Queue Get Message Data*) is used to get the actual data within the RMQ message.

Basic examples

The following example illustrates the instruction RMQGetMsgData:

See also [RMQGetMsgData - Get the data part from an RMQ message on page 613](#).

Example 1

```
VAR rmqmessage myrmqmsg;
VAR num data;
...
RMQGetMsgData myrmqmsg, data;
! Handle data
```

Data of the data type num is fetched from the variable myrmqmsg and stored in the variable data.

Arguments

RMQGetMsgData Message Data

Message

Data type: rmqmessage

Variable containing the received RMQ message.

Data

Data type: anytype

Variable of the expected data type, used for storage of the received data.

Program execution

The instruction RMQGetMsgData is used to get the actual data within the RMQ message, convert it to binary data, compile the data to see if it is possible to store it in the variable specified in the instruction, and then copy it to the variable.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_RMQ_VALUE	The received message and the data type used in argument Data does not have the same data type.
ERR_RMQ_DIM	The data types are equal, but the dimensions differ between the data in the message and the variable used in argument Data.
ERR_RMQ_MSGSIZE	The size of the received data is bigger than the maximum configured size for the RMQ for the receiving task.
ERR_RMQ_INVMSG	This error will be thrown if the message is invalid. This may for instance happen if a PC application sends a corrupt message.

Continues on next page

1 Instructions

1.208 RMQGetMsgData - Get the data part from an RMQ message

RobotStudio Connect or Multitasking

Continued

More examples

More examples of how to use the instruction RMQGetMsgData are illustrated below.

Example 1

```
RECORD mydatatype
  int x;
  int y;
ENDRECORD

VAR intnum msgreceive;
VAR mydatatype mydata;

PROC main()
  ! Setup interrupt
  CONNECT msgreceive WITH msghandler;
  ! Order cyclic interrupt to occur for data type mydatatype
  IRMQMessage mydata, msgreceive;
  WHILE TRUE DO
    ! Performing cycle
    ...
  ENDWHILE
ENDPROC

TRAP msghandler
  VAR rmqmessage message;
  VAR rmqheader header;

  ! Get the RMQ message
  RMQGetMessage message;
  ! Copy RMQ header information
  RMQGetMsgHeader message \Header:=header;

  IF header.datatype = "mydatatype" AND header.ndim = 0 THEN
    ! Copy the data from the message
    RMQGetMsgData message, mydata;
  ELSE
    TPWrite "Received a type not handled or with wrong dimension";
  ENDIF
ENDTRAP
```

When a new message is received, the trap routine msghandler is executed and the new message is copied to the variable message (instruction RMQGetMessage). Then the RMQ header data is copied (instruction RMQGetMsgHeader). If the message is of the expected data type and has the right dimension, the data is copied to the variable mydata (instruction RMQGetMsgData).

Syntax

```
RMQGetMsgData
[ Message ':' = ] < variable (VAR) of rmqmessage > ', '
[ Data ':' = ] < reference (VAR) of anytype > ';'
```

Continues on next page

1.208 RMQGetMsgData - Get the data part from an RMQ message

RobotStudio Connect or Multitasking
Continued

Related information

For information about	See
Description of the RAPID Message Queue functionality	<i>Application manual - Controller software OmniCore</i> , section <i>RAPID Message Queue</i> .
Find the identity number of a RAPID Message Queue task	RMQFindSlot - Find a slot identity from the slot name on page 608
Send data to the queue of a RAPID task	RMQSendMessage - Send an RMQ data message on page 622
Get the first message from a RAPID Message Queue.	RMQGetMessage - Get an RMQ message on page 610
Send data to the queue of a RAPID task and wait for an answer from the client	RMQSendWait - Send an RMQ data message and wait for a response on page 626
Extract the header data from an rmqmessage	RMQGetMsgHeader - Get header information from an RMQ message on page 616
Order and enable interrupts for a specific data type	IRMQMessage - Orders RMQ interrupts for a data type on page 291
Get the slot name from a specified slot identity	RMQGetSlotName - Get the name of an RMQ client on page 1431
RMQ Message	rmqmessage - RAPID Message Queue message on page 1712

1 Instructions

1.209 RMQGetMsgHeader - Get header information from an RMQ message

RobotStudio Connect or Multitasking

1.209 RMQGetMsgHeader - Get header information from an RMQ message

Usage

RMQGetMsgHeader (*RAPID Message Queue Get Message Header*) get the header information within the received RMQ message and store it in variables of type rmqheader, rmqslot or num.

Basic examples

The following examples illustrate the instruction RMQGetMsgHeader:

See also [More examples on page 617](#).

Example 1

```
VAR rmqmessage myrmqmsg;  
VAR rmqheader myrmqheader;  
...  
RMQGetMsgHeader myrmqmsg, \Header:=myrmqheader;
```

In this example the variable myrmqheader is filled with data copied from the rmqheader part of the variable myrmqmsg.

Example 2

```
VAR rmqmessage rmqmessage1;  
VAR rmqheader rmqheader1;  
VAR rmqslot rmqslot1;  
VAR num userdef := 0;  
...  
RRMQGetMsgHeader rmqmessage1 \Header:=rmqheader1 \SenderId:=rmqslot1  
  \UserDef:=userdef;
```

In this example the variables rmqheader1, rmqslot1 and userdef are filled with data copied from the variable rmqmessage1.

Arguments

RMQGetMsgHeader Message [\Header] [\SenderId] [\UserDef]

Message

Data type: rmqmessage

Variable containing the received RMQ message from which the information about the message should be copied.

[\Header]

Data type: rmqheader

Variable for storage of the RMQ header information that is copied from the variable specified as the parameter Message.

[\SenderId]

Data type: rmqslot

Variable for storage of the sender identity information that is copied from the variable specified as the parameter Message.

Continues on next page

1.209 RMQGetMsgHeader - Get header information from an RMQ message

RobotStudio Connect or Multitasking
Continued

[\UserDef]

User Defined data**Data type:** num

Variable for storage of user-defined data that is copied from the variable specified as the parameter Message. To get any valid data in this variable, the sender needs to specify that this should be included when sending an RMQ message. If it is not used, the value will be set to -1.

Program execution

The instruction RMQGetMsgHeader gets the header information within the received RMQ message and copies it to variables of type rmqheader, rmqs lot or num depending on what arguments are used.

More examples

More examples of how to use the instruction RMQGetMsgHeader are illustrated below.

Example 1

```

RECORD mydatatype
  int x;
  int y;
ENDRECORD

VAR intnum msgrreceive;
VAR mydatatype mydata;

PROC main()
  ! Setup interrupt
  CONNECT msgrreceive WITH msghandler;
  ! Order cyclic interrupt to occur for data type mydatatype
  IRMQMessage mydata, msgrreceive;
  WHILE TRUE DO
    ! Performing cycle
    ...
  ENDWHILE
ENDPROC

TRAP msghandler
  VAR rmqmessage message;
  VAR rmqheader header;

  ! Get the RMQ message
  RMQGetMessage message;
  ! Copy RMQ header information
  RMQGetMsgHeader message \Header:=header;

  IF header.datatype = "mydatatype" AND header.ndim = 0 THEN
    ! Copy the data from the message
    RMQGetMsgData message, mydata;
  
```

Continues on next page

1 Instructions

1.209 RMQGetMsgHeader - Get header information from an RMQ message

RobotStudio Connect or Multitasking

Continued

```
ELSE
    TPWrite "Received a type not handled or with wrong dimension";
ENDIF
ENDTRAP
```

When a new message is received, the trap routine msghandler is executed and the new message is copied to the variable message (instruction RMQGetMessage). Then the RMQ header data is copied (instruction RMQGetMsgHeader). If the message is of the expected data type and has the right dimension, the data is copied to the variable mydata (instruction RMQGetMsgData).

Syntax

```
RMQGetMsgHeader
[ Message ':' = ' ] < variable (VAR) of rmqmessage > ', '
[ '\ ' Header ':' = ' < variable (VAR) of rmqheader >
[ '\ ' SenderId ':' = ' < variable (VAR) of rmqslot >
[ '\ ' UserDef ':' = ' < variable (VAR) of num > ';'
```

Related information

For information about	See
Description of the RAPID Message Queue functionality	<i>Application manual - Controller software OmniCore</i> , section <i>RAPID Message Queue</i> .
Find the identity number of a RAPID Message Queue task	RMQFindSlot - Find a slot identity from the slot name on page 608
Send data to the queue of a RAPID task	RMQSendMessage - Send an RMQ data message on page 622
Get the first message from a RAPID Message Queue.	RMQGetMessage - Get an RMQ message on page 610
Send data to the queue of a RAPID task and wait for an answer from the client	RMQSendWait - Send an RMQ data message and wait for a response on page 626
Extract the data from an rmqmessage	RMQGetMsgData - Get the data part from an RMQ message on page 613
Order and enable interrupts for a specific data type	IRMQMessage - Orders RMQ interrupts for a data type on page 291
Get the slot name from a specified slot identity	RMQGetSlotName - Get the name of an RMQ client on page 1431
RMQ Slot	rmqslot - Identity number of an RMQ client on page 1713
RMQ Header	rmqmessage - RAPID Message Queue message on page 1712
RMQ Message	rmqheader - RAPID Message Queue Message header on page 1710

1.210 RMQReadWait - Returns message from RMQ

Usage

RMQReadWait is used in synchronous mode to receive any type of message.

Basic examples

The following example illustrates the instruction RMQReadWait:

See also [More examples on page 619](#).

Example

```
VAR rmqmessage myrmqmsg;  
RMQReadWait myrmqmsg;
```

The first message in the queue is received in the variable myrmqmsg.

Arguments

RMQReadWait Message [\Timeout]

Message

Data type: rmqmessage

The variable in which the received message is placed.

[\Timeout]

Data type: num

The maximum amount of time [s] that program execution waits for a message. If this time runs out before the condition is met, the error handler will be called, if there is one, with the error code ERR_RMQ_TIMEOUT. If there is no error handler, the execution will be stopped. It is possible to set the timeout to 0 (zero) seconds, so that there is no wait at all.

If the parameter \Timeout is not used, the waiting time is 60 sec. To wait forever, use the predefined constant WAIT_MAX.

Program execution

All incoming messages are queued and RMQReadWait handles the messages in FIFO order, one message at a time. It is the users responsibility to avoid a full queue and to be prepared to handle any type of message supported by RAPID Message Queue.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_RMQ_TIMEOUT	No answer has been received within the time-out time
ERR_RMQ_INVMSG	This error will be thrown if the message is invalid. This can for example happen if a PC application sends a corrupt message

More examples

More examples of how to use the instruction RMQReadWait are illustrated below.

Continues on next page

1 Instructions

1.210 RMQReadWait - Returns message from RMQ

RobotStudio Connect or Multitasking

Continued

Example 1

```
VAR rmqmessage myrmqmsg;  
RMQReadWait myrmqmsg \Timeout:=30;
```

The first message in the queue is received in the variable myrmqmsg. If no message is received within 30 seconds the program execution is stopped.

Example 2

```
PROC main()  
  VAR rmqmessage myrmqmsg;  
  FOR i FROM 1 TO 25 DO  
    RMQReadWait myrmqmsg \Timeout:=30;  
    ...  
  ENDFOR  
  
  ERROR  
  IF ERRNO = ERR_RMQ_TIMEOUT THEN  
    TPWrite "ERR_RMQ_TIMEOUT error reported";  
    ...  
  ENDIF  
ENDPROC
```

Messages are received from the queue and stored in the variable myrmqmsg. If receiving a message takes longer than 30 seconds, the error handler is called.

Limitations

RMQReadWait is only supported in synchronous mode. Executing this instruction in interrupt based mode will cause a fatal runtime error.

RMQReadWait is not supported in trap execution level or user execution level. Executing this instruction in either of these levels will cause a fatal runtime error.

Syntax

```
RMQReadWait  
[ Message ':' = ] < variable (VAR) of rmqmessage>  
[ '\ ' Timeout ':' = ] < expression (IN) of num > ] ';' ;'
```

Related information

For information about	See
Description of the RAPID Message Queue functionality	<i>Application manual - Controller software OmniCore</i> , section <i>RAPID Message Queue</i> .
Description of task execution modes	<i>Technical reference manual - System parameters</i>
rmqmessage data type	rmqmessage - RAPID Message Queue message on page 1712 .
Send data to the queue of a RAPID task	RMQSendMessage - Send an RMQ data message on page 622 .
Send data to the queue of a RAPID task and wait for an answer from the client	RMQSendWait - Send an RMQ data message and wait for a response on page 626 .

Continues on next page

1.210 RMQReadWait - Returns message from RMQ
RobotStudio Connect or Multitasking
Continued

For information about	See
Find the identity number of a RAPID Message Queue task	RMQFindSlot - Find a slot identity from the slot name on page 608.
Extract the header data from an rmqmessage	RMQGetMsgHeader - Get header information from an RMQ message on page 616.
Extract the data from an rmqmessage	RMQGetMsgData - Get the data part from an RMQ message on page 613.
Order and enable interrupts for a specific data type	IRMQMessage - Orders RMQ interrupts for a data type on page 291.
Get the slot name from a specified slot identity	RMQGetSlotName - Get the name of an RMQ client on page 1431.
Empty RAPID Message Queue	RMQEmptyQueue - Empty RAPID Message Queue on page 606.
Get the first message from a RAPID Message Queue	RMQGetMessage - Get an RMQ message on page 610.

1 Instructions

1.211 RMQSendMessage - Send an RMQ data message

RobotStudio Connect or Multitasking

1.211 RMQSendMessage - Send an RMQ data message

Usage

RMQSendMessage (*RAPID Message Queue Send Message*) is used to send data to an RMQ configured for a RAPID task, or to a Robot Application Builder client.

Basic examples

The following examples illustrate the instruction RMQSendMessage:

See also [More examples on page 623](#).

Example 1

```
VAR rmqslot destination_slot;  
VAR string data:="Hello world";  
..  
RMQFindSlot destination_slot,"RMQ_Task2";  
RMQSendMessage destination_slot,data;
```

The example shows how to send the value in the variable data to the RAPID task "Task2" with the configured RMQ "RMQ_Task2".

Example 2

```
VAR rmqslot destination_slot;  
CONST robtarg p5:= [ [600, 500, 225.3], [1, 0, 0, 0], [1, 1, 0,  
0], [ 11, 12.3, 9E9, 9E9, 9E9, 9E9] ];  
VAR num my_id:=1;  
..  
RMQFindSlot destination_slot,"RMQ_Task2";  
RMQSendMessage destination_slot, p5 \UserDef:=my_id;  
my_id:=my_id + 1;
```

The example shows how to send the value in the constant p5 to the RAPID task "Task2" with the configured RMQ "RMQ_Task2". A user-defined number is also sent. This number can be used by the receiver as an identifier.

Arguments

RMQSendMessage Slot SendData [\UserDef]

Slot

Data type: rmqslot

The identity slot number of the client that should receive the message.

SendData

Data type: anytype

Reference to a variable, persistent or constant containing the data to be sent to the client with identity as in argument Slot.

[\UserDef]

User Defined data

Data type: num

Continues on next page

1.211 RMQSendMessage - Send an RMQ data message

RobotStudio Connect or Multitasking
Continued

Data specifying user-defined information to the receiver of the SendData, i.e the client with identity number as in variable Slot. The value must be an integer between 0 and 32767.

Program execution

The instruction RMQSendMessage is used to send data to a specified client. The instruction packs the indata in a storage container and sends it.

If the receiving client is not interested in receiving messages, i.e has not setup any interrupt to occur for the data type specified in the RMQSendMessage instruction or is not waiting in an RMQSendWait instruction, the message will be discarded, and a warning will be generated.

Not all data types can be sent with the instruction (see limitations).

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_RMQ_MSGSIZE	The size of message is too big. Either the data exceeds the maximum allowed message size, or the receiving client is not configured to receive the size of the data that is sent.
ERR_RMQ_FULL	The destination message queue is full.
ERR_RMQ_INVALID	The destination slot has not been connected or the destination slot is no longer available. If not connected, a call to RMQFindSlot must be done. If not available, the reason is that a remote client has disconnected from the controller.

More examples

More examples of how to use the instruction RMQSendMessage are illustrated below.

Example 1

```

MODULE SenderMod
  RECORD msgrec
    num x;
    num y;
  ENDRECORD

  PROC main()
    VAR rmqslot destinationSlot;
    VAR msgrec msg :=[0, 0, 0];

    ! Connect to a Robot Application Builder client
    RMQFindSlot destinationSlot "My_RAB_client";

    ! Perform cycle
    WHILE TRUE DO
      ! Update msg with valid data
      ...
      ! Send message
    
```

Continues on next page

1 Instructions

1.211 RMQSendMessage - Send an RMQ data message

RobotStudio Connect or Multitasking

Continued

```
        RMQSendMessage destinationSlot, msg;
    ...
ENDWHILE
ERROR
IF ERRNO = ERR_RMQ_INVALID THEN
    ! Handle destination client lost
    WaitTime 1;
    ! Reconnect to Robot Application Builder client
    RMQFindSlot destinationSlot "My_RAB_client";
    ! Avoid execution stop due to retry count exceed
    ResetRetryCount;
    RETRY;
ELSIF ERRNO = ERR_RMQ_FULL THEN
    ! Handle destination queue full
    WaitTime 1;
    ! Avoid execution stop due to retry count exceed
    ResetRetryCount;
    RETRY;
ENDIF
ENDPROC
ENDMODULE
```

The example shows how to use instruction RMQSendMessage with errorhandling of occuring run-time errors. The program sends user-defined data of the type msgrec to a Robot Application Builder client called "My_RAB_client".

Limitations

It is not possible to set up interrupts, or send or receive data instances of data types that are of non-value, semi-value types or data type motsetdata.

The maximum size of data that can be sent to a Robot Application Builder client is about 5000 bytes. The maximum size of data that can be received by an RMQ and stored in an rmqmessage data type is about 5000 bytes. The size of the data that can be received by an RMQ can be configured (default size 448, max size 5000).

Syntax

```
RMQSendMessage
[ Slot ':' = ] < variable (VAR) of rmqslot > ', '
[ SendData ':' = ] < reference (REF) of anytype >
[ '\' UserDef ':' = ] < expression (IN) of num > ] ';' ;
```

Related information

For information about	See
Description of the RAPID Message Queue functionality	<i>Application manual - Controller software OmniCore</i> , section <i>RAPID Message Queue</i> .
Find the identity number of a RAPID Message Queue task	RMQFindSlot - Find a slot identity from the slot name on page 608
Get the first message from a RAPID Message Queue.	RMQGetMessage - Get an RMQ message on page 610

Continues on next page

1.211 RMQSendMessage - Send an RMQ data message
RobotStudio Connect or Multitasking
Continued

For information about	See
Send data to the queue of a RAPID task and wait for an answer from the client	RMQSendWait - Send an RMQ data message and wait for a response on page 626
Extract the header data from an rmqmessage	RMQGetMsgHeader - Get header information from an RMQ message on page 616
Extract the data from an rmqmessage	RMQGetMsgData - Get the data part from an RMQ message on page 613
Order and enable interrupts for a specific data type	IRMQMessage - Orders RMQ interrupts for a data type on page 291
Get the slot name from a specified slot identity	RMQGetSlotName - Get the name of an RMQ client on page 1431
RMQ Slot	rmqslot - Identity number of an RMQ client on page 1713

1 Instructions

1.212 RMQSendWait - Send an RMQ data message and wait for a response

RobotStudio Connect or Multitasking

1.212 RMQSendWait - Send an RMQ data message and wait for a response

Usage

With the `RMQSendWait` (*RAPID Message Queue Send Wait*) instruction it is possible to send data to an RMQ or to a Robot Application Builder client, and wait for an answer from the specified client. If using this instruction, the user needs to know what kind of data type will be sent in the answer from the client.

Basic examples

The following examples illustrate the instruction `RMQSendWait`:

See also [More examples on page 628](#).

Example 1

```
VAR rmqslot destination_slot;  
VAR string sendstr:="This string is from T_ROB1";  
VAR rmqmessage receivemsg;  
VAR num mynum;  
..  
RMQFindSlot destination_slot, "RMQ_T_ROB2";  
RMQSendWait destination_slot, sendstr, receivemsg, mynum;  
RMQGetMsgData receivemsg, mynum;
```

The example shows how to send the data in the variable `sendstr` to the RAPID task "T_ROB2" with the configured RMQ "RMQ_T_ROB2". Now the instruction `RMQSendWait` waits for a reply from the task "T_ROB2". The instruction in "T_ROB2" needs to send data that is stored in a `num` data type to terminate the waiting instruction `RMQSendWait`. When the message has been received, the data is copied to the variable `mynum` from the variable `receivemsg` with the instruction `RMQGetMsgData`.

Example 2

```
VAR rmqslot rmqslot1;  
VAR string mysendstr;  
VAR rmqmessage rmqmessage1;  
VAR string receivestr;  
VAR num mysendid:=1;  
..  
mysendstr:="Message from Task1";  
RMQFindSlot rmqslot1, "RMQ_Task2";  
RMQSendWait rmqslot1, mysendstr \UserDef:=mysendid, rmqmessage1,  
    receivestr \Timeout:=20;  
RMQGetMsgData rmqmessage1, receivestr;  
mysendid:=mysendid + 1;
```

The example shows how to send the data in the variable `mysendstr` to the RAPID task "Task2" with the configured RMQ "RMQ_Task2". A user-defined number is also sent. This number can be used by the receiver as an identifier and must be bounced back to the sender to terminate the waiting `RMQSendWait` instruction. Another demand to terminate the waiting instruction is that the right data type is sent from the client. That data type is specified by the variable `receivestr` in the

Continues on next page

1.212 RMQSendWait - Send an RMQ data message and wait for a response *RobotStudio Connect or Multitasking* *Continued*

RMQSendWait instruction. After the message has been received, the actual data is copied to the variable `receivestr` with the instruction `RMQGetMsgData`.

Arguments

RMQSendWait Slot SendData [\UserDef] Message ReceiveDataType
[\Timeout]

Slot

Data type: `rmqslot`

The identity number of the client that should receive the message.

SendData

Data type: `anytype`

Reference to a variable, persistent or constant containing the data to be sent to the client with identity number as in the variable `Slot`.

[\UserDef]

User Defined data

Data type: `num`

Data specifying user-defined information to the receiver of the `SendData`, that is, the client with the identity number as in the variable `Slot`. If using this optional argument, the `RMQSendWait` instruction will only terminate if the `ReceiveDataType` and the specified `UserDef` is as specified in the message answer. The value must be an integer between 0 and 32767.

Message

Data type: `rmqmessage`

The variable in which the received message is placed.

ReceiveDataType

Data type: `anytype`

A reference to a persistent, variable or constant of the data type that the instruction is waiting for. The actual data is not copied to this variable when the `RMQSendWait` is executed. This argument is only used to specify the actual data type the `RMQSendWait` instruction is waiting for.

[\Timeout]

Data type: `num`

The maximum amount of time [s] that program execution waits for an answer. If this time runs out before the condition is met, the error handler will be called, if there is one, with the error code `ERR_RMQ_TIMEOUT`. If there is no error handler, the execution will be stopped.

If the parameter `\Timeout` is not used, the waiting time is 60 s. To wait forever, use the predefined constant `WAIT_MAX`.

Program execution

The instruction `RMQSendWait` sends data and waits for an answer from the client with the specified slot identity. The answer must be an `rmqmessage` from the client

Continues on next page

1 Instructions

1.212 RMQSendWait - Send an RMQ data message and wait for a response

RobotStudio Connect or Multitasking

Continued

that got the message and the answer must be of the same data type that is specified in the argument `ReceiveDataType`. The message will be sent in the same way as when using `RMQSendMessage`, i.e. the receiver will get a normal **RAPID Message Queue** message. It is the responsibility of the sender that the receiver knows that a reply is needed. If the optional argument `UserDef` is used in the `RMQSendWait`, the demand is that the receiving client uses the same `UserDef` in the answer.

If the receiving client is not interested in receiving messages, that is, has not set up any interrupt to occur for the data type specified in the `RMQSendWait` instruction, the message will be discarded, and a warning will be generated. The instruction returns an error after the time used in the argument `TimeOut`, or the default time-out time 60 s. This error can be dealt with in an error handler.

The `RMQSendWait` instruction has the highest priority if a message is received and it fits the description for both the expected answer and a message connected to a trap routine (see instruction [IRMQMessage - Orders RMQ interrupts for a data type on page 291](#)).

If a power failure occurs when waiting for an answer from the client, the variable used in the argument `Slot` is set to 0 and the instruction is executed again. The instruction will then fail because of an invalid slot identity and the error handler will be called, if there is one, with the error code `ERR_RMQ_INVALID`. The slot identity can be reinitialized there.

Not all data types can be sent with the instruction (see limitations).

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_RMQ_MSGSIZE</code>	The size of message is too big. Either the data exceeds the maximum allowed message size, or the receiving client is not configured to receive the size of the data that is sent.
<code>ERR_RMQ_FULL</code>	The destination message queue is full.
<code>ERR_RMQ_INVALID</code>	The <code>rmqslot</code> has not been initialized, or the destination slot is no longer available. This can happen if the destination slot is a remote client and the remote client has disconnected from the controller. <code>RMQSendWait</code> was interrupted by a power failure, and at restart the <code>rmqslot</code> is set to 0.
<code>ERR_RMQ_TIMEOUT</code>	No answer has been received within the time-out time.
<code>ERR_RMQ_INVMSG</code>	This error will be thrown if the message is invalid. This may for instance happen if a PC application sends a corrupt message.

More examples

More examples of how to use the instruction `RMQSendWait` are illustrated below.

Example 1

```
MODULE RMQ_Task1_mod
PROC main()
  VAR rmqslot destination_slot;
  VAR string mysendstr:="String sent from RMQ_Task1_mod";
```

Continues on next page

1.212 RMQSendWait - Send an RMQ data message and wait for a response

RobotStudio Connect or Multitasking
Continued

```

VAR string myrecstr;
VAR rmqmessage recmsg;
VAR rmqheader header;

!Get slot identity to client called RMQ_Task2
RMQFindSlot destination_slot, "RMQ_Task2";

WHILE TRUE DO
  ! Do something
  ...
  !Send data in mysendstr, wait for an answer of type string
  RMQSendWait destination_slot, mysendstr, recmsg, myrecstr;
  !Get information about the received message
  RMQGetMsgHeader recmsg \Header:=header;
  IF header.datatype = "string" AND header.ndim = 0 THEN
    ! Copy the data in recmsg
    RMQGetMsgData recmsg, myrecstr;
    TPWrite "Received string: " + myrecstr;
  ELSE
    TPWrite "Not a string that was received";
  ENDIF
ENDWHILE
ENDPROC
ENDMODULE

```

The data in the variable mysendstr is sent to the RAPID task "Task2" with the configured RAPID Message Queue "RMQ_Task2" with the instruction RMQSendWait. The answer from the RAPID task "Task2" should be a string (specified of the data type of the variable myrecstr). The RMQ message received as an answer is received in the variable recmsg. The use of the variable myrecstr in the call to RMQSendWait is just specification of the data type the sender is expecting as an answer. No valid data is placed in the variable in the RMQSendWait call.

Limitations

It is not allowed to execute RMQSendWait in synchronous mode. That will cause a fatal runtime error.

It is not possible to set up interrupts, or send or receive data instances of data types that are of non-value, semi-value types or data type motsetdata.

The maximum size of data that can be sent to a Robot Application Builder client is about 5000 bytes. The maximum size of data that can be received by an RMQ and stored in an rmqmessage data type is about 5000 bytes. The size of the data that can be received by an RMQ can be configured (default size 448, max size 5000).

Syntax

```

RMQSendWait
[ Slot ':' = ] < variable (VAR) of rmqslot > ', '
[ SendData ':' = ] < reference (REF) of anytype >
[ '\ ' UserDef ':' = ] < expression (IN) of num > ', '
[ Message ':' = ] < variable (VAR) of rmqmessage > ', '

```

Continues on next page

1 Instructions

1.212 RMQSendWait - Send an RMQ data message and wait for a response

RobotStudio Connect or Multitasking

Continued

```
[ ReceiveDataType ':= ' ] < reference (REF) of anytype > ', '
[ '\\ ' Timeout ':= ' < expression (IN) of num > ] ';' ;'
```

Related information

For information about	See
Description of the RAPID Message Queue functionality	<i>Application manual - Controller software OmniCore</i> , section <i>RAPID Message Queue</i> .
Find the identity number of a RAPID Message Queue task	RMQFindSlot - Find a slot identity from the slot name on page 608
Send data to the queue of a RAPID task	RMQSendMessage - Send an RMQ data message on page 622
Get the first message from a RAPID Message Queue.	RMQGetMessage - Get an RMQ message on page 610
Extract the header data from an rmqmessage	RMQGetMsgHeader - Get header information from an RMQ message on page 616
Extract the data from an rmqmessage	RMQGetMsgData - Get the data part from an RMQ message on page 613
Order and enable interrupts for a specific data type	IRMQMessage - Orders RMQ interrupts for a data type on page 291
Get the slot name from a specified slot identity	RMQGetSlotName - Get the name of an RMQ client on page 1431
RMQ Slot	rmqslot - Identity number of an RMQ client on page 1713
RMQ Message	rmqmessage - RAPID Message Queue message on page 1712

1.213 SafetyControllerSyncRequest - Initiation of hardware synchronization procedure

SafeMove Premium, SafeMove Premium+, PROFIsafe

1.213 SafetyControllerSyncRequest - Initiation of hardware synchronization procedure

Usage

SafetyControllerSyncRequest is used to initiate the hardware synchronization procedure.

Basic examples

The following example illustrates the instruction SafetyControllerSyncRequest.

Example 1

```
SafetyControllerSyncRequest;
Initiate the hardware synchronization procedure.
```

Program execution

This instruction must be called prior to the synchronization signal activation.

Syntax

```
SafetyControllerSyncRequest ';' ;
```

Related information

For information about	See
SafetyControllerGetChecksum	SafetyControllerGetChecksum - Get the checksum for the user configuration file on page 1442
SafetyControllerGetSWVersion	SafetyControllerGetSWVersion - Get the safety controller firmware version on page 1447
SafetyControllerGetUserChecksum	SafetyControllerGetUserChecksum - Get the checksum for protected parameters on page 1448

1 Instructions

1.214 Save - Save a program module *RobotWare Base*

1.214 Save - Save a program module

Usage

Save is used to save a program module.

The specified program module in the program memory will be saved with the original (specified in Load or StartLoad) or specified file path.

It is also possible to save a system module at the specified file path.

Basic examples

The following example illustrates the instruction Save:

See also [More examples on page 633](#).

Example 1

```
Load "HOME:/PART_B.modx";  
...  
Save "PART_B";
```

Load the program module with the file name PART_B.modx from HOME: into the program memory.

Save the program module PART_B with the original file path HOME: and with the original file name PART_B.modx.

Arguments

Save [\TaskRef][\TaskName] ModuleName [\FilePath] [\File]

[\TaskRef]

Task Reference

Data type: taskId

The program task identity in which the program module should be saved.

For all program tasks in the system the predefined variables of the data type taskId will be available. The variable identity will be "taskname"+"Id", e.g. for the T_ROB1 task the variable identity will be T_ROB1Id.

[\TaskName]

Data type: string

The program task name in which the program module should be saved.

If none of the arguments \TaskRef or \TaskName is specified then the specified program module in the current (executing) program task will be saved.

ModuleName

Data type: string

The program module to save.

[\FilePath]

Data type: string

The file path and the file name to the place where the program module is to be saved. The file name shall be excluded when the argument \File is used.

Continues on next page

[\File]

Data type: string

When the file name is excluded in the argument \FilePath it must be specified with this argument.

The argument \FilePath\File can only be omitted for program modules loaded with Load or StartLoad-WaitLoad and the program module will be stored at the same destination as specified in these instructions. To store the program module at another destination it is also possible to use the argument \FilePath \File.

The argument \FilePath \File must be used to be able to save a program module that previously was loaded from the FlexPendant, external computer, or system configuration.

Program execution

Program execution waits for the program module to finish saving before proceeding with the next instruction.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_IOERROR	The save file cannot be opened because of denied permission, no such directory, or no space left on device.
ERR_MODULE	The program module cannot be saved because there is no module name, unknown module name, or ambiguous module name.
ERR_PATH	The argument \FilePath is not specified for program modules loaded from the FlexPendant, System Parameters, or an external computer.
ERR_TASKNAME	The program task name in argument \TaskName cannot be found in the system.

More examples

More examples of how to use the instruction Save are illustrated below.

Example 1

```
Save "PART_A" \FilePath:="HOME:/DOORDIR/PART_A.modx";
```

Save the program module PART_A to HOME: in the file PART_A.modx and in the directory DOORDIR.

Example 2

```
Save "PART_A" \FilePath:="HOME:" \File:="DOORDIR/PART_A.modx";
```

Same as in the above example 1 but another syntax.

Example 3

```
Save \TaskRef:=TSK1Id, "PART_A"
\FilePath:="HOME:/DOORDIR/PART_A.modx";
```

Continues on next page

1 Instructions

1.214 Save - Save a program module

RobotWare Base

Continued

Save program module PART_A in program task TSK1 to the specified destination. This is an example where the instruction Save is executing in one program task and the saving is done in another program task.

Example 4

```
Save \TaskName:="TSK1", "PART_A"  
    \FilePath:="HOME:/DOORDIR/PART_A.modx";
```

Save program module PART_A in program task TSK1 to the specified destination. This is another example of where the instruction Save is executing in one program task and the saving is done in another program task.

Limitations

Trap routines, system I/O events, and other program tasks cannot execute during the saving operation. Therefore, any such operations will be delayed.

The save operation can interrupt update of PERS data done step by step from other program tasks. This will result in inconsistent whole PERS data.

A program stop during execution of the Save instruction can result in a guard stop with motors off. The error message "20025 Stop order timeout" will be displayed on the FlexPendant.

Avoid ongoing robot movements during the saving.

Syntax

```
Save  
  [[ '\\' TaskRef ':' <variable (VAR) of taskid>]  
  |[ '\\' TaskName' ':' <expression (IN) of string>] ',']  
  [ ModuleName' ':' ] <expression (IN) of string>  
  [ '\\' FilePath' ':' <expression (IN) of string> ]  
  [ '\\' File' ':' <expression (IN) of string>] ';' ;
```

Related information

For information about	See
Program tasks	taskid - Task identification on page 1748
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

1.215 SaveCfgData - Save system parameters to file

Usage

SaveCfgData is used to save system parameters to file. This can be useful after updating the system parameters with instruction WriteCfgData.

Basic examples

The following examples illustrates the instruction SaveCfgData.

Example 1

```
SaveCfgData "SYSPAR" \File:="MYEIO.cfg", EIO_DOMAIN;  
Saving I/O configuration domain to the file MYEIO.cfg in directory SYSPAR.
```

Example 2

```
SaveCfgData "SYSPAR", ALL_DOMAINS;  
Saving all existing configuration domains to directory SYSPAR. The files will get  
the names EIO.cfg, MMC.cfg, PROC.cfg, SIO.cfg, SYS.cfg and MOC.cfg.
```

Arguments

```
SaveCfgData FilePath [\File] Domain
```

FilePath

Data type: string

The file path and the file name to where the file should be saved. The file name shall be excluded when the argument \File is used.

[\File]

Data type: string

When the file name is excluded in the argument \FilePath it must be specified with this argument.

Domain

Data type: cfgdomain

The system parameter domain to save.

Program execution

Saves system parameters to file.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CFG_ILL_DOMAIN	The cfgdomain used is invalid or not in use.
ERR_CFG_WRITEFILE	The directory does not exist, or the FilePath and File used is a directory, or some other problem regarding saving the file.

Continues on next page

1 Instructions

1.215 SaveCfgData - Save system parameters to file

RobotWare Base

Continued

Syntax

```
SaveCfgData
  [FilePath ':= ' ] <expression (IN) of string>
  ['\ ' File ':= ' <expression (IN) of string>]
  [Domain ':= ' ] <expression (IN) of cfgdomain> ';'

```

Related information

For information about	See
cfgdomain data	cfgdomain - Configuration domain on page 1615
System parameters	<i>Technical reference manual - System parameters</i>
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

1.216 SearchC - Searches circularly using the robot

Usage

SearchC (*Search Circular*) is used to search for a position when moving the tool center point (TCP) circularly.

During the movement the robot supervises a digital input signal or a persistent variable. When the value of the signal or persistent variable changes to the requested one the robot immediately reads the current position.

This instruction can typically be used when the tool held by the robot is a probe for surface detection. The outline coordinates of a work object can be obtained using the SearchC instruction.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

When using search instructions it is important to configure the I/O system to have a very short time from setting the physical signal to the system to getting the information regarding the setting (use I/O device with interrupt control, not poll control). How to do this can differ between fieldbuses. If using DeviceNet the ABB units (local I/O) will give short times since they are using connection type *Change of State*. If using other fieldbuses ensure that you configure the network in a proper way to get right conditions.

Basic examples

The following examples illustrate the instruction SearchC:

See also [More examples on page 643](#).

Example 1

```
SearchC di1, sp, cirpoint, p10, v100, probe;
```

The TCP of the probe is moved circularly towards the position p10 at a speed of v100. When the value of the signal di1 changes to active the position is stored in sp.

Example 2

```
SearchC \Stop, di2, sp, cirpoint, p10, v100, probe;
```

The TCP of the probe is moved circularly towards the position p10. When the value of the signal di2 changes to active the position is stored in sp and the robot stops immediately.

Example 3

```
PERS bool mypers:=FALSE;
```

```
...
```

```
SearchC \Stop, mypers, sp, cirpoint, p10, v100, probe;
```

The TCP of the probe is moved circularly towards the position p10. When the value of the persistent variable mypers changes to TRUE the position is stored in sp and the robot stops immediately.

Continues on next page

1 Instructions

1.216 SearchC - Searches circularly using the robot

RobotWare Base

Continued

Arguments

```
SearchC [\Stop] | [\SStop] | [\Sup] Signal | PersBool [\Flanks] |  
        [\PosFlank] | [\NegFlank] | [\HighLevel] | [\LowLevel]  
SearchPoint CirPoint ToPoint [\ID] Speed [\V] | [\T] Tool  
        [\WObj] [\Corr] [\TLoad]
```

[\Stop]

Stiff Stop

Data type: switch

The robot movement is stopped as quickly as possible without keeping the TCP on the path when the value of the search signal changes to active or the persistent variable value changes to TRUE. The robot is moved a small distance before it stops and is not moved back to the searched position, i.e. to the position where the signal or persistent value changed.

Test first with a slow speed, for example <100 mm/s, and then gradually increase the speed to the desired value.



WARNING

Stopping the search with a stiff stop (switch \Stop) is only allowed if the TCP-speed is lower than 100 mm/s. A stiff stop at higher speed can cause some axes to move in unpredictable directions.



Note

For a YuMi robot, the maximum speed for searching with stiff stop is 1000 mm/s.

[\SStop]

Soft Stop

Data type: switch

The robot movement is stopped as quickly as possible while keeping the TCP on the path (soft stop) when the value of the search signal changes to active or the persistent variable value changes to TRUE. The robot is moved only a small distance before it stops and is not moved back to the searched position, i.e. to the position where the signal changed.

[\Sup]

Supervision

Data type: switch

The search instruction is sensitive to signal activation or persistent variable value change during the complete movement (flying search), i.e. even after the first signal change or persistent variable change has been reported. If more than one match occurs during a search then a recoverable error is generated with the robot in the ToPoint.

If the arguments \Stop, \SStop, and \Sup are omitted (no switch used at all):

- the movement continues (flying search) to the position specified in the ToPoint argument (same as with argument \Sup)

Continues on next page

- error is reported for none search hit but is not reported for more than one search hit (first search hit is returned as the SearchPoint)

Signal

Data type: signaldi

The name of the signal to supervise.

PersBool

Data type: bool

The persistent variable to supervise.

[\Flanks]

Data type: switch

The positive and the negative edge of the signal is valid for a search hit. If using argument PersBool it is the value change of the variable that is valid for a search hit.

For signal: If the argument \Flanks is omitted, only the positive edge of the signal is valid for a search hit and a signal supervision will be activated at the beginning of a search process. This means that if the signal has the positive value already at the beginning of a search process, or the communication with the signal is lost then the robot movement is stopped as quickly as possible, while keeping the TCP on the path (soft stop). A user recovery error ERR_SIGSUPSEARCH will be generated and can be handled in the error handler.

For persistent variable: If the argument \Flanks is omitted, it is only when the value change to TRUE that is a valid search hit and a variable supervision will be activated at the beginning of a search process. This means that if persistent variable has the positive value already at the beginning of a search process then the robot movement is stopped as quickly as possible, while keeping the TCP on the path (soft stop). A user recovery error ERR_PERSSUPSEARCH will be generated and can be handled in the error handler.

[\PosFlank]

Data type: switch

The positive edge of the signal is valid for a search hit, or the change of the value to TRUE if using a persistent variable.

[\NegFlank]

Data type: switch

The negative edge of the signal is valid for a search hit, or the change of the value to FALSE if using a persistent variable.

[\HighLevel]

Data type: switch

The same functionality as if not using \Flanks switch.

For signal: The positive edge of the signal is valid for a search hit, and a signal supervision will be activated at the beginning of a search process. This means that if the signal has the positive value already at the beginning of a search process or the communication with the signal is lost then the robot movement is stopped as

Continues on next page

1 Instructions

1.216 SearchC - Searches circularly using the robot

RobotWare Base

Continued

quickly as possible, while keeping the TCP on the path (soft stop). A user recovery error ERR_SIGSUPSEARCH will be generated and can be handled in the error handler.

For persistent variable: Only the value change to TRUE is a valid search hit and a variable supervision will be activated at the beginning of a search process. This means that if persistent variable has the positive value already at the beginning of a search process then the robot movement is stopped as quickly as possible, while keeping the TCP on the path (soft stop). A user recovery error ERR_PERSSUPSEARCH will be generated and can be handled in the error handler.

[\LowLevel]

Data type: switch

For signal: The negative edge of the signal is valid for a search hit, and a signal supervision will be activated at the beginning of a search process. This means that if the signal has value 0 already at the beginning of a search process or the communication with the signal is lost then the robot movement is stopped as quickly as possible, while keeping the TCP on the path (soft stop). A user recovery error ERR_SIGSUPSEARCH will be generated and can be handled in the error handler.

For persistent variable: Only the value change to FALSE is a valid search hit and a variable supervision will be activated at the beginning of a search process. This means that if persistent variable has the value FALSE already at the beginning of a search process then the robot movement is stopped as quickly as possible, while keeping the TCP on the path (soft stop). A user recovery error ERR_PERSSUPSEARCH will be generated and can be handled in the error handler.

SearchPoint

Data type: robtarget

The position of the TCP and external axes when the search signal has been triggered. The position is specified in the outermost coordinate system taking the specified tool, work object, and active ProgDisp/ExtOffs coordinate system into consideration.

CirPoint

Data type: robtarget

The circle point of the robot. See the instruction MoveC for a more detailed description of circular movement. The circle point is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction). SearchC always uses a stop point as zone data for the destination.

[\ID]

Synchronization id

Data type: identno

Continues on next page

The argument [\ID] is mandatory in the MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the tool center point, the external axes and the tool reorientation.

[\V]

Velocity

Data type: num

This argument is used to specify the velocity of the TCP in mm/s directly in the instruction. It is then substituted for the corresponding velocity specified in the speed data.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination position.

[\WObj]

Work Object

Data type: wobjdata

The work object (coordinate system) to which the robot positions in the instruction are related.

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified for a linear movement relative to the work object to be performed.

[\Corr]

Correction

Data type: switch

Continues on next page

1 Instructions

1.216 SearchC - Searches circularly using the robot

RobotWare Base

Continued

When this argument is present the correction data written to a corrections entry by the instruction `CorrWrite` will be added to the path and destination position.

The RobotWare option *Path Corrections* is required when using this argument.

[`\TLoad`]

Total load

Data type: `loaddata`

The `\TLoad` argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the `\TLoad` argument is used, then the `loaddata` in the current `tooldata` is not considered.

If the `\TLoad` argument is set to `load0`, then the `\TLoad` argument is not considered and the `loaddata` in the current `tooldata` is used instead.

To be able to use the `\TLoad` argument it is necessary to set the value of the system parameter `ModalPayloadMode` to 0. If `ModalPayloadMode` is set to 0, it is no longer possible to use the instruction `GripLoad`.

The total load can be identified with the service routine `LoadIdentify`. If the system parameter `ModalPayloadMode` is set to 0, the operator has the possibility to copy the `loaddata` from the tool to an existing or new `loaddata` persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input `SimMode` (Simulated Mode). If the digital input signal is set to 1, the `loaddata` in the optional argument `\TLoad` is not considered, and the `loaddata` in the current `tooldata` is used instead.



Note

The default functionality to handle payload is to use the instruction `GripLoad`. Therefore the default value of the system parameter `ModalPayloadMode` is 1.

Program execution

See the instruction `MoveC` for information about circular movement.

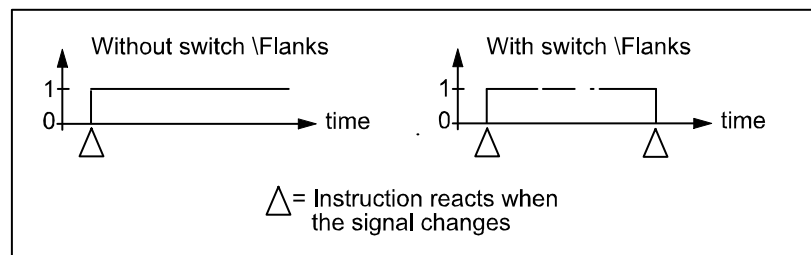
The movement is always ended with a stop point, i.e. the robot stops at the destination point.

When a flying search is used, i.e. the `\Sup` argument is specified or none switch at all is specified, the robot movement always continues to the programmed destination point. When a search is made using the switch `\Stop` or `\SStop`, the robot movement stops when the first search hit is detected.

The `SearchC` instruction returns the position of the TCP when the value of the digital signal or persistent variable changes to the requested one, as illustrated in figure below.

The figure shows how flank-triggered signal detection is used (the position is stored when the signal is changed the first time only).

Continues on next page



xx0500002237

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_WHLSEARCH	- No signal detection occurred. - More than one signal detection occurred – this occurs only if the \Sup argument is used.
ERR_SIGSUPSEARCH	The signal has already a positive value at the beginning of the search process or the communication with the signal is lost. This occurs only if the \Flanks argument is omitted.
ERR_PERSSUPSEARCH	The persistent variable is already TRUE at the beginning of the search process. This occurs only if the \Flanks argument is omitted.

Errors can be handled in different ways depending on the selected running mode:

- Continuous forward / Instruction forward / ERR_WHLSEARCH:** No position is returned and the movement always continues to the programmed destination point. The system variable ERRNO is set to ERR_WHLSEARCH and the error can be handled in the error handler of the routine.
- Continuous forward / Instruction forward / ERR_SIGSUPSEARCH and ERR_PERSSUPSEARCH:** No position is returned and the movement always stops as quickly as possible at the beginning of the search path. The system variable ERRNO is set to ERR_SIGSUPSEARCH or ERR_PERSSUPSEARCH depending on used argument (signal or persistent variable), and the error can be handled in the error handler of the routine.
- Instruction backward:** During backward execution the instruction carries out the movement without any supervision.

More examples

More examples of how to use the instruction SearchC are illustrated below.

Example 1

```
SearchC \Sup, di1\Flanks, sp, cirpoint, p10, v100, probe;
```

Continues on next page

1 Instructions

1.216 SearchC - Searches circularly using the robot

RobotWare Base

Continued

The TCP of the probe is moved circularly towards the position p10. When the value of the signal di1 changes to active or passive the position is stored in sp. If the value of the signal changes twice then program generates an error.

Limitations

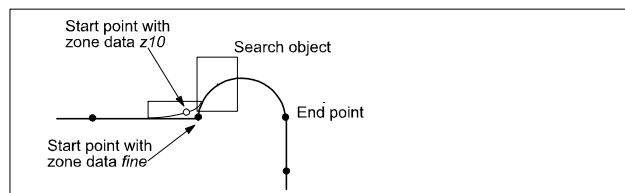
General limitations according to instruction MoveC.

SearchC cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Zone data for the positioning instruction that precedes SearchC must be used carefully. The recommendation is to use z0, or a small zone that still gives a smooth movement. The start of the search, i.e. when the I/O signal is ready to react, is not, in this case, the programmed destination point of the previous positioning instruction but a point along the real robot path. The figure below illustrates an example of something that may go wrong when zone data other than fine is used.

The instruction SearchC should never be restarted after the circle point has been passed. Otherwise the robot will not take the programmed path (positioning around the circular path in another direction compared to that which is programmed).

The figure shows how a match is made on the wrong side of the object because the wrong zone data was used.



xx0500002238

Continues on next page

**WARNING**

Limitations for searching if coordinated synchronized movements:

- If using SearchL, SearchC, or SearchExtJ for one program task and some other move instruction in other program task, it is only possible to use flying search with switch \Sup. Besides that, it is only possible to do error recovery with TRYNEXT.
- It is possible to use all searching functionality if using some of the instructions SearchL, SearchC, or SearchExtJ in all involved program tasks with coordinated synchronized movements and generate search hit from same digital input signal. This will generate search hit synchronously in all search instructions. Any error recovery must also be the same in all involved program tasks.

While searching is active, it is not possible to store the current path with the instruction StorePath.

Repetition accuracy for search hit position with TCP speed 20-1,000 mm/s is 0.1-0.4 mm.

Typical stop distance using a search velocity of 50 mm/s:

- without TCP on path (switch \Stop) 1-3 mm
- with TCP on path (switch \SStop) 4-8 mm

Limitations for searching on a conveyor:

- a search will stop the robot when hit or if the search fails, so make the search in the same direction as the conveyor moves and continue after the search-stop with a move to a safe position. Use error handling to move to a safe position when search fails.
- the repetition accuracy for the search hit position will be poorer when searching on a conveyor and depends on the speed of the conveyor and how stable the speed is.

Syntax

SearchC

```
[ '\ ' Stop ', ' ] | [ '\ ' SStop ', ' ] | [ '\ ' Sup ', ' ]
[ Signal ':=' ] <variable (VAR) of signaldi>|
[ PersBool ':=' ] <persistent (PERS) of bool>
[ '\ ' Flanks ] |
[ '\ ' PosFlank ] |
[ '\ ' NegFlank ] |
[ '\ ' HighLevel ] |
[ '\ ' LowLevel ] ', '
[ SearchPoint ':=' ] <variable or persistent (INOUT) of
  robtarg>', '
[ CirPoint ':=' ] <expression (IN) of robtarg>', '
[ ToPoint ':=' ] <expression (IN) of robtarg>', '
[ '\ ' ID ':=' ] <expression (IN) of identno>', '
[ Speed ':=' ] <expression (IN) of speeddata>
[ '\ ' V ':=' ] <expression (IN) of num>|
```

Continues on next page

1 Instructions

1.216 SearchC - Searches circularly using the robot

RobotWare Base

Continued

```
['\ ' T ':=' <expression (IN) of num>'],'  
[Tool ':=' ] <persistent (PERS) of tooldata>  
['\ ' WObj ':=' <persistent (PERS) of wobjdata>  
['\ ' Corr ]  
['\ ' TLoad ':=' <persistent (PERS) of loaddata>'];'
```

Related information

For information about	See
Linear searches	SearchL - Searches linearly using the robot on page 655
Writes to a corrections entry	CorrWrite - Writes to a correction generator on page 176
Moves the robot circularly	MoveC - Moves the robot circularly on page 398
Circular movement	<i>Technical reference manual - RAPID Overview</i>
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Using error handlers	<i>Technical reference manual - RAPID Overview</i>
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayloadMode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>
<i>Path Corrections</i>	<i>Application manual - Controller software OmniCore</i>

1.217 SearchExtJ - Search with one or several mechanical units without TCP

Usage

SearchExtJ (*Search External Joints*) is used to search for an external axes position when moving only linear or rotating external axes. The external axes can belong to one or several mechanical units without TCP.

During the movement the robot supervises a digital input signal or a persistent variable. When the value of the signal or persistent variable changes to the requested one the robot immediately reads the current position.

This instruction can only be used if:

- The actual program task is defined as a Motion Task
- The task controls one or several mechanical units without TCP

When using search instructions it is important to configure the I/O system to have a very short time delay from setting the physical signal until the system gets the information about the setting (use I/O device with interrupt control, not poll control). How to do this can differ between fieldbuses. If using DeviceNet, the ABB units DSQC 651 (AD Combi I/O) and DSQC 652 (Digital I/O) will give a short time delay since they are using the connection type Change of State. If using other fieldbuses, ensure that the network is properly configured to get the correct conditions.

Basic examples

The following examples illustrate the instruction SearchExtJ:

See also [More examples on page 653](#).

Example 1

```
SearchExtJ di1, searchp, jpos10, vrot20;
```

The mec. unit with rotational axes is moved towards the position jpos10 at a speed of vrot20. When the value of the signal di1 changes to active, the position is stored in searchp.

Example 2

```
SearchExJ \Stop, di2, posx, jpos20, vlin50;
```

The mec. unit with linear axis is moved towards the position jpos20. When the value of the signal di2 changes to active, the position is stored in posx and the ongoing movement is stopped immediately.

Example 3

```
PERS bool mypers:=FALSE;
...
SearchExJ \Stop, di2, posx, jpos20, vlin50;
```

The mec. unit with linear axis is moved towards the position jpos20. When the value of the persistent variable mypers changes to TRUE, the position is stored in posx and the ongoing movement is stopped immediately.

Arguments

```
SearchExtJ [\Stop] | [\SStop] | [\Sup] Signal | PersBool [\Flanks]
| [\PosFlank] | [\NegFlank] | [\HighLevel] | [\LowLevel]
SearchJointPos ToJointPos [ID] [\UseEOffs] Speed [\T]
```

Continues on next page

1 Instructions

1.217 SearchExtJ - Search with one or several mechanical units without TCP

RobotWare Base

Continued

[\Stop]

Stiff Stop

Data type: switch

The robot movement is stopped as quickly as possible without keeping the TCP on the path when the value of the search signal changes to active or the persistent variable value changes to TRUE. The robot is moved a small distance before it stops and is not moved back to the searched position, i.e. to the position where the signal or persistent value changed.



WARNING

To stop the searching with stiff stop (switch \Stop) is only allowed if the TCP-speed is lower than 100 mm/s. At a stiff stop with higher speeds some axes can move in unpredictable direction.

[\SStop]

Soft Stop

Data type: switch

The robot movement is stopped as quickly as possible while keeping the TCP on the path (soft stop) when the value of the search signal changes to active or the persistent variable value changes to TRUE. The robot is moved only a small distance before it stops and is not moved back to the searched position, i.e. to the position where the signal changed.

[\Sup]

Supervision

Data type: switch

The search instruction is sensitive to signal activation or persistent variable value change during the complete movement (flying search), i.e. even after the first signal change or persistent variable change has been reported. If more than one match occurs during a search then a recoverable error is generated with the robot in the ToPoint.

If the arguments \Stop, \SStop, and \Sup are omitted (no switch used at all):

- The movement continues (flying search) to the position specified in the ToJointPos argument (same as with argument \Sup)
- An error is reported for one search hit but is not reported for more than one search hit (the first search hit is returned as the SearchJointPos)

Signal

Data type: signaldi

The name of the signal to supervise.

PersBool

Data type: bool

The persistent variable to supervise.

Continues on next page

[\Flanks]

Data type: switch

The positive and the negative edge of the signal is valid for a search hit. If using argument `PersBool` it is the value change of the variable that is valid for a search hit.

For signal: If the argument `\Flanks` is omitted, only the positive edge of the signal is valid for a search hit and a signal supervision will be activated at the beginning of a search process. This means that if the signal has the positive value already at the beginning of a search process, or the communication with the signal is lost then the movement is stopped as quickly as possible. A user recovery error `ERR_SIGSUPSEARCH` will be generated and can be handled in the error handler.

For persistent variable: If the argument `\Flanks` is omitted, it is only when the value change to `TRUE` that is a valid search hit and a variable supervision will be activated at the beginning of a search process. This means that if persistent variable has the positive value already at the beginning of a search process then the movement is stopped as quickly as possible. A user recovery error `ERR_PERSSUPSEARCH` will be generated and can be handled in the error handler.

[\PosFlank]

Data type: switch

The positive edge of the signal is valid for a search hit, or the change of the value to `TRUE` if using a persistent variable.

[\NegFlank]

Data type: switch

The negative edge of the signal is valid for a search hit, or the change of the value to `FALSE` if using a persistent variable.

[\HighLevel]

Data type: switch

The same functionality as if not using `\Flanks` switch.

For signal: The positive edge of the signal is valid for a search hit, and a signal supervision will be activated at the beginning of a search process. This means that if the signal has the positive value already at the beginning of a search process or the communication with the signal is lost then the movement is stopped as quickly as possible. A user recovery error `ERR_SIGSUPSEARCH` will be generated and can be handled in the error handler.

For persistent variable: Only the value change to `TRUE` is a valid search hit and a variable supervision will be activated at the beginning of a search process. This means that if persistent variable has the positive value already at the beginning of a search process then the movement is stopped as quickly as possible. A user recovery error `ERR_PERSSUPSEARCH` will be generated and can be handled in the error handler.

[\LowLevel]

Data type: switch

Continues on next page

1 Instructions

1.217 SearchExtJ - Search with one or several mechanical units without TCP

RobotWare Base

Continued

For signal: The negative edge of the signal is valid for a search hit, and a signal supervision will be activated at the beginning of a search process. This means that if the signal has value 0 already at the beginning of a search process or the communication with the signal is lost then the movement is stopped as quickly as possible. A user recovery error ERR_SIGSUPSEARCH will be generated and can be handled in the error handler.

For persistent variable: Only the value change to FALSE is a valid search hit and a variable supervision will be activated at the beginning of a search process. This means that if persistent variable has the value FALSE already at the beginning of a search process then the movement is stopped as quickly as possible. A user recovery error ERR_PERSSUPSEARCH will be generated and can be handled in the error handler.

SearchJointPos

Data type: jointtarget

The position of the external axes when the search signal has been triggered. The position takes any active ExtOffs into consideration.

ToJointPos

Data type: jointtarget

The destination point for the external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction). SearchExtJ always uses a stop point as zone data for the destination.

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in the MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

[\UseEOffs]

Use External Offset

Data type: switch

The offset for external axes, setup by instruction EOffsSet, is activated for SearchExtJ instruction when the argument UseEOffs is used. See instruction EOffsSet for more information about external offset.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the linear or rotating external axis.

[\T]

Time

Data type: num

Continues on next page

This argument is used to specify the total time in seconds during which the mechanical units move. It is then substituted for the corresponding speed data.

This argument is used to specify the total time in seconds during which the mechanical unit moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the mechanical unit cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

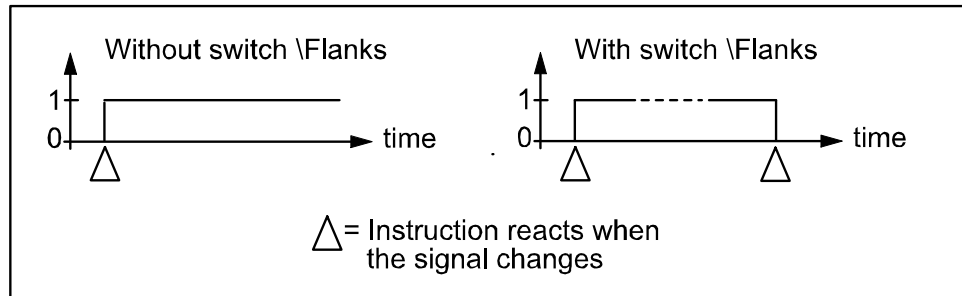
Program execution

See the instruction MoveExt J for information about movement of mechanical units without TCP.

The movement always ends with a stop point, i.e. the additional axes stop at the destination point. If a flying search is used, that is, the \Sup argument is specified or no switch is specified, the movement always continues to the programmed destination point. If a search is made using the switch \Stop or \SStop, the movement stops when the first search hit is detected.

The SearchExtJ instruction stores the position of the external axes when the value of the digital signal or persistent variable changes to the requested one, as illustrated in figure below.

The figure shows how flank-triggered signal detection is used (the position is only stored when the signal is changed the first time).



xx0500002243

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_WHLSEARCH	- No signal detection occurred. - More than one signal detection occurred – this occurs only if the \Sup argument is used.
ERR_SIGSUPSEARCH	The signal has already a positive value at the beginning of the search process or the communication with the signal is lost. This occurs only if the \Flanks argument is omitted.

Continues on next page

1 Instructions

1.217 SearchExtJ - Search with one or several mechanical units without TCP

RobotWare Base

Continued

Name	Cause of error
ERR_PERSSUPSEARCH	The persistent variable is already TRUE at the beginning of the search process. This occurs only if the \Flanks argument is omitted.

Errors can be handled in different ways depending on the selected running mode:

- **Continuous forward / Instruction forward / ERR_WHLSEARCH:** No position is returned and the movement always continues to the programmed destination point. The system variable ERRNO is set to ERR_WHLSEARCH and the error can be handled in the error handler of the routine.
- **Continuous forward / Instruction forward / ERR_SIGSUPSEARCH and ERR_PERSSUPSEARCH:** No position is returned and the movement always stops as quickly as possible at the beginning of the search path. The system variable ERRNO is set to ERR_SIGSUPSEARCH or ERR_PERSSUPSEARCH depending on used argument (signal or persistent variable), and the error can be handled in the error handler of the routine.
- **Instruction backward:** During backward execution the instruction carries out the movement without any supervision.

Example

```
VAR num fk;
...
MoveExtJ jpos10, vrot100, fine;
SearchExtJ \Stop, di1, sp, jpos20, vrot5;
...
ERROR
  IF ERRNO=ERR_WHLSEARCH THEN
    StorePath;
    MoveExtJ jpos10, vrot50, fine;
    RestoPath;
    ClearPath;
    StartMove;
    RETRY;
  ELSEIF ERRNO=ERR_SIGSUPSEARCH THEN
    TPWrite "The signal of the SearchExtJ instruction is already
      high!";
    TPReadFK fk,"Try again after manual reset of signal ?", "YES",
      stEmpty, stEmpty, stEmpty, "NO";
    IF fk = 1 THEN
      StorePath;
      MoveExtJ jpos10, vrot50, fine;
      RestoPath;
      ClearPath;
      StartMove;
      RETRY;
    ELSE
      Stop;
    ENDIF
  ENDIF
ENDIF
```

Continues on next page

1.217 SearchExtJ - Search with one or several mechanical units without TCP

RobotWare Base
Continued

If the signal is already active at the beginning of the search process or the communication with the signal is lost, a user dialog will be activated (TPReadFK . . . ;). Reset the signal and push YES on the user dialog and the mec. unit moves back to jpos10 and tries once more. Otherwise program execution will stop.

If the signal is passive at the beginning of the search process, the mec. unit searches from position jpos10 to jpos20. If no signal detection occurs, the robot moves back to jpos10 and tries once more.

More examples

More examples of how to use the instruction SearchExtJ are illustrated below.

Example 1

```
SearchExtJ \Sup, di1\Flanks, searchp, jpos10, vrot20;
```

The mec. unit is moved towards the position jpos10. When the value of the signal di1 changes to active or passive, the position is stored in searchp. If the value of the signal changes twice, the program generates an error after the search process is finished.

Example 2

```
SearchExtJ \Stop, di1, sp, jpos20, vlin50;
MoveExtJ sp, vlin50, fine \Inpos := inpos50;
```

A check on the signal di1 will be made at the beginning of the search process and if the signal already has a positive value or the communication with the signal is lost, the movement stops. Otherwise the mec. unit is moved towards the position jpos20. When the value of the signal di1 changes to active, the position is stored in sp. The mec. unit is moved back to this point using an accurately defined stop point.

Limitations

SearchExtJ cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Limitations for searching if coordinated synchronized movements:

- If using SearchL, SearchC, or SearchExtJ for one program task and some other move instruction in another program task, it is only possible to use flying search with switch \Sup. Besides that, it is only possible to do error recovery with TRYNEXT.
- It is possible to use all searching functions if using some of the instructions SearchL, SearchC or SearchExtJ in all involved program tasks with coordinated synchronized movements and generate search hits from the same digital input signal. This will generate search hits synchronously in all search instructions. Any error recovery must also be the same in all involved program tasks.
- While searching is active, it isn't possible to store current path with instruction StorePath.

Continues on next page

1 Instructions

1.217 SearchExtJ - Search with one or several mechanical units without TCP

RobotWare Base

Continued

Syntax

```
SearchExtJ
['\' Stop ',''] | ['\' SStop ',''] | ['\' Sup ','']
[Signal ':=' ] <variable (VAR) of signaldi> |
[PersBool ':=' ] <persistent (PERS) of bool>
['\' Flanks ] |
['\' PosFlank ] |
['\' NegFlank ] |
['\' HighLevel ] |
['\' LowLevel ','']
[SearchJointPos ':=' ] <variable or persistent (INOUT) of
jointtarget>','
[ToJointPos ':=' ] <expression (IN) of jointtarget >
['\' ID ':=' ] <expression (IN) of identno >'],'
['\' UseEOffs ','']
[Speed ':=' ] <expression (IN) of speeddata>
['\' T ':=' ] <expression (IN) of num> ]';'
```

Related information

For information about	See
Move mec. units without TCP	MoveExtJ - Move one or several mechanical units without TCP on page 427
Definition of jointtarget	jointtarget - Joint position data on page 1661
Definition of velocity	speeddata - Speed data on page 1729
Using error handlers	<i>Technical reference manual - RAPID Overview</i>
Motion in general	<i>Technical reference manual - RAPID Overview</i>

1.218 SearchL - Searches linearly using the robot

Usage

SearchL (*Search Linear*) is used to search for a position when moving the tool center point (TCP) linearly.

During the movement the robot supervises a digital input signal or a persistent variable. When the value of the signal or persistent variable changes to the requested one the robot immediately reads the current position.

This instruction can typically be used when the tool held by the robot is a probe for surface detection. Using the SearchL instruction the outline coordinates of a work object can be obtained.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

When using search instructions it is important to configure the I/O system to have a very short time from setting the physical signal to the system to getting the information regarding the setting (use I/O device with interrupt control, not poll control). How to do this can differ between fieldbuses. If using DeviceNet the ABB units (local I/O) will give short times since they are using connection type *Change of State*. If using other fieldbuses ensure that you configure the network in a proper way to get right conditions.

Basic examples

The following examples illustrate the instruction SearchL:

See also [More examples on page 662](#).

Example 1

```
SearchL di1, sp, p10, v100, probe;
```

The TCP of the probe is moved linearly towards the position p10 at a speed of v100. When the value of the signal di1 changes to active the position is stored in sp.

Example 2

```
SearchL \Stop, di2, sp, p10, v100, probe;
```

The TCP of the probe is moved linearly towards the position p10. When the value of the signal di2 changes to active the position is stored in sp and the robot stops immediately.

Example 3

```
PERS bool mypers:=FALSE;
...
SearchL mypers, sp, p10, v100, probe;
```

The TCP of the probe is moved linearly towards the position p10 at a speed of v100. When the value of the persistent variable mypers changes to TRUE the position is stored in sp.

Continues on next page

1 Instructions

1.218 SearchL - Searches linearly using the robot

RobotWare Base

Continued

Arguments

```
SearchL [\Stop] | [\SStop] | [\Sup] Signal | PersBool [\Flanks] |  
        [\PosFlank] | [\NegFlank] | [\HighLevel] | [\LowLevel]  
SearchPoint ToPoint [\ID] Speed [\V] | [\T] Tool [\WObj]  
[\Corr] [\TLoad]
```

[\Stop]

Stiff Stop

Data type: switch

The robot movement is stopped as quickly as possible without keeping the TCP on the path when the value of the search signal changes to active or the persistent variable value changes to TRUE. The robot is moved a small distance before it stops and is not moved back to the searched position, i.e. to the position where the signal or persistent value changed.

Test first with a slow speed, for example <100 mm/s, and then gradually increase the speed to the desired value.



WARNING

Stopping the search with a stiff stop (switch \Stop) is only allowed if the TCP-speed is lower than 100 mm/s. A stiff stop at higher speed can cause some axes to move in unpredictable directions.



Note

For a YuMi robot, the maximum speed for searching with stiff stop is 1000 mm/s.

[\SStop]

Soft Stop

Data type: switch

The robot movement is stopped as quickly as possible while keeping the TCP on the path (soft stop) when the value of the search signal changes to active or the persistent variable value changes to TRUE. The robot is moved only a small distance before it stops and is not moved back to the searched position, i.e. to the position where the signal changed.

[\Sup]

Supervision

Data type: switch

The search instruction is sensitive to signal activation or persistent variable value change during the complete movement (flying search), i.e. even after the first signal change or persistent variable change has been reported. If more than one match occurs during a search then a recoverable error is generated with the robot in the ToPoint.

If the arguments \Stop, \SStop, and \Sup are omitted (no switch used at all):

- the movement continues (flying search) to the position specified in the ToPoint argument (same as with argument \Sup)

Continues on next page

- error is reported for none search hit but is not reported for more than one search hit (first search hit is returned as the SearchPoint)

Signal

Data type: signal di

The name of the signal to supervise.

PersBool

Data type: bool

The persistent variable to supervise.

[\Flanks]

Data type: switch

The positive and the negative edge of the signal is valid for a search hit. If using argument PersBool it is the value change of the variable that is valid for a search hit.

For signal: If the argument \Flanks is omitted, only the positive edge of the signal is valid for a search hit and a signal supervision will be activated at the beginning of a search process. This means that if the signal has the positive value already at the beginning of a search process, or the communication with the signal is lost then the robot movement is stopped as quickly as possible, while keeping the TCP on the path (soft stop). A user recovery error ERR_SIGSUPSEARCH will be generated and can be handled in the error handler.

For persistent variable: If the argument \Flanks is omitted, it is only when the value change to TRUE that is a valid search hit and a variable supervision will be activated at the beginning of a search process. This means that if persistent variable has the positive value already at the beginning of a search process then the robot movement is stopped as quickly as possible, while keeping the TCP on the path (soft stop). A user recovery error ERR_PERSSUPSEARCH will be generated and can be handled in the error handler.

[\PosFlank]

Data type: switch

The positive edge of the signal is valid for a search hit, or the change of the value to TRUE if using a persistent variable.

[\NegFlank]

Data type: switch

The negative edge of the signal is valid for a search hit, or the change of the value to FALSE if using a persistent variable.

[\HighLevel]

Data type: switch

The same functionality as if not using \Flanks switch.

For signal: The positive edge of the signal is valid for a search hit, and a signal supervision will be activated at the beginning of a search process. This means that if the signal has the positive value already at the beginning of a search process or the communication with the signal is lost then the robot movement is stopped as

Continues on next page

1 Instructions

1.218 SearchL - Searches linearly using the robot

RobotWare Base

Continued

quickly as possible, while keeping the TCP on the path (soft stop). A user recovery error ERR_SIGSUPSEARCH will be generated and can be handled in the error handler.

For persistent variable: Only the value change to TRUE is a valid search hit and a variable supervision will be activated at the beginning of a search process. This means that if persistent variable has the positive value already at the beginning of a search process then the robot movement is stopped as quickly as possible, while keeping the TCP on the path (soft stop). A user recovery error ERR_PERSSUPSEARCH will be generated and can be handled in the error handler.

[\LowLevel]

Data type: switch

For signal: The negative edge of the signal is valid for a search hit, and a signal supervision will be activated at the beginning of a search process. This means that if the signal has value 0 already at the beginning of a search process or the communication with the signal is lost then the robot movement is stopped as quickly as possible, while keeping the TCP on the path (soft stop). A user recovery error ERR_SIGSUPSEARCH will be generated and can be handled in the error handler.

For persistent variable: Only the value change to FALSE is a valid search hit and a variable supervision will be activated at the beginning of a search process. This means that if persistent variable has the value FALSE already at the beginning of a search process then the robot movement is stopped as quickly as possible, while keeping the TCP on the path (soft stop). A user recovery error ERR_PERSSUPSEARCH will be generated and can be handled in the error handler.

SearchPoint

Data type: robtarget

The position of the TCP and external axes when the search signal has been triggered. The position is specified in the outermost coordinate system taking the specified tool, work object, and active ProgDisp/ExtOffs coordinate system into consideration.

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction). SearchL always uses a stop point as zone data for the destination.

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in the MultiMove systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

Continues on next page

The speed data that applies to movements. Speed data defines the velocity of the tool center point, the external axes, and the tool reorientation.

[\V]

Velocity

Data type: num

This argument is used to specify the velocity of the TCP in mm/s directly in the instruction. It is then substituted for the corresponding velocity specified in the speed data.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination position.

[\WObj]

Work Object

Data type: wobjdata

The work object (coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if so then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used then this argument must be specified for a linear movement relative to the work object to be performed.

[\Corr]

Correction

Data type: switch

Correction data written to a corrections entry by the instruction `CorrWrite` will be added to the path and destination position if this argument is present.

The RobotWare option *Path Corrections* is required when using this argument.

[\TLoad]

Total load

Data type: loaddata

Continues on next page

1 Instructions

1.218 SearchL - Searches linearly using the robot

RobotWare Base

Continued

The `\TLoad` argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the `\TLoad` argument is used, then the `loaddata` in the current `tooldata` is not considered.

If the `\TLoad` argument is set to `load0`, then the `\TLoad` argument is not considered and the `loaddata` in the current `tooldata` is used instead.

To be able to use the `\TLoad` argument it is necessary to set the value of the system parameter `ModalPayloadMode` to 0. If `ModalPayloadMode` is set to 0, it is no longer possible to use the instruction `GripLoad`.

The total load can be identified with the service routine `LoadIdentify`. If the system parameter `ModalPayloadMode` is set to 0, the operator has the possibility to copy the `loaddata` from the tool to an existing or new `loaddata` persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input `SimMode` (Simulated Mode). If the digital input signal is set to 1, the `loaddata` in the optional argument `\TLoad` is not considered, and the `loaddata` in the current `tooldata` is used instead.



Note

The default functionality to handle payload is to use the instruction `GripLoad`. Therefore the default value of the system parameter `ModalPayloadMode` is 1.

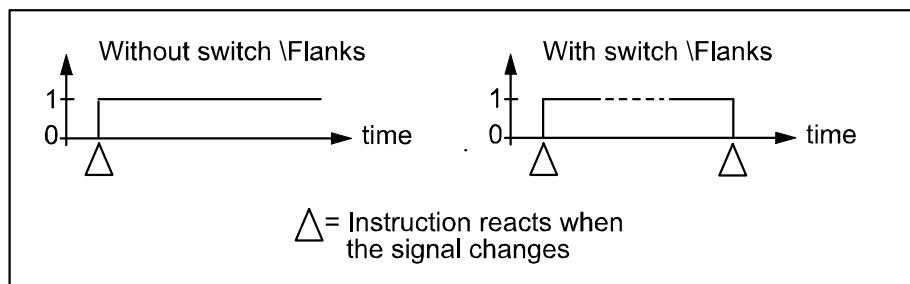
Program execution

See the instruction `MoveL` for information about linear movement.

The movement always ends with a stop point, i.e. the robot stops at the destination point. If a flying search is used, i.e. the `\Sup` argument is specified or none switch at all is specified, then the robot movement always continues to the programmed destination point. If a search is made using the switch `\Stop` or `\SStop` the robot movement stops when the first search hit is detected.

The `SearchL` instruction stores the position of the TCP when the value of the digital signal or persistent variable changes to the requested one, as illustrated in figure below.

The figure shows how flank-triggered signal detection is used (the position is stored when the signal is changed the first time only).



xx0500002243

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_WHLSEARCH	- No signal detection occurred. - More than one signal detection occurred – this occurs only if the \Sup argument is used.
ERR_SIGSUPSEARCH	The signal has already a positive value at the beginning of the search process or the communication with the signal is lost. This occurs only if the \Flanks argument is omitted.
ERR_PERSSUPSEARCH	The persistent variable is already TRUE at the beginning of the search process. This occurs only if the \Flanks argument is omitted.

Errors can be handled in different ways depending on the selected running mode:

- **Continuous forward / Instruction forward / ERR_WHLSEARCH:** No position is returned and the movement always continues to the programmed destination point. The system variable ERRNO is set to ERR_WHLSEARCH and the error can be handled in the error handler of the routine.
- **Continuous forward / Instruction forward / ERR_SIGSUPSEARCH and ERR_PERSSUPSEARCH:** No position is returned and the movement always stops as quickly as possible at the beginning of the search path. The system variable ERRNO is set to ERR_SIGSUPSEARCH or ERR_PERSSUPSEARCH depending on used argument (signal or persistent variable), and the error can be handled in the error handler of the routine.
- **Instruction backward:** During backward execution the instruction carries out the movement without any supervision.

Example

```

VAR num fk;
...
MoveL p10, v100, fine, tool1;
SearchL \Stop, di1, sp, p20, v100, tool1;
...
ERROR
  IF ERRNO=ERR_WHLSEARCH THEN
    StorePath;
    MoveL p10, v100, fine, tool1;
    RestoPath;
    ClearPath;
    StartMove;
    RETRY;
  ELSEIF ERRNO=ERR_SIGSUPSEARCH THEN
    TPWrite "The signal of the SearchL instruction is already
            high!";

```

Continues on next page

1 Instructions

1.218 SearchL - Searches linearly using the robot

RobotWare Base

Continued

```
TPReadFK fk,"Try again after manual reset of signal ?", "YES",
stEmpty, stEmpty, stEmpty, "NO";
IF fk = 1 THEN
  StorePath;
  MoveL p10, v100, fine, tool1;
  RestoPath;
  ClearPath;
  StartMove;
  RETRY;
ELSE
  Stop;
ENDIF
ENDIF
```

If the signal is already active at the beginning of the search process or the communication with the signal is lost then a user dialog will be activated (TPReadFK . . . ;). Reset the signal and push YES on the user dialog, and the robot moves back to p10 and tries once more. Otherwise program execution will stop.

If the signal is passive at the beginning of the search process then the robot searches from position p10 to p20. If no signal detection occurs then the robot moves back to p10 and tries once more.

More examples

More examples of how to use the instruction SearchL are illustrated below.

Example 1

```
SearchL \Sup, di1 \Flanks, sp, p10, v100, probe;
```

The TCP of the probe is moved linearly towards the position p10. When the value of the signal di1 changes to active or passive the position is stored in sp. If the value of the signal changes twice then the program generates an error after the search process is finished.

Example 2

```
SearchL \Stop, di1, sp, p10, v100, tool1;
MoveL sp, v100, fine \Inpos := inpos50, tool1;
PDispOn *, tool1;
MoveL p100, v100, z10, tool1;
MoveL p110, v100, z10, tool1;
MoveL p120, v100, z10, tool1;
PDispOff;
```

At the beginning of the search process, a check on the signal di1 will be done and if the signal already has a positive value or the communication with the signal is lost, the robot stops. Otherwise the TCP of tool1 is moved linearly towards the position p10. When the value of the signal di1 changes to active, the position is stored in sp. The robot is moved back to this point using an accurately defined stop point. Using program displacement, the robot then moves relative to the searched position, sp.

Example 3

```
PERS bool MyTrigger:=FALSE;
...
```

Continues on next page

```

SearchL \Stop, MyTrigger, sp, p10, v100, tool1;
MoveL sp, v100, fine \Inpos := inpos50, tool1;
PDispOn *, tool1;
MoveL p100, v100, z10, tool1;
MoveL p110, v100, z10, tool1;
MoveL p120, v100, z10, tool1;
PDispOff;

```

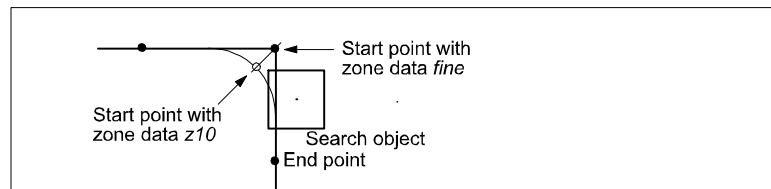
At the beginning of the search process, a check on the persistent variable `MyTrigger` will be done and if the variable already is `TRUE`, the robot stops. Otherwise the TCP of `tool1` is moved linearly towards the position `p10`. When the value of the persistent variable `MyTrigger` changes to `TRUE`, the position is stored in `sp`. The robot is moved back to this point using an accurately defined stop point. Using program displacement, the robot then moves relative to the searched position, `sp`.

Limitations

`SearchL` cannot be executed in an `UNDO` handler or `RAPID` routine connected to any of the following special system events: `PowerOn`, `Stop`, `QStop`, `Restart`, `Reset` or `Step`.

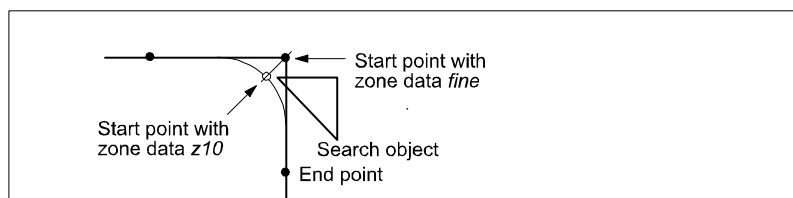
Zone data for the positioning instruction that precedes `SearchL` must be used carefully. The start of the search, i.e. when the I/O signal is ready to react, is not, in this case, the programmed destination point of the previous positioning instruction but a point along the real robot path. The figures below illustrate examples of things that may go wrong when zone data other than `fine` is used.

The following figure shows that a match is made on the wrong side of the object because the wrong zone data was used.



xx0500002244

The following figure shows that no match was detected because the wrong zone data was used.



xx0500002245

The following figure shows that no match was detected because the wrong zone data was used.

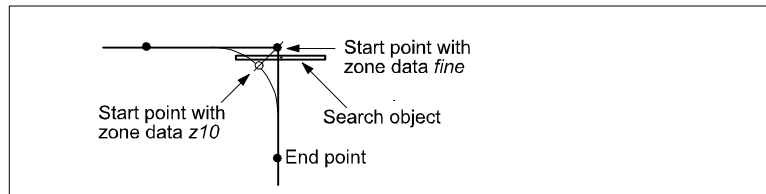
Continues on next page

1 Instructions

1.218 SearchL - Searches linearly using the robot

RobotWare Base

Continued



xx0500002246

Limitations for searching if coordinated synchronized movements:

- If using SearchL, SearchC, or SearchExtJ for one program task and some other move instruction in other program task, it is only possible to use flying search with switch \Sup. Besides that, it is only possible to do error recovery with TRYNEXT.
- It is possible to use all searching functionality if using some of the instructions SearchL, SearchC, or SearchExtJ in all involved program tasks with coordinated synchronized movements and generate search hit from same digital input signal. This will generate search hit synchronously in all search instructions. Any error recovery must also be the same in all involved program tasks.

While searching is active, it is not possible to store the current path with the instruction StorePath.

Repetition accuracy for search hit position with TCP speed 20-1,000 mm/s is 0.1-0.4 mm.

Typical stop distance using a search velocity of 50 mm/s:

- without TCP on path (switch \Stop) 1-3 mm
- with TCP on path (switch \SStop) 4-8 mm

Limitations for searching on a conveyor:

- a search will stop the robot when hit or if the search fails, so make the search in the same direction as the conveyor moves and continue after the search-stop with a move to a safe position. Use error handling to move to a safe position when search fails.
- the repetition accuracy for the search hit position will be poorer when searching on a conveyor and depends on the speed of the conveyor and how stable the speed is.

Syntax

```
SearchL
['\ Stop ',''] | ['\ SStop ',''] | ['\ Sup ','']
[Signal ':=' ] <variable (VAR) of signaldi> |
[PersBool ':=' ] <persistent (PERS) of bool>
['\ Flanks'] |
['\ PosFlank'] |
['\ NegFlank'] |
['\ HighLevel'] |
['\ LowLevel'] ','
[SearchPoint ':=' ] <variable or persistent (INOUT) of
  robtarg>','
```

Continues on next page

```
[ToPoint ':='] <expression (IN) of robtarget>
['\ ' ID ':='] <expression (IN) of identno>]', '
[Speed ':='] <expression (IN) of speeddata>
['\ ' V ':='] <expression (IN) of num> ] |
['\ ' T ':='] <expression (IN) of num> ]', '
[Tool ':='] <persistent (PERS) of tooldata>
['\ ' WObj ':='] <persistent (PERS) of wobjdata> ]
['\ ' Corr ]
['\ ' TLoad ':='] <persistent (PERS) of loaddata> ]';'
```

Related information

For information about	See
Circular searches	SearchC - Searches circularly using the robot on page 637
Writes to a corrections entry	CorrWrite - Writes to a correction generator on page 176
Moves the robot linearly	MoveL - Moves the robot linearly on page 457
Linear movement	<i>Technical reference manual - RAPID Overview</i>
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Using error handlers	<i>Technical reference manual - RAPID Overview</i>
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayLoad-Mode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>
<i>Path Corrections</i>	<i>Application manual - Controller software OmniCore</i>

1 Instructions

1.219 SenDevice - connect to a sensor device

Sensor Interface

1.219 SenDevice - connect to a sensor device

Usage

SenDevice is used to connect to a sensor device connected to the sensor interface.

The sensor interface communicates with sensors via I/O devices.

Configuration example

This is an example of a sensor channel configuration.

These parameters belong to the type *Transmission Protocol* in the topic *Communication*.

Name	Type	Remote Address	Remote Port
sen1:	SOCKDEV	192.168.125.101	6344

Basic examples

The following example illustrates the instruction SenDevice:

Example 1

```
! Define variable numbers
CONST num SensorOn := 6;
CONST num XCoord := 8;
CONST num YCoord := 9;
CONST num ZCoord := 10;
VAR pos SensorPos;
! Connect to the sensor device" sen1:" (defined in sio.cfg).
SenDevice "sen1:";
! Request start of sensor measurements
WriteVar "sen1:", SensorOn, 1;
! Read a cartesian position from the sensor.
SensorPos.x := ReadVar "sen1:", XCoord;
SensorPos.y := ReadVar "sen1:", YCoord;
SensorPos.z := ReadVar "sen1:", ZCoord;
! Stop sensor
WriteVar "sen1:", SensorOn, 0;
```

Arguments

SenDevice device

device

Data type: string

The I/O device name configured in sio.cfg for the sensor used.

Syntax

```
ReadBlock
[device ':='] <expression(IN) of string>', '
[BlockNo ':='] <expression (IN) of num>', '
[FileName ':='] <expression (IN) of string>;'
```

Continues on next page

Related information

For information about	See
Write a sensor variable	WriteVar - Write variable on page 1082
Read a sensor variable	ReadVar - Read variable from a device on page 1426
Configuration of sensor communication	<i>Technical reference manual - System parameters</i>

1 Instructions

1.220 Set - Sets a digital output signal
RobotWare Base

1.220 Set - Sets a digital output signal

Usage

Set is used to set the value of a digital output signal to one.

Basic examples

The following examples illustrate the instruction Set:

Example 1

```
Set do15;
```

The signal do15 is set to 1.

Example 2

```
Set weldon;
```

The signal weldon is set to 1.

Arguments

Set Signal

Signal

Data type: signaldo

The name of the signal to be set to one.

Program execution

There is a short delay before the signal physically gets its new value. If you do not want the program execution to continue until the signal has got its new value then you can use the instruction SetDO with the optional parameter \Sync.

The true value depends on the configuration of the signal. If the signal is inverted in the system parameters then this instruction causes the physical channel to be set to zero.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Syntax

```
Set  
[ Signal '[:=' ] < variable (VAR) of signaldo > ';' ]
```

Continues on next page

Related information

For information about	See
Setting a digital output signal to zero	Reset - Resets a digital output signal on page 590
Change the value of a digital output signal	SetDO - Changes the value of a digital output signal on page 682
Input/Output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

1 Instructions

1.221 SetAllDataVal - Set a value to all data objects in a defined set

RobotWare Base

1.221 SetAllDataVal - Set a value to all data objects in a defined set

Usage

SetAllDataVal(*Set All Data Value*) makes it possible to set a new value to all data objects of a certain type that match the given grammar.

Basic examples

The following example illustrates the instruction SetAllDataVal:

```
VAR mydata mydata0:=0;  
...  
SetAllDataVal "mydata"\TypeMod:="mytypes"\Hidden, mydata0;
```

This will set all data objects of data type mydata in the system to the same value that the variable mydata0 has (in the example to 0). The user defined data type mydata is defined in the module mytypes.

Arguments

SetAllDataVal Type [\TypeMod] [\Object] [\Hidden] Value

Type

Data type: string

The type name of the data objects to be set.

[\TypeMod]

Type Module

Data type: string

The module name where the data type is defined, if using user defined data types. Argument TypeMod cannot be used for data in modules installed as -Shared or -Installed. The module name is not available for those data.

See *Technical reference manual - System parameters*, topic *Controller*, type *Automatic Loading of Modules*.

[\Object]

Data type: string

The default behavior is to set all data objects of the data type above but this option makes it possible to name one or several objects with a regular expression. See also the instruction SetDataSearch.

[\Hidden]

Data type: switch

This also matches data objects that are in routines (routine data or parameters) hidden by some routine in the call chain.

Value

Data type: anytype

This argument holds the new value to be set. The data type must be the same as the data type for the object to be set.

Continues on next page

Program execution

The instruction will fail if the specification for Type or TypeMod is wrong.

If the matching data object is an array then all elements of the array will be set to the specified value.

If the matching data object is read-only data then the value will not be changed.

If the system does not have any matching data objects then the instruction will accept it and return successfully.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_SYMBOL_TYPE	The data object and the variable used in argument Value is of different types. If using ALIAS datatypes, you will also get this ERROR, even though the types might have the same base data type.

Limitations

For a semivalue data type it is not possible to search for the associated value data type. For example, if searching for dionum then there are no search results for signal signaldi and if searching for num then there are no search results for signals signalgi or signalai.

It is not possible to set a value to a variable declared as LOCAL in a built-in RAPID module.

Syntax

```
SetAllDataVal
[Type ':='] <expression (IN) of string>
['\''TypeMod ':='<expression (IN) of string>]
['\''Object ':='<expression (IN) of string>]
['\''Hidden ] ', '
[Value ':='] <variable (VAR) of anytype>;'
```

Related information

For information about	See
Define a symbol set in a search session	SetDataSearch - Define the symbol set in a search sequence on page 674
Get next matching symbol	GetNextSym - Get next matching symbol on page 1277
Get the value of a data object	GetDataVal - Get the value of a data object on page 225
Set the value of a data object	SetDataVal - Set the value of a data object on page 679
The related data type datapos	datapos - Enclosing block for a data object on page 1627
Advanced RAPID	Application manual - Controller software OmniCore

1 Instructions

1.222 SetAO - Changes the value of an analog output signal *RobotWare Base*

1.222 SetAO - Changes the value of an analog output signal

Usage

SetAO is used to change the value of an analog output signal.

Basic examples

The following example illustrates the instruction SetAO:

See also [More examples on page 673](#).

Example 1

```
SetAO ao2, 5.5;
```

The signal ao2 is set to 5.5.

Arguments

SetAO Signal Value

Signal

Data type: signalao

The name of the analog output signal to be changed.

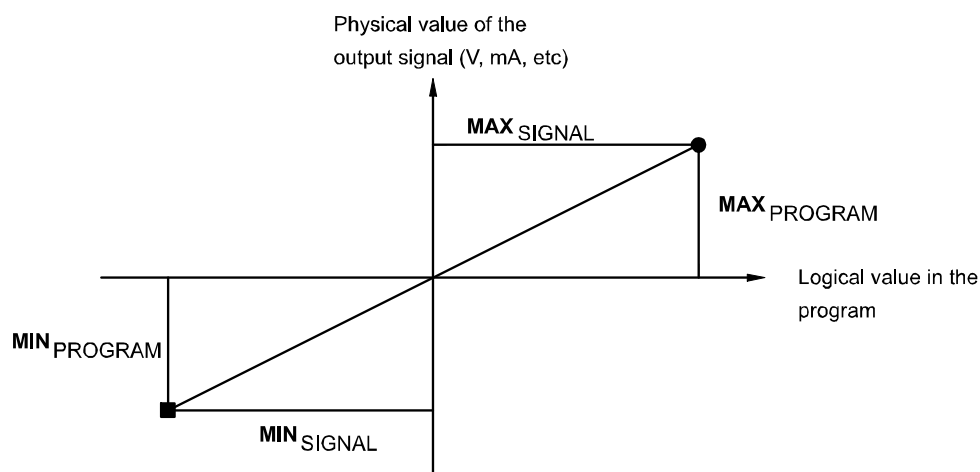
Value

Data type: num

The desired value of the signal.

Program execution

The programmed value is scaled (in accordance with the system parameters) before it is sent on the physical channel. A diagram of how analog signal values are scaled is shown in the figure below.



xx0500002408

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_AO_LIM	The programmed <code>Value</code> argument for the specified analog output signal <code>Signal</code> is outside limits.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

More examples

More examples of the instruction `SetAO` are illustrated below.

Example 1

```
SetAO weldcurr, curr_outp;
```

The signal `weldcurr` is set to the same value as the current value of the variable `curr_outp`.

Syntax

```
SetAO
[ Signal ':' = ' ] < variable (VAR) of signalao > ', '
[ Value ':' = ' ] < expression (IN) of num > ';'

```

Related information

For information about	See
Input/Output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

1 Instructions

1.223 SetDataSearch - Define the symbol set in a search sequence

RobotWare Base

1.223 SetDataSearch - Define the symbol set in a search sequence

Usage

SetDataSearch is used together with function GetNextSym to retrieve data objects from the system.

Basic examples

The following examples illustrate the instruction SetDataSearch:

Example 1

```
VAR datapos block;  
VAR string name;  
...  
SetDataSearch "robtargt"\InTask;  
WHILE GetNextSym(name,block \Recursive) DO  
...  

```

This session will find all objects for a robtargt in the task.

Example 2

```
RECORD testrecord  
  num value1;  
  num value2;  
ENDRECORD  
  
VAR datapos block;  
VAR string name;  
VAR testrecord mydata1:= [1,2];  
VAR testrecord mydata2:= [3,4];  
...  
SetDataSearch "testrecord" \TypeMod:="MYMODULE" \InTask;  
WHILE GetNextSym(name,block \Recursive) DO  
...  

```

The data type testrecord is a user defined data type, and defined in the module named MYMODULE. This session will find all objects for a testrecord in the task.

Arguments

```
SetDataSearch Type [\TypeMod] [\Object] [\PersSym]  
              [\VarSym][\ConstSym] [\InTask] | [\InMod]  
              [\InRout][\GlobalSym] | [\LocalSym]
```

Type

Data type: string

The data type name of the data objects to be retrieved.

[\TypeMod]]

Type Module

Data type: string

The module name where the data type is defined, if using user defined data types.

Continues on next page

Argument TypeMode cannot be used for data in modules installed as -Shared or -Installed. The module name is not available for those data.

See *Technical reference manual - System parameters*, topic *Controller*, type *Automatic Loading of Modules*.

[\Object]

Data type: string

The default behavior is to set all data objects of the data type above but this option makes it possible to name one or several objects with a regular expression.

A regular expression is a powerful mechanism to specify a grammar to match the data object names. The string can consist of either ordinary characters and meta characters. A meta character is a special operator used to represent one or more ordinary characters in the string with the purpose to extend the search. It is possible to see if a string matches a specified pattern as a whole or search within a string for a substring matching a specified pattern.

Within a regular expression all alphanumeric characters match themselves. That is to say that the pattern "abc" will only match a data object named "abc". To match all data object names containing the character sequence "abc" it is necessary to add some meta characters. The regular expression for this is ".*abc.*".

The available meta character set is shown below.

Expression	Meaning
.	Any single character.
[s]	Any single character in the non-empty set s, where s is a sequence of characters. Ranges may be specified as c-c.
[^s]	Any single character not in the set s.
r*	Zero or more occurrences of the regular expression r.
r+	One or more occurrences of the regular expression r.
r?	Zero or one occurrence of the regular expression r.
(r)	The regular expression r. Used for separate that regular expression from another.
r r'	The regular expressions r or r'.
.*	Any character sequence (zero, one, or several characters).

The default behavior is to accept any symbols but if one or several of following PersSym, VarSym, or ConstSym is specified then only symbols that match the specification are accepted.

[\PersSym]

Persistent Symbols

Data type: switch

Accept persistent variable (PERS) symbols.

[\VarSym]

Variable Symbols

Data type: switch

Continues on next page

1 Instructions

1.223 SetDataSearch - Define the symbol set in a search sequence

RobotWare Base

Continued

Accept variable (VAR) symbols.

[\ConstSym]

Constant Symbols

Data type: switch

Accept constant (CONST) symbols.

If not one of the flags \InTask or \InMod are specified then the search is started at system level. The system level is the root to all other symbol definitions in the symbol tree. At the system level all build- in symbols are located plus the handle to the task level. At the task level all loaded global symbols are located plus the handle to the modules level.

If the \Recursive flag is set in GetNextSym then the search session will enter all loaded modules and routines below the system level.

[\InTask]

In Task

Data type: switch

Start the search at the task level. At the task level all loaded global symbols are located plus the handle to the modules level.

If the \Recursive flag is set in GetNextSym then the search session will enter all loaded modules and routines below the task level.

[\InMod]

In Module

Data type: string

Start the search at the specified module level. At the module level all loaded global and local symbols declared in the specified module are located plus the handle to the routines level.

If the \Recursive flag is set in GetNextSym then the search session will enter all loaded routines below the specified module level (declared in the specified module).

[\InRout]

In Routine

Data type: string

Search only at the specified routine level.

The module name for the routine must be specified in the argument \InMod .

The default behavior is to match both local and global module symbols, but if one of following \GlobalSym or \LocalSym is specified then only symbols that match the specification are accepted.

[\GlobalSym]

Global Symbols

Data type: switch

Skip local module symbols.

Continues on next page

[\LocalSym]

Local Symbols

Data type: switch

Skip global module symbols.

Program execution

The instruction will fail if the specification for one of Type, TypeMod, InMod, or InRout is wrong.

If the system does not have any matching objects the instruction will accept it and return successfully but the first GetNextSym will return FALSE.

Limitations

Array data objects cannot be defined in the symbol search set and cannot be found in a search sequence.

For a semivalue data type it is not possible to search for the associated value data type. For example, if searching for dionum then there are no search results for signal signaldi and if searching for num then there are no search results for signals signalgi or signalai.

Installed built-in symbols declared as LOCAL will never be found, irrespective of use of argument \GlobalSym, \LocalSym or none of these.

Installed built-in symbols declared as global or as TASK will always be found, irrespective of use of argument \GlobalSym, \LocalSym or none of these.

It is not possible to use SetDataSearch for searching for data of some ALIAS data type defined with RAPID code. No limitation for predefined ALIAS data type.

Syntax

```
SetDataSearch
[Type ':='] <expression (IN) of string>
['\TypeMod ':='<expression (IN) of string>]
['\Object ':='<expression (IN) of string>]
['\PersSym]
['\VarSym]
['\ConstSym]
['\InTask]
|['\InMod' :=<expression (IN) of string>]
|['\InRout' :=<expression (IN) of string>]
|['\GlobalSym]
|['\LocalSym'];'
```

Related information

For information about	See
Get next matching symbol	GetNextSym - Get next matching symbol on page 1277
Get the value of a data object	GetDataVal - Get the value of a data object on page 225
Set the value of many data objects	SetAllDataVal - Set a value to all data objects in a defined set on page 670

Continues on next page

1 Instructions

1.223 SetDataSearch - Define the symbol set in a search sequence

RobotWare Base

Continued

For information about	See
The related data type datapos	datapos - Enclosing block for a data object on page 1627
<i>Advanced RAPID</i>	<i>Application manual - Controller software OmniCore</i>

1.224 SetDataVal - Set the value of a data object

Usage

SetDataVal (*Set Data Value*) makes it possible to set a value for a data object that is specified with a string variable.

Basic examples

The following examples illustrate the instruction SetDataVal:

Example 1

```
VAR datapos block;
VAR bool truevar:=TRUE;
...
SetDataSearch "bool" \Object:="my.*" \InMod:="mymod"\LocalSym;
WHILE GetNextSym(name,block) DO
    SetDataVal name\Block:=block,truevar;
ENDWHILE
```

This session will set all local bool that begin with my in the module mymod to TRUE.

Example 2

```
VAR string StringArrVar_copy{2};
...
StringArrVar_copy{1} := "test1";
StringArrVar_copy{2} := "test2";
SetDataVal "StringArrVar", StringArrVar_copy;
```

This session will set the array StringArrVar to contain the two strings test1 and test2.

Arguments

SetDataVal Object [\Block][\TaskRef][\TaskName] Value

Object

Data type: string

The name of the data object.

[\Block]

Data type: datapos

The enclosed block to the data object. This can only be fetched with the GetNextSym function.

If this argument is omitted then the value of the visible data object in the current program execution scope will be set.

[\TaskRef]

Task Reference

Data type: taskId

The program task identity in which to search for the data object specified. When using this argument, you may search for PERS or TASKPERS declarations in other tasks, any other declarations will result in an error.

Continues on next page

1 Instructions

1.224 SetDataVal - Set the value of a data object

RobotWare Base

Continued

For all program tasks in the system the predefined variables of the data type `taskId` will be available. The variable identity will be "taskname"+"Id", e.g. for the `T_ROB1` task the variable identity will be `T_ROB1Id`.

`[\TaskName]`

Data type: `string`

The program task name in which to search for the data object specified. When using this argument, you may search for `PERS` or `TASKPERS` declarations in other tasks, any other declarations will result in an error.

Value

Data type: `anytype`

Variable which holds the new value to be set. The data type must be the same as the data type for the data object to be set. The set value must be fetched from a variable but can be stored in a variable or persistent.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_SYM_ACCESS</code>	• The data object is non-existent. • The data object is read-only data. • The data object is routine data or routine parameter and not located in the current active routine. • Searching in other tasks for other declarations than <code>PERS</code> or <code>TASKPERS</code>.ⁱ
<code>ERR_INVDIM</code>	The data object and the variable used in argument <code>Value</code> have different dimensions
<code>ERR_SYMBOL_TYPE</code>	The data object and the variable used in argument <code>Value</code> is of different types. If using <code>ALIAS</code> datatypes, you will also get this <code>ERROR</code> , even though the types might have the same base data type.
<code>ERR_TASKNAME</code>	The program task name in argument <code>\TaskName</code> cannot be found in the system.

ⁱ When using the arguments `TaskRef` or `TaskName` you may search for `PERS` or `TASKPERS` declarations in other tasks, any other declarations will result in an error.
Searching for a `PERS` declared as `LOCAL` in other tasks will also result in an error.

Limitations

For a semivalue data type it is not possible to search for the associated value data type. E.g. if searching for `dionum` then no search hit for signal `signalIdi` will be obtained and if searching for `num` then no search hit for signals `signalgi` or `signalai` will be obtained.

It is not possible to set a value to a variable declared as `LOCAL` in a built-in `RAPID` module.

Syntax

```
SetDataVal  
[ Object ':= ' ] < expression (IN) of string >
```

Continues on next page

1.224 SetDataVal - Set the value of a data object

*RobotWare Base**Continued*

```
[ '\Block' := '<variable (VAR) of datapos>'
|[ '\TaskRef' := ' <variable (VAR) of taskid>'
|[ '\TaskName' := ' <expression (IN) of string>' ', ' ]
[ Value := ' ] <variable (VAR) of anytype>'];'
```

Related information

For information about	See
Define a symbol set in a search session	SetDataSearch - Define the symbol set in a search sequence on page 674
Get next matching symbol	GetNextSym - Get next matching symbol on page 1277
Get the value of a data object	GetDataVal - Get the value of a data object on page 225
Set the value of many data objects	SetAllDataVal - Set a value to all data objects in a defined set on page 670
The related data type datapos	datapos - Enclosing block for a data object on page 1627
<i>Advanced RAPID</i>	<i>Application manual - Controller software Omni-Core</i>

1 Instructions

1.225 SetDO - Changes the value of a digital output signal

RobotWare Base

1.225 SetDO - Changes the value of a digital output signal

Usage

SetDO is used to change the value of a digital output signal, with or without a time delay.

Basic examples

The following examples illustrate the instruction SetDO.

Example 1

```
SetDO do15, 1;
```

The signal do15 is set to 1.

Example 2

```
SetDO weld, off;
```

The signal weld is set to off

.

Example 3

```
SetDO \SDelay := 0.2, weld, high;
```

The signal weld is set to high with a delay of 0.2 s. The program execution continues with the next instruction.

Arguments

SetDO [\SDelay] Signal Value

[\SDelay]

Signal Delay

Data type: num

Delays the change for the amount of time given in seconds (max. 2000s). Program execution continues directly with the next instruction. After the given time delay the signal is changed without the rest of the program execution being affected.

Signal

Data type: signaldo

The name of the signal to be changed.

Value

Data type: dionum

The desired value of the signal 0 or 1.

Specified Value	Set digital output to
0	0
Any value except 0	1

Program execution

The true value depends on the configuration of the signal. If the signal is inverted in the system parameters then the value of the physical channel is the opposite.

Continues on next page

1.225 SetDO - Changes the value of a digital output signal

RobotWare Base

Continued

If the argument \SDeLay is not used then the signal will be set as fast as possible, and the next instruction will be executed at once without waiting for the signal to be physically set.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_ARGVALERR	The value for the SDeLay argument exceeds the maximum value allowed (2000 s).
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Limitations

If a SetDO with a \SDeLay argument is followed by a new SetDO on the same signal, with or without \SDeLay argument, then the first SetDO will be cancelled if the second SetDO is executed before the delay time of the first SetDO have expired.

Syntax

```
SetDO
  ['\ ' SDeLay ' := ' <expression (IN) of num> ', ' ]
  [Signal ' := ' ] <variable (VAR) of signaldo> ', '
  [Value ' := ' ] <expression (IN) of dionum> ', ' ]
```

Related information

For information about	See
Input/Output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

1 Instructions

1.226 SetGO - Changes the value of a group of digital output signals

RobotWare Base

1.226 SetGO - Changes the value of a group of digital output signals

Usage

SetGO is used to change the value of a group of digital output signals with or without a time delay.

Basic examples

The following examples illustrate the instruction SetGO:

Example 1

```
SetGO go2, 12;
```

The signal go2 is set to 12. If go2 comprises 4 signals, e.g. outputs 6-9, then outputs 6 and 7 are set to zero while outputs 8 and 9 are set to one.

Example 2

```
SetGO \SDelay := 0.4, go2, 10;
```

The signal go2 is set to 10. If go2 comprises 4 signals, e.g. outputs 6-9, then outputs 6 and 8 are set to zero while outputs 7 and 9 are set to one with a delay of 0.4 s. The program execution continues with the next instruction.

Example 3

```
SetGO go32, 4294967295;
```

The signal go32 is set to 4294967295. go32 comprises 32 signals, which are all set to one.

Arguments

```
SetGO [ \SDelay ] Signal Value | Dvalue
```

[\SDelay]

Signal Delay

Data type: num

Delays the change for the period of time stated in seconds (max. 2000s). Program execution continues directly with the next instruction. After the specified time delay the value of the signals is changed without the rest of the program execution being affected.

If the argument is omitted then the signal values are changed directly.

Signal

Data type: signalgo

The name of the signal group to be changed.

Value

Data type: num

The desired value of the signal group (a positive integer) is shown in the table below.

The permitted value is dependent on the number of signals in the group. A num datatype can hold the value for a group of 23 signals or less.

Continues on next page

1.226 SetGO - Changes the value of a group of digital output signals

RobotWare Base

Continued

Dvalue

Data type: dnum

The desired value of the signal group (a positive integer) is shown in the table below.

The permitted value is dependent on the number of signals in the group. A dnum datatype can hold the value for a group of 32 signals or less.

No. of signals	Permitted Value	Permitted Dvalue
1	0-1	0-1
2	0-3	0-3
3	0-7	0-7
4	0-15	0-15
5	0-31	0-31
6	0-63	0-63
7	0-127	0-127
8	0-255	0-255
9	0-511	0-511
10	0-1023	0-1023
11	0-2047	0-2047
12	0-4095	0-4095
13	0-8191	0-8191
14	0-16383	0-16383
15	0-32767	0-32767
16	0-65535	0-65535
17	0-131071	0-131071
18	0-262143	0-262143
19	0-524287	0-524287
20	0-1048575	0-1048575
21	0-2097151	0-2097151
22	0-4194303	0-4194303
23	0-8388607	0-8388607
24	*	0-16777215
25	*	0-33554431
26	*	0-67108863
27	*	0-134217727
28	*	0-268435455
29	*	0-536870911
30	*	0-1073741823
31	*	0-2147483647
32	*	0-4294967295

Continues on next page

1 Instructions

1.226 SetGO - Changes the value of a group of digital output signals

RobotWare Base

Continued

*) The Value argument of type num can only hold up to 23 signals compared to the Dvalue argument of type dnum that can hold up to 32 signals.

Program execution

The programmed value is converted to an unsigned binary number. This binary number is sent on the signal group with the result that individual signals in the group are set to 0 or 1. Because of internal delays the value of the signal may be undefined for a short period of time.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_ARGVALERR	The value for the SDelay argument exceeds the maximum value allowed (2000 s).
ERR_GO_LIM	The programmed Value or Dvalue argument for the specified digital group output signal Signal is outside limits.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Limitations

Maximum number of signals that can be used for a group is 23 if argument Value is used and 32 if argument Dvalue is used. This limitation is valid for all instructions and functions using group signals.

Syntax

```
SetGO
[ '\ ' SDelay ':' < expression (IN) of num > ', ' ]
[ Signal ':' < variable (VAR) of signalgo > ', '
[ Value ':' < expression (IN) of num >
| [ Dvalue ':' < expression (IN) of dnum > ';' ]
```

Related information

For information about	See
Other input/output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O (system parameters)	<i>Technical reference manual - System parameters</i>

1.227 SetLeadThrough - Activate and deactivate lead-through *LeadThrough*

1.227 SetLeadThrough - Activate and deactivate lead-through

Usage

SetLeadThrough is used to activate and deactivate lead-through for a TCP robot.

Basic examples

The following examples illustrates the instruction SetLeadThrough.

Example 1

```
SetLeadThrough \On;
```

Activates lead-through for the TCP robot ROB_L if executed in the T_ROB_L RAPID task. By default a StopMove instruction is ordered when lead-through is activated.

Example 2

```
SetLeadThrough \Off;
```

Deactivates lead-through for the TCP robot ROB_L if executed in the T_ROB_L RAPID task. By default a ClearPath instruction and a StartMove instruction is also executed.

Example 3

```
SetLeadThrough \On \NoStopMove;
..
StopMove;
..
SetLeadThrough \Off \NoStartMove \NoClearPath;
..
StartMove;
```

Set lead-through for the TCP robot. The lead-through will not be activated until a StopMove instruction has been executed or the program execution has been stopped. The deactivation of the lead-through is done and later on the movement is restarted.

Arguments

```
SetLeadThrough [\On] | [\Off] [\NoStopMove] | [\NoStartMove]
[\NoClearPath]
```

[\On]

Data type: switch
Activate lead-through.

[\Off]

Data type: switch
Deactivate lead-through.

[\NoStopMove]

Data type: switch
Can only be used together with the \On switch.

Continues on next page

1 Instructions

1.227 SetLeadThrough - Activate and deactivate lead-through

LeadThrough

Continued

If using `\NoStopMove` switch, no `StopMove` order will be executed. Lead-through has been set, but not activated. Lead-through is activated when the program execution is stopped or when a `StopMove` instruction is executed.

`[\NoStartMove]`

Data type: switch

Can only be used together with the `\Off` switch.

If this switch is used, the restart of the movement of the TCP robot will not be ordered. A `StartMove` instruction is needed to resume the movement.

`[\NoClearPath]`

Data type: switch

Can only be used together with the `\Off` switch.

The path is not cleared when deactivating lead-through, and the TCP robot will continue on the programmed path when the `StartMove` order is executed.

Program execution

Lead-through status is set if the argument `\On` (or no argument) is used, but not activated until a `StopMove` instruction has been executed or the program execution is stopped.

By default a `StopMove` instruction is executed when lead-through is activated with `SetLeadThrough \On`. A `ClearPath` instruction and a `StartMove` instruction is executed when lead-through is deactivated if not using `\NoClearPath` or `\NoStartMove` switches.

If the `SetLeadThrough` instruction is executed from a non-motion task, the lead-through activation will be done for the TCP robot in the connected motion task. The `StartMove` order must be done from the same task as the `StopMove` order.

The activation of lead-through is valid until a `SetLeadThrough \Off` instruction is executed.

The default value (no lead-through) is automatically set:

- when using the restart mode **Reset RAPID**.
- when loading a new program or a new module.
- when starting program execution from the beginning.
- when moving the program pointer to main.
- when moving the program pointer to a routine.
- when moving the program pointer in such a way that the execution order is lost.
- when going to motors off.

Continues on next page

1.227 SetLeadThrough - Activate and deactivate lead-through

LeadThrough
Continued

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_PATHDIST	The robot is too far from the path (more than 10 mm or 20 degrees) to perform a restart of the interrupted movement. Move the robot closer to the path before attempting RETRY.
ERR_STARTMOVE	The robot is in hold state when executing a <code>SetLeadThrough \Off</code> . Wait some time before attempting RETRY.
ERR_PROGSTOP	The robot is in program stop state when executing a <code>SetLeadThrough \Off</code> . Wait some time before attempting RETRY.
ERR_ALRDY_MOVING	The robot is already moving when executing a <code>SetLeadThrough \Off</code> . Wait some time before attempting RETRY.

Limitations

- Only one of several non-motion tasks is allowed at the same time to do `SetLeadThrough` against the same motion task.
- `SetLeadThrough` only works for TCP robots.

The instruction `SetLeadThrough` can only be used for YuMi and GoFa robots.

Syntax

```
SetLeadThrough
  ['\'On] | ['\'Off]
  ['\'NoStopMove] | ['\'NoStartMove]
  ['\'NoClearPath] ';'

```

Related information

For information about	See
Check lead-through status	IsLeadThrough - Check lead-through status on page 1328
Stopping movements	StopMove - Stops robot movement on page 792
Continuing a movement	StartMove - Restarts robot movement on page 763
Continuing a movement	StartMoveRetry - Restarts robot movement and execution on page 766
More examples	ClearPath - Clear current path on page 136

1 Instructions

1.228 SetSysData - Set system data *RobotWare Base*

1.228 SetSysData - Set system data

Usage

SetSysData activates the specified system data name for the specified data type. With this instruction it is possible to change the current active Tool, Work Object, PayLoad or Total Load for the robot in actual or connected motion task.

Basic examples

The following example illustrates the instruction SetSysData:

Example 1

```
SetSysData tool5;  
The tool tool5 is activated.  
SetSysData tool0 \ObjectName := "tool6";  
The tool tool6 is activated.  
SetSysData anytool \ObjectName := "tool2";  
The tool tool2 is activated.
```

Arguments

```
SetSysData SourceObject [\ObjectName]
```

SourceObject

Data type:anytype

Persistent variable that should be active as current system data.

The data type of this argument also specifies the type of system data to be activated for the robot in actual or connected motion task.

Data type	Type of system data
tooldata	Tool
wobjdata	Work Object
loaddata	Payload/Total Load

Entire array or record component cannot be used.

[\ObjectName]

Data type:string

If this optional argument is specified then it specifies the name of the data object to be active (overrides name specified in argument SourceObject). The data type of the data object to be active is always fetched from the argument SourceObject.

Program execution

The current active system data object for the Tool, Work Object, PayLoad or Total Load is set according to the arguments.

Note that this instruction only activates a new data object (or the same as before) and never changes the value of any data object.

Continues on next page

Syntax

```
SetSysData
[ SourceObject:=' ] < persistent(PERS) of anytype>
[ '\ObjectName:=' < expression (IN) of string> ] ';'

```

Related information

For information about	See
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of payload	loaddata - Load data on page 1664
Get system data	GetSysData - Get system data on page 232
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
System parameter <i>ModalPayloadMode</i> for activating and deactivating payload. (Topic Controller, Type General RAPID, Action values, <i>ModalPayloadMode</i>)	Technical reference manual - System parameters
<i>Advanced RAPID</i>	Application manual - Controller software Omni-Core

1 Instructions

1.229 SetupCyclicBool - Setup a Cyclic bool condition *RobotWare Base*

1.229 SetupCyclicBool - Setup a Cyclic bool condition

Usage

SetupCyclicBool is used to set up a logical condition that cyclically will be evaluated and assigned to a persistent boolean variable, a *Cyclic bool*.

Basic examples

The following example illustrates the instruction SetupCyclicBool.

See also [More examples on page 693](#).

Example 1

```
PERS bool cyclicflag1;

PROC main()
  SetupCyclicBool cyclicflag1, di1=1 AND do2=1;
  ...
```

Sets up a cyclic evaluation of the logical condition `di1=1 AND do2=1` and assigns the result to the persistent boolean variable `cyclicflag1`.

Arguments

SetupCyclicBool Flag Cond [`\Signal`]

Flag

Data type: `bool`

The persistent boolean variable that stores the value of the logical condition.

Cond

Data type: `bool`

The logical expression that should be evaluated cyclically.

The expression can consist of:

- Constants or persistent variables of the types `bool`, `num` and `dnum` (and alias of `bool`, `num` and `dnum`).
- Global digital input and output signals.
- Operands: 'NOT' 'AND' 'OR' 'XOR' '=' '(' ')' '

[`\Signal`]

Data type: `signaldo`

The result of the logical condition is written to the digital output signal used in the optional argument `Signal` when the expression is updated. It is not recommended to use the resultant signal as a part of the condition for a cyclic bool.



Note

Do not change the signal value from RAPID, for example, with `SetDO`. Then it can have another value than the expression that it should reflect.

Continues on next page

Program execution

With this instruction it is possible to setup more complex conditions and use the cyclic flag instead to see if the condition is met or not.

The cyclic evaluation of the logical condition and the assignment to the persistent boolean variable is done every 12 ms.

The behavior of the Cyclic bool functionality can be configured. For more information see *Application manual - Controller software OmniCore* and *Technical reference manual - System parameters*.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with the instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed (only valid for ICI field bus).

More examples

More examples of the instruction SetupCyclicBool are illustrated below.

Example 1

```

ALIAS bool aliasBool;
PERS bool cyclicflag1;
TASK PERS aliasBool cyclicflag2:=FALSE;
PERS aliasBool flag1:=FALSE;
TASK PERS aliasBool flag2:=FALSE;
CONST num HIGH:=1;
CONST num LOW:=0;

PROC main()
  SetupCyclicBool cyclicflag1, (di1=HIGH AND di2=HIGH AND di3=LOW)
    OR flag1=TRUE;
  SetupCyclicBool cyclicflag2, di4=HIGH AND flag2=TRUE;
  ...
  WaitUntil cyclicflag1=TRUE;
  IF cyclicflag2 = TRUE THEN
    MoveL p1, v1000, z30, tool2;
  ELSE
    MoveL p2, v1000, z30, tool2;
  ENDIF
  ...

```

The example above sets up cyclic evaluation of 2 expressions. The execution waits until cyclicflag1 is set. cyclicflag2 decides to which position the robot should move.

Continues on next page

1 Instructions

1.229 SetupCyclicBool - Setup a Cyclic bool condition

RobotWare Base

Continued

Example 2

```
!This condition is wrong:  
SetupCyclicBool m1, 5;
```

```
!This condition is correct:  
SetupCyclicBool m1, myNum = 5;
```

The first condition is not correct since the value 5 is not a boolean. The second condition is correct since the comparison can be evaluated as a boolean condition, i.e. TRUE or FALSE.

Limitations

- The expression must be evaluated to a boolean value TRUE or FALSE. All parts of the expression must also be evaluated to a boolean value TRUE or FALSE.
- Any PERS num or dnum, CONST num or dnum or literal num or dnum used in a condition must be of integer type. If using any decimal value this will cause a fatal error.

Syntax

```
SetupCyclicBool  
[Flag ':='] <persistent (PERS) of bool>', '  
[Cond ':='] <expression (IN) of bool>  
['\ ' Signal ':=' <variable (VAR) of signaldo>'];'
```

Related information

For information about	See
Check if a persistent variable is a Cyclic bool	IsCyclicBool - Checks if a persistent variable is a Cyclic bool on page 1321
Remove a Cyclic bool condition	RemoveCyclicBool - Remove a Cyclic bool condition on page 583
Remove all Cyclic bool conditions	RemoveAllCyclicBool - Remove all Cyclic bool conditions on page 581
Cyclically evaluated logical conditions, Cyclic bool	<i>Application manual - Controller software Omni-Core</i>
Configuring Cyclic bool	<i>Technical reference manual - System parameters</i>

1.230 SimCollision - Simulate a collision

Usage

`SimCollision` is used to simulate a collision. The instruction can be valuable when testing error handling for collisions.

Basic examples

The following example illustrates the instruction `SimCollision`.

Example 1

```
SimCollision;  
Simulate a motion collision to test error handling.
```

Program execution

Execution of `SimCollision` will simulate a motion collision. The instruction can be valuable when testing error handling for motion collisions and should only be used for testing purposes. The instruction will generate an event log 41910, *Collision simulated with instruction SimCollision*, when used.

Syntax

```
SimCollision';'
```

Related information

For information about	See
Settings for if error handling should be executed or not	<i>Technical reference manual - System parameters</i> , topic <i>Controller</i> , type <i>General RAPID</i> , <i>Collision-ErrorHandling</i>
<i>Collision Detection</i>	<i>Application manual - Controller software Omni-Core</i>

1 Instructions

1.231 SingArea - Defines interpolation around singular points *RobotWare Base*

1.231 SingArea - Defines interpolation around singular points

Usage

SingArea is used to define how the robot is to move in the proximity of singular points.

SingArea is also used to define linear and circular interpolation for robots with less than six axes, and a six-axes robot can be programmed to run with axis 4 locked to 0 or ± 180 degrees.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following examples illustrate the instruction SingArea:

Example 1

```
SingArea \Wrist;
```

The orientation of the tool may be changed slightly to pass a singular point (axes 4 and 6 in line).

Robots with less than six axes may not be able to reach an interpolated tool orientation. By using SingArea \Wrist the robot can achieve the movement but the orientation of the tool will be slightly changed.

Example 2

```
SingArea \LockAxis4;
```

A six-axis robot can be programmed to run with axis 4 locked to 0 or ± 180 degrees to avoid singularity problems when axis 5 is close to 0.

The programmed position is reached with axis 4 locked to 0 or ± 180 degrees. If the position was not programmed with axis 4 at 0 or ± 180 degrees, it is now reached with a different tool orientation.

If the starting position of axis 4 deviates more than 2 degrees from the locked position, then the first movement will behave as if SingArea was called with the argument \Wrist.

Example 3

```
SingArea \Off;
```

The tool orientation is not allowed to differ from the programmed orientation. If a singular point is passed then one or more axes may perform a sweeping movement resulting in a reduction in TCP velocity.

Robots with less than six axes may not be able to reach a programmed tool orientation. As a result the robot will stop.

Arguments

```
SingArea [\Wrist] | [\LockAxis4] | [\Off]
```

[\Wrist]

Data type: switch

Continues on next page

The tool orientation is allowed to differ somewhat to avoid wrist singularity. Used when axes 4 and 6 are parallel (axis 5 at 0 degrees). Also used for linear and circular interpolation of robots with less than six axes where the tool orientation is allowed to differ.

`[\LockAxis4]`

Data type: switch

The programmed position is reached with axis 4 locked to 0 or ± 180 degrees. If the position was not programmed with axis 4 at 0 or ± 180 degrees, it is now reached with a different tool orientation.

If the starting position of axis 4 deviates more than 2 degrees from the locked position, then the first movement will behave as if SingArea was called with the argument `\Wrist`.

`[\Off]`

Data type: switch

The tool orientation is not allowed to differ. Used when no singular points are passed or when the orientation is not permitted to be changed.

If none of the arguments are specified the system will be set to `\Off`.

Program execution

The specified interpolation applies for the next executed movement instruction until a new SingArea instruction is executed.

If the argument `\Wrist` is specified then the orientation is joint-interpolated to avoid singular points. In this way the TCP follows the correct path, but the orientation of the tool deviates somewhat. This will also happen when a singular point is not passed.

If the argument `\LockAxis4` is specified, then axis 4 is locked to 0 or ± 180 degrees to avoid singular points. The TCP will in general follow the correct path, but the orientation of the tool will deviate if the position was not programmed with axis 4 at 0 or ± 180 degrees. For paths with large reorientations, the TCP may deviate from the programmed linear path.

The movement is only affected on execution of linear or circular interpolation.

By default, program execution automatically uses the `Off` argument for robots with six axes. Robots with less than six axes may use either the `Off` argument or the `/Wrist` argument by default. This is automatically set in event routine SYS_RESET.

The default value is automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to `main`
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Continues on next page

1 Instructions

1.231 SingArea - Defines interpolation around singular points

RobotWare Base

Continued

Syntax

```
SingArea  
[ '\ ' Wrist ] | [ '\ ' LockAxis4 ] | [ '\ ' Off ] ';' 
```

Related information

For information about	See
Singularity	<i>Technical reference manual - RAPID Overview</i>
Interpolation	<i>Technical reference manual - RAPID Overview</i>
Motion settings data	motsetdata - Motion settings data on page 1674

1.232 SkipWarn - Skip the latest warning

Usage

SkipWarn(*Skip Warning*) is used to skip the latest generated warning message to be stored in the Event Log during execution in running mode continuously or cycle (no warnings skipped in FWD or BWD step).

With SkipWarn it is possible to repeatedly do error recovery in RAPID without filling the Event Log with only warning messages.

Basic examples

The following example illustrates the instruction SkipWarn:

Example 1

```
%"notexistingproc"%;  
nextinstruction;  
ERROR  
IF ERRNO = ERR_REFUNKPRC THEN  
  SkipWarn;  
  TRYNEXT;  
ENDIF  
ENDPROC
```

The program will execute the nextinstruction and no warning message will be stored in the Event Log.

Syntax

```
SkipWarn ';;'
```

Related information

For information about	See
Error recovery	<i>Technical reference manual - RAPID Overview</i> <i>Technical reference manual - RAPID Overview</i>
Error number	errnum - Error number on page 1634

1 Instructions

1.233 SocketAccept - Accept an incoming connection *RobotWare Base*

1.233 SocketAccept - Accept an incoming connection

Usage

SocketAccept is used to accept incoming connection requests. SocketAccept can only be used for server applications.

The ports in the controller's firewall must be opened, see the type *Firewall Manager* in *Technical reference manual - System parameters*.

Basic examples

The following example illustrates the instruction SocketAccept:

See also [More examples on page 701](#).

Example 1

```
VAR socketdev server_socket;  
VAR socketdev client_socket;  
...  
SocketCreate server_socket;  
SocketBind server_socket, "192.168.0.1", 1025;  
SocketListen server_socket;  
SocketAccept server_socket, client_socket;
```

A server socket is created and bound to port 1025 on the controller network address 192.168.0.1. After execution of SocketListen the server socket starts to listen for incoming connections on this port and address. SocketAccept waits for any incoming connections, accepts the connection request, and returns a client socket for the established connection.

Arguments

SocketAccept Socket ClientSocket [\ClientAddress] [\Time]

Socket

Data type: socketdev

The server socket that are waiting for incoming connections. The socket must already be created, bounded, and ready for listening.

ClientSocket

Data type: socketdev

The returned new client socket that will be updated with the accepted incoming connection request.

[\ClientAddress]

Data type: string

The variable that will be updated with the IP-address of the accepted incoming connection request.

[\Time]

Data type: num

The maximum amount of time [s] that program execution waits for incoming connections. If this time runs out before any incoming connection then the error

Continues on next page

handler will be called, if there is one, with the error code ERR_SOCKET_TIMEOUT. If there is no error handler then the execution will be stopped.

If parameter \Time is not used then the waiting time is 60 s. To wait forever, use the predefined constant WAIT_MAX.

Program execution

The server socket will wait for any incoming connection requests. When accepting the incoming connection request the instruction is ready and the returned client socket is by default connected and can be used in SocketSend and SocketReceive instructions.



Tip

The firewall must allow socket messaging, see *Technical reference manual - System parameters*.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_SOCKET_CLOSED	The socket is closed (has been closed or is not created). Use SocketCreate to create a new socket.
ERR_SOCKET_EXEC_LEVEL	Use of socket instructions on different RAPID execution levels at the same time, that is, normal execution level and TRAP level.
ERR_SOCKET_TIMEOUT	The connection was not established within the time out time
ERR_SOCKET_UNSPEC	Unspecified exception from underlying call to the operating system.

More examples

More examples of the instruction SocketAccept are illustrated below.

Example 1

```

VAR socketdev server_socket;
VAR socketdev client_socket;
VAR string receive_string;
VAR string client_ip;
...
SocketCreate server_socket;
SocketBind server_socket, "192.168.0.1", 1025;
SocketListen server_socket;
WHILE TRUE DO
  SocketAccept server_socket, client_socket
    \ClientAddress:=client_ip;
  SocketReceive client_socket \Str := receive_string;
  SocketSend client_socket \Str := "Hello client with ip-address
    " +client_ip;
  ! Wait for client acknowledge

```

Continues on next page

1 Instructions

1.233 SocketAccept - Accept an incoming connection

RobotWare Base

Continued

```
...
SocketClose client_socket;
ENDWHILE
ERROR
RETRY;
UNDO
SocketClose server_socket;
SocketClose client_socket;
```

A server socket is created and bound to port 1025 on the controller network address 192.168.0.1. After execution of SocketListen the server socket starts to listen for incoming connections on this port and address. SocketAccept will accept the incoming connection from some client and store the client address in the string client_ip. Then the server receives a string message from the client and stores the message in receive_string. Then the server responds with the message "Hello client with ip-address xxx.xxx.x.x" and closes the client connection.

After that the server is ready for a connection from the same or some other client in the WHILE loop. If PP is moved to main in the program then all open sockets are closed (SocketClose can always be done even if the socket is not created).

Syntax

```
SocketAccept
[Socket ':'='] <variable (VAR) of socketdev>','
[ClientSocket ':'='] <variable (VAR) of socketdev>
['\' ClientAddress ':'='] <variable (VAR) of string>]
['\' Time ':'='] <expression (IN) of num>]';'
```

Related information

For information about	See
Socket communication in general	<i>Application manual - Controller software Omni-Core</i> , section <i>Socket Messaging</i>
Create a new socket	SocketCreate - Create a new socket on page 712
Connect to remote computer (only client)	SocketConnect - Connect to a remote computer on page 709
Send data to remote computer	SocketSend - Send data to remote computer on page 728
Receive data from remote computer	SocketReceive - Receive data from remote computer on page 717
Close the socket	SocketClose - Close a socket on page 707
Bind a socket (only server)	SocketBind - Bind a socket to my IP-address and port on page 704
Listening connections (only server)	SocketListen - Listen for incoming connections on page 715
Get current socket state	SocketGetStatus - Get current socket state on page 1451
Example client socket application	SocketSend - Send data to remote computer on page 728

Continues on next page

1.233 SocketAccept - Accept an incoming connection

RobotWare Base

Continued

For information about	See
Example of server socket application	SocketReceive - Receive data from remote computer on page 717
Firewall settings	<i>Technical reference manual - System parameters</i>

1 Instructions

1.234 SocketBind - Bind a socket to my IP-address and port

RobotWare Base

1.234 SocketBind - Bind a socket to my IP-address and port

Usage

SocketBind is used to bind a socket to the specified server IP-address and port number. SocketBind can only be used for server applications.

The ports in the controller's firewall must be opened, see the type *Firewall Manager* in *Technical reference manual - System parameters*.

Basic examples

The following example illustrates the instruction SocketBind:

Example 1

```
VAR socketdev server_socket;  
  
SocketCreate server_socket;  
SocketBind server_socket, "192.168.0.1", 1025;
```

A server socket is created and bound to port 1025 on the controller network address 192.168.0.1. The server socket can now be used in an SocketListen instruction to listen for incoming connections on this port and address.

Arguments

SocketBind Socket LocalAddress LocalPort

Socket

Data type: socketdev

The server socket to bind. The socket must be created but not already bound.

LocalAddress

Data type: string

The server network address to bind the socket to. The only valid addresses are any public WAN addresses or the controller service port address 192.168.125.1.

LocalPort

Data type: num

The server port number to bind the socket to. Generally ports 1025-4999 are free to use.

Program execution

The server socket is bound to the specified server port and IP-address.

An error is generated if the specified port is already in use.

Use the SocketBind and SocketListen instructions in the startup of the program to associate a local address with a socket and then listen for incoming connections on the specified port. This is recommended to do only once for each socket and port that is used (TCP/IP).

Use the SocketBind instruction if receiving data with SocketReceiveFrom (UDP/IP).

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_SOCKET_ADDR_INVALID	The specified address is invalid.
ERR_SOCKET_ADDR_INUSE	The address and port is already in use and cannot be used again. Use a different port number.
ERR_SOCKET_EXEC_LEVEL	Use of socket instructions on different RAPID execution levels at the same time, that is, normal execution level and TRAP level.
ERR_SOCKET_IS_BOUND	The socket has already been bound to an address and cannot be bound again.
ERR_SOCKET_CLOSED	The socket is closed (has been closed or is not created) Use SocketCreate to create a new socket.
ERR_SOCKET_UNSPEC	Unspecified exception from underlying call to the operating system.

Syntax

```
SocketBind
  [Socket ':='] <variable (VAR) of socketdev>', '
  [LocalAddress ':='] <expression (IN) of string>', '
  [LocalPort ':='] <expression (IN) of num>';'
```

Related information

For information about	See
Socket communication in general	<i>Application manual - Controller software Omni-Core</i>
Create a new socket	SocketCreate - Create a new socket on page 712
Connect to remote computer (only client)	SocketConnect - Connect to a remote computer on page 709
Send data to remote computer	SocketSend - Send data to remote computer on page 728
Receive data from remote computer	SocketReceive - Receive data from remote computer on page 717
Close the socket	SocketClose - Close a socket on page 707
Listening connections (only server)	SocketListen - Listen for incoming connections on page 715
Accept connections (only server)	SocketAccept - Accept an incoming connection on page 700
Get current socket state	SocketGetStatus - Get current socket state on page 1451
Example client socket application	SocketSend - Send data to remote computer on page 728
Example server socket application	SocketReceive - Receive data from remote computer on page 717

Continues on next page

1 Instructions

1.234 SocketBind - Bind a socket to my IP-address and port

RobotWare Base

Continued

For information about	See
Receive data from remote computer	SocketReceiveFrom - Receive data from remote computer on page 723

1.235 SocketClose - Close a socket

Usage

SocketClose is used when a socket connection is no longer going to be used.
After a socket has been closed it cannot be used in any socket call except SocketCreate.

Basic examples

The following example illustrates the instruction SocketClose:

Example 1

```
SocketClose socket1;
```

The socket is closed and cannot be used anymore.

Arguments

SocketClose Socket

Socket

Data type: socketdev
The socket to be closed.

Program execution

The socket will be closed and its allocated resources will be released.
Any socket can be closed at any time. The socket cannot be used after closing. It can be reused for a new connection after a call to SocketCreate.

Limitations

Closing the socket connection immediately after sending the data with SocketSend can lead to loss of sent data. This is because TCP/IP socket has built-in functionality to resend the data if there is some communication problem.

To avoid such problems with loss of data, do the following before SocketClose:

- handshake the shutdown or
- WaitTime 2

Avoid fast loops with SocketCreate ... SocketClose, because the socket is not really closed until a certain time (TCP/IP functionality).

Syntax

```
SocketClose  
[Socket ':='] <variable (VAR) of socketdev>;'
```

Related information

For information about	See
Socket communication in general	<i>Application manual - Controller software Omni-Core</i> , section <i>Socket Messaging</i>
Create a new socket	SocketCreate - Create a new socket on page 712

Continues on next page

1 Instructions

1.235 SocketClose - Close a socket

RobotWare Base

Continued

For information about	See
Connect to a remote computer (only client)	SocketConnect - Connect to a remote computer on page 709
Send data to remote computer	SocketSend - Send data to remote computer on page 728
Receive data from remote computer	SocketReceive - Receive data from remote computer on page 717
Bind a socket (only server)	SocketBind - Bind a socket to my IP-address and port on page 704
Listening connections (only server)	SocketListen - Listen for incoming connections on page 715
Accept connections (only server)	SocketAccept - Accept an incoming connection on page 700
Get current socket state	SocketGetStatus - Get current socket state on page 1451
Example client socket application	SocketSend - Send data to remote computer on page 728
Send data to remote computer	SocketSendTo - Send data to remote computer on page 733
Example server socket application	SocketReceive - Receive data from remote computer on page 717
Receive data from remote computer	SocketReceiveFrom - Receive data from remote computer on page 723

1.236 SocketConnect - Connect to a remote computer

Usage

SocketConnect is used to connect the socket to a remote computer in a client application.

Basic examples

The following example illustrates the instruction SocketConnect:

See also [More examples on page 710](#).

Example 1

```
SocketConnect socket1, "192.168.0.1", 1025;
```

Trying to connect to a remote computer at ip-address 192.168.0.1 and port 1025.

Arguments

```
SocketConnect Socket Address Port [\Time]
```

Socket

Data type: socketdev

The client socket to connect. The socket must be created but not already connected.

Address

Data type: string

The address of the remote computer. The remote computer must be specified as an IP address. It is not possible to use the name of the remote computer.

Port

Data type: num

The port on the remote computer. Generally ports 1025-4999 are free to use. Ports below 1025 can already be taken.

Port is restricted to 1025-4999 if using address 127.0.0.1 or any other address assigned to an interface on the main computer.

[\Time]

Data type: num

The maximum amount of time [s] that program execution waits for the connection to be accepted or denied. If this time runs out before the condition is met then the error handler will be called, if there is one, with the error code ERR_SOCK_TIMEOUT. If there is no error handler then the execution will be stopped.

If parameter \Time is not used the waiting time is 60 s. To wait forever, use the predefined constant WAIT_MAX.

Program execution

The socket tries to connect to the remote computer on the specified address and port. The program execution will wait until the connection is established, failed, or a timeout occurs.

Continues on next page

1 Instructions

1.236 SocketConnect - Connect to a remote computer

RobotWare Base

Continued



Tip

The firewall must allow socket messaging, see *Technical reference manual - System parameters*.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_SOCK_ADDR_INVALID	The specified address is invalid
ERR_SOCK_CLOSED	The socket is closed (has been closed or is not created). Use SocketCreate to create a new socket.
ERR_SOCK_EXEC_LEVEL	Use of socket instructions on different RAPID execution levels at the same time, that is, normal execution level and TRAP level.
ERR_SOCK_IS_CONN	The socket is connected.
ERR_SOCK_NET_UNREACH	Network is unreachable or connection is lost after a socket is opened.
ERR_SOCK_TIMEOUT	The connection was not established within the time-out time.
ERR_SOCK_UNSPEC	Unspecified exception from underlying call to the operating system.

More examples

More examples of the instruction SocketConnect are illustrated below.

Example 1

```
VAR num retry_no := 0;
VAR socketdev my_socket;
...
SocketCreate my_socket;
SocketConnect my_socket, "192.168.0.1", 1025;
...
ERROR
  IF ERRNO = ERR_SOCK_TIMEOUT THEN
    IF retry_no < 5 THEN
      WaitTime 1;
      retry_no := retry_no + 1;
      RETRY;
    ELSE
      RAISE;
    ENDIF
  ENDIF
```

A socket is created and tries to connect to a remote computer. If the connection is not established within the default time-out time, i.e. 60 seconds, then the error handler retries to connect. Four retries are attempted then the error is reported to the user.

Continues on next page

Syntax

SocketConnect

```
[Socket ':='] <variable (VAR) of socketdev>', '
[Address ':='] <expression (IN) of string>', '
[Port ':='] <expression (IN) of num>
['\ ' Time ':=' <expression (IN) of num>]';'
```

Related information

For information about	Described in:
Socket communication in general	<i>Application manual - Controller software Omni-Core</i>
Create a new socket	SocketCreate - Create a new socket on page 712
Send data to remote computer	SocketSend - Send data to remote computer on page 728
Receive data from remote computer	SocketReceive - Receive data from remote computer on page 717
Bind a socket (only server)	SocketBind - Bind a socket to my IP-address and port on page 704
Listening connections (only server)	SocketListen - Listen for incoming connections on page 715
Accept connections (only server)	SocketAccept - Accept an incoming connection on page 700
Get current socket state	SocketGetStatus - Get current socket state on page 1451
Example client socket application	SocketSend - Send data to remote computer on page 728
Example server socket application	SocketReceive - Receive data from remote computer on page 717
Firewall settings	<i>Technical reference manual - System parameters</i>

1 Instructions

1.237 SocketCreate - Create a new socket *RobotWare Base*

1.237 SocketCreate - Create a new socket

Usage

SocketCreate is used to create a new socket for connection based communication or connectionless communication.

Both socket messaging of stream type protocol TCP/IP with delivery guarantee and datagram protocol UDP/IP is supported. Both server and client application can be developed. For datagram protocol UDP/IP, broadcast is supported.

Basic examples

The following examples illustrate the instruction SocketCreate:

Example 1

```
VAR socketdev socket1;  
...  
SocketCreate socket1;
```

A new socket device using stream type protocol TCP/IP is created and assigned into the variable socket1.

Example 2

```
VAR socketdev udp_sock1;  
...  
SocketCreate udp_sock1 \UDP;
```

A new socket device using datagram protocol UDP/IP is created and assigned into the variable udp_sock1.

Arguments

```
SocketCreate Socket [\UDP] [\ISOLatin1Encoding]
```

Socket

Data type: socketdev

The variable for storage of the system's internal socket data.

[\UDP]

Data type: switch

Specifies that the socket should be of the type datagram protocol UDP/IP.

[\ISOLatin1Encoding]

Data type: switch

If using this switch the SocketSendXXX/SocketReceiveXXX instructions convert the data used in the argument Str to/from ISO 8859-1 (Latin-1) encoding before sending/receiving it.

This makes it possible to communicate with external clients/servers requiring ISO 8859-1 encoded data.

If this switch is used in SocketCreate, then it is not needed in the instructions SocketSend, SocketSendTo, SocketReceive, and SocketReceiveFrom.

Continues on next page

Program execution

The instruction creates a new socket device.

The socket must not already be in use. The socket is in use between SocketCreate and SocketClose.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_SOCKET_UNSPEC	Unspecified exception from underlying call to the operating system.

Limitations

Any number of sockets can be declared but it is only possible to use 32 sockets at the same time.

Avoid fast loops with SocketCreate ... SocketClose, because the socket is not really closed until after a certain time (when using TCP/IP functionality).

Syntax

```
SocketCreate
  [Socket ':='] <variable (VAR) of socketdev>
  ['\ ' UDP]
  ['\ ' ISOLatin1Encoding]';'
```

Related information

For information about	See
Socket communication in general	<i>Application manual - Controller software Omni-Core</i> , section <i>Socket Messaging</i>
Connect to remote computer (only client)	SocketConnect - Connect to a remote computer on page 709
Send data to remote computer	SocketSend - Send data to remote computer on page 728
Receive data from remote computer	SocketReceive - Receive data from remote computer on page 717
Close the socket	SocketClose - Close a socket on page 707
Bind a socket (only server)	SocketBind - Bind a socket to my IP-address and port on page 704
Listening connections (only server)	SocketListen - Listen for incoming connections on page 715
Accept connections (only server)	SocketAccept - Accept an incoming connection on page 700
Get current socket state	SocketGetStatus - Get current socket state on page 1451
Example client socket application	SocketSend - Send data to remote computer on page 728

Continues on next page

1 Instructions

1.237 SocketCreate - Create a new socket

RobotWare Base

Continued

For information about	See
Send data to remote computer	SocketSendTo - Send data to remote computer on page 733
Example server socket application	SocketReceive - Receive data from remote computer on page 717
Receive data from remote computer	SocketReceiveFrom - Receive data from remote computer on page 723

1.238 SocketListen - Listen for incoming connections

Usage

SocketListen is used to start listening for incoming connections, i.e. start acting as a server. SocketListen can only be used for server applications.

Basic examples

The following example illustrates the instruction SocketListen:

Example 1

```

VAR socketdev server_socket;
VAR socketdev client_socket;
...
SocketCreate server_socket;
SocketBind server_socket, "192.168.0.1", 1025;
SocketListen server_socket;
WHILE listening DO;
    ! Waiting for a connection request
    SocketAccept server_socket, client_socket;

```

A server socket is created and bound to port 1025 on the controller network address 192.168.0.1. After execution of SocketListen the server socket starts to listen for incoming connections on this port and address.

Arguments

SocketListen Socket

Socket

Data type: socketdev

The server socket that should start listening for incoming connections. The socket must already be created and bound.

Program execution

The server socket starts listening for incoming connections. When the instruction is ready the socket is ready to accept an incoming connection.

Use the SocketBind and SocketListen instructions in the startup of the program to associate a local address with a socket and then listen for incoming connections on the specified port. This is recommended to do only once for each socket and port that is used.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_SOCKET_CLOSED	The socket is closed (has been closed or is not created). Use SocketCreate to create a new socket.
ERR_SOCKET_IS_CONN	The socket is connected.
ERR_SOCKET_NOT_BOUND	The socket has not been bound to an address.

Continues on next page

1 Instructions

1.238 SocketListen - Listen for incoming connections

RobotWare Base

Continued

Name	Cause of error
ERR_SOCKET_UNSPEC	Unspecified exception from underlying call to the operating system.

Syntax

```
SocketListen  
[Socket ':='] <variable (VAR) of socketdev>;'
```

Related information

For information about	See
Socket communication in general	<i>Application manual - Controller software Omni-Core</i>
Create a new socket	SocketCreate - Create a new socket on page 712
Connect to remote computer (only client)	SocketConnect - Connect to a remote computer on page 709
Send data to remote computer	SocketSend - Send data to remote computer on page 728
Receive data from remote computer	SocketReceive - Receive data from remote computer on page 717
Close the socket	SocketClose - Close a socket on page 707
Bind a socket (only server)	SocketBind - Bind a socket to my IP-address and port on page 704
Accept connections (only server)	SocketAccept - Accept an incoming connection on page 700
Get current socket state	SocketGetStatus - Get current socket state on page 1451
Example client socket application	SocketSend - Send data to remote computer on page 728
Example server socket application	SocketReceive - Receive data from remote computer on page 717

1.239 SocketReceive - Receive data from remote computer

Usage

SocketReceive is used for receiving data from a remote computer.
SocketReceive can be used both for client and server applications.

Basic examples

The following example illustrates the instruction SocketReceive:

See also [More examples on page 719](#).

Example 1

```
VAR string str_data;
...
SocketReceive socket1 \Str := str_data;
```

Receive data from a remote computer and store it in the string variable str_data.

Arguments

```
SocketReceive Socket [ \Str ] | [ \RawData ] | [ \Data ]
                  [\ReadNoOfBytes] [\NoRecBytes] [\Time] [ \ISOLatin1Encoding
                  ]
```

Socket

Data type: socketdev

In a client application where the socket receives the data, the socket must already be created and connected.

In a server application where the socket receives the data, the socket must already be accepted.

[\Str]

Data type: string

The variable in which the received string data should be stored.

The string length is limited to 80 bytes.

[\RawData]

Data type: rawbytes

The variable in which the received rawbytes data should be stored. Max. number of rawbytes 5000 can be handled (this limit can be configured with the system parameter *RapidSocketMemSize*, topic *Controller*, type *General Rapid*).

[\Data]

Data type: array of byte

The variable in which the received byte data should be stored. Max. number of byte 5000 can be handled (this limit can be configured with the system parameter *RapidSocketMemSize*, topic *Controller*, type *General Rapid*).

Only one of the optional parameters \Str, \RawData, and \Data can be used at the same time.

Continues on next page

1 Instructions

1.239 SocketReceive - Receive data from remote computer

RobotWare Base

Continued

[\ReadNoOfBytes]

Read number of Bytes

Data type: num

The number of bytes to read. The minimum value of bytes to read is 1, and the maximum value is the size of the data type used, that is, 80 bytes if using a variable of the data type string.

If communicating with a client that always sends a fixed number of bytes, this optional parameter can be used to specify that the same number of bytes should be read for each SocketReceive instruction.

If the sender sends RawData, the receiver needs to specify that 4 bytes should be received for each rawbytes sent.



Note

It is not recommended to use this argument if using multibyte characters, as it might result in a character being split, which will result in errors.

[\NoRecBytes]

Number Received Bytes

Data type: num

Variable for storage of the number of bytes needed from the specified socket dev.

The same result can also be achieved with

- function StrLen on variable in argument \Str
- function RawBytesLen on variable in argument \RawData

[\Time]

Data type: num

The maximum amount of time [s] that program execution waits for the data to be received. If this time runs out before the data is transferred then the error handler will be called, if there is one, with the error code ERR_SOCK_TIMEOUT. If there is no error handler then the execution will be stopped.

If parameter \Time is not used then the waiting time is 60 s. To wait forever, use the predefined constant WAIT_MAX.

[\ISOLatin1Encoding]

Data type: switch

If using this switch the SocketReceive instruction handles the received data as ISO 8859-1 (Latin-1) encoded data, and converts the data to UTF8 encoding before copying it to the RAPID string used in argument Str.

This makes it possible to communicate with external clients/servers requiring ISO 8859-1 encoded data.

Program execution

The execution of SocketReceive will wait until the data is available or fail with a timeout error.

Continues on next page

The number of bytes read is specified by the data type used in the instruction. If using a string data type to receive data in, 80 bytes is received if there are 80 bytes that can be read. If using optional argument ReadNoOfBytes the user can specify how many bytes that should be received for each SocketReceive.

The data that is transferred on the cable is maximum 5000 bytes in one message (this limit can be configured with the system parameter *RapidSocketMemSize*, topic *Controller*, type *General Rapid*). No header is added by default to the message. The usage of any header is reserved for the actual application.

Parameter	Input data	Cable data	Output data
\Str	1 char	1 byte (8 bits)	1 char
\RawData	1 rawbytes	1 byte (8 bits)	1 rawbytes
\Data	1 byte	1 byte (8 bits)	1 byte

It is possible to mix the used data type (string, rawbytes, or array of byte) between SocketSend and SocketReceive.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_SOCK_CLOSED	The socket is closed. Broken connection.
ERR_SOCK_EXEC_LEVEL	Use of socket instructions on different RAPID execution levels at the same time, that is, normal execution level and TRAP level.
ERR_SOCK_NET_UNREACH	Network is unreachable or connection is lost after a socket is opened.
ERR_SOCK_NOT_CONN	The socket is not connected
ERR_SOCK_TIMEOUT	No data was received within the time out time.

More examples

More examples of the instruction SocketReceive are illustrated below.

Example 1

```

VAR socketdev server_socket;
VAR socketdev client_socket;
VAR string client_ip;

PROC server_messaging()
  VAR string receive_string;
  ...
  ! Create, bind, listen and accept of sockets in error handlers
  SocketReceive client_socket \Str := receive_string;
  SocketSend client_socket \Str := "Hello client with
    ip-address"+client_ip;
  ! Wait for acknowlegde from client
  ...
  SocketClose server_socket;

```

Continues on next page

1 Instructions

1.239 SocketReceive - Receive data from remote computer

RobotWare Base

Continued

```
        SocketClose client_socket;
    ERROR
        IF ERRNO=ERR_SOCK_TIMEOUT THEN
            RETRY;
        ELSEIF ERRNO=ERR_SOCK_CLOSED THEN
            server_recover;
            RETRY;
        ELSE
            ! No error recovery handling
        ENDIF
    ENDPROC

PROC server_recover()
    SocketClose server_socket;
    SocketClose client_socket;
    SocketCreate server_socket;
    SocketBind server_socket, "192.168.0.1", 1025;
    SocketListen server_socket;
    SocketAccept server_socket,
        client_socket\ClientAddress:=client_ip;
    ERROR
        IF ERRNO=ERR_SOCK_TIMEOUT THEN
            RETRY;
        ELSEIF ERRNO=ERR_SOCK_CLOSED THEN
            RETURN;
        ELSE
            ! No error recovery handling
        ENDIF
    ENDPROC
```

This is an example of a server program with creation, binding, listening, and accepting of sockets in error handlers. In this way the program can handle power fail restart.

In the procedure `server_recover`, a server socket is created and bound to port 1025 on the controller network address 192.168.0.1. After execution of `SocketListen` the server socket starts to listen for incoming connections on this port and address. `SocketAccept` will accept the incoming connection from some client and store the client address in the string `client_ip`.

In the communication procedure `server_messaging` the server receives a string message from the client and stores the message in `receive_string`. Then the server responds with the message "Hello client with ip-address xxx.xxx.x.x".

Example 2

```
VAR byte bytearray{500};
VAR socketdev client_socket;

PROC receive_message()
    VAR robtarget myrobt;
    BytesReset bytearray;
    SocketReceive client_socket \Data := bytearray;
```

Continues on next page

1.239 SocketReceive - Receive data from remote computer

RobotWare Base

Continued

```

IF BytesToVal(bytearr, myrobt) = FALSE THEN
  TPWrite "Received data not a robtarget";
ELSE
  MoveJ myrobt, vmax, z30, tool2;
  ...

```

In this example data is received in a byte array, and then converted to a robtarget that is used in a MoveJ instruction.

Limitations

All sockets are closed after power fail restart. This problem can be handled by error recovery. See example above.

Avoid fast loops with SocketCreate ... SocketClose because the socket is not really closed until a certain time (TCP/IP functionality).

The maximum size of the data that can be received in one call is limited to 5000 bytes (this limit can be configured with the system parameter *RapidSocketMemSize*, topic *Controller*, type *General Rapid*).

Syntax

```

SocketReceive
[Socket ':='] <variable (VAR) of socketdev>
['\' Str ':=' <variable (VAR) of string>]
['\' RawData ':=' <variable (VAR) of rawbytes>]
['\' Data ':=' <array {*} (VAR) of byte>]
['\' ReadNoOfBytes ':=' <expression (IN) of num>]
['\' NoRecBytes ':=' <variable (VAR) of num>]
['\' Time ':=' <expression (IN) of num>]
['\ISOLatin1Encoding '];'

```

Related information

For information about	See
Socket communication in general	<i>Application manual - Controller software Omni-Core</i>
Create a new socket	SocketCreate - Create a new socket on page 712
Connect to remote computer (only client)	SocketConnect - Connect to a remote computer on page 709
Send data to remote computer	SocketSend - Send data to remote computer on page 728
Close the socket	SocketClose - Close a socket on page 707
Bind a socket (only server)	SocketBind - Bind a socket to my IP-address and port on page 704
Listening connections (only server)	SocketListen - Listen for incoming connections on page 715
Accept connections (only server)	SocketAccept - Accept an incoming connection on page 700
Get current socket state	SocketGetStatus - Get current socket state on page 1451

Continues on next page

1 Instructions

1.239 SocketReceive - Receive data from remote computer

RobotWare Base

Continued

For information about	See
Example client socket application	SocketSend - Send data to remote computer on page 728
Test for the presence of data on a socket.	SocketPeek - Test for the presence of data on a socket on page 1454
Convert a byte array to a value	BytesToVal - Converts a byte array to a value on page 1166
<i>RapidSocketMemSize</i>	<i>Technical reference manual - System parameters</i>

1.240 SocketReceiveFrom - Receive data from remote computer

Usage

SocketReceiveFrom is used for receiving data from a remote computer. SocketReceiveFrom can be used both for client and server applications. SocketReceiveFrom is used for connectionless communication with datagram protocol UDP/IP.

Basic examples

The following example illustrates the instruction SocketReceiveFrom:

See also [More examples on page 719](#).

Example 1

```
VAR string str_data;
VAR string RemoteAddress;
VAR num RemotePort;
...
SocketCreate \UDP;
SocketBind myUDPSock, "192.168.9.100", 4044;
SocketReceiveFrom socket1 \Str := str_data, RemoteAddress,
    RemotePort;
```

Receive data from a remote computer and store it in the string variable str_data. The address of the remote computer is stored in the string variable RemoteAddress and the port number is stored in the num variable RemotePort.

Arguments

```
SocketReceiveFrom Socket [ \Str ] | [ \RawData ] | [ \Data ]
    [\ReadNoOfBytes] [\NoRecBytes] RemoteAddress RemotePort
    [\Time] [ \ISOLatin1Encoding ]
```

Socket

Data type: socketdev

A socket device identifying a bound socket.

[\Str]

Data type: string

The variable in which the received string data should be stored.

The string length is limited to 80 bytes.

[\RawData]

Data type: rawbytes

The variable in which the received rawbytes data should be stored. Max. number of rawbytes 5000 can be handled (this limit can be configured with the system parameter *RapidSocketMemSize*, topic *Controller*, type *General Rapid*).

[\Data]

Data type: array of byte

Continues on next page

1 Instructions

1.240 SocketReceiveFrom - Receive data from remote computer

RobotWare Base

Continued

The variable in which the received byte data should be stored. Max. number of byte 5000 can be handled (this limit can be configured with the system parameter *RapidSocketMemSize*, topic *Controller*, type *General Rapid*).

Only one of the optional parameters `\Str`, `\RawData`, and `\Data` can be used at the same time.

[`\ReadNoOfBytes`]

Read number of Bytes

Data type: num

The number of bytes to read. The minimum value of bytes to read is 1, and the maximum amount is the value of the size of the data type used, that is, 80 bytes if using a variable of the data type string.

If communicating with a client that always sends a fixed number of bytes, this optional parameter can be used to specify that the same amount of bytes should be read for each `SocketReceive` instruction.

If the sender sends `RawData`, the receiver needs to specify that 4 bytes should be received for each `rawbytes` sent.



Note

It is not recommended to use this argument if using multibyte characters, as it might result in a character being split, which will result in errors.

[`\NoRecBytes`]

Number Received Bytes

Data type: num

Variable for storage of the number of bytes needed from the specified socket dev.

The same result can also be achieved with

- function `StrLen` on variable in argument `\Str`
- function `RawBytesLen` on variable in argument `\RawData`

`RemoteAddress`

Data type: string

A string variable containing the source address of the remote computer.

`RemotePort`

Data type: num

A num variable containing the port used by the remote computer when sending the datagram package.

[`\Time`]

Data type: num

The maximum amount of time [s] that program execution waits for the data to be received. If this time runs out before the data is transferred then the error handler will be called, if there is one, with the error code `ERR_SOCKET_TIMEOUT`. If there is no error handler then the execution will be stopped.

Continues on next page

If parameter `\Time` is not used then the waiting time is 60 s. To wait forever, use the predefined constant `WAIT_MAX`.

[`\ISOLatin1Encoding`]

Data type: switch

If using this switch the `SocketReceiveFrom` instruction handles the received data as ISO 8859-1 (Latin-1) encoded data, and converts the data to UTF8 encoding before copying it to the RAPID string used in argument `Str`.

This makes it possible to communicate with external clients/servers requiring ISO 8859-1 encoded data.

Program execution

The execution of `SocketReceiveFrom` receives a datagram and stores the source address and source port. It will wait until the data is available or fail with a timeout error.

The amount of bytes read is specified by the data type used in the instruction. If using a string data type to receive data in, 80 bytes is received if there are 80 bytes that can be read.

The data that is transferred on the cable is maximum 5000 bytes in one message (this limit can be configured with the system parameter `RapidSocketMemSize`, topic *Controller*, type *General Rapid*). No header is added by default to the message. The usage of any header is reserved for the actual application.

Parameter	Input data	Cable data	Output data
<code>\Str</code>	1 char	1 byte (8 bits)	1 char
<code>\RawData</code>	1 rawbytes	1 byte (8 bits)	1 rawbytes
<code>\Data</code>	1 byte	1 byte (8 bits)	1 byte

It is possible to mix the used data type (string, rawbytes, or array of byte) between `SocketSendTo` and `SocketReceiveFrom`.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_SOCK_CLOSED</code>	The socket is closed.
<code>ERR_SOCK_EXEC_LEVEL</code>	Use of socket instructions on different RAPID execution levels at the same time, that is, normal execution level and TRAP level.
<code>ERR_SOCK_MSG_SIZE</code>	The datagram received is bigger than the buffer used to receive the data in.
<code>ERR_SOCK_NET_UNREACH</code>	Network is unreachable or connection is lost after a socket is opened.
<code>ERR_SOCK_NOT_BOUND</code>	The socket has not been bound to an address.
<code>ERR_SOCK_TIMEOUT</code>	No data was received within the time out time.

Continues on next page

1 Instructions

1.240 SocketReceiveFrom - Receive data from remote computer

RobotWare Base

Continued

More examples

More examples of the instruction SocketReceiveFrom are illustrated below.

Example 1

```
VAR socketdev udp_socket;
VAR string client_ip;
VAR num client_port;

PROC server_messaging()
  VAR string receive_string;
  ...
  ! Create and bind of sockets in error handlers
  SocketReceiveFrom udp_socket \Str := receive_string, client_ip,
    client_port;
  SocketSendTo udp_socket, client_ip, client_port \Str := "Hello
    client with ip-address"+client_ip;
  ...
  SocketClose udp_socket;
ERROR
  IF ERRNO=ERR SOCK_TIMEOUT THEN
    RETRY;
  ELSEIF ERRNO=SOCK_CLOSED THEN
    messaging_recover;
    RETRY;
  ELSE
    ! No error recovery handling
  ENDIF
ENDPROC

PROC messaging_recover()
  SocketClose udp_socket;
  SocketCreate udp_socket \UDP;
  SocketBind udp_socket, "192.168.0.1", 1025;
ERROR
  IF ERRNO=ERR SOCK_CLOSED THEN
    RETURN;
  ELSE
    ! No error recovery handling
  ENDIF
ENDPROC
```

This is an example of a server program with creation and binding of sockets in error handlers. In this way the program can handle power fail restart.

In the communication procedure server_messaging the server receives a string message from the client and stores the message in receive_string. Then the server responds with the message "Hello client with ip-address xxx.xxx.x.x".

Limitations

All sockets are closed after power fail restart. This problem can be handled by error recovery. See example above.

Continues on next page

1.240 SocketReceiveFrom - Receive data from remote computer

RobotWare Base

Continued

The maximum size of the data that can be received in one call is limited to 5000 bytes (this limit can be configured with the system parameter *RapidSocketMemSize*, topic *Controller*, type *General Rapid*).

Syntax

```
SocketReceiveFrom
[Socket ':='] <variable (VAR) of socketdev>
['\' Str ':=' <variable (VAR) of string>]
|['\' RawData ':=' <variable (VAR) of rawbytes>]
|['\' Data ':=' <array {*} (VAR) of byte>]
|['\' ReadNoOfBytes ':=' <expression (IN) of num>]
|['\' NoRecBytes ':=' <variable (VAR) of num>]
[RemoteAddress ':='] <variable (VAR) of string>
[RemotePort ':='] <variable (VAR) of num>
|['\' Time ':=' <expression (IN) of num>]
|['\' ISO Latin1 Encoding ']';'
```

Related information

For information about	See
Socket communication in general	<i>Application manual - Controller software Omni-Core</i>
Create a new socket	SocketCreate - Create a new socket on page 712
Connect to remote computer (only client)	SocketConnect - Connect to a remote computer on page 709
Send data to remote computer	SocketSend - Send data to remote computer on page 728
Close the socket	SocketClose - Close a socket on page 707
Bind a socket (only server)	SocketBind - Bind a socket to my IP-address and port on page 704
Get current socket state	SocketGetStatus - Get current socket state on page 1451
Example client socket application	SocketSend - Send data to remote computer on page 728
Send data to remote computer	SocketSendTo - Send data to remote computer on page 733
Test for the presence of data on a socket.	SocketPeek - Test for the presence of data on a socket on page 1454
<i>RapidSocketMemSize</i>	<i>Technical reference manual - System parameters</i>

1 Instructions

1.241 SocketSend - Send data to remote computer

RobotWare Base

1.241 SocketSend - Send data to remote computer

Usage

SocketSend is used to send data to a remote computer. SocketSend can be used both for client and server applications.

Basic examples

The following example illustrates the instruction SocketSend:

See also [More examples on page 729](#).

Example 1

```
SocketSend socket1 \Str := "Hello world";
```

Sends the message "Hello world" to the remote computer.

Arguments

```
SocketSend Socket [ \Str ] | [ \RawData ] | [ \Data ] [ \NoOfBytes ] [ \ISOLatin1Encoding ]
```

Socket

Data type: socketdev

In client application the socket to send from must already be created and connected.

In server application the socket to send to must already be accepted.

[\Str]

Data type: string

The string to send to the remote computer.

[\RawData]

Data type: rawbytes

The rawbytes data to send to the remote computer.

[\Data]

Data type: array of byte

The data in the byte array to send to the remote computer.

Only one of the optional parameters \Str, \RawData, or \Data can be used at the same time.

[\NoOfBytes]

Data type: num

If this argument is specified only this number of bytes will be sent to the remote computer. The call to SocketSend will fail if \NoOfBytes is larger than the actual number of bytes in the data structure to send.

If this argument is not specified then the whole data structure (valid part of rawbytes) will be sent to the remote computer.

[\ISOLatin1Encoding]

Data type: switch

Continues on next page

If using this switch the SocketSend instruction converts the data used in the argument `Str` to ISO 8859-1 (Latin-1) encoding before sending it.

This makes it possible to communicate with external clients/servers requiring ISO 8859-1 encoded data.

Program execution

The specified data is sent to the remote computer. If the connection is broken an error is generated.

The data that is transferred on the cable is maximum 5000 bytes in one message (this limit can be configured with the system parameter *RapidSocketMemSize*, topic *Controller*, type *General Rapid*). No header is added by default to the message. The usage of any header is reserved for the actual application.

Parameter	Input data	Cable data	Output data
\Str	1 char	1 byte (8 bits)	1 char
\RawData	1 rawbytes	1 byte (8 bits)	1 rawbytes
\Data	1 byte	1 byte (8 bits)	1 byte

It's possible to mix the used data type (string, rawbytes, or array of byte) between SocketSend and SocketReceive.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_SOCK_CLOSED	The socket is closed. Broken connection.
ERR_SOCK_NET_UNREACH	Network is unreachable or connection is lost after a socket is opened.
ERR_SOCK_NOT_CONN	The socket is not connected
ERR_SOCK_UNSPEC	Unspecified exception from underlying call to the operating system.

More examples

More examples of the instruction SocketSend are illustrated below.

Example 1

```

VAR socketdev client_socket;
VAR string receive_string;

PROC client_messaging()
...
! Create and connect the socket in error handlers
SocketSend client_socket \Str := "Hello server";
SocketReceive client_socket \Str := receive_string;
...
SocketClose client_socket;
ERROR
IF ERRNO=ERR_SOCK_TIMEOUT THEN

```

Continues on next page

1 Instructions

1.241 SocketSend - Send data to remote computer

RobotWare Base

Continued

```
        RETRY;
    ELSEIF ERRNO=ERR_SOCK_CLOSED THEN
        client_recover;
        RETRY;
    ELSE
        ! No error recovery handling
    ENDIF
ENDPROC

PROC client_recover()
    SocketClose client_socket;
    SocketCreate client_socket;
    SocketConnect client_socket, "192.168.0.2", 1025;
ERROR
    IF ERRNO=ERR_SOCK_TIMEOUT THEN
        RETRY;
    ELSEIF ERRNO=ERR_SOCK_CLOSED THEN
        RETURN;
    ELSE
        ! No error recovery handling
    ENDIF
ENDPROC
```

This is an example of a client program with creation and connection of socket in error handlers. In this way the program can handle power fail restart.

In the procedure `client_recover` the client socket is created and connected to a remote computer server with IP-address 192.168.0.2 on port 1025.

In the communication procedure `client_messaging` the client sends "Hello server" to the server and the server responds with "Hello client" to the client, which is stored in the variable `receive_string`.

Example 2

```
VAR socketdev client_socket;
VAR string receive_string;

PROC client_messaging()
    ...
    ! Send cr and lf to the server
    SocketSend client_socket \Str := "\0D\0A";
    ...
ENDPROC
```

This is an example of a client program that sends non printable characters (binary data) in a string. This can be useful if communicating with sensors or other clients that requires such characters.

Example 3

```
VAR byte bytearray{500};
VAR socketdev sockdev1;

PROC send_message()
```

Continues on next page

1.241 SocketSend - Send data to remote computer

RobotWare Base

Continued

```

VAR robtarget myrobt:=[ [803.36,734.89,1430.26],
    [0.0616282,-0.704416,0.704416,0.0616269],[0,0,-1,0],
    [9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
VAR num length;
BytesReset bytearray;
length := ValToBytes(myrobt, bytearray);
SocketSend sockdev1 \Data := bytearray \NoOfBytes:=length;
...

```

In this example data a robtarget is converted to a byte array, and length bytes of data is then sent to a remote computer.

Limitations

All sockets are closed after power fail restart. This problem can be handled by error recovery. See example above.

Avoid fast loops with SocketCreate ... SocketClose because the socket is not really closed until a certain time (TCP/IP functionality).

The size of the data to send is limited to 5000 bytes (this limit can be configured with the system parameter *RapidSocketMemSize*, topic *Controller*, type *General Rapid*).

Syntax

```

SocketSend
[Socket ':='] <variable (VAR) of socketdev>
[\Str ':=' <expression (IN) of string>]
|[\RawData ':=' <variable (VAR) of rawdata>]
|[\Data ':=' <array {*} (IN) of byte>]
|['\ NoOfBytes ':=' <expression (IN) of num>]
|['\ ISOLatin1Encoding'];'

```

Related information

For information about	See
Socket communication in general	<i>Application manual - Controller software Omni-Core</i>
Create a new socket	SocketCreate - Create a new socket on page 712
Connect to remote computer (only client)	SocketConnect - Connect to a remote computer on page 709
Receive data from remote computer	SocketReceive - Receive data from remote computer on page 717
Close the socket	SocketClose - Close a socket on page 707
Bind a socket (only server)	SocketBind - Bind a socket to my IP-address and port on page 704
Listening connections (only server)	SocketListen - Listen for incoming connections on page 715
Accept connections (only server)	SocketAccept - Accept an incoming connection on page 700
Get current socket state	SocketGetStatus - Get current socket state on page 1451

Continues on next page

1 Instructions

1.241 SocketSend - Send data to remote computer

RobotWare Base

Continued

For information about	See
Example server socket application	SocketReceive - Receive data from remote computer on page 717
Use of non-printable characters (binary data) in string literals.	<i>Technical reference manual - RAPID kernel</i>
Convert a value to a byte array	ValToBytes - Converts a value to a byte array on page 1582
<i>RapidSocketMemSize</i>	<i>Technical reference manual - System parameters</i>

1.242 SocketSendTo - Send data to remote computer

Usage

SocketSendTo is used to send data to a remote computer. SocketSendTo can be used both for client and server applications.

SocketSendTo is used for connectionless communication with datagram protocol UDP/IP.

Basic examples

The following example illustrates the instruction SocketSendTo:

See also [More examples on page 729](#).

Example 1

```
VAR socketdev udp_socket;
```

```
SocketCreate udp_socket \UDP;
```

```
SocketSendTo udp_socket, Address, Port \Str := "Hello world";
```

Sends the message "Hello world" to the remote computer with IP address Address and port Port.

Arguments

```
SocketSendTo Socket RemoteAddress RemotePort [ \Str ] | [ \RawData ] | [ \Data ] [ \NoOfBytes ] [ \ISOLatin1Encoding ]
```

Socket

Data type: socketdev

The socket must already been created.

RemoteAddress

Data type: string

The address of the remote computer. The remote computer must be specified as an IP address. It is not possible to use the name of the remote computer.

RemotePort

Data type: num

The port on the remote computer. Generally ports 1025-4999 are free to use. Ports below 1025 can already be taken.

Port is restricted to 1025-4999 if using address 127.0.0.1 or any other address assigned to an interface on the main computer.

[\Str]

Data type: string

The string to send to the remote computer.

[\RawData]

Data type: rawbytes

The rawbytes data to send to the remote computer.

Continues on next page

1 Instructions

1.242 SocketSendTo - Send data to remote computer

RobotWare Base

Continued

[\Data]

Data type: array of byte

The data in the byte array to send to the remote computer.

Only one of the optional parameters \Str, \RawData, or \Data can be used at the same time.

[\NoOfBytes]

Data type: num

If this argument is specified only this number of bytes will be sent to the remote computer. The call to SocketSendTo will fail if \NoOfBytes is larger than the actual number of bytes in the data structure to send.

If this argument is not specified then the whole data structure (valid part of rawbytes) will be sent to the remote computer.

[\ISOLatin1Encoding]

Data type: switch

If using this switch the SocketSendTo instruction converts the data used in the argument Str to ISO 8859-1 (Latin-1) encoding before sending it.

This makes it possible to communicate with external clients/servers requiring ISO 8859-1 encoded data.

Program execution

The specified data is sent to the remote computer.

The data that is transferred on the cable is maximum 5000 bytes in one message (this limit can be configured with the system parameter *RapidSocketMemSize*, topic *Controller*, type *General Rapid*). No header is added by default to the message. The usage of any header is reserved for the actual application.

Parameter	Input data	Cable data	Output data
\Str	1 char	1 byte (8 bits)	1 char
\RawData	1 rawbytes	1 byte (8 bits)	1 rawbytes
\Data	1 byte	1 byte (8 bits)	1 byte

It's possible to mix the used data type (string, rawbytes, or array of byte) between SocketSendTo and SocketReceiveFrom.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_SOCK_CLOSED	The socket is closed.
ERR_SOCK_NET_UNREACH	Network is unreachable or connection is lost after a socket is opened.

More examples

More examples of the instruction SocketSendTo are illustrated below.

Continues on next page

Example 1

```

VAR socketdev client_socket;
VAR string receive_string;
VAR string RemoteAddress;
VAR num RemotePort;

PROC client_messaging()
...
! Create and bind the socket in error handlers
SocketSendTo client_socket, "192.168.0.2", 1025 \Str := "Hello
server";
SocketReceiveFrom client_socket \Str := receive_string,
RemoteAddress, RemotePort;
...
SocketClose client_socket;
ERROR
IF ERRNO=ERR_SOCKET_TIMEOUT THEN
RETRY;
ELSEIF ERRNO=ERR_SOCKET_CLOSED THEN
client_recover;
RETRY;
ELSE
! No error recovery handling
ENDIF
ENDPROC

PROC client_recover()
SocketClose client_socket;
SocketCreate client_socket \UDP;
SocketBind client_socket, "192.168.0.2", 1025;
ERROR
IF ERRNO=ERR_SOCKET_TIMEOUT THEN
RETRY;
ELSEIF ERRNO=ERR_SOCKET_CLOSED THEN
RETURN;
ELSE
! No error recovery handling
ENDIF
ENDPROC

```

This is an example of a client program with creation and bind of socket in error handlers. In this way the program can handle power fail restart.

In the procedure `client_recover` the client socket is created and bound to a remote computer server with IP-address 192.168.0.2 on port 1025.

In the communication procedure `client_messaging` the client sends "Hello server" to the server and the server responds with "Hello client" to the client, which is stored in the variable `receive_string`.

Example 2

```

VAR socketdev udp_socket;

```

Continues on next page

1 Instructions

1.242 SocketSendTo - Send data to remote computer

RobotWare Base

Continued

```
PROC message_send()  
...  
! Send cr and lf to the server  
SocketSendTo udp_socket, "192.168.0.2", 1025 \Str := "\0D\0A";  
...  
ENDPROC
```

This is an example the program sends non printable characters (binary data) in a string. This can be useful if communicating with sensors or other clients that requires such characters.

Limitations

All sockets are closed after power fail restart. This problem can be handled by error recovery. See example above.

The size of the data to send is limited to 5000 bytes (this limit can be configured with the system parameter *RapidSocketMemSize*, topic *Controller*, type *General Rapid*).

Syntax

```
SocketSendTo  
[Socket ':='] <variable (VAR) of socketdev>  
[RemoteAddress ':='] <expression (IN) of string>  
[RemotePort ':='] <expression (IN) of num>  
[\Str ':=' <expression (IN) of string>  
|[\RawData ':=' <variable (VAR) of rawdata>  
|[\Data ':=' <array {*} (IN) of byte>  
|['\ NoOfBytes ':=' <expression (IN) of num>]  
[\ISOLatin1Encoding ]';'
```

Related information

For information about	See
Socket communication in general	Application manual - Controller software Omni-Core
Create a new socket	SocketCreate - Create a new socket on page 712
Connect to remote computer (only client)	SocketConnect - Connect to a remote computer on page 709
Receive data from remote computer	SocketReceive - Receive data from remote computer on page 717
Close the socket	SocketClose - Close a socket on page 707
Bind a socket (only server)	SocketBind - Bind a socket to my IP-address and port on page 704
Get current socket state	SocketGetStatus - Get current socket state on page 1451
Example server socket application	SocketReceive - Receive data from remote computer on page 717
Receive data from remote computer	SocketReceiveFrom - Receive data from remote computer on page 723

Continues on next page

1.242 SocketSendTo - Send data to remote computer

RobotWare Base

Continued

For information about	See
Use of non-printable characters (binary data) in string literals.	<i>Technical reference manual - RAPID kernel</i>
<i>RapidSocketMemSize</i>	<i>Technical reference manual - System parameters</i>

1 Instructions

1.243 SoftAct - Activating the soft servo *RobotWare Base*

1.243 SoftAct - Activating the soft servo

Usage

SoftAct (*Soft Servo Activate*) is used to activate the so called “soft” servo on any axis of the robot or external mechanical unit.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in any motion tasks.

Basic examples

The following example illustrates the instruction SoftAct:

Example 1

```
SoftAct 3, 20;
```

Activation of soft servo on robot axis 3 with softness value 20%.

Example 2

```
SoftAct 1, 90 \Ramp:=150;
```

Activation of the soft servo on robot axis 1 with softness value 90% and ramp factor 150%.

Example 3

```
SoftAct \MechUnit:=orbit1, 1, 40 \Ramp:=120;
```

Activation of soft servo on axis 1 for the mechanical unit orbit1 with softness value 40% and ramp factor 120%.

Arguments

```
SoftAct [\MechUnit] Axis Softness [\Ramp]
```

[\MechUnit]

Mechanical Unit

Data type: mecunit

The name of the mechanical unit. If this argument is omitted then it means activation of the soft servo for specified robot axis in the current program task.

Axis

Data type: num

Number of the robot or external axis to work with soft servo.

Softness

Data type: num

Softness value in percent (0 - 100%). 0% denotes min. softness (max. stiffness), and 100% denotes max. softness.

[\Ramp]

Data type: num

Ramp factor in percent ($\geq 100\%$). The ramp factor is used to control the engagement of the soft servo. A factor 100% denotes the normal value; with greater

Continues on next page

values the soft servo is engaged more slowly (longer ramp). The default value for ramp factor is 100 %.

Program execution

Softness is activated at the value specified for the current axis. The softness value is valid for all movement until a new softness value is programmed for the current axis or until the soft servo is deactivated by the instruction SoftDeact.

Limitations

Soft servo for any robot or external axis is always deactivated when there is a power failure. This limitation can be handled in the user program when restarting after a power failure.

The same axis must not be activated twice unless there is a moving instruction in between. Thus, the following program sequence should be avoided. Otherwise there will be a jerk in the robot movement:

```
SoftAct n , x ;
SoftAct n , y ;
```

(n = robot axis n, x, and y softness values)



WARNING

The braking distance for category 1 stops will be longer when soft servo is active.

Syntax

```
SoftAct
[ '\MechUnit' := < variable (VAR) of mecunit> ',' ]
[ Axis := ] < expression (IN) of num> ','
[ Softness := ] < expression (IN) of num> ','
[ '\Ramp' := < expression (IN) of num> ] ;
```

Related information

For information about	See
Deactivate soft servo	SoftDeact - Deactivating the soft servo on page 740
Behavior with the soft servo engaged	<i>Technical reference manual - RAPID Overview</i>
Configuration of external axes	<i>Application manual - Additional axes</i>

1 Instructions

1.244 SoftDeact - Deactivating the soft servo *RobotWare Base*

1.244 SoftDeact - Deactivating the soft servo

Usage

SoftDeact (*Soft Servo Deactivate*) is used to deactivate the so called “soft” servo.

Basic examples

The following examples illustrate the instruction SoftDeact:

Example 1

```
SoftDeact;
```

Deactivating the soft servo on all axes.

Example 2

```
SoftDeact \Ramp:=150;
```

Deactivating the soft servo on all axes, with ramp factor 150 %.

Arguments

```
SoftDeact [\Ramp]
```

[\Ramp]

Data type: num

Ramp factor in percent ($\geq 100\%$). The ramp factor is used to control the deactivating of the soft servo. A factor 100% denotes the normal value. With greater values the soft servo is deactivated more slowly (longer ramp). The default value for ramp factor is 100 %.

Program execution

The soft servo is deactivated for the mechanical units that are controlled from current program task. If SoftDeact is done from a non-motion task, the soft servo is deactivated for the mechanical unit controlled by the connected motion task. Executing a SoftDeact when in synchronized movement mode, soft servo will be deactivated for all mechanical units that are synchronized.

When deactivating soft servo with SoftDeact the robot will move to the programmed position even if the robot has moved out of position during soft servo activation.

Syntax

```
SoftDeact  
[ '\Ramp :=' < expression (IN) of num> ]';'
```

Related information

For information about	See
Activating the soft servo	SoftAct - Activating the soft servo on page 738

1.245 SoftElbow - Making the elbow flexible for external forces

Usage

SoftElbow is used to activate or deactivate soft elbow on a 7-axes robot. When active, the elbow can be pushed so the elbow position is changed without affecting the TCP. The TCP will continue to move along its programmed path.

Basic example

The following examples illustrate the instruction SoftElbow:

Example 1

```
SoftElbow \On;
```

After executing this instruction, the robot elbow can be moved without affecting the TCP.

Arguments

```
SoftElbow [\On] | [\Off]
```

[\On]

Data type: switch

Activates soft elbow.

[\Off]

Data type: switch

Deactivates soft elbow.

Program execution

Once soft elbow is turned on, the elbow will remain soft until it is turned off with a new SoftElbow instruction.

As long as soft elbow is active, the elbow will bend away from any obstacle or anything pushing the elbow. If the robot is moving, the TCP will continue following its path and the program execution will not be interrupted in any way.

The default value (deactivated soft elbow) is automatically set:

- when using the restart mode Reset RAPID
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Limitations

- SoftElbow is only available for 7-axes robots (e.g. YuMi).
- SoftElbow will not work when the tool is in contact with a fixed object and a non-negligible force is applied (for example when pressing an object into a fixture).

Continues on next page

1 Instructions

1.245 SoftElbow - Making the elbow flexible for external forces

Seven axis robot

Continued

- While the arm is being pushed, it may lead to somewhat decreased path accuracy.
- SoftElbow is not compatible with other compliant modes (for example Lead Through, Force control or SoftMove).
- SoftElbow is not compatible with MultiMove Coordinated.
- SoftElbow only works well with moderate speeds, typically lower than 1000mm/s.
- Absolute accuracy will be temporarily deactivated while soft elbow is active.

Syntax

```
SoftElbow  
  ['\ ' On] | ['\ ' Off]';'
```

1.246 SpeedLimAxis - Set speed limitation for an axis

Usage

SpeedLimAxis is used to set a speed limit value for an axis. The speed reduction is done when the system input signal LimitSpeed is set to 1. With this instruction it is possible to setup a speed limitation that later on should be applied.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in any Motion tasks.

Basic examples

The following examples illustrate the instruction SpeedLimAxis:

Example 1

```
SpeedLimAxis STN_1, 1, 20;
```

This will limit the speed to 20 degrees/second on axis 1 for mechanical unit STN_1 when system input LimitSpeed is set to 1.

Example 2

```
SpeedLimAxis ROB_1, 1, 10;
SpeedLimAxis ROB_1, 2, 30;
SpeedLimAxis ROB_1, 3, 30;
SpeedLimAxis ROB_1, 4, 30;
SpeedLimAxis ROB_1, 5, 30;
SpeedLimAxis ROB_1, 6, 30;
```

This will limit the speed to 30 degrees/second on axis 2 to 6, and limit the speed to 10 degrees/second on axis 1 for mechanical unit ROB_1 when system input LimitSpeed is set to 1.

Arguments

```
SpeedLimAxis MechUnit AxisNo AxisSpeed
```

MechUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

AxisNo

Data type: num

The number of the current axis for the mechanical unit.

AxisSpeed

Data type: num

The speed that should be applied. For a rotating axis the speed should be in degrees/second and for a linear axis it should be in mm/s.

Continues on next page

1 Instructions

1.246 SpeedLimAxis - Set speed limitation for an axis

RobotWare Base

Continued

Program execution

SpeedLimAxis is used to set a speed limit value for an axis for a specific mechanical unit. The speed reduction is not done at once. The values are stored and are applied when the system input signal LimitSpeed is set to 1.

If SpeedLimAxis is not used to set a limitation for an axis, then the speed limitation for manual mode will be used instead. If no limitation at all is wanted for a specific axis, a high value should be entered. Furthermore, if no limitation of the checkpoint speed is set using the instruction SpeedLimCheckPoint, then the speed limitations for manual mode will be used to limit the checkpoint speed.

When the system input signal LimitSpeed is set to 1, the speed is ramped down to the reduced speed.

When the system input signal LimitSpeed is set to 0, the speed is ramped up to the programmed speed used in the current movement instruction.

The maximum allowed acceleration during ramping up is controlled by the system parameter *Limit Speed Acc Limitation* in the type *Motion Planner*.

The system output signal LimitSpeed is set to 1, when the reduced speed is reached. The system output signal LimitSpeed is set to 0, when the speed starts to ramp up.

The default values for speed limitation are automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AXIS_PAR	Parameter axis in instruction is wrong
ERR_SPEEDLIM_VALUE	The speed used in argument AxisSpeed is too low.

More examples

More examples of the instruction SpeedLimAxis are illustrated below.

Example 1

```
..
VAR intnum sigint1;
VAR intnum sigint2;
..
PROC main()
  ! Setup interrupts reacting on a signal input
  IDelete sigint1;
```

Continues on next page

1.246 SpeedLimAxis - Set speed limitation for an axis

RobotWare Base

Continued

```

CONNECT sigint1 WITH setlimitspeed;
ISignalDI \SingleSafe, mysensorsignal, 1, sigint1;
IDelete sigint2;
CONNECT sigint2 WITH resetlimitspeed;
ISignalDI \SingleSafe, mysensorsignal, 0, sigint2;
..
MoveL p1, z50, fine, tool2;
MoveL p2, z50, fine, tool2;
..
MoveL p10, v100, fine, tool2;
! Set limitations for checkpoints and axes
SpeedLimCheckPoint 200;
SpeedLimAxis ROB_1, 1, 10;
SpeedLimAxis ROB_1, 2, 10;
SpeedLimAxis ROB_1, 3, 10;
SpeedLimAxis ROB_1, 4, 20;
SpeedLimAxis ROB_1, 5, 20;
SpeedLimAxis ROB_1, 6, 20;
WHILE run_loop = TRUE DO
    MoveL p1, vmax, z50, tool2;
    ..
    MoveL p99, vmax, fine, tool2;
ENDWHILE
! Set the default manual mode max speed
SpeedLimCheckPoint 0;
SpeedLimAxis ROB_1, 1, 0;
SpeedLimAxis ROB_1, 2, 0;
SpeedLimAxis ROB_1, 3, 0;
SpeedLimAxis ROB_1, 4, 0;
SpeedLimAxis ROB_1, 5, 0;
SpeedLimAxis ROB_1, 6, 0;
..
TRAP setlimitspeed
IDelete sigint1;
CONNECT sigint1 WITH setlimitspeed;
ISignalDI \SingleSafe, mysensorsignal, 1, sigint1;
! Set out signal that is cross connected to system input
    LimitSpeed
SetDO do1LimitSpeed, 1;
ENDTRAP
TRAP resetlimitspeed
IDelete sigint2;
CONNECT sigint2 WITH resetlimitspeed;
ISignalDI \SingleSafe, mysensorsignal, 0, sigint2;
! Reset out signal that is cross connected to system input
    LimitSpeed
SetDO do1LimitSpeed, 0;
ENDTRAP

```

During the robot movement from position p1 to p10, the default speed limitation is used (manual mode speed). A new speed limit for the checkpoints for the TCP

Continues on next page

1 Instructions

1.246 SpeedLimAxis - Set speed limitation for an axis

RobotWare Base

Continued

robot and for the axes are added. The trap routine `setlimitspeed` will apply the speed limitation if signal `mysensorsignal` changes value to 1.

The trap routine `resetlimitspeed` will remove the speed limitation when signal `mysensorsignal` changes value to 0.

The new settings for the speed limitation will be used as long as the variable `run_loop` is TRUE and the system input signal `LimitSpeed` is set to 1. When `run_loop` is set to FALSE the default speed limitation (manual mode speed) is set.



Note

If `SpeedLimCheckPoint` is omitted, then the TCP speed will by default be limited to 250 mm/s. To remove that limitation, call `SpeedLimCheckPoint` with a high speed as argument.



Note

The trap routine in the example is only used to visualize the functionality. The signal used to limit the speed could also be connected either directly to the system input signal `LimitSpeed`, or through a safety PLC.

Limitations

The speed limit is only applied when the system input `LimitSpeed` is set to 1. Otherwise, the default TCP speed is used.

`SpeedLimAxis` cannot be used in the POWER ON event routine.

When reducing the speed of one axis or checkpoint, the other axes will also be reduced to the same percentage to be able to run along the programmed path. The process speed along the programmed path will vary.

When using `SafeMove` together with speed limitation, `SafeMove` must be setup with a margin since the `SafeMove` and motion calculations are slightly different.

Syntax

```
SpeedLimAxis
[MechUnit ':='] <variable (VAR) of mecunit>', '
[AxisNo ':='] <expression (IN) of num>', '
[AxisSpeed ':='] <expression (IN) of num>;'
```

Related information

For information about	See
Positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Set speed limitation for check points	SpeedLimCheckPoint - Set speed limitation for check points on page 747
System input and output signals	<i>Technical reference manual - System parameters</i>

1.247 SpeedLimCheckPoint - Set speed limitation for check points

Usage

SpeedLimCheckPoint is used to set a speed limit value for a TCP robot. The speed reduction is done when the system input signal LimitSpeed is set to 1. With this instruction it is possible to setup a speed limit that later on should be applied.

The reduction of the speed is done if any of the checkpoints are running faster than the limit set by SpeedLimCheckPoint. (For More information about checkpoints, see [More examples on page 749](#).)

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in any Motion tasks.

Basic examples

The following example illustrates the instruction SpeedLimCheckPoint:

Example 1

```
VAR num limit_speed:=200;  
SpeedLimCheckPoint limit_speed;
```

This will limit the speed to 200 mm/s for the TCP robot when system input LimitSpeed is set to 1.

Arguments

SpeedLimCheckPoint RobSpeed

RobSpeed

Data type: num

The speed limitation in mm/s that should be applied.

Continues on next page

1 Instructions

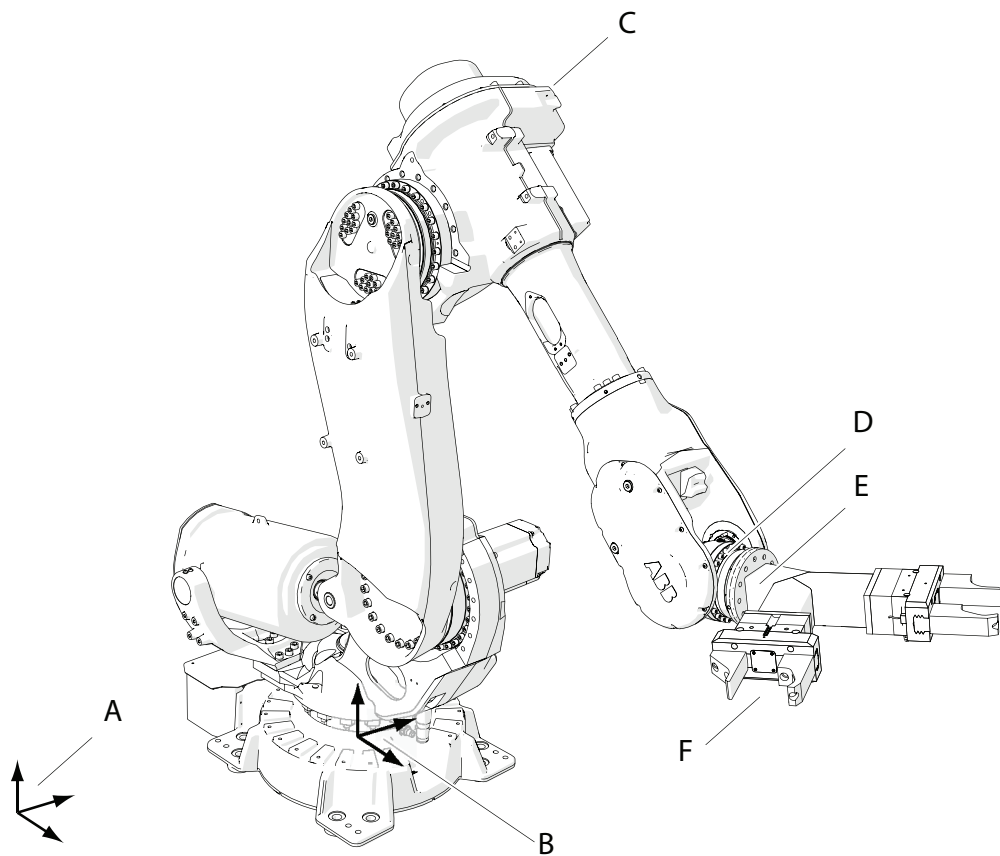
1.247 SpeedLimCheckPoint - Set speed limitation for check points

RobotWare Base

Continued

Program execution

Definition of checkpoints, see figure below.



xx1200000521

A	World coordinate system
B	Base coordinate system
C	Arm checkpoint
D	Wrist Center Point (WCP)
E	tool0
F	Tool Center Point (TCP)

SpeedLimCheckPoint is used to set a speed limit value for 4 checkpoints for a TCP robot. The checkpoints that will be limited are the arm, the wrist, tool0, and the active TCP, as seen in the picture above. The speed reduction is not done at once. The values are stored and are applied when the system input signal LimitSpeed is set to 1. The speed of the checkpoints are limited relative to the base coordinate system.

If instruction SpeedLimCheckPoint is not used to set a limitation, the speed limitation for manual mode will be used as limitation. If no limitation at all is wanted for the checkpoints, a high value should be entered. Furthermore, if no limitation of the axis speeds are set using the instruction SpeedLimAxis, then the speed limitations for manual mode will be used to limit the axis speed.

Continues on next page

When the system input signal `LimitSpeed` is set to 1, the speed is ramped down to the reduced speed.

When the system input signal `LimitSpeed` is set to 0, the speed is ramped up to the programmed speed used in the current movement instruction.

The maximum allowed acceleration during ramping up is controlled by the system parameter *Limit Speed Acc Limitation* in the type *Motion Planner*.

The system output signal `LimitSpeed` is set to 1, when the reduced speed is reached. The system output signal `LimitSpeed` is set to 0, when the speed starts to ramp up.

The default values for speed limitation are automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to `main`
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_SPEEDLIM_VALUE</code>	The speed used in argument <code>RobSpeed</code> is too low.

More examples

More examples of the instruction `SpeedLimCheckPoint` are illustrated below.

Example 1

```

..
VAR intnum sigint1;
VAR intnum sigint2;
..
PROC main()
  ! Setup interrupts reacting on a signal input
  IDelete sigint1;
  CONNECT sigint1 WITH setlimitspeed;
  ISignalDI \SingleSafe, mysensorsignal, 1, sigint1;
  IDelete sigint2;
  CONNECT sigint2 WITH resetlimitspeed;
  ISignalDI \SingleSafe, mysensorsignal, 0, sigint2;
  ..
  MoveL p1, z50, fine, tool2;
  MoveL p2, z50, fine, tool2;
  ..
  MoveL p10, v100, fine, tool2;
  ! Set limitations for checkpoints and axes

```

Continues on next page

1 Instructions

1.247 SpeedLimCheckPoint - Set speed limitation for check points

RobotWare Base

Continued

```
SpeedLimCheckPoint 200;
SpeedLimAxis ROB_1, 1, 10;
SpeedLimAxis ROB_1, 2, 10;
SpeedLimAxis ROB_1, 3, 10;
SpeedLimAxis ROB_1, 4, 20;
SpeedLimAxis ROB_1, 5, 20;
SpeedLimAxis ROB_1, 6, 20;
WHILE run_loop = TRUE DO
  MoveL p1, vmax, z50, tool2;
  ..
  MoveL p99, vmax, fine, tool2;
ENDWHILE
! Set the default manual mode max speed
SpeedLimCheckPoint 0;
SpeedLimAxis ROB_1, 1, 0;
SpeedLimAxis ROB_1, 2, 0;
SpeedLimAxis ROB_1, 3, 0;
SpeedLimAxis ROB_1, 4, 0;
SpeedLimAxis ROB_1, 5, 0;
SpeedLimAxis ROB_1, 6, 0;
..
TRAP setlimitspeed
  IDelete sigint1;
  CONNECT sigint1 WITH setlimitspeed;
  ISignalDI \SingleSafe, mysensorsignal, 1, sig1int1;
  ! Set out signal that is cross connected to system input
    LimitSpeed
  SetDO do1LimitSpeed, 1;
ENDTRAP
TRAP resetlimitspeed
  IDelete sigint2;
  CONNECT sigint2 WITH resetlimitspeed;
  ISignalDI \SingleSafe, mysensorsignal, 0, sig1int2;
  ! Reset out signal that is cross connected to system input
    LimitSpeed
  SetDO do1LimitSpeed, 0;
ENDTRAP
```

During the robot movement from position p1 to p10, the default speed limitation is used (manual mode speed). A new speed limit for the checkpoints for the TCP robot and for the axes are added. The trap routine `setlimitspeed` will apply the speed limitation if signal `mysensorsignal` changes value to 1.

The trap routine `resetlimitspeed` will remove the speed limitation when signal `mysensorsignal` changes value to 0.

The new settings for the speed limitation will be used as long as the variable `run_loop` is TRUE and the system input signal `LimitSpeed` is set to 1. When `run_loop` is set to FALSE the default speed limitation (manual mode speed) is set.

Continues on next page

**Note**

The trap routine in the example is only used to visualize the functionality. The signal used to limit the speed could also be connected either directly to the system input signal `LimitSpeed`, or through a safety PLC.

Limitations

The speed limit is only applied when the system input *LimitSpeed* is set to 1. Otherwise, the default TCP speed is used.

`SpeedLimCheckPoint` cannot be used in the POWER ON event routine.

If a robot is standing on a moving track, then the checkpoint speed in the world frame can be higher than the specified checkpoint speed limit in the base frame. The checkpoint speed in the world frame can be the sum of the track speed and the checkpoint speed in the base frame. To also limit the checkpoint speed in the world frame, make sure that the sum of both does not exceed the limit.

When reducing the speed of one axis or checkpoint, the other axes will also be reduced to the same percentage to be able to run along the programmed path. The process speed along the programmed path will vary.

When using `SafeMove` together with speed limitation, `SafeMove` must be setup with a margin and tested, since the `SafeMove` and motion calculations are slightly different. A change of tool TCP on the fly is not synchronized with `SafeMove`. So the tool TCP in `SafeMove` must either be shorter than the tools used by the robot, or the max checkpoint speed for `SafeMove` must be setup with an extra margin and tested.

Syntax

```
SpeedLimCheckPoint
  [RobSpeed ':='] <expression (IN) of num>';'
```

Related information

For information about	See
Positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Set speed limitation for an axis	SpeedLimAxis - Set speed limitation for an axis on page 743
Defining arm loads	<i>Technical reference manual - System parameters</i>
System input and output signals	<i>Technical reference manual - System parameters</i>

1 Instructions

1.248 SpeedRefresh - Update speed override for ongoing movement *RobotWare Base*

1.248 SpeedRefresh - Update speed override for ongoing movement

Usage

SpeedRefresh is used to change the movement speed for the ongoing robot movement in current motion program task. With this instruction it is possible to create some type of coarse speed adaptation from some sensor input.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in any Motion tasks.

Basic examples

The following example illustrates the instruction SpeedRefresh:

Example 1

```
VAR num change_speed:=70;  
SpeedRefresh change_speed;
```

This will change the current speed override to 70%.

Arguments

SpeedRefresh Override

Override

Data type: num

The speed override value within range 0 ... 100 %.

Program execution

The actual speed override value for the ongoing movements of robot and external units in current motion program task will be updated.

All speed data components for any mechanical units in current motion task will be influenced.



Note

Speed override set from SpeedRefresh is not equal to setting the speed from the FlexPendant. These are two different values. The product of these two values and the programmed speed will be the speed that is used in the movement.

If a PP to main is done or if a new program is loaded, the speed that was set with SpeedRefresh will be reset, and the speed set from the FlexPendant will be applied.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_SPEED_REFRESH_LIM	Override has a value outside the range of 0 to 100 %.

Continues on next page

More examples

More examples of the instruction SpeedRefresh are illustrated below.

Example 1

```

VAR intnum time_int;
VAR num override;
...
PROC main()
  CONNECT time_int WITH speed_refresh;
  ITimer 0.1, time_int;
  ISleep time_int;
  ...
  MoveL p1, v100, fine, tool2;
  ! Read current speed override set from FlexPendant
  override := CSpeedOverride (\CTask);
  IWatch time_int;
  MoveL p2, v100, fine, tool2;
  IDelete time_int;
  ! Reset to FlexPendant old speed override
  WaitTime 0.5;
  SpeedRefresh override;
  ...
TRAP speed_refresh
  VAR speed_corr;
  ! Analog input signal value from sensor, value 0 ... 10
  speed_corr := (ai_sensor * 10);
  SpeedRefresh speed_corr;
  ERROR
    IF ERRNO = ERR_SPEED_REFRESH_LIM THEN
      IF speed_corr > 100 speed_corr := 100;
      IF speed_corr < 0 speed_corr := 0;
      RETRY;
    ENDIF
  ENDTRAP

```

During the robot movement from position p1 to p2, the speed override value is updated every 0.1 s in the trap routine speed_refresh. The analog input signal ai_sensor is used for calculation of Override value for the instruction SpeedRefresh. There is no trap routine execution before or after the robot movement between p1 and p2. The manual speed override from FlexPendant is restored. After that the robot has to reach p2.

Limitations

Note that with SpeedRefresh the speed override will not be done momentary. Instead there will be a lag of 0.3 - 0.5 seconds between the order and the influence on the physical robot.

The user is responsible to reset the speed override value from the RAPID program after the SpeedRefresh sequence.

If SpeedRefresh is used in the START or in the RESET event routine, the speed that is set is always the actual FlexPendant speed override.

Continues on next page

1 Instructions

1.248 SpeedRefresh - Update speed override for ongoing movement

RobotWare Base

Continued

Syntax

```
SpeedRefresh  
[ Override ':= ' ] < expression (IN) of num > ';' ;'
```

Related information

For information about	See
Positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Definition of velocity	speeddata - Speed data on page 1729
Read current speed override	CSpeedOverride - Reads the current override speed on page 1210

1.249 SpyStart - Start recording of execution time data

Usage

SpyStart is used to start the recording of instruction and time data during execution.

The execution data will be stored in a file for later analysis.

The stored data is intended for debugging RAPID programs, specifically for multi-tasking systems (only necessary to have SpyStart - SpyStop in one program task).

Basic examples

The following example illustrates the instruction SpyStart:

Example 1

```
SpyStart "HOME:/spy.log";
```

Starts recording the execution time data in the file spy.log on the HOME: disk.

Arguments

SpyStart File

File

Data type: string

The file path and the file name to the file that will contain the execution data.

Program execution

The specified file is opened for writing and the execution time data begins recording in the file.

Recording of execution time data is active until:

- execution of instruction SpyStop
- starting program execution from the beginning
- loading a new program
- next **Restart**
- changing from manual to auto and Auto Condition Reset enabled

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEOPEN	The file in the SpyStart instruction can't be opened.

File format

TASK	INSTR	IN	CODE	OUT
MAIN	FOR i FROM 1 TO 3 DO	0	READY	0
MAIN	mynum:=mynum+i;	1	READY	1

Continues on next page

1 Instructions

1.249 SpyStart - Start recording of execution time data

RobotWare Base

Continued

TASK	INSTR	IN	CODE	OUT
MAIN	ENDFOR	2	READY	2
MAIN	mynum:=mynum+i;	2	READY	2
MAIN	ENDFOR	2	READY	2
MAIN	mynum:=mynum+i;	2	READY	2
MAIN	ENDFOR	2	READY	3
MAIN	SetDo1,1;	3	READY	3
MAIN	IF di1=0 THEN	3	READY	4
MAIN	MoveL p1, v1000, fine, tool0;	4	WAIT	14
MAIN	MoveL p1, v1000, fine, tool0;	111	READY	111
MAIN	ENDIF	108	READY	108
MAIN	MoveL p2, v1000, fine, tool0;	111	WAIT	118
MAIN	MoveL p2, v1000, fine, tool0;	326	READY	326
MAIN	SpyStop;	326	READY	

TASK column shows executed program task.

INSTR column shows executed instruction in specified program task.

IN column shows the time in ms when entering the executed instruction.

CODE column shows if the instruction is READY or the instruction WAIT for completion at OUT time.

OUT column shows the time in ms upon leaving the executed instruction.

All times are given in ms (relative values).

SYSTEM TRAP means that the system is doing something else than execution of RAPID instructions.

If the procedure calls to some NOSTEPIN procedure (module) then the output list shows only the name of the called procedure. This is repeated for every executed instruction in the NOSTEPIN routine.

Limitations

Never use the spy function in production programs because the function increases the cycle time and consumes memory on the mass memory device in use.

Syntax

```
SpyStart  
[File':=']<expression (IN) of string>;'
```

Related information

For information about	See
Stop recording of execution data	SpyStop - Stop recording of time execution data on page 758
Auto condition	<i>Technical reference manual - System parameters</i>

Continues on next page

1.249 SpyStart - Start recording of execution time data

RobotWare Base

Continued

For information about	See
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

1 Instructions

1.250 SpyStop - Stop recording of time execution data

RobotWare Base

1.250 SpyStop - Stop recording of time execution data

Usage

SpyStop is used to stop the recording of time data during execution.

The data, which can be useful for optimizing the execution cycle time, is stored in a file for later analysis.

Basic examples

The following example illustrates the instruction SpyStop :

See also [More examples on page 758](#).

Example 1

```
SpyStop;
```

Stops recording the execution time data in the file specified by the previous SpyStart instruction.

Program execution

The execution data recording is stopped and the file specified by the previous SpyStart instruction is closed. If no SpyStart instruction has been executed before then the SpyStop instruction is ignored.

More examples

More examples of the instruction SpyStop are illustrated below.

Example 1

```
IF debug = TRUE SpyStart "HOME:/spy.log";  
produce_sheets;  
IF debug = TRUE SpyStop;
```

If the debug flag is true then start recording execution data in the file spy . log on the HOME: disk. Perform actual production; stop recording, and close the file spy . log.

Limitations

Never use the spy function in production programs because the function increases the cycle time and consumes memory on the mass memory device in use.

Syntax

```
SpyStop' ; '
```

Related information

For information about	See
Start recording of execution data	SpyStart - Start recording of execution time data on page 755

1.251 StartLoad - Load a program module during execution

Usage

StartLoad is used to start the loading of a program module into the program memory during execution.

When loading is in progress other instructions can be executed in parallel. The loaded module must be connected to the program task with the instruction WaitLoad before any of its symbols/routines can be used.

The loaded program module will be added to the modules already existing in the program memory.

A program or system module can be loaded in static (default) or dynamic mode. Depending on the used mode, some operations will unload the module or not affect the module at all.

Static mode

The following table shows how two different operations affect a static loaded program or system modules.

	Set PP to main from TP	Open new RAPID program
Program Module	Not affected	Unloaded
System Module	Not affected	Not affected

Dynamic mode

The following table shows how two different operations affect a dynamic loaded program or system modules.

	Set PP to main from TP	Open new RAPID program
Program Module	Unloaded	Unloaded
System Module	Unloaded	Unloaded

Both static and dynamic loaded modules can be unloaded by the instruction UnLoad.

Basic examples

The following example illustrates the instruction StartLoad:

See also [More examples on page 761](#).

Example 1

```
VAR loadsession load1;

! Start loading of new program module PART_B containing routine
  routine_b in dynamic mode
StartLoad \Dynamic, diskhome \File:="PART_B.modx", load1;

! Executing in parallel in old module PART_A containing routine_a
%"routine_a"%;

! Unload of old program module PART_A
UnLoad diskhome \File:="PART_A.modx";
```

Continues on next page

1 Instructions

1.251 StartLoad - Load a program module during execution

RobotWare Base

Continued

```
! Wait until loading and linking of new program module PART_B is
  ready
WaitLoad load1;
```

```
! Execution in new program module PART_B
%"routine_b"%;
```

Starts the loading of program module PART_B.modx from diskhome into the program memory with instruction StartLoad. In parallel with the loading the program executes routine_a in module PART_A.modx. Then instruction WaitLoad waits until the loading and linking is finished. The module is loaded in dynamic mode.

Variable load1 holds the identity of the load session updated by StartLoad and referenced by WaitLoad.

To save linking time the instruction UnLoad and WaitLoad can be combined in the instruction WaitLoad by using the optional argument \UnloadPath.

Arguments

StartLoad [\Dynamic] FilePath [\File] LoadNo

[\Dynamic]

Data type: switch

The switch enables loading of a program module in dynamic mode. Otherwise the loading is in static mode.

FilePath

Data type: string

The file path and the file name to the file that will be loaded into the program memory. The file name shall be excluded when the argument \File is used.

[\File]

Data type: string

When the file name is excluded in the argument FilePath it must be defined with this argument.

LoadNo

Data type: loadsession

This is a reference to the load session that should be used in the instruction WaitLoad to connect the loaded program module to the program task.

Program execution

Execution of StartLoad will only order the loading and then proceed directly with the next instruction without waiting for the loading to be completed.

The instruction WaitLoad will then wait at first for the loading to be completed if it is not already finished, and then it will be linked and initialized. The initiation of the loaded module sets all variables at module level to their initial values.

Continues on next page

Unresolved references will default be accepted for this loading operation StartLoad - WaitLoad, but it will be a run time error on execution of an unresolved reference.

To obtain a good program structure that is easy to understand and maintain, all loading and unloading of program modules should be done from the main module, which is always present in the program memory during execution.

For loading of program that contains a main procedure to a main program (with another main procedure), see instruction Load, [Load - Load a program module during execution on page 332](#).

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILNOTFND	File not found.
ERR_LOADNO_INUSE	The variable specified in argument LoadNo is already in use.

More examples

More examples of how to use the instruction StartLoad are illustrated below.

Example 1

```
StartLoad \Dynamic, "HOME:/DOORDIR/DOOR1.modx", load1;
```

Loads the program module DOOR1.modx from the directory HOME:/DOORDIR to the program memory. The program module is loaded in dynamic mode.

Example 2

```
StartLoad \Dynamic, "HOME:" \File:="/DOORDIR/DOOR1.modx", load1;
```

Same as in example 1 but with another syntax.

Example 3

```
StartLoad "HOME:" \File:="/DOORDIR/DOOR1.modx", load1;
```

Same as in examples 1 and 2 above but the module is loaded in static mode.

Example 4

```
StartLoad \Dynamic, "HOME:" \File:="/DOORDIR/DOOR1.modx", load1;
WaitLoad load1;
```

is the same as

```
Load \Dynamic, "HOME:" \File:="/DOORDIR/DOOR1.modx";
```

Limitations

If a power fail comes while running a StartLoad instruction, the system will not be able to recover at startup. The controller will probably end up in system failure state, and the system must be restored from a backup.

To minimize this risk, it is better to load several small modules instead of one big/large module.

Continues on next page

1 Instructions

1.251 StartLoad - Load a program module during execution

RobotWare Base

Continued

Syntax

```
StartLoad
['\'Dynamic ',']
[FilePath' :='] <expression (IN) of string>
['\'File ' :='] <expression (IN) of string> ] ', '
[LoadNo ' :='] <variable (VAR) of loadsession>;'
```

Related information

For information about	See
Connect the loaded module to the task	WaitLoad - Connect the loaded module to the task on page 1031
Load session	loadsession - Program load session on page 1671
Load a program module	Load - Load a program module during execution on page 332
Unload a program module	UnLoad - Unload a program module during execution on page 978
Cancel loading of a program module	CancelLoad - Cancel loading of a module on page 78
Procedure call with Late binding	<i>Technical reference manual - RAPID Overview</i>
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

1.252 StartMove - Restarts robot movement

Usage

StartMove is used to resume robot, external axes movement and belonging process after the movement has been stopped

- by the instruction StopMove.
- after execution of StorePath ... RestoPath sequence.
- after asynchronously raised movements errors, such as ERR_PATH_STOP or specific process error after handling in the ERROR handler.

For base system it is possible to use this instruction in the following type of program tasks:

- main task T_ROB1 for restart of the movement in that task.
- any other task for restart of the movements in the main task.

For MultiMove system it is possible to use this instruction in the following type of program tasks:

- motion task, for restart of the movement in that task.
 - non motion task, for restart of the movement in the connected motion task.
- Besides that, if movement is restarted in one connected motion task belonging to a coordinated synchronized task group, the movement is restarted in all the cooperating tasks.

Basic examples

The following examples illustrate the instruction StartMove:

Example 1

```

StopMove;
waitDI ready_input,1;
StartMove;

```

The robot starts to move again when the input ready_input is set.

Example 2

```

...
MoveL p100, v100, z10, tool1;
StorePath;
p:= CRobT(\Tool:=tool1);
! New temporary movement
MoveL p1, v100, fine, tool1;
...
MoveL p, v100, fine, tool1;
RestoPath;
StartMove;
...

```

After moving back to a stopped position p (in this example equal to p100), the robot starts to move again on the basic path level.

Arguments

StartMove [\AllMotionTasks]

Continues on next page

1 Instructions

1.252 StartMove - Restarts robot movement

RobotWare Base

Continued

[`\AllMotionTasks`]

Data type: switch

Restart the movement of all mechanical units in the system. The switch [`\AllMotionTasks`] can only be used from a non-motion program task.

Program execution

Any processes associated with the stopped movement are restarted at the same time that the motion resumes.



Note

If a `StopMove` instruction has been used to stop movement, a `StartMove` instruction must be executed in the same task that performed the `StopMove`. This behavior is the same regardless of using the argument `\AllMotionTasks` or not.

To restart a `MultiMove` application in synchronized coordinated mode, `StartMove` must be executed in all motion tasks that are involved in coordination.

With the switch `\AllMotionTasks` (only allowed from non-motion program task) the movements for all mechanical units in the system are restarted.

In a base system without the switch `\AllMotionTasks`, the movements for following mechanical units are restarted:

- always the mechanical units in the main task, independent of which task executes the `StartMove` instruction.

In a `MultiMove` system without the switch `\AllMotionTasks` the movements for the following mechanical units are restarted:

- the mechanical units in the motion task executing `StartMove`.
 - the mechanical units in the motion task that are connected to the non motion task executing `StartMove`. Besides that, if mechanical units are restarted in one connected motion task belonging to a coordinated synchronized task group then the mechanical units are restarted in all the cooperated tasks.
-

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_PATHDIST</code>	The robot is too far from the path (more than 10 mm or 20 degrees) to perform a restart of the interrupted movement. Move the robot closer to the path before attempting <code>RETRY</code> .
<code>ERR_STARTMOVE</code>	The robot is in hold state when executing a <code>StartMove</code> instruction. Wait some time before attempting <code>RETRY</code> .
<code>ERR_PROGSTOP</code>	The robot is in program stop state when executing a <code>StartMove</code> instruction. Wait some time before attempting <code>RETRY</code> .

Continues on next page

Name	Cause of error
ERR_ALRDY_MOVING	The robot is already moving when executing a StartMove instruction. Wait some time before attempting RETRY.

Limitations

Only one of several non-motion tasks is allowed at the same time to do StopMove - StartMove sequence against some motion task.

It is not possible to do any error recovery if StartMove is executed in any error handler.

Syntax

```
StartMove  
['\'AllMotionTasks'];'
```

Related information

For information about	See
Stopping movements	StopMove - Stops robot movement on page 792
Continuing a movement	StartMoveRetry - Restarts robot movement and execution on page 766
More examples	StorePath - Stores the path when an interrupt occurs on page 798 RestoPath - Restores the path after an interrupt on page 600

1 Instructions

1.253 StartMoveRetry - Restarts robot movement and execution *RobotWare Base*

1.253 StartMoveRetry - Restarts robot movement and execution

Usage

StartMoveRetry is used to resume robot and external axes movements and belonging processes and also retry the execution from an ERROR handler.

This instruction can be used in an ERROR handler in the following types of program tasks:

- main task T_ROB1 in a base system
- any motion task in a *MultiMove* system

Basic examples

The following example illustrates the instruction StartMoveRetry:

Example 1

```
VAR robtarget p_err;  
...  
MoveL p1\ID:=50, v1000, z30, tool1 \Wobj:=stn1;  
...  
ERROR  
  IF ERRNO = ERR_PATH_STOP THEN  
    StorePath;  
    p_err := CRobT(\Tool:= tool1 \Wobj:=wobj0);  
    ! Fix the problem  
    MoveL p_err, v100, fine, tool1;  
    RestoPath;  
    StartMoveRetry;  
  ENDIF  
ENDPROC
```

This is an example from a MultiMove system with coordinated synchronized movements (two robots working on some rotated work object).

During the movement to position p1, the other cooperated robot gets some process error so that the coordinated synchronized movements stops. This robot then gets the error ERR_PATH_STOP, and the execution is transferred to the ERROR handler.

In the ERROR handler, do the following:

- StorePath stores the original path, goes to a new path level, and sets the MultiMove system in independent mode.
- If there are problems with the robot then initiate movements on the new path level.
- Before RestoPath go back to the error position.
- RestoPath goes back to the original path level and sets the MultiMove system back to synchronized mode again.
- StartMoveRetry restarts the interrupted movement and any process. It also transfers the execution back to resume the normal execution.

Continues on next page

Program execution

StartMoveRetry does the following sequence:

- regain to path
- restart any processes associated with the stopped movement
- restart the interrupted movement
- RETRY of the program execution

StartMoveRetry does the same as StartMove and RETRY together in one indivisible operation.

Only the mechanical units in the program task that execute StartMoveRetry are restarted.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_PATHDIST	The robot is too far from the path (more than 10 mm or 20 degrees) to perform a restart of the interrupted movement.
ERR_STARTMOVE	The robot is in hold state when executing a StartMoveRetry instruction.
ERR_PROGSTOP	The robot is in program stop state when executing a StartMoveRetry instruction.
ERR_ALRDY_MOVING	The robot is already moving when executing a StartMoveRetry instruction.

Limitations

Can only be used in an ERROR handler in a motion task.

In a MultiMove system executing coordinated synchronized movements the following programming rules must be followed in the ERROR handler:

- StartMoveRetry must be used in all cooperated program tasks.
- If movement is needed in any ERROR handler then the instructions StorePath ... RestoPath must be used in all cooperated program tasks.
- The program must move the robot back to the error position before RestoPath is executed if the robot was moved on the StorePath level.

Syntax

```
StartMoveRetry ';' ;
```

Related information

For information about	See
Stopping movements	StopMove - Stops robot movement on page 792
Continuing a movement	StartMove - Restarts robot movement on page 763
Resume execution after an error	RETRY - Resume execution after an error on page 602

Continues on next page

1 Instructions

1.253 StartMoveRetry - Restarts robot movement and execution

RobotWare Base

Continued

For information about	See
Store/restore path	StorePath - Stores the path when an interrupt occurs on page 798 RestoPath - Restores the path after an interrupt on page 600

1.254 STCalib - Calibrate a Servo Tool

Usage

STCalib is used to calibrate the distance between the tool tips. This is necessary after tip change or tool change, and it is recommended after performing a tip dress or after using the tool for a while.

Note! The tool performs two close/open movements during the calibration. The first close movement will detect the tip contact position.

**Note**

Do not use this instruction in combination with software equalizing and the 'Calibration No Pos Update' activated in the SpotWare application. In this case the spot instruction Calibrate should be used instead.

Basic examples

The following examples illustrate the instruction STCalib:

Example 1

```
VAR num curr_tip_wear;
VAR num retval;
CONST num max_adjustment := 20;
```

```
STCalib "SGUN_1" \ToolChg;
```

Calibrate a servo gun after a tool change. Wait until the gun calibration has finished before continuing with the next Rapid instruction.

Example 2

```
STCalib "SGUN_1" \ToolChg \Conc;
```

Calibrate a servo gun after a tool change. Continue with the next Rapid instruction without waiting for the gun calibration to be finished.

Example 3

```
STClose "SGUN_1", 10;
WaitTime 2;
STOpen "SGUN_1";
STCalib "SGUN_1" \TipChg;
```

Calibrate a servo gun after a tip change. Use STClose/STOpen with total tip wear as thickness to press the new tips in place before calibration.

Example 4

```
STCalib "SGUN_1" \TipWear \RetTipWear := curr_tip_wear;
```

Calibrate a servo gun after tip wear. Save the tip wear in variable curr_tip_wear.

Example 5

```
STCalib "SGUN_1" \TipChg \RetPosAdj:=retval;
IF retval > max_adjustment THEN
  TPWrite "The tips are lost!";
...
```

Calibrate a servo gun after a tip change. Check if the tips are missing.

Continues on next page

1 Instructions

1.254 STCalib - Calibrate a Servo Tool

Servo Tool Control

Continued

Example 6

```
STCalib "SGUN_1" \TipChg \PrePos:=10;
```

Calibrate a servo gun after a tip change. Move fast to position 10 mm then start to search for contact position with slower speed.

Example 7

Example of non valid combination:

```
STCalib "SGUN_1" \TipWear \RetTipWear := curr_tip_wear \Conc;
```

Perform a tip wear calibration. Continue with the next Rapid instruction without waiting for the gun calibration to be finished. The parameter `curr_tip_wear` will in this case **not** hold any valid value since the `\Conc` switch is used (The next Rapid instruction will start to execute before the calibration process is finished).

Arguments

```
STCalib ToolName [\ToolChg] | [\TipChg] | [\TipWear] [\RetTipWear]  
[\RetPosAdj] [\PrePos] [\Conc]
```

ToolName

Data type: string

The name of the mechanical unit.

[\ToolChg]

Data type: switch

Calibration after a tool change.

[\TipChg]

Data type: switch

Calibration after a tip change.

[\TipWear]

Data type: switch

Calibration after tip wear.

[\RetTipWear]

Data type: num

The achieved tip wear [mm].

[\RetPosAdj]

Data type: num

The positional adjustment since the last calibration [mm].

[\PrePos]

Data type: num

The position to move with high speed before the search for contact position with slower speed is started [mm].

[\Conc]

Data type: switch

Continues on next page

Subsequent instructions are executed while the gun is moving. The argument can be used to shorten cycle time. This is useful when, for example, two guns are controlled at the same time.

Program execution

Calibration modes

If the mechanical unit exists then the servo tool is ordered to calibrate. The calibration is done according to the switches, see below. If the RetTipWear parameter is used then the tip wear is updated.

Calibration after toolchange:

The tool will close with slow speed waiting for tips in contact to open fast, close fast to a low force, and open again in one sequence. The tip wear will remain unchanged.

Calibration after tipchange:

The tool will close with slow speed waiting for tips in contact to open fast, close fast to a low force, and open again in one sequence. The tip wear will be reset.

Calibration after tipwear:

The tool will close with high speed to the contact position, open fast, close fast to a low force, and open again in one sequence. The tip wear will be updated.

NOTE! If the switch Conc is used then the instruction will be considered ready once started and therefore the return value RetTipWear will not be available. In this case the RetTipWear will be returned by the function STIsOpen. For more details, see RobotWareOS functions - STIsOpen.

Positional adjustment

The optional argument RetPosAdj can be used to detect, for example, if the tips are lost after a tip change. The parameter will hold the value of the positional adjustment since the last calibration. The value can be negative or positive.

Using a pre-position

To speed up the calibration it is possible to define a pre-position. When the calibration starts the gun arm will run fast to the pre-position, stop, and then continue slowly*) forward to detect the tip contact position. If a pre-position is used then select it carefully! It is important that the tips do not get in contact until *after* the pre-position is reached! Otherwise, the accuracy of the calibration will become poor, and motion supervision errors may possibly occur. A pre-position will be ignored if it is larger than the current gun position (in order not to slow down the calibration).

*) The second movement will also be fast if the \TipWear option is used.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_SGUN	The specified servo tool name is not a configured servo tool.

Continues on next page

1 Instructions

1.254 STCalib - Calibrate a Servo Tool

Servo Tool Control

Continued

Name	Cause of error
ERR_SGUN_ESTOP	Emergency stop during servo tool movement. The instruction is invoked from a background task and there is an emergency stop, the instruction will be finished. Note that if the instruction is invoked from the main task then the program pointer will be stopped at the instruction, and the instruction will be restarted from the beginning at program restart.
ERR_SGUN_MOTOFF	The instruction is invoked from a background task and the system is in motors off state.
ERR_SGUN_NEGVAL	The argument PrePos is specified with a value less than zero.
ERR_SGUN_NOTACT	The servo tool mechanical unit is not activated. Use instruction ActUnit to activate the servo tool.
ERR_SGUN_NOTINIT	The servo tool position is not initialized. The servo tool position must be initialized the first time the gun is installed or after a fine calibration is made. Use the service routine ManServiceCalib or perform a tip change calibration. The tip wear will be reset.
ERR_SGUN_NOTOPEN	The gun is not open when STCalib is invoked.
ERR_SGUN_NOTSYNC	The servo tool tips are not synchronized. The servo tool tips must be synchronized if the revolution counter has been lost and/or updated. No process data such as tip wear will be lost.

Syntax

```
STCalib
[ 'ToolName' := ' ] < expression (IN) of string > ', '
[ '\ToolChg ] | [ '\TipChg ] | [ '\TipWear ]
[ ' \RetTipWear' := ' < variable or persistent(INOUT) of num >
  ]';
[ '\RetPosAdj' := ' < variable or persistent(INOUT) of num > ]';
[ '\PrePos' := ' < expression (IN) of num > ]'
[ '\Conc' ];'
```

Related information

For information about	See
Open a servo tool	STOpen - Open a Servo Tool on page 790
Close a servo tool	STClose - Close a Servo Tool on page 773

1.255 STClose - Close a Servo Tool

Usage

STClose is used to close the Servo Tool.

Basic examples

The following examples illustrate the instruction STClose:

Example 1

```
VAR num curr_thickness1;  
VAR num curr_thickness2;
```

```
STClose "SGUN_1", 1000, 5;
```

Close the servo gun with tip force 1000 N and plate thickness 5 mm. Wait until the gun is closed before continuing with the next Rapid instruction.

Example 2

```
STClose "SGUN_1", 2000, 3\RetThickness:=curr_thickness;
```

Close the servo gun with tip force 2000 N and plate thickness 3 mm. Get the measured thickness in variable curr_thickness.

Example 3

Concurrent mode:

```
STClose "SGUN_1", 1000, 5 \Conc;  
STClose "SGUN_2", 2000, 3 \Conc;
```

Close the servo "SGUN_1" with tip force 1000 N and plate thickness 5 mm. Continue the program execution without waiting for "SGUN_1" to be closed, and close the servo "SGUN_2" with tip force 2000N and plate thickness 3 mm. Continue the execution of the Rapid program without waiting for "SGUN_2" to be closed.

Example 4

```
IF STIsClosed ("SGUN_1")\RetThickness:=curr_thickness1 THEN  
  IF curr_thickness1 < 0.2 Set do_weld_start1;  
ENDIF  
IF STIsClosed ("SGUN_2")\RetThickness:=curr_thickness2 THEN  
  IF curr_thickness2 < 0.2 Set do_weld_start2;  
ENDIF
```

Get the measured thickness in the function STIsClosed variable curr_thickness1 and curr_thickness2.

Example 5

Example of non valid combination:

```
STClose "SGUN_1", 2000, 3\RetThickness:=curr_thickness \Conc;
```

Close the servo gun and continue with the Rapid program execution. The parameter curr_thickness will in this case not hold any valid value since the \Conc switch is used (The next Rapid instruction will start to execute before the gun is closed).

Arguments

STClose ToolName TipForce Thickness [\RetThickness][\Conc]

Continues on next page

1 Instructions

1.255 STClose - Close a Servo Tool

Servo Tool Control

Continued

ToolName

Data type: string

The name of the mechanical unit.

TipForce

Data type: num

The desired tip force [N].

Thickness

Data type: num

The expected contact position for the servo tool [mm].

[\RetThickness]

Data type: num

The achieved thickness [mm], will only get a value if the \Conc switch is not used.

[\Conc]

Data type: switch

Subsequent instructions are executed while the gun is moving. The argument can be used to shorten cycle time. This is useful when e.g. two guns are controlled at the same time.

Program execution

If the mechanical unit exists then the servo tool is ordered to close to the expected thickness and force.

The closing will start to move the tool arm to the expected contact position (thickness). The movement is stopped in this position, and a switch from position control mode to force control mode is done.

The tool arm is moved with max speed and acceleration as it is defined in the system parameters for corresponding external axis. As for other axes movements, the speed is reduced in manual mode.

When the desired tip force is achieved the instruction is ready and the achieved thickness is returned if the optional argument RetThickness is specified.

NOTE! If the switch Conc is used then the instruction will be considered to be ready once started and therefore the return value RetThickness will not be available. In this case the RetThickness will be returned by the function STIsClosed. For more details see RobotWare OS functions - STIsClosed.

It is possible to close the tool during a programmed robot movement as long as the robot movement does not include a movement of the tool arm.

For more details see Servo tool motion control.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_NO_SGUN	The specified servo tool name is not a configured servo tool.
ERR_SGUN_ESTOP	Emergency stop during servo tool movement. The instruction is invoked from a background task and there is an emergency stop, the instruction will be finished. Note that if the instruction is invoked from the main task then the program pointer will be stopped at the instruction, and the instruction will be restarted from the beginning at program restart.
ERR_SGUN_MOTOFF	The instruction is invoked from a background task and the system is in motors off state.
ERR_SGUN_NEGVAL	The argument <code>PrePos</code> is specified with a value less than zero.
ERR_SGUN_NOTACT	The servo tool mechanical unit is not activated. Use instruction <code>ActUnit</code> to activate the servo tool.
ERR_SGUN_NOTINIT	The servo tool position is not initialized. The servo tool position must be initialized the first time the gun is installed or after a fine calibration is made. Use the service routine <code>ManServiceCalib</code> or perform a tip change calibration. The tip wear will be reset.
ERR_SGUN_NOTOPEN	The gun is not open when <code>STClose</code> is invoked.
ERR_SGUN_NOTSYNC	The servo tool tips are not synchronized. The servo tool tips must be synchronized if the revolution counter has been lost and/or updated. No process data such as tip wear will be lost.

Syntax

```

STClose
[ 'ToolName' := ] < expression (IN) of string > ', '
[ 'Tipforce' := ] < expression (IN) of num > ', '
[ 'Thickness' := ] < expression (IN) of num > ]
[ '\ 'RetThickness' := ] < variable or persistent (INOUT) of num
    > ]
[ '\ 'Conc ]

```

Related information

For information about	See
Open a servo tool	STOpen - Open a Servo Tool on page 790

1 Instructions

1.256 StepBwdPath - Move backwards one step on path *RobotWare Base*

1.256 StepBwdPath - Move backwards one step on path

Usage

StepBwdPath is used to move the TCP backwards on the robot path from a RESTART event routine.

It is up to the user to introduce a restart process flag so StepBwdPath in the RESTART event routine is only executed at process restart and not at all program restarts.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove System, in Motion tasks.

Basic examples

The following example illustrates the instruction StepBwdPath:

Example 1

```
StepBwdPath 30, 1;  
StepBwdPath 30, 1;
```

The first instruction move backwards 30 mm. The second instruction move backwards 30 mm further.

Arguments

StepBwdPath StepLength StepTime

StepLength

Data type: num

Specifies the distance, in millimeters, to move backwards during this step. This argument must be a positive value.

StepTime

Data type: num

This argument is obsolete. Set it to 1.

Program execution

The robot moves back on its path for the specified distance. The path is exactly the same in the reverse way as it was before the stop occurred. In the case of a category 0 stop or halt with motors off, the RESTART event routine is called after the regain phase has completed so the robot will already be back on its path when this instruction is executed.

The actual speed for this movement is the programmed speed on the movement order but limited to 250 mm/s.

Following properties are valid in MultiMove System - Synchronized Coordinated Movements:

- All involved mechanical units are moved backward simultaneously and coordinated
- Each executed StepBwdPath in any involved program task results in one new backward movement step (without need of any StartMove)

Continues on next page

- To restart and continue the interrupted process movements, instruction StartMove must be executed in all involved program tasks

Error handling

If an attempt is made to move beyond these limits then the error handler will be called with ERRNO set to ERR_BWDLIMIT.

Limitations

After the program has been stopped it is possible to step backwards on the path with the following limits:

- The StepBwdPath movements are limited to the last fine point, and the length of the movement order history that normally is five.

Syntax

```
StepBwdPath
  [ StepLength':=' ] < expression (IN) of num >', '
  [ StepTime ':=' ] < expression (IN) of num >;'
```

Related information

For information about	See
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Positioning instructions	<i>Technical reference manual - RAPID Overview</i>
<i>Advanced RAPID</i>	<i>Application manual - Controller software Omni-Core</i>

1 Instructions

1.257 STIndGun - Sets the servo tool in independent mode

Servo Tool Control

1.257 STIndGun - Sets the servo tool in independent mode

Usage

STIndGun (*Servo Tool independent gun*) is used to set the servo tool (e.g. gun or gripper) in independent mode and thereafter move the tool to a specified independent position. The tool will stay in independent mode until the instruction STIndGunReset is executed.

During independent mode the control of the tool is separated from the robot. The tool can be closed, opened, calibrated, or moved to a new independent position, but it will not follow coordinated robot movements.

Independent mode is useful if the tool performs a task that is independent of the robot's task, e.g. tip dressing of a stationary gun.

Basic examples

The following example illustrates the instruction STIndGun:

Example 1

This procedure could be run from a background task while the robot in the main task can continue with, for example, move instructions.

```
PROC tipdress()

    ! Note that the gun will move to current robtarget position, if
    ! already in independent mode.
    STIndGunReset "SGUN_1";
    ...
    STIndGun "SGUN_1", 30;
    StClose "SGUN_1", 1000, 5;
    WaitTime 10;
    STOpen "SGUN_1";
    ...
    STIndGunReset "SGUN_1";

ENDPROC
```

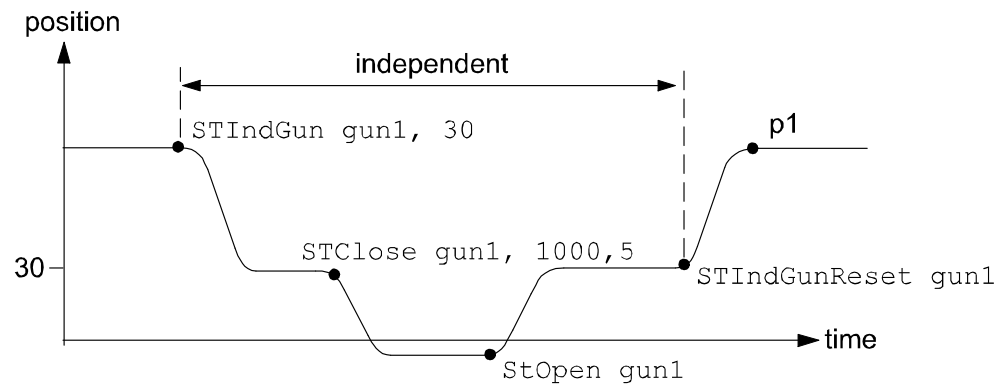
Independent mode is activated, and the gun is moved to an independent position (30 mm). During independent mode the instructions StClose, WaitTime, and STOpen are executed without interfering with robot motion. The instruction StIndGunReset will take the gun out of independent mode and move the gun to current robtarget position.

Continues on next page

1.257 STIndGun - Sets the servo tool in independent mode

Servo Tool Control

Continued



xx0500002342

The position p1 depends on the position of the gun given in the robtarget just performed by the robot.

Arguments

STIndGun ToolName GunPos

ToolName

Data type: string

The name of the mechanical unit.

GunPos

Data type: num

The position (stroke) of the servo gun in mm.

Syntax

```
STIndGun
[ ToolName ':=' ] < expression (IN) of string > ','
[ GunPos ':=' < expression (IN) of num > ]';'
```

1 Instructions

1.258 STIndGunReset - Resets the servo tool from independent mode

Servo Tool Control

1.258 STIndGunReset - Resets the servo tool from independent mode

Usage

STIndGunReset (*Servo Tool independent gun reset*) is used to reset the servo tool from independent mode and thereafter move the gun to current robtarget position.

Basic examples

The following example illustrates the instruction STIndGunReset:

```
STIndGunReset "SGUN_1";
```

Arguments

```
STIndGunReset ToolName
```

ToolName

Data type: string

The name of the mechanical unit.

Program execution

The instruction will reset the gun from independent mode and move the gun to current robtarget position. During this movement the coordinated speed of the gun must be zero, otherwise the reset will be delayed. The coordinated speed will be zero if the robot is standing still or if the current robot movement includes a "zero movement" of the gun.

Limitations

Note that the reset movement of the gun only will be finished if the coordinated speed of the tool between two points are zero or if the consecutive point is a stop point.

Syntax

```
STIndGunReset  
[ToolName '[:=']<expression (IN) of string>'];'
```

1.259 SToolRotCalib - Calibration of TCP and rotation for stationary tool

Usage

SToolRotCalib (*Stationary Tool Rotation Calibration*) is used to calibrate the TCP and rotation of a stationary tool.

The position of the robot and its movements are always related to its tool coordinate system, i.e. the TCP and tool orientation. To get the best accuracy it is important to define the tool coordinate system as correctly as possible.

The calibration can also be done with a manual method using the FlexPendant, see *Operating manual - OmniCore*.

Description

To define the TCP and rotation of a stationary tool, you need a movable pointing tool mounted on the end effector of the robot.

Before using the instruction SToolRotCalib, some preconditions must be fulfilled:

- The stationary tool that is to be calibrated must be mounted stationary and defined with the correct component robhold (FALSE).
- The pointing tool (robhold TRUE) must be defined and calibrated with the correct TCP values.
- If using the robot with absolute accuracy then the load and center of gravity for the pointing tool should be defined. LoadIdentify can be used for the load definition.
- The pointing tool, wobj0, and PDispOff must be activated before jogging the robot.
- Jog the TCP of the pointing tool as close as possible to the TCP of the stationary tool (origin of the tool coordinate system) and define a robtarget for the reference point RefTip.
- Jog the robot without changing the tool orientation so the TCP of the pointing tool is pointing at some point on the positive z-axis of the tool coordinate system, and define a robtarget for point ZPos.
- Jog the robot without changing the tool orientation so the TCP of the pointing tool is pointing at some point on the positive x-axis of the tool coordinate system, and define a robtarget for point XPos.

As a help for pointing out the positive z-axis and x-axis, some type of elongator tool can be used.

Definition of robtargets RefTip, ZPos, and XPos. See figure below.

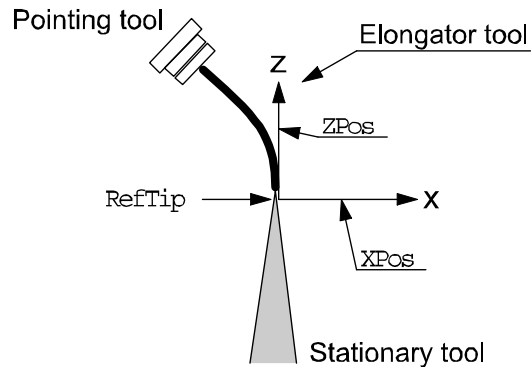
Continues on next page

1 Instructions

1.259 SToolRotCalib - Calibration of TCP and rotation for stationary tool

RobotWare Base

Continued



xx0500002343



Note

It is not recommended to modify the positions RefTip, ZPos, and XPos in the instruction SToolRotCalib.

Basic examples

The following example illustrates the instruction SToolRotCalib:

Example 1

```
! Created with pointing TCP pointing at the stationary tool
! coordinate system
CONST robtarget pos_tip := [...];
CONST robtarget pos_z := [...];
CONST robtarget pos_x := [...];

PERS tooldata tool1:= [ FALSE, [[0, 0, 0], [1, 0, 0, 0]], [0, [0,
0, 0], [1, 0, 0, 0], 0, 0, 0]];

!Instructions for creating or ModPos of pos_tip, pos_z and pos_x
MoveJ pos_tip, v10, fine, point_tool;
MoveJ pos_z, v10, fine, point_tool;
MoveJ pos_x, v10, fine, point_tool;

SToolRotCalib pos_tip, pos_z, pos_x, tool1;
```

The position of the TCP (tframe.trans) and the tool orientation (tframe.rot) of tool1 in the world coordinate system is calculated and updated.

Arguments

SToolRotCalib RefTip ZPos XPos Tool

RefTip

Data type: robtarget

The point where the TCP of the pointing tool is pointing at the stationary tool TCP to calibrate.

ZPos

Data type: robtarget

Continues on next page

1.259 SToolRotCalib - Calibration of TCP and rotation for stationary tool

RobotWare Base
Continued

The elongator point that defines the positive z direction.

XPos

Data type: robtarget

The elongator point that defines the positive x direction.

Tool

Data type: tooldata

The persistent variable of the tool that is to be calibrated.

Program execution

The system calculates and updates the TCP (`tframe.trans`) and the tool orientation (`tframe.rot`) in the specified `tooldata`. The calculation is based on the specified 3 `robtarget`. The remaining data in `tooldata` is not changed.

Syntax

```
SToolRotCalib
  [RefTip ':='] <expression (IN) of robtarget>', '
  [ZPos ':='] <expression (IN) of robtarget>', '
  [XPos ':='] <expression (IN) of robtarget>', '
  [Tool ':='] <persistent (PERS) of tooldata>' ;'
```

Related information

For information about	See
Calibration of TCP for a moving tool	MToolTCPCalib - Calibration of TCP for moving tool on page 497
Calibration of rotation for a moving tool	MToolRotCalib - Calibration of rotation for moving tool on page 494
Calibration of TCP for a stationary tool	MToolTCPCalib - Calibration of TCP for moving tool on page 497

1 Instructions

1.260 SToolTCPCalib - Calibration of TCP for stationary tool *RobotWare Base*

1.260 SToolTCPCalib - Calibration of TCP for stationary tool

Usage

SToolTCPCalib (*Stationary Tool TCP Calibration*) is used to calibrate the Tool Center Point - TCP for a stationary tool.

The position of the robot and its movements are always related to its tool coordinate system, i.e. the TCP and tool orientation. To get the best accuracy it is important to define the tool coordinate system as correctly as possible.

The calibration can also be done with a manual method using the FlexPendant (described in *Operating manual - OmniCore*).

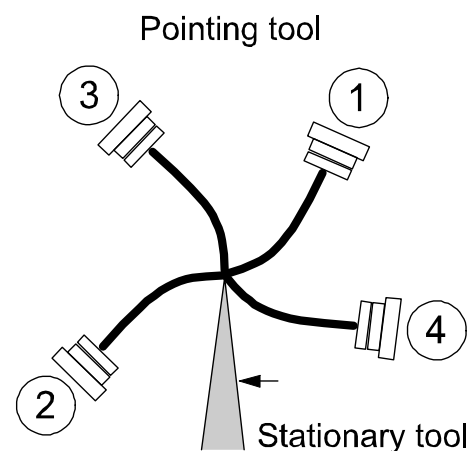
Description

To define the TCP of a stationary tool, you need a movable pointing tool mounted on the end effector of the robot.

The following are the prerequisites before using the instruction SToolTCPCalib:

- The stationary tool that is to be calibrated must be mounted stationary and defined with the correct component robhold (FALSE).
- The pointing tool (robhold TRUE) must be defined and calibrated with the correct TCP values.
- If using the robot with absolute accuracy then the load and center of gravity for the pointing tool should be defined. LoadIdentify can be used for the load definition.
- The pointing tool, wobj0 and PDispOff, must be activated before jogging the robot.
- Jog the TCP of the pointing tool as close as possible to the TCP of the stationary tool and define a robtarget for the first point p1.
- Define the further three positions p2, p3, and p4, all with different orientations.
- It is recommended that the TCP is pointing in different directions to obtain a reliable statistical result.

Definition of 4 robtargets p1...p4. See figure below.



xx0500002344

Continues on next page

**Note**

It is not recommended to modify the positions Pos1 to Pos4 in the instruction SToolTCPCalib.

The reorientation between the 4 positions should be as big as possible, putting the robot in different configurations. Its also good practice to check the quality of the TCP after a calibration. Which can be performed by reorientation of the tool to check if the TCP is standing still.

Basic example

The following example illustrates the instruction SToolTCPCalib:

Example 1

```
! Created with pointing TCP pointing at the stationary TCP
CONST robtarget p1 := [...];
CONST robtarget p2 := [...];
CONST robtarget p3 := [...];
CONST robtarget p4 := [...];

PERS tooldata tool1:= [ FALSE, [[0, 0, 0], [1, 0, 0, 0]], [0,001,
    [0, 0, 0.001], [1, 0, 0, 0], 0, 0, 0]];
VAR num max_err;
VAR num mean_err;
! Instructions for creating or ModPos of p1 - p4
MoveJ p1, v10, fine, point_tool;
MoveJ p2, v10, fine, point_tool;
MoveJ p3, v10, fine, point_tool;
MoveJ p4, v10, fine, point_tool;

SToolTCPCalib p1, p2, p3, p4, tool1, max_err, mean_err;
```

The TCP value (tframe.trans) of tool1 will be calibrated and updated. max_err and mean_err will hold the max error in mm from the calculated TCP and the mean error in mm from the calculated TCP, respectively.

Arguments

SToolTCPCalib Pos1 Pos2 Pos3 Pos4 Tool MaxErr MeanErr

Pos1

Data type: robtarget

The first approach point.

Pos2

Data type: robtarget

The second approach point.

Pos3

Data type: robtarget

The third approach point.

Continues on next page

1 Instructions

1.260 SToolTCPCalib - Calibration of TCP for stationary tool

RobotWare Base

Continued

Pos4

Data type: robtarget

The fourth approach point.

Tool

Data type: tooldata

The persistent variable of the tool that is to be calibrated.

MaxErr

Data type: num

The maximum error in mm for one approach point.

MeanErr

Data type: num

The average distance that the approach points are from the calculated TCP, i.e. how accurately the robot was positioned relative to the stationary TCP.

Program execution

The system calculates and updates the TCP value in the world coordinate system (tframe.trans) in the specified tooldata. The calculation is based on the specified 4 robtarget. The remaining data in tooldata, such as tool orientation (tframe.rot), is not changed.

Syntax

```
SToolTCPCalib
[ Pos1 ':' ] < expression (IN) of robtarget > ','
[ Pos2 ':' ] < expression (IN) of robtarget > ','
[ Pos3 ':' ] < expression (IN) of robtarget > ','
[ Pos4 ':' ] < expression (IN) of robtarget > ','
[ Tool ':' ] < persistent (PERS) of tooldata > ','
[ MaxErr ':' ] < variable (VAR) of num > ','
[ MeanErr ':' ] < variable (VAR) of num > ';' ;
```

Related information

For information about	See
Calibration of TCP for a moving tool	SToolTCPCalib - Calibration of TCP for stationary tool on page 784
Calibration of rotation for a moving tool	MToolRotCalib - Calibration of rotation for moving tool on page 494
Calibration of TCP and rotation for a stationary tool	SToolRotCalib - Calibration of TCP and rotation for stationary tool on page 781

1.261 Stop - Stops program execution

Usage

Stop is used to stop the program execution. Any movement performed at the time will be finished before the Stop instruction is ready.

Basic examples

The following example illustrates the instruction Stop:

See also [More examples on page 789](#).

Example 1

```
TPWrite "The line to the host computer is broken";  
Stop;
```

Program execution stops after a message has been written on the FlexPendant.

Arguments

Stop [\NoRegain] | [\AllMoveTasks]

[\NoRegain]

Data type: switch

Specifies for the next program start, whether or not the affected mechanical unit should return to the stop position.

If the argument \NoRegain is set then the robot and external axes will not return to the stop position (if they have been jogged away from it).

If the argument is omitted and if the robot or external axes have been jogged away from the stop position then the robot displays a question on the FlexPendant. The user can then answer whether or not the robot should return to the stop position.

[\AllMoveTasks]

Data type: switch

Specifies that programs in all running normal tasks besides the actual task should be stopped.

If the argument is omitted then only the program in the task that executes the instruction will be stopped.

Program execution

The instruction stops program execution when the affected mechanical units in the actual motion task have reached zero speed for the movement it is performing at the time, and stands still. Program execution can then be restarted from the next instruction.

If the instruction is used without any switches then only the program in that task will be affected.

If the ALLMoveTasks switch is used in a task (Normal, Static, or Semistatic) then the program in that task and all normal tasks will stop. See more about declaration of tasks in documentation for System Parameters

Continues on next page

1 Instructions

1.261 Stop - Stops program execution

RobotWare Base

Continued

The NoRegain switch is only possible to use in motion tasks since it only concerns the motion path.

If there is a Stop instruction in an event routine then the execution of the routine will be stopped, and the execution continues as described in [Stop on page 788](#).

If there is a Stop\AllMoveTasks instruction in an event routine in a MultiMove system, then the task containing the instruction continues as described in [Stop on page 788](#), and all other motion tasks executing an event routine continues as described in [Stop \AllMoveTasks on page 788](#) (same effect as for normal program stop during execution of the event routine).

Stop

Event routines	Effect by Stop instruction
POWER ON	The execution is stopped for all tasks. The execution continues in the event routine at the next start order.
START	The execution is stopped for all tasks. The execution continues in the event routine at the next start order.
RESTART	The execution is stopped for all tasks. The execution continues in the event routine at the next start order.
STOP	The execution is stopped. The execution does not continue in the event routine at the next start order.
QSTOP	The execution is stopped. The execution does not continue in the event routine at the next start order.
RESET	The execution is stopped. The execution does not continue in the event routine at the next start order.

Stop \AllMoveTasks

Event routines	Effect by Stop \AllMoveTasks instruction
POWER ON	The execution is stopped for all tasks. The execution continues in the event routine at the next start order.
START	The execution is stopped for all tasks. The execution continues in the event routine at the next start order.
RESTART	The execution is stopped for all tasks. The execution continues in the event routine at the next start order.
STOP	The execution is stopped for all tasks. The execution does not continue in the event routine at the next start order.
QSTOP	The execution is stopped for all tasks. The execution does not continue in the event routine at the next start order.
RESET	The execution is stopped. The execution does not continue in the event routine at the next start order.

Continues on next page

More examples

More examples of how to use the instruction Stop are illustrated below.

Example 1

```
MoveL p1, v500, fine, tool1;
TPWrite "Jog the robot to the position for pallet corner 1";
Stop \NoRegain;
p1_read := CRobT(\Tool:=tool1 \WObj:=wobj0);
MoveL p2, v500, z50, tool1;
```

Program execution stops with the robot at p1. The operator jogs the robot to p1_read. For the next program start the robot does not regain to p1, so the position p1_read can be stored in the program.

Syntax

```
Stop
[ '\ ' NoRegain ] '|'
[ '\ ' AllMoveTasks ]';'
```

Related information

For information about	See
Terminating program execution	EXIT - Terminates program execution on page 203
Only stopping robot movements	StopMove - Stops robot movement on page 792
Stop program for debugging	DebugBreak - Break program execution on page 50

1 Instructions

1.262 STOpen - Open a Servo Tool *Servo Tool Control*

1.262 STOpen - Open a Servo Tool

Usage

STOpen is used to open the Servo Tool.

Basic examples

The following examples illustrate the instruction STOpen:

Example 1

```
STOpen "SGUN_1";
```

Open the servo tool "SGUN_1". Wait until the gun is opened before continuing with the next Rapid instruction.

Example 2

```
STOpen "SGUN_1" \Conc;
```

Open the servo tool "SGUN_1". Continue with the next Rapid instruction without waiting for the gun to be opened.

Example 3

```
STOpen "SGUN_1" \WaitZeroSpeed;
```

Stop the servo tool "SGUN_1", wait until any coordinated movement has finished, and then open the servo tool "SGUN_1".

Arguments

```
STOpen ToolName [\WaitZeroSpeed] [\Conc]
```

ToolName

Data type: string

The name of the mechanical unit.

[\WaitZeroSpeed]

Data type: switch

Stop the servo tool, wait until any coordinated movement has finished, and then open the servo tool.

[\Conc]

Data type: switch

Subsequent instructions are executed while the gun is moving. The argument can be used to shorten cycle time. This is useful when, for example, two guns are controlled at the same time.

Program execution

If the mechanical unit exists then the servo tool is ordered to open. The tip force is reduced to zero and the tool arm is moved back to the pre_close position.

The tool arm is moved with max speed and acceleration as it is defined in the system parameters for the corresponding external axis. As for other axes movements, the speed is reduced in manual mode.

Continues on next page

It is possible to open the tool during a programmed robot movement as long as the robot movement does not include a movement of the tool arm. If the tool is opened during such movement then an error 50251 Tool opening failed will be displayed. The switch WaitZeroSpeed can be used to reduce the risk for this error.

If the switch \Conc is used then the instruction will be considered to be ready before the servo tool is opened. It is recommended that the function STIsOpen is used after STOpen to avoid any problems in concurrent mode.

For more details, see Servo tool motion control.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_SGUN	The specified servo tool name is not a configured servo tool.
ERR_SGUN_NOTACT	The servo tool mechanical unit is not activated. Use instruction ActUnit to activate the servo tool.
ERR_SGUN_NOTINIT	The servo tool position is not initialized. The servo tool position must be initialized the first time the gun is installed or after a fine calibration is made. Use the service routine ManServiceCalib or perform a tip change calibration. The tip wear will be reset.
ERR_SGUN_NOTSYNC	The servo tool tips are not synchronized. The servo tool tips must be synchronized if the revolution counter has been lost and/or updated. No process data such as tip wear will be lost.



Note

If the instruction is invoked from a background task and there is an emergency stop the instruction will be finished without an error.

Syntax

```
STOpen
[ 'ToolName ':'=' ] < expression (IN) of string > ','
[ '\WaitZeroSpeed' ] ','
[ '\Conc' ] '
```

Related information

For information about	See
Close a servo tool	STClose - Close a Servo Tool on page 773

1 Instructions

1.263 StopMove - Stops robot movement *RobotWare Base*

1.263 StopMove - Stops robot movement

Usage

StopMove is used to stop robot and external axes movements and any belonging process temporarily. If the instruction StartMove is given then the movement and process resumes.

This instruction can, for example, be used in a trap routine to stop the robot temporarily when an interrupt occurs.

For base system it is possible to use this instruction in the following type of program tasks:

- main task T_ROB1 for stopping the movement in that task.
- any other task for stopping the movements in the main task.

For MultiMove systems it is possible to use this instruction in following type of program tasks:

- motion task for stopping the movement in that task.
 - non-motion task for stopping the movement in the connected motion task.
- Besides that, if movement is stopped in one motion task belonging to a coordinated synchronized task group then the movement is stopped in all the cooperated tasks.



Note

The StopMove and StartMove sequence must always be executed by the same task.

Basic examples

The following example illustrates the instruction StopMove:

See also [More examples on page 793](#).

Example 1

```
StopMove;  
WaitDI ready_input, 1;  
StartMove;
```

The robot movement is stopped until the input, ready_input is set.

Arguments

StopMove [\AllMotionTasks]

[\AllMotionTasks]

Data type: switch

Stop the movement of all mechanical units in the system. The switch [\AllMotionTasks] can only be used from a non-motion program task.

Continues on next page

Program execution

The movements of the robot and external axes stop without the brakes being engaged. Any processes associated with the movement in progress are stopped at the same time as the movement is stopped.

Program execution continues after waiting for the robot and external axes to stop (standing still).

With the switch `\AllMotionTasks` (only allowed from non-motion program task) the movements for all mechanical units in the system are stopped.

In a base system without the switch `\AllMotionTasks`, the movements for the following mechanical units are stopped:

- always the mechanical units in the main task, independent of which task executes the `StopMove` instruction.

In a `MultiMove` system without the switch `\AllMotionTasks`, the movements for the following mechanical units are stopped:

- the mechanical units in the motion task executing `StopMove`.
- the mechanical units in the motion task that are connected to the non-motion task executing `StopMove`. Besides that, if mechanical units are stopped in one connected motion task belonging to a coordinated synchronized task group then the mechanical units are stopped in all the cooperated tasks.

The `StopMove` state in the motion task generated from the motion task itself will automatically be reset when starting that task from the beginning.

The `StopMove` state in connected motion task, generated from some non-motion task, will automatically be reset:

- if normal non-motion task, at the start of that task from the beginning.
- if semi-static non-motion task, at power fail restart when the task is starting from the beginning.
- if static non-motion task, at installation start when the task is starting from the beginning.

More examples

More examples of the instruction `StopMove` are illustrated below.

Example 1

```
VAR intnum intno1;
...
PROC main()
...
CONNECT intno1 WITH go_to_home_pos;
ISignalDI di1,1,intno1;
...

TRAP go_to_home_pos
VAR robtarget p10;
StopMove;
StorePath;
p10:=CRobT(\Tool:=tool1 \WObj:=wobj0);
```

Continues on next page

1 Instructions

1.263 StopMove - Stops robot movement

RobotWare Base

Continued

```
MoveL home,v500,fine,tool1;
WaitDI di1,0;
MoveL p10,v500,fine,tool1;
RestoPath;
StartMove;
ENDTRAP
```

When the input di1 is set to 1 an interrupt is activated which in turn activates the interrupt routine go_to_home_pos. The current movement is stopped, and the robot moves instead to the home position. When di1 is set to 0 the robot returns to the position at which the interrupt occurred and continues to move along the programmed path.

Example 2

```
VAR intnum intno1;
...
PROC main()
...
CONNECT intno1 WITH go_to_home_pos;
ISignalDI di1,1,intno1;
...

TRAP go_to_home_pos ()
VAR robtarg p10;
StorePath;
p10:=CRobT(\Tool:=tool1 \Wobj:=wobj0);
MoveL home,v500,fine,tool1;
WaitDI di1,0;
MoveL p10,v500,fine,tool1;
RestoPath;
StartMove;
ENDTRAP
```

Similar to the previous example but the robot does not move to the home position until the current movement instruction is finished.

StorePath is waiting for the robot movement to stop, and then does the movement to the home position.

Limitations

Only one of several non-motion tasks is allowed at the same time to do StopMove - StartMove sequence against some motion task.

Syntax

```
StopMove
['\AllMotionTasks'];'
```

Related information

For information about	See
Continuing a movement	StartMove - Restarts robot movement on page 763 StartMoveRetry - Restarts robot movement and execution on page 766

Continues on next page

1.263 StopMove - Stops robot movement

RobotWare Base

Continued

For information about	See
Store - restore path	StorePath - Stores the path when an interrupt occurs on page 798 RestoPath - Restores the path after an interrupt on page 600

1 Instructions

1.264 StopMoveReset - Reset the system stop move state *RobotWare Base*

1.264 StopMoveReset - Reset the system stop move state

Usage

StopMoveReset is used to reset the system stop move state without starting any movements.

Asynchronously raised movements errors, such as ERR_PATH_STOP or specific process error during the movements, can be handled in the ERROR handler. When such an error occurs the movements are stopped at once, and the system stop move flag is set for actual program tasks. This means that the movement is not restarted if doing any program start while program pointer is inside the ERROR handler.

Restart of the movements after such movement error will be done after one of these action:

- Execute StartMove or StartMoveRetry.
- Execute StopMoveReset and the movement will restart at the next program start.

Basic examples

The following example illustrates the instruction StopMoveReset:

Example 1

```
...
ArcL p101, v100, seam1, weld1, weave1, z10, gun1;
...
ERROR
  IF ERRNO=AW_WELD_ERR OR ERRNO=ERR_PATH_STOP THEN
    ! Execute something but without any restart of the movement
    ! ProgStop - ProgStart must be allowed
    ...
    ! No idea to try to recover from this error, so let the error
    ! stop the program
    ...
    ! Reset the move stop flag, so it's possible to manual restart
    ! the program and the movement after that the program has
    ! stopped
    StopMoveReset;
  ENDIF
ENDPROC
```

After that above ERROR handler has executed the ENDPROC, the program execution stops and the pointer is at the beginning of the ArcL instruction. Next program start restarts the program and movement from the position where the original movement error occurred.

Arguments

StopMoveReset [\AllMotionTasks]

[\AllMotionTasks]

Data type: switch

Continues on next page

1.264 StopMoveReset - Reset the system stop move state

RobotWare Base

Continued

Reset the system stop move state for all mechanical units in the system. The switch [\AllMotionTasks] can only be used from a non-motion program task.

Program execution

To reset a MultiMove application in synchronized coordinated mode, StopMoveReset must be executed in all motion tasks that are involved in coordination.

With the switch \AllMotionTasks (only allowed from non-motion program task) the reset is done for all all mechanical units in the system.

In a base system without the switch \AllMotionTasks, the reset is always done for the main task, independent of which task that executes the StopMoveReset instruction.

For base system it is possible to use StopMoveReset in the following type of program tasks:

- main task T_ROB1 to reset the stop move state in that task.
- any other task to reset the stop move state in the main task.

For MultiMove system it is possible to use this instruction in the following type of program tasks:

- motion task, to reset the stop move state in that task.
- non motion task, to reset the stop move state in the connected motion task. Besides that, if the reset of the stop move state in one connected motion task belonging to a coordinated synchronized task group, the stop move state is reset in all the cooperating tasks.

Syntax

```
StopMoveReset
  ['\AllMotionTasks'];'
```

Related information

For information about	See
Stop the movement	StopMove - Stops robot movement on page 792
Continuing a movement	StartMove - Restarts robot movement on page 763 StartMoveRetry - Restarts robot movement and execution on page 766
Store - restore path	StorePath - Stores the path when an interrupt occurs on page 798 RestoPath - Restores the path after an interrupt on page 600

1 Instructions

1.265 StorePath - Stores the path when an interrupt occurs

Path Recovery

1.265 StorePath - Stores the path when an interrupt occurs

Usage

StorePath is used to store the movement path being executed, e.g. when an error or interrupt occurs. The error handler or a trap routine can then start a new temporary movement and finally restart the original movement that was stored earlier.

For example, this instruction can be used to go to a service position or to clean the gun when an error occurs.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Basic examples

The following example illustrates the instruction StorePath:

See also [More examples on page 799](#).

Example 1

```
StorePath;
```

The current movement path is stored for later use. Set the system to independent movement mode.

Example 2

```
StorePath \KeepSync;
```

The current movement path is stored for later use. Keep synchronized movement mode.

Arguments

```
StorePath [\KeepSync]
```

[\KeepSync]

Keep Synchronization

Data type: switch

Keeps synchronized movement mode after the StorePath \KeepSync. The KeepSync switch can only be used if the system is in synchronized movement mode before the StorePath \KeepSync call.

Without the optional parameter \KeepSync, in a MultiMove coordinated synchronized system, the system is set to independent-semicoordinated movement mode. After execution of StorePath in all involved tasks, the system is in semicoordinated mode if further on use of coordinated work object. Otherwise it is in independent mode. If in semicoordinated mode it is recommended to always start with a movement in the mechanical unit that controls the user frame before WaitSyncTask in all involved tasks.

Program execution

The current movement path of the robot and external axes are saved. After this, another movement can be started in a trap routine or in an error handler. When

Continues on next page

1.265 StorePath - Stores the path when an interrupt occurs

*Path Recovery**Continued*

the reason for the error or interrupt has been rectified then the saved movement path can be restarted.

More examples

More examples of how to use the instruction StorePath are illustrated below.

Example 1

```

TRAP machine_ready
  VAR robtarget p1;
  StorePath;
  p1 := CRobT();
  MoveL p100, v100, fine, tool1;
  ...
  MoveL p1, v100, fine, tool1;
  RestoPath;
  StartMove;
ENDTRAP

```

When an interrupt occurs that activates the trap routine machine_ready, the movement path which the robot is executing at the time is stopped at the end of the instruction (ToPoint) and stored. After this the robot remedies the interrupt by, for example, replacing a part in the machine. Then the normal movement is restarted.

Limitations

Only the movement path data is stored with the instruction StorePath.

If the user wants to order movements on the new path level then the actual stop position must be stored directly after StorePath and before RestoPath makes a movement to the stored stop position on the path.

Only one movement path can be stored at a time.

Syntax

```

StorePath
  ['\'KeepSync'] ';'

```

Related information

For information about	See
Restoring a path	RestoPath - Restores the path after an interrupt on page 600
More examples	RestoPath - Restores the path after an interrupt on page 600 PathRecStart - Start the path recorder on page 534 SyncMoveResume - Set synchronized coordinated movements on page 817 SyncMoveSuspend - Set independent-semicoordinated movements on page 819

1 Instructions

1.266 STTune - Tuning Servo Tool *Servo Tool Control*

1.266 STTune - Tuning Servo Tool

Usage

STTune is used to tune/change a servo tool parameter. The parameter is changed temporarily from the original value, which is set up in the system parameters. The new tune value will be active immediately after executing the instruction.

STTune is useful in tuning procedures. A tuning procedure is typically used to find an optimal value for a parameter. An experiment (i.e. a program execution with a servo tool movement) is repeated when using different parameter tune values.

STTune shall not be used during calibration or tool closure.

Description

RampTorqRefOpen

Tunes the system parameter Ramp when decrease force, which decides how fast force is released while opening the tool. The unit is Nm/s and a typical value 200.

Corresponding system parameter: topic *Motion*, type *Force master*, parameter ramp_torque_ref_opening.

RampTorqRefClose

Tunes the system parameter Ramp when increase force, which decides how fast force is built up while opening the tool. The unit is Nm/s and a typical value 80.

Corresponding system parameter: topic *Motion*, type *Force master*, parameter ramp_torque_ref_closing.

KV

Tunes the system parameter KV, which is used for speed limitation. The unit is Nms/rad and a typical value 1. For more details, see the external axis documentation.

Corresponding system parameter: topic *Motion*, type *Force master*, parameter Kv.

SpeedLimit

Tunes the system parameter Speed limit, which is used for speed limitation. The unit is rad/s (motor speed) and a typical value 60. For more details, see the external axis documentation.

Corresponding system parameter: topic *Motion*, type *Force master*, parameter speed_limit.

CollAlarmTorq

Tunes the system parameter Collision alarm torque, which is used for the automatic calibration of new tips. The unit is Nm (motor torque) and a typical value 1. For more details, see the external axis documentation.

Corresponding system parameter: topic *Motion*, type *Force master*, parameter alarm_torque.

Continues on next page

CollContactPos

Tunes the system parameter `Collision delta pos`, which is used for automatic calibration of new tips. The unit is m and a typical value 0,002. For more details, see the external axis documentation.

Corresponding system parameter: topic *Motion*, type *Force master*, parameter `distance_to_contact_position`.

CollisionSpeed

Tunes the system parameter `Collision speed`, which is used for automatic calibration of new tips. The unit is m/s and a typical value 0,02. For more details, see the external axis documentation.

Corresponding system parameter: topic *Motion*, type *Force master*, parameter `col_speed`.

CloseTimeAdjust

Constant time adjustment (s), positive or negative, of the moment when the tool tips reaches contact during a tool closure. May be used to delay the closing slightly when the synchronized pre-closing is used for welding.

Corresponding system parameter: topic *Motion*, type *SG process*, parameter `min_close_time_adjust`.

ForceReadyDelayT

Constant time delay (s) before sending the weld ready signal after reaching the programmed force.

Corresponding system parameter: topic *Motion*, type *SG process*, parameter `pre_sync_delay_time`.

PostSyncTime

Release time anticipation (s) of the next robot movement after a weld. This tune type can be tuned to synchronize the gun opening with the next robot movement. The synchronization may fail if the parameters is set too high.

Corresponding system parameter: topic *Motion*, type *SG process*, parameter `post_sync_time`.

CalibTime

The wait time (s) during a calibration before the positional tool tip correction is done. For best results do not use too low a value like 0.5 s.

Corresponding system parameter: topic *Motion*, type *SG process*, parameter `calib_time`.

CalibForceLow

The minimum tip force (N) used during a TipWear calibration. For best result of the thickness detection it is recommended to use the minimum programmed weld force.

Corresponding system parameter: topic *Motion*, type *SG process*, parameter `calib_force_low`.

Continues on next page

1 Instructions

1.266 STTune - Tuning Servo Tool

Servo Tool Control

Continued

CalibForceHigh

The maximum tip force (N) used during a TipWear calibration. For best result of the thickness detection it is recommended to use the max programmed weld force.

Corresponding system parameter: topic *Motion*, type *SG process*, parameter *calib_force_high*.

Basic examples

The following example illustrates the instruction STTune:

Example 1

```
STTune SGUN_1, 0.050, CloseTimeAdjust;
```

The servo tool parameter CloseTimeAdjust is temporarily set to 0.050 seconds.

Arguments

STTune MecUnit TuneValue Type

MecUnit

Data type: mecunit

The name of the mechanical unit.

TuneValue

Data type: num

New tuning value.

Type

Data type: tunegtype

Parameter type. Servo tool parameters available for tuning are RampTorqRefOpen, RampTorqRefClose, KV, SpeedLimit, CollAlarmTorq, CollContactPos, CollisionSpeed, CloseTimeAdjust, ForceReadyDelayT, PostSyncTime, CalibTime, CalibForceLow, CalibForceHigh. These types are predefined in the system parameters and defines the original values.

Program execution

The specified tuning type and tuning value are activated for the specified mechanical unit. This value is applicable for all movements until a new value is programmed for the current mechanical unit or until the tuning types and values are reset using the instruction STTuneReset.

The original tune values may be permanently changed in the system parameters.

The default servo tool tuning values are automatically set

- by executing instruction STTuneReset.
- at a **Restart**.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_SGUN	The specified servo tool name is not a configured servo tool.

Syntax

```
STTune
[ MecUnit ':=' ] < variable (VAR) of mecunit > ','
[ TuneValue' :=' ] < expression (IN) of num > ','
[ 'Type ':=' ] < expression (IN) of tunegtype > '];'
```

Related information

For information about	See
Restore of servo tool parameters	TuneReset - Resetting servo tuning on page 953
Tuning of servo tool	<i>Application manual - Additional axes</i>

1 Instructions

1.267 STTuneReset - Resetting Servo tool tuning *Servo Tool Control*

1.267 STTuneReset - Resetting Servo tool tuning

Usage

STTuneReset is used to restore original values of servo tool parameters if they have been changed by the STTune instruction.

Basic examples

The following example illustrates the instruction STTuneReset:

Example 1

```
STTuneReset SGUN_1;
```

Restore *original values of servo tool parameters* for the mechanical unit SGUN_1.

Arguments

```
STTuneReset MecUnit
```

MecUnit

Data type: mecunit

The name of the mechanical unit.

Program execution

The original servo tool parameters are restored.

This is also achieved at a **Restart**.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_SGUN	The specified servo tool name is not a configured servo tool.

Syntax

```
STTuneReset  
[ MecUnit '[:=' ] < variable (VAR) of mecunit > ', '
```

Related information

For information about	See
Tuning of servo tool parameters	STTune - Tuning Servo Tool on page 800
Tuning of servo tool parameters	<i>Application manual - Additional axes</i>

1.268 SyncMoveOff - End coordinated synchronized movements

Usage

SyncMoveOff is used to end a sequence of synchronized movements and, in most cases, coordinated movements. First, all involved program tasks will wait to synchronize in a stop point, and then the motion planners for the involved program tasks are set to independent mode.

The instruction SyncMoveOff can only be used in a *MultiMove* system with option *Coordinated Robots* and only in program tasks defined as Motion Task.



WARNING

To reach safe synchronization functionality every meeting point (parameter SyncID) must have a unique name. The name of the meeting point must also be the same for all the program tasks that should meet.

Basic examples

The following example illustrates the instruction SyncMoveOff:

See also [More examples on page 807](#).

Example 1

```
!Program example in task T_ROB1

PERS tasks task_list{2} := [ ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync1;
VAR syncident sync2;

...
SyncMoveOn sync1, task_list;
...
SyncMoveOff sync2;
...

!Program example in task T_ROB2

PERS tasks task_list{2} := [ ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync1;
VAR syncident sync2;

...
SyncMoveOn sync1, task_list;
...
SyncMoveOff sync2;
...
```

The program task that first reaches SyncMoveOff with identity sync2 waits until the other tasks reach SyncMoveOff with the same identity sync2. At that synchronization point sync2, the motion planners for the involved program tasks

Continues on next page

1 Instructions

1.268 SyncMoveOff - End coordinated synchronized movements

RW-MRS Synchronized

Continued

are set to independent mode. After that, both task T_ROB1 and T_ROB2 continue their execution.

Arguments

SyncMoveOff SyncID [\TimeOut]

SyncID

Synchronization Identity

Data type: syncident

Variables that specify the name of the unsynchronization (meeting) point. Data type syncident is a non-value type. It is only used as an identifier for naming the unsynchronization point.

The variable must be defined and have an equal name in all cooperated program tasks. It is recommended to always define the variable global in each task (VAR syncident ...).

[\TimeOut]

Data type: num

The max. time to wait for the other program tasks to reach the unsynchronization point. The time-out is defined in seconds (resolution 0,001s).

If this time runs out before all program tasks have reached the unsynchronization point then the error handler will be called, if there is one, with the error code ERR_SYNCMOVEOFF. If there is no error handler then the execution will be stopped.

If this argument is omitted then the program task will wait forever.

Program execution

The program task that first reaches SyncMoveOff waits until all other specified tasks reach SyncMoveOff with the same SyncID identity. At that SyncID unsynchronization point the motion planner for the involved program tasks is set to independent mode. After that, involved program tasks continue their execution.

The motion planner for the involved program tasks are set to unsynchronized mode. This means the following:

- All RAPID program tasks and all movements from these tasks are working independently of each other again.
- Any move instruction must not be marked with any ID number. See instruction MoveL.

It is possible to exclude program tasks for testing purpose from FlexPendant - Task Selection Panel. The instructions SyncMoveOn and SyncMoveOff will still work with the reduced number of program tasks, even for only one program task.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_SYNCMOVEOFF	Time-out from SyncMoveOff.

Continues on next page

More examples

More examples of how to use the instruction SyncMoveOff are illustrated below.

Example of simple synchronized movement

```
!Program example in task T_ROB1
PERS tasks task_list{2} := [ ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync1;
VAR syncident sync2;
VAR syncident sync3;

PROC main()
...
MoveL p_zone, vmax, z50, tcp1;
WaitSyncTask sync1, task_list;
MoveL p_fine, v1000, fine, tcp1;
syncmove;
...
ENDPROC

PROC syncmove()
SyncMoveOn sync2, task_list;
MoveL * \ID:=10, v100, z10, tcp1 \WObj:= rob2_obj;
MoveL * \ID:=20, v100, fine, tcp1 \WObj:= rob2_obj;
SyncMoveOff sync3;
UNDO
    SyncMoveUndo;
ENDPROC

!Program example in task T_ROB2
PERS tasks task_list{2} := [ ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync1;
VAR syncident sync2;
VAR syncident sync3;

PROC main()
...
MoveL p_zone, vmax, z50, obj2;
WaitSyncTask sync1, task_list;
MoveL p_fine, v1000, fine, obj2;
syncmove;
...
ENDPROC

PROC syncmove()
SyncMoveOn sync2, task_list;
MoveL * \ID:=10, v100, z10, obj2;
MoveL * \ID:=20, v100, fine, obj2 ;
SyncMoveOff sync3;
UNDO
    SyncMoveUndo;
ENDPROC
```

Continues on next page

1 Instructions

1.268 SyncMoveOff - End coordinated synchronized movements

RW-MRS Synchronized

Continued

First program tasks T_ROB1 and T_ROB2 are waiting at WaitSyncTask with identity sync1 for each other, programmed with corner path for the preceding movements for saving cycle time.

Then the program tasks are waiting at SyncMoveOn with identity sync2 for each other, programmed with a necessary stop point for the preceding movements. After that, the motion planner for the involved program tasks is set to synchronized mode.

After that, T_ROB2 is moving the obj2 to ID point 10 and 20 in world coordinate system while T_ROB1 is moving the tcp1 to ID point 10 and 20 on the moving object obj2.

Then the program tasks are waiting at SyncMoveOff with identity sync3 for each other, programmed with a necessary stop point for the preceding movements. After that, the motion planner for the involved program tasks is set to independent mode.

Example with error recovery

```
!Program example with use of time-out function
VAR syncident sync3;

...
SyncMoveOff sync3 \TimeOut := 60;
...
ERROR
  IF ERRNO = ERR_SYNCMOVEOFF THEN
    RETRY;
  ENDIF
```

The program task waits for an instruction SyncMoveOff and for some other program task to reach the same synchronization point sync3. After waiting 60 seconds, the error handler is called with ERRNO equal to ERR_SYNCMOVEOFF. Then the instruction SyncMoveOff is called again for an additional wait of 60 seconds.

Example with semi coordinated and coordinated movement

```
!Example with semicoordinated and synchronized movement
!Program example in task T_ROB1
PERS tasks task_list{2} := [ ["T_ROB1"], ["T_ROB2"] ];
PERS wobjdata rob2_obj:= [FALSE,FALSE,"ROB_2",
  [[0,0,0],[1,0,0,0]], [[155.241,-51.5938,57.6297],
  [0.493981,0.506191,-0.501597,0.49815]]];
VAR syncident sync0;
VAR syncident sync1;
VAR syncident sync2;
VAR syncident sync3;
VAR syncident sync4;

PROC main()
  ...
  WaitSyncTask sync0, task_list;
  MoveL p1_90, v100, fine, tcp1 \wobj:= rob2_obj;
  WaitSyncTask sync1, task_list;
```

Continues on next page

1.268 SyncMoveOff - End coordinated synchronized movements

*RW-MRS Synchronized**Continued*

```

SyncMoveOn sync2, task_list;
MoveL p1_100 \ID:=10, v100, fine, tcp1 \WObj:= rob2_obj;
SyncMoveOff sync3;
!Wait until the movement has been finished in T_ROB2
WaitSyncTask sync3, task_list;
!Now a semicoordinated movement can be performed
MoveL p1_120, v100, z10, tcp1 \WObj:= rob2_obj;
MoveL p1_130, v100, fine, tcp1 \WObj:= rob2_obj;
WaitSyncTask sync4, task_list;
...
ENDPROC

```

```

!Program example in task T_ROB2
PERS tasks task_list{2} := [ ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync0;
VAR syncident sync1;
VAR syncident sync2;
VAR syncident sync3;
VAR syncident sync4;

PROC main()
...
MoveL p_fine, v1000, fine, tcp2;
WaitSyncTask sync0, task_list;
!Wait until the movement in T_ROB1 task is finished
WaitSyncTask sync1, task_list;
SyncMoveOn sync2, task_list;
MoveL p2_100 \ID:=10, v100, fine, tcp2;
SyncMoveOff sync3;
!The path has been removed at SyncMoveOff
!Perform a movement to wanted position for the object to
!make the position available for other tasks
MoveL p2_100, v100, fine, tcp2;
WaitSyncTask sync3, task_list;
WaitSyncTask sync4, task_list;
MoveL p2_110, v100, z10, tcp2;
...
ENDPROC

```

When switching between semicoordinated to synchronized movement, a WaitSyncTask is needed (when using identity sync1).

When switching between synchronized to semicoordinated movement, the task that move the work object (rob2_obj) needs to move to the desired position. After that a WaitSyncTask is needed (identity sync3) before the semicoordinated movement can be performed.

Limitations

The SyncMoveOff instruction can only be executed if all involved robots stand still in a stop point.

Continues on next page

1 Instructions

1.268 SyncMoveOff - End coordinated synchronized movements

RW-MRS Synchronized

Continued

If this instruction is preceded by a move instruction then that move instruction must be programmed with a stop point (zonedata fine), not a fly-by point.

Otherwise restart after power failure will not be possible.

SyncMoveOff cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset, or Step.

Syntax

```
SyncMoveOff
[ SyncID ':= ' ] < variable (VAR) of syncident>
[ '\TimeOut' := ' < expression (IN) of num> ] ';' ;'
```

Related information

For information about	See
Specify cooperated program tasks	tasks - RAPID program tasks on page 1749
Identity for synchronization point	syncident - Identity for synchronization point on page 1745
Start coordinated synchronized movements	SyncMoveOn - Start coordinated synchronized movements on page 811
Set independent movements	SyncMoveUndo - Set independent movements on page 821
Test if in synchronized mode	IsSyncMoveOn - Test if in synchronized movement mode on page 1337
MultiMove system with option Coordinated robots	Application manual - MultiMove

1.269 SyncMoveOn - Start coordinated synchronized movements

Usage

SyncMoveOn is used to start a sequence of synchronized movements and in most cases, coordinated movements. First, all involved program tasks will wait to synchronize in a stop point and then the motion planner for the involved program tasks is set to synchronized mode.

The instruction SyncMoveOn can only be used in a *MultiMove* system with option *Coordinated Robots* and only in program tasks defined as Motion Task.



WARNING

To reach safe synchronization functionality every meeting point (parameter SyncID) must have a unique name. The name of the meeting point must also be the same for all the program tasks that should meet in the meeting point.

Basic examples

The following example illustrates the instruction SyncMoveOn:

See also [More examples on page 813](#).

Example 1

```
!Program example in task T_ROB1

PERS tasks task_list{2} := [ ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync1;
VAR syncident sync2;

...
SyncMoveOn sync1, task_list;
...
SyncMoveOff sync2;
...

!Program example in task T_ROB2

PERS tasks task_list{2} := [ ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync1;
VAR syncident sync2;

...
SyncMoveOn sync1, task_list;
...
SyncMoveOff sync2;
...
```

The program task that first reaches SyncMoveOn with identity sync1 waits until the other task reaches its SyncMoveOn with the same identity sync1. At that synchronization point, sync1, the motion planner for the involved program tasks is set to synchronized mode. After that, both task T_ROB1 and T_ROB2 continue

Continues on next page

1 Instructions

1.269 SyncMoveOn - Start coordinated synchronized movements

RW-MRS Synchronized

Continued

their execution, synchronized until they reach SyncMoveOff with the same identity sync2.

Arguments

SyncMoveOn SyncID TaskList [\TimeOut]

SyncID

Synchronization Identity

Data type:syncident

Variable that specifies the name of the synchronization (meeting) point. Data type syncident is a non-value type that is only used as an identifier for naming the synchronization point.

The variable must be defined and have an equal name in all cooperated program tasks. It is recommended to always define the variable global in each task (VAR syncident ...).

TaskList

Data type:tasks

Persistent variable that in a task list (array) specifies the name (string) of the program tasks that should meet in the synchronization point with name according argument SyncID.

The persistent variable must be defined and have equal name and equal contents in all cooperated program tasks. It is recommended to always define the variable global in the system (PERS tasks ...).

[\TimeOut]

Data type: num

The max. time to wait for the other program tasks to reach the synchronization point. The time-out is defined in seconds (resolution 0.001s).

If this time runs out before all program tasks have reached the synchronization point then the error handler will be called, if there is one, with the error code ERR_SYNCMOVEON. If there is no error handler then the execution will be stopped.

If this argument is omitted then the program task will wait for ever.

Program execution

The program task that first reaches SyncMoveOn waits until all other specified tasks reach their SyncMoveOn with the same SyncID identity. At that SyncID synchronization point the motion planner for the involved program tasks is set to synchronized mode. After that, involved program tasks continue their execution.

The motion planner for the involved program tasks is set to synchronized mode. This means the following:

- Each movement instruction in any program task in the TaskList is working synchronous with movement instructions in other program tasks in the TaskList.
- All cooperated movement instructions are planned and interpolated in the same Motion Planner.

Continues on next page

1.269 SyncMoveOn - Start coordinated synchronized movements

*RW-MRS Synchronized**Continued*

- All movements start and end at the same time. The movement that takes the longest time will be the speed master with reduced speed in relation to the work object for the other movements.
- All cooperated move instruction must be marked with the same ID number. See instruction MoveL.

It is possible to exclude program tasks for testing purpose from FlexPendant - Task Selection Panel. The instruction SyncMoveOn will still work with the reduced number of program tasks even for only one program task.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_SYNCMOVEON	Time-out from SyncMoveOn.

More examples

More examples of how to use the instruction SyncMoveOn are illustrated below.

Example 1

```
!Program example in task T_ROB1
PERS tasks task_list{2} := ["T_ROB1"], ["T_ROB2"]];
VAR syncident sync1;
VAR syncident sync2;
VAR syncident sync3;

PROC main()
...
MoveL p_zone, vmax, z50, tcp1;
WaitSyncTask sync1, task_list;
MoveL p_fine, v1000, fine, tcp1;
syncmove;
...
ENDPROC

PROC syncmove()
SyncMoveOn sync2, task_list;
MoveL * \ID:=10, v100, z10, tcp1 \WOBJ:= rob2_obj;
MoveL * \ID:=20, v100, fine, tcp1 \WOBJ:= rob2_obj;
SyncMoveOff sync3;
UNDO
SyncMoveUndo;
ENDPROC

!Program example in task T_ROB2
PERS tasks task_list{2} := ["T_ROB1"], ["T_ROB2"]];
VAR syncident sync1;
VAR syncident sync2;
VAR syncident sync3;

PROC main()
```

Continues on next page

1 Instructions

1.269 SyncMoveOn - Start coordinated synchronized movements

RW-MRS Synchronized

Continued

```
...
MoveL p_zone, vmax, z50, obj2;
WaitSyncTask sync1, task_list;
MoveL p_fine, v1000, fine, obj2;
syncmove;
...
ENDPROC

PROC syncmove()
  SyncMoveOn sync2, task_list;
  MoveL * \ID:=10, v100, z10, obj2;
  MoveL * \ID:=20, v100, fine, obj2;
  SyncMoveOff sync3;
  UNDO
    SyncMoveUndo;
ENDPROC
```

First, program tasks T_ROB1 and T_ROB2 are waiting at WaitSyncTask with identity sync1 for each other. They are programmed with corner path for the preceding movements for saving cycle time.

Then the program tasks are waiting at SyncMoveOn with identity sync2 for each other. They are programmed with a necessary stop point for the preceding movements. After that the motion planner for the involved program tasks is set to synchronized mode.

After that, T_ROB2 is moving the obj2 to ID point 10 and 20 in world coordinate system while T_ROB1 is moving the tcp1 to ID point 10 and 20 on the moving object obj2.

Example 2

```
!Program example with use of time-out function
VAR syncident sync3;

...
SyncMoveOn sync3, task_list \TimeOut :=60;
...
ERROR
  IF ERRNO = ERR_SYNCMOVEON THEN
    RETRY;
  ENDIF
```

The program task waits for instruction SyncMoveOn for the program task T_ROB2 to reach the same synchronization point sync3. After waiting 60 seconds, the error handler is called with ERRNO equal to ERR_SYNCMOVEON. Then the instruction SyncMoveOn is called again for an additional wait of 60 seconds.

Example 3- Program example with three tasks

```
!Program example in task T_ROB1
PERS tasks task_list1 {2} :=[["T_ROB1"], ["T_ROB2"]];
PERS tasks task_list2 {3} :=[["T_ROB1"], ["T_ROB2"], ["T_ROB3"]];
VAR syncident sync1;
...
VAR syncident sync5;
```

Continues on next page

1.269 SyncMoveOn - Start coordinated synchronized movements

*RW-MRS Synchronized**Continued*

```

...
SyncMoveOn sync1, task_list1;
...
SyncMoveOff sync2;
WaitSyncTask sync3, task_list2;
SyncMoveOn sync4, task_list2;
...
SyncMoveOff sync5;
...

!Program example in task T_ROB2

PERS tasks task_list1 {2} := ["T_ROB1"], ["T_ROB2"];
PERS tasks task_list2 {3} := ["T_ROB1"], ["T_ROB2"], ["T_ROB3"];
VAR syncident sync1;
...
VAR syncident sync5;

...
SyncMoveOn sync1, task_list1;
...
SyncMoveOff sync2;
WaitSyncTask sync3, task_list2;
SyncMoveOn sync4, task_list2;
...
SyncMoveOff sync5;
...

!Program example in task T_ROB3

PERS tasks task_list2 {3} := ["T_ROB1"], ["T_ROB2"], ["T_ROB3"];
VAR syncident sync3;
VAR syncident sync4;
VAR syncident sync5;

...
WaitSyncTask sync3, task_list2;
SyncMoveOn sync4, task_list2;
...
SyncMoveOff sync5;
...

```

In this example, at first, program task T_ROB1 and T_ROB2 are moving synchronized and T_ROB3 is moving independent. Further on in the program all three tasks are moving synchronized. To prevent the instruction of SyncMoveOn to be executed in T_ROB3 before the first synchronization of T_ROB1 and T_ROB2 have ended, the instruction WaitSyncTask is used.

Continues on next page

1 Instructions

1.269 SyncMoveOn - Start coordinated synchronized movements

RW-MRS Synchronized

Continued

Limitations

The SyncMoveOn instruction can only be executed if all involved robots stand still in a stop point.

Only one coordinated synchronized movement group can be active at the same time.

If this instruction is preceded by a move instruction then that move instruction must be programmed with a stop point (zonedata fine), not a fly-by point.

Otherwise restart after power failure will not be possible.

SyncMoveOn cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset, or Step.

Syntax

```
SyncMoveOn
[ SyncID ':=' ] < variable (VAR) of syncident> ', '
[ TaskList ':=' ] < persistent array {*} (PERS) of tasks> ', '
[ '\ ' Timeout ':=' < expression (IN) of num > ] ';' ;
```

Related information

For information about	See
Specify cooperated program tasks	tasks - RAPID program tasks on page 1749
Identity for synchronization point	syncident - Identity for synchronization point on page 1745
End coordinated synchronized movements	SyncMoveOff - End coordinated synchronized movements on page 805
Set independent movements	SyncMoveUndo - Set independent movements on page 821
Test if in synchronized mode	IsSyncMoveOn - Test if in synchronized movement mode on page 1337
MultiMove system with option Coordinated Robots	Application manual - MultiMove
Wait for synchronized tasks	WaitSyncTask - Wait at synchronization point for other program tasks on page 1037

1.270 SyncMoveResume - Set synchronized coordinated movements

RW-MRS Synchronized

1.270 SyncMoveResume - Set synchronized coordinated movements

Usage

SyncMoveResume is used to go back to synchronized movements from independent movement mode. The instruction can only be used on StorePath level, e.g. after a StorePath \KeepSync has been executed and the system is in independent motion mode after SyncMoveSuspend has been executed. To be able to use the instruction the system must have been in synchronized motion mode before executing the StorePath and SyncMoveSuspend instruction.

The instruction SyncMoveResume can only be used in a *MultiMove* system with options *Coordinated Robots* and *Path Recovery* and only in program tasks defined as *Motion Task*.

Basic examples

The following example illustrates the instruction SyncMoveResume:

Example 1

```

ERROR
StorePath \KeepSync;
! Save position
p11 := CRobT(\Tool:=tool2);
! Move in synchronized motion mode
MoveL p12\ID:=111, v50, fine, tool2;
SyncMoveSuspend;
! Move in independent mode somewhere, e.g. to a cleaning station
p13 := CRobT();
MoveL p14, v100, fine, tool2;
! Do something at cleaning station
MoveL p13, v100, fine, tool2;
SyncMoveResume;
! Move in synchronized motion mode back to start position p11
MoveL p11\ID:=112, v50, fine, tool2;
RestoPath;
StartMove;
RETRY;

```

Some kind of recoverable error occurs. The system is kept in synchronized mode, and a synchronized movement is done to a point, e.g. moving backwards on path. After that, an independent movement is done to a cleaning station. Then the robot is moved back to the point where the error occurred and the program continues where it was interrupted by the error.

Program execution

SyncMoveResume forces resume of synchronized mode when system is in independent movement mode on StorePath level.

SyncMoveResume is required in all tasks that were executing in synchronized movement before entering independent movement mode. If one Motion task executes a SyncMoveResume then that task will wait until all tasks that earlier were

Continues on next page

1 Instructions

1.270 SyncMoveResume - Set synchronized coordinated movements

RW-MRS Synchronized

Continued

in synchronized movement mode execute a SyncMoveResume instruction. After that, involved program tasks continue their execution.

Limitations

The SyncMoveResume can only be used to go back to synchronized movement mode and can only be used on StorePath level.

If this instruction is preceded by a move instruction then that move instruction must be programmed with a stop point (zonedata fine), not a fly-by point. Otherwise restart after power failure will not be possible.

SyncMoveResume cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset, or Step.

Syntax

SyncMoveResume ' ; '

Related information

For information about	See
Specify cooperated program tasks	tasks - RAPID program tasks on page 1749
Start coordinated synchronized movements	SyncMoveOn - Start coordinated synchronized movements on page 811
End coordinated synchronized movements	SyncMoveOff - End coordinated synchronized movements on page 805
Test if in synchronized mode	SyncMoveOn - Start coordinated synchronized movements on page 811
Stores the path	StorePath - Stores the path when an interrupt occurs on page 798
Restores the path	RestoPath - Restores the path after an interrupt on page 600
Suspends synchronized movements	SyncMoveSuspend - Set independent-semicoordinated movements on page 819

1.271 SyncMoveSuspend - Set independent-semicoordinated movements

Usage

SyncMoveSuspend is used to suspend synchronized movements mode and set the system to independent-semicoordinated movement mode. The instruction can only be used on StorePath level, e.g. after a StorePath or StorePath \KeepSync has been executed and the system is in synchronized movement mode.

The instruction SyncMoveSuspend can only be used in a *MultiMove System* with options *Coordinated Robots* and *Path Recovery* and only in program tasks defined as *Motion Task*.

Basic examples

The following example illustrates the instruction SyncMoveSuspend:

Example 1

```

ERROR
  StorePath \KeepSync;
  ! Save position
  p11 := CRobT(\Tool:=tool2);
  ! Move in synchronized motion mode
  MoveL p12\ID:=111, v50, fine, tool2;
  SyncMoveSuspend;
  ! Move in independent mode somewhere, e.g. to a cleaning station
  p13 := CRobT();
  MoveL p14, v100, fine, tool2;
  ! Do something at cleaning station
  MoveL p13, v100, fine, tool2;
  SyncMoveResume;
  ! Move in synchronized motion mode back to start position p11
  MoveL p11\ID:=112, v50, fine, tool2;
  RestoPath;
  StartMove;
  RETRY;

```

Some kind of recoverable error occurs. The system is kept in synchronized mode, and a synchronized movement is done to a point, e.g. moving backwards on path. After that, an independent movement is done to a cleaning station. Then the robot is moved back to the point where the error occurred and the program continues where it was interrupted by the error.

Program execution

SyncMoveSuspend forces reset of synchronized movements and sets the system to independent-semicoordinated movement mode.

SyncMoveSuspend is required in all synchronized Motion tasks to set the system in independent-semicoordinated movement mode. If one Motion tasks executes a SyncMoveSuspend then that task waits until the other tasks have executed a SyncMoveSuspend instruction.

Continues on next page

1 Instructions

1.271 SyncMoveSuspend - Set independent-semicoordinated movements

RW-MRS Synchronized

Continued

After execution of SyncMoveSuspend in all involved tasks, the system is in semicoordinated mode if it further uses a coordinated work object. Otherwise, it is in independent mode. If in semicoordinated mode, it is recommended to always start with a movement in the mechanical unit that controls the user frame before WaitSyncTask in all involved tasks.

Limitations

The SyncMoveSuspend instruction suspends synchronized mode only on StorePath level. After returning from StorePath level, the system is set to the mode that it was in before the StorePath.

If this instruction is preceded by a move instruction then that move instruction must be programmed with a stop point (zonedata fine), not a fly-by point. Otherwise restart after power failure will not be possible.

SyncMoveSuspend cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset, or Step.

Syntax

SyncMoveSuspend ';' ;'

Related information

For information about	See
Specify cooperated program tasks	tasks - RAPID program tasks on page 1749
Start coordinated synchronized movements	SyncMoveOn - Start coordinated synchronized movements on page 811
End coordinated synchronized movements	SyncMoveOff - End coordinated synchronized movements on page 805
Test if in synchronized mode	IsSyncMoveOn - Test if in synchronized movement mode on page 1337
Stores the path	StorePath - Stores the path when an interrupt occurs on page 798
Restores the path	RestoPath - Restores the path after an interrupt on page 600
Resume synchronized movements	SyncMoveResume - Set synchronized coordinated movements on page 817

1.272 SyncMoveUndo - Set independent movements

Usage

SyncMoveUndo is used to force a reset of synchronized coordinated movements and set the system to independent movement mode.

The instruction SyncMoveUndo can only be used in a *MultiMove* system with option *Coordinated Robots* and only in program tasks defined as Motion Task.

Basic examples

The following example illustrates the instruction SyncMoveUndo:

Example 1

Program example in task T_ROB1

```

PERS tasks task_list{2} := [ ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync1;
VAR syncident sync2;
VAR syncident sync3;
PROC main()

...
MoveL p_zone, vmax, z50, tcp1;
WaitSyncTask sync1, task_list;
MoveL p_fine, v1000, fine, tcp1;
syncmove;
...
ENDPROC

PROC syncmove()
SyncMoveOn sync2, task_list;
MoveL * \ID:=10, v100, z10, tcp1 \WOBJ:= rob2_obj;
MoveL * \ID:=20, v100, fine, tcp1 \WOBJ:= rob2_obj;
SyncMoveOff sync3;
UNDO
SyncMoveUndo;
ENDPROC

```

If the program is stopped while the execution is inside the procedure syncmove and the program pointer is moved out of the procedure syncmove then all instruction inside the UNDO handler is executed. In this example, the instruction SyncMoveUndo is executed and the system is set to independent movement mode.

Program execution

Force reset of synchronized coordinated movements and set the system to independent movement mode.

It is enough to execute SyncMoveUndo in one program task to set the whole system to the independent movement mode. The instruction can be executed several times without any error if the system is already in independent movement mode.

Continues on next page

1 Instructions

1.272 SyncMoveUndo - Set independent movements

RobotWare Base

Continued

The system is set to the default independent movement mode also

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to `main`
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Syntax

`SyncMoveUndo ' ; '`

Related information

For information about	See
Specify cooperated program tasks	tasks - RAPID program tasks on page 1749
Identity for synchronization point	syncident - Identity for synchronization point on page 1745
Start coordinated synchronized movements	SyncMoveOn - Start coordinated synchronized movements on page 811
End coordinated synchronized movements	SyncMoveOff - End coordinated synchronized movements on page 805
Test if in synchronized mode	IsSyncMoveOn - Test if in synchronized movement mode on page 1337

1.273 SystemStopAction - Stop the robot system

Usage

SystemStopAction can be used to stop the robot system in different ways depending how serious the error or problem is.

Basic examples

The following examples illustrate the instruction SystemStopAction:

Example 1

```
SystemStopAction \Stop;
```

This will stop program execution and robot movements in all motion tasks. No specific action is needed to be done before restarting the program execution.

Example 2

```
SystemStopAction \StopBlock;
```

This will stop program execution and robot movements in all motion tasks. All program pointers must be moved before the program execution can be restarted.

Example 3

```
SystemStopAction \Halt;
```

This will result in motors off, stop program execution, and robot movements in all motion tasks. Motors on must be done before the program execution can be restarted.

Arguments

```
SystemStopAction [\Stop] [\StopBlock] [\Halt]
```

[\Stop]

Data type: switch

\Stop is used to stop program execution and robot movements in all motion tasks. No specific action is needed to be done before restart of the program execution.

[\StopBlock]

Data type: switch

\StopBlock is used stop program execution and robot movements in all motion tasks. All program pointers must be moved before the program execution can be restarted.

[\Halt]

Data type: switch

\Halt will result in motors off state, stop of program execution and robot movements in all motion tasks. Motors on must be done before the program execution can be restarted.

Program execution

SystemStopAction is used to stop the robot system in different ways depending how serious the error or problem is. The program execution is stopped in the executing task if the task is a normal task.

Continues on next page

1 Instructions

1.273 SystemStopAction - Stop the robot system

RobotWare Base

Continued

If executing the SystemStopAction in a static or semistatic task, the program execution will stop for all normal tasks but continue for that task. See more about declaration of tasks in documentation for System Parameters.

Limitations

If the robot is performing a circular movement during a SystemStopAction \StopBlock then the program pointer and the robot have to be moved to the beginning of the circular movement before the program execution is restarted.

Syntax

```
SystemStopAction
[ '\Stop ]
| [ '\StopBlock ]
| [ '\Halt ]';'
```

Related information

For information about	See
Stop program execution	Stop - Stops program execution on page 787
Terminate program execution	EXIT - Terminates program execution on page 203
Only stop robot movements	StopMove - Stops robot movement on page 792
Write some error message	ErrLog - Write an error message on page 192

1.274 TEST - Depending on the value of an expression ...

Usage

TEST is used when different instructions are to be executed depending on the value of an expression or data.

If there are not too many alternatives then the IF . . ELSE instruction can also be used.

Basic examples

The following example illustrates the instruction TEST:

Example 1

```

TEST reg1
CASE 1,2,3 :
    routine1;
CASE 4 :
    routine2;
DEFAULT :
    TPWrite "Illegal choice";
    Stop;
ENDTEST

```

Different instructions are executed depending on the value of reg1. If the value is 1, 2, or 3, then routine1 is executed. If the value is 4, then routine2 is executed. Otherwise, an error message is printed and execution stops.

Arguments

```

TEST Test data {CASE Test value {, Test value} : ...} [ DEFAULT:
... ] ENDTEST

```

Test data

Data type: All

The data or expression with which the test value will be compared.

Test value

Data type: Same as test data

The value which the test data must have for the associated instructions to be executed.

Program execution

The test data is compared with the test values in the first CASE condition. If the comparison is true then the associated instructions are executed. After that, program execution continues with the instruction following ENDTEST.

If the first CASE condition is not satisfied then other CASE conditions are tested and so on. If none of the conditions are satisfied then the instructions associated with DEFAULT are executed (if this is present).

Syntax

TEST <expression>

Continues on next page

1 Instructions

1.274 TEST - Depending on the value of an expression ...

RobotWare Base

Continued

```
{ CASE <test value> { ',' <test value> } ':'  
  <statement list> }  
[ DEFAULT ':'  
  <statement list> ]  
ENDTEST
```

Related information

For information about	See
Expressions	<i>Technical reference manual - RAPID Instructions, Functions and Data types</i>

1.275 TestSignDefine - Define test signal

Usage

TestSignDefine is used to define one test signal for the robot motion system.

A test signal continuously mirrors some specified motion data stream. For example, torque reference for some specified axis. The actual value at a certain time can be read in RAPID with the function TestSignRead.

Only test signals for external axes can be reached. Test signals are also available on request for the robot axes and for not predefined test signals for external axes.

Basic examples

The following example illustrates the instruction TestSignDefine:

Example 1

```
TestSignDefine 1, testsignal_resolver_angle, Orbit, 2, 0.1;
```

Test signal resolver_angle connected to channel 1 will give the value of the resolver angle for external axis 2 on the orbit manipulator, sampled at 100 ms rate.

Arguments

```
TestSignDefine Channel SignalId MechUnit Axis SampleTime
```

Channel

Data type: num

The channel numbers 1-12 to be used for the test signal. The same number must be used in the function TestSignRead for reading the actual value of the test signal.

SignalId

Data type: testsignal

The name or number of the test signal. See predefined constants described in data type testsignal.

MechUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

Axis

Data type: num

The axis number within the mechanical unit.

SampleTime

Data type: num

Sample time in seconds.

Continues on next page

1 Instructions

1.275 TestSignDefine - Define test signal

RobotWare Base

Continued

For sample time < 0.004 s, the function TestSignRead returns the mean value of the latest available internal samples as shown in the table below.

Sample Time in seconds	Result from TestSignRead
0	Mean value of the latest 8 samples generated each 0.5 ms
0.001	Mean value of the latest 4 samples generated each 1 ms
0.002	Mean value of the latest 2 samples generated each 2 ms
Greater or equal to 0.004	Momentary value generated at specified sample time
0.1	Momentary value generated at specified sample time 100 ms

Program execution

The definition of test signal is activated and the robot system starts the sampling of the test signal.

The sampling of the test signal is active until:

- A new TestSignDefine instruction for the actual channel is executed.
- All test signals are deactivated with execution of instruction TestSignReset.
- All test signals are deactivated at a Restart of the system.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AXIS_PAR	There is an error in the parameter Axis.
ERR_UNIT_PAR	There is an error in the parameter MechUnit.

Syntax

```
TestSignDefine
[ Channel ':= ' ] < expression (IN) of num> ' , '
[ SignalId ':= ' ] < expression (IN) of testsignal> ' , '
[ MechUnit ':= ' ] < variable (VAR) of mecunit> ' , '
[ Axis ':= ' ] < expression (IN) of num> ' , '
[ SampleTime ':= ' ] < expression (IN) of num> ' ; '
```

Related information

For information about	See
Test signal	testsignal - Test signal on page 1751
Read test signal	TestSignRead - Read test signal value on page 1506
Reset test signals	TestSignReset - Reset all test signal definitions on page 829

1.276 TestSignReset - Reset all test signal definitions

Usage

TestSignReset is used to deactivate all previously defined test signals.

Basic examples

The following example illustrates the instruction TestSignReset:

Example 1

```
TestSignReset;
```

Deactivate all previously defined test signals.

Program execution

The definitions of all test signals are deactivated, and the robot system stops the sampling of any test signals.

The sampling of defined test signals is active until:

- A **Restart** of the system
- Execution of this instruction TestSignReset

Syntax

```
TestSignReset';'
```

Related information

For information about	See
Test signal	testsignal - Test signal on page 1751
Define test signal	TestSignDefine - Define test signal on page 827
Read test signal	TestSignRead - Read test signal value on page 1506

1 Instructions

1.277 TextTabInstall - Installing a text table

RobotWare Base

1.277 TextTabInstall - Installing a text table

Usage

TextTabInstall is used to install a text table in the system.

Basic examples

The following example illustrates the instruction TextTabInstall.

Example 1

```
! System Module with Event Routine to be executed at event
! POWER ON, RESET or START
```

```
PROC install_text()
  IF TextTabFreeToUse("text_table_name") THEN
    TextTabInstall "HOME:/text_file.xml";
  ENDIF
ENDPROC
```

The first time the event routine `install_text` is executed the function `TextTabFreeToUse` returns **TRUE**, and the text file `text_file.xml` is installed in the system. After that, the installed text strings can be fetched from the system to **RAPID** by the functions `TextTabGet` and `TextGet`.

The next time the event routine `install_text` is executed, the function `TextTabFreeToUse` returns **FALSE**, and the installation is not repeated.

Arguments

TextTabInstall File

File

Data type: string

The file path and the file name to the file that contains text strings to be installed in the system.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_FILEOPEN	The file in the TextTabInstall instruction cannot be opened.

Limitations

Limitations for installation of text tables (text resources) in the system:

- It is not possible to install the same text table more than once in the system.
 - It is not possible to uninstall (free) a single text table from the system. The only way to uninstall text tables from the system is to restart the controller using the restart mode **Reset system**. All text tables (both system and user defined) will then be uninstalled.
-

Continues on next page

Syntax

```
TextTabInstall  
[File ':='] <expression (IN) of string>';'
```

Related information

For information about	See
Test whether text table is free	TextTabFreeToUse - Test whether text table is free on page 1512
Format of text files	<i>Technical reference manual - RAPID kernel</i>
Get text table number	TextTabGet - Get text table number on page 1514
Get text from system text tables	TextGet - Get text from system text tables on page 1508
String functions	<i>Technical reference manual - RAPID Overview</i>
Definition of string	string - Strings on page 1739
<i>Advanced RAPID</i>	<i>Application manual - Controller software OmniCore</i>

1 Instructions

1.278 TPErase - Erases text printed on the FlexPendant *RobotWare Base*

1.278 TPErase - Erases text printed on the FlexPendant

Usage

TPErase (*FlexPendant Erase*) is used to clear the display of the FlexPendant.

Basic examples

The following example illustrates the instruction TPErase:

Example 1

```
TPErase;  
TPWrite "Execution started";
```

The FlexPendant display is cleared before Execution started is written.

Program execution

The FlexPendant display is completely cleared of all text. The next time text is written it will be entered on the uppermost line of the display.

Syntax

```
TPErase;
```

Related information

For information about	See
Writing on the FlexPendant	<i>Technical reference manual - RAPID Overview</i>

1.279 TPreadDnum - Reads a number from the FlexPendant

Usage

TPreadDnum (*FlexPendant Read Numerical*) is used to read a number from the FlexPendant

Basic examples

The following example illustrates the instruction TPreadDnum:

Example 1

```
VAR dnum value;
```

```
TPreadDnum value, "How many units should be produced?";
```

The text *How many units should be produced?* is written on the FlexPendant display. Program execution waits until a number has been input from the numeric keyboard on the FlexPendant. That number is stored in *value*.

Arguments

```
TPreadDnum TPAnswer TPText [\MaxTime][\DIBreak] [\DIPassive]  
[\DOBreak] [\DOPassive] [\PersBoolBreak] [\PersBoolPassive]  
[\BreakFlag]
```

TPAnswer

Data type: dnum

The variable for which the number input via the FlexPendant is returned.

TPText

Data type: string

The information text to be written on the FlexPendant.

The string length is limited to 80 bytes, with 40 characters per row.

[\MaxTime]

Data type: num

The maximum amount of time that program execution waits. If no number is input within this time, the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_MAXTIME can be used to test whether or not the maximum time has elapsed.

[\DIBreak]

Digital Input Break

Data type: signal di

The digital signal that may interrupt the operator dialog. If no number is input when the signal is set to 1 (or is already 1), the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\DIPassive]

Digital Input Passive

Continues on next page

1 Instructions

1.279 TPReadDnum - Reads a number from the FlexPendant

RobotWare Base

Continued

Data type: switch

This switch overrides the default behavior when using DIBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DIBreak is set to 0 (or already is 0). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\DIBreak]

Digital Output Break

Data type: signaldo

The digital signal that support termination request from other tasks. If no button is selected when the signal is set to 1 (or is already 1), the program continues to execute in the error handler, unless the BreakFlag is used (see below). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\DOPassive]

Digital Output Passive

Data type: switch

This switch overrides the default behavior when using DIBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DIBreak is set to 0 (or already is 0). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\PersBoolBreak]

Persistent Boolean Break

Data type: bool

The persistent boolean that may interrupt the operator dialog. If no button is selected when the persistent boolean is set to TRUE (or is already TRUE) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\PersBoolPassive]

Persistent Boolean Passive

Data type: switch

This switch overrides the default behavior when using PersBoolBreak optional argument. Instead of reacting when persistent boolean is set to TRUE (or already TRUE), the instruction should continue in the error handler (if no BreakFlag is used) when the persistent boolean PersBoolBreak is set to FALSE (or already is FALSE). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\BreakFlag]

Data type: errnum

A variable that will hold the error code if MaxTime, DIBreak, DOBreak, or PersBoolBreak is used. If this optional variable is omitted then the error handler

Continues on next page

will be executed. The constants ERR_TP_MAXTIME, ERR_TP_DIBREAK, ERR_TP_DOBREAK, and ERR_TP_PERSB00LBREAK can be used to select the reason.

Program execution

The information text is always written on a new line. If the display is full of text, this body of text is moved up one line first. There can be up to 7 lines above the new text written.

Program execution waits until a number is typed on the numeric keyboard (followed by Enter or OK) or the instruction is interrupted by a time out or signal action..

Reference to TPReadFK about description of concurrent TPReadFK or TPReadDnum request on FlexPendant from same or other program tasks.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_TP_MAXTIME	Time-out (parameter \MaxTime) before input from the operator.
ERR_TP_DIBREAK	A read instruction from FlexPendant was interrupted by a digital input. A digital input was set (parameter \DIBreak) before input from the operator.
ERR_TP_DOBREAK	A read instruction from FlexPendant was interrupted by a digital output. A digital output was set(parameter \DOBreak) before input from the operator.
ERR_TP_NO_CLIENT	No client to interact with when using a read instruction from FlexPendant.
ERR_TP_PERSB00LBREAK	A read instruction from FlexPendant was interrupted by a persistent boolean. A persistent boolean was changed (parameter \PersBoolBreak) before input from the operator.

Syntax

```
TPReadDnum
[TPAnswer':='] <variable or persistent (INOUT) of dnum>', '
[TPText':='] <expression (IN) of string>
['\MaxTime':=' <expression (IN) of num>]
['\DIBreak':=' <variable (VAR) of signaldi>]
['\DIPassive]
['\DOBreak':=' <variable (VAR) of signaldo>]
['\DOPassive]
['\PersBoolBreak ':=' <persistent (PERS) of bool>]
['\PersBoolPassive]
['\BreakFlag':=' <variable or persistent (INOUT) of errnum>]
';'
```

Continues on next page

1 Instructions

1.279 TPreadDnum - Reads a number from the FlexPendant

RobotWare Base

Continued

Related information

For information about	See
Writing to and reading from the FlexPendant	<i>Technical reference manual - RAPID Overview</i>
Entering a number on the FlexPendant	<i>Operating manual - OmniCore</i>
Examples of how to use the arguments MaxTime, DIBreak and BreakFlag	<i>TPReadFK - Reads function keys on page 837</i>
Clean up the Operator window	<i>TPErase - Erases text printed on the FlexPendant on page 832</i>

1.280 TPreadFK - Reads function keys

Usage

TPreadFK (*FlexPendant Read Function Key*) is used to write text on the functions keys and to find out which key is pressed.

Basic examples

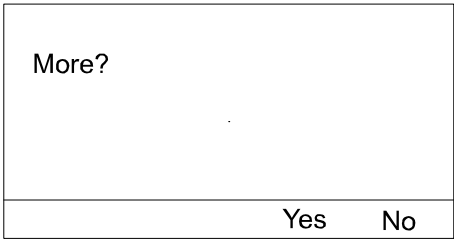
The following example illustrates the instruction TPreadFK:
See also [More examples on page 840](#).

Example 1

```
TPreadFK reg1, "More?", stEmpty, stEmpty, stEmpty, "Yes", "No";
```

The text More? is written on the FlexPendant display and the function keys 4 and 5 are activated by means of the text strings Yes and No respectively (see figure below). Program execution waits until one of the function keys 4 or 5 is pressed. In other words, reg1 will be assigned 4 or 5 depending on which of the keys are pressed.

The figure shows that the operator can put in information via the function keys.



xx0500002345

Arguments

```
TPreadFK TPAnswer TPText TPFK1 TPFK2 TPFK3 TPFK4 TPFK5 [\MaxTime]
[\DIBreak] [\DIPassive] [\DOBreak] [\DOPassive]
[\PersBoolBreak] [\PersBoolPassive] [\BreakFlag]
```

TPAnswer

Data type: num
The variable for which, depending on which key is pressed, the numeric value 1..5 is returned. If the function key 1 is pressed then 1 is returned, and so on.

TPText

Data type: string
The information text to be written on the FlexPendant.
The string length is limited to 80 bytes, with 40 characters per row.

TPFKx

Function key text
Data type: string
The text to be written on the appropriate function key (a maximum of 45 characters). TPFK1 is the left-most key.

Continues on next page

1 Instructions

1.280 TPReadFK - Reads function keys

RobotWare Base

Continued

Function keys without text are specified by the predefined string constant `stEmpty` with value empty string ("").

`[\MaxTime]`

Data type: `num`

The maximum amount of time in seconds that program execution waits. If no function key is pressed within this time then the program continues to execute in the error handler unless the `BreakFlag` is used (see below). The constant `ERR_TP_MAXTIME` can be used to test whether or not the maximum time has elapsed.

`[\DIBreak]`

Digital Input Break

Data type: `signal di`

The digital signal that may interrupt the operator dialog. If no function key is pressed when the signal is set to 1 (or is already 1) then the program continues to execute in the error handler unless the `BreakFlag` is used (see below). The constant `ERR_TP_DIBREAK` can be used to test whether or not this has occurred.

`[\DIPassive]`

Digital Input Passive

Data type: `switch`

This switch overrides the default behavior when using `DIBreak` optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no `BreakFlag` is used) when the signal `DIBreak` is set to 0 (or already is 0). The constant `ERR_TP_DIBREAK` can be used to test whether or not this has occurred.

`[\DOBreak]`

Digital Output Break

Data type: `signal do`

The digital signal that supports termination request from other tasks. If no button is selected when the signal is set to 1 (or is already 1) then the program continues to execute in the error handler unless the `BreakFlag` is used (see below). The constant `ERR_TP_DOBREAK` can be used to test whether or not this has occurred.

`[\DOPassive]`

Digital Output Passive

Data type: `switch`

This switch overrides the default behavior when using `DOBreak` optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no `BreakFlag` is used) when the signal `DOBreak` is set to 0 (or already is 0). The constant `ERR_TP_DOBREAK` can be used to test whether or not this has occurred.

`[\PersBoolBreak]`

Persistent Boolean Break

Continues on next page

Data type: bool

The persistent boolean that may interrupt the operator dialog. If no button is selected when the persistent boolean is set to TRUE (or is already TRUE) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\\PersBoolPassive]

Persistent Boolean Passive

Data type: switch

This switch overrides the default behavior when using PersBoolBreak optional argument. Instead of reacting when persistent boolean is set to TRUE (or already TRUE), the instruction should continue in the error handler (if no BreakFlag is used) when the persistent boolean PersBoolBreak is set to FALSE (or already is FALSE). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\\BreakFlag]

Data type: errnum

A variable that will hold the error code if MaxTime, DIBreak, DOBreak, or PersBoolBreak is used. If this optional variable is omitted then the error handler will be executed. The constants ERR_TP_MAXTIME, ERR_TP_DIBREAK, ERR_TP_DOBREAK, and ERR_TP_PERSBOOLBREAK can be used to select the reason.

Program execution

The information text is always written on a new line. If the display is full of text then this body of text is moved up one line first. There can be up to 7 lines above the new written text.

Text is written on the appropriate function keys.

Program execution waits until one of the activated function keys are pressed.

Description of concurrent TPreadFK or TPreadNum request on FlexPendant (TP request) from the same or other program tasks:

- New TP request from other program tasks will not take focus (new put in queue)
- New TP request from a trap routine in the same program task will take focus (old put in queue)
- Program stop take focus (old put in queue)
- New TP request in program stop state takes focus (old put in queue)

Predefined data

```
CONST string stEmpty := "";
```

The predefined constant stEmpty can be used for Function Keys without text.

Continues on next page

1 Instructions

1.280 TPreadFK - Reads function keys

RobotWare Base

Continued

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_TP_MAXTIME	Time-out (parameter \MaxTime) before input from the operator.
ERR_TP_DIBREAK	A read instruction from FlexPendant was interrupted by a digital input. A digital input was set (parameter \DIBreak) before input from the operator.
ERR_TP_DOBREAK	A read instruction from FlexPendant was interrupted by a digital output. A digital output was set(parameter \DOBreak) before input from the operator.
ERR_TP_NO_CLIENT	No client to interact with when using a read instruction from FlexPendant.
ERR_TP_PERSBOOLBREAK	A read instruction from FlexPendant was interrupted by a persistent boolean. A persistent boolean was changed (parameter \PersBoolBreak) before input from the operator.

More examples

More examples of how to use the instruction TPreadFK are illustrated below.

Example 1

```
VAR errnum errvar;  
...  
TPreadFK reg1, "Go to service position?", stEmpty, stEmpty, stEmpty,  
  "Yes", "No"  
\MaxTime:= 600  
  \DIBreak:= di5\BreakFlag:= errvar;  
IF reg1 = 4 OR errvar = ERR_TP_DIBREAK THEN  
  MoveL service, v500, fine, tool1;  
  Stop;  
ENDIF  
IF errvar = ERR_TP_MAXTIME EXIT;
```

The robot is moved to the service position if the forth function key ("Yes") is pressed or if the input 5 is activated. If no answer is given within 10 minutes then the execution is terminated.

Limitations

Avoid using too low values for the timeout parameter \MaxTime when TPreadFK is frequently executed, for example in a loop. It can result in an unpredictable behavior of the system performance, like slowing the FlexPendant response.

Syntax

TPreadFK

Continues on next page

```

[TPAnswer ':='] <variable or persistent (INOUT) of num>', '
[TPText ':='] <expression (IN) of string>', '
[TPFK1 ':='] <expression (IN) of string>', '
[TPFK2 ':='] <expression (IN) of string>', '
[TPFK3 ':='] <expression (IN) of string>', '
[TPFK4 ':='] <expression (IN) of string>', '
[TPFK5 ':='] <expression (IN) of string>
['\ ' MaxTime ':='] <expression (IN) of num>]
['\ ' DIBreak ':='] <variable (VAR) of signaldi>]
['\ ' DIPassive]
['\ ' DOBreak ':='] <variable (VAR) of signaldo>]
['\ ' DOPassive]
['\ ' PersBoolBreak ':='] <persistent (PERS) of bool>]
['\ ' PersBoolPassive]
['\ ' BreakFlag ':='] <variable or persistent (INOUT) of errnum>]';'

```

Related information

For information about	See
Writing to and reading from the FlexPendant	<i>Technical reference manual - RAPID Overview</i>
Replying via the FlexPendant	<i>Operating manual - OmniCore</i>
Clean up the Operator window	TPErase - Erases text printed on the FlexPendant on page 832

1 Instructions

1.281 TReadNum - Reads a number from the FlexPendant
RobotWare Base

1.281 TReadNum - Reads a number from the FlexPendant

Usage

TReadNum (*FlexPendant Read Numerical*) is used to read a number from the FlexPendant.

Basic examples

The following example illustrates the instruction TReadNum:

See also [More examples on page 844](#).

Example 1

```
TReadNum reg1, "How many units should be produced?";
```

The text `How many units should be produced?` is written on the FlexPendant display. Program execution waits until a number has been input from the numeric keyboard on the FlexPendant. That number is stored in reg1.

Arguments

```
TReadNum TAnswer TText [\MaxTime][\DIBreak] [\DIPassive]  
          [\D0Break] [\D0Passive] [\PersBoolBreak] [\PersBoolPassive]  
          [\BreakFlag]
```

TAnswer

Data type: num

The variable for which the number input via the FlexPendant is returned.

TText

Data type: string

The information text to be written on the FlexPendant.

The string length is limited to 80 bytes, with 40 characters per row.

[\MaxTime]

Data type: num

The maximum amount of time that program execution waits. If no number is input within this time, the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_MAXTIME can be used to test whether or not the maximum time has elapsed.

[\DIBreak]

Digital Input Break

Data type: signal di

The digital signal that may interrupt the operator dialog. If no number is input when the signal is set to 1 (or is already 1), the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\DIPassive]

Digital Input Passive

Data type: switch

Continues on next page

1.281 TPReadNum - Reads a number from the FlexPendant RobotWare Base Continued

This switch overrides the default behavior when using DIBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DIBreak is set to 0 (or already is 0). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\DIBreak]

Digital Output Break

Data type: signaldo

The digital signal that supports termination request from other tasks. If no button is selected when the signal is set to 1 (or is already 1), the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\DOPassive]

Digital Output Passive

Data type: switch

This switch overrides the default behavior when using DIBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DIBreak is set to 0 (or already is 0). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\PersBoolBreak]

Persistent Boolean Break

Data type: bool

The persistent boolean that may interrupt the operator dialog. If no button is selected when the persistent boolean is set to TRUE (or is already TRUE) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\PersBoolPassive]

Persistent Boolean Passive

Data type: switch

This switch overrides the default behavior when using PersBoolBreak optional argument. Instead of reacting when persistent boolean is set to TRUE (or already TRUE), the instruction should continue in the error handler (if no BreakFlag is used) when the persistent boolean PersBoolBreak is set to FALSE (or already is FALSE). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\BreakFlag]

Data type: errnum

A variable that will hold the error code if MaxTime, DIBreak, DIBreak, or PersBoolBreak is used. If this optional variable is omitted then the error handler

Continues on next page

1 Instructions

1.281 TPreadNum - Reads a number from the FlexPendant

RobotWare Base

Continued

will be executed. The constants ERR_TP_MAXTIME, ERR_TP_DIBREAK, ERR_TP_DOBREAK, and ERR_TP_PERSB00LBREAK can be used to select the reason.

Program execution

The information text is always written on a new line. If the display is full of text, this body of text is moved up one line first. There can be up to 7 lines above the new text written.

Program execution waits until a number is typed on the numeric keyboard (followed by Enter or OK) or the instruction is interrupted by a time out or signal action.

Reference to TPreadFK about description of concurrent TPreadFK or TPreadNum request on FlexPendant from same or other program tasks.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_TP_MAXTIME	Time-out (parameter \MaxTime) before input from the operator.
ERR_TP_DIBREAK	A read instruction from FlexPendant was interrupted by a digital input. A digital input was set (parameter \DIBreak) before input from the operator.
ERR_TP_DOBREAK	A read instruction from FlexPendant was interrupted by a digital output. A digital output was set(parameter \DOBreak) before input from the operator.
ERR_TP_NO_CLIENT	No client to interact with when using a read instruction from FlexPendant.
ERR_TP_PERSB00LBREAK	A read instruction from FlexPendant was interrupted by a persistent boolean. A persistent boolean was changed (parameter \PersBoolBreak) before input from the operator.

More examples

More examples of how to use the instruction TPreadNum are illustrated below.

Example 1

```
TPreadNum reg1, "How many units should be produced?";
FOR i FROM 1 TO reg1 DO
  produce_part;
ENDFOR
```

The text How many units should be produced? is written on the FlexPendant display. The routine produce_part is then repeated the number of times that is input via the FlexPendant.

Continues on next page

Syntax

```

TPReadNum
[TPAnswer':='<variable or persistent (INOUT) of num>', '
[TPText':='<expression (IN) of string>
['\MaxTime':='<expression (IN) of num>]
['\DIBreak':='<variable (VAR) of signaldi>]
['\DIPassive]
['\DOBreak':='<variable (VAR) of signaldo>]
['\DOPassive]
['\PersBoolBreak ':='<persistent (PERS) of bool>]
['\PersBoolPassive]
['\BreakFlag':='<variable or persistent (INOUT) of ernum>]
';'

```

Related information

For information about	See
Writing to and reading from the FlexPendant	<i>Technical reference manual - RAPID Overview</i>
Entering a number on the FlexPendant	<i>Operating manual - OmniCore</i>
Examples of how to use the arguments MaxTime, DIBreak and BreakFlag	TPReadFK - Reads function keys on page 837
Clean up the Operator window	TPErase - Erases text printed on the FlexPendant on page 832

1 Instructions

1.282 TPShow - Switch window on the FlexPendant *RobotWare Base*

1.282 TPShow - Switch window on the FlexPendant

Usage

TPShow (*FlexPendant Show*) is used to select FlexPendant window from RAPID.

Basic examples

The following example illustrates the instruction TPShow:

Example 1

```
TPShow TP_LATEST;
```

The latest used FlexPendant Window before the current FlexPendant window will be active after execution of this instruction.

Arguments

TPShow Window

Window

Data type: tpnum

The window TP_LATEST will show the latest used FlexPendant window before current FlexPendant window.

Program execution

The selected FlexPendant window will be activated.

Predefined data

```
CONST tpnum TP_LATEST := 2;
```

Syntax

```
TPShow  
[Window':=''] <expression (IN) of tpnum> ';' ;
```

Related information

For information about	See
Communicating using the FlexPendant	<i>Technical reference manual - RAPID Overview</i>
FlexPendant Window number	tpnum - FlexPendant window number on page 1759
Clean up the Operator window	TPErase - Erases text printed on the FlexPendant on page 832

1.283 TPWrite - Writes on the FlexPendant

Usage

TPWrite (*FlexPendant Write*) is used to write text on the FlexPendant. The value of certain data can be written as well as text.

Basic examples

The following examples illustrate the instruction TPWrite:

Example 1

```
TPWrite "Execution started";
```

The text Execution started is written on the FlexPendant.

Example 2

```
TPWrite "No of produced parts="\Num:=reg1;
```

If, for example, reg1 holds the value 5 then the text No of produced parts=5 is written on the FlexPendant.

Example 3

```
VAR string my_robot;
...
my_robot := RobName();
IF my_robot="" THEN
  TPWrite "This task does not control any TCP robot";
ELSE
  TPWrite "This task controls TCP robot with name "+ my_robot;
ENDIF
```

Write to FlexPendant the name of the TCP robot which is controlled from this program task. If no TCP robot is controlled, write that the task controls no robot.

Arguments

```
TPWrite String [\Num] | [\Bool] | [\Pos] | [\Orient] | [\Dnum]
```

String

Data type: string

The text to be written on the FlexPendant.

The string length is limited to 80 bytes, with 40 characters per row.

[\Num]

Numeric

Data type: num

The data whose numeric value is to be written after the text string.

[\Bool]

Boolean

Data type: bool

The data whose logical value is to be written after the text string.

Continues on next page

1 Instructions

1.283 TPWrite - Writes on the FlexPendant

RobotWare Base

Continued

`[\Pos]`

Position

Data type: pos

The data whose position is to be written after the text string.

`[\Orient]`

Orientation

Data type: orient

The data whose orientation is to be written after the text string.

`[\Dnum]`

Numeric

Data type: dnum

The data whose numeric value is to be written after the text string.

Program execution

Text written on the FlexPendant always begins on a new line. When the display is full of text (11 lines) then this text is moved up one line first.

If one of the arguments `\Num`, `\Dnum`, `\Bool`, `\Pos`, or `\Orient` is used then its value is first converted to a text string before it is added to the first string. The conversion from value to text string takes place as follows:

Argument	Value	Text string
<code>\Num</code>	23	"23"
<code>\Num</code>	1.141367	"1.14137"
<code>\Bool</code>	TRUE	"TRUE"
<code>\Pos</code>	[1817.3,905.17,879.11]	"[1817.3,905.17,879.11]"
<code>\Orient</code>	[0.96593,0,0.25882,0]	"[0.96593,0,0.25882,0]"
<code>\Dnum</code>	4294967295	"4294967295"

The value is converted to a string with standard RAPID format. This means, in principle, 6 significant digits. If the decimal part is less than 0.000005 or greater than 0.999995 then the number is rounded to an integer.

Limitations

The arguments `\Num`, `\Dnum`, `\Bool`, `\Pos`, and `\Orient` are mutually exclusive and thus cannot be used simultaneously in the same instruction.

Syntax

```
TPWrite
[TPText':=' ] <expression (IN) of string>
['\Num':=' <expression (IN) of num> ]
| ['\Bool':=' <expression (IN) of bool> ]
| ['\Pos':=' <expression (IN) of pos> ]
| ['\Orient':=' <expression (IN) of orient> ]
| ['\Dnum':=' <expression (IN) of dnum> '];'
```

Continues on next page

Related information

For information about	See
Clearing and reading the FlexPendant	<i>Technical reference manual - RAPID Overview</i>
Clean up the Operator window	<i>TPErse - Erases text printed on the FlexPendant on page 832</i>

1 Instructions

1.284 TriggAbsJ - Absolute joint robot movements with events *RobotWare Base*

1.284 TriggAbsJ - Absolute joint robot movements with events

Usage

TriggAbsJ is used to move the robot and external axes to an absolute position defined in axes positions, and set output signals and/or run interrupt routines at roughly fixed positions. For example, if the end point is a singular point.

The final position of the robot during a movement with TriggAbsJ is neither affected by the given tool and work object nor by active program displacement. The robot uses this data to calculate the load, TCP velocity, and the corner path. The same tools can be used in adjacent movement instructions.

The robot and external axes move to the destination position along a non-linear path. All axes reach the destination position at the same time.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove system, in *Motion* tasks.

Basic examples

The following example illustrates the instruction TriggAbsJ.

Example 1

```
VAR triggdata triggdata1;
...
TriggIO triggdata1, 0 \Start \D0p:=gun, 1;
MoveL p1, v500, z50, tool1;
TriggAbsJ jpos10, v500, triggdata1, fine, tool1;
```

The digital output signal gun is set when the robot TCP passes the absolute axis position *jpos10*.

The figure shows an example of fixed position I/O event.

Arguments

```
TriggAbsJ [\Conc] ToJointPos [\ID] [\ NoEoffs] Speed [\T] Trigg_1
| TriggArray [ \T2 ] [ \T3 ] [\T4] [\T5] [\T6] [\T7] [\T8]
[\KeepStartPath] [\KeepEndPath] Zone [\Inpos] Tool [\WObj]
[\TLoad]
```

[\Conc]

Concurrent

Data type: switch

Subsequent instructions are executed while the robot is moving. The argument is usually not used but can be used to avoid unwanted stops caused by overloaded CPU when using fly-by points. This is useful when the programmed points are very close together at high speeds. The argument is also useful when, for example, communicating with external equipment and synchronization between the external equipment and robot movement is not required.

Using the argument \Conc, the number of movement instructions in succession is limited to 5. In a program section that includes StorePath-RestPath, movement instructions with the argument \Conc are not permitted.

Continues on next page

If this argument is omitted and the ToPoint is not a stop point then the subsequent instruction is executed some time before the robot has reached the programmed zone.

This argument cannot be used in coordinated synchronized movement in a MultiMove system.

ToJointPos

Data type: jointtarget

The destination absolute joint position of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

[\NoEOffs]

No External Offsets

Data type: switch

If the argument \NoEOffs is set then the movement with TriggAbsJ is not affected by active offsets for external axes.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

Trigg_1

Data type: triggdta

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

Continues on next page

1 Instructions

1.284 TriggAbsJ - Absolute joint robot movements with events

RobotWare Base

Continued

TriggArray

Trigg Data Array Parameter

Data type: triggdata

Array variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggSpeed, TriggCheckIO, or TriggRampA0.

The limitation is 25 elements in the array and 1 to 25 defined trigger conditions must be defined.

It is not possible to use the optional arguments T2, T3, T4, T5, T6, T7, or T8 at the same time as the TriggArray argument is used.

[\T2]

Trigg 2

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T3]

Trigg 3

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T4]

Trigg 4

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T5]

Trigg 5

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T6]

Trigg 6

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

Continues on next page

[\T7]

Trigg 7**Data type:** triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T8]

Trigg 8**Data type:** triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Inpos]

In position**Data type:** stoppoint data

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

Continues on next page

1 Instructions

1.284 TriggAbsJ - Absolute joint robot movements with events

RobotWare Base

Continued

[\WObj]

Work Object

Data type: wobjdata

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used this argument must be specified in order for a circle relative to the work object to be executed.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See the instruction [MoveAbsJ - Moves the robot to an absolute joint position on page 386](#) for information about absolute joint position movement.

As the trigger conditions are fulfilled when the robot is positioned closer and closer to the end point, the defined trigger activities are carried out. The trigger conditions are fulfilled either at a certain distance before the end point of the instruction, or at a certain distance after the start point of the instruction, or at a certain point in time (limited to a short time) before the end point of the instruction.

Continues on next page

During the stepping execution forward, the I/O activities are carried out but the interrupt routines are not run. During stepping the execution backwards, no trigger activities at all are carried out.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

ERR_AO_LIM	The programmed <code>ScaleValue</code> argument for the specified analog output signal <i>AOp</i> in some of the connected <code>TriggSpeed</code> instructions result in out of limit for the analog signal together with the programmed speed in this instruction.
ERR_DIPLAG_LIM	The programmed <code>DipLag</code> argument in some of the connected <code>TriggSpeed</code> instructions is too big in relation to the used <i>Event Preset Time</i> in the system parameter configuration.
ERR_NORUNUNIT	There is no contact with the I/O device when entering instruction and the used <code>triggdata</code> depends on a running I/O device, i.e. a signal is used in the <code>triggdata</code> .
ERR_CONC_MAX	The number of movement instructions in succession using the argument <code>\Conc</code> has been exceeded.

More examples

More examples of the instruction `TriggAbsJ` are illustrated below.

Example 1

```
VAR intnum intno1;
VAR triggdata trigg1;
...
PROC main()
  CONNECT intno1 WITH trap1;
  TriggInt trigg1, 0.1 \Time, intno1;
  ...
  TriggAbsJ jpos10, v500, trigg1, fine, gun1;
  TriggAbsJ jpos20, v500, trigg1, fine, gun1;
  ...
  IDelete intno1;
```

The interrupt routine *trap1* is run when the work point is at a position 0.1 seconds before the stop point *jpos10* or *jpos20* respectively.

Example 2

```
VAR num Distance:=0;
VAR triggdata trigg_array{25};
VAR signaldo myaliassignaldo;
VAR string signalname;
...
PROC main()
  ...
  FOR i FROM 1 TO 25 DO
    signalname:="do";
    signalname:=signalname+ValToStr(i);
    AliasIO signalname, myaliassignaldo;
```

Continues on next page

1 Instructions

1.284 TriggAbsJ - Absolute joint robot movements with events

RobotWare Base

Continued

```
TriggEquip trigg_array{i}, Distance \Start, 0
    \DOP:=myaliassignaldo, SetValue:=1;
Distance:=Distance+10;
ENDFOR
TriggAbsJ jpos10, v500, trigg_array, z30, tool2;
MoveJ p2, v500, z30, tool2;
...
```

The digital output signals *do1* to *do25* is set during the movement to *jpos10*. The distance between the signal settings is 10 mm.

Limitations

If the current start point deviates from the usual so that the total positioning length of the instruction TriggAbsJ is shorter than usual (for example, at the start of TriggAbsJ with the robot position at the end point), it may happen that several or all of the trigger conditions are fulfilled immediately and at the same position. In such cases, the sequence in which the trigger activities are carried will be undefined. The program logic in the user program may not be based on a normal sequence of trigger activities for an incomplete movement.

UNDO or system events

TriggAbsJ cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Short movements

There is a limitation on 10 queued movement instructions using trigger conditions setup by instruction TriggSpeed. If the queue is full, the system will stop. To avoid this limitation, use longer movements, or use a lower speed.

Syntax

```
TriggAbsJ
[ '\ ' Conc ', ' ]
[ ToJointPos' := ' ] < expression (IN) of jointtarget >
[ '\ ' ID' := ' < expression (IN) of identno > ], '
[ '\ ' NoEoffs ], '
[ Speed' := ' ] < expression (IN) of speeddata >
[ '\ ' T' := ' < expression (IN) of num > ], '
[ Trigg_1' := ' ] < variable (VAR) of triggdata > |
[ TriggArray' := ' ] < array variable {*} (VAR) of triggdata >
[ '\ ' T2' := ' < variable (VAR) of triggdata > ]
[ '\ ' T3' := ' < variable (VAR) of triggdata > ]
[ '\ ' T4' := ' < variable (VAR) of triggdata > ]
[ '\ ' T5' := ' < variable (VAR) of triggdata > ]
[ '\ ' T6' := ' < variable (VAR) of triggdata > ]
[ '\ ' T7' := ' < variable (VAR) of triggdata > ]
[ '\ ' T8' := ' < variable (VAR) of triggdata > ]
[ '\ ' KeepStartPath' := ' < expression (IN) of num > ]
[ '\ ' KeepEndPath' := ' < expression (IN) of num > ], '
[ Zone' := ' ] < expression (IN) of zonedata >
[ '\ ' Inpos' := ' < expression (IN) of stoppointdata > ], '
```

Continues on next page

1.284 TriggAbsJ - Absolute joint robot movements with events

RobotWare Base

Continued

```
[ Tool ':= ' ] < persistent (PERS) of tooldata >
[ '\ ' WObj' := ' < persistent (PERS) of wobjdata > ]
[ '\ ' TLoad' := ' < persistent (PERS) of loaddata > ] ';'

```

Related information

For information about	See
Define the payload for the robot	GripLoad - Defines the payload for a robot on page 239
Example of how to use TLoad	MoveAbsJ - Moves the robot to an absolute joint position on page 386
Joint movements with triggers	TriggJ - Axis-wise robot movements with events on page 894
Definition of triggers	TriggIO - Define a fixed position or time I/O event near a stop point on page 888 TriggEquip - Define a fixed position and time I/O event on the path on page 877 TriggRampAO - Define a fixed position ramp AO event on the path on page 927 TriggInt - Defines a position related interrupt on page 883 TriggCheckIO - Defines I/O check at a fixed position on page 867

1 Instructions

1.285 TriggC - Circular robot movement with events

RobotWare Base

1.285 TriggC - Circular robot movement with events

Usage

TriggC (*Trigg Circular*) is used to set output signals and/or run interrupt routines at fixed positions at the same time that the robot is moving on a circular path.

One or more (max. 25) events can be defined using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampAO and afterwards these definitions are referred to in the instruction TriggC.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction TriggC:

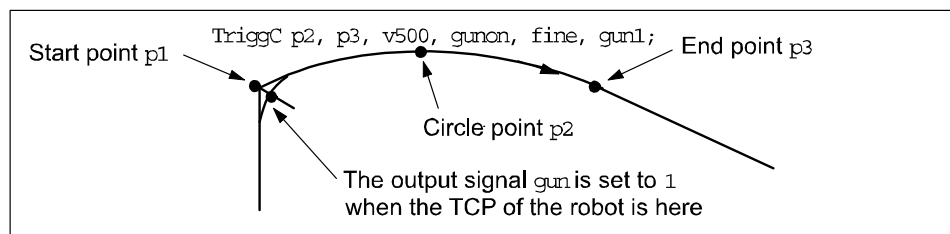
See also [More examples on page 863](#).

Example 1

```
VAR triggdata gunon;  
  
TriggIO gunon, 0 \Start \D0p:=gun, 1;  
MoveL p1, v500, z50, gun1;  
TriggC p2, p3, v500, gunon, fine, gun1;
```

The digital output signal gun is set when the robot's TCP passes the midpoint of the corner path of the point p1.

The figure shows an example of fixed position I/O event.



xx0500002267

Arguments

```
TriggC [\Conc] CirPoint ToPoint [\ID] Speed [\T] Trigg_1 |  
TriggArray [\T2] [\T3] [\T4] [\T5] [\T6] [\T7] [\T8]  
[\KeepStartPath] [\KeepEndPath] Zone [\Inpos] Tool [\WObj] [  
\Corr ] [\TLoad]
```

[\Conc]

Concurrent

Data type: switch

Subsequent instructions are executed while the robot is moving. The argument is usually not used but can be used to avoid unwanted stops caused by overloaded CPU when using fly-by points. This is useful when the programmed points are very close together at high speeds. The argument is also useful when, for example,

Continues on next page

communicating with external equipment and synchronization between the external equipment and robot movement is not required.

Using the argument \Conc, the number of movement instructions in succession is limited to 5. In a program section that includes StorePath-RestoPath, movement instructions with the argument \Conc are not permitted.

If this argument is omitted and the ToPoint is not a stop point then the subsequent instruction is executed some time before the robot has reached the programmed zone.

This argument cannot be used in coordinated synchronized movement in a MultiMove system.

CirPoint

Data type: robtarget

The circle point of the robot. The circle point is a position on the circle between the start point and the destination point. To obtain the best accuracy it should be placed about halfway between the start and destination points. If it is placed too close to the start or destination point, the robot may give a warning. The circle point is defined as a named position or stored directly in the instruction (marked with an * in the instruction). The position of the external axes are not used.

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when

Continues on next page

1 Instructions

1.285 TriggC - Circular robot movement with events

RobotWare Base

Continued

the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

Trigg_1

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

TriggArray

Trigg Data Array Parameter

Data type: triggdata

Array variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggSpeed, TriggCheckIO, or TriggRampA0.

The limitation is 25 elements in the array and 1 to 25 defined trigger conditions must be defined.

It is not possible to use the optional arguments T2, T3, T4, T5, T6, T7, or T8 at the same time as the TriggArray argument is used.

[\T2]

Trigg 2

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T3]

Trigg 3

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T4]

Trigg 4

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T5]

Trigg 5

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

Continues on next page

[\T6]

Trigg 6**Data type:** triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T7]

Trigg 7**Data type:** triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T8]

Trigg 8**Data type:** triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Inpos]

In position**Data type:** stoppoint data*Continues on next page*

1 Instructions

1.285 TriggC - Circular robot movement with events

RobotWare Base

Continued

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[\WObj]

Work Object

Data type: wobjdata

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used this argument must be specified in order for a circle relative to the work object to be executed.

[\Corr]

Correction

Data type: switch

Correction data written to a corrections entry by the instruction CorrWrite will be added to the path and destination position if this argument is present.

The RobotWare option *Path Corrections* is required when using this argument.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.

Continues on next page

**Note**

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See the instruction MoveC for information about circular movement.

As the trigger conditions are fulfilled when the robot is positioned closer and closer to the end point, the defined trigger activities are carried out. The trigger conditions are fulfilled either at a certain distance before the end point of the instruction, or at a certain distance after the start point of the instruction, or at a certain point in time (limited to a short time) before the end point of the instruction.

During stepping the execution forward, the I/O activities are carried out but the interrupt routines are not run. During stepping the execution backward, no trigger activities at all are carried out.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AO_LIM	The programmed ScaleValue argument for the specified analog output signal AOp in some of the connected TriggSpeed instructions result in out of limit for the analog signal together with the programmed Speed in this instruction.
ERR_DIPLAG_LIM	The programmed DipLag argument in some of the connected TriggSpeed instructions is too big in relation to the used Event Preset Time in System Parameters.
ERR_NORUNUNIT	There is no contact with the I/O device when entering instruction and the used triggdata depends on a running I/O device, i.e. a signal is used in the triggdata.
ERR_CONC_MAX	The number of movement instructions in succession using argument \Conc has been exceeded.

More examples

More examples of how to use the instruction TriggC are illustrated below.

Example 1

```

VAR intnum intno1;
VAR triggdata trigg1;
...
PROC main()
...
CONNECT intno1 WITH trap1;
TriggInt trigg1, 0.1 \Time, intno1;
...
TriggC p1, p2, v500, trigg1, fine, gun1;
TriggC p3, p4, v500, trigg1, fine, gun1;
...

```

Continues on next page

1 Instructions

1.285 TriggC - Circular robot movement with events

RobotWare Base

Continued

```
IDelete intno1;
```

The interrupt routine trap1 is run when the work point is at a position 0.1 s before the point p2 or p4 respectively.

Example 2

```
VAR num Distance:=0;
VAR triggdata trigg_array{25};
VAR signaldo myaliassignaldo;
VAR string signalname;
...
PROC main()
...
FOR i FROM 1 TO 25 DO
  signalname:="do";
  signalname:=signalname+ValToStr(i);
  AliasIO signalname, myaliassignaldo;
  TriggEquip trigg_array{i}, Distance \Start, 0
    \DOp:=myaliassignaldo, SetValue:=1;
  Distance:=Distance+10;
ENDFOR
TriggC p1, p2, v500, trigg_array, z30, tool2;
MoveC p3, p4, v500, z30, tool2;
...
```

The digital output signals do1 to do25 is set during the movement to p2. The distance between the signal settings is 10 mm.

Limitations

General limitations according to instruction MoveC.

If the current start point deviates from the usual point so that the total positioning length of the instruction TriggC is shorter than usual then it may happen that several or all of the trigger conditions are fulfilled immediately and at the same position. In such cases, the sequence in which the trigger activities are carried out will be undefined. The program logic in the user program may not be based on a normal sequence of trigger activities for an “incomplete movement”.



WARNING

The instruction TriggC should never be started from the beginning with the robot in position after the circle point. Otherwise, the robot will not take the programmed path (positioning around the circular path in another direction compared to that which is programmed).

UNDO or system events

TriggC cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Continues on next page

Short movements

There is a limitation on 10 queued movement instructions using trigger conditions setup by instruction TriggSpeed. If the queue is full, the system will stop. To avoid this limitation, use longer movements, or use a lower speed.

Syntax

```
TriggC
[ '\\' Conc ',' ]
[ CirPoint' :=' ] < expression (IN) of robtarget > ','
[ ToPoint' :=' ] < expression (IN) of robtarget > ','
[ '\\' ID' :=' < expression (IN) of identno > ] ','
[ Speed' :=' ] < expression (IN) of speeddata >
[ '\\' T' :=' < expression (IN) of num > ] ','
[ Trigg_1' :=' ] < variable (VAR) of triggdata >
| [ TriggArray' :=' ] < array variable {*} (VAR) of triggdata >
[ '\\' T2' :=' < variable (VAR) of triggdata > ]
[ '\\' T3' :=' < variable (VAR) of triggdata > ]
[ '\\' T4' :=' < variable (VAR) of triggdata > ]
[ '\\' T5' :=' < variable (VAR) of triggdata > ]
[ '\\' T6' :=' < variable (VAR) of triggdata > ]
[ '\\' T7' :=' < variable (VAR) of triggdata > ]
[ '\\' T8' :=' < variable (VAR) of triggdata > ]
[ '\\' KeepStartPath' :=' < expression (IN) of num > ]
[ '\\' KeepEndPath' :=' < expression (IN) of num > ] ','
[ Zone' :=' ] < expression (IN) of zonedata >
[ '\\' Inpos' :=' < expression (IN) of stoppointdata > ] ','
[ Tool' :=' ] < persistent (PERS) of tooldata >
[ '\\' WObj' :=' < persistent (PERS) of wobjdata > ]
[ '\\' Corr ]
[ '\\' TLoad' :=' < persistent (PERS) of loaddata > ] ';'

```

Related information

For information about	See
Linear movement with triggers	TriggL - Linear robot movements with events on page 902
Joint movement with triggers	TriggJ - Axis-wise robot movements with events on page 894
Move the robot circularly	MoveC - Moves the robot circularly on page 398
Definition of triggers	TriggIO - Define a fixed position or time I/O event near a stop point on page 888 TriggEquip - Define a fixed position and time I/O event on the path on page 877 TriggInt - Defines a position related interrupt on page 883 TriggCheckIO - Defines I/O check at a fixed position on page 867 TriggRampAO - Define a fixed position ramp AO event on the path on page 927 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event on page 934

Continues on next page

1 Instructions

1.285 TriggC - Circular robot movement with events

RobotWare Base

Continued

For information about	See
Handling triggdata	triggdata - Positioning events, trigg on page 1761 TriggDataReset - Reset the content in a triggdata variable on page 875 TriggDataCopy - Copy the content in a triggdata variable on page 873 TriggDataValid - Check if the content in a triggdata variable is valid on page 1516
Writes to a corrections entry	CorrWrite - Writes to a correction generator on page 176
Circular movement	Technical reference manual - RAPID Overview
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of stop point data	stoppointdata - Stop point data on page 1733
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	Technical reference manual - RAPID Overview
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	Operating manual - OmniCore
System input signal <i>SimMode</i> for running the robot in simulated mode without payload.	Technical reference manual - System parameters
System parameter <i>ModalPayLoad-Mode</i> for activating and deactivating payload.	Technical reference manual - System parameters
<i>Path Corrections</i>	Application manual - Controller software OmniCore

1.286 TriggCheckIO - Defines I/O check at a fixed position

Usage

TriggCheckIO is used to define conditions for testing the value of a digital, a group of digital, or an analog input or output signal at a fixed position along the robot's movement path. If the condition is fulfilled then there will be no specific action. But if it is not then an interrupt routine will be run after the robot has optionally stopped on path as fast as possible.

To obtain a fixed position I/O check, TriggCheckIO compensates for the lag in the control system (lag between servo and robot).

The data defined is used for implementation in one or more subsequent TriggL, TriggC, or TriggJ instructions.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction TriggCheckIO:

See also [More examples on page 870](#).

Example 1

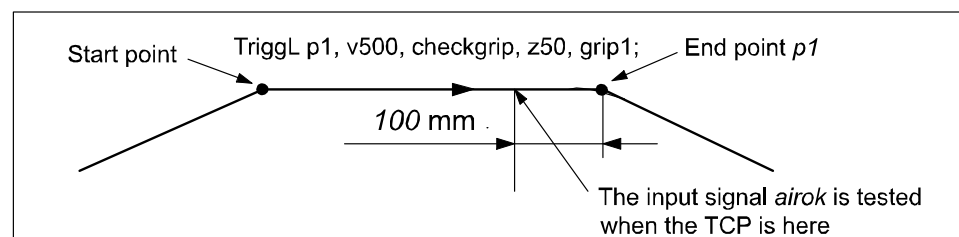
```
VAR trigdata checkgrip;
VAR intnum intno1;

PROC main()
  CONNECT intno1 WITH trap1;
  TriggCheckIO checkgrip, 100, airok, EQ, 1, intno1;

  TriggL p1, v500, checkgrip, z50, grip1;
```

The digital input signal *airok* is checked to have the value 1 when the TCP is 100 mm before the point *p1*. If it is set then normal execution of the program continues. If it is not set then the interrupt routine *trap1* is run.

The figure shows an example of fixed position I/O check.



xx0500002254

Arguments

```
TriggCheckIO TriggData Distance [\Start] | [\Next] | [\Time] Signal
              Relation CheckValue | CheckDvalue [\StopMove] Interrupt
              [\Inhib] [\Mode]
```

Continues on next page

1 Instructions

1.286 TriggCheckIO - Defines I/O check at a fixed position

RobotWare Base

Continued

TriggData

Data type: triggdta

Variable for storing the triggdta returned from this instruction. These triggdta are then used in the subsequent TriggL, TriggC, or TriggJ instructions.

Distance

Data type: num

Defines the position on the path where the I/O check shall occur.

Specified as the distance in mm (positive value) from the end point of the movement path (applicable if the argument \Start or \Time is not set).

See [Program execution on page 869](#) for further details.

[\Start]

Data type: switch

Used when the distance for the argument Distance starts at the movement start point instead of the end point.

[\Next]

Data type: switch

Used when the distance for the argument Distance is forward towards the next programmed point. If the Distance is longer than the distance to the next fine point, the event will be executed at the fine point.

[\Time]

Data type: switch

Used when the value specified for the argument Distance is in fact a time in seconds (positive value) instead of a distance.

Fixed position I/O in time can only be used for short times (< 0.5 s) before the robot reaches the end point of the instruction. See the section *Limitations* for more details.

Signal

Data type: signalxx

The name of the signal that will be tested. May be any type of I/O signal.

Relation

Data type: opnum

Defines how to compare the actual value of the signal with the one defined by the argument CheckValue. See opnum data type for the list of the predefined constants to be used.

CheckValue

Data type: num

Value to which the actual value of the input or output signal is to be compared (within the allowed range for the current signal). If the signal is a digital signal, it must be an integer value.

If the signal is a digital group signal, the permitted value is dependent on the number of signals in the group. Max value that can be used in the CheckValue

Continues on next page

argument is 8388608, and that is the value a 23 bit digital group signal can have as maximum value (see ranges for num).

CheckDvalue

Data type: dnum

Value to which the actual value of the input or output signal is to be compared (within the allowed range for the current signal). If the signal is a digital signal, it must be an integer value.

If the signal is a digital group signal, the permitted value is dependent on the number of signals in the group. The maximal amount of signal bits a digital group signal can have is 32. With a dnum variable it is possible to cover the value range 0-4294967295, which is the value range a 32 bits digital signal can have.

[\StopMove]

Data type: switch

Specifies that if the condition is not fulfilled then the robot will stop on path as quickly as possible before the interrupt routine is run.

Interrupt

Data type: intnum

Variable used to identify the interrupt routine to run.

[\Inhib]

Inhibit

Data type: bool

The name of a persistent variable flag for inhibiting the execution of the interrupt routine.

If this optional argument is used and the actual value of the specified flag is TRUE at the position-time for I/O check, the check will not be performed.

[\Mode]

Data type: triggmode

Is used to specify different action modes when defining triggers.

Program execution

When running the instruction TriggCheckIO, the trigger condition is stored in a specified variable for the argument TriggData.

Afterwards, when one of the instructions TriggL, TriggC, or TriggJ is executed, the following are applicable with regard to the definitions in TriggCheckIO:

The table describes distance specified in the argument Distance:

Linear movement	The straight line distance
Circular movement	The circle arc length
Non-linear movement	The approximate arc length along the path (to obtain adequate accuracy, the distance should not exceed one half of the arc length).

The figure shows fixed position I/O check on a corner path.

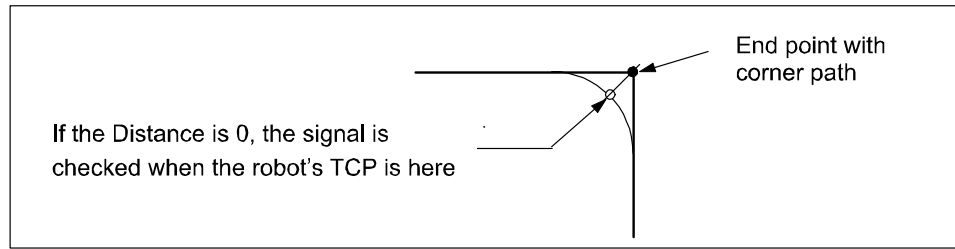
Continues on next page

1 Instructions

1.286 TriggCheckIO - Defines I/O check at a fixed position

RobotWare Base

Continued



xx0500002256

The fixed position I/O check will be done when the start point (end point) is passed if the specified distance from the end point (start point) is not within the length of movement of the current instruction (TriggL . . .).

When the TCP of the robot is at specified place on the path, the following I/O check will be done by the system:

- Read the value of the I/O signal.
- Compare the read value with CheckValue according specified Relation.
- If the comparison is TRUE then nothing more is done.
- If the comparison is FALSE then following is done:
 - If optional parameter \StopMove is present then the robot is stopped on the path as quickly as possible.
 - Generate and execute the specified trap routine.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AO_LIM	The programmed CheckValue or CheckDvalue argument for the specified analog output signal Signal is outside limits.
ERR_GO_LIM	The programmed CheckValue or CheckDvalue argument for the specified digital group output signal Signal is outside limits.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.

More examples

More examples of how to use the instruction TriggCheckIO are illustrated below.

Example 1

```
VAR triggdata checkgate;  
VAR intnum gateclosed;  
  
PROC main()  
  CONNECT gateclosed WITH waitgate;  
  TriggCheckIO checkgate,150, gatedi, EQ, 1 \StopMove, gateclosed;  
  TriggL p1, v600, checkgate, z50, grip1;  
  ...  
ENDPROC
```

Continues on next page

```

TRAP waitgate
  ! Block movement
  StopMove;
  ! log some information
  ...
  ! Wait until signal is set
  WaitDI gatedi,1;
  ! Unlock block, and resume movement
  StartMove;
ENDTRAP

```

The gate for the next workpiece operation is checked to be open (digital input signal `gatedi` is checked to have the value 1) when the TCP is 150 mm before the point `p1`. If it is open then the robot will move on to `p1` and continue. If it is not open then the robot is stopped on path and the interrupt routine `waitgate` is run. This interrupt blocks further movements, log some information and typically waits for the conditions to be OK to execute a `StartMove` instruction to restart the interrupted path.

Limitations

I/O checks with distance (without the argument `\Time`) is intended for flying points (corner path). I/O checks with distance, using stop points, results in worse accuracy than specified below.

I/O checks with time (with the argument `\Time`) is intended for stop points. I/O checks with time, using flying points, results in worse accuracy than specified below.

I/O checks with time can only be specified from the end point of the movement. This time cannot exceed the current braking time of the robot, which is max. approximately 0.5 s (typical values at speed 500 mm/s for IRB 2400 is 150 ms, and for IRB 6400 is 250 ms). If the specified time is greater than the current braking time then the I/O check will be generated anyway but not until braking is started (later than specified). The whole of the movement time for the current movement can be utilized during small and fast movements.

Typical absolute accuracy values for testing of digital inputs +/- 5 ms. Typical repeat accuracy values for testing of digital inputs +/- 2 ms.

`TriggCheckIO` cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: `PowerOn`, `Stop`, `QStop`, `Restart`, `Reset` or `Step`.

Syntax

```

TriggCheckIO
[ TriggData ':' ] < variable (VAR) of triggdata> ','
[ Distance ':' ] < expression (IN) of num>
[ '\ ' Start ] | [ '\ ' Next ] | [ '\ ' Time ] ','
[ Signal ':' ] < variable (VAR) of anytype> ','
[ Relation ':' ] < expression (IN) of opnum> ','
[ CheckValue ':' ] < expression (IN) of num>
| [ CheckDvalue ':' ] < expression (IN) of dnum>
[ '\ ' StopMove ] ','

```

Continues on next page

1 Instructions

1.286 TriggCheckIO - Defines I/O check at a fixed position

RobotWare Base

Continued

```
[ Interrupt ':= ' ] < variable(VAR) of intnum>  
[ '\ ' Inhib ':= ' < persistent (PERS) of bool> ]  
[ '\ ' Mode ':= ' < expression (IN) of triggmode> ] ';'
```

Related information

For information about	See
Use of triggers	TriggL - Linear robot movements with events on page 902 TriggC - Circular robot movement with events on page 858 TriggJ - Axis-wise robot movements with events on page 894
Definition of position-time I/O event	TriggIO - Define a fixed position or time I/O event near a stop point on page 888 TriggEquip - Define a fixed position and time I/O event on the path on page 877
Definition of position related interrupts	TriggInt - Defines a position related interrupt on page 883
Storage of trigg data	triggdata - Positioning events, trigg on page 1761
Defining different trigg action modes	triggmode - Trigg action mode on page 1766
Definition of comparison operators	opnum - Comparison operator on page 1682

1.287 TriggDataCopy - Copy the content in a triggdata variable

Usage

TriggDataCopy is used to copy the content in a triggdata variable.

Basic examples

The following example illustrates the instruction TriggDataCopy.

Example 1

```

VAR triggdata trigg_array{25};
...
PROC MyTriggProcL(robtarget myrobt, \VAR triggdata T1 \VAR triggdata
  T2 \VAR triggdata T3)
  VAR num triggcnt:=2;
  ! Reset entire trigg_array array before using it
  FOR i FROM 1 TO 25 DO
    TriggDataReset trigg_array[i];
  ENDFOR
  TriggEquip trigg_array{1}, 10 \Start, 0 \D0p:=do1, SetValue:=1;
  TriggEquip trigg_array{2}, 40 \Start, 0 \D0p:=do2, SetValue:=1;
  ! Check if optional argument is present,
  ! and if any trigger condition has been setup in T1
  IF Present(T1) AND TriggDataValid(T1) THEN
    ! Copy actual trigger condition to trigg_array
    TriggDataCopy T1, trigg_array{triggcnt};
    Incr triggcnt;
  ENDIF
  IF Present(T2) AND TriggDataValid(T2) THEN
    Incr triggcnt;
    TriggDataCopy T2, trigg_array{triggcnt};
  ENDIF
  IF Present(T3) AND TriggDataValid(T3) THEN
    Incr triggcnt;
    TriggDataCopy T3, trigg_array{triggcnt};
  ENDIF
  TriggL p1, v500, trigg_array, z30, tool2;
  ...

```

The procedure MyTriggProcL above uses the TriggDataCopy instruction to copy the triggdata optional arguments to right place in the triggdata array that is used in the TriggL instruction.

Arguments

TriggDataCopy Source Destination

Source

Data type: triggdata

The triggdata variable to copy from.

Destination

Data type: triggdata

Continues on next page

1 Instructions

1.287 TriggDataCopy - Copy the content in a triggdata variable

RobotWare Base

Continued

The triggdata variable to copy to.

Program execution

The TriggDataCopy instruction is used to copy data from one triggdata variable to another triggdata variable. This instruction can be useful when working with triggdata array variables.

Limitations

TriggDataCopy cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
TriggDataCopy
[Source ':='] < variable (VAR) of triggdata > ','
[Destination ':='] < variable (VAR) of triggdata > ';'

```

Related information

For information about	See
Linear movement with triggers	TriggL - Linear robot movements with events on page 902
Joint movement with triggers	TriggJ - Axis-wise robot movements with events on page 894
Circular movement with triggers	TriggC - Circular robot movement with events on page 858
Definition of triggers	TriggIO - Define a fixed position or time I/O event near a stop point on page 888 TriggEquip - Define a fixed position and time I/O event on the path on page 877 TriggInt - Defines a position related interrupt on page 883 TriggCheckIO - Defines I/O check at a fixed position on page 867 TriggRampAO - Define a fixed position ramp AO event on the path on page 927 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event on page 934
Handling triggdata	triggdata - Positioning events, trigg on page 1761 TriggDataReset - Reset the content in a triggdata variable on page 875 TriggDataValid - Check if the content in a triggdata variable is valid on page 1516

1.288 TriggDataReset - Reset the content in a triggdata variable

Usage

TriggDataReset is used to reset the content in a triggdata variable.

Basic examples

The following example illustrates the instruction TriggDataReset.

Example 1

```

VAR triggdata trigg_array{25};
...
PROC MyTriggProcL(robtarget myrobt, \VAR triggdata T1 \VAR triggdata
  T2 \VAR triggdata T3)
  VAR num triggcnt:=2;
  ! Reset entire trigg_array array before using it
  FOR i FROM 1 TO 25 DO
    TriggDataReset trigg_array{i};
  ENDFOR
  TriggEquip trigg_array{1}, 10 \Start, 0 \D0p:=do1, SetValue:=1;
  TriggEquip trigg_array{2}, 40 \Start, 0 \D0p:=do2, SetValue:=1;
  ! Check if optional argument is present,
  ! and if any trigger condition has been setup in T1
  IF Present(T1) AND TriggDataValid(T1) THEN
    ! Copy actual trigger condition to trigg_array
    TriggDataCopy trigg_array{triggcnt}, T1;
    Incr triggcnt;
  ENDIF
  IF Present(T2) AND TriggDataValid(T2) THEN
    Incr triggcnt;
    TriggDataCopy trigg_array{triggcnt}, T2;
  ENDIF
  IF Present(T3) AND TriggDataValid(T3) THEN
    Incr triggcnt;
    TriggDataCopy trigg_array{triggcnt}, T3;
  ENDIF
  TriggL p1, v500, trigg_array, z30, tool2;
  ...

```

The procedure MyTriggProcL above uses the TriggDataReset instruction to reset the triggdata array before it is used.

Arguments

TriggDataReset TriggData

TriggData

Data type: triggdata

The triggdata variable to reset.

Continues on next page

1 Instructions

1.288 TriggDataReset - Reset the content in a triggdata variable

RobotWare Base

Continued

Program execution

The TriggDataReset instruction is used to remove any trigger condition previously used in a triggdata variable. This instruction can be useful when working with triggdata array variables.

Limitations

TriggDataReset cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
TriggDataReset  
[TriggData ':='] < variable (VAR) of triggdata > ';' ;
```

Related information

For information about	See
Linear movement with triggers	TriggL - Linear robot movements with events on page 902
Joint movement with triggers	TriggJ - Axis-wise robot movements with events on page 894
Circular movement with triggers	TriggC - Circular robot movement with events on page 858
Definition of triggers	TriggIO - Define a fixed position or time I/O event near a stop point on page 888 TriggEquip - Define a fixed position and time I/O event on the path on page 877 TriggInt - Defines a position related interrupt on page 883 TriggCheckIO - Defines I/O check at a fixed position on page 867 TriggRampAO - Define a fixed position ramp AO event on the path on page 927 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event on page 934
Handling triggdata	triggdata - Positioning events, trigg on page 1761 TriggDataCopy - Copy the content in a triggdata variable on page 873 TriggDataValid - Check if the content in a triggdata variable is valid on page 1516

1.289 TriggEquip - Define a fixed position and time I/O event on the path

Usage

TriggEquip (*Trigg Equipment*) is used to define conditions and actions for setting a digital, a group of digital, or an analog output signal at a fixed position along the robot's movement path with possibility to do time compensation for the lag in the external equipment.

TriggIO (not TriggEquip) should always be used if there is need for good accuracy of the I/O settings near a stop point.

The data defined is used for implementation in one or more subsequent TriggL, TriggC, or TriggJ instructions.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction TriggEquip:

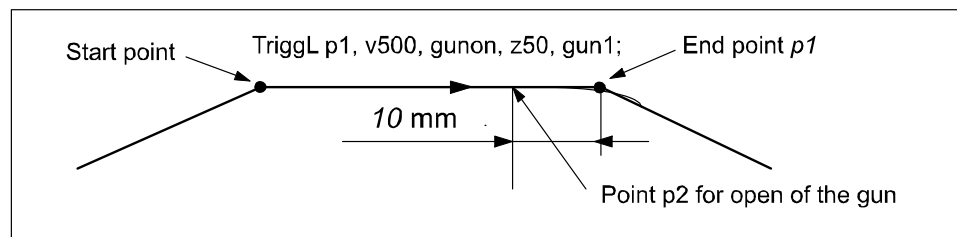
See also [More examples on page 881](#).

Example 1

```
VAR trigdata gunon;
...
TriggEquip gunon, 10, 0.1 \D0p:=gun, 1;
TriggL p1, v500, gunon, z50, gun1;
```

The tool gun1 starts to open when its TCP is 0,1 s before the fictitious point p2 (10 mm before point p1). The gun is full open when TCP reach point p2.

The figure shows an example of a fixed position time I/O event.



xx0500002260

Arguments

```
TriggEquip TriggData Distance [\Start] | [\Next] EquipLag [\D0p]
| [\G0p] | [\A0p] | [\ProcID] SetValue | SetDvalue [\Inhib]
[\InhibSetValue] [\Mode]
```

TriggData

Data type: trigdata

Variable for storing the trigdata returned from this instruction. These trigdata are then used in the subsequent TriggL, TriggC, or TriggJ instructions.

Continues on next page

1 Instructions

1.289 TriggEquip - Define a fixed position and time I/O event on the path

RobotWare Base

Continued

Distance

Data type: num

Defines the position on the path where the I/O equipment event shall occur.

Specified as the distance in mm (positive value) from the end point of the movement path towards the start point (applicable if the arguments \Start and \Next are not set).

See [Program execution on page 880](#) for further details.

[\Start]

Data type: switch

Used when the distance for the argument Distance starts at the movement start point instead of the end point.

[\Next]

Data type: switch

Used when the distance for the argument Distance is forward towards the next programmed point. If the Distance is longer than the distance to the next fine point, the event will be executed at the fine point.

EquipLag

Equipment Lag

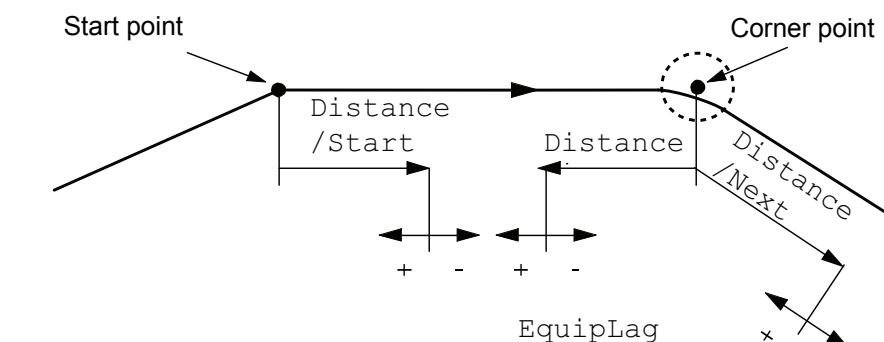
Data type: num

Specify the lag for the external equipment in s.

For compensation of external equipment lag, use a positive argument value. Positive argument value means that the I/O signal is set by the robot system at a specified time before the TCP physically reaches the specified distance in relation to the movement start or end point.

Negative argument value means that the I/O signal is set by the robot system at a specified time after that the TCP has physically passed the specified distance in relation to the movement start or end point.

The figure shows use of argument EquipLag.



xx0500002262

[\DOp]

Digital Output

Continues on next page

1.289 TriggEquip - Define a fixed position and time I/O event on the path

RobotWare Base
Continued

Data type: signaldo

The name of the signal when a digital output signal shall be changed.

[\GOp]

Group Output

Data type: signalgo

The name of the signal when a group of digital output signals shall be changed.

[\AOp]

Analog Output

Data type: signalao

The name of the signal when a analog output signal shall be changed.

[\ProcID]

Process Identity

Data type: num

Not implemented for customer use.

(The identity of the IPM process to receive the event. The selector is specified in the argument SetValue.)

SetValue

Data type: num

The desired value of the signal (within the allowed range for the current signal). If the signal is a digital signal, it must be an integer value. If the signal is a digital group signal, the permitted value is dependent on the number of signals in the group. Max value that can be used in the SetValue argument is 8388608, and that is the value a 23 bit digital group signal can have as maximum value (see ranges for num).

SetDvalue

Data type: dnum

The desired value of the signal (within the allowed range for the current signal). If the signal is a digital signal, it must be an integer value. If the signal is a digital group signal, the permitted value is dependent on the number of signals in the group. The maximal amount of signal bits a digital group signal can have is 32. With a dnum variable it is possible to cover the value range 0-4294967295, which is the value range a 32 bits digital signal can have.

[\Inhib]

Inhibit

Data type: bool

The name of a persistent variable flag for inhibiting the setting of the signal at runtime.

If this optional argument is used and the actual value of the specified flag is TRUE at the position-time for setting of the signal then the specified signal (DOp, GOp or AOp) will be set to 0 instead of a specified value.

Continues on next page

1 Instructions

1.289 TriggEquip - Define a fixed position and time I/O event on the path

RobotWare Base

Continued

[\InhibSetValue]

InhibitSetValue

Data type: bool, num or dnum

The name of a persistent variable of the data type bool, num or dnum or any alias of those three base data types.

This optional argument can only be used together with optional argument Inhib.

If this optional argument is used and the value of the persistent variable flag used in optional argument Inhib is TRUE at the position-time for setting the signal, the value of the persistent variable used in optional argument InhibSetValue is read and the value is used for setting of the DOp, GOp or AOp signal.

If using a boolean persistent variable, the value TRUE is translated to value 1, and FALSE is translated to value 0.

[\Mode]

Data type: trigemode

Is used to specify different action modes when defining triggers.

Program execution

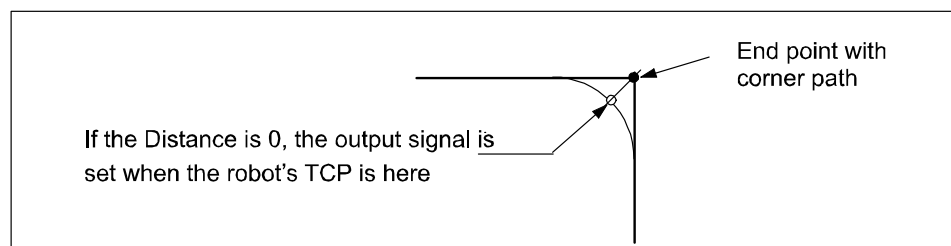
When running the instruction TriggEquip, the trigger condition is stored in the specified variable for the argument TriggData.

Afterwards, when one of the instructions TriggL, TriggC, or TriggJ is executed then the following are applicable with regard to the definitions in TriggEquip:

The table describes the distance specified in the argument Distance:

Linear movement	The straight line distance
Circular movement	The circle arc length
Non-linear movement	The approximate arc length along the path (to obtain adequate accuracy, the distance should not exceed one half of the arc length).

The figure shows fixed position time I/O on a corner path.



xx0500002263

The position-time related event will be generated when the start point (end point) is passed if the specified distance from the end point (start point) is not within the length of movement of the current instruction (TriggL . . .). With use of argument EquipLag with negative time (delay), the I/O signal can be set after the end point.

Continues on next page

1.289 TriggEquip - Define a fixed position and time I/O event on the path

RobotWare Base
Continued

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_AO_LIM	The programmed <code>SetValue</code> argument for the specified analog output signal <code>AOp</code> is out of limit.
ERR_GO_LIM	The programmed <code>SetValue</code> or <code>SetDvalue</code> argument for the specified digital group output signal <code>GOp</code> is out of limit.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID . It has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .

More examples

More examples of how to use the instruction `TriggEquip` are illustrated below.

Example 1

```
VAR triggdata glueflow;
...
TriggEquip glueflow, 1 \Start, 0.05 \AOp:=glue, 5.3;
MoveJ p1, v1000, z50, tool1;
TriggL p2, v500, glueflow, z50, tool1;
```

The analog output signal `glue` is set to the value 5.3 when the TCP passes a point located 1 mm after the start point `p1` with compensation for equipment lag 0.05 s.

Example 2

```
...
TriggL p3, v500, glueflow, z50, tool1;
```

The analog output signal `glue` is set once more to the value 5.3 when the TCP passes a point located 1 mm after the start point `p2`.

Limitations

I/O events with distance is intended for flying points (corner path). Using stop points will result in worse accuracy than specified below.

Regarding the accuracy for I/O events with distance and using flying points, the following is applicable when setting a digital output at a specified distance from the start point or end point in the instruction `TriggL` or `TriggC`:

- The accuracy specified below is valid when using a positive `EquipLag` that is less than 40 ms, which is equivalent to the lag in the robot servo without changing the system parameter *Event Preset Time*. The lag can vary between different robot types.
- The accuracy specified below is valid when using a positive `EquipLag` that is less than the configured *Event Preset Time* in the system parameters.
- The accuracy specified below is not valid when using a positive `EquipLag` that is larger than the configured *Event Preset Time* in the system parameters. In this case, an approximate method is used in which the dynamic limitations

Continues on next page

1 Instructions

1.289 TriggEquip - Define a fixed position and time I/O event on the path

RobotWare Base

Continued

of the robot are not taken into consideration. Then SingArea \Wrist must be used to achieve an acceptable accuracy.

- The accuracy specified below is valid when using a negative EquipLag.

The typical absolute accuracy values for setting digital outputs is: ± 5 ms.

The typical repeat accuracy values for setting digital outputs is: ± 2 ms.

TriggEquip cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
TriggEquip
[ TriggData ':=' ] < variable (VAR) of triggdata> ', '
[ Distance' :=' ] < expression (IN) of num>
[ '\ ' Start ] | [ '\ ' Next ] ', '
[ EquipLag ':=' ] < expression (IN) of num>
[ '\ ' DOp ':=' < variable (VAR) of signaldo> ]
| [ '\ ' GOp ':=' < variable (VAR) of signalgo> ]
| [ '\ ' AOp ':=' < variable (VAR) of signalao> ]
| [ '\ ' ProcID ':=' < expression (IN) of num> ] ', '
[ SetValue ':=' ] < expression (IN) of num>
| [ SetDvalue ':=' ] < expression (IN) of dnum> ', '
[ '\ ' Inhib ':=' < persistent (PERS) of bool> ]
[ '\ ' InhibSetValue ':=' < persistent (PERS) of anytype> ]
[ '\ ' Mode ':=' < expression (IN) of triggmode> ] ';'
```

Related information

For information about	See
Use of triggers	TriggL - Linear robot movements with events on page 902 TriggC - Circular robot movement with events on page 858 TriggJ - Axis-wise robot movements with events on page 894
Definition of other triggs	TriggIO - Define a fixed position or time I/O event near a stop point on page 888 TriggInt - Defines a position related interrupt on page 883
Define I/O check at a fixed position	TriggCheckIO - Defines I/O check at a fixed position on page 867
Storage of trigg data	triggdata - Positioning events, trigg on page 1761
Defining different trigg action modes	triggmode - Trigg action mode on page 1766
Set of I/O	SetDO - Changes the value of a digital output signal on page 682 SetGO - Changes the value of a group of digital output signals on page 684 SetAO - Changes the value of an analog output signal on page 672
Configuration of Event preset time	Technical reference manual - System parameters

1.290 TriggInt - Defines a position related interrupt

Usage

TriggInt is used to define conditions and actions for running an interrupt routine at a specified position on the robot's movement path.

The data defined is used for implementation in one or more subsequent TriggL, TriggC, or TriggJ instructions.

This instruction can only be used in the main task T_ROB1 or, if in a MultiMove System, in Motion tasks.

Basic examples

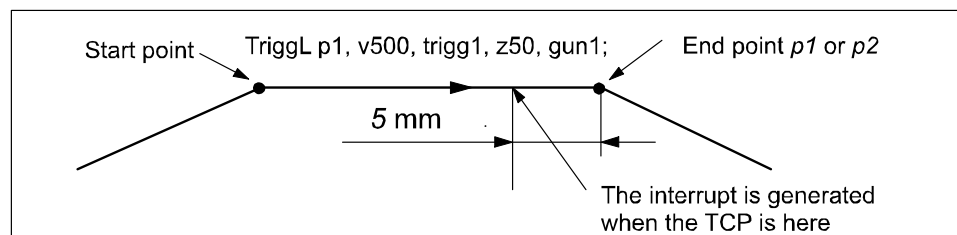
The following example illustrates the instruction TriggInt:

Example 1

```
VAR intnum intno1;
VAR trigdata trigg1;
...
PROC main()
  CONNECT intno1 WITH trap1;
  TriggInt trigg1, 5, intno1;
  ...
  TriggL p1, v500, trigg1, z50, gun1;
  TriggL p2, v500, trigg1, z50, gun1;
  ...
  IDelete intno1;
```

The interrupt routine trap1 is run when the TCP is at a position 5mm before the point p1 or p2 respectively.

The figure shows an example of position related interrupt.



xx0500002251

Arguments

TriggInt TriggData Distance [\Start] | [\Next] | [\Time] Interrupt
[\Inhib] [\Mode]

TriggData

Data type: trigdata

Variable for storing the trigdata returned from this instruction. These trigdata are then used in the subsequent TriggL, TriggC, or TriggJ instructions.

Continues on next page

1 Instructions

1.290 TriggInt - Defines a position related interrupt

RobotWare Base

Continued

Distance

Data type: num

Defines the position on the path where the interrupt shall be generated.

Specified as the distance in mm (positive value) from the end point of the movement path (applicable if the argument \Start or \Time is not set).

See [Program execution on page 884](#) for further details.

[\Start]

Data type: switch

Used when the distance for the argument Distance starts at the movement start point instead of the end point.

[\Next]

Data type: switch

Used when the distance for the argument Distance is forward towards the next programmed point. If the Distance is longer than the distance to the next fine point, the event will be executed at the fine point.

[\Time]

Data type: switch

Used when the value specified for the argument Distance is in fact a time in seconds (positive value) instead of a distance.

Fixed position I/O in time can only be used for short times (< 0.5 s) before the robot reaches the end point of the instruction. See the section *Limitations* for more details.

Interrupt

Data type: intnum

Variable used to identify an interrupt.

[\Inhib]

Inhibit

Data type: bool

The name of a persistent variable flag for inhibiting the execution of the interrupt routine.

If this optional argument is used and the actual value of the specified flag is TRUE at the position-time for interrupt execution, the interrupt will not be executed.

[\Mode]

Data type: trigmode

Is used to specify different action modes when defining triggers.

Program execution

When running the instruction TriggInt, data is stored in a specified variable for the argument TriggData and the interrupt that is specified in the variable for the argument Interrupt is activated.

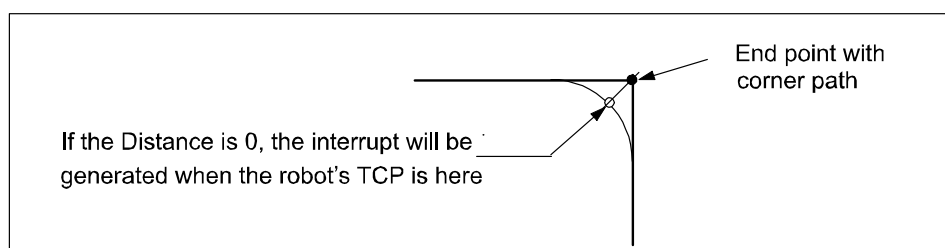
Continues on next page

Afterwards, when one of the instructions TriggL, TriggC, or TriggJ is executed, the following are applicable with regard to the definitions in TriggInt:

The table describes the distance specified in the argument Distance:

Linear movement	The straight line distance
Circular movement	The circle arc length
Non-linear movement	The approximate arc length along the path (to obtain adequate accuracy, the distance should not exceed one half of the arc length).

The figure shows position related interrupt on a corner path.



xx0500002253

The position related interrupt will be generated when the start point (end point) is passed if the specified distance from the end point (start point) is not within the length of movement of the current instruction (TriggL...).

The interrupt is considered to be a safe interrupt. A safe interrupt cannot be put in sleep with instruction ISleep. The safe interrupt event will be queued at program stop and stepwise execution, and when starting in continuous mode again, the interrupt will be executed. The only time a safe interrupt will be thrown is when the interrupt queue is full. Then an error will be reported. The interrupt will not survive program reset, e.g. PP to main.

More examples

More examples of how to use the instruction TriggInt are illustrated below.

Example 1

This example describes programming of the instructions that interact to generate position related interrupts:

```
VAR intnum intno2;
VAR triggdata trigg2;
```

- Declaration of the variables intno2 and trigg2 (shall not be initiated).
- CONNECT intno2 WITH trap2;
- Allocation of interrupt numbers that are stored in the variable intno2.
- The interrupt number is coupled to the interrupt routine trap2.
- TriggInt trigg2, 0, intno2;
- The interrupt number in the variable intno2 is flagged as used.
- The interrupt is activated.
- Defined trigger conditions and interrupt numbers are stored in the variable trigg2

Continues on next page

1 Instructions

1.290 TriggInt - Defines a position related interrupt

RobotWare Base

Continued

```
TriggL p1, v500, trigg2, z50, gun1;
```

- The robot is moved to the point p1.
- When the TCP reaches the point p1 an interrupt is generated, and the interrupt routine trap2 is run.

```
TriggL p2, v500, trigg2, z50, gun1;
```

- The robot is moved to the point p2.
- When the TCP reaches the point p2, an interrupt is generated and the interrupt routine trap2 is run once more.

```
IDelete intno2;
```

- The interrupt number in the variable intno2 is de-allocated.

Limitations

Interrupt events with distance (without the argument \Time) are intended for flying points (corner path). Interrupt events with distance, using stop points results in worse accuracy than specified below.

Interrupt events with time (with the argument \Time) are intended for stop points. Interrupt events with time, using flying points, result in worse accuracy than specified below. I/O events with time can only be specified from the end point of the movement. This time cannot exceed the current braking time of the robot, which is max. approximately 0.5 s (typical values at speed 500 mm/s for IRB 2400 is 150 ms, and for IRB 6400 is 250 ms). If the specified time is greater than the current braking time then the event will be generated anyhow but not until braking is started (later than specified). The whole of the movement time for the current movement can be utilized during small and fast movements.

Typical absolute accuracy values for generation of interrupts +/- 5 ms. Typical repeat accuracy values for generation of interrupts +/- 2 ms. Normally there is a delay of 2 to 30 ms between interrupt generation and response depending on the type of movement being performed at the time of the interrupt. See *Technical reference manual - RAPID Overview*.

To obtain the best accuracy when setting an output at a fixed position along the robot's path, use the instructions TriggIO or TriggEquip in preference to the instructions TriggInt with SetD0/SetG0/SetA0 in an interrupt routine.

TriggInt cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
TriggInt  
[TriggData '[:=' ] <variable (VAR) of triggdata>','  
[Distance '[:' ] <expression (IN) of num>  
['\ ' Start] | ['\ ' Next ] | ['\ ' Time'],'  
[Interrupt '[:=' ] <variable (VAR) of intnum>  
['\ ' Inhib '[:=' ] <persistent (PERS) of bool>  
['\ ' Mode '[:=' ] <expression (IN) of triggmode>'],';
```

Continues on next page

Related information

For information about	See
Use of triggers	TriggL - Linear robot movements with events on page 902 TriggC - Circular robot movement with events on page 858 TriggJ - Axis-wise robot movements with events on page 894
Definition of position fix I/O	TriggIO - Define a fixed position or time I/O event near a stop point on page 888 TriggEquip - Define a fixed position and time I/O event on the path on page 877
Define I/O check at a fixed position	TriggCheckIO - Defines I/O check at a fixed position on page 867
Storage of trigg data	triggdata - Positioning events, trigg on page 1761
Defining different trigg action modes	triggmode - Trigg action mode on page 1766
Interrupts	<i>Technical reference manual - RAPID Overview</i>

1 Instructions

1.291 TriggIO - Define a fixed position or time I/O event near a stop point RobotWare Base

1.291 TriggIO - Define a fixed position or time I/O event near a stop point

Usage

TriggIO is used to define conditions and actions for setting a digital, a group of digital, or an analog output signal at a fixed position along the robot's movement path.

TriggIO (not TriggEquip) should always be used if needed for good accuracy of the I/O settings near a stop point.

To obtain a fixed position I/O event, TriggIO compensates for the lag in the control system (lag between robot and servo) but not for any lag in the external equipment. For compensation of both lags use TriggEquip.

The data defined is used for implementation in one or more subsequent TriggL, TriggC, or TriggJ instructions.

This instruction can only be used in the main T_ROB1 task or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction TriggIO:

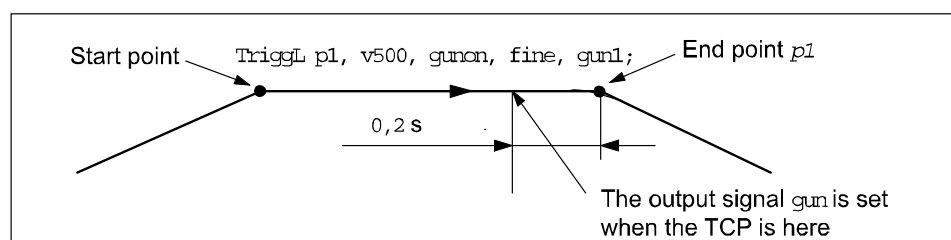
See also [More examples on page 891](#).

Example 1

```
VAR triggdata gunon;  
...  
TriggIO gunon, 0.2\Time\D0p:=gun, 1;  
TriggL p1, v500, gunon, fine, gun1;
```

The digital output signal `gun` is set to the value 1 when the TCP is 0,2 seconds before the point `p1`.

The figure shows an example of fixed position I/O event.



xx0500002247

Arguments

```
TriggIO TriggData Distance [\Start] | [\Time] [\D0p] | [\G0p] |  
[\A0p] | [\ProcID] SetValue | SetDvalue [\D0Delay] [\Inhib]  
[\InhibSetValue] [\Mode]
```

TriggData

Data type: triggdata

Continues on next page

1.291 TriggIO - Define a fixed position or time I/O event near a stop point

RobotWare Base

Continued

Variable for storing the `triggdata` returned from this instruction. These `triggdata` are then used in the subsequent `TriggL`, `TriggC`, or `TriggJ` instructions.

Distance

Data type: num

Defines the position on the path where the I/O event shall occur.

Specified as the distance in mm (positive value) from the end point of the movement path (applicable if the argument `\Start` or `\Time` is not set).

See the sections [Program execution on page 891](#), and [Limitations on page 892](#) for further details.

[`\Start`]

Data type: switch

Used when the distance for the argument `Distance` starts at the movement start point instead of the end point.

[`\Time`]

Data type: switch

Used when the value specified for the argument `Distance` is in fact a time in seconds (positive value) instead of a distance.

Fixed position I/O in time can only be used for short times (< 0.5 s) before the robot reaches the end point of the instruction. See the section *Limitations* for more details.

[`\DOp`]*Digital Output*

Data type: signaldo

The name of the signal when a digital output signal shall be changed.

[`\GOp`]*Group Output*

Data type: signalgo

The name of the signal when a group of digital output signals shall be changed.

[`\AOp`]*Analog Output*

Data type: signalao

The name of the signal when an analog output signal shall be changed.

[`\ProcID`]*Process Identity*

Data type: num

Not implemented for customer use.

(The identity of the IPM process to receive the event. The selector is specified in the argument `SetValue`.)

SetValue

Data type: num

Continues on next page

1 Instructions

1.291 TriggIO - Define a fixed position or time I/O event near a stop point

RobotWare Base

Continued

The desired value of the signal (within the allowed range for the current signal). If the signal is a digital signal, it must be an integer value. If the signal is a digital group signal, the permitted value is dependent on the number of signals in the group. Max value that can be used in the `SetValue` argument is 8388608, and that is the value a 23 bit digital group signal can have as maximum value (see ranges for `num`).

`SetDvalue`

Data type: `dnum`

The desired value of the signal (within the allowed range for the current signal). If the signal is a digital signal, it must be an integer value. If the signal is a digital group signal, the permitted value is dependent on the number of signals in the group. The maximal amount of signal bits a digital group signal can have is 32. With a `dnum` variable it is possible to cover the value range 0-4294967295, which is the value range a 32 bits digital signal can have.

[`\DODelay`]

Digital Output Delay

Data type: `num`

Time delay in seconds (positive value) for a digital, group, or analog output signal.

Only used to delay setting of output signals after the robot has reached the specified position. There will be no delay if the argument is omitted.

The delay is not synchronized with the movement.

[`\Inhib`]

Inhibit

Data type: `bool`

The name of a persistent variable flag for inhibiting the setting of the signal at runtime.

If this optional argument is used and the actual value of the specified flag is `TRUE` at the position-time for setting of the signal then the specified signal (`D0p`, `G0p` or `A0p`) will be set to 0 instead of a specified value.

[`\InhibSetValue`]

InhibitSetValue

Data type: `bool`, `num` or `dnum`

The name of a persistent variable of the data type `bool`, `num` or `dnum` or any alias of those three base data types.

This optional argument can only be used together with optional argument `Inhib`.

If this optional argument is used and the value of the persistent variable flag used in optional argument `Inhib` is `TRUE` at the position-time for setting the signal, the value of the persistent variable used in optional argument `InhibSetValue` is read and the value is used for setting of the `D0p`, `G0p` or `A0p` signal.

If using a boolean persistent variable, the value `TRUE` is translated to value 1, and `FALSE` is translated to value 0.

Continues on next page

[\Mode]

Data type: triggmode

Is used to specify different action modes when defining triggers.

Program execution

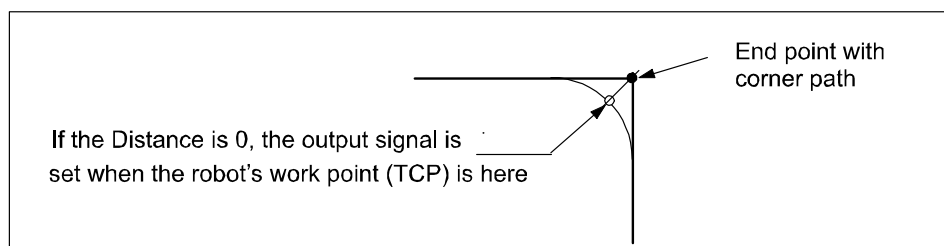
When running the instruction TriggIO, the trigger condition is stored in a specified variable in the argument TriggData.

Afterwards, when one of the instructions TriggL, TriggC, or TriggJ is executed, the following are applicable with regard to the definitions in TriggIO:

The following table describes the distance specified in the argument Distance:

Linear movement	The straight line distance
Circular movement	The circle arc length
Non-linear movement	The approximate arc length along the path (to obtain adequate accuracy, the distance should not exceed one half of the arc length).

The figure shows fixed position I/O on a corner path.



xx0500002248

The fixed position I/O will be generated when the start point (end point) is passed if the specified distance from the end point (start point) is not within the length of movement of the current instruction (Trigg...).

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AO_LIM	The programmed SetValue argument for the specified analog output signal AOp is out of limit.
ERR_GO_LIM	The programmed SetValue or SetDvalue argument for the specified digital group output signal GOp is out of limit.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.

More examples

More examples of how to use the instruction TriggIO are illustrated below.

Example 1

```
VAR triggdata glueflow;
```

Continues on next page

1 Instructions

1.291 TriggIO - Define a fixed position or time I/O event near a stop point

RobotWare Base

Continued

```
TriggIO glueflow, 1 \Start \AOp:=glue, 5.3;
```

```
MoveJ p1, v1000, z50, tool1;
```

```
TriggL p2, v500, glueflow, z50, tool1;
```

The analog output signal `glue` is set to the value 5.3 when the work point (TCP) passes a point located 1 mm after the start point p1.

Example 2

```
...
```

```
TriggL p3, v500, glueflow, z50, tool1;
```

The analog output signal `glue` is set once more to the value 5.3 when the work point (TCP) passes a point located 1 mm after the start point p2.

Limitations

I/O events with distance (without the argument `\Time`) is intended for flying points (corner path). I/O events with distance=0, using stop points, will delay the trigg until the robot has reached the point with accuracy +/-24 ms.

I/O events with time (with the argument `\Time`) are intended for stop points. I/O events with time, using flying points result in worse accuracy than specified below. I/O events with time can only be specified from the end point of the movement. This time cannot exceed the current braking time of the robot, which is max. approximately 0.5 s (typical values at speed 500 mm/s for IRB 2400 is 150 ms, and for IRB 6400 is 250 ms). If the specified time is greater than the current braking time then the event will be generated anyway but not until braking is started (later than specified). The whole of the movement time for the current movement can be utilized during small and fast movements.

Typical absolute accuracy values for set of digital outputs +/- 5 ms. Typical repeat accuracy values for set of digital outputs +/- 2 ms.

TriggIO cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
TriggIO
[TriggData ':='] <variable (VAR) of triggdata>', '
[Distance ':='] <expression (IN) of num>
['\ ' Start] | ['\ ' Time]
['\ ' DOp ':='] <variable (VAR) of signaldo>
|[ '\ ' GOp ':='] <variable (VAR) of signalgo>
|[ '\ ' AOp ':='] <variable (VAR) of signalao>
|[ '\ ' ProcID ':='] <expression (IN) of num>', '
[SetValue ':='] <expression (IN) of num>
|[ SetDvalue ':='] <expression (IN) of dnum>
['\ ' DODelay ':='] <expression (IN) of num>
['\ ' Inhib ':='] <persistent (PERS) of bool>
['\ ' InhibSetValue ':='] <persistent (PERS) of anytype>
['\ ' Mode ':='] <expression (IN) of triggmode>];'
```

Continues on next page

1.291 TriggIO - Define a fixed position or time I/O event near a stop point

RobotWare Base

Continued

Related information

For information about	See
Use of triggers	TriggL - Linear robot movements with events on page 902 TriggC - Circular robot movement with events on page 858 TriggJ - Axis-wise robot movements with events on page 894
Definition of position-time I/O event	TriggEquip - Define a fixed position and time I/O event on the path on page 877
Definition of position related interrupts	TriggInt - Defines a position related interrupt on page 883
Storage of trigg data	triggdata - Positioning events, trigg on page 1761
Defining different trigg action modes	triggmode - Trigg action mode on page 1766
Define I/O check at a fixed position	TriggCheckIO - Defines I/O check at a fixed position on page 867
Set of I/O	SetDO - Changes the value of a digital output signal on page 682 SetGO - Changes the value of a group of digital output signals on page 684 SetAO - Changes the value of an analog output signal on page 672

1 Instructions

1.292 TriggJ - Axis-wise robot movements with events RobotWare Base

1.292 TriggJ - Axis-wise robot movements with events

Usage

TriggJ (*TriggJoint*) is used to set output signals and/or run interrupt routines at roughly fixed positions at the same time as the robot is moving quickly from one point to another when that movement does not have to be in a straight line.

One or more (max. 25) events can be defined using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampAO and afterwards these definitions are referred to in the instruction TriggJ.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction TriggJ:

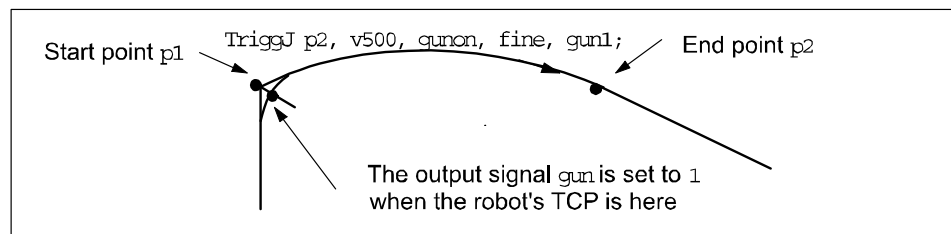
See also [More examples on page 899](#).

Example 1

```
VAR triggdata gunon;  
...  
TriggIO gunon, 0 \Start \D0p:=gun, 1;  
MoveL p1, v500, z50, gun1;  
TriggJ p2, v500, gunon, fine, gun1;
```

The digital output signal gun is set when the robot's TCP passes the midpoint of the corner path of the point p1.

The figure shows an example of fixed position I/O event.



Arguments

```
TriggJ [\Conc] ToPoint [\ID] Speed [\T] Trigg_1 | TriggArray [ \T2  
] [ \T3 ] [\T4] [\T5] [\T6] [\T7] [\T8] [\KeepStartPath]  
[\KeepEndPath] Zone [\Inpos] Tool [\WObj] [\TLoad]
```

[\Conc]

Concurrent

Data type: switch

Subsequent instructions are executed while the robot is moving. The argument is usually not used but can be used to avoid unwanted stops caused by overloaded CPU when using fly-by points. This is useful when the programmed points are very close together at high speeds. The argument is also useful when, for example,

Continues on next page

communicating with external equipment and synchronization between the external equipment and robot movement is not required.

Using the argument \Conc, the number of movement instructions in succession is limited to 5. In a program section that includes StorePath-RestoPath, movement instructions with the argument \Conc are not permitted.

If this argument is omitted and the ToPoint is not a stop point then the subsequent instruction is executed some time before the robot has reached the programmed zone.

This argument cannot be used in coordinated synchronized movement in a MultiMove system.

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

Trigg_1

Data type: trigdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

Continues on next page

1 Instructions

1.292 TriggJ - Axis-wise robot movements with events

RobotWare Base

Continued

TriggArray

Trigg Data Array Parameter

Data type: triggdata

Array variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggSpeed, TriggCheckIO, or TriggRampA0.

The limitation is 25 elements in the array and 1 to 25 defined trigger conditions must be defined.

It is not possible to use the optional arguments T2, T3, T4, T5, T6, T7, or T8 at the same time as the TriggArray argument is used.

[\T2]

Trigg 2

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T3]

Trigg 3

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T4]

Trigg 4

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T5]

Trigg 5

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T6]

Trigg 6

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

Continues on next page

[\T7]

Trigg 7**Data type:** triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T8]

Trigg 8**Data type:** triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Inpos]

In position**Data type:** stoppoint data

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

Continues on next page

1 Instructions

1.292 TriggJ - Axis-wise robot movements with events

RobotWare Base

Continued

[\WObj]

Work Object

Data type: wobjdata

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used this argument must be specified in order for a circle relative to the work object to be executed.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See the instruction MoveJ for information about joint movement.

As the trigger conditions are fulfilled when the robot is positioned closer and closer to the end point, the defined trigger activities are carried out. The trigger conditions are fulfilled either at a certain distance before the end point of the instruction, or at a certain distance after the start point of the instruction, or at a certain point in time (limited to a short time) before the end point of the instruction.

During the stepping execution forward, the I/O activities are carried out but the interrupt routines are not run. During stepping the execution backwards, no trigger activities at all are carried out.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_AO_LIM	The programmed <code>ScaleValue</code> argument for the specified analog output signal <code>AOp</code> in some of the connected <code>TriggSpeed</code> instructions result in out of limit for the analog signal together with the programmed <code>Speed</code> in this instruction.
ERR_DIPLAG_LIM	The programmed <code>DipLag</code> argument in some of the connected <code>TriggSpeed</code> instructions is too big in relation to the used <code>Event Preset Time</code> in <code>System Parameters</code> .
ERR_NORUNUNIT	There is no contact with the I/O device when entering instruction and the used <code>triggdata</code> depends on a running I/O device, i.e. a signal is used in the <code>triggdata</code> .
ERR_CONC_MAX	The number of movement instructions in succession using argument <code>\Conc</code> has been exceeded.

More examples

More examples of how to use the instruction `TriggJ` are illustrated below.

Example 1

```

VAR intnum intno1;
VAR triggdata trigg1;
...
PROC main()
  CONNECT intno1 WITH trap1;
  TriggInt trigg1, 0.1 \Time, intno1;
  ...
  TriggJ p1, v500, trigg1, fine, gun1;
  TriggJ p2, v500, trigg1, fine, gun1;
  ...
  IDelete intno1;

```

The interrupt routine `trap1` is run when the work point is at a position 0.1 s before the stop point `p1` or `p2` respectively.

Example 2

```

VAR num Distance:=0;
VAR triggdata trigg_array{25};
VAR signaldo myaliassignaldo;
VAR string signalname;
...
PROC main()
  ...
  FOR i FROM 1 TO 25 DO
    signalname:="do";
    signalname:=signalname+ValToStr(i);
    AliasIO signalname, myaliassignaldo;
    TriggEquip trigg_array{i}, Distance \Start, 0
      \DOp:=myaliassignaldo, SetValue:=1;
    Distance:=Distance+10;
  
```

Continues on next page

1 Instructions

1.292 TriggJ - Axis-wise robot movements with events

RobotWare Base

Continued

```
ENDFOR
TriggJ p1, v500, trigg_array, z30, tool2;
MoveJ p2, v500, z30, tool2;
...
```

The digital output signals do1 to do25 is set during the movement to p1. The distance between the signal settings is 10 mm.

Limitations

If the current start point deviates from the usual so that the total positioning length of the instruction TriggJ is shorter than usual (e.g. at the start of TriggJ with the robot position at the end point), it may happen that several or all of the trigger conditions are fulfilled immediately and at the same position. In such cases, the sequence in which the trigger activities are carried will be undefined. The program logic in the user program may not be based on a normal sequence of trigger activities for an incomplete movement.

UNDO or system events

TriggJ cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Short movements

There is a limitation on 10 queued movement instructions using trigger conditions setup by instruction TriggSpeed. If the queue is full, the system will stop. To avoid this limitation, use longer movements, or use a lower speed.

Syntax

```
TriggJ
[ '\ ' Conc ' , ' ]
[ ToPoint ' := ' ] < expression (IN) of robtarget >
[ '\ ' ID ' := ' < expression (IN) of identno > ] ' , '
[ Speed ' := ' ] < expression (IN) of speeddata >
[ '\ ' T ' := ' < expression (IN) of num > ] ' , '
[ Trigg_1 ' := ' ] < variable (VAR) of triggdata > |
[ TriggArray ' := ' ] < array variable {*} (VAR) of triggdata >
[ '\ ' T2 ' := ' < variable (VAR) of triggdata > ]
[ '\ ' T3 ' := ' < variable (VAR) of triggdata > ]
[ '\ ' T4 ' := ' < variable (VAR) of triggdata > ]
[ '\ ' T5 ' := ' < variable (VAR) of triggdata > ]
[ '\ ' T6 ' := ' < variable (VAR) of triggdata > ]
[ '\ ' T7 ' := ' < variable (VAR) of triggdata > ]
[ '\ ' T8 ' := ' < variable (VAR) of triggdata > ]
[ '\ ' KeepStartPath ' := ' < expression (IN) of num > ]
[ '\ ' KeepEndPath ' := ' < expression (IN) of num > ] ' , '
[ Zone ' := ' ] < expression (IN) of zonedata >
[ '\ ' Inpos ' := ' < expression (IN) of stoppointdata > ] ' , '
[ Tool ' := ' ] < persistent (PERS) of tooldata >
[ '\ ' WObj ' := ' < persistent (PERS) of wobjdata > ]
[ '\ ' TLoad ' := ' < persistent (PERS) of loaddata > ] ' ; '
```

Continues on next page

Related information

For information about	See
Linear movement with triggers	TriggL - Linear robot movements with events on page 902
Circular movement with triggers	TriggC - Circular robot movement with events on page 858
Definition of triggers	TriggIO - Define a fixed position or time I/O event near a stop point on page 888 TriggEquip - Define a fixed position and time I/O event on the path on page 877 TriggRampAO - Define a fixed position ramp AO event on the path on page 927 TriggInt - Defines a position related interrupt on page 883 TriggCheckIO - Defines I/O check at a fixed position on page 867
Handling triggdata	triggdata - Positioning events, trigg on page 1761 TriggDataReset - Reset the content in a triggdata variable on page 875 TriggDataCopy - Copy the content in a triggdata variable on page 873 TriggDataValid - Check if the content in a triggdata variable is valid on page 1516
Moves the robot by joint movement	MoveJ - Moves the robot by joint movement on page 431
Joint movement	<i>Technical reference manual - RAPID Overview</i>
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of stop point data	stoppointdata - Stop point data on page 1733
Definition of tools	tooldata - Tool data on page 1753
Definition of work object	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayloadMode</i> for activating and deactivating payload	<i>Technical reference manual - System parameters</i>

1 Instructions

1.293 TriggL - Linear robot movements with events RobotWare Base

1.293 TriggL - Linear robot movements with events

Usage

TriggL (*Trigg Linear*) is used to set output signals and/or run interrupt routines at fixed positions at the same time that the robot is making a linear movement. One or more (max. 25) events can be defined using the instructions TriggIO, TriggEquip, TriggInt, TriggSpeed, TriggCheckIO, or TriggRampAO. Afterwards these definitions are referred to in the instruction TriggL. This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction TriggL:

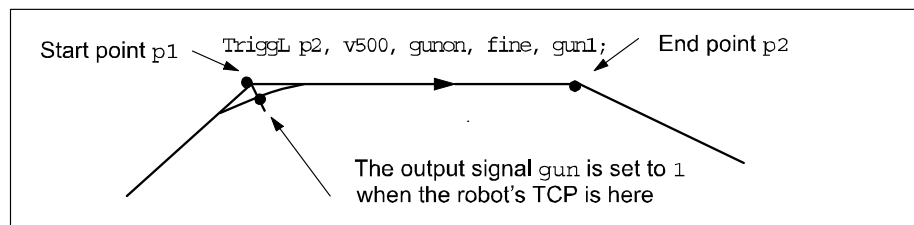
See also [More examples on page 907](#).

Example 1

```
VAR triggdata gunon;  
  
TriggIO gunon, 0 \Start \D0p:=gun, 1;  
MoveJ p1, v500, z50, gun1;  
TriggL p2, v500, gunon, fine, gun1;
```

The digital output signal gun is set when the robot's TCP passes the midpoint of the corner path of the point p1.

The figure shows an example of fixed position I/O event.



xx0500002291

Arguments

```
TriggL [\Conc] ToPoint [\ID] Speed [\T] Trigg_1 | TriggArray [\T2]  
[\T3] [\T4] [\T5] [\T6] [\T7] [\T8] [\KeepStartPath]  
[\KeepEndPath] Zone [\Inpos] Tool [\WObj] [\Corr] [\TLoad]  
[\FollowConveyor]
```

[\Conc]

Concurrent

Data type: switch

Subsequent instructions are executed while the robot is moving. The argument is usually not used but can be used to avoid unwanted stops caused by overloaded CPU when using fly-by points. This is useful when the programmed points are very close together at high speeds. The argument is also useful when, for example,

Continues on next page

communicating with external equipment and synchronization between the external equipment and robot movement is not required.

Using the argument \Conc, the number of movement instructions in succession is limited to 5. In a program section that includes StorePath-RestoPath, movement instructions with the argument \Conc are not permitted.

If this argument is omitted and the ToPoint is not a stop point then the subsequent instruction is executed some time before the robot has reached the programmed zone.

This argument cannot be used in coordinated synchronized movement in a MultiMove system.

ToPoint

Data type: robtarget

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

[\ID]

Synchronization id

Data type: identno

The argument [\ID] is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

Speed

Data type: speeddata

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

[\T]

Time

Data type: num

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

Trigg_1

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

Continues on next page

1 Instructions

1.293 TriggL - Linear robot movements with events

RobotWare Base

Continued

TriggArray

Trigg Data Array Parameter

Data type: triggdata

Array variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggSpeed, TriggCheckIO, or TriggRampA0.

The limitation is 25 elements in the array and 1 to 25 defined trigger conditions must be defined.

It is not possible to use the optional arguments T2, T3, T4, T5, T6, T7, or T8 at the same time as the TriggArray argument is used.

[\T2]

Trigg 2

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T3]

Trigg 3

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T4]

Trigg 4

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T5]

Trigg 5

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T6]

Trigg 6

Data type: triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

Continues on next page

[\T7]

Trigg 7**Data type:** triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

[\T8]

Trigg 8**Data type:** triggdata

Variable that refers to trigger conditions and trigger activity defined earlier in the program using the instructions TriggIO, TriggEquip, TriggInt, TriggCheckIO, TriggSpeed, or TriggRampA0.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Inpos]

In position**Data type:** stoppoint data

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

Continues on next page

1 Instructions

1.293 TriggL - Linear robot movements with events

RobotWare Base

Continued

[\WObj]

Work Object

Data type: wobjdata

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used this argument must be specified in order for a circle relative to the work object to be executed.

[\Corr]

Correction

Data type: switch

Correction data written to a corrections entry by the instruction CorrWrite will be added to the path and destination position if this argument is present.

The RobotWare option *Path Corrections* is required when using this argument.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

[\FollowConveyor]

Data type: switch

Continues on next page

If running coordinated movement with conveyor and there is an unexpected fine point (corner path executed as stop point, event logs 50024 or 50124), this switch parameter will specify that the robot will use a coordinated fine point instead of a stationary fine point. As a result, the robot will not stop and will follow the conveyor.

Program execution

See the instruction MoveL for information about linear movement.

As the trigger conditions are fulfilled when the robot is positioned closer and closer to the end point, the defined trigger activities are carried out. The trigger conditions are fulfilled either at a certain distance before the end point of the instruction, or at a certain distance after the start point of the instruction, or at a certain point in time (limited to a short time) before the end point of the instruction.

During stepping the execution forward, the I/O activities are carried out but the interrupt routines are not run. During stepping the execution backwards, no trigger activities at all are carried out.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AO_LIM	The programmed ScaleValue argument for the specified analog output signal AOp in some of the connected TriggSpeed instructions result in out of limit for the analog signal together with the programmed Speed in this instruction.
ERR_DIPLAG_LIM	The programmed DipLag argument in some of the connected TriggSpeed instructions is too big in relation to the used Event Preset Time in System Parameters.
ERR_NORUNUNIT	There is no contact with the I/O device when entering instruction and the used triggdata depends on a running I/O device, i.e. a signal is used in the triggdata.
ERR_CONC_MAX	The number of movement instructions in succession using argument \Conc has been exceeded.

More examples

More examples of how to use the instruction TriggL are illustrated below.

Example 1

```
VAR intnum intno1;
VAR triggdata trigg1;
...
PROC main()
  CONNECT intno1 WITH trap1;
  TriggInt trigg1, 0.1 \Time, intno1;
  ...
  TriggL p1, v500, trigg1, fine, gun1;
  TriggL p2, v500, trigg1, fine, gun1;
  ...
  IDelete intno1;
```

Continues on next page

1 Instructions

1.293 TriggL - Linear robot movements with events

RobotWare Base

Continued

The interrupt routine `trap1` is run when the work point is at a position 0.1 s before the point `p1` or `p2` respectively.

Example 2

```
VAR num Distance:=0;
VAR triggdata trigg_array{25};
VAR signaldo myaliassignaldo;
VAR string signalname;
...
PROC main()
...
FOR i FROM 1 TO 25 DO
  signalname:="do";
  signalname:=signalname+ValToStr(i);
  AliasIO signalname, myaliassignaldo;
  TriggEquip trigg_array{i}, Distance \Start, 0
    \DOP:=myaliassignaldo, SetValue:=1;
  Distance:=Distance+10;
ENDFOR
TriggL p1, v500, trigg_array, z30, tool2;
MoveL p2, v500, z30, tool2;
...
```

The digital output signals `do1` to `do25` is set during the movement to `p1`. The distance between the signal settings is 10 mm.

Limitations

If the current start point deviates from the usual so that the total positioning length of the instruction `TriggL` is shorter than usual (e.g. at the start of `TriggL` with the robot position at the end point) it may happen that several or all of the trigger conditions are fulfilled immediately and at the same position. In such cases, the sequence in which the trigger activities are carried out will be undefined. The program logic in the user program may not be based on a normal sequence of trigger activities for an incomplete movement.

UNDO or system events

`TriggL` cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: `PowerOn`, `Stop`, `QStop`, `Restart`, `Reset` or `Step`.

Short movements

There is a limitation on 10 queued movement instructions using trigger conditions setup by instruction `TriggSpeed`. If the queue is full, the system will stop. To avoid this limitation, use longer movements, or use a lower speed.

Syntax

```
TriggL
['\' Conc ',']
[ToPoint' :=' ] <expression (IN) of robtarg>
['\' ID :=' <expression (IN) of identno>'],'
[Speed :=' ] <expression (IN) of speeddata>
```

Continues on next page


```

['\ ' T ':=' <expression (IN) of num>'],'
[Trigg_1 ':=' ] <variable (VAR) of triggdata>|
[TriggArray ':=' ] <array variable {*} (VAR) of triggdata>
['\ ' T2 ':=' <variable (VAR) of triggdata>]
['\ ' T3 ':=' <variable (VAR) of triggdata>]
['\ ' T4 ':=' <variable (VAR) of triggdata>]
['\ ' T5 ':=' <variable (VAR) of triggdata>]
['\ ' T6 ':=' <variable (VAR) of triggdata>]
['\ ' T7 ':=' <variable (VAR) of triggdata>]
['\ ' T8 ':=' <variable (VAR) of triggdata>]
['\ ' KeepStartPath ':=' <expression (IN) of num>]
['\ ' KeepEndPath ':=' <expression (IN) of num>'],'
[Zone ':=' ] <expression (IN) of zonedata>
['\ ' Inpos ':=' <expression (IN) of stoppointdata>'],'
[Tool ':=' ] <persistent (PERS) of tooldata>
['\ ' WObj ':=' <persistent (PERS) of wobjdata>]
['\ ' Corr]
['\ ' TLoad ':=' <persistent (PERS) of loaddata>]
[ '\ ' FollowConveyor ] ';'

```

Related information

For information about	See
Circular movement with triggers	TriggC - Circular robot movement with events on page 858
Joint movement with triggers	TriggJ - Axis-wise robot movements with events on page 894
Definition of triggers	TriggIO - Define a fixed position or time I/O event near a stop point on page 888 TriggEquip - Define a fixed position and time I/O event on the path on page 877 TriggInt - Defines a position related interrupt on page 883 TriggCheckIO - Defines I/O check at a fixed position on page 867 TriggRampAO - Define a fixed position ramp AO event on the path on page 927 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event on page 934
Handling triggdata	triggdata - Positioning events, trigg on page 1761 TriggDataReset - Reset the content in a triggdata variable on page 875 TriggDataCopy - Copy the content in a triggdata variable on page 873 TriggDataValid - Check if the content in a triggdata variable is valid on page 1516
Writes to a corrections entry	CorrWrite - Writes to a correction generator on page 176
Linear movement	Technical reference manual - RAPID Overview
Definition of load	loaddata - Load data on page 1664
Definition of velocity	speeddata - Speed data on page 1729
Definition of stop point data	stoppointdata - Stop point data on page 1733

Continues on next page

1 Instructions

1.293 TriggL - Linear robot movements with events

RobotWare Base

Continued

For information about	See
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Definition of zone data	zonedata - Zone data on page 1783
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayLoad-Mode</i> for activating and deactivating payload	<i>Technical reference manual - System parameters</i>
<i>Path Corrections</i>	<i>Application manual - Controller software OmniCore</i>

1.294 TriggJI0s - Joint robot movements with I/O events

Usage

TriggJI0s (*Trigg Joint I/O*) is used to set output signals at fixed positions at the same time that the robot is making a joint movement.

The TriggJI0s instruction is optimized to give good accuracy when using movements with zones (compare with TriggEquip/TriggL).

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction TriggJI0s:

See also [More examples on page 923](#).

Example 1

```
VAR triggios gunon{1};

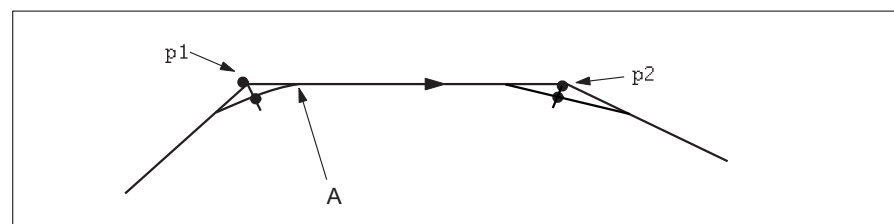
gunon{1}.used:=TRUE;
gunon{1}.distance:=3;
gunon{1}.start:=TRUE;
gunon{1}.signalname:="gun";
gunon{1}.equiplag:=0;
gunon{1}.setvalue:=1;

MoveJ p1, v500, z50, gun1;
TriggJI0s p2, v500, \TriggData1:=gunon, z50, gun1;
MoveL p3, v500, z50, gun1;
```

The signal gun is set when the TCP is 3 mm after point p1.

The RAPID code and figure shows an example of a fixed position I/O event.

```
TriggJI0s p2, v500, \TriggData1:=gunon, z50, gun1;
```



xx1500000304

A The output signal gun is set to 1 when the robot's TCP is here.

Arguments

```
TriggJI0s [\Conc] ToPoint [\ID] Speed [\T] [\TriggData1]
[\TriggData3] [\KeepStartPath] [\KeepEndPath] Zone [\Inpos]
Tool [\WObj] [\TLoad]
```

[\Conc]

Concurrent

Data type: switch

Continues on next page

1 Instructions

1.294 TriggJIOs - Joint robot movements with I/O events

RobotWare Base

Continued

Subsequent instructions are executed while the robot is moving. The argument is usually not used but can be used to avoid unwanted stops caused by overloaded CPU when using fly-by points. This is useful when the programmed points are very close together at high speeds. The argument is also useful when, for example, communicating with external equipment and synchronization between the external equipment and robot movement is not required.

Using the argument `\Conc`, the number of movement instructions in succession is limited to 5. In a program section that includes `StorePath-RestoPath`, movement instructions with the argument `\Conc` are not permitted.

If this argument is omitted and the `ToPoint` is not a stop point then the subsequent instruction is executed some time before the robot has reached the programmed zone.

This argument cannot be used in coordinated synchronized movement in a `MultiMove` system.

`ToPoint`

Data type: `robtarg`

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

`[ \ID ]`

Synchronization id

Data type: `identno`

The argument `[ \ID ]` is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

`Speed`

Data type: `speeddata`

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

`[ \T ]`

Time

Data type: `num`

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

`[\TriggData1]`

Data type: array of `triggios`

Continues on next page

Variable (array) that refers to trigger conditions and trigger activity. When using this argument, it is possible to set analog output signals, digital output signals and digital group output signals. If using a digital group output signal there is a limitation on 23 signals in the group.

[\TriggData3]

Data type: array of triggiosdnum

Variable (array) that refers to trigger conditions and trigger activity. When using this argument, it is possible to set analog output signals, digital output signals and digital group output signals that consists of 32 signals in the group and can have a maximum set value of 4294967295.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Inpos]

In position

Data type: stoppoint data

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[\WObj]

Work Object

Data type: wobjdata

Continues on next page

1 Instructions

1.294 TriggJIOs - Joint robot movements with I/O events

RobotWare Base

Continued

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used this argument must be specified in order for a circle relative to the work object to be executed.

[\TLoad]

Total load

Data type: loaddata

The \TLoad argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the \TLoad argument is used, then the loaddata in the current tooldata is not considered.

If the \TLoad argument is set to load0, then the \TLoad argument is not considered and the loaddata in the current tooldata is used instead.

To be able to use the \TLoad argument it is necessary to set the value of the system parameter ModalPayloadMode to 0. If ModalPayloadMode is set to 0, it is no longer possible to use the instruction GripLoad.

The total load can be identified with the service routine LoadIdentify. If the system parameter ModalPayloadMode is set to 0, the operator has the possibility to copy the loaddata from the tool to an existing or new loaddata persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input SimMode (Simulated Mode). If the digital input signal is set to 1, the loaddata in the optional argument \TLoad is not considered, and the loaddata in the current tooldata is used instead.



Note

The default functionality to handle payload is to use the instruction GripLoad. Therefore the default value of the system parameter ModalPayloadMode is 1.

Program execution

See the instruction MoveJ for information about joint movement, [MoveJ - Moves the robot by joint movement on page 431](#).

With the instruction TriggJIOs it is possible to setup 1-50 different trigger activities on I/O signals along a path from A to B. The signals that can be used are digital output signals, digital group output signals and analog output signals. The trigger conditions are fulfilled either at a certain distance before the end point of the instruction, or at a certain distance after the start point of the instruction.

The instruction requires use of either TriggData1, TriggData2, or TriggData3 argument or all three of them. Use of any of the triggs is optional though. To inhibit use of a trigg the component used can be set to FALSE in the array element of the data types triggios/triggstrgo/triggiosdnum. If no array element is in

Continues on next page

use, then the TriggJI0s instruction will behave as a MoveJ, and no I/O activities will be carried out.

If stepping the program forward, the I/O activities are carried out. During stepping the execution backwards, no I/O activities at all are carried out.

If setting component EquipLag in TriggData1, TriggData2 or TriggData3 argument to a negative time (delay), the I/O signal can be set after the destination point (ToPoint).

If using the argument TriggData2 or TriggData3 it is possible to use values up to 4294967295, which is the maximum value a group of digital signals can have (32 signals in a group signal is max for the system).

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_GO_LIM	The programmed setvalue argument for the specified digital group output signal signalname is outside limits. (Declared in TriggData1, TriggData2 or TriggData3).
ERR_AO_LIM	The programmed setvalue argument for the specified analog output signal signalname is outside limits. (Declared in TriggData1 or TriggData3).

More examples

More examples of how to use the instruction TriggJI0s are illustrated below.

Example 1

```
VAR triggios mytriggios{3}:=[TRUE, 3, TRUE, 0, "go1", 55, 0],
    [TRUE, 15, TRUE, 0, "ao1", 10, 0], [TRUE, 3, FALSE, 0, "do1",
    1, 0]];
...
MoveL p1, v500, z50, gun1;
TriggJI0s p2, v500, \TriggData1:=mytriggios, z50, gun1;
MoveL p3, v500, z50, gun1;
```

The digital group output signal go1 will be set to value 55 3 mm from p1. Analog output signal will be set to value 10 15 mm from p1. Digital output signal do1 will be set 3 mm from ToPoint p2.

Example 2

```
VAR triggios mytriggios{3}:=[TRUE, 3, TRUE, 0, "go1", 55, 0],
    [TRUE, 15, TRUE, 0, "ao1", 10, 0], [TRUE, 3, FALSE, 0, "do1",
    1, 0]];
VAR triggstrgo mytriggstrgo{3}:=[TRUE, 3, TRUE, 0, "go2", "1",
    0], [TRUE, 15, TRUE, 0, "go2", "800000", 0], [TRUE, 4, FALSE,
    0, "go2", "4294967295", 0]];
VAR triggiosdnum mytriggiosdnum{3}:=[TRUE, 10, TRUE, 0, "go3",
    4294967295, 0], [TRUE, 10, TRUE, 0, "ao2", 5, 0], [TRUE, 10,
    TRUE, 0, "do2", 1, 0]];

```

Continues on next page

1 Instructions

1.294 TriggJIos - Joint robot movements with I/O events

RobotWare Base

Continued

```
...  
MoveL p1, v500, z50, gun1;  
TriggJIos p2, v500, \TriggData1:=mytriggios \TriggData2:=  
    mytriggstrgo \TriggData3:=mytriggiosdnum, z50, gun1;  
MoveL p3, v500, z50, gun1;
```

The digital group output signal go1 will be set to value 55 3 mm from p1. Analog output signal ao1 will be set to value 10 15 mm from p1. Digital output signal do1 will be set 3 mm from ToPointp2. Those position events is setup by variable mytriggios. The variable mytriggstrgo sets up position events to occur 3 and 15 mm from p1. First the signal go2 is set to 1, then it is set to 800000. The signal will be set to value 4294967295 4 mm from the ToPoint p2. This is the maximum value for a 32 bits digital output signal. The variable mytriggiosdnum sets up three position events to occur 10 mm from p1. First the signal go3 is set to 4294967295, then ao2 is set to 5 and last do2 is set to 1.

Limitations

If the current start point deviates from the usual so that the total positioning length of the instruction TriggJIos is shorter than usual (e.g. at the start of TriggJIos with the robot position at the end point) it may happen that several or all of the trigger conditions are fulfilled immediately and at the same position. In such cases, the sequence in which the trigger activities are carried out will be undefined. The program logic in the user program may not be based on a normal sequence of trigger activities for an incomplete movement.

The limitation of the number of triggs in the instruction TriggJIos is 50 for each programmed instruction. If triggs happen at a closer distance, the system might not handle it. That depends on how the movement is done, TCP speed used and how close the triggs are programmed. Those limitations exists, but it is hard to predict when those problems will occur.

TriggJIos cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Limitations regarding accuracy

I/O events with distance is intended for flying points (corner path). Using stop points will result in worse accuracy than specified below.

Regarding the accuracy for I/O events with distance and using flying points, the following is applicable when setting a digital output at a specified distance from the start point or end point in the instruction TriggLIos or TriggCIos:

- The accuracy specified below is valid when using a positive *equiplag*¹ that is less than 40 ms, which is equivalent to the lag in the robot servo, without changing the system parameter *Event Preset Time*. The lag can vary between different robot types.
- The accuracy specified below is valid when using a positive *equiplag* that is less than the configured *Event Preset Time* in the system parameters.
- The accuracy specified below is not valid when using a positive *equiplag* that is larger than the configured *Event Preset Time* in the system parameters.

Continues on next page

In this case, an approximate method is used in which the dynamic limitations of the robot are not taken into consideration. Then SingArea \Wrist must be used to achieve an acceptable accuracy.

- The accuracy specified below is valid when using a negative equiplag.

! equiplag is a dataobject of data type triggios

The typical absolute accuracy values for setting digital outputs is: ± 5 ms.

The typical repeat accuracy values for setting digital outputs is: ± 2 ms.

Syntax

```
TriggJIos
['\ ' Conc ',']
[ToPoint ':='] <expression (IN) of robtarget>
['\ ' ID ':='] <expression (IN) of identno>]', '
[Speed ':='] <expression (IN) of speeddata>
['\ ' T ':='] <expression (IN) of num>]', '
['\ ' TriggData1 ':='] <array {*} (VAR) of triggios>
['\ ' TriggData3 ':='] <array {*} (VAR) of triggiosdnum>
['\ ' KeepStartPath ':='] <expression (IN) of num>]
['\ ' KeepEndPath ':='] <expression (IN) of num>]', '
[Zone ':='] <expression (IN) of zonedata>
['\ ' Inpos ':='] <expression (IN) of stoppointdata>]', '
[Tool ':='] <persistent (PERS) of tooldata>
['\ ' WObj ':='] <persistent (PERS) of wobjdata>]
['\ ' TLoad ':='] <persistent (PERS) of loaddata>]';'
```

Related information

For information about	See
Linear robot movements with I/O events	TriggLIos - Linear robot movements with I/O events on page 919
Storage of trigg conditions and trigger activity	triggios - Positioning events, trigg on page 1762
Storage of trigg conditions and trigger activity	triggiosdnum - Positioning events, trigg on page 1764
Allocation of event objects	<i>Technical reference manual - System parameters</i>
Linear movement	<i>Technical reference manual - RAPID Overview</i>
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Definition of load	loaddata - Load data on page 1664
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload	<i>Technical reference manual - System parameters</i>

Continues on next page

1 Instructions

1.294 TriggJIOs - Joint robot movements with I/O events

RobotWare Base

Continued

For information about	See
System parameter <i>ModalPayloadMode</i> for activating and deactivating payload	<i>Technical reference manual - System parameters</i>
<i>Path Corrections</i>	<i>Application manual - Controller software OmniCore</i>

1.295 TriggLI0s - Linear robot movements with I/O events

Usage

TriggLI0s (Trigg Linear I/O) is used to set output signals at fixed positions at the same time that the robot is making a linear movement.

The TriggLI0s instruction is optimized to give good accuracy when using movements with zones (compare with TriggEquip/TriggL).

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction TriggLI0s:

See also [More examples on page 923](#).

Example 1

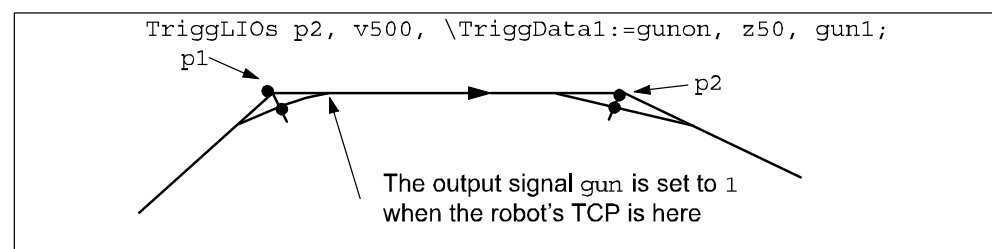
```
VAR triggios gunon{1};

gunon{1}.used:=TRUE;
gunon{1}.distance:=3;
gunon{1}.start:=TRUE;
gunon{1}.signalname:="gun";
gunon{1}.equiplag:=0;
gunon{1}.setvalue:=1;

MoveJ p1, v500, z50, gun1;
TriggLI0s p2, v500, \TriggData1:=gunon, z50, gun1;
MoveL p3, v500, z50, gun1;
```

The signal gun is set when the TCP is 3 mm after point p1.

The figure shows an example of a fixed position I/O event.



en0800000157

Arguments

```
TriggLI0s [\Conc] ToPoint [\ID] Speed [\T] [\TriggData1]
[\TriggData3] [\KeepStartPath] [\KeepEndPath] Zone [\Inpos]
Tool [\WObj] [\Corr] [\TLoad]
```

[\Conc]

Concurrent

Data type: switch

Continues on next page

1 Instructions

1.295 TriggLIOs - Linear robot movements with I/O events

RobotWare Base

Continued

Subsequent instructions are executed while the robot is moving. The argument is usually not used but can be used to avoid unwanted stops caused by overloaded CPU when using fly-by points. This is useful when the programmed points are very close together at high speeds. The argument is also useful when, for example, communicating with external equipment and synchronization between the external equipment and robot movement is not required.

Using the argument `\Conc`, the number of movement instructions in succession is limited to 5. In a program section that includes `StorePath-RestoPath`, movement instructions with the argument `\Conc` are not permitted.

If this argument is omitted and the `ToPoint` is not a stop point then the subsequent instruction is executed some time before the robot has reached the programmed zone.

This argument cannot be used in coordinated synchronized movement in a `MultiMove` system.

`ToPoint`

Data type: `robtarg`

The destination point of the robot and external axes. It is defined as a named position or stored directly in the instruction (marked with an * in the instruction).

`[ \ID ]`

Synchronization id

Data type: `identno`

The argument `[ \ID ]` is mandatory in *MultiMove* systems, if the movement is synchronized or coordinated synchronized. This argument is not allowed in any other case. The specified id number must be the same in all the cooperating program tasks. By using the id number the movements are not mixed up at the runtime.

`Speed`

Data type: `speeddata`

The speed data that applies to movements. Speed data defines the velocity of the TCP, the tool reorientation, and external axes.

`[ \T ]`

Time

Data type: `num`

This argument is used to specify the total time in seconds during which the robot moves. It is substituted for the corresponding speed data. The speed data is computed under the assumption that the speed is constant during the movement. If the robot cannot keep this speed during the whole movement, for example, when the movement starts from a finepoint or ends in a finepoint, the actual movement time will be larger than the programmed time.

`[\TriggData1]`

Data type: array of `triggios`

Continues on next page

Variable (array) that refers to trigger conditions and trigger activity. When using this argument, it is possible to set analog output signals, digital output signals and digital group output signals. If using a digital group output signal there is a limitation on 23 signals in the group.

[\TriggData3]

Data type: array of triggiosdnum

Variable (array) that refers to trigger conditions and trigger activity. When using this argument, it is possible to set analog output signals, digital output signals and digital group output signals that consists of 32 signals in the group and can have a maximum set value of 4294967295.

\KeepStartPath

Data type: num

If the move instruction starts from a fine point, \KeepStartPath defines a distance, in mm, from the start point during which the movement must follow the programmed path, and not enter any corner zone.

If the move instruction starts from a fly-by point, \KeepStartPath is ignored. If the start point is a fine point or a fly-by point is determined by the Zone argument of the previous move instruction.

\KeepEndPath

Data type: num

If the move instruction ends in a fine point, \KeepEndPath defines a distance, in mm, from the destination point during which the movement must follow the programmed path, and not be part of any corner zone.

If the move instruction ends in a fly-by point, \KeepEndPath is ignored.

Zone

Data type: zonedata

Zone data for the movement. Zone data describes the size of the generated corner path.

[\Inpos]

In position

Data type: stoppoint data

This argument is used to specify the convergence criteria for the position of the robot's TCP in the stop point. The stop point data substitutes the zone specified in the Zone parameter.

Tool

Data type: tooldata

The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination point.

[\WObj]

Work Object

Data type: wobjdata

Continues on next page

1 Instructions

1.295 TriggLIOs - Linear robot movements with I/O events

RobotWare Base

Continued

The work object (object coordinate system) to which the robot position in the instruction is related.

This argument can be omitted and if it is then the position is related to the world coordinate system. If, on the other hand, a stationary TCP or coordinated external axes are used this argument must be specified in order for a circle relative to the work object to be executed.

[\Corr]

Correction

Data type: switch

Correction data written to a corrections entry by the instruction `CorrWrite` will be added to the path and destination position if this argument is present.

The RobotWare option *Path Corrections* is required when using this argument.

[\TLoad]

Total load

Data type: loaddata

The `\TLoad` argument describes the total load used in the movement. The total load is the tool load together with the payload that the tool is carrying. If the `\TLoad` argument is used, then the `loaddata` in the current `tooldata` is not considered.

If the `\TLoad` argument is set to `load0`, then the `\TLoad` argument is not considered and the `loaddata` in the current `tooldata` is used instead.

To be able to use the `\TLoad` argument it is necessary to set the value of the system parameter `ModalPayloadMode` to 0. If `ModalPayloadMode` is set to 0, it is no longer possible to use the instruction `GripLoad`.

The total load can be identified with the service routine `LoadIdentify`. If the system parameter `ModalPayloadMode` is set to 0, the operator has the possibility to copy the `loaddata` from the tool to an existing or new `loaddata` persistent variable when running the service routine.

It is possible to test run the program without any payload by using a digital input signal connected to the system input `SimMode` (Simulated Mode). If the digital input signal is set to 1, the `loaddata` in the optional argument `\TLoad` is not considered, and the `loaddata` in the current `tooldata` is used instead.



Note

The default functionality to handle payload is to use the instruction `GripLoad`. Therefore the default value of the system parameter `ModalPayloadMode` is 1.

Program execution

See the instruction `MoveL` for information about linear movement.

With the instruction `TriggLIOs` it is possible to setup 1-50 different trigger activities on I/O signals along a path from A to B. The signals that can be used are digital output signals, digital group output signals and analog output signals. The trigger conditions are fulfilled either at a certain distance before the end point of the instruction, or at a certain distance after the start point of the instruction.

Continues on next page

The instruction requires use of either TriggData1, TriggData2 or TriggData3 argument or all three of them. Use of any of the triggs is optional though. To inhibit use of a trigg the component used can be set to FALSE in the array element of the data types triggios/triggstrgo/triggiosdnum. If no array element is in use, then the TriggLIOs instruction will behave as a MoveL, and no I/O activities will be carried out.

If stepping the program forward, the I/O activities are carried out. During stepping the execution backwards, no I/O activities at all are carried out.

If setting component EquipLag in TriggData1, TriggData2 or TriggData3 argument to a negative time (delay), the I/O signal can be set after the destination point (ToPoint).

If using the argument TriggData2 or TriggData3 it is possible to use values up to 4294967295, which is the maximum value a group of digital signals can have (32 signals in a group signal is max for the system).

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_GO_LIM	The programmed setvalue argument for the specified digital group output signal signalname is outside limits. (Declared in TriggData1, TriggData2 or TriggData3).
ERR_AO_LIM	The programmed setvalue argument for the specified analog output signal signalname is outside limits. (Declared in TriggData1 or TriggData3).
ERR_CONC_MAX	The number of movement instructions in succession using argument \Conc has been exceeded.

More examples

More examples of how to use the instruction TriggLIOs are illustrated below.

Example 1

```
VAR triggios mytriggios{3}:=[TRUE, 3, TRUE, 0, "go1", 55, 0],
    [TRUE, 15, TRUE, 0, "ao1", 10, 0], [TRUE, 3, FALSE, 0, "do1",
    1, 0]];
...
MoveL p1, v500, z50, gun1;
TriggLIOs p2, v500, \TriggData1:=mytriggios, z50, gun1;
MoveL p3, v500, z50, gun1;
```

The digital group output signal go1 will be set to value 55 3 mm from p1. Analog output signal will be set to value 10 15 mm from p1. Digital output signal do1 will be set 3 mm from ToPoint p2.

Continues on next page

1 Instructions

1.295 TriggLIos - Linear robot movements with I/O events

RobotWare Base

Continued

Example 2

```
VAR triggios mytriggios{3}:=[TRUE, 3, TRUE, 0, "go1", 55, 0],  
    [TRUE, 15, TRUE, 0, "ao1", 10, 0], [TRUE, 3, FALSE, 0, "do1",  
    1, 0]];  
VAR triggstrgo mytriggstrgo{3}:=[TRUE, 3, TRUE, 0, "go2", "1",  
    0], [TRUE, 15, TRUE, 0, "go2", "800000", 0], [TRUE, 4, FALSE,  
    0, "go2", "4294967295", 0]];  
VAR triggiosdnum mytriggiosdnum{3}:=[TRUE, 10, TRUE, 0, "go3",  
    4294967295, 0], [TRUE, 10, TRUE, 0, "ao2", 5, 0], [TRUE, 10,  
    TRUE, 0, "do2", 1, 0]];  
  
...  
MoveL p1, v500, z50, gun1;  
TriggLIos p2, v500, \TriggData1:=mytriggios \TriggData2:=  
    mytriggstrgo \TriggData3:=mytriggiosdnum, z50, gun1;  
MoveL p3, v500, z50, gun1;
```

The digital group output signal go1 will be set to value 55 3 mm from p1. Analog output signal ao1 will be set to value 10 15 mm from p1. Digital output signal do1 will be set 3 mm from ToPointp2. Those position events is setup by variable mytriggios. The variable mytriggstrgo sets up position events to occur 3 and 15 mm from p1. First the signal go2 is set to 1, then it is set to 800000. The signal will be set to value 4294967295 4 mm from the ToPoint p2. This is the maximum value for a 32 bits digital output signal. The variable mytriggiosdnum sets up three position events to occur 10 mm from p1. First the signal go3 is set to 4294967295, then ao2 is set to 5 and last do2 is set to 1.

Limitations

If the current start point deviates from the usual so that the total positioning length of the instruction TriggLIos is shorter than usual (e.g. at the start of TriggLIos with the robot position at the end point) it may happen that several or all of the trigger conditions are fulfilled immediately and at the same position. In such cases, the sequence in which the trigger activities are carried out will be undefined. The program logic in the user program may not be based on a normal sequence of trigger activities for an incomplete movement.

The limitation of the number of triggs in the instruction TriggLIos is 50 for each programmed instruction. If triggs happen at a closer distance, the system might not handle it. That depends on how the movement is done, TCP speed used and how close the triggs are programmed. Those limitations exists, but it is hard to predict when those problems will occur.

TriggLIos cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Limitations regarding accuracy

I/O events with distance is intended for flying points (corner path). Using stop points will result in worse accuracy than specified below.

Continues on next page

Regarding the accuracy for I/O events with distance and using flying points, the following is applicable when setting a digital output at a specified distance from the start point or end point in the instruction TriggLIOs or TriggCIOs:

- The accuracy specified below is valid when using a positive `equiplag`¹ that is less than 40 ms, which is equivalent to the lag in the robot servo, without changing the system parameter *Event Preset Time*. The lag can vary between different robot types.
- The accuracy specified below is valid when using a positive `equiplag` that is less than the configured *Event Preset Time* in the system parameters.
- The accuracy specified below is not valid when using a positive `equiplag` that is larger than the configured *Event Preset Time* in the system parameters. In this case, an approximate method is used in which the dynamic limitations of the robot are not taken into consideration. Then `SingArea \Wrist` must be used to achieve an acceptable accuracy.
- The accuracy specified below is valid when using a negative `equiplag`.

¹ `equiplag` is a dataobject of data type `triggios`

The typical absolute accuracy values for setting digital outputs is: ± 5 ms.

The typical repeat accuracy values for setting digital outputs is: ± 2 ms.

Syntax

```
TriggLIOs
['\ ' Conc ',']
[ToPoint ':='] <expression (IN) of robtarget >
['\ ' ID ':='] <expression (IN) of identno>','
[Speed ':='] <expression (IN) of speeddata>
['\ ' T ':='] <expression (IN) of num>','
['\ ' TriggData1 ':='] <array {*} (VAR) of triggios>
['\ ' TriggData3 ':='] <array {*} (VAR) of triggiosdnum>
['\ ' KeepStartPath ':='] <expression (IN) of num>]
['\ ' KeepEndPath ':='] <expression (IN) of num>','
[Zone ':='] <expression (IN) of zonedata>
['\ ' Inpos ':='] <expression (IN) of stoppointdata>','
[Tool ':='] <persistent (PERS) of tooldata>
['\ ' WObj ':='] <persistent (PERS) of wobjdata>
['\ ' Corr]
['\ ' TLoad ':='] <persistent (PERS) of loaddata>'];'
```

Related information

For information about	See
Joint robot movements with I/O events	TriggJIOs - Joint robot movements with I/O events on page 911
Storage of trigg conditions and trigger activity	triggios - Positioning events, trigg on page 1762
Storage of trigg conditions and trigger activity	triggiosdnum - Positioning events, trigg on page 1764
Allocation of event objects	<i>Technical reference manual - System parameters</i>

Continues on next page

1 Instructions

1.295 TriggLIOs - Linear robot movements with I/O events

RobotWare Base

Continued

For information about	See
Linear movement	<i>Technical reference manual - RAPID Overview</i>
Motion in general	<i>Technical reference manual - RAPID Overview</i>
Definition of load	loaddata - Load data on page 1664
Example of how to use TLoad, Total Load.	MoveL - Moves the robot linearly on page 457
Defining the payload for a robot	GripLoad - Defines the payload for a robot on page 239
LoadIdentify, load identification service routine	<i>Operating manual - OmniCore</i>
System input signal <i>SimMode</i> for running the robot in simulated mode without payload	<i>Technical reference manual - System parameters</i>
System parameter <i>ModalPayloadMode</i> for activating and deactivating payload	<i>Technical reference manual - System parameters</i>
<i>Path Corrections</i>	<i>Application manual - Controller software OmniCore</i>

1.296 TriggRampAO - Define a fixed position ramp AO event on the path

Usage

TriggRampAO(*Trigg Ramp Analog Output*) is used to define conditions and actions for ramping up or down analog output signal value at a fixed position along the robot's movement path with possibility to do time compensation for the lag in the external equipment.

The data defined is used for implementation in one or more subsequent TriggL, TriggC, or TriggJ instructions. Beside these instructions, TriggRampAO can also be used in CapL or CapC instructions.

The type of trig actions connected to the same TriggL/C/J instruction can be TriggRampAO or any of TriggIO, TriggEquip, TriggSpeed, TriggInt, or TriggCheckIO instructions. Any type of combination is allowed except that only one TriggSpeed action on the same signal in the same TriggL/C/J instruction is allowed.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction TriggRampAO:

See also [More examples on page 931](#).

Example 1

```
VAR trigdata ramp_up;
...
TriggRampAO ramp_up, 0 \Start, 0.1, aolaser1, 8, 15;
MoveL p1, v200, z10, gun1;
TriggL p2, v200, ramp_up, z10, gun1;
```

The analog signal aolaser1 will start ramping up its logical value from current value to the new value 8, when the TCP of the tool gun1 is 0.1 s before the center of the corner path at p1. The whole ramp-up will be done while the robot moves 15 mm.

Example 2

```
VAR trigdata ramp_down;
...
TriggRampAO ramp_down, 15, 0.1, aolaser1, 2, 10;
MoveL p3, v200, z10, gun1;
TriggL p4, v200, ramp_down, z10, gun1;
```

The analog signal aolaser1 will start ramping down its logical value from current value to the new value 2, when the TCP of the tool gun1 is 15 mm plus 0.1 s before the centre of the corner path at p4. The whole ramp-down will be done while the robot moves 10 mm.

Arguments

```
TriggRampAO TriggData Distance [\Start] | [\Next] EquipLag AOutput
SetVal RampLength [\Time] [\Inhib] [\InhibSetVal] [\Mode]
```

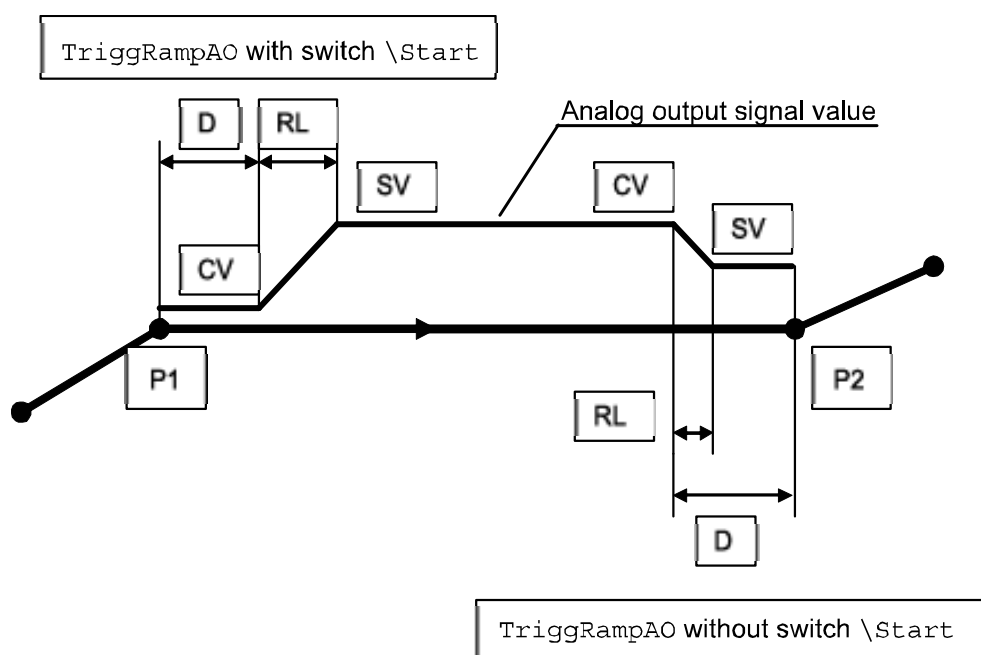
Continues on next page

1 Instructions

1.296 TriggRampAO - Define a fixed position ramp AO event on the path

RobotWare Base

Continued



xx0600003433

D	Parameter Distance
RL	Parameter RampLength
CV	Current analog signal Value
SV	Parameter SetValue for the analog signal value
P1	ToPoint for preceding move instruction
P2	ToPoint for actual TriggL/C/J instruction

TriggData

Data type: triggdata

Variable for storing the triggdata returned from this instruction. These triggdata are then used in the subsequent TriggL, TriggC, or TriggJ instructions.

Distance

Data type: num

Defines the distance from the centre of the corner path where the ramp of the analog output shall start.

Specified as the distance in mm (positive value) from the end point (ToPoint) of the movement path (applicable if the argument \Start is not set).

See [Program execution on page 930](#) for further details.

[\Start]

Data type: switch

Used when the distance for the argument Distance starts at the movement start point instead of the end point.

[\Next]

Data type: switch

Continues on next page

1.296 TriggRampAO - Define a fixed position ramp AO event on the path

RobotWare Base
Continued

Used when the distance for the argument Distance is forward towards the next programmed point. If the Distance is longer than the distance to the next fine point, the event will be executed at the fine point.

EquipLag

Equipment Lag

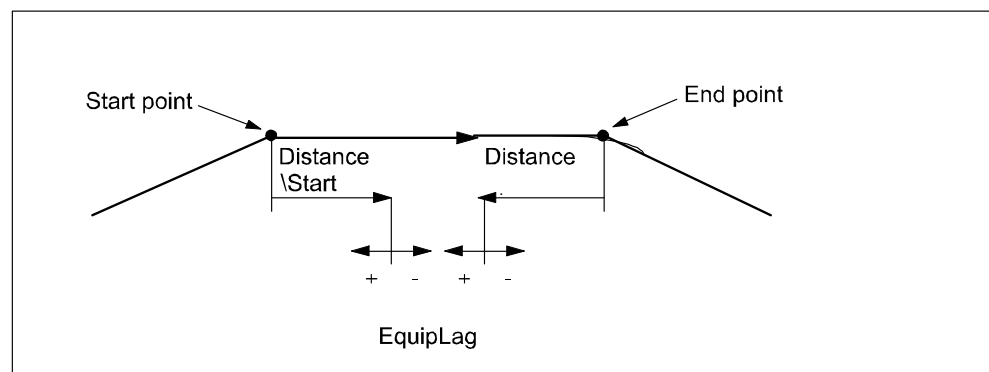
Data type: num

Specify the lag for the external equipment in s.

For compensation of external equipment lag, use positive argument value. Positive argument value means that the start of the ramping of the AO signal is done by the robot system at a specified time before the TCP physically reaches the specified distance point in relation to the movement start or end point.

Negative argument value means that starting the ramping of the AO signal is done by the robot system at a specified time after that the TCP has physically passed the specified distance point in relation to the movement start or end point.

The figure shows use of argument EquipLag.



xx0500002262

AOutput

Analog Output

Data type: signalao

The name of the analog output signal.

SetValue

Data type: num

The value to which the analog output signal should be ramped up or down to (must be within the allowed logical range value for the signal). The ramping is started with the current value of the analog output signal.

RampLength

Data type: num

The ramping length in mm along the TCP movement path.

[\Time]

Data type: switch

Continues on next page

1 Instructions

1.296 TriggRampAO - Define a fixed position ramp AO event on the path

RobotWare Base

Continued

If used, then the RampLength specifies the ramp time in s instead of ramping length.

Must be used, if subsequent TriggL, TriggC, or TriggJ specifies that the total movement should be done on time (argument \T) instead of speed.

[\Inhib]

Inhibit

Data type: bool

The name of a persistent variable flag for inhibiting the setting of the signal at runtime.

If this optional argument is used and the actual value of the specified flag is TRUE at the position-time for start ramping the I/O signal then the specified signal (AOutput) will be set to 0.

[\InhibSetValue]

InhibitSetValue

Data type: bool, num or dnum

The name of a persistent variable of the data type bool, num or dnum or any alias of those three base data types.

This optional argument can only be used together with optional argument Inhib.

If this optional argument is used and the value of the persistent variable flag used in optional argument Inhib is TRUE at the position-time for setting the signal, the value of the persistent variable used in optional argument InhibSetValue is read and the value is used for setting of the AOutput signal.

If using a boolean persistent variable, the value TRUE is translated to value 1, and FALSE is translated to value 0.

[\Mode]

Data type: triggmodes

Is used to specify different action modes when defining triggers.

Program execution

When running the instruction TriggRampAO, the trigger condition is stored in the specified variable for the argument TriggData.

Afterwards, when one of the instructions TriggL, TriggC or TriggJ is executed, the following are applicable with regard to the definitions in TriggRampAO:

The table describes the distance specified in the argument Distance:

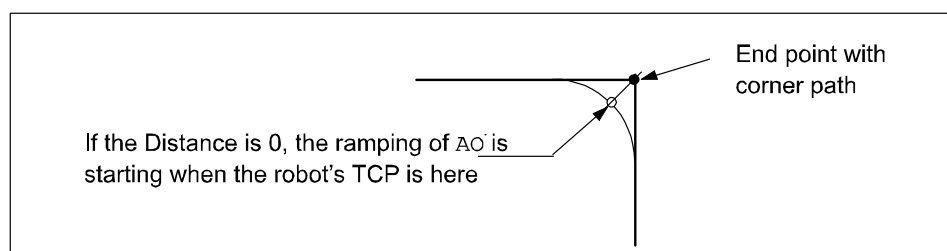
Linear movement	The straight line distance
Circular movement	The circle arc length
Non-linear movement	The approximate arc length along the path (to obtain adequate accuracy, the distance should not exceed one half of the arc length).

The figure shows ramping of AO in a corner path.

Continues on next page

1.296 TriggRampAO - Define a fixed position ramp AO event on the path

RobotWare Base
Continued



xx0600003439

Program execution characteristics of TriggRampAO connected to any TriggL/C/J:

- The ramping of the AO is started when the robot reaches the specified Distance point on the robot path (with compensation for the specified EquipLag)
- The ramping function will be performed during a time period calculated from specified RampLength and the programmed TCP speed. The calculation takes into consideration VelSet, manual speed override, and max. 250 mm/s in MAN mode but not any other speed limitations.
- Updating of the AO signal value from start (current read) value to specified SetValue will be done each 10 ms resulting in a staircase form. If the calculated ramp time or specified ramp time is greater than 0.5 s then the ramping frequency will slow down:
 - ≤ 0.5 s gives max. 50 step each 10 ms
 - ≤ 1 s gives max. 50 steps each 20 ms
 - ≤ 1.5 s gives max. 50 steps each 30 ms and so on

The TriggRampAO action is also done in FWD step but not in BWD step mode.

At any type of stop (ProgStop, Emergency Stop ...) if the ramping function is active for the occasion:

- if ramping up, the AO is set to an old value momentarily.
- if ramping down, the AO is set to the new SetValue momentarily.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AO_LIM	The programmed SetValue argument for the specified analog output signal AOutput is out of limit.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID and it has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.

More examples

More examples of how to use the instruction TriggRampAO are illustrated below.

Example 1

```
VAR trigdata ramp_up;
VAR trigdata ramp_down;
```

Continues on next page

1 Instructions

1.296 TriggRampAO - Define a fixed position ramp AO event on the path

RobotWare Base

Continued

```
...  
TriggRampAO ramp_up, 0 \Start, 0.1, aolaser1, 8, 15;  
TriggRampAO ramp_down, 15, 0.1, aolaser1, 2, 10;  
MoveL p1, v200, z10, gun1;  
TriggL p2, v200, ramp_up, \T2:=ramp_down, z10, gun1;
```

In this example both the ramp-up and ramp-down of the AO is done in the same TriggL instruction on the same movement path. It works without any interference of the AO settings if the movement path is long enough.

The analog signal aolaser1 will start ramping up its logical value from the current value to the new value 8 when the TCP of the tool gun1 is 0.1 s before the center of the corner path at p1. The whole ramp-up will be done while the robot moves 15 mm.

The analog signal aolaser1 will start ramping down its logical value from the current value 8 to the new value 2 when the TCP of the tool gun1 is 15 mm plus 0.1 s before the centre of the corner path at p2. The whole ramp-up will be done while the robot moves 10 mm.

Limitations

The analog output signal value will not be compensated for lower TCP-speed in corner path or during other acceleration or deceleration phases (the AO is not TCP speed proportional).

Only the start point of the AO ramping will be done at the specified position on the path. The ramping up or down will be done with “dead calculation”, with high accuracy:

- At constant speed the deviation for the end of the AO ramping compared with the specified will be low.
- During acceleration or deceleration phases, such as near stop points, the deviation will be higher.
- Recommendation: use corner paths before ramp up and after ramp down.

If use of two or several TriggRampAO on the same analog output signal and connected to the same TriggL/C/J instruction and both or several RampLength are located on the same part of the robot path then the AO settings will interact with each other.

The position (+/- time) related ramp AO event will start when the previous ToPoint is passed if the specified Distance from the actual ToPoint is not within the length of movement for the current TriggL/C/J instruction. The position (+/- time) related ramp AO event will start when the actual ToPoint is passed if the specified Distance from the previous ToPoint is not within the length of movement for the current TriggL/C/J instruction (with argument \Start).

No support for restart of the ramping AO function after any type of stop (ProgStop, Emergency Stop ...).

At Power Fail Restart the TriggL/C/J instruction is started from the beginning of the current Power Fail position.

Continues on next page

1.296 TriggRampAO - Define a fixed position ramp AO event on the path

RobotWare Base
Continued

TriggRampAO cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
TriggRampAO
[ TriggData ':' ] < variable (VAR) of triggdata > ','
[ Distance ':' ] < expression (IN) of num >
[ '\\' Start ] | [ '\\' Next ] ','
[ EquipLag ':' ] < expression (IN) of num > ','
[ AOutput ':' ] < variable (VAR) of signalao > ','
[ SetValue ':' ] < expression (IN) of num > ','
[ RampLength ':' ] < expression (IN) of num > ','
[ '\\' Time ]
[ '\\' Inhib ':' ] < persistent (PERS) of bool > ]
[ '\\' InhibSetValue ':' ] < persistent (PERS) of anytype > ]
[ '\\' Mode ':' ] < expression (IN) of triggmode > ] ';'

```

Related information

For information about	See
Use of triggers	TriggL - Linear robot movements with events on page 902 TriggC - Circular robot movement with events on page 858 TriggJ - Axis-wise robot movements with events on page 894
Definition of other triggs	TriggEquip - Define a fixed position and time I/O event on the path on page 877
Storage of triggdata	triggdata - Positioning events, trigg on page 1761 triggmode - Trigg action mode on page 1766
Set of analog output signal	SetAO - Changes the value of an analog output signal on page 672 signalxx - Digital and analog signals on page 1725
Configuration of event preset time	Technical reference manual - System parameters

1 Instructions

1.297 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event
RobotWare Base

1.297 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event

Usage

TriggSpeed is used to define conditions and actions for control of an analog output signal with output value proportional to the actual TCP speed. The beginning, scaling, and ending of the analog output can be specified at a fixed position-time along the robot's movement path. It is possible to use time compensation for the lag in the external equipment for the beginning, scaling, and ending of the analog output and also for speed dips of the robot.

The data defined is used in one or more subsequent TriggL, TriggC, or TriggJ instructions.

This instruction can only be used in the main task T_R0B1, if in a MultiMove System, in Motion tasks.

Basic examples

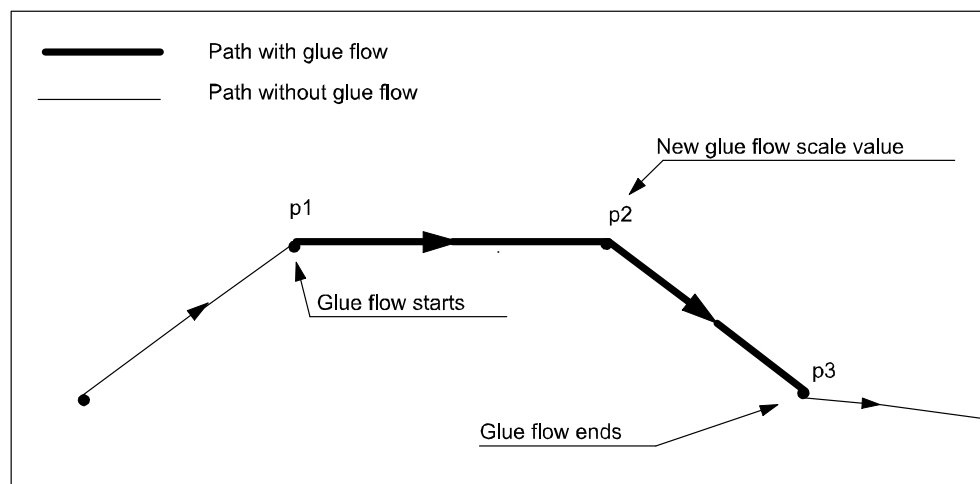
The following example illustrates the instruction TriggSpeed:

See also [More examples on page 940](#).

Example 1

```
VAR triggdata glueflow;  
TriggSpeed glueflow, 0, 0.05, glue_ao, 0.8\DipLag:=0.04  
  \ErrD0:=glue_err;  
TriggL p1, v500, glueflow, z50, gun1;  
TriggSpeed glueflow, 10, 0.05, glue_ao, 1;  
TriggL p2, v500, glueflow, z10, gun1;  
TriggSpeed glueflow, 0, 0.05, glue_ao, 0;  
TriggL p3, v500, glueflow, z50, gun1;
```

The figure below illustrates an example of TriggSpeed sequence



xx0500002329

The glue flow (analog output glue_ao) with scale value 0.8 starts when TCP is 0.05 s before point p1, new glue flow scale value 1 when TCP is 10 mm plus 0.05

Continues on next page

1.297 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event

RobotWare Base

Continued

s before point p2, and the glue flow ends (scale value 0) when TCP is 0.05 s before point p3.

Any speed dip by the robot is time compensated in such a way that the analog output signal glue_ao is affected 0.04 s before the TCP speed dip occurs.

If overflow of the calculated logical analog output value in glue_ao then the digital output signal glue_err is set. If there is no more overflow then glue_err is reset.

Arguments

```
TriggSpeed TriggData Distance [\Start] | [\Next] ScaleLag AOp
          ScaleValue [\DipLag] [\ErrD0] [\Inhib] [\InhibSetValue]
          [\Mode]
```

TriggData

Data type: triggdata

Variable for storing the triggdata returned from this instruction. These triggdata are then used in the subsequent TriggL, TriggC, or TriggJ instructions.

Distance

Data type: num

Defines the position on the path for change of the analog output value.

Specified as the distance in mm (positive value) from the end point of the movement path (applicable if the argument \Start is not set).

See [Program execution on page 938](#) for further details.

[\Start]

Data type: switch

Used when the distance for the argument Distance starts at the movement start point instead of the end point.

[\Next]

Data type: switch

Used when the distance for the argument Distance is forward towards the next programmed point. If the Distance is longer than the distance to the next fine point, the event will be executed at the fine point.

ScaleLag

Data type: num

Specify the lag as time in s (positive value) in the external equipment for change of the analog output value (starting, scaling, and ending).

For compensation of external equipment lag, this argument value means that the analog output signal is set by the robot at a specified time before the TCP physically reaches the specified distance in relation to the movement's start or end point.

The argument can also be used to extend the analog output beyond the end point. Set the time in seconds that the robot shall keep the analog output. Set the time with a negative sign. The limit is -0.10 seconds.

The figure below illustrates the use of argument ScaleLag

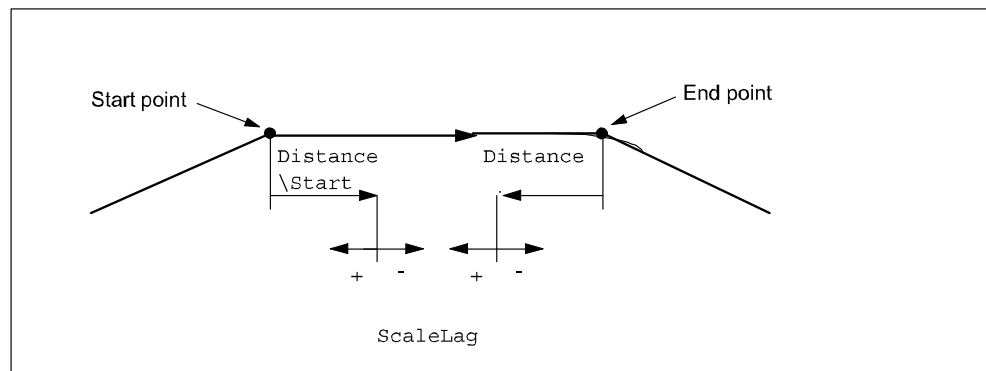
Continues on next page

1 Instructions

1.297 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event

RobotWare Base

Continued



xx0500002330

AOp

Analog Output

Data type: signalao

The name of the analog output signal.

ScaleValue

Data type: num

The scale value for the analog output signal.

The physical output value for the analog signal is calculated by the robot:

- Logical output value = Scale value * Actual TCP speed in mm/s.
- Physical output value = According definition in configuration for actual analog output signal with above Logical output value as input.

[\DipLag]

Data type: num

Specify the lag as time in s (positive value) for the external equipment when changing of the analog output value because of robot speed dips.

For compensation of external equipment lag, this argument value means that the analog output signal is set by the robot at a specified time before the TCP speed dip occurs.



Note

This argument can only be used by the robot for the first TriggSpeed (in combination with one of TriggL, TriggC, or TriggJ) in a sequence of several TriggSpeed instructions. The first specified argument value is valid for all the following TriggSpeed in the sequence.

[\ErrDO]

Error Digital Output

Data type: signaldo

The name of the digital output signal for reporting analog value overflow.

If during movement the calculation of the logical analog output value for signal in argument AOp results in overflow because of overspeed then this signal is set and

Continues on next page

1.297 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event

RobotWare Base

Continued

the physical analog output value is reduced to the maximum value. If there is no more overflow then the signal is reset.

**Note**

This argument can only be used by the robot for the 1st TriggSpeed (in combination with one of TriggL, TriggC, or TriggJ) in a sequence of several TriggSpeed instructions. The 1st given argument value is valid for all the following TriggSpeed in the sequence.

[\Inhib]

Inhibit

Data type: bool

The name of a persistent variable flag for inhibiting the setting of the analog signal at runtime.

If this optional argument is used and the actual value of the specified flag is TRUE at the time for setting the analog signal then the specified signal AOp will be set to 0 instead of a calculated value.

**Note**

This argument can only be used by the robot for the 1st TriggSpeed (in combination with one of TriggL, TriggC, or TriggJ) in a sequence of several TriggSpeed instructions. The 1st given argument value is valid for all the following TriggSpeed in the sequence.

[\InhibSetValue]

InhibitSetValue

Data type: bool, num or dnum

The name of a persistent variable of the data type bool, num or dnum or any alias of those three base data types.

This optional argument can only be used together with optional argument Inhib.

If this optional argument is used and the value of the persistent variable flag used in optional argument Inhib is TRUE at the position-time for setting the signal, the value of the persistent variable used in optional argument InhibSetValue is read and the value is used for setting of the AOp signal.

If using a boolean persistent variable, the value TRUE is translated to value 1, and FALSE is translated to value 0.

**Note**

This argument can only be used by the robot for the 1st TriggSpeed (in combination with one of TriggL, TriggC, or TriggJ) in a sequence of several TriggSpeed instructions. The 1st given argument value is valid for all the following TriggSpeed in the sequence.

Continues on next page

1 Instructions

1.297 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event

RobotWare Base

Continued

[\Mode]

Data type: triggmode

Is used to specify different action modes when defining triggers.



Note

This argument can only be used by the robot for the 1st TriggSpeed (in combination with one of TriggL, TriggC, or TriggJ) in a sequence of several TriggSpeed instructions. The 1st given argument value is valid for all the following TriggSpeed in the sequence.

Program execution

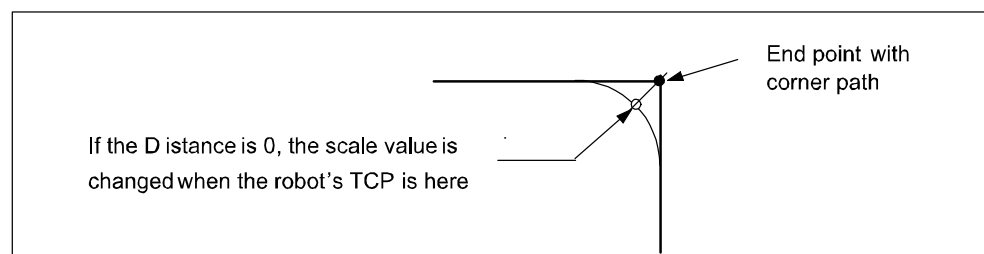
When running the instruction TriggSpeed the trigger condition is stored in the specified variable for the argument TriggData.

Afterwards, when one of the instructions TriggL, TriggC, or TriggJ is executed then the following are applicable with regard to the definitions in TriggSpeed:

For the distance specified in the argument Distance, see the table below:

Linear movement	The straight line distance
Circular movement	The circle arc length
Non-linear movement	The approximate arc length along the path (to obtain adequate accuracy, the distance should not exceed one half of the arc length).

The figure below illustrates the fixed position-time scale value event on a corner path.



xx0500002331

The position-time related scale value event will be generated when the start point (end point) is passed if the specified distance from the end point (start point) is not within the length of the movement of the current instruction (TriggL, TriggC, or TriggJ).

The 1st TriggSpeed used by one of TriggL, TriggC, or TriggJ instruction will internally in the system create a process with the same name as the analog output signal. The same process will be used by all succeeding TriggL, TriggC, or TriggJ which refers to same signal name and setup by a TriggSpeed instruction.

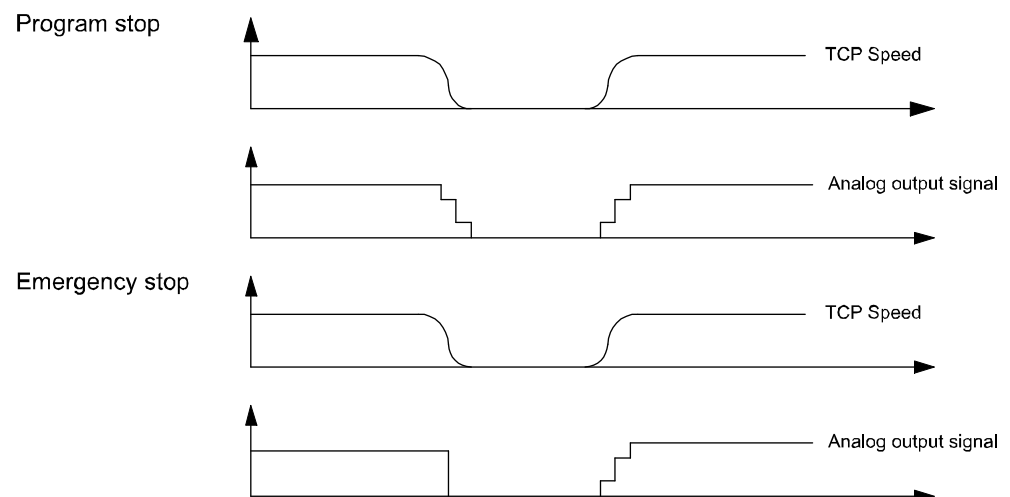
The process will immediately set the analog output to 0, in the event of a program emergency stop. In the event of a program stop, the analog output signal will stay TCP-speed proportional until the robot stands still. The process keeps “alive” and ready for a restart. When the robot restarts, the signal is TCP-speed proportional directly from the start.

Continues on next page

1.297 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event

RobotWare Base

Continued



xx0500002332

The process will “die” after handling a scale event with value 0 if no succeeding TriggL, TriggC, or TriggJ is in the queue at the time.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.

Given two consecutive movement orders with TriggL/TriggSpeed instructions. A negative value in parameter ScaleLag makes it possible to move the scale event from the first movement order to the beginning of the second movement order. If the second movement order scales at the beginning then there is no control if the two scales interfere.

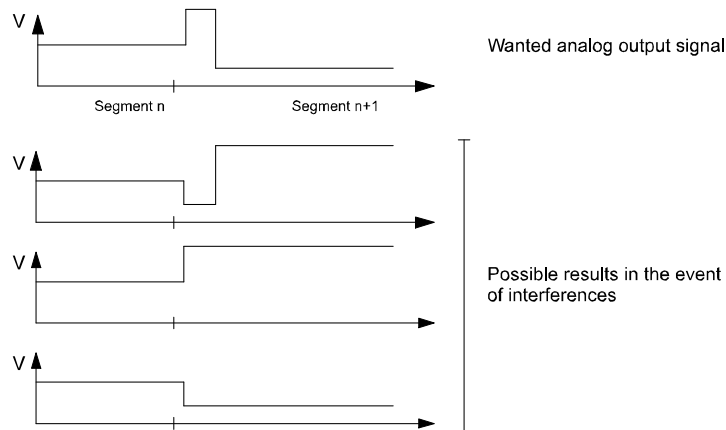
Continues on next page

1 Instructions

1.297 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event

RobotWare Base

Continued



xx0500002334

More examples

More examples of the instruction TriggSpeed are illustrated below.

Example 1

```
VAR triggdata flow;  
TriggSpeed flow, 10 \Start, 0.05, flowsignal, 0.5 \DipLag:=0.03;  
MoveJ p1, v1000, z50, tool1;  
TriggL p2, v500, flow, z50, tool1;
```

The analog output signal `flowsignal` is set to a logical value = $(0.5 * \text{actual TCP speed in mm/s}) \cdot 0.05 \text{ s}$ before the TCP passes a point located 10 mm after the start point p. The output value is adjusted to be proportional to the actual TCP speed during the movement to p2.

...

```
TriggL p3, v500, flow, z10, tool1;
```

The robot moves from p2 to p3 with the analog output value proportional to the actual TCP speed. The analog output value will be decreased at time 0.03 s before the robot reduces the TCP speed during the passage of the corner path z10.

Example 2

```
VAR triggdata glueflow;  
VAR triggdata glueflowend;  
TriggSpeed glueflow, 0, 0.05, glue_ao, 1;  
TriggSpeed glueflowend, 25 \Next, 0, glue_ao, 0;  
TriggL p1, v500, glueflow, z50, gun1;  
TriggL p2, v500, glueflow, z50, gun1;  
TriggL p3, v500, glueflowend, z50, gun1;  
MoveL p4, v500, z50, gun1;
```

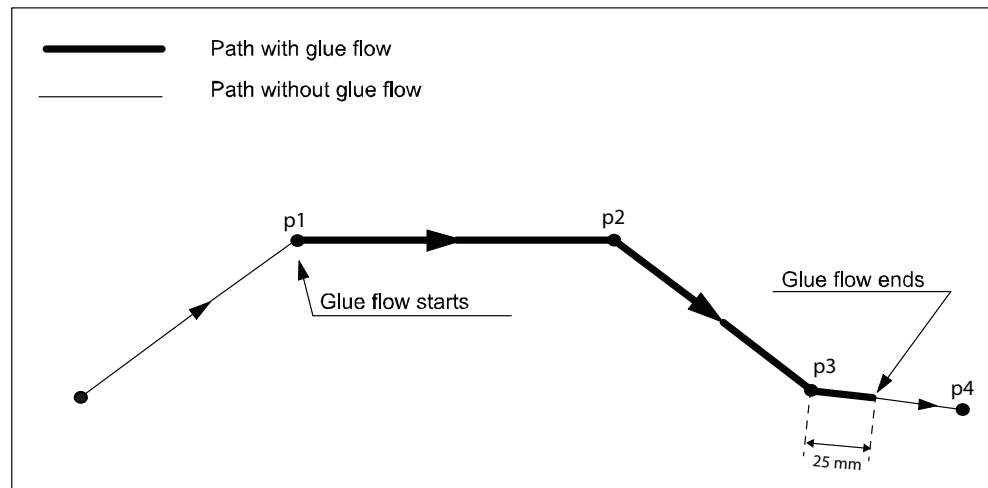
The figure below illustrates an example of TriggSpeed sequence and use of \Next argument

Continues on next page

1.297 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event

RobotWare Base

Continued



xx1800000010

The glue flow (analog output `glue_ao`) with scale value 0.8 starts when TCP is 0.05 s before point p1. The glue flow ends (scale value 0) when TCP is 25 mm after point p3.

Related system parameters

The system parameter *Event Preset Time* is used to delay the robot to make it possible to activate/control the external equipment before the robot runs through the position.

The table below illustrates the recommendation for setup of system parameter *Event Preset Time*, where typical Servo Lag is 0.040 s..

ScaleLag	DipLag	Required Event Preset Time to avoid runtime execution error	Recommended Event Preset Time to obtain best accuracy
ScaleLag > DipLag	Always	DipLag, if DipLag > ServoLag	ScaleLag in s plus 0.090 s
ScaleLag < DipLag	DipLag < Servo Lag	- " -	0.090 s
- " -	DipLag > Servo Lag	- " -	DipLag in s plus 0.030 s

Limitations

The limitations for the instruction TriggSpeed are illustrated below.

Accuracy of position-time related scale value event

Typical absolute accuracy values for scale value events ± 5 ms.

Typical repeat accuracy values for scale value events ± 2 ms.

Accuracy of TCP speed dips adaptation (deceleration - acceleration phases)

Typical absolute accuracy values for TCP speed dips adaptation ± 5 ms.

Typical repeat accuracy values for TCP speed dips adaptation ± 2 ms (the value depends on the configured *Path resolution*).

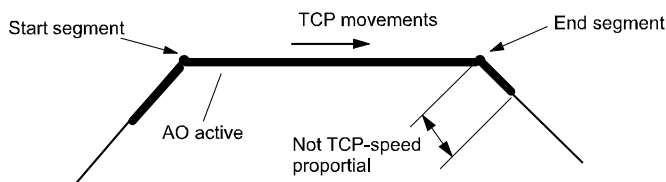
Continues on next page

1 Instructions

1.297 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event
RobotWare Base
Continued

Negative ScaleLag

If a negative value on parameter ScaleLag is used to move the zero scaling over to the next movement order then the analog output signal will not be reset if a program stop occurs. An emergency stop will always reset the analog signal. The analog signal is no longer TCP-speed proportional after the end point on the movement order.



xx0500002333

UNDO or system events

TriggSpeed cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Short movements

There is a limitation on 10 queued movement instructions using trigger conditions setup by instruction TriggSpeed. If the queue is full, the system will stop. To avoid this limitation, use longer movements, or use a lower speed.

Syntax

```
TriggSpeed
[ TriggData ':' = ] < variable (VAR) of triggdata> ','
[ Distance ':' = ] < expression (IN) of num>
[ '\\' Start ] | [ '\\' Next ] ','
[ ScaleLag ':' = ] < expression (IN) of num> ','
[ AOpl ':' = ] < variable (VAR) of signalao> ','
[ ScaleValue ':' = ] < expression (IN) of num>
[ '\\' DipLag ':' = ] < expression (IN) of num> ]
[ '\\' ErrDO ':' = ] < variable (VAR ) of signaldo> ]
[ '\\' Inhib ':' = ] < persistent (PERS ) of bool >]
[ '\\' InhibSetValue ':' = ] < persistent (PERS) of anytype> ]
[ '\\' Mode ':' = ] < expression (IN) of triggmode> ] ';' ;'
```

Related information

For information about	See
Use of triggers	TriggL - Linear robot movements with events on page 902 TriggC - Circular robot movement with events on page 858 TriggJ - Axis-wise robot movements with events on page 894

Continues on next page

1.297 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event

RobotWare Base

Continued

For information about	See
Definition of other triggs	TriggIO - Define a fixed position or time I/O event near a stop point on page 888 TriggInt - Defines a position related interrupt on page 883 TriggEquip - Define a fixed position and time I/O event on the path on page 877
Storage of triggdata	triggdata - Positioning events, trigg on page 1761 triggmode - Trigg action mode on page 1766
Configuration of Event preset time	<i>Technical reference manual - System parameters</i>
<i>Advanced RAPID</i>	<i>Application manual - Controller software OmniCore</i>

1 Instructions

1.298 TriggStopProc - Generate restart data for trigg signals at stop
RobotWare Base

1.298 TriggStopProc - Generate restart data for trigg signals at stop

Usage

The instruction TriggStopProc creates an internal supervision process in the system for zero setting of specified process signals and the generation of restart data in a specified persistent variable at every program stop (STOP) or emergency stop (QSTOP) in the system.

TriggStopProc and the data type restartdata are intended to be used for restart after program stop (STOP) or emergency stop (QSTOP) of own process instructions defined in RAPID (NOSTEPIN routines).

It is possible in a user defined RESTART event routine to analyze the current restart data, step backwards on the path with instruction StepBwdPath, and activate suitable process signals before the movement restarts.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in any motion tasks.

Note for MultiMove system that only one TriggStopProc support process with the specified shadow signal name (argument ShadowDO) can be active in the system at the same time. It means that TriggStopProc supervises program stop or emergency stop in the program task where it was last executed.

Arguments

TriggStopProc RestartRef [\D0] [\G01] [\G02] [\G03] [\G04] ShadowDO

RestartRef

Restart Reference

Data type: restartdata

The persistent variable in which restart data will be available after every stop of program execution.

[\D01]

Digital Output 1

Data type: signaldo

The signal variable for a digital process signal to be set to zero and supervised in restart data when program execution is stopped.

[\G01]

Group Output 1

Data type: signalgo

The signal variable for a digital group process signal to be set to zero and supervised in restart data when program execution is stopped.

[\G02]

Group Output 2

Data type: signalgo

The signal variable for a digital group process signal to be set to zero and supervised in restart data when program execution is stopped.

Continues on next page

1.298 TriggStopProc - Generate restart data for trigg signals at stop

RobotWare Base
Continued

[\G03]

Group Output 3

Data type: signalgo

The signal variable for a digital group process signal to be set to zero and supervised in restart data when program execution is stopped.

[\G04]

Group Output 4

Data type: signalgo

The signal variable for a digital group process signal to be set to zero and supervised in restart data when program execution is stopped.

At least one of the optional parameters D01, G01 . . . G04 must be used.

ShadowD0

Shadow Digital Output

Data type: signaldo

The signal variable for the digital signal, which must mirror whether or not the process is active along the robot path.

This signal will not be set to zero by the process TriggStopProc at STOP or QSTOP, but its values will be mirrored in restartdata.

Program execution**Setup and execution of TriggStopProc**

TriggStopProc must be called from both:

- the START event routine or in the unit part of the program (set PP to main, kill the internal process for TriggStopProc)
- the POWERON event routine (power off, kill the internal process for TriggStopProc)

The internal name of the process for TriggStopProc is the same as the signal name in the argument ShadowD0. If TriggStopProc, with the same signal name in argument ShadowD0, is executed twice from the same or another program task then only the last executed TriggStopProc will be active.

Execution of TriggStopProc only starts the supervision of I/O signals at STOP and QSTOP.

Program stop STOP

The process TriggStopProc comprises the following steps:

- 1 Wait until the robot stands still on the path.
- 2 Store the current value (prevalue according to restartdata) of all used process signals. Zero sets all used process signals except ShadowD0.
- 3 Do the following during the next time slot, about 500 ms, if some process signals change their value during this time:
 - Store the current value again (postvalue according to restartdata)
 - Set that signal to zero except ShadowD0

Continues on next page

1 Instructions

1.298 TriggStopProc - Generate restart data for trigg signals at stop

RobotWare Base

Continued

- Count the number of value transitions (flanks) of the signal ShadowD0
- 4 Update the specified persistent variable with restart data.

Emergency stop (QSTOP)

The process TriggStopProc comprises the following steps:

- 1 Do the next step as soon as possible.
- 2 Store the current value (prevalue according to restartdata) of all used process signals. Set to zero all used process signals except ShadowD0.
- 3 Do the following during the next time slot, about 500 ms, if some process signal changes its value during this time:
 - Store its current value again (postvalue according to restartdata)
 - Set to zero that signal except ShadowD0
 - Count the number of value transitions (flanks) of the signal ShadowD0
- 4 Update the specified persistent variable with restart data.

Critical area for process restart

Both the robot servo and the external equipment have some lags. All the instructions in the Trigg family are designed so that all signals will be set at suitable places on the robot path, independently of different lags in external equipment, to obtain process results that are as good as possible. Because of this, the settings of I/O signals can be delayed between 0-80ms internally in the system after the robot stands still at program stop (STOP) or after registration of an emergency stop (QSTOP). Because of this disadvantage for the restart functionality, both the prevalue, postvalue, and the shadow flanks are introduced in restart data.

If this critical timeslot of 0-80ms coincides with the following application process cases then it is difficult to perform a good process restart:

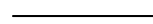
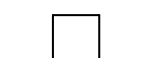
- At the start of the application process
- At the end of the application process
- During a short application process
- During a short interrupt in the application process

The figure below illustrates process phases at STOP or QSTOP within critical time slot 0-80ms

Continues on next page

1.298 TriggStopProc - Generate restart data for trigg signals at stop

RobotWare Base
Continued

No active process	presadowval = 0 shadowflanks = 0 postshadow val = 0	shadowval: 1 0 
Active process	presadowval = 1 shadowflanks = 0 postshadow val = 1	shadowval: 1 0 
Start of process	presadowval = 0 shadowflanks = 1 postshadow val = 1	shadowval: 1 0 
End of process	presadowval = 1 shadowflanks = 1 postshadow val = 0	shadowval: 1 0 
Short process	presadowval = 0 shadowflanks = 2 postshadow val = 0	shadowval: 1 0 
Short interrupt in process	presadowval = 1 shadowflanks = 2 postshadow val = 1	shadowval: 1 0 

xx0500002326

Performing a restart

A restart of process instructions (NOSTEPIN routines) along the robot path must be done in a RESTART event routine.

The RESTART event routine can consist of the following steps:

	Action
1.	After QSTOP the regain to path is done at program start.
2.	Analyze the restart data from the latest STOP or QSTOP.

Continues on next page

1 Instructions

1.298 TriggStopProc - Generate restart data for trigg signals at stop

RobotWare Base

Continued

	Action
3.	Determine the strategy for process restart from the result of the analysis such as: • Process active, do process restart • Process inactive, do not process restart • Do suitable actions depending on type of process application: - Start of process - End of process - Short process - Short interrupt in process
4.	Step backwards on the path.
5.	Continue the program results in movement restart.

If waiting in any STOP or QSTOP event routine until the TriggStopProc process is ready with e.g. `WaitUntil (myproc.restartstop=TRUE), \MaxTime:=2;`, the user must always reset the flag in the RESTART event routine with e.g. `myproc.restartstop:=FALSE`. After that the restart is ready.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_NO_ALIASIO_DEF</code>	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
<code>ERR_NORUNUNIT</code>	There is no contact with the I/O device.

Limitations

No support for restart of process instructions after a power failure.

TriggStopProc cannot be executed in an UNDO handler or RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, Reset or Step.

Syntax

```
TriggStopProc
[ RestartRef ':' '=' ] < persistent (PERS) of restartdata>
[ '\ ' D01 ':' '=' < variable (VAR) of signaldo>
[ '\ ' G01 ':' '=' < variable (VAR) of signalgo> ]
[ '\ ' G02 ':' '=' < variable (VAR) of signalgo> ]
[ '\ ' G03 ':' '=' < variable (VAR) of signalgo> ]
[ '\ ' G04 ':' '=' < variable (VAR) of signalgo> ] ','
[ ShadowDO ':' '=' ] < variable (VAR) of signaldo> ';' ;
```

Related information

For information about	See
Process instructions	TriggL - Linear robot movements with events on page 902 TriggC - Circular robot movement with events on page 858

Continues on next page

1.298 TriggStopProc - Generate restart data for trigg signals at stop

RobotWare Base
Continued

For information about	See
Restart data	restartdata - Restart data for trigg signals on page 1706
Step backward on path	StepBwdPath - Move backwards one step on path on page 776
<i>Advanced RAPID</i>	<i>Application manual - Controller software Omni-Core</i>

1 Instructions

1.299 TryInt - Test if data object is a valid integer

RobotWare Base

1.299 TryInt - Test if data object is a valid integer

Usage

TryInt is used to test if a given data object is a valid integer.

Basic examples

The following examples illustrate the instruction TryInt:

Example 1

```
VAR num myint := 4;
...
TryInt myint;
```

The value of myint will be evaluated and since 4 is a valid integer, the program execution continues.

Example 2

```
VAR dnum mydnum := 200000000;
...
TryInt mydnum;
```

The value of mydnum will be evaluated and since 200000000 is a valid dnum integer, the program execution continues.

Example 3

```
VAR num myint := 5.2;
...
TryInt myint;
...
ERROR
  IF ERRNO = ERR_INT_NOTVAL THEN
    myint := Round(myint);
    RETRY;
  ENDIF
```

The value of myint will be evaluated and since 5.2 is not a valid integer, an error will be raised. In the error handler, myint will be rounded to 5 and the instruction TryInt is executed one more time.

Arguments

TryInt DataObj | DataObj2

DataObj

Data Object

Data type: num

The data object to test if it is a valid integer.

DataObj2

Data Object 2

Data type: dnum

The data object to test if it is a valid integer.

Continues on next page

Program execution

The given data object is tested:

- If it is a valid integer, the execution continues with the next instruction.
- If it is not a valid integer, the execution continues in the error handler in an actual procedure.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_INT_NOTVAL	DataObj contains a decimal value.
ERR_INT_MAXVAL	• The value of DataObj is larger or smaller than the integer value range of data type num. • The value of DataObj2 is larger or smaller than the integer value range of data type dnum.

Note that a value of 3.0 is evaluated as an integer, since .0 can be ignored.

Syntax

```
TryInt
  [ DataObj ':= ' ] < expression (IN) of num>
  | [ DataObj2 ':= ' ] < expression (IN) of dnum>' ;'
```

Related information

For information about	See
Data type num	num - Numeric values on page 1680

1 Instructions

1.300 TRYNEXT - Jumps over an instruction which has caused an error

RobotWare Base

1.300 TRYNEXT - Jumps over an instruction which has caused an error

Usage

The TRYNEXT instruction is used to resume execution after an error, starting with the instruction following the instruction that caused the error.

Basic examples

The following example illustrates the instruction TryNext:

Example 1

```
reg2 := reg3/reg4;  
...  
ERROR  
  IF ERRNO = ERR_DIVZERO THEN  
    reg2:=0;  
    TRYNEXT;  
  ENDIF
```

An attempt is made to divide reg3 by reg4. If reg4 is equal to 0 (division by zero) then a jump is made to the error handler where reg2 is assigned to 0. The TRYNEXT instruction is then used to continue with the next instruction.

Program execution

Program execution continues with the instruction subsequent to the instruction that caused the error.

Limitations

The instruction can only exist in a routine's error handler.

Syntax

```
TRYNEXT ' ; '
```

Related information

For information about	See
Error handlers	<i>Technical reference manual - RAPID Overview</i>

1.301 TuneReset - Resetting servo tuning

Usage

TuneReset is used to reset the dynamic behavior of all robot axes and external mechanical units to their normal values.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction TuneReset:

Example 1

```
TuneReset ;  
Resetting tuning values for all axes to 100%.
```

Program execution

The tuning values for all axes are reset to 100%.

The default servo tuning values for all axes are automatically set by executing instruction TuneReset

- at a **Restart**.
- when a new program is loaded.
- when starting program execution from the beginning.

Syntax

```
TuneReset ';' ;
```

Related information

For information about	See
Tuning servos	TuneServo - Tuning servos on page 954

1 Instructions

1.302 TuneServo - Tuning servos *RobotWare Base*

1.302 TuneServo - Tuning servos

Usage

TuneServo is used to tune the dynamic behavior of separate axes on the robot. For most applications it is not necessary to use TuneServo, but for some applications, TuneServo is needed to obtain the desired accuracy. The use of TuneServo can in many cases be replaced by selecting a predefined *Motion Process Mode*, see *Technical reference manual - System parameters*, or by modifying a predefined *Motion Process Mode*.

For external axes TuneServo can be used for load adaptation.

Avoid doing TuneServo commands at the same time that the robot is moving. It can result in momentary high torque causing error indication and stops.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.



Note

To obtain optimal tuning it is essential that the correct load data is used. Check this before using TuneServo.



WARNING

Incorrect use of the TuneServo can cause oscillating movements or torques that can damage the robot. You must bear this in mind and be careful when using the TuneServo.

Description

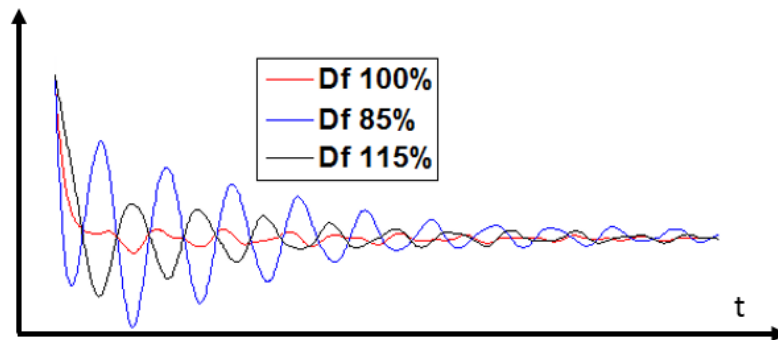
Reduce overshoots and vibrations - TUNE_DF

TUNE_DF can be used for adjusting the predicted mechanical resonance frequency of a particular axis. A tune value of 95% reduces the resonance frequency by 5%. The most common use of TUNE_DF is to compensate for a foundation of inadequate stiffness, i.e. a flexible foundation. In this case, the tune value for axis 1 and 2 is lowered, typically to a value between 80% and 99%.

Use of TUNE_DF for axis 3 - 6 is rare and is normally not recommended. An exception is tuning of axis 4 - 6 for compensating the resonance frequency of an extended flexible payload.

Correctly adjusted, not too high and not too low, TUNE_DF reduces overshoots and vibrations. Be careful when adjusting TUNE_DF, since a too high or too low tune value can impair the movement considerably. One example of is shown in the figure below. In this case, a tune value of 100% gives the best result.

Continues on next page



xx1400001280

The tune value can be automatically optimized by using TuneMaster, which is recommended.

For manual tuning, an example RAPID code snippet for tuning axis 1 is as follows:

```
MoveAbsJ [[0,0,0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]],
  v200, fine, myTool;
FOR DF FROM 80 TO 100 STEP 5 DO
  TuneServo ROB_1,1,DF\Type:=TUNE_DF;
  MoveAbsJ [[2,0,0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]],
    vmax, fine, myTool;
  WaitTime 1;
  MoveAbsJ [[0,0,0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]],
    vmax, fine, myTool;
  WaitTime 1;
ENDFOR
TuneReset;
```

Here, the tune value is changed in 5% steps, 2% steps could also be used. Note that the movement should be short, 2 degrees is a typical value. The robot should be positioned in a typical work area position. The tune value that minimizes overshoots and vibrations, by visual inspection, should be chosen.

Overshoots and vibrations can also be reduced by lowering the tune value for TUNE_DH or by reducing acceleration by using AccSet. In many cases, this is the best solution. However, if a problem can be solved by TUNE_DF, the cycle time is unaffected and the use of TUNE_DF is thus the best solution.

For robots where *Mounting Stiffness Factor* is available, see *Motion Process Mode* in *Technical reference manual - System parameters*, the use of *Mounting Stiffness Factor* for compensating a flexible foundation, replaces the use of TUNE_DF.

Reduce overshoots and vibrations - TUNE_DH

TUNE_DH can be used for increasing the smoothness of the robot path by adjusting the effective bandwidth of the system. The tune value can only be lowered and values above 100% will not affect the movements. A tune value less than 100% decreases the bandwidth and increases the smoothness, thereby reducing overshoots and vibrations.

TUNE_DH only increases cycle time in fine points, whereas acceleration reductions increases cycle time all along the robot path. Therefore, using TUNE_DH can be a

Continues on next page

1 Instructions

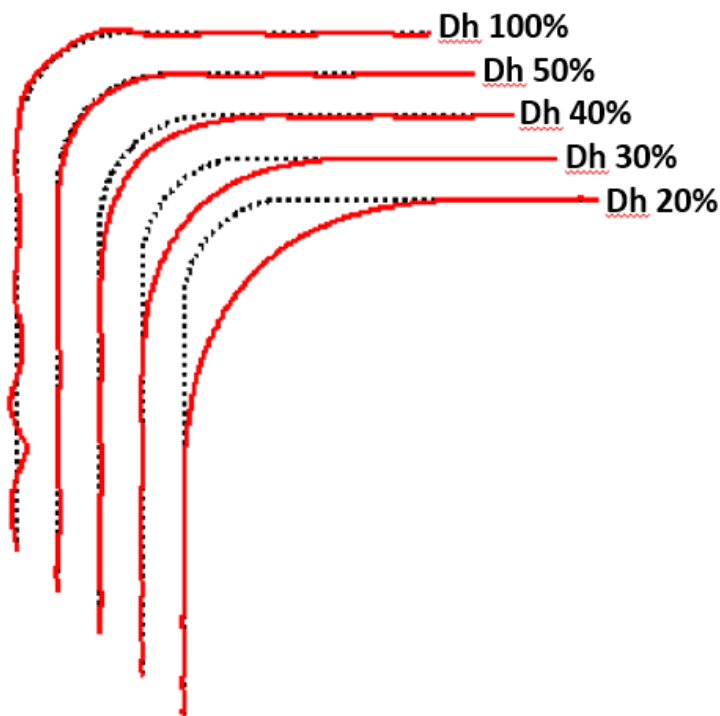
1.302 TuneServo - Tuning servos

RobotWare Base

Continued

very cycle time efficient way to reduce vibrations and overshoots compared to lowering the acceleration by using the AccSet instruction. At high speed, larger corner zones than programmed will be noticeable when using TUNE_DH. Thus, use of TUNE_DH reduces path errors caused by vibrations but increases path errors at high speed by taking shortcuts in corner zones. The shortcuts will increase with decreased tune value and increased speed. If these shortcuts are not acceptable, AccSet is recommended instead of TUNE_DH.

The figure below shows the effect of a decreased tune value and that an undesired vibration can be removed with a proper tune value. For smaller tune values, the shortcut in the corner zone becomes noticeable.



xx1400001281

It is sufficient to execute the instruction TuneServo with the argument \Type:=TUNE_DH for one axis. All axes in the same mechanical unit will automatically get the same tune value.

Examples:

- Cutting with TCP speeds up to 300 mm/s. A tune value of 50% reduces undesired vibrations.
This is sometimes combined with AccSet, e.g. AccSet 50,100;.
- Material handling at high speed. A tune value of 15% reduces undesired vibrations.

Continues on next page



CAUTION

Never change the tune value when the robot is moving and be careful when using small tune values (less than 30%) since the robot will take shortcuts in corner zones.

Only for ABB internal use - TUNE_DK, TUNE_DL, TUNE_DG, TUNE_DI



WARNING

Only for ABB internal use. Do not use these tune types. Incorrect use can cause oscillating movements or torques that can damage the robot.

Tuning external axes - TUNE_KP, TUNE_KV, TUNE_TI

These tune types affect position control gain (kp), speed control gain (kv), and speed control integration time (ti) for external axes. These are used for adapting external axes to different load inertias. Basic tuning of external axes can also be simplified by using these tune types.

Tuning robot axes - TUNE_KP, TUNE_KV, TUNE_TI

These parameters can be used for changing the behavior of the servo controller. TUNE_KP affects the equivalent gain of the position controller, TUNE_KV affects the equivalent gain of the speed controller, and TUNE_TI affects the integral action of the controller.

Increasing the tune value for TUNE_KV increases the servo stiffness of the robot and can be useful in contact applications since the total stiffness of the robot system depends on both the servo stiffness and the mechanical stiffness. An increased tune value for TUNE_KV also reduces the path errors at low speed and can be useful in cutting and welding applications where the speed is below 100 mm/s. Typical tune values are 150% - 200%. A tune value which is too high causes motor vibrations and must be avoided. Always be careful and be observant for increased motor noise level when adjusting TUNE_KV and do not use higher tune values than needed for fulfilling the application requirement. Too high tune value can also increase vibrations due to mechanical resonances.

An increased tune value for TUNE_KP and a decreased tune value for TUNE_TI increases the servo stiffness and reduces low speed path errors in the low frequency region. Typical tune values for TUNE_KP are 150% - 300%, and for TUNE_TI 20% - 50%. In most cases, TUNE_KV is the most important parameter and TUNE_KP and TUNE_TI do not need adjustment. Too high tune value for TUNE_KP or too low tune value for TUNE_TI can also increase vibrations due to mechanical resonances.

Example:

- Robot in deburring application need higher servo stiffness to reduce path errors. TUNE_KV 175%, TUNE_KP 250%, and TUNE_TI 30%.

This is often combined with AccSet, e.g. AccSet 30,100;.

Continues on next page

1 Instructions

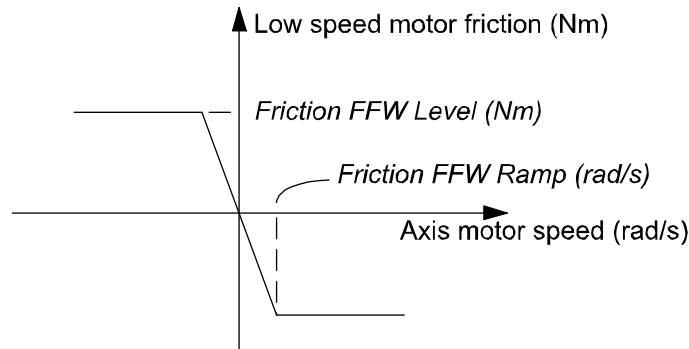
1.302 TuneServo - Tuning servos

RobotWare Base

Continued

Friction compensation - TUNE_FRIC_LEV, TUNE_FRIC_RAMP

These tune types can be used to reduce robot path errors caused by friction and backlash at low speeds (10 - 200 mm/s). These path errors appear when a robot axis changes direction of movement. Activate friction compensation for an axis by setting the system parameter Motion/Control Parameters/Friction FFW On to Yes. The friction model is a constant level with opposite sign of the axis speed direction. *Friction FFW Level (Nm)* is the absolute friction level at (low) speeds and is greater than *Friction FFW Ramp (rad/s)*. See the figure below, which shows a friction model.



xx0500002188

TUNE_FRIC_LEV overrides the value of the system parameter *Friction FFW Level*. Tuning *Friction FFW Level* (using TUNE_FRIC_LEV) for each robot axis can improve the robot's path accuracy considerably in the speed range 20-100 mm/s. For larger robots, the effect will be minimal as other sources of tracking errors dominate these robots.

TUNE_FRIC_RAMP overrides the value of the system parameter *Friction FFW Ramp*. In most cases there is no need to tune the *Friction FFW Ramp*. The default setting will be appropriate.

Tune one axis at a time. Change the tuning value in small steps and find the level that minimizes the robot path error at positions on the path where this specific axis changes direction of movement. Repeat the same procedure for the next axis and so on.

The final tuning values can be transferred to the system parameters. Example:

- Friction FFW Level = 1. Final tune value (TUNE_FRIC_LEV) = 150%.
- Set Friction FFW Level = 1.5 and tune value = 100% (default value) which is equivalent.

Basic examples

The following example illustrates the instruction TuneServo:

Example 1

```
TuneServo MHA160R1, 1, 110 \Type:= TUNE_KP;
```

Activating of tuning type TUNE_KP with the tuning value 110% on axis 1 in the mechanical unit MHA160R1.

Arguments

TuneServo MecUnit Axis TuneValue [\Type]

Continues on next page

MecUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

Axis

Data type: num

The number of the current axis for the mechanical unit (1 - 6).

TuneValue

Data type: num

Tuning value in percent (1 - 500). 100% is the normal value.

[\Type]

Data type: tunetype

Type of servo tuning. Available types are TUNE_DF, TUNE_KP, TUNE_KV, TUNE_TI, TUNE_FRIC_LEV, TUNE_FRIC_RAMP, TUNE_DG, TUNE_DH, TUNE_DI. Type TUNE_DK and TUNE_DL only for ABB internal use.

This argument can be omitted when using tuning type TUNE_DF.

Program execution

The specified tuning type and tuning value are activated for the specified axis. This value is applicable for all movements until a new value is programmed for the current axis, or until the tuning types and values for all axes are reset using the instruction TuneReset.

The default servo tuning values for all axes are automatically set by executing instruction TuneReset

- at a **Restart**.
- when a new program is loaded.
- when starting program execution from the beginning.

Limitations

Any active servo tuning are always set to default values at power fail.

This limitation can be handled in the user program at restart after power failure.

Syntax

```
TuneServo
  [MecUnit ':=' ] < variable (VAR) of mecunit> ', '
  [Axis ':=' ] < expression (IN) of num> ', '
  [TuneValue ':=' ] < expression (IN) of num>
  ['\ ' Type ':=' <expression (IN) of tunetype>] ';'
```

Related information

For information about	See
Other motion settings	<i>Technical reference manual - RAPID Overview</i>

Continues on next page

1 Instructions

1.302 TuneServo - Tuning servos

RobotWare Base

Continued

For information about	See
Types of servo tuning	tunetype - Servo tune type on page 1771
Reset of all servo tunings	TuneReset - Resetting servo tuning on page 953
MotionProcessModeSet - Set motion process mode.	MotionProcessModeSet - Set motion process mode on page 381
Tuning of external axes	<i>Application manual - Additional axes</i>
Friction compensation	<i>Technical reference manual - System parameters</i>

1.303 UIDisplay - user messages

Usage

UIDisplay (*User Interface Display*) is used to communicate with the user of the robot system on the available user device, such as the FlexPendant. With UIDisplay, applications can be launched from a RAPID program.

Basic examples

The following examples illustrate the instruction UIDisplay:

Assuming that there is web app called *MyWebApp*. This app with all of its contents deployed onto the controller directory HOME\WebApps and this app has implemented the required navigation support.

The examples provide the sample RAPID code where it requests the FlexPendant to launch *MyWebApp* and navigate to different views based on arguments defined in the UIDisplay instruction.

Example 1

```
CONST string ID:="MyWebApp";
VAR uidisplaystatus mystatus;
...
! Launch one view of MyWebApp
UIDisplay ID, \Status:=mystatus;
```

The code will launch *MyWebApp* and navigate to the landing page in the app.

Example 2

```
CONST string ID:="MyWebApp";
PERS uidisplaynum myinstance:=0;
VAR uidisplaystatus mystatus;
...
! Launch one view of MyWebApp
UIDisplay ID, \InstanceID:=myinstance\Status:=mystatus
```

The code will launch *MyWebApp* and navigate to the landing page in the app.

Example 3

```
CONST string ID:="MyWebApp";
CONST string Args1:"MainView=Dashboard&SubView=ProductionData";
CONST string Args2:"MainView=Statistics&SubView=Jobs";
PERS uidisplaynum myinstance:=0;
VAR uidisplaystatus mystatus;
...
! Launch one view of MyWebApp
UIDisplay ID, \Args:=Args1\InstanceID:=myinstance \Status:=mystatus;
```

The code will launch the *MyWebApp* and navigate to the *Dashboard* view and open a sub-view called *ProductionData*.

```
! Launch another view with Args2 data
```

```
UIDisplay ID, \Args:=Args2\InstanceID:=myinstance \Status:=mystatus;
```

The code will launch the *MyWebApp* and navigate to the *Statistics* view and open a sub-view called *Jobs*.

Continues on next page

1 Instructions

1.303 UIDisplay - user messages

RobotWare Base

Continued

Arguments

UIDisplay ID [\Args] [\InstanceID] [\Status]

ID

Data type: string

This string contains the name of the app.

[\Args]

Data type: string

This string contains the name of the view to navigate to.



Tip

The suggested format for the Args argument is a name-value pair, as seen in the examples.

Program execution

The UIDisplay instruction is used to launch individual apps on the FlexPendant. To launch individual WebApps, then the WebApp and its content must be placed in the directory HOME\WebApps: in the active system.

If using the argument \Status then the program execution will wait until the application is launched. If errors in the application are not handled then it is only the result of the launch that is supervised. Without the \Status parameter, the FlexPendant is ordered to launch the application but there is no check to determine if it is possible to launch it or not.

Predefined data

The following constants of the data type uidisplaystatus are predefined in the system:

Value	Constant	Description
0	DisplaySuccess	OK
-1	DisplayAppNotFound	The app could not be found, or does not exist
-2	DisplayAppNotLoaded	The app was found, but could not be loaded
-3	DisplayInvalidArgs	Invalid arguments specified for this app

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_TP_NO_CLIENT	There is no client, e.g. a FlexPendant, to take care of the instruction.

Continues on next page

If parameter \Status is used then these situations can then be dealt with by the error handler:

- If something else goes wrong when trying to launch a WebApp then the system variable ERRNO is set to ERR_UIDISPLAY_FATAL, and the execution continues in the error handler.

Limitations

Apps that have been launched with the UIDisplay instruction do not survive power- fail situations. POWER ON event routine can be used to setup the application again.

Syntax

```
UIDisplay
[ID ':='] < expression (IN) of string >', '
['\Args' :=] < expression (IN) of string>]
['\InstanceId ':=] < persistent (PERS) of udisplaynum>]
['\Status ':=] < variable (VAR) of udisplaystatus >]
```

Related information

For information about	See
Building individual applications for the FlexPendant	http://developercenter.robotstudio.com/
uidisplaynum	uidisplaynum - Instance ID for UIDisplay on page 1772
Clean up the operator window	TPErase - Erases text printed on the FlexPendant on page 832

1 Instructions

1.304 UIMsgBox - User Message Dialog Box type basic *RobotWare Base*

1.304 UIMsgBox - User Message Dialog Box type basic

Usage

UIMsgBox (*User Interaction Message Box*) is used to communicate with the user of the robot system on available user device, such as the FlexPendant. A message is written to the operator, who answers by selecting a button. The user selection is then transferred back to the program.

Basic examples

The following examples illustrate the instruction UIMsgBox:

See also [More examples on page 971](#).

Example 1

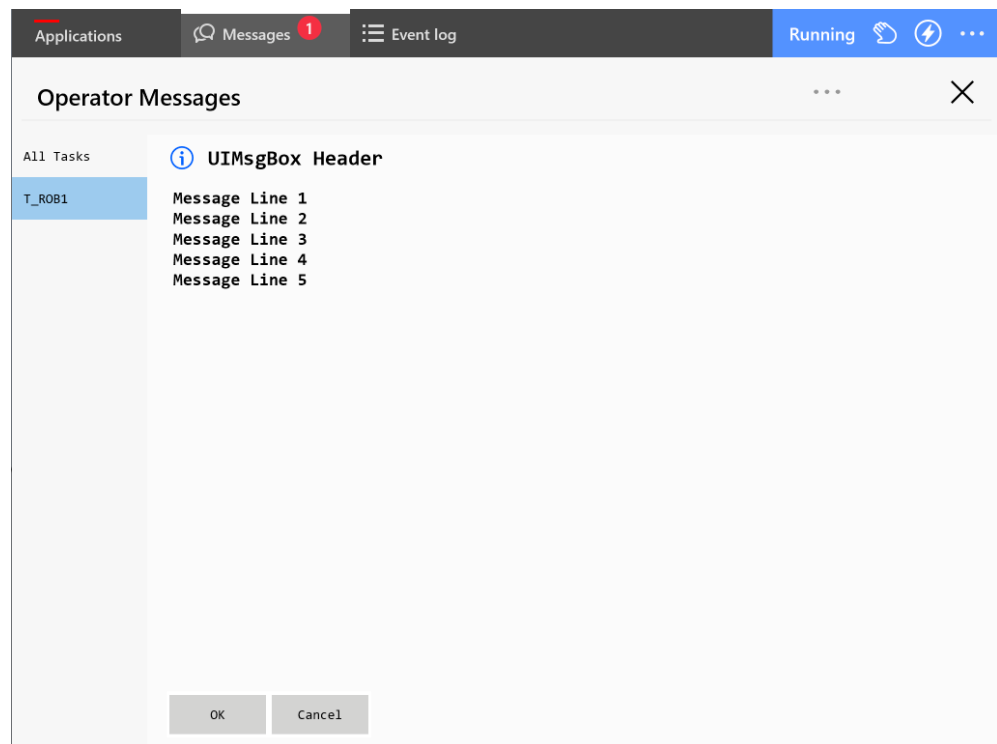
```
UIMsgBox "Continue the program ?";
```

The message "Continue the program ?" is displayed. The program proceeds when the user presses the default button OK.

Example 2

```
VAR btnres answer;  
...  
UIMsgBox  
  \Header:="UIMsgBox Header",  
  "Message Line 1"  
  \MsgLine2:"Message Line 2"  
  \MsgLine3:"Message Line 3"  
  \MsgLine4:"Message Line 4"  
  \MsgLine5:"Message Line 5"  
  \Buttons:=btnOKCancel  
  \Icon:=iconInfo  
  \Result:=answer;  
IF answer = resOK my_proc;
```

Continues on next page



xx2000001833

Above message box with icon, header, message line 1 to 5, and push buttons is written on the FlexPendant display. Program execution waits until OK or Cancel is pressed. In other words, answer will be assigned 1 (OK) or 5 (Cancel) depending on which of the buttons is pressed. If answer is OK then my_proc will be called. Note that Message Line 1 ... Message Line 5 are displayed on separate lines 1 to 5 (the switch \Wrap is not used).

Example 3

```
UIMsgBox \Header:= "Critical error", "Move the program pointer to
continue" \Buttons:=btnNone \Icon:=iconInfo;
```

This example will result in a dialog that will stay open until the operator moves the program pointer.

Arguments

```
UIMsgBox [\Header] MsgLine1 [MsgLine2] [MsgLine3] [MsgLine4] [MsgLine5]
[Wrap] [Buttons] [Icon] [Image] [Result] [MaxTime] [DIBreak] [DIPassive]
[DOBreak] [DOPassive] [\PersBoolBreak] [\PersBoolPassive] [BreakFlag]
[UIActiveSignal]
```

[\Header]

Data type: string

Header text to be written at the top of the message box. Max. 40 characters.

MsgLine1

Message Line 1

Data type: string

Continues on next page

1 Instructions

1.304 UIMsgBox - User Message Dialog Box type basic

RobotWare Base

Continued

Text line 1 to be written on the display. Max. 55 characters.

[\\MsgLine2]

Message Line 2

Data type: string

Additional text line 2 to be written on the display. Max. 55 characters.

[\\MsgLine3]

Message Line 3

Data type: string

Additional text line 3 to be written on the display. Max. 55 characters.

[\\MsgLine4]

Message Line 4

Data type: string

Additional text line 4 to be written on the display. Max. 55 characters.

[\\MsgLine5]

Message Line 5

Data type: string

Additional text line 5 to be written on the display. Max. 55 characters.

[\\Wrap]

Data type: switch

If selected, all the strings *MsgLine1* ... *MsgLine5* will be concatenated to one string with a single space between each individual string and spread out on as few lines as possible.

Default, each message string *MsgLine1* ... *MsgLine5* will be on separate lines on the display.

[\\Buttons]

Data type: buttondata

Defines the push buttons to be displayed. Only one of the predefined buttons combination of type buttondata can be used. See [Predefined data on page 969](#).

Default, the system displays the OK button. (\\Buttons:=btnOK).

[\\Icon]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 969](#).

Default no icon.

[\\Image]

Data type: string

The name or full path to the image that should be used. If only a filename is provided, the FlexPendant will look for it in the HOME: directory. The path must follow this format: HOME:/subfolder1/image.png

Continues on next page

No restart is required when a new or updated image is added. If an existing image is replaced by a new image with the same filename, then the user needs to log out and log in.

The files are included in backup and restore. If the files are placed directly in the active system, they are not included in backup and restore.

The image can have the width of 250 pixels and the height of 470 pixels. If the image is bigger, only 250x470 pixels of the image are shown, starting at the top left of the image.

The program execution will just continue if an image is used that has not been found in the specified path.

Supported image formats: jpg, png, jpeg, bmp

If other formats are used, it may or may not work.

[\\Result]

Data type: btnres

The variable for which, depending on which button is pressed, the numeric value 0..7 is returned. Only one of the predefined constants of type btnres can be used to test the user selection. See [Predefined data on page 969](#).

If any type of system break such as \\MaxTime, \\DIBreak, or \\DOBreak or if \\Buttons:=btnNone, resUnkwn equal to 0 is returned.

[\\MaxTime]

Data type: num

The maximum amount of time in seconds that program execution waits. If no button is selected within this time then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_MAXTIME can be used to test whether or not the maximum time has elapsed.

[\\DIBreak]

Digital Input Break

Data type: signaldi

The digital input signal that may interrupt the operator dialog. If no button is selected when the signal is set to 1 (or is already 1), the program continues to execute in the error handler, unless the BreakFlag is used (see below). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\\DIPassive]

Digital Input Passive

Data type: switch

This switch overrides the default behavior when using DIBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DIBreak is set to 0 (or already is 0). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\\DOBreak]

Digital Output Break

Continues on next page

1 Instructions

1.304 UIMsgBox - User Message Dialog Box type basic

RobotWare Base

Continued

Data type: signaldo

The digital output signal that may interrupt the operator dialog. If no button is selected when the signal is set to 1 (or is already 1) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\DOPassive]

Digital Output Passive

Data type: switch

This switch overrides the default behavior when using DOBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DOBreak is set to 0 (or already is 0). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\PersBoolBreak]

Persistent Boolean Break

Data type: bool

The persistent boolean that may interrupt the operator dialog. If no button is selected when the persistent boolean is set to TRUE (or is already TRUE) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\PersBoolPassive]

Persistent Boolean Passive

Data type: switch

This switch overrides the default behavior when using PersBoolBreak optional argument. Instead of reacting when persistent boolean is set to TRUE (or already TRUE), the instruction should continue in the error handler (if no BreakFlag is used) when the persistent boolean PersBoolBreak is set to FALSE (or already is FALSE). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\BreakFlag]

Data type: errnum

A variable that will hold the error code if MaxTime, DIBreak, DOBreak, or PersBoolBreak is used. If this optional variable is omitted then the error handler will be executed. The constants ERR_TP_MAXTIME, ERR_TP_DIBREAK, ERR_TP_DOBREAK, and ERR_TP_PERSBOOLBREAK can be used to select the reason.

[\UIActiveSignal]

Data type: signaldo

The digital output signal used in optional argument UIActiveSignal is set to 1 when the message box is activated on the FlexPendant. When the user selection has been done and the execution continue, the signal is set to 0 again.

Continues on next page

No supervision of stop or restart exist. The signal is set to 0 when the instruction is ready, or when PP is moved.

Program execution

The message box is displayed according to the programmed arguments. Program execution waits until the user selects one button or the message box is interrupted by a time-out or signal action. The user selection and interrupt reason are transferred back to the program.

New message box on trap level takes the focus from the message box on the basic level.

Predefined data

icondata

The following constants of the data type icondata are predefined in the system:

Value	Constant	Icon
0	iconNone	No icon
1	iconInfo	Information icon
2	iconWarning	Warning icon
3	iconError	Error icon
4	iconQuestion	Question icon

buttondata

The following constants of the data type buttondata are predefined in the system.

Value	Constants	Button displayed
-1	btnNone	No button
0	btnOK	OK
1	btnAbtrRtryIgn	Abort, Retry and Ignore
2	btnOKCancel	OK and Cancel
3	btnRetryCancel	Retry and Cancel
4	btnYesNo	Yes and No
5	btnYesNoCancel	Yes, No and Cancel

It is possible to display user defined push buttons with the functions UIMessageBox and UIListView.



Note

The texts displayed using buttondata are automatically localized to the selected language for the user interface. Other strings are not automatically localized.

Continues on next page

1 Instructions

1.304 UIMsgBox - User Message Dialog Box type basic

RobotWare Base

Continued

btnres

The following constants of the data type btnres are predefined in the system.

Value	Constants	Button answer
0	resUnkwn	Unknown result
1	resOK	OK
2	resAbort	Abort
3	resRetry	Retry
4	resIgnore	Ignore
5	resCancel	Cancel
6	resYes	Yes
7	resNo	No

It is possible to work with user defined push buttons that answer with the functions `UIMessageBox` and `UIListView`.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
ERR_TP_NO_CLIENT	There is no client, e.g. a <code>FlexPendant</code> , to take care of the instruction.
ERR_UI_BUTTONS	The argument <code>Buttons</code> of type <code>buttondata</code> has a not allowed value.
ERR_UI_ICON	The argument <code>Icon</code> of type <code>icondata</code> has a not allowed value.

If parameter `\BreakFlag` is not used then these situations can then be dealt with by the error handler:

- If there is a time-out (parameter `\MaxTime`) before an input from the operator then the system variable `ERRNO` is set to `ERR_TP_MAXTIME` and the execution continues in the error handler.
- If digital input is set (parameter `\DIBreak`) before an input from the operator then the system variable `ERRNO` is set to `ERR_TP_DIBREAK` and the execution continues in the error handler.
- If a digital output is set (parameter `\DOBreak`) before an input from the operator then the system variable `ERRNO` is set to `ERR_TP_DOBREAK` and the execution continues in the error handler.
- If a persistent boolean is set (parameter `\PersBoolBreak`) before an input from the operator then the system variable `ERRNO` is set to `ERR_TP_PERSBOOLBREAK` and the execution continues in the error handler.

Continues on next page

More examples

More examples of how to use the instruction UIMsgBox are illustrated below.

Example 1

```
VAR errnum err_var;
...
UIMsgBox \Header:= "Example 1", "Waiting for a break condition..."
        \Buttons:=btnNone \Icon:=iconInfo \MaxTime:=60 \DIBreak:=di5
        \BreakFlag:=err_var;

TEST err_var
CASE ERR_TP_MAXTIME:
    ! Time out break, max time 60 seconds has elapsed
CASE ERR_TP_DIBREAK:
    ! Input signal break, signal di5 has been set to 1
DEFAULT:
    ! Not such case defined
ENDTEST
```

The message box is displayed until a break condition has become true. The operator cannot answer or remove the message box because btnNone is set for the argument \Buttons. The message box is removed when di5 is set to 1 or at time out (after 60 seconds).

Example 2

```
VAR errnum err_var;
...
UIMsgBox \Header:= "Example 2", "Waiting for a break condition..."
        \Buttons:=btnNone \Icon:=iconInfo \MaxTime:=60 \DIBreak:=di5
        \DIPassive \BreakFlag:=err_var;

TEST err_var
CASE ERR_TP_MAXTIME:
    ! Time out break, max time 60 seconds has elapsed
CASE ERR_TP_DIBREAK:
    ! Input signal break, signal di5 has been set to 0
DEFAULT:
    ! Not such case defined
ENDTEST
```

The message box is displayed until a break condition has become true. The operator can not answer or remove the message box because btnNone is set for the argument \Buttons. The message box is removed when di5 is set to 0 or at time out (after 60 seconds).

Limitations

Avoid using too small values for the time-out parameter \MaxTime when UIMsgBox is frequently executed, like in a loop. It can result in an unpredictable behavior of the system performance, like slow response of the FlexPendant.

Syntax

UIMsgBox

Continues on next page

1 Instructions

1.304 UIMsgBox - User Message Dialog Box type basic

RobotWare Base

Continued

```
['\\Header':=' <expression (IN) of string>',']  
[MsgLine1:=''] <expression (IN) of string>  
['\\MsgLine2':='<expression (IN) of string>  
['\\MsgLine3':='<expression (IN) of string>  
['\\MsgLine4':='<expression (IN) of string>  
['\\MsgLine5':='<expression (IN) of string>  
['\\Wrap]  
['\\Buttons':=' <expression (IN) of buttontdata>  
['\\Icon':=' <expression (IN) of icondata>  
['\\Image':='<expression (IN) of string>  
['\\Result':='< variable or persistent (INOUT) of btnres>  
['\\MaxTime':=' <expression (IN) of num>  
['\\DIBreak':=' <variable (VAR) of signaldi>  
['\\DIPassive]  
['\\DOBreak':=' <variable (VAR) of signaldo>  
['\\DOPassive]  
['\\PersBoolBreak ':=' <persistent (PERS) of bool>  
['\\PersBoolPassive]  
['\\BreakFlag':=' <variable or persistent (INOUT) of errnum>  
['\\UIActiveSignal ':=' <variable (VAR) of signaldo>' ;'
```

Related information

For information about	See
Icon display data	icondata - Icon display data on page 1652
Push button data	buttontdata - Push button data on page 1595
Push button result data	btnres - Push button result data on page 1593
User Interaction Message Box type advanced	UIMessageBox - User Message Box type advanced on page 1556
User Interaction Number Entry	UINumEntry - User Number Entry on page 1565
User Interaction Number Tune	UINumTune - User Number Tune on page 1573
User Interaction Alpha Entry	UIAlphaEntry - User Alpha Entry on page 1524
User Interaction List View	UIListView - User List View on page 1547
System connected to FlexPendant and so on.	UIClientExist - Exist User Client on page 1531
Clean up the Operator window	TPErase - Erases text printed on the FlexPendant on page 832

1.305 UIMsgWrite - User message dialog box type non-waiting

Usage

UIMsgWrite (*User Interaction Message Write*) is used to communicate with the user of the robot system on an available user device, such as the FlexPendant. A message is written to the operator.

Basic examples

The following examples illustrate the instruction UIMsgWrite.

Example 1

```
VAR string myHeader := "Signal error!";

UIMsgWrite myHeader, "Set signal di1 high please!" \Icon:=iconInfo;
WaitDI di1, 1;
UIMsgWriteAbort;
```

The message "*Set signal di1 high please!*" is displayed. The program proceeds and the message is removed when the signal di1 is set.

Example 2

```
VAR string myHeader := "Signal Error!";
VAR string myMsgArray{5}:= ["Set", "signal", "di1", "high",
    "please!"];
UIMsgWrite myHeader, myMsgArray, \Icon:=iconInfo
    \Image:= "MyImage.jpg";
WaitDI di1, 1;
UIMsgWriteAbort;
```

The message including header, five lines of message, icon, and image is displayed. The program proceeds and the message is removed when the signal di1 is set. Note that message line 1 to message line 5 are displayed on separate lines 1 to 5 (the switch \Wrap is not used).

Arguments

```
UIMsgWrite Header Message | MsgArray [\Wrap] [\Icon] [\Image]
[\PersBool] | [\PersBoolName] [\AbortValue] [\UIActiveSignal]
```

Header

Data type: string

Header text to be written at the top of the message box. Maximum 40 characters.

Message

Data type: string

One text line to be written on the display. Maximum 50 characters.

MsgArray

(*Message Array*)

Data type: string

Continues on next page

1 Instructions

1.305 UIMsgWrite - User message dialog box type non-waiting

RobotWare Base

Continued

Several text lines from an array to be written on the display. Only one of the parameters `Message` or `MsgArray` can be used at the same time.

Maximum layout space is 5 lines with 50 characters each.

`[\Wrap]`

Data type: `switch`

If selected, all the lines in `MsgArray` will be concatenated to one string with a single space between each individual string and spread out on as few lines as possible.

Default, each line in `MsgArray` will be on separate lines on the display.

`[\Icon]`

Data type: `icondata`

Defines the icon to be displayed. Only one of the predefined icons of type `icondata` can be used, see [Predefined data on page 975](#).

Default no icon.

`[\Image]`

Data type: `string`

The name or full path to the image that should be used. If only a filename is provided, the FlexPendant will look for it in the `HOME:` directory. The path must follow this format: `HOME:/subfolder1/image.png`

No restart is required when a new or updated image is added. If an existing image is replaced by a new image with the same filename, then the user needs to log out and log in.

The files are included in backup and restore. If the files are placed directly in the active system, they are not included in backup and restore.

The image can have the width of 250 pixels and the height of 470 pixels. If the image is bigger, only 250x470 pixels of the image are shown, starting at the top left of the image.

The program execution will just continue if an image is used that has not been found in the specified path.

Supported image formats: `jpg`, `png`, `jpeg`, `bmp`

If other formats are used, it may or may not work.

`[\PersBool]`

(Persistent Bool)

Data type: `bool`

The message will be displayed as long as the specified `bool` is `FALSE`. If the parameter `AbortValue` is used, the message will be displayed as long as the specified `bool` differs in value from `AbortValue`.

Only an entire `PERS bool` or `TASK PERS bool` variable can be used.

`[\PersBoolName]`

(Persistent Bool Name)

Data type: `string`

Continues on next page

The message will be displayed as long as the specified bool is FALSE. If the parameter AbortValue is used, the message will be displayed as long as the specified bool differs in value from AbortValue.

Only an entire PERS bool or TASK PERS bool variable name can be used.

If using the \PersBoolName argument, it is possible to use a PERS bool variable declared in another task in the UIMsgWrite instruction.

[\AbortValue]

Data type: bool

Only valid if PersBool is present. The expected value for PersBool. The message will be displayed until PersBool equals AbortValue.

[\UIActiveSignal]

Data type: signaldo

The digital output signal used in optional argument UIActiveSignal is set to 1 when the message box is activated on the FlexPendant. The signal is set to 0 when the message box is removed with instruction UIMsgWriteAbort or when the PersBool expression is fulfilled.

No supervision of stop or restart exist. The signal is set to 0 when PP is moved.

Program execution

The message with icon, header, message lines, image, and unfulfilled expressions are displayed according to the programmed arguments. The message is displayed until the message is aborted by UIMsgWriteAbort, or the expression used in PersBool or PersBoolName arguments is fulfilled.

- A new message on basic level will replace an older message.
- A new message on trap level will replace an older message on basic level, and stay active when returning to basic level.
- A new message in a service routine will always be aborted when returning to basic level. Any active message on basic level will then be reactivated.
- A new user message generated by the following instructions and functions will replace a message generated by UIMsgWrite:

TPReadFK, TPReadDnum, TPReadNum, UIMsgBox, UIMessageBox, UIDnumEntry, UIDnumTune, UINumEntry, UINumTune, UIAlphaEntry, UIListView. A message box from one of the waiting instructions WaitAI, WaitAO, WaitGI, WaitGO, WaitDI, WaitDO, WaitUntil will also replace a message generated by UIMsgWrite.

Predefined data

The following constants of the data type icondata are predefined in the system:

Value	Constant	Icon
0	iconNone	No icon
1	iconInfo	Information icon
2	iconWarning	Warning icon

Continues on next page

1 Instructions

1.305 UIMsgWrite - User message dialog box type non-waiting

RobotWare Base

Continued

Value	Constant	Icon
3	iconError	Error icon
4	iconQuestion	Question icon

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).
ERR_SYM_ACCESS	The data object used in [<code>\PersBoolName</code>] is non-existent.

Syntax

```
UIMsgWrite
[Header ':='] <expression (IN) of string> ', '
[Message ':='] <expression (IN) of string>
| [MsgArray ':='] <array {*} (IN) of string>
['\ ' Wrap]
['\ ' Icon ':=' <expression (IN) of icondata>]
['\ ' Image ':=' <expression (IN) of string>]
['\ ' PersBool ':=' <persistent (IN) of bool>]
| ['\ ' PersBoolName ':=' <persistent (IN) of string>]
['\ ' AbortValue ':=' <variable or persistent (IN) of bool>]
['\ ' UIActiveSignal ':=' <variable (VAR) of signaldo>] ';'
;
```

Related information

For information about	See
Icon display data	icondata - Icon display data on page 1652
Abort user message dialog	UIMsgWriteAbort - Abort user message dialog box type non-waiting on page 977
System connected to FlexPendant and so on.	UIClientExist - Exist User Client on page 1531
Cyclic bool	Application manual - Controller software Omni-Core

1.306 UIMsgWriteAbort - Abort user message dialog box type non-waiting

Usage

UIMsgWriteAbort is used to abort an active message that has previously been launched by an UIMsgWrite instruction.

Basic examples

The following example illustrates the instruction UIMsgWriteAbort.

Example 1

```

VAR string myHeader := "Signal error!";

UIMsgWrite myHeader, "Set signal di1 high please!", iconInfo;
WaitDI di1, 1;
UIMsgWriteAbort;

```

The message *"Set signal di1 high please!"* is displayed. The program proceeds and the message is removed when the signal di1 is set.

Syntax

```
UIMsgWriteAbort ';' ;'
```

Related information

For information about	See
Icon display data	icondata - Icon display data on page 1652
Write user message dialog	UIMsgWrite - User message dialog box type non-waiting on page 973
System connected to FlexPendant and so on.	UIClientExist - Exist User Client on page 1531
Cyclic bool	<i>Application manual - Controller software Omni-Core</i>

1 Instructions

1.307 UnLoad - Unload a program module during execution

RobotWare Base

1.307 UnLoad - Unload a program module during execution

Usage

UnLoad is used to unload a program module from the program memory during execution.

The program module must have previously been loaded into the program memory using the instructions Load or StartLoad - WaitLoad.

Basic examples

The following example illustrates the instruction UnLoad:

See also [More examples on page 979](#) below.

Example 1

```
UnLoad diskhome \File:="PART_A.modx";
```

Unload the program module PART_A.modx from the program memory that was previously loaded into the program memory with Load. (See instruction Load). diskhome is a predefined string constant "HOME:".

Arguments

```
UnLoad [\ErrIfChanged] | [\Save] FilePath [\File]
```

[\ErrIfChanged]

Data type: switch

If this argument is used, and the module has been changed since it was loaded into the system, then the instruction will generate the error recovery code ERR_NOTSAVED.

[\Save]

Data type: switch

If this argument is used then the program module is saved before the unloading starts. The program module will be saved at the original place specified in the Load or StartLoad instruction.

FilePath

Data type: string

The file path and the file name to the file that will be unloaded from the program memory. The file path and the file name must be the same as in the previously executed Load or StartLoad instruction. The file name shall be excluded when the argument \File is used.

[\File]

Data type: string

When the file name is excluded in the argument FilePath, then it must be defined with this argument. The file name must be the same as in the previously executed Load or StartLoad instruction.

Continues on next page

Program execution

To be able to execute an UnLoad instruction in the program, a Load or StartLoad - WaitLoad instruction with the same file path and name must have been executed earlier in the program.

The program execution waits for the program module to finish unloading before the execution proceeds with the next instruction.

After that the program module is unloaded, and the rest of the program modules will be linked.

For more information see the instructions Load or StartLoad-Waitload.

**Note**

Be aware of that Load, UnLoad, and WaitLoad can affect both the motion execution and other RAPID execution and shall therefore be called with caution.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NOTSAVED	The argument \ErrIfChanged is used and the module has been changed.
ERR_UNLOAD	The file in the UnLoad instruction cannot be unloaded because of ongoing execution within the module or wrong path (module not loaded with Load or StartLoad).

More examples

More examples of how to use the instruction UnLoad are illustrated below.

Example 1

```
UnLoad "HOME:/DOORDIR/D00R1.modx";
```

Unload the program module D00R1.modx from the program memory that was previously loaded into the program memory.

Example 2

```
UnLoad "HOME:" \File:="D0ORDIR/D00R1.modx";
```

Same as in example 1 above but another syntax.

Example 3

```
Unload \Save, "HOME:" \File:="D0ORDIR/D00R1.modx";
```

Same as in examples 1 and 2 above but saves the program module before unloading.

Limitations

It is not allowed to unload a program module that is executing (program pointer in the module).

Trap routines, system I/O events, and other program tasks cannot execute during the unloading.

Continues on next page

1 Instructions

1.307 UnLoad - Unload a program module during execution

RobotWare Base

Continued

Avoid ongoing robot movements during the unloading.

Program stop during execution of UnLoad instruction can result in guard stop with motors off and error message "20025 Stop order timeout" on the FlexPendant.

Syntax

```
UnLoad
  ['\\ErrIfChanged ','] | ['\\Save ',']
  [FilePath':=']<expression (IN) of string>
  ['\\File':=' <expression (IN) of string>'];'
```

Related information

For information about	See
Check program references	CheckProgRef - Check program references on page 127
Load a program module	Load - Load a program module during execution on page 332 StartLoad - Load a program module during execution on page 759 WaitLoad - Connect the loaded module to the task on page 1031
Path references and the directory structure	Operating manual - OmniCore , section Directory structure on OmniCore

1.308 UnpackRawBytes - Unpack data from rawbytes data

Usage

UnpackRawBytes is used to unpack the contents of a container of type rawbytes to variables of type byte, num, dnum or string.

Basic examples

The following example illustrates the instruction UnpackRawBytes.

See also [More examples on page 984](#).

Example 1

```

VAR iODEV io_device;
VAR rawbytes raw_data_out;
VAR rawbytes raw_data_in;
VAR num integer;
VAR dnum bigInt;
VAR num float;
VAR string string1;
VAR byte byte1;
VAR byte data1;

! Data packed in raw_data_out according to the protocol
...
Open "chan1:", io_device\Bin;
WriteRawBytes io_device, raw_data_out;
ReadRawBytes io_device, raw_data_in\Time := 1;
Close io_device;

```

According to the protocol that is known to the programmer, the message is sent to device "chan1:". Then the answer is read from the device.

The answer contains, for an example, the following:

byte number:	contents:
1-4	integer 5
5-8	float 234.6
9-25	string "This is real fun!". This is a ISO 8859-1 (Latin-1) string, with single-byte characters.
26	hex value '4D'
27	ASCII code 122, that is, z
28-36	integer 4294967295
37-40	integer 4294967295

```
UnpackRawBytes raw_data_in, 1, integer \IntX := DINT;
```

The contents of integer will be 5.

```
UnpackRawBytes raw_data_in, 5, float \Float4;
```

The contents of float will be 234.6 decimal.

```
UnpackRawBytes raw_data_in, 9, string1 \ISOLatin1Encoding:=17;
```

The contents of string1 will be "This is real fun!".

Continues on next page

1 Instructions

1.308 UnpackRawBytes - Unpack data from rawbytes data

RobotWare Base

Continued

```
UnpackRawBytes raw_data_in, 26, byte1 \Hex1;
```

The contents of byte1 will be '4D' hexadecimal.

```
UnpackRawBytes raw_data_in, 27, data1 \Hex1;
```

The contents of data1 will be 122, the ASCII code for "z".

```
UnpackRawBytes raw_data_in, 28, bigInt \IntX := LINT;
```

The contents of bigInt will be 4294967295.

```
UnpackRawBytes raw_data_in, 37, bigInt \IntX := UDINT;
```

The contents of bigInt will be 4294967295.

Arguments

```
UnpackRawBytes RawData [ \Network ] StartIndex Value [ \Hex1 ] | [
    \IntX ] | [ \Float4 ] | [ \UTF8Encoding ] | [
    \ISOLatin1Encoding ]
```

See [Combining the arguments on page 983](#).

RawData

Data type: rawbytes

Variable container to unpack data from.

[\Network]

Data type: switch

Indicates that integer and float shall be unpacked from big-endian (network order) represented in RawData. ProfiBus and InterBus use big-endian.

Without this switch, integer and float will be unpacked in little-endian (not network order) representation from RawData. DeviceNet uses little-endian.

Only relevant together with optional parameter \IntX - UINT, UDINT, , ULINT, INT, DINT, LINT, and \Float4.

StartIndex

Data type: num

StartIndex between 1 and 65536 indicates where to start unpacking data from RawData.

Value

Data type: anytype

Variable containing the data that was unpacked from RawData.

Allowed data types are: byte, num, dnum or string. Array cannot be used.

[\Hex1]

Data type: switch

The data to be unpacked and placed in Value has hexadecimal format in 1 byte and will be converted to decimal format in a byte variable.

[\IntX]

Data type: inttypes

Continues on next page

The data to be unpacked has the format according to the specified constant of data type `inttypes`. The data will be converted to a `num` or a `dnum` variable containing an integer and stored in `Value`.

See [Predefined data on page 984](#).

[`\Float4`]

Data type: `switch`

The data to be unpacked and placed in `Value` has float, 4 bytes, format, and it will be converted to a `num` variable containing a float.

[`\UTF8Encoding`]

Data type: `num`

If the optional argument `UTF8Encoding` together with a `RAPID` string in argument `Value` the data in the `rawbytes` variable will be copied as it is to the `RAPID` string variable. The `num` value used in argument is the number of bytes to copy.

String data is not NULL terminated in data of type `rawbytes`.



Note

One character can be 1-4 bytes in the `rawbytes` container, and will have the same size in the `RAPID` string variable.

[`\ISOLatin1Encoding`]

Data type: `num`

If the optional argument `ISOLatin1Encoding` together with a `RAPID` string in argument `Value` the data in the `rawbytes` variable will be converted from ISO 8859-1 (Latin-1) to UTF8 characters before copying the data to the `RAPID` string variable used in `Value`. The `num` value used in argument is the number of ISO 8859-1 (Latin-1) characters to copy.

String data is not NULL terminated in data of type `rawbytes`.



Note

One character is 1 byte in the `rawbytes` container, but can be 1-2 bytes in the `RAPID` string variable.

Combining the arguments

One of the arguments `\Hex1`, `\IntX`, `\Float4`, `\UTF8Encoding`, `ISOLatin1Encoding` must be used.

The following combinations are allowed:

Data type of <code>Value</code> :	Allowed optional parameters:
<code>num</code> ⁱ	<code>\IntX</code>
<code>dnum</code> ⁱⁱ	<code>\IntX</code>
<code>num</code>	<code>\Float4</code>
<code>string</code>	<code>\UTF8Encoding</code> (1-80 bytes) or <code>\ISOLatin1Encoding</code> (1-80 characters)

Continues on next page

1 Instructions

1.308 UnpackRawBytes - Unpack data from rawbytes data

RobotWare Base

Continued

Data type of Value:	Allowed optional parameters:
byte	\Hex1

- i Must be an integer within the value range of selected symbolic constant USINT, UINT, UDINT, SINT, INT or DINT.
- ii Must be an integer within the value range of selected symbolic constant USINT, UINT, UDINT, ULINT, SINT, INT, DINT or LINT.

Program execution

During program execution data is unpacked from the container of type rawbytes into a variable of type anytype.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type iODEV will be reset.

Predefined data

The following symbolic constants of the data type inttypes are predefined and can be used to specify the integer in parameter \IntX.

Symbolic constant	Constant value	Integer format	Integer value range
USINT	1	Unsigned 1 byte integer	0 ... 255
UINT	2	Unsigned 2 byte integer	0 ... 65 535
UDINT	4	Unsigned 4 byte integer	0 ... 8 388 608 ⁱ 0 ... 4 294 967 295 ⁱⁱ
ULINT	8	Unsigned 8 byte integer	0 ... 4 503 599 627 370 496 ⁱⁱⁱ
SINT	- 1	Signed 1 byte integer	- 128... 127
INT	- 2	Signed 2 byte integer	- 32 768 ... 32 767
DINT	- 4	Signed 4 byte integer	- 8 388 607 ... 8 388 608 ⁱ -2 147 483 648 ... 2 147 483 647 ^{iv}
LINT	- 8	Signed 8 byte integer	- 4 503 599 627 370 496... 4 503 599 627 370 496 ⁱⁱⁱ

- i Limitation in RAPID for storage of integer in data type num.
- ii Range when using a dnum variable and inttype UDINT.
- iii Limitation in RAPID for storage of integer in data type dnum.
- iv Range when using a dnum variable and inttype DINT.

More examples

More examples of how to use the instructions UnPackRawBytes and PackRawBytes are illustrated below.

According to the protocol that is known to the programmer, the content of the rawbytes variable will be like this for the following examples.

Example 1

Byte number:	Contents:
1-4	An integer, the length of the RAPID string
5-39	The actual RAPID string in UTF8 encoding
40-43	An decimal value

Continues on next page

1.308 UnpackRawBytes - Unpack data from rawbytes data

*RobotWare Base**Continued*

```

VAR rawbytes raw_data;
VAR num integer;
VAR num float := 13.4;
VAR string multibyte_str:="å, ä, ö is multi-byte characters";
..
! Get the number of bytes of the multibyte_str RAPID string
integer:=StrSize(multibyte_str);
! Set the length of multibyte_str in the first 4 bytes
PackRawBytes integer, raw_data, (RawBytesLen(raw_data)+1)
  \IntX:=DINT;
! The contents of next 35 bytes in raw_data will the content of
  multibyte_str
PackRawBytes multibyte_str, raw_data, (RawBytesLen(raw_data)+1)
  \UTF8Encoding;
! The contents of the next 4 bytes in raw_data will be 13.4 decimal.
PackRawBytes float, raw_data, (RawBytesLen(raw_data)+1) \Float4;
..

```

Pack the size of the string to send, the actual RAPID string (UTF8 encoded string), and a decimal value in the rawbytes container.

Example 2

```

VAR rawbytes raw_data;
VAR num read_int;
VAR string read_str;
VAR num read_float;
..
! Get the number of bytes the RAPID string contains
UnpackRawBytes raw_data, 1, read_int \IntX:=DINT;
! Get the actual RAPID string. read_int specifies number of bytes
  to read
UnpackRawBytes raw_data, 5, read_str \UTF8Encoding:=read_int;
! Get the decimal value. Use read string length to get right byte
  position
UnpackRawBytes raw_data, 5+read_int, read_float \Float4;
..

```

Unpack the size of the RAPID string, the actual RAPID string (UTF8 encoded string), and a decimal value from the rawbytes container.

Syntax

```

UnpackRawBytes
[RawData ':='] <variable (VAR) of rawbytes>
['\ ' Network]', '
[StartIndex ':='] <expression (IN) of num>', '
[Value ':='] <variable (VAR) of anytype>
['\ ' Hex1]
|['\ ' IntX' :=] <expression (IN) of inttypes>]
|['\ ' Float4 ]
|['\ ' UTF8Encoding' :=] <expression (IN) of num>]
|['\ ' ISOLatin1Encoding '=' <expression (IN) of num>]';'

```

Continues on next page

1 Instructions

1.308 UnpackRawBytes - Unpack data from rawbytes data

RobotWare Base

Continued

Related information

For information about	See
rawbytes data	rawbytes - Raw data on page 1702
Get the length of rawbytes data	RawBytesLen - Get the length of rawbytes data on page 1404
Clear the contents of rawbytes data	ClearRawBytes - Clear the contents of rawbytes data on page 140
Copy the contents of rawbytes data	CopyRawBytes - Copy the contents of rawbytes data on page 165
Pack DeviceNet header into rawbytes data	PackDNHeader - Pack DeviceNet Header into rawbytes data on page 506
Pack data into rawbytes data	PackRawBytes - Pack data into rawbytes data on page 509
Write rawbytes data	WriteRawBytes - Write rawbytes data on page 1078
Read rawbytes data	ReadRawBytes - Read rawbytes data on page 576
Bit/Byte Functions	<i>Technical reference manual - RAPID Overview</i>
String functions	<i>Technical reference manual - RAPID Overview</i>
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>

1.309 VelSet - Changes the programmed velocity

Usage

VelSet is used to increase or decrease the programmed velocity of all subsequent movement instructions. This instruction is also used to limit the maximum TCP velocity.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the instruction VelSet:

See also [More examples on page 988](#).

Example 1

```
VelSet 50, 800;
```

All the programmed velocities are decreased to 50% of the value in the instruction. The TCP velocity is not permitted to exceed 800 mm/s.

Arguments

VelSet Override Max

Override

Data type: num

Desired velocity as a percentage of programmed velocity. 100% corresponds to the programmed velocity.

Max

Data type: num

Maximum TCP velocity in mm/s.

Program execution

The programmed velocity applies for the next executed movement instruction until a new VelSet instruction is executed.

The argument *Override* affects:

- All velocity components (TCP, orientation, rotating, and linear external axes) in speeddata.
- The programmed velocity override in the positioning instruction (the argument \V).
- Timed movements.

The argument *Override* does not affect:

- The welding speed in welddata.
- The heating and filling speed in seamdata.

The argument *Max* only limits the velocity of the TCP if it is lower than the programmed velocity.

Continues on next page

1 Instructions

1.309 VelSet - Changes the programmed velocity

RobotWare Base

Continued

The default values for Override and Max are 100% and `vmax.v_tcp` mm/s respectively. These values are automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to `main`
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.



Note

The maximum TCP speed for the used robot type can be changed in the *Motion* configuration system parameters, type *Motion Planner* and attribute *Linear Max Speed*. The RAPID function `MaxRobSpeed` returns the same value.

More examples

More examples of how to use the instruction `VelSet` are illustrated below.

Example 1

```
VelSet 50, 800;  
MoveL p1, v1000, z10, tool1;  
MoveL p2, v2000, z10, tool1;  
MoveL p3, v1000\T:=5, z10, tool1;
```

The speed is 500 mm/s to point p1 and 800 mm/s to p2. It takes 10 seconds to move from p2 to p3.

Limitations

The maximum speed is not taken into consideration when the time is specified in the movement instruction.

Syntax

```
VelSet  
[ Override ':=' ] < expression (IN) of num > ', '  
[ Max ':=' ] < expression (IN) of num > ';' ;
```

Related information

For information about	See
Reduction of acceleration	AccSet - Reduces the acceleration on page 23
Max. TCP speed for this robot	MaxRobSpeed - Maximum robot speed on page 1346
Motion settings data	motsetdata - Motion settings data on page 1674
Definition of velocity	speeddata - Speed data on page 1729
Positioning instructions	Technical reference manual - RAPID Overview

1.310 WaitAI - Waits until an analog input signal value is set

Usage

WaitAI (*Wait Analog Input*) is used to wait until an analog input signal value is set.

Basic examples

The following examples illustrate the instruction WaitAI:

Example 1

```
WaitAI ai1, \GT, 5;
```

Program execution only continues after the ai1 analog input has value greater than 5.

Example 2

```
WaitAI ai1, \LT, 5;
```

Program execution only continues after the ai1 analog input has value less than 5.

Arguments

```
WaitAI Signal [\LT] | [\GT] Value [\MaxTime] [\ValueAtTimeout]  
[\Visualize] [\Header] [\Message] | [\MsgArray] [\Wrap]  
[\Icon] [\Image] [\VisualizeTime] [\UIActiveSignal]  
[\ErrorNumber] [\TimeOutSignal] [\TimeOutGOSignal]  
[\TimeOutGOValue]
```

Signal

Data type: signalai

The name of the analog input signal.

[\LT]

Less Than

Data type: switch

If using this parameter, the WaitAI instruction waits until the analog signal value is less than the value in Value.

[\GT]

Greater Than

Data type: switch

If using this parameter the WaitAI instruction waits until the analog signal value is greater than the value in Value.

Value

Data type: num

The desired value of the signal.

[\MaxTime]

Maximum Time

Data type: num

Continues on next page

1 Instructions

1.310 WaitAI - Waits until an analog input signal value is set

RobotWare Base

Continued

The maximum period of waiting time permitted, expressed in seconds. If this time runs out before the condition is met, the error handler will be called, if there is one, with the error code ERR_WAIT_MAXTIME. If there is no error handler, the execution will be stopped.

[`\ValueAtTimeout`]

Data type: num

If the instruction time-out, the current signal value will be stored in this variable. The variable will only be set if the system variable ERRNO is set to ERR_WAIT_MAXTIME.

[`\Visualize`]

Data type: switch

If selected, the visualization is activated. The visualization consists of a message box with the condition that is not fulfilled, icon, header, message lines, and image is displayed according to the programmed arguments.

[`\Header`]

Data type: string

Header text to be written at the top of the message box. Maximum 40 characters. If no `\Header` argument is used a default message will be displayed.

[`\Message`]

Data type: string

One text line to be written on the display. Maximum 50 characters.

[`\MsgArray`]

(*Message Array*)

Data type: string

Several text lines from an array to be written on the display. Only one of the parameters `\Message` or `\MsgArray` can be used at the same time.

Maximum layout space is 5 lines with 50 characters each.

[`\Wrap`]

Data type: switch

If selected, all the specified strings in the argument `\MsgArray` will be concatenated to one string with a single space between each individual string and spread out on as few lines as possible.

Default, each string in the argument `\MsgArray` will be on separate lines on the display.

[`\Icon`]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 1652](#).

Default, no icon.

Continues on next page

[\Image]

Data type: string

The name of the image that should be used. To launch your own images, the images have to be placed in the *HOME:* directory in the active system or directly in the active system.

The recommendation is to place the files in the *HOME:* directory so that they are saved if a backup and restore is done.

A restart is required and then the FlexPendant will load the images.

The image that will be shown can have the width of 185 pixels and the height of 300 pixels. If the image is larger, then only 185 * 300 pixels of the image will be shown starting at the top left of the image.

No exact value can be specified on the size that an image can have or the amount of images that can be loaded to the FlexPendant. It depends on the size of other files loaded to the FlexPendant. The program execution will just continue if an image is used that has not been loaded to the FlexPendant.

[\VisualizeTime]

Data type: num

The waiting time before the message box should appear on the FlexPendant. If using the arguments \VisualizeTime and \MaxTime, the time used in argument \MaxTime needs to be bigger than the time used in argument \VisualizeTime.

The default time for the visualization if not using the argument \VisualizeTime is 5 s. Minimum value 1 s. Maximum value no limit. Resolution 0.001 s.

[\UIActiveSignal]

Data type: signaldo

The digital output signal used in optional argument UIActiveSignal is set to 1 when the visualization message box is activated on the FlexPendant. When the message box is removed (when the condition is met), the signal is set to 0 again.

No supervision of stop or restart exist. The signal is set to 0 when the instruction is ready, or when PP is moved.

[\ErrorNumber]

Error number

Data type: errnum

A variable (before used it is set to 0 by the system) that will hold the error constant if the instruction ends before the signal has the desired value.

If this optional variable is omitted then the error handler will be executed. The constants ERR_GO_LIM, ERR_NO_ALIASIO_DEF, ERR_NORUNUNIT, ERR_SIG_NOT_VALID, and ERR_WAIT_MAXTIME can be used to select the reason.

[\TimeOutSignal]

Data type: signaldo

If TimeOutSignal is used, the signal is set to 0 when entering the wait instruction. It is set to 1 if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the wait instruction.

Continues on next page

1 Instructions

1.310 WaitAI - Waits until an analog input signal value is set

RobotWare Base

Continued

This argument can only be used if the argument `MaxTime` is used.

`[\TimeOutGOSignal]`

Data type: `signalgo`

If `TimeOutGOSignal` is used, the signal is set to 0 when entering the `Wait` instruction. It is set to the value used in the argument `TimeOutGOValue` if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the `Wait` instruction.

The optional arguments `TimeOutGOSignal` and `TimeOutGOValue` must be used together.

This argument can only be used if the argument `MaxTime` is used.

`[\TimeOutGOValue]`

Data type: `dnum`

The argument `TimeOutGOValue` holds the value that the signal in argument `TimeOutGOSignal` will be set to, if the instruction times out after waiting.

The optional arguments `TimeOutGOSignal` and `TimeOutGOValue` must be used together.

This argument can only be used if the argument `MaxTime` is used.

Program execution

If the value of the signal is correct when the instruction is executed, the program simply continues with the following instruction.

If the signal value is incorrect, the robot enters a waiting state and the program continues when the signal changes to the correct value. The change is detected with an interrupt, which gives a fast response (not polled).

When the robot is waiting, the time is supervised. By default, the robot can wait forever, but the maximal waiting time can be specified with the optional argument `\MaxTime`. If this maximum time is exceeded, an error is raised.

If program execution is stopped, and later restarted, the instruction evaluates the current value of the signal. Any change during program stop is rejected.

In manual mode, after waiting more than 3 s, an alert box will pop up asking if the instruction should be simulated. It is possible to configure the alert to not appear, by setting the system parameter *SimulateMenu* to NO, see *Technical reference manual - System parameters*, topic *Controller*, type *General RAPID*.

If the switch `\Visualize` is used, a message box is displayed on the FlexPendant according to the programmed arguments. If no `\Header` argument is used a default header text will be displayed. When the execution of the `WaitAI` instruction is ready, the message box will be removed from the FlexPendant.

New message box on trap level takes the focus from the message box on the basic level.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AO_LIM	The programmed Value argument for the specified analog input signal Signal is outside limits.
ERR_GO_LIM	The programmed TimeOutGOValue argument for the specified digital group output signal TimeOutGOSignal is out of limit.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).
ERR_WAIT_MAXTIME	There is a time-out (parameter \MaxTime) before the signal changes to the right value.

More examples

More examples of the instruction WaitAI are illustrated below.

Example 1

```
VAR num myvalattimeout:=0;
WaitAI ai1, \LT, 5 \MaxTime:=4 \ValueAtTimeout:=myvalattimeout;
ERROR
  IF ERRNO=ERR_WAIT_MAXTIME THEN
    TPWrite "Value of ai1 at timeout:" + ValToStr(myvalattimeout);
    TRYNEXT;
  ELSE
    ! No error recovery handling
  ENDIF
```

Program execution continues only if ai1 is less than 5, or when timing out. If timing out, the value of the signal ai1 at timeout can be logged without another read of signal.

Example 2

```
WaitAI ai1 \GT, 5 \Visualize \Header:="Waiting for signal"
  \MsgArray:["Movement will not start until", "the condition
  below is TRUE"] \Icon:=iconError;
MoveL p40, v500, z20, L10tip;
..
```

If the condition is not met then the header and message specified in the optional arguments \Header and \MsgArray will be written on the display of the FlexPendant together with the condition that is not met.

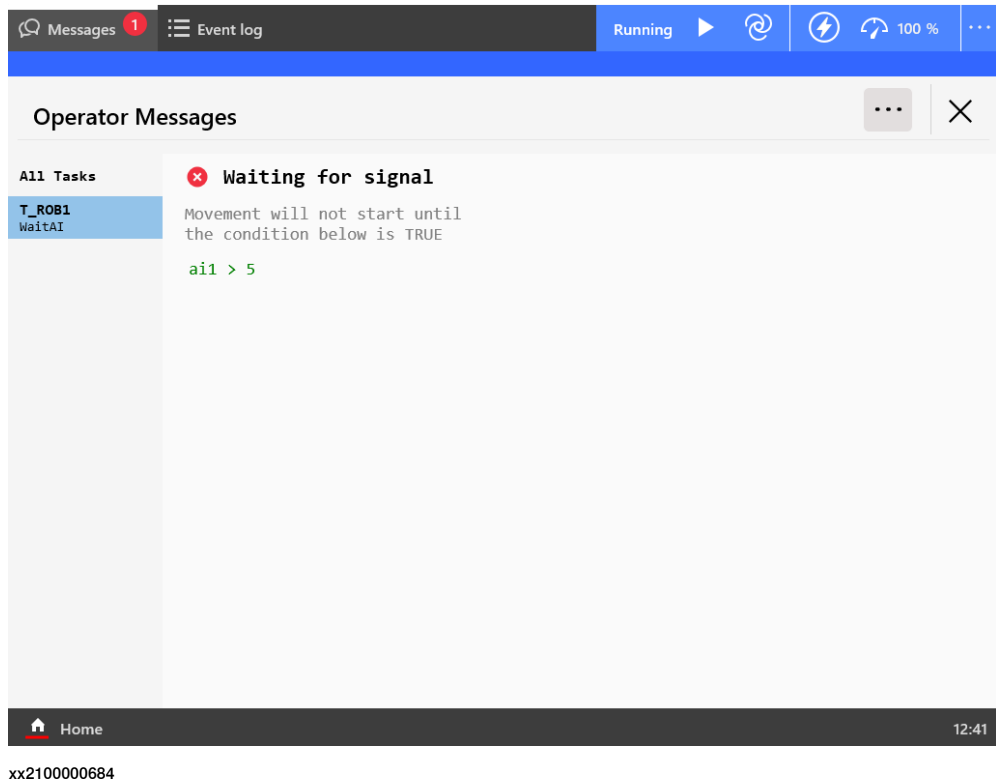
Continues on next page

1 Instructions

1.310 WaitAI - Waits until an analog input signal value is set

RobotWare Base

Continued



Syntax

```
WaitAI
[ Signal ':' ] <variable (VAR) of signalai> ','
[ '\\' LT ] | [ '\\' GT ] ','
[ Value ':' ] <expression (IN) of num>
['\\MaxTime ':'<expression (IN) of num>]
['\\ValueAtTimeout ':'<variable (VAR) of num>]
['\\ Visualize]
['\\ Header ':'<expression (IN) of string>]
['\\ Message ':'<expression (IN) of string>]
| ['\\ MsgArray ':'<array {*} (IN) of string>]
['\\ Wrap]
['\\ Icon ':'<expression (IN) of icondata>]
['\\ Image ':'<expression (IN) of string>]
['\\ VisualizeTime ':'<expression (IN) of num>]
['\\ UIActiveSignal ':'<variable (VAR) of signaldo>]
['\\ ErrorNumber ':'<variable or persistent (INOUT) of errnum>]
['\\ TimeOutSignal '='<variable (VAR) of signaldo>]
['\\ TimeOutGOSignal '='<variable (VAR) of signalgo>]
['\\ TimeOutGOValue '='<expression (IN) of dnum>'];'
```

Related information

For information about	See
Waiting until a condition is satisfied	WaitUntil - Waits until a condition is met on page 1046

Continues on next page

1.310 WaitAI - Waits until an analog input signal value is set

RobotWare Base

Continued

For information about	See
Waiting for a specified period of time	WaitTime - Waits a given amount of time on page 1044
Waiting until an analog output is set/reset	WaitAO - Waits until an analog output signal value is set on page 996

1 Instructions

1.311 WaitAO - Waits until an analog output signal value is set
RobotWare Base

1.311 WaitAO - Waits until an analog output signal value is set

Usage

WaitAO (*Wait Analog Output*) is used to wait until an analog output signal value is set.

Basic examples

The following examples illustrate the instruction WaitAO:

Example 1

```
WaitAO ao1, \GT, 5;
```

Program execution only continues after the ao1 analog output has value greater than 5.

Example 2

```
WaitAO ao1, \LT, 5;
```

Program execution only continues after the ao1 analog output has value less than 5.

Arguments

```
WaitAO Signal [\LT] | [\GT] Value [\MaxTime] [\ValueAtTimeout]  
[\Visualize] [\Header] [\Message] | [\MsgArray] [\Wrap]  
[\Icon] [\Image] [\VisualizeTime] [\UIActiveSignal]  
[\ErrorNumber] [\TimeOutSignal] [\TimeOutGOSignal]  
[\TimeOutGOValue]
```

Signal

Data type: signalao

The name of the analog output signal.

[\LT]

Less Than

Data type: switch

If using this parameter, the WaitAO instruction waits until the analog signal value is less than the value in Value.

[\GT]

Greater Than

Data type: switch

If using this parameter, the WaitAO instruction waits until the analog signal value is greater than the value in Value.

Value

Data type: num

The desired value of the signal.

[\MaxTime]

Maximum Time

Data type: num

Continues on next page

The maximum period of waiting time permitted, expressed in seconds. If this time runs out before the condition is met, the error handler will be called, if there is one, with the error code ERR_WAIT_MAXTIME. If there is no error handler, the execution will be stopped.

[`\ValueAtTimeout`]

Data type: num

If the instruction time-out, the current signal value will be stored in this variable. The variable will only be set if the system variable ERRNO is set to ERR_WAIT_MAXTIME.

[`\Visualize`]

Data type: switch

If selected, the visualization is activated. The visualization consists of a message box with the condition that is not fulfilled, icon, header, message lines, and image is displayed according to the programmed arguments.

[`\Header`]

Data type: string

Header text to be written at the top of the message box. Maximum 40 characters. If no `\Header` argument is used a default message will be displayed.

[`\Message`]

Data type: string

One text line to be written on the display. Maximum 50 characters.

[`\MsgArray`]

(*Message Array*)

Data type: string

Several text lines from an array to be written on the display. Only one of the parameters `\Message` or `\MsgArray` can be used at the same time.

Maximum layout space is 5 lines with 50 characters each.

[`\Wrap`]

Data type: switch

If selected, all the specified strings in the argument `\MsgArray` will be concatenated to one string with a single space between each individual string and spread out on as few lines as possible.

Default, each string in the argument `\MsgArray` will be on separate lines on the display.

[`\Icon`]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 1652](#).

Default, no icon.

Continues on next page

1 Instructions

1.311 WaitAO - Waits until an analog output signal value is set

RobotWare Base

Continued

[`\Image`]

Data type: `string`

The name of the image that should be used. To launch your own images, the images have to be placed in the *HOME:* directory in the active system or directly in the active system.

The recommendation is to place the files in the *HOME:* directory so that they are saved if a backup and restore is done.

A restart is required and then the FlexPendant will load the images.

The image that will be shown can have the width of 185 pixels and the height of 300 pixels. If the image is larger, then only 185 * 300 pixels of the image will be shown starting at the top left of the image.

No exact value can be specified on the size that an image can have or the amount of images that can be loaded to the FlexPendant. It depends on the size of other files loaded to the FlexPendant. The program execution will just continue if an image is used that has not been loaded to the FlexPendant.

[`\VisualizeTime`]

Data type: `num`

The waiting time before the message box should appear on the FlexPendant. If using the arguments `\VisualizeTime` and `\MaxTime`, the time used in argument `\MaxTime` needs to be bigger than the time used in argument `\VisualizeTime`.

The default time for the visualization if not using the argument `\VisualizeTime` is 5 s. Minimum value 1 s. Maximum value no limit. Resolution 0.001 s.

[`\UIActiveSignal`]

Data type: `signaldo`

The digital output signal used in optional argument `UIActiveSignal` is set to 1 when the visualization message box is activated on the FlexPendant. When the message box is removed (when the condition is met), the signal is set to 0 again.

No supervision of stop or restart exist. The signal is set to 0 when the instruction is ready, or when PP is moved.

[`\ErrorNumber`]

Error number

Data type: `errnum`

A variable (before used it is set to 0 by the system) that will hold the error constant if the instruction ends before the signal has the desired value.

If this optional variable is omitted then the error handler will be executed. The constants `ERR_GO_LIM`, `ERR_NO_ALIASIO_DEF`, `ERR_NORUNUNIT`, `ERR_SIG_NOT_VALID`, and `ERR_WAIT_MAXTIME` can be used to select the reason.

[`\TimeOutSignal`]

Data type: `signaldo`

If `TimeOutSignal` is used, the signal is set to 0 when entering the `Wait` instruction.

It is set to 1 if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the `Wait` instruction.

Continues on next page

This argument can only be used if the argument `MaxTime` is used.

`[\TimeOutGOSignal]`

Data type: `signalgo`

If `TimeOutGOSignal` is used, the signal is set to 0 when entering the `Wait` instruction. It is set to the value used in the argument `TimeOutGOValue` if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the `Wait` instruction.

The optional arguments `TimeOutGOSignal` and `TimeOutGOValue` must be used together.

This argument can only be used if the argument `MaxTime` is used.

`[\TimeOutGOValue]`

Data type: `dnum`

The argument `TimeOutGOValue` holds the value that the signal in argument `TimeOutGOSignal` will be set to, if the instruction times out after waiting.

The optional arguments `TimeOutGOSignal` and `TimeOutGOValue` must be used together.

This argument can only be used if the argument `MaxTime` is used.

Program execution

If the value of the signal is correct when the instruction is executed, the program simply continues with the following instruction.

If the signal value is incorrect, the robot enters a waiting state and the program continues when the signal changes to the correct value. The change is detected with an interrupt, which gives a fast response (not polled).

When the robot is waiting, the time is supervised. By default, the robot can wait forever, but the maximal waiting time can be specified with the optional argument `\MaxTime`. If this maximum time is exceeded, an error is raised.

If program execution is stopped, and later restarted, the instruction evaluates the current value of the signal. Any change during program stop is rejected.

In manual mode, after waiting more than 3 s, an alert box will pop up asking if the instruction should be simulated. It is possible to configure the alert to not appear, by setting the system parameter *SimulateMenu* to NO, see *Technical reference manual - System parameters*, topic *Controller*, type *General RAPID*.

If the switch `\Visualize` is used, a message box is displayed on the FlexPendant according to the programmed arguments. If no `\Header` argument is used a default header text will be displayed. When the execution of the `WaitAO` instruction is ready, the message box will be removed from the FlexPendant.

New message box on trap level takes the focus from the message box on the basic level.

Continues on next page

1 Instructions

1.311 WaitAO - Waits until an analog output signal value is set

RobotWare Base

Continued

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AO_LIM	The programmed Value argument for the specified analog output signal Signal is outside limits.
ERR_GO_LIM	The programmed TimeOutGOValue argument for the specified digital group output signal TimeOutGOSignal is out of limit.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).
ERR_WAIT_MAXTIME	There is a time-out (parameter \MaxTime) before the signal changes to the right value.

More examples

More examples of the instruction WaitAO are illustrated below.

Example 1

```
VAR num myvalattimeout:=0;
WaitAO ao1, \LT, 5 \MaxTime:=4 \ValueAtTimeout:=myvalattimeout;
ERROR
  IF ERRNO=ERR_WAIT_MAXTIME THEN
    TPWrite "Value of ao1 at timeout:" + ValToStr(myvalattimeout);
    TRYNEXT;
  ELSE
    ! No error recovery handling
  ENDIF
```

Program execution continues only if ao1 is less than 5, or when timing out. If timing out, the value of the signal ao1 at timeout can be logged without another read of signal.

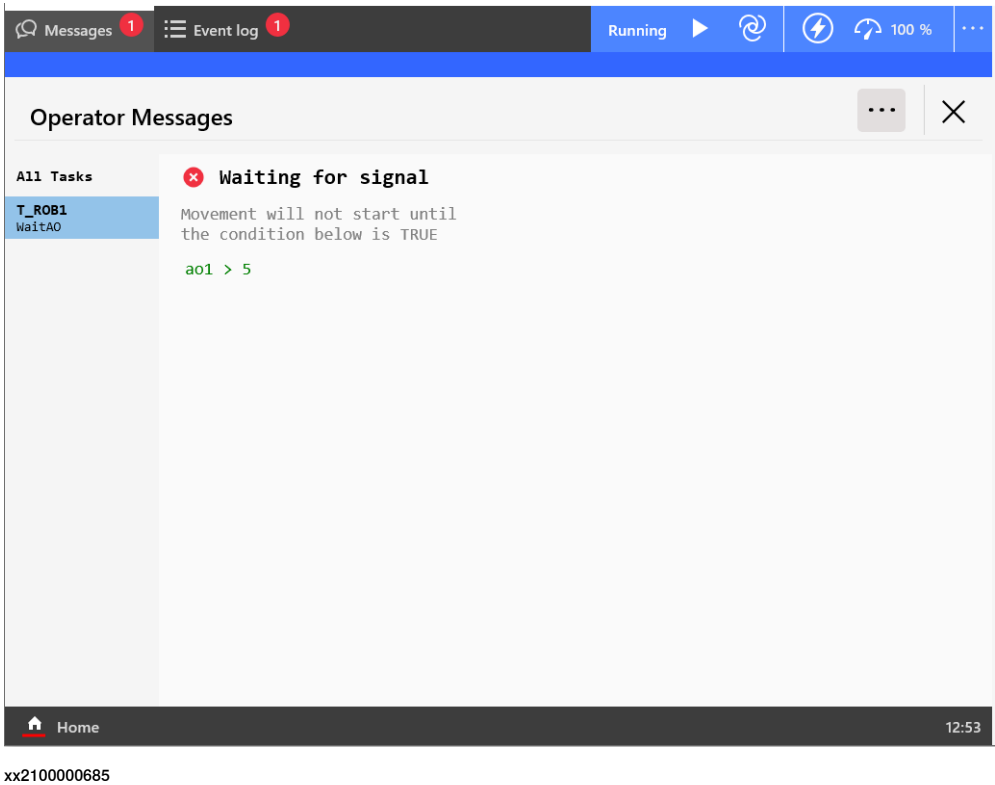
Example 2

```
WaitAO ao1 \GT, 5 \Visualize \Header:="Waiting for signal"
  \MsgArray:=["Movement will not start until", "the condition
  below is TRUE"] \Icon:=iconError;
MoveL p40, v500, z20, L10tip;
..
```

If the condition is not met then the header and message specified in the optional arguments \Header and \MsgArray will be written on the display of the FlexPendant together with the condition that is not met.

Continues on next page

1.311 WaitAO - Waits until an analog output signal value is set
RobotWare Base
Continued



Syntax

```
WaitAO
[ Signal ':'= ' ] <variable (VAR) of signalao> ', '
[ '\ ' LT] | [ '\ ' GT] ', '
[ Value ':'= ' ] <expression (IN) of num>
[ '\ 'MaxTime ':'=<expression (IN) of num>]
[ '\ 'ValueAtTimeout' ':'= <variable (VAR) of num>]
[ '\ ' Visualize]
[ '\ ' Header ':'= <expression (IN) of string>]]
[ '\ ' Message ':'= <expression (IN) of string>]
| [ '\ ' MsgArray ':'= <array {*} (IN) of string>]
[ '\ ' Wrap]
[ '\ ' Icon ':'= <expression (IN) of icondata>]
[ '\ ' Image ':'= <expression (IN) of string>]
[ '\ ' VisualizeTime ':'= <expression (IN) of num>]
[ '\ ' UIActiveSignal ':'= <variable (VAR) of signaldo>]
[ '\ ' ErrorNumber ':'= <variable or persistent (INOUT) of errnum>]
[ '\ ' TimeOutSignal '=' <variable (VAR) of signaldo>]
[ '\ ' TimeOutGOSignal '=' <variable (VAR) of signalgo>]
[ '\ ' TimeOutGOValue '=' <expression (IN) of dnum>]';'
```

Related information

For information about	See
Waiting until a condition is satisfied	WaitUntil - Waits until a condition is met on page 1046

Continues on next page

1 Instructions

1.311 WaitAO - Waits until an analog output signal value is set

RobotWare Base

Continued

For information about	See
Waiting for a specified period of time	WaitTime - Waits a given amount of time on page 1044
Waiting until an analog input is set/reset	WaitAI - Waits until an analog input signal value is set on page 989

1.312 WaitDI - Waits until a digital input signal is set

Usage

WaitDI (*Wait Digital Input*) is used to wait until a digital input is set.

Basic examples

The following examples illustrate the instruction WaitDI:

Example 1

```
WaitDI di4, 1;
```

Program execution continues only after the di4 input has been set.

Example 2

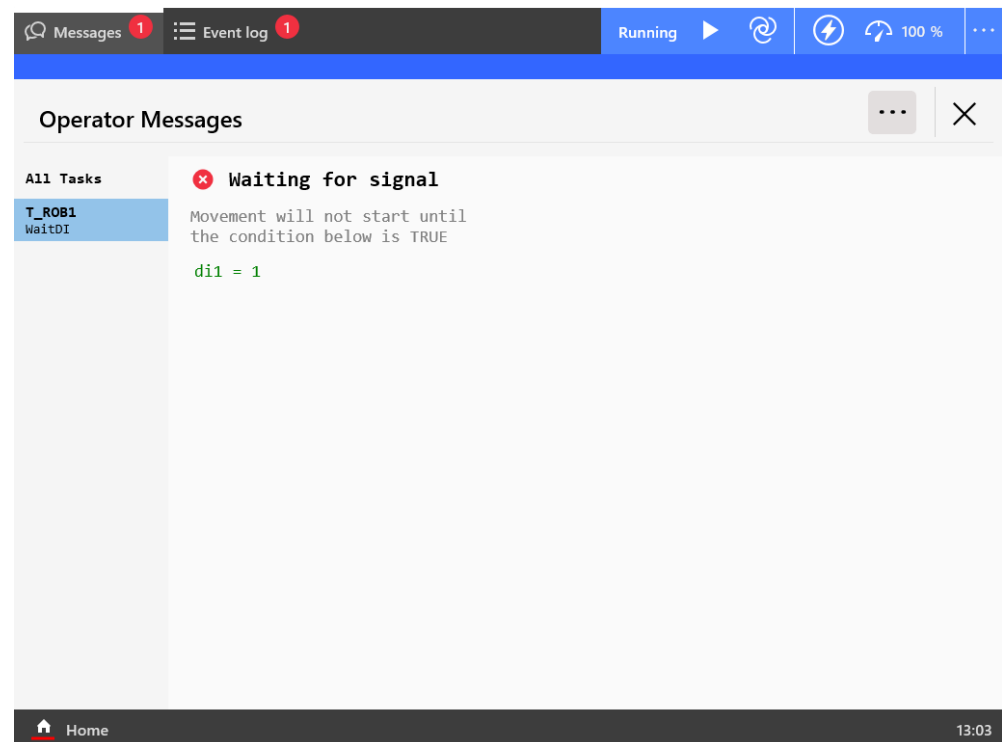
```
WaitDI grip_status, 0;
```

Program execution continues only after the grip_status input has been reset.

Example 3

```
WaitDI di1, 1, \Visualize \Header:="Waiting for signal"
      \MsgArray:=["Movement will not start until", "the condition
below is TRUE"] \Icon:=iconError;
MoveL p40, v500, z20, L10tip;
..
```

If the condition is not met then the header and message specified in the optional arguments \Header and \MsgArray will be written on the display of the FlexPendant together with the condition that is not met.



xx2100000682

Continues on next page

1 Instructions

1.312 WaitDI - Waits until a digital input signal is set

RobotWare Base

Continued

Arguments

WaitDI Signal Value [\MaxTime] [\TimeFlag] [\Visualize] [\Header]
[\Message] | [\MsgArray] [\Wrap] [\Icon] [\Image]
[\VisualizeTime] [\UIActiveSignal] [\ErrorNumber]
[\TimeOutSignal] [\TimeOutGOSignal] [\TimeOutGOValue]

Signal

Data type: signaldi

The name of the signal.

Value

Data type: dionum

The desired value of the signal.

[\MaxTime]

Maximum Time

Data type: num

The maximum period of waiting time permitted, expressed in seconds. If this time runs out before the condition is met and the TimeFlag argument or ErrorNumber argument is not used then the error handler can be called with the error code ERR_WAIT_MAXTIME. If there is no error handler then the execution will be stopped.

[\TimeFlag]

Timeout Flag

Data type: bool

The output parameter that contains the value TRUE if the maximum permitted waiting time runs out before the condition is met. If this parameter is included in the instruction then it is not considered to be an error if the maximum time runs out. This argument is ignored if the MaxTime argument is not included in the instruction.



Note

If both TimeFlag and ErrorNumber are used, then the TimeFlag is ignored. The boolean variable is not set if the instruction times out.

[\Visualize]

Data type: switch

If selected, the visualization is activated. The visualization consists of a message box with the condition that is not fulfilled, icon, header, message lines, and image is displayed according to the programmed arguments.

[\Header]

Data type: string

Header text to be written at the top of the message box. Maximum 40 characters. If no \Header argument is used a default message will be displayed.

[\Message]

Data type: string

Continues on next page

One text line to be written on the display. Maximum 50 characters.

[\MsgArray]

(Message Array)

Data type: string

Several text lines from an array to be written on the display. Only one of the parameters \Message or \MsgArray can be used at the same time.

Maximum layout space is 5 lines with 50 characters each.

[\Wrap]

Data type: switch

If selected, all the specified strings in the argument \MsgArray will be concatenated to one string with a single space between each individual string and spread out on as few lines as possible.

Default, each string in the argument \MsgArray will be on separate lines on the display.

[\Icon]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 1652](#).

Default, no icon.

[\Image]

Data type: string

The name of the image that should be used. To launch your own images, the images have to be placed in the *HOME:* directory in the active system or directly in the active system.

The recommendation is to place the files in the *HOME:* directory so that they are saved if a backup and restore is done.

A restart is required and then the FlexPendant will load the images.

The image that will be shown can have the width of 185 pixels and the height of 300 pixels. If the image is larger, then only 185 * 300 pixels of the image will be shown starting at the top left of the image.

No exact value can be specified on the size that an image can have or the amount of images that can be loaded to the FlexPendant. It depends on the size of other files loaded to the FlexPendant. The program execution will just continue if an image is used that has not been loaded to the FlexPendant.

[\VisualizeTime]

Data type: num

The waiting time before the message box should appear on the FlexPendant. If using the arguments \VisualizeTime and \MaxTime, the time used in argument \MaxTime needs to be bigger than the time used in argument \VisualizeTime.

The default time for the visualization if not using the argument \VisualizeTime is 5 s. Minimum value 1 s. Maximum value no limit. Resolution 0.001 s.

Continues on next page

1 Instructions

1.312 WaitDI - Waits until a digital input signal is set

RobotWare Base

Continued

[`\UIActiveSignal`]

Data type: `signaldo`

The digital output signal used in optional argument `UIActiveSignal` is set to 1 when the visualization message box is activated on the FlexPendant. When the message box is removed (when the condition is met), the signal is set to 0 again.

No supervision of stop or restart exist. The signal is set to 0 when the instruction is ready, or when PP is moved.

[`\ErrorNumber`]

Error number

Data type: `errnum`

A variable (before used it is set to 0 by the system) that will hold the error constant if the instruction ends before the signal has the desired value.

If this optional variable is omitted then the error handler will be executed. The constants `ERR_GO_LIM`, `ERR_NO_ALIASIO_DEF`, `ERR_NORUNUNIT`, `ERR_SIG_NOT_VALID`, and `ERR_WAIT_MAXTIME` can be used to select the reason.

[`\TimeoutSignal`]

Data type: `signaldo`

If `TimeoutSignal` is used, the signal is set to 0 when entering the `Wait` instruction. It is set to 1 if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the `Wait` instruction.

This argument can only be used if the argument `MaxTime` is used.

[`\TimeoutGOSignal`]

Data type: `signalgo`

If `TimeoutGOSignal` is used, the signal is set to 0 when entering the `Wait` instruction. It is set to the value used in the argument `TimeoutGOValue` if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the `Wait` instruction.

The optional arguments `TimeoutGOSignal` and `TimeoutGOValue` must be used together.

This argument can only be used if the argument `MaxTime` is used.

[`\TimeoutGOValue`]

Data type: `dnum`

The argument `TimeoutGOValue` holds the value that the signal in argument `TimeoutGOSignal` will be set to, if the instruction times out after waiting.

The optional arguments `TimeoutGOSignal` and `TimeoutGOValue` must be used together.

This argument can only be used if the argument `MaxTime` is used.

Program execution

If the value of the signal is correct, when the instruction is executed, then the program simply continues with the following instruction.

Continues on next page

If the signal value is not correct then the robot enters a waiting state and when the signal changes to the correct value, the program continues. The change is detected with an interrupt, which gives a fast response (not polled).

When the robot is waiting, the time is supervised. By default, the robot can wait forever, but the maximal waiting time can be specified with the optional argument \MaxTime. If this maximum time is exceeded, an error is raised.

If program execution is stopped, and later restarted, the instruction evaluates the current value of the signal. Any change during program stop is rejected.

In manual mode, after waiting more than 3 s, an alert box will pop up asking if the instruction should be simulated. It is possible to configure the alert to not appear, by setting the system parameter *SimulateMenu* to NO, see *Technical reference manual - System parameters*, topic *Controller*, type *General RAPID*.

If the switch \Visualize is used, a message box is displayed on the FlexPendant according to the programmed arguments. If no \Header argument is used a default header text will be displayed. When the execution of the WaitDI instruction is ready, the message box will be removed from the FlexPendant.

New message box on trap level takes the focus from the message box on the basic level.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_GO_LIM	The programmed TimeOutGOValue argument for the specified digital group output signal TimeOutGOSignal is out of limit.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).
ERR_WAIT_MAXTIME	There is a time-out (parameter \MaxTime) before the signal changes to the right value.

Syntax

```
WaitDI
[ Signal ':' ] <variable (VAR) of signaldi> , '
[ Value ':' ] <expression (IN) of dionum>
['\MaxTime' :=<expression (IN) of num>]
['\TimeFlag':=<variable (VAR) of bool>]
['\ Visualize]
['\ Header ':' <expression (IN) of string>]]
['\ Message ':' <expression (IN) of string>]
| ['\ MsgArray ':' <array {*} (IN) of string>]
['\ Wrap]
```

Continues on next page

1 Instructions

1.312 WaitDI - Waits until a digital input signal is set

RobotWare Base

Continued

```
['\' Icon ':=' <expression (IN) of icondata>]  
['\' Image ':=' <expression (IN) of string>]  
['\' VisualizeTime ':=' <expression (IN) of num>]  
['\' UIActiveSignal ':=' <variable (VAR) of signaldo>]  
['\' ErrorNumber ':=' <variable or persistent (INOUT) of errnum>]  
['\' TimeOutSignal '= ' <variable (VAR) of signaldo>]  
['\' TimeOutGOSignal '= ' <variable (VAR) of signalgo>]  
['\' TimeOutGOValue '= ' <expression (IN) of dnum>]';'
```

Related information

For information about	See
Waiting until a condition is satisfied	WaitUntil - Waits until a condition is met on page 1046
Waiting for a specified period of time	WaitTime - Waits a given amount of time on page 1044

1.313 WaitDO - Waits until a digital output signal is set

Usage

WaitDO (*Wait Digital Output*) is used to wait until a digital output is set.

Basic examples

The following examples illustrate the instruction WaitDO:

Example 1

```
WaitDO do4, 1;
```

Program execution continues only after the do4 output has been set.

Example 2

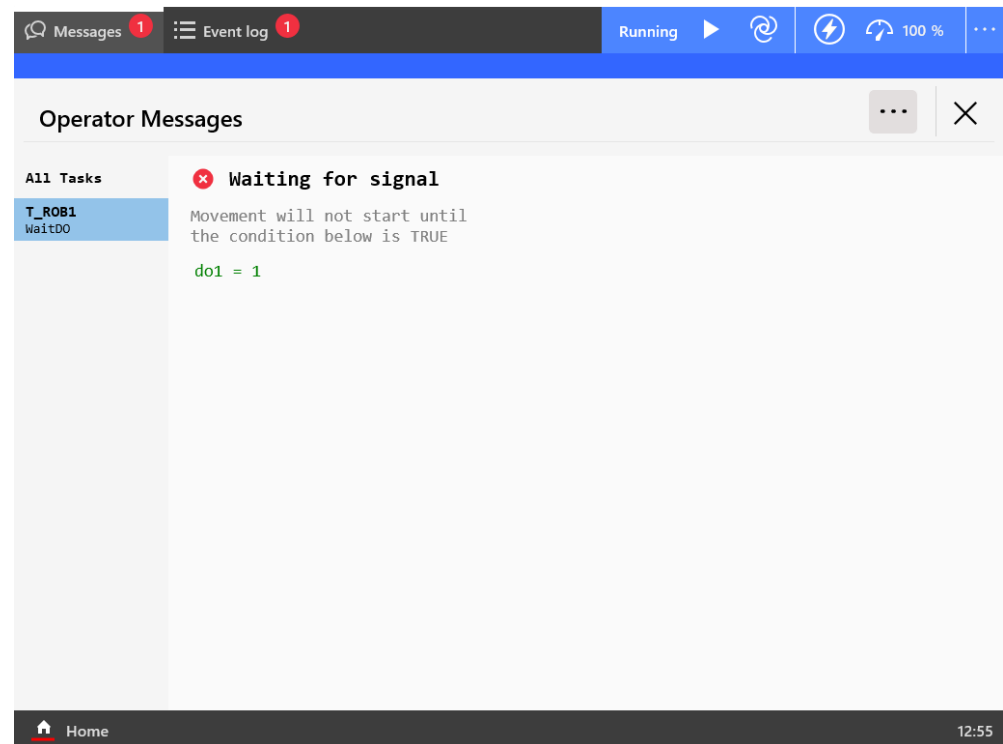
```
WaitDO grip_status, 0;
```

Program execution continues only after the grip_status output has been reset.

Example 3

```
WaitDO do1, 1, \Visualize \Header:="Waiting for signal"
      \MsgArray:=["Movement will not start until", "the condition
      below is TRUE"] \Icon:=iconError;
MoveL p40, v500, z20, L10tip;
..
```

If the condition is not met then the header and message specified in the optional arguments \Header and \MsgArray will be written on the display of the FlexPendant together with the condition that is not met.



xx2100000683

Continues on next page

1 Instructions

1.313 WaitDO - Waits until a digital output signal is set

RobotWare Base

Continued

Arguments

WaitDO Signal Value [\MaxTime] [\TimeFlag] [\Visualize] [\Header]
[\Message] | [\MsgArray] [\Wrap] [\Icon] [\Image]
[\VisualizeTime] [\UIActiveSignal] [\ErrorNumber]
[\TimeOutSignal] [\TimeOutGOSignal] [\TimeOutGOValue]

Signal

Data type: signaldo

The name of the signal.

Value

Data type: dionum

The desired value of the signal.

[\MaxTime]

Maximum Time

Data type: num

The maximum period of waiting time permitted, expressed in seconds. If this time runs out before the condition is met and the TimeFlag argument or ErrorNumber argument is not used then the error handler can be called with the error code ERR_WAIT_MAXTIME. If there is no error handler then the execution will be stopped.

[\TimeFlag]

Timeout Flag

Data type: bool

The output parameter that contains the value TRUE if the maximum permitted waiting time runs out before the condition is met. If this parameter is included in the instruction then it is not considered to be an error if the maximum time runs out. This argument is ignored if the MaxTime argument is not included in the instruction.



Note

If both TimeFlag and ErrorNumber are used, then the TimeFlag is ignored. The boolean variable is not set if the instruction times out.

[\Visualize]

Data type: switch

If selected, the visualization is activated. The visualization consists of a message box with the condition that is not fulfilled, icon, header, message lines, and image is displayed according to the programmed arguments.

[\Header]

Data type: string

Header text to be written at the top of the message box. Maximum 40 characters. If no \Header argument is used a default message will be displayed.

[\Message]

Data type: string

Continues on next page

One text line to be written on the display. Maximum 50 characters.

[\MsgArray]

(Message Array)

Data type: string

Several text lines from an array to be written on the display. Only one of the parameters \Message or \MsgArray can be used at the same time.

Maximum layout space is 5 lines with 50 characters each.

[\Wrap]

Data type: switch

If selected, all the specified strings in the argument \MsgArray will be concatenated to one string with a single space between each individual string and spread out on as few lines as possible.

Default, each string in the argument \MsgArray will be on separate lines on the display.

[\Icon]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 1652](#).

Default, no icon.

[\Image]

Data type: string

The name of the image that should be used. To launch your own images, the images have to be placed in the *HOME:* directory in the active system or directly in the active system.

The recommendation is to place the files in the *HOME:* directory so that they are saved if a backup and restore is done.

A restart is required and then the FlexPendant will load the images.

The image that will be shown can have the width of 185 pixels and the height of 300 pixels. If the image is larger, then only 185 * 300 pixels of the image will be shown starting at the top left of the image.

No exact value can be specified on the size that an image can have or the amount of images that can be loaded to the FlexPendant. It depends on the size of other files loaded to the FlexPendant. The program execution will just continue if an image is used that has not been loaded to the FlexPendant.

[\VisualizeTime]

Data type: num

The waiting time before the message box should appear on the FlexPendant. If using the arguments \VisualizeTime and \MaxTime, the time used in argument \MaxTime needs to be bigger than the time used in argument \VisualizeTime.

The default time for the visualization if not using the argument \VisualizeTime is 5 s. Minimum value 1 s. Maximum value no limit. Resolution 0.001 s.

Continues on next page

1 Instructions

1.313 WaitDO - Waits until a digital output signal is set

RobotWare Base

Continued

[\\UIActiveSignal]

Data type: signaldo

The digital output signal used in optional argument UIActiveSignal is set to 1 when the visualization message box is activated on the FlexPendant. When the message box is removed (when the condition is met), the signal is set to 0 again.

No supervision of stop or restart exist. The signal is set to 0 when the instruction is ready, or when PP is moved.

[\\ErrorNumber]

Error number

Data type: errnum

A variable (before used it is set to 0 by the system) that will hold the error constant if the instruction ends before the signal has the desired value.

If this optional variable is omitted then the error handler will be executed. The constants ERR_GO_LIM, ERR_NO_ALIASIO_DEF, ERR_NORUNUNIT, ERR_SIG_NOT_VALID, and ERR_WAIT_MAXTIME can be used to select the reason.

[\\TimeoutSignal]

Data type: signaldo

If TimeoutSignal is used, the signal is set to 0 when entering the wait instruction. It is set to 1 if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the wait instruction.

This argument can only be used if the argument MaxTime is used.

[\\TimeoutGOSignal]

Data type: signalgo

If TimeoutGOSignal is used, the signal is set to 0 when entering the wait instruction. It is set to the value used in the argument TimeoutGOValue if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the wait instruction.

The optional arguments TimeoutGOSignal and TimeoutGOValue must be used together.

This argument can only be used if the argument MaxTime is used.

[\\TimeoutGOValue]

Data type: dnum

The argument TimeoutGOValue holds the value that the signal in argument TimeoutGOSignal will be set to, if the instruction times out after waiting.

The optional arguments TimeoutGOSignal and TimeoutGOValue must be used together.

This argument can only be used if the argument MaxTime is used.

Program execution

If the value of the output signal is correct, when the instruction is executed, then the program simply continues with the following instruction.

Continues on next page

If the value of the output signal is not correct then the robot enters a waiting state. When the signal changes to the correct value then the program continues. The change is detected with an interrupt, which gives a fast response (not polled).

When the robot is waiting, the time is supervised. By default, the robot can wait forever, but the maximal waiting time can be specified with the optional argument \MaxTime. If this maximum time is exceeded, an error is raised.

If program execution is stopped, and later restarted, the instruction evaluates the current value of the signal. Any change during program stop is rejected.

In manual mode, after waiting more than 3 s, an alert box will pop up asking if the instruction should be simulated. It is possible to configure the alert to not appear, by setting the system parameter *SimulateMenu* to NO, see *Technical reference manual - System parameters*, topic *Controller*, type *General RAPID*.

If the switch \Visualize is used, a message box is displayed on the FlexPendant according to the programmed arguments. If no \Header argument is used a default header text will be displayed. When the execution of the WaitDO instruction is ready, the message box will be removed from the FlexPendant.

New message box on trap level takes the focus from the message box on the basic level.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_GO_LIM	The programmed TimeOutGOValue argument for the specified digital group output signal TimeOutGOSignal is out of limit.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).
ERR_WAIT_MAXTIME	There is a time-out (parameter \MaxTime) before the signal changes to the right value.

Syntax

```
WaitDO
[ Signal ':'<variable (VAR) of signaldo>','
[ Value ':'<expression (IN) of dionum>
['\MaxTime' ':'<expression (IN) of num>
['\TimeFlag' ':'<variable (VAR) of bool>
['\ Visualize]
['\ Header ':'<expression (IN) of string>]]
['\ Message ':'<expression (IN) of string>]
| ['\ MsgArray ':'<array {*} (IN) of string>]
['\ Wrap]
```

Continues on next page

1 Instructions

1.313 WaitDO - Waits until a digital output signal is set

RobotWare Base

Continued

```
['\' Icon ':=' <expression (IN) of icondata>]  
['\' Image ':=' <expression (IN) of string>]  
['\' VisualizeTime ':=' <expression (IN) of num>]  
['\' UIActiveSignal ':=' <variable (VAR) of signaldo>]  
['\' ErrorNumber ':=' <variable or persistent (INOUT) of errnum>]  
['\' TimeOutSignal '= ' <variable (VAR) of signaldo>]  
['\' TimeOutGOSignal '= ' <variable (VAR) of signalgo>]  
['\' TimeOutGOValue '= ' <expression (IN) of dnum>'];'
```

Related information

For information about	See
Waiting until a condition is satisfied	WaitUntil - Waits until a condition is met on page 1046
Waiting for a specified period of time	WaitTime - Waits a given amount of time on page 1044
Waiting until an input is set/reset	WaitDI - Waits until a digital input signal is set on page 1003

1.314 WaitGI - Waits until a group of digital input signals are set

Usage

WaitGI (*Wait Group digital Input*) is used to wait until a group of digital input signals are set to specified values.

Basic examples

The following example illustrates the instruction WaitGI:

See also [More examples on page 1019](#).

Example 1

```
WaitGI gi4, 5;
```

Program execution continues only after the gi4 input has the value 5.

Example 2

```
WaitGI grip_status, 0;
```

Program execution continues only after the grip_status input has been reset.

Arguments

```
WaitGI Signal [\NOTEQ] | [\LT] | [\GT] Value | Dvalue [\MaxTime]
[\ValueAtTimeout] | [\DvalueAtTimeout] [\Visualize] [\Header]
[\Message] | [\MsgArray] [\Wrap] [\Icon] [\Image]
[\VisualizeTime] [\UIActiveSignal] [\ErrorNumber]
[\TimeOutSignal] [\TimeOutGOSignal] [\TimeOutGOValue]
```

Signal

Data type: signalgi

The name of the digital group input signal.

[\NOTEQ]

NOT Equal

Data type: switch

If using this parameter, the WaitGI instruction waits until the digital group signal value divides from the value in Value.

[\LT]

Less Than

Data type: switch

If using this parameter, the WaitGI instruction waits until the digital group signal value is less than the value in Value.

[\GT]

Greater Than

Data type: switch

If using this parameter, the WaitGI instruction waits until the digital group signal value is greater than the value in Value.

Continues on next page

1 Instructions

1.314 WaitGI - Waits until a group of digital input signals are set

RobotWare Base

Continued

Value

Data type: num

The desired value of the signal. Must be an integer value within the working range of the used digital group input signal. The permitted value is dependent on the number of signals in the group. Max value that can be used in the Value argument is 8388608, and that is the value a 23 bit digital signal can have as maximum value.

Dvalue

Data type: dnum

The desired value of the signal. Must be an integer value within the working range of the used digital group input signal. The permitted value is dependent on the number of signals in the group. The maximal amount of signal bits a digital group signal can have is 32. With a dnum variable it is possible to cover the value range 0-4294967295, which is the value range a 32 bits digital signal can have.

[MaxTime]

Maximum Time

Data type: num

The maximum period of waiting time permitted, expressed in seconds. If this time runs out before the condition is met, the error handler will be called (if there is one) with the error code ERR_WAIT_MAXTIME. If there is no error handler, the execution will be stopped.

[ValueAtTimeout]

Data type: num

If the instruction time-out, the current signal value will be stored in this variable. The variable will only be set if the system variable ERRNO is set to ERR_WAIT_MAXTIME. If the Dvalue argument is used, use argument DvalueAtTimeout to store current value on signal (reason: limitation of maximum integer value for num).

Signal values between 0 and 8388608 are always stored as an exact integer.

[DvalueAtTimeout]

Data type: dnum

If the instruction time-out, the current signal value will be stored in this variable. The variable will only be set if the system variable ERRNO is set to ERR_WAIT_MAXTIME.

Signal values between 0 and 4294967295 are always stored as an exact integer.

[Visualize]

Data type: switch

If selected, the visualization is activated. The visualization consists of a message box with the condition that is not fulfilled, icon, header, message lines, and image is displayed according to the programmed arguments.

[Header]

Data type: string

Continues on next page

Header text to be written at the top of the message box. Maximum 40 characters.
If no \Header argument is used a default message will be displayed.

[\Message]

Data type: string

One text line to be written on the display. Maximum 50 characters.

[\MsgArray]

(Message Array)

Data type: string

Several text lines from an array to be written on the display. Only one of the parameters \Message or \MsgArray can be used at the same time.

Maximum layout space is 5 lines with 50 characters each.

[\Wrap]

Data type: switch

If selected, all the specified strings in the argument \MsgArray will be concatenated to one string with a single space between each individual string and spread out on as few lines as possible.

Default, each string in the argument \MsgArray will be on separate lines on the display.

[\Icon]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 1652](#).

Default, no icon.

[\Image]

Data type: string

The name of the image that should be used. To launch your own images, the images have to be placed in the *HOME:* directory in the active system or directly in the active system.

The recommendation is to place the files in the *HOME:* directory so that they are saved if a backup and restore is done.

A restart is required and then the FlexPendant will load the images.

The image that will be shown can have the width of 185 pixels and the height of 300 pixels. If the image is larger, then only 185 * 300 pixels of the image will be shown starting at the top left of the image.

No exact value can be specified on the size that an image can have or the amount of images that can be loaded to the FlexPendant. It depends on the size of other files loaded to the FlexPendant. The program execution will just continue if an image is used that has not been loaded to the FlexPendant.

[\VisualizeTime]

Data type: num

Continues on next page

1 Instructions

1.314 WaitGI - Waits until a group of digital input signals are set

RobotWare Base

Continued

The waiting time before the message box should appear on the FlexPendant. If using the arguments `\VisualizeTime` and `\MaxTime`, the time used in argument `\MaxTime` needs to be bigger than the time used in argument `\VisualizeTime`.

The default time for the visualization if not using the argument `\VisualizeTime` is 5 s. Minimum value 1 s. Maximum value no limit. Resolution 0.001 s.

[`\UIActiveSignal`]

Data type: `signaldo`

The digital output signal used in optional argument `UIActiveSignal` is set to 1 when the visualization message box is activated on the FlexPendant. When the message box is removed (when the condition is met), the signal is set to 0 again. No supervision of stop or restart exist. The signal is set to 0 when the instruction is ready, or when PP is moved.

[`\ErrorNumber`]

Error number

Data type: `errnum`

A variable (before used it is set to 0 by the system) that will hold the error constant if the instruction ends before the signal has the desired value.

If this optional variable is omitted then the error handler will be executed. The constants `ERR_GO_LIM`, `ERR_NO_ALIASIO_DEF`, `ERR_NORUNUNIT`, `ERR_SIG_NOT_VALID`, and `ERR_WAIT_MAXTIME` can be used to select the reason.

[`\TimeoutSignal`]

Data type: `signaldo`

If `TimeoutSignal` is used, the signal is set to 0 when entering the `Wait` instruction. It is set to 1 if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the `Wait` instruction.

This argument can only be used if the argument `MaxTime` is used.

[`\TimeoutGOSignal`]

Data type: `signalgo`

If `TimeoutGOSignal` is used, the signal is set to 0 when entering the `Wait` instruction. It is set to the value used in the argument `TimeoutGOValue` if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the `Wait` instruction.

The optional arguments `TimeoutGOSignal` and `TimeoutGOValue` must be used together.

This argument can only be used if the argument `MaxTime` is used.

[`\TimeoutGOValue`]

Data type: `dnum`

The argument `TimeoutGOValue` holds the value that the signal in argument `TimeoutGOSignal` will be set to, if the instruction times out after waiting.

The optional arguments `TimeoutGOSignal` and `TimeoutGOValue` must be used together.

Continues on next page

This argument can only be used if the argument `MaxTime` is used.

Program execution

If the value of the signal is correct when the instruction is executed, the program simply continues with the following instruction.

If the signal value is not correct, the robot enters a waiting state and the program continues when the signal changes to the correct value. The change is detected with an interrupt, which gives a fast response (not polled).

When the robot is waiting, the time is supervised. By default, the robot can wait forever, but the maximal waiting time can be specified with the optional argument `\MaxTime`. If this maximum time is exceeded, an error is raised.

If program execution is stopped, and later restarted, the instruction evaluates the current value of the signal. Any change during program stop is rejected.

In manual mode, after waiting more than 3 s, an alert box will pop up asking if the instruction should be simulated. It is possible to configure the alert to not appear, by setting the system parameter *SimulateMenu* to NO, see *Technical reference manual - System parameters*, topic *Controller*, type *General RAPID*.

If the switch `\Visualize` is used, a message box is displayed on the FlexPendant according to the programmed arguments. If no `\Header` argument is used a default header text will be displayed. When the execution of the `WaitGI` instruction is ready, the message box will be removed from the FlexPendant.

New message box on trap level takes the focus from the message box on the basic level.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_GO_LIM</code>	The programmed group signal value argument for a digital group output signal is out of limit.
<code>ERR_NO_ALIASIO_DEF</code>	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
<code>ERR_NORUNUNIT</code>	There is no contact with the I/O device.
<code>ERR_SIG_NOT_VALID</code>	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).
<code>ERR_WAIT_MAXTIME</code>	There is a time-out (parameter <code>\MaxTime</code>) before the signal changes to the right value.

More examples

More examples of the instruction `WaitGI` are illustrated below.

Example 1

```
WaitGI gi1,\NOTEQ,0;
```

Program execution only continues after the `gi1` differs from the value 0.

Continues on next page

1 Instructions

1.314 WaitGI - Waits until a group of digital input signals are set

RobotWare Base

Continued

Example 2

```
WaitGI gi1,\LT,1;
```

Program execution only continues after the gi1 is less than 1.

Example 3

```
WaitGI gi1,\GT,0;
```

Program execution continues only after the gi1 is greater than 0.

Example 4

```
VAR num myvalattimeout:=0;
WaitGI gi1, 5 \MaxTime:=4 \ValueAtTimeout:=myvalattimeout;
ERROR
  IF ERRNO=ERR_WAIT_MAXTIME THEN
    TPWrite "Value of gi1 at timeout:" + ValToStr(myvalattimeout);
    TRYNEXT;
  ELSE
    ! No error recovery handling
  ENDIF
```

Program execution continues only if gi1 is equal to 5, or when timing out. If timing out, the value of the signal gi1 at timeout can be logged without another read of signal.

Example 5

```
WaitGI gi1, 4, \Visualize \Header:="Waiting for signal"
  \MsgArray:=["Movement will not start until", "the condition
  below is TRUE"] \Icon:=iconError;
MoveL p40, v500, z20, L10tip;
..
```

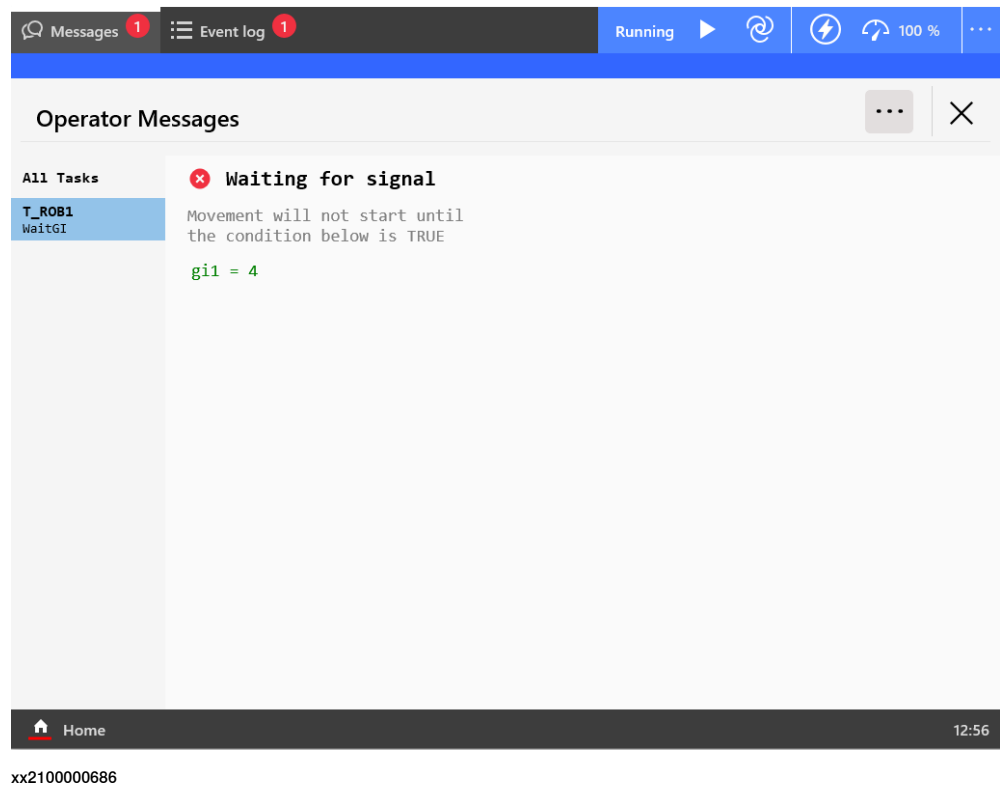
If the condition is not met then the header and message specified in the optional arguments \Header and \MsgArray will be written on the display of the FlexPendant together with the condition that is not met.

Continues on next page

1.314 WaitGI - Waits until a group of digital input signals are set

RobotWare Base

Continued



xx2100000686

Syntax

WaitGI

```
[ Signal ':' ] <variable (VAR) of signalgi> ','
[ '\\' NOTEQ ] | [ '\\' LT ] | [ '\\' GT ] ','
[ Value ':' ] <expression (IN) of num>
| [ Dvalue ':' ] <expression (IN) of dnum>
[ '\\' MaxTime ':' ] <expression (IN) of num> ]
[ '\\' ValueAtTimeout ':' ] <variable (VAR) of num> ]
| [ '\\' DvalueAtTimeout ':' ] <variable (VAR) of dnum> ]
[ '\\' Visualize ]
[ '\\' Header ':' ] <expression (IN) of string> ]
[ '\\' Message ':' ] <expression (IN) of string> ]
| [ '\\' MsgArray ':' ] <array {*} (IN) of string> ]
[ '\\' Wrap ]
[ '\\' Icon ':' ] <expression (IN) of icondata> ]
[ '\\' Image ':' ] <expression (IN) of string> ]
[ '\\' VisualizeTime ':' ] <expression (IN) of num> ]
[ '\\' UIActiveSignal ':' ] <variable (VAR) of signaldo> ]
[ '\\' ErrorNumber ':' ] <variable or persistent (INOUT) of errnum> ]
[ '\\' TimeoutSignal '=' ] <variable (VAR) of signaldo> ]
[ '\\' TimeoutGOSignal '=' ] <variable (VAR) of signalgo> ]
[ '\\' TimeoutGOValue '=' ] <expression (IN) of dnum> ]';'
```

Continues on next page

1 Instructions

1.314 WaitGI - Waits until a group of digital input signals are set

RobotWare Base

Continued

Related information

For information about	See
Waiting until a condition is satisfied	WaitUntil - Waits until a condition is met on page 1046
Waiting for a specified period of time	WaitTime - Waits a given amount of time on page 1044
Waiting until a group of digital output signals are set/reset	WaitGO - Waits until a group of digital output signals are set on page 1023

1.315 WaitGO - Waits until a group of digital output signals are set

Usage

WaitGO (*Wait Group digital Output*) is used to wait until a group of digital output signals are set to a specified value.

Basic examples

The following examples illustrate the instruction WaitGO:

See also [More examples on page 1027](#).

Example 1

```
WaitGO go4, 5;
```

Program execution only continues after the go4 output has value 5.

Example 2

```
WaitGO grip_status, 0;
```

Program execution only continues after the grip_status output has been reset.

Arguments

```
WaitGO Signal [\NOTEQ] | [\LT] | [\GT] Value | Dvalue [\MaxTime]
[\ValueAtTimeout] | [\DvalueAtTimeout] [\Visualize] [\Header]
[\Message] | [\MsgArray] [\Wrap] [\Icon] [\Image]
[\VisualizeTime] [\UIActiveSignal] [\ErrorNumber]
[\TimeOutSignal] [\TimeOutGOSignal] [\TimeOutGOValue]
```

Signal

Data type: signalgo

The name of the digital group output signal.

[\NOTEQ]

NOT Equal

Data type: switch

If using this parameter, the WaitGO instruction waits until the digital group signal value divides from the value in Value.

[\LT]

Less Than

Data type: switch

If using this parameter, the WaitGO instruction waits until the digital group signal value is less than the value in Value.

[\GT]

Greater Than

Data type: switch

If using this parameter, the WaitGO instruction waits until the digital group signal value is greater than the value in Value.

Continues on next page

1 Instructions

1.315 WaitGO - Waits until a group of digital output signals are set

RobotWare Base

Continued

Value

Data type: num

The desired value of the signal. Must be an integer value within the working range of the used digital group output signal. The permitted value is dependent on the number of signals in the group. Max value that can be used in the Value argument is 8388608, and that is the value a 23 bit digital signal can have as maximum value.

Dvalue

Data type: dnum

The desired value of the signal. Must be an integer value within the working range of the used digital group output signal. The permitted value is dependent on the number of signals in the group. The maximal amount of signal bits a digital group signal can have is 32. With a dnum variable it is possible to cover the value range 0-4294967295, which is the value range a 32 bits digital signal can have.

[MaxTime]

Maximum Time

Data type: num

The maximum period of waiting time permitted, expressed in seconds. If this time runs out before the condition is met, the error handler will be called, if there is one, with the error code ERR_WAIT_MAXTIME. If there is no error handler, the execution will be stopped.

[ValueAtTimeout]

Data type: num

If the instruction time-out, the current signal value will be stored in this variable. The variable will only be set if the system variable ERRNO is set to ERR_WAIT_MAXTIME. If the Dvalue argument is used, use argument DvalueAtTimeout to store current value on signal (reason: limitation of maximum integer value for num).

Signal values between 0 and 8388608 are always stored as an exact integer.

[DvalueAtTimeout]

Data type: dnum

If the instruction time-out, the current signal value will be stored in this variable. The variable will only be set if the system variable ERRNO is set to ERR_WAIT_MAXTIME.

Signal values between 0 and 4294967295 are always stored as an exact integer.

[Visualize]

Data type: switch

If selected, the visualization is activated. The visualization consists of a message box with the condition that is not fulfilled, icon, header, message lines, and image is displayed according to the programmed arguments.

[Header]

Data type: string

Continues on next page

1.315 WaitGO - Waits until a group of digital output signals are set *RobotWare Base* *Continued*

Header text to be written at the top of the message box. Maximum 40 characters.
If no \Header argument is used a default message will be displayed.

[\Message]

Data type: string

One text line to be written on the display. Maximum 50 characters.

[\MsgArray]

(Message Array)

Data type: string

Several text lines from an array to be written on the display. Only one of the parameters \Message or \MsgArray can be used at the same time.

Maximum layout space is 5 lines with 50 characters each.

[\Wrap]

Data type: switch

If selected, all the specified strings in the argument \MsgArray will be concatenated to one string with a single space between each individual string and spread out on as few lines as possible.

Default, each string in the argument \MsgArray will be on separate lines on the display.

[\Icon]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 1652](#).

Default, no icon.

[\Image]

Data type: string

The name of the image that should be used. To launch your own images, the images have to be placed in the *HOME:* directory in the active system or directly in the active system.

The recommendation is to place the files in the *HOME:* directory so that they are saved if a backup and restore is done.

A restart is required and then the FlexPendant will load the images.

The image that will be shown can have the width of 185 pixels and the height of 300 pixels. If the image is larger, then only 185 * 300 pixels of the image will be shown starting at the top left of the image.

No exact value can be specified on the size that an image can have or the amount of images that can be loaded to the FlexPendant. It depends on the size of other files loaded to the FlexPendant. The program execution will just continue if an image is used that has not been loaded to the FlexPendant.

[\VisualizeTime]

Data type: num

Continues on next page

1 Instructions

1.315 WaitGO - Waits until a group of digital output signals are set

RobotWare Base

Continued

The waiting time before the message box should appear on the FlexPendant. If using the arguments \VisualizeTime and \MaxTime, the time used in argument \MaxTime needs to be bigger than the time used in argument \VisualizeTime.

The default time for the visualization if not using the argument \VisualizeTime is 5 s. Minimum value 1 s. Maximum value no limit. Resolution 0.001 s.

[\UIActiveSignal]

Data type: signaldo

The digital output signal used in optional argument UIActiveSignal is set to 1 when the visualization message box is activated on the FlexPendant. When the message box is removed (when the condition is met), the signal is set to 0 again. No supervision of stop or restart exist. The signal is set to 0 when the instruction is ready, or when PP is moved.

[\ErrorNumber]

Error number

Data type: errnum

A variable (before used it is set to 0 by the system) that will hold the error constant if the instruction ends before the signal has the desired value.

If this optional variable is omitted then the error handler will be executed. The constants ERR_GO_LIM, ERR_NO_ALIASIO_DEF, ERR_NORUNUNIT, ERR_SIG_NOT_VALID, and ERR_WAIT_MAXTIME can be used to select the reason.

[\TimeoutSignal]

Data type: signaldo

If TimeoutSignal is used, the signal is set to 0 when entering the Wait instruction. It is set to 1 if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the Wait instruction.

This argument can only be used if the argument MaxTime is used.

[\TimeoutGOSignal]

Data type: signalgo

If TimeoutGOSignal is used, the signal is set to 0 when entering the Wait instruction. It is set to the value used in the argument TimeoutGOValue if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the Wait instruction.

The optional arguments TimeoutGOSignal and TimeoutGOValue must be used together.

This argument can only be used if the argument MaxTime is used.

[\TimeoutGOValue]

Data type: dnum

The argument TimeoutGOValue holds the value that the signal in argument TimeoutGOSignal will be set to, if the instruction times out after waiting.

The optional arguments TimeoutGOSignal and TimeoutGOValue must be used together.

Continues on next page

1.315 WaitGO - Waits until a group of digital output signals are set

RobotWare Base
Continued

This argument can only be used if the argument `MaxTime` is used.

Program execution

If the value of the signal is correct when the instruction is executed, the program simply continues with the following instruction.

If the signal value is incorrect, the robot enters a waiting state and the program continues when the signal changes to the correct value. The change is detected with an interrupt, which gives a fast response (not polled).

When the robot is waiting, the time is supervised. By default, the robot can wait forever, but the maximal waiting time can be specified with the optional argument `\MaxTime`. If this maximum time is exceeded, an error is raised.

If program execution is stopped, and later restarted, the instruction evaluates the current value of the signal. Any change during program stop is rejected.

In manual mode, after waiting more than 3 s, an alert box will pop up asking if the instruction should be simulated. It is possible to configure the alert to not appear, by setting the system parameter *SimulateMenu* to NO, see *Technical reference manual - System parameters*, topic *Controller*, type *General RAPID*.

If the switch `\Visualize` is used, a message box is displayed on the FlexPendant according to the programmed arguments. If no `\Header` argument is used a default header text will be displayed. When the execution of the `WaitGO` instruction is ready, the message box will be removed from the FlexPendant.

New message box on trap level takes the focus from the message box on the basic level.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_GO_LIM</code>	The programmed group signal value argument for a digital group output signal is out of limit.
<code>ERR_NO_ALIASIO_DEF</code>	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
<code>ERR_NORUNUNIT</code>	There is no contact with the I/O device.
<code>ERR_SIG_NOT_VALID</code>	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).
<code>ERR_WAIT_MAXTIME</code>	There is a time-out (parameter <code>\MaxTime</code>) before the signal changes to the right value.

More examples

More examples of the instruction `WaitGO` are illustrated below.

Example 1

```
WaitGO go1,\NOTEQ,0;
```

Program execution only continues after the `go1` differs from the value 0.

Continues on next page

1 Instructions

1.315 WaitGO - Waits until a group of digital output signals are set

RobotWare Base

Continued

Example 2

```
WaitGO go1,\LT,1;
```

Program execution only continues after the go1 is less than 1.

Example 3

```
WaitGO go1,\GT,0;
```

Program execution only continues after the go1 is greater than 0.

Example 4

```
VAR num myvalattimeout:=0;
WaitGO go1, 5 \MaxTime:=4 \ValueAtTimeout:=myvalattimeout;
ERROR
  IF ERRNO=ERR_WAIT_MAXTIME THEN
    TPWrite "Value of go1 at timeout:" + ValToStr(myvalattimeout);
    TRYNEXT;
  ELSE
    ! No error recovery handling
  ENDIF
```

Program execution continues only if go1 is equal to 5, or when timing out. If timing out, the value of the signal go1 at timeout can be logged without another read of signal.

Example 5

```
WaitGO go1, 4, \Visualize \Header:="Waiting for signal"
  \MsgArray:=["Movement will not start until", "the condition
  below is TRUE"] \Icon:=iconError;
MoveL p40, v500, z20, L10tip;
..
```

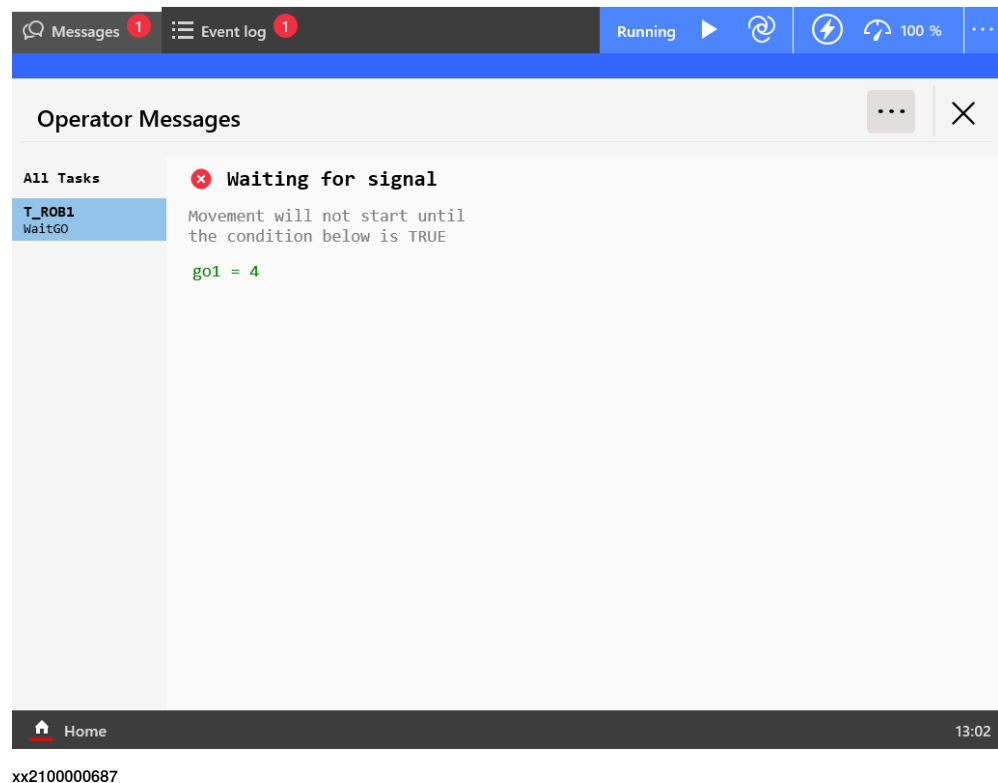
If the condition is not met then the header and message specified in the optional arguments \Header and \MsgArray will be written on the display of the FlexPendant together with the condition that is not met.

Continues on next page

1.315 WaitGO - Waits until a group of digital output signals are set

RobotWare Base

Continued



Syntax

WaitGO

```
[ Signal ':' ] <variable (VAR) of signalgo> ','
[ '\\' NOTEQ ] | [ '\\' LT ] | [ '\\' GT ] ','
[ Value ':' ] <expression (IN) of num>
| [ Dvalue ':' ] <expression (IN) of dnum>
[ '\\' MaxTime ':' ] <expression (IN) of num>
[ '\\' ValueAtTimeout ':' ] <variable (VAR) of num> ]
| [ '\\' DvalueAtTimeout ':' ] <variable (VAR) of dnum> ]
[ '\\' Visualize ]
[ '\\' Header ':' ] <expression (IN) of string>]]
[ '\\' Message ':' ] <expression (IN) of string>]
| [ '\\' MsgArray ':' ] <array {*} (IN) of string>]
[ '\\' Wrap ]
[ '\\' Icon ':' ] <expression (IN) of icondata>]
[ '\\' Image ':' ] <expression (IN) of string>]
[ '\\' VisualizeTime ':' ] <expression (IN) of num>]
[ '\\' UIActiveSignal ':' ] <variable (VAR) of signaldo>]
[ '\\' ErrorNumber ':' ] <variable or persistent (INOUT) of errnum>]
[ '\\' TimeOutSignal '=' ] <variable (VAR) of signaldo>]
[ '\\' TimeOutGOSignal '=' ] <variable (VAR) of signalgo>]
[ '\\' TimeOutGOValue '=' ] <expression (IN) of dnum>]';'
```

Continues on next page

1 Instructions

1.315 WaitGO - Waits until a group of digital output signals are set

RobotWare Base

Continued

Related information

For information about	See
Waiting until a condition is satisfied	WaitUntil - Waits until a condition is met on page 1046
Waiting for a specified period of time	WaitTime - Waits a given amount of time on page 1044
Waiting until a group of digital input signals are set/reset	WaitGI - Waits until a group of digital input signals are set on page 1015

1.316 WaitLoad - Connect the loaded module to the task

Usage

WaitLoad is used to connect with the module that is loaded with the instruction StartLoad to the program task.

The loaded program module will be added to the modules already existing in the program memory.

A module that is loaded with StartLoad must be connected to the program task with the instruction WaitLoad before any of its symbols or routines can be used.

WaitLoad can also unload a program module if the optional switches are used. This will minimize the number of links (1 instead of 2).

WaitLoad can also check for any unsolved references if the optional switch \CheckRef is used.

Basic examples

The following example illustrates the instruction WaitLoad:

See also [More examples on page 1033](#).

Example 1

```

VAR loadsession load1;
...
StartLoad "HOME:/PART_A.modx", load1;
MoveL p10, v1000, z50, tool1 \WObj:=wobj1;
MoveL p20, v1000, z50, tool1 \WObj:=wobj1;
MoveL p30, v1000, z50, tool1 \WObj:=wobj1;
MoveL p40, v1000, z50, tool1 \WObj:=wobj1;
WaitLoad load1;
%"routine_x"%;
Unload "HOME:/PART_A.modx";

```

Load the program module PART_A.modx from HOME: into the program memory. In parallel, move the robot. Then connect the new program module to the program task and call the routine routine_x in the module PART_A.

Arguments

WaitLoad [\UnloadPath] [\UnloadFile] LoadNo [\CheckRef]

[\UnloadPath]

Data type: string

The file path and the file name to the file that will be unloaded from the program memory. The file name should be excluded when the argument \UnloadFile is used.

[\UnloadFile]

Data type: string

When the file name is excluded in the argument \UnloadPath, then it must be defined with this argument.

Continues on next page

1 Instructions

1.316 WaitLoad - Connect the loaded module to the task

RobotWare Base

Continued

LoadNo

Data type: loadsession

This is a reference to the load session, created by the instruction StartLoad that is needed to connect the loaded program module to the program task.

[\CheckRef]

Data type: switch

Check after loading of the module for unsolved references in the program task. If not used no check for unsolved references are done.

Program execution

The instruction WaitLoad will first wait for the loading to be completed, if it is not already done, and then the module will be linked and initialized. The initiation of the loaded module sets all variables at module level to their initial values.

Unresolved references will always be accepted for the loading operations

StartLoad - WaitLoad if parameter \CheckRef is not used, but it will be a run time error on execution of an unresolved reference.

The system starts with the unloading operation, if specified. If the unloading of the module fails, then no new module will be loaded.

If any error from the loading operation, including unresolved references if use of switch \CheckRef, the loaded module will not be available any more in the program memory.

To obtain a good program structure, that is easy to understand and maintain, all loading and unloading of program modules should be done from the main module, which is always present in the program memory during execution.

For loading a program that contains a main procedure to a main program (with another main procedure), see instruction Load.



Note

Be aware of that Load, UnLoad, and WaitLoad can affect both the motion execution and other RAPID execution and shall therefore be called with caution.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILNOTFND	The file specified in the StartLoad instruction cannot be found.
ERR_IOERROR	Some type of problem to read the file to load.
ERR_UNKPROC	Argument LoadNo refers to an unknown load session.
ERR_PRGMEMFULL	The module cannot be loaded because the program memory is full.
ERR_LOADED	The program module is already loaded into the program memory.

Continues on next page

1.316 WaitLoad - Connect the loaded module to the task

RobotWare Base

Continued

Name	Cause of error
ERR_SYNTAX	The loaded module contains syntax errors.
ERR_LINKREF	The loaded module result in fatal link errors. • The loaded module result in fatal link errors. • WaitLoad is used with the switch \CheckRef to check for any reference error and the program memory contains unresolved references.

The following errors can only occur when the argument \UnloadPath is used in the instruction WaitLoad:

Name	Cause of error
ERR_UNLOAD	• The module specified in the argument \UnloadPath cannot be unloaded because of ongoing execution within the module • The module specified in the argument \UnloadPath cannot be unloaded because the program module is not loaded with Load or StartLoad-WaitLoad from the RAPID program.

If some of these error occurs, the actual module will be unloaded and will not be available in the ERROR handler.

More examples

More examples of the instruction WaitLoad are illustrated below.

Example 1

```

StartLoad "HOME:/DOORDIR/DOOR2.modx", load1;
...
WaitLoad \UnloadPath:="HOME:/DOORDIR/DOOR1.modx", load1;

```

Load the program module DOOR2.modx from HOME: in the directory DOORDIR into the program memory and connect the new module to the task. The program module DOOR1.modx will be unloaded from the program memory.

Example 2

```

StartLoad "HOME:" \File:="DOORDIR/DOOR2.modx", load1;
! The robot can do some other work
WaitLoad \UnloadPath:="HOME:" \File:="DOORDIR/DOOR1.modx", load1;

```

It is the same as the instructions below but the robot can do some other work during the loading time and also do it faster (only one link instead of the two links below).

```

Load "HOME:" \File:="DOORDIR/DOOR2.modx";
UnLoad "HOME:" \File:="DOORDIR/DOOR1.modx";

```



Note

RETRY cannot be used for error recovery for any errors from WaitLoad.

Limitations

It is not possible to change the current value of some PERS variable by loading the same module with a new init value for the actual PERS variable.

Continues on next page

1 Instructions

1.316 WaitLoad - Connect the loaded module to the task

RobotWare Base

Continued

Example:

- File `my_module.modx` with declaration `PERS num my_pers:=1;` is loaded in the system.
- The file `my_module.modx` is edited on disk with new persistent value eg. `PERS num my_pers:=3;`
- The code below is executed.
- After loading the `my_module.modx` again, the value of `my_pers` is still 1 instead of 3.

```
StartLoad \Dynamic, "HOME:/my_module.modx", load1;
...
WaitLoad \UnloadPath:="HOME:/my_module.modx", load1;
```

This limitation is a consequence of PERS variable characteristic. The current value of the PERS variable will not be changed by the new loaded PERS init value if the PERS variable is in any use at the loading time.

The above problems will not occur if the following code is executed instead:

```
Unload "HOME:/my_module.modx";
StartLoad \Dynamic, "HOME:/my_module.modx", load1;
...
WaitLoad load1;
```

Another option is to use a CONST for the init value and do the following assignment in the beginning of the execution in the new module: `my_pers := my_const;`

Syntax

WaitLoad

```
[ '\ ' UnloadPath ':=' <expression (IN) of string> ', ' ]
[ '\ ' UnloadFile ':=' <expression (IN) of string> ', ' ]
[ LoadNo ':=' ] <variable (VAR) of loadsession>
[ '\ ' CheckRef ] ';'
```

Related information

For information about	See
Load a program module during execution	StartLoad - Load a program module during execution on page 759
Load session	loadsession - Program load session on page 1671
Load a program module	Load - Load a program module during execution on page 332
Unload a program module	Unload - Unload a program module during execution on page 978
Cancel loading of a program module	CancelLoad - Cancel loading of a module on page 78
Check program references	CheckProgRef - Check program references on page 127
Procedure call with Late binding	Technical reference manual - RAPID Overview

1.317 WaitRob - Wait until stop point or zero speed

Usage

WaitRob (*Wait Robot*) waits until the robot and external axes have reached stop point or have zero speed.

Basic examples

The following example illustrates the instruction WaitRob:

See also [More examples on page 1035](#).

Example 1

```
WaitRob \InPos;
```

Program execution waits until the robot and external axes have reached stop point.

Arguments

WaitRob [\InPos] | [\ZeroSpeed]

[\InPos]

In Position

Data type: switch

If this argument is used then the robot and external axes must have reached the stop point (ToPoint of current move instruction) before the execution can continue.

This is not supported for conveyor tracking.

[\ZeroSpeed]

Zero Speed

Data type: switch

If this argument is used then the robot and external axes must have zero speed before the execution can continue.

If none of the arguments \InPos or \ZeroSpeed is entered, an error message will be displayed.

More examples

More examples of how to use the instruction WaitRob are illustrated below.

Example 1

```
PROC stop_event()  
  WaitRob \ZeroSpeed;  
  SetDO rob_moving, 0;  
ENDPROC
```

The example shows an event routine that executes at program stop. The digital out signal rob_moving is 1 as long as the robot is moving and is set to 0 when the robot and external axes has stopped moving after a program stop.

Syntax

```
WaitRob  
  [ '\ ' InPos ] | [ '\ ' ZeroSpeed ] ';' ;
```

Continues on next page

1 Instructions

1.317 WaitRob - Wait until stop point or zero speed

RobotWare Base

Continued

Related information

For information about	See
Motion in general	<i>Technical reference manual - RAPID Overview, section Motion and I/O principles</i>
Other positioning instructions	<i>Technical reference manual - RAPID Overview, section RAPID summary - Motion</i>
Definition of stop point data	stoppointdata - Stop point data on page 1733

1.318 WaitSyncTask - Wait at synchronization point for other program tasks

Usage

WaitSyncTask is used to synchronize several program tasks at a special point in each program. Each program task waits until all program tasks have reach the named synchronization point.

**Note**

The instruction WaitSyncTask only synchronizes the program execution. To synchronize both the program execution and the robot movements, then the Move instruction before the WaitSyncTask must be a stop-point in all involved program tasks. It is also possible to synchronize both the program execution and the robot movements by using WaitSyncTask \Inpos ... in all involved program tasks.

**WARNING**

To reach safe synchronization functionality, the meeting point (parameter SyncID) must have an unique name in each program task. The name must also be the same for the program tasks that should meet in the meeting point.

Basic examples

The following examples illustrate the instruction WaitSyncTask:

See also [More examples on page 1039](#).

Example 1

Program example in task T_ROB1

```
PERS tasks task_list{2} := [ ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync1;

...
WaitSyncTask sync1, task_list;
...
```

Example 2

Program example in task T_ROB2

```
PERS tasks task_list{2} := [ ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync1;

...
WaitSyncTask sync1, task_list;
...
```

The program task, that first reaches WaitSyncTask with identity sync1, waits until the other program task reaches its WaitSyncTask with the same identity sync1. Then both program tasks T_ROB1 and T_ROB2 continue their execution.

Continues on next page

1 Instructions

1.318 WaitSyncTask - Wait at synchronization point for other program tasks

Multitasking

Continued

Arguments

WaitSyncTask [**\InPos**] SyncID TaskList [**\TimeOut**]

[**\InPos**]

In Position

Data type: switch

If this argument is used then the robot and external axes must have come to a standstill before this program task starts waiting for other program tasks to reach its meeting point specified in the WaitSyncTask instruction.

SyncID

Synchronization identity

Data type: syncident

Variable that specifies the name of the synchronization (meeting) point. Data type syncident is a non-value type only used as an identifier for naming the synchronization point.

The variable must be defined and have an equal name in all cooperated program tasks. It is recommended to always define the variable global in each program task (VAR syncident ...).

TaskList

Data type: tasks

Persistent variable, that in a task list (array) specifies the name (string) of the program tasks, that should meet in the synchronization point with its name according to the argument SyncID.

The persistent variable must be defined and have an equal name and equal contents in all cooperated program tasks. It is recommended to always define the variable global in the system (PERS tasks ...).

[**\TimeOut**]

Data type: num

The max. time for waiting for the other program tasks to reach the synchronization point. Time-out in seconds (resolution 0.001s). If this argument is not specified then the program task will wait for ever.

If this time runs out before all program tasks have reached the synchronization point then the error handler will be called, if there is one, with the error code ERR_WAITSYNCTASK. If there is no error handler then the execution will be stopped.

Program execution

The actual program task will wait at WaitSyncTask until the other program tasks in the TaskList have reached the same SyncID point. At that time the respective program task will continue to execute its next instruction.

WaitSyncTask can be programmed between move instructions with corner zone in between. Depending on the timing balance between the program tasks at execution time, the system can:

- at best timing, keep all corner zones.

Continues on next page

1.318 WaitSyncTask - Wait at synchronization point for other program tasks

*Multitasking**Continued*

- at worst timing, only keep the corner zone for the program task that reaches the WaitSyncTask last. For the other program tasks it will result in stop points.

It is possible to exclude program tasks for testing purposes from FlexPendant - Task Selection Panel.

The following principles can be used:

- Principle 1) Exclude the program task cycle-permanent from Task Selection Panel before starting from main (after set of PP to main) - This disconnection will be valid during the whole program cycle.
- Principle 2) Exclude the program task temporarily from the Task Selection Panel between some WaitSyncTask instructions in the program cycle - The system will only run the other connected tasks but will, with error message, force the user to connect the excluded program tasks before passing co-operated WaitSyncTask.
- Principle 3) If running according principle 2, it is possible to exclude some program task's permanent cycle from Task Selection Panel for further running according to principle 1 by executing the service routine SkipTaskExec.

Note that the Task Selection Panel is locked when running the system in synchronized movements.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_WAITSYNCTASK	A time-out occurs because WaitSyncTask not ready.

More examples

More examples of the instruction WaitSyncTask are illustrated below.

Example 1**Program example in task T_ROB1**

```

PERS tasks task_list{2} := [ ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync1;

...
WaitSyncTask \InPos, sync1, task_list \TimeOut := 60;
...
ERROR
  IF ERRNO = ERR_WAITSYNCTASK THEN
    RETRY;
  ENDIF

```

The program task T_ROB1 waits in instruction WaitSyncTask until its mechanical units are in position and after that it waits for the program task T_ROB2 to reach its synchronization point with the same identity. After waiting for 60 s, the error handler is called with ERRNO equal to ERR_WAITSYNCTASK. Then the instruction WaitSyncTask is called again for an additional 60 s.

Continues on next page

1 Instructions

1.318 WaitSyncTask - Wait at synchronization point for other program tasks

Multitasking

Continued

Limitation

If this instruction is preceded by a move instruction then that move instruction must be programmed with a stop point (zonedata fine), not a fly-by point. Otherwise restart after power failure will not be possible.

WaitSyncTask \InPos cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, or Step.

Syntax

```
WaitSyncTask
[ '\ ' InPos ', ' ]
[ SyncID ' := ' ] < variable (VAR) of syncident > ', '
[ TaskList ' := ' ] < persistent array {*} (PERS) of tasks >
[ '\ ' Timeout ' := ' < expression (IN) of num > ] ';' ;
```

Related information

For information about	See
Specify cooperated program tasks	tasks - RAPID program tasks on page 1749
Identity for synchronization point	syncident - Identity for synchronization point on page 1745

1.319 WaitTestAndSet - Wait until variable becomes FALSE, then set**Usage**

WaitTestAndSet instruction waits for a specified bool persistent variable value to become FALSE. When the variable value becomes FALSE, the instruction will set value to TRUE and continue the execution. The persistent variable can be used as a binary semaphore for synchronization and mutual exclusion.

This instruction has the same underlying functionality as the TestAndSet function, but the WaitTestAndSet is waiting as long as the bool is FALSE while the TestAndSet instruction terminates immediately.

It is not recommended to use WaitTestAndSet instruction in a trap routine, UNDO handler, or event routines.

Examples of resources that can need protection from access at the same time:

- Use of some RAPID routines with function problems when executed in parallel.
- Use of the FlexPendant - Operator Log.

Basic examples

The following example illustrates the instruction WaitTestAndSet:

See also [More examples on page 1042](#).

Example 1

MAIN program task:

```
PERS bool tproutine_inuse := FALSE;
...
WaitTestAndSet tproutine_inuse;
TPWrite "First line from MAIN";
TPWrite "Second line from MAIN";
TPWrite "Third line from MAIN";
tproutine_inuse := FALSE;
```

BACK1 program task:

```
PERS bool tproutine_inuse := FALSE;
...
WaitTestAndSet tproutine_inuse;
TPWrite "First line from BACK1";
TPWrite "Second line from BACK1";
TPWrite "Third line from BACK1";
tproutine_inuse := FALSE;
```

To avoid mixing up the lines in the Operator Log (one from MAIN and one from BACK1) the use of the WaitTestAndSet function guarantees that all three lines from each task are not separated.

If program task MAIN takes the semaphore WaitTestAndSet(tproutine_inuse) first then program task BACK1 must wait until the program task MAIN has left the semaphore.

Continues on next page

1 Instructions

1.319 WaitTestAndSet - Wait until variable becomes FALSE, then set

RobotWare Base

Continued

Arguments

WaitTestAndSet Object

Object

Data type: bool

User defined data object to be used as semaphore. The data object must be a persistent variable PERS. If WaitTestAndSet are used between different program tasks then the object must be a global PERS.

Program execution

This instruction will in one indivisible step check and set the user defined persistent variable like code example below:

- if it has the value FALSE, set it to TRUE
- if it has the value TRUE, wait until it become FALSE and then set it to TRUE

```
IF Object = FALSE THEN
  Object := TRUE;
ELSE
  ! Wait until it become FALSE
  WaitUntil Object = FALSE;
  Object := TRUE;
ENDIF
```

After that the instruction is ready. To avoid problems, because persistent variables keep their value if program pointer PP is moved to main, always set the semaphore object to FALSE in the START event routine.

More examples

More examples of the instruction WaitTestAndSet are illustrated below.

Example 1

```
PERS bool semPers:= FALSE;
...
PROC doit(...)
  WaitTestAndSet semPers;
  ...
  semPers := FALSE;
ENDPROC
```



Note

If program execution is stopped in the routine doit and the program pointer is moved to main then the variable semPers will not be reset. To avoid this, reset the variable semPers to FALSE in the START event routine.

Syntax

```
WaitTestAndSet
[ Object '[:=' ] < persistent (PERS) of bool> ':'
```

Continues on next page

1.319 WaitTestAndSet - Wait until variable becomes FALSE, then set
RobotWare Base
Continued

Related information

For information about	See
Test variable and set if unset (type polled with WaitTime)	TestAndSet - Test variable and set if unset on page 1501

1 Instructions

1.320 WaitTime - Waits a given amount of time
RobotWare Base

1.320 WaitTime - Waits a given amount of time

Usage

WaitTime is used to wait a given amount of time. This instruction can also be used to wait until the robot and external axes have come to a standstill.

Basic examples

The following example illustrates the instruction WaitTime:

See also [More examples on page 1044](#) below.

Example 1

```
WaitTime 0.5;
```

Program execution waits 0.5 seconds.

Arguments

WaitTime [*\InPos*] Time

[*\InPos*]

In Position

Data type: switch

If this argument is used then the robot and external axes must have come to a standstill before the waiting time starts to be counted. This argument can only be used if the task controls mechanical units.

Time

Data type: num

The time, expressed in seconds, that program execution is to wait. Min. value 0 s. Max. value no limit. Resolution 0.001 s.

Program execution

Program execution temporarily stops for the given amount of time. Interrupt handling and other similar functions, nevertheless, are still active.

In manual mode, after waiting more than 3 s, an alert box will pop up asking if the instruction should be simulated. It is possible to configure the alert to not appear, by setting the system parameter *SimulateMenu* to NO, see *Technical reference manual - System parameters*, topic *Controller*, type *General RAPID*.

More examples

More examples of how to use the instruction WaitTime are illustrated below.

Example 1

```
WaitTime \InPos,0;
```

Program execution waits until the robot and the external axes have come to a standstill.

Limitations

The argument *\Inpos* cannot be used together with *SoftServo*.

Continues on next page

If this instruction is preceded by a Move instruction then that Move instruction must be programmed with a stop point (zonedata fine), not a fly-by point. Otherwise it will not be possible to restart after a power failure.

WaitTime \Inpos cannot be executed in a RAPID routine connected to any of the following special system events: PowerOn, Stop, QStop, Restart, or Step.

Syntax

```
WaitTime
['\' InPos ',']
[ Time ':='] <expression (IN) of num> ';'

```

Related information

For information about	See
Waiting until a condition is met	WaitUntil - Waits until a condition is met on page 1046
Waiting until an I/O is set/reset	WaitDI - Waits until a digital input signal is set on page 1003

1 Instructions

1.321 WaitUntil - Waits until a condition is met

RobotWare Base

1.321 WaitUntil - Waits until a condition is met

Usage

WaitUntil is used to wait until a logical condition is met; for example, it can wait until one or several inputs have been set.

Basic examples

The following example illustrates the instruction WaitUntil:

See also [More examples on page 1050](#).

Example 1

```
WaitUntil di4 = 1;
```

Program execution continues only after the di4 input has been set.

Arguments

```
WaitUntil [\InPos] Cond [\MaxTime] [\TimeFlag] [\PollRate]  
          [\Visualize] [\Header] [\Message] | [\MsgArray] [\Wrap]  
          [\Icon] [\Image] [\VisualizeTime] [\UIActiveSignal]  
          [\ErrorNumber] [\TimeOutSignal] [\TimeOutGOSignal]  
          [\TimeOutGOValue]
```

[\InPos]

In Position

Data type: switch

If this argument is used then the robot and external axes must have reached the stop point (ToPoint of current move instruction) before the execution can continue. This argument can only be used if the task controls mechanical units.

Cond

Data type: bool

The logical expression that is to be waited for.

[\MaxTime]

Data type: num

The maximum period of waiting time permitted, expressed in seconds. If this time runs out before the condition is set then the error handler will be called, if there is one, with the error code ERR_WAIT_MAXTIME. If there is no error handler then the execution will be stopped.

[\TimeFlag]

Timeout Flag

Data type: bool

The output parameter that contains the value TRUE if the maximum permitted waiting time runs out before the condition is met. If this parameter is included in the instruction then it is not considered to be an error if the max. time runs out. This argument is ignored if the MaxTime argument is not included in the instruction.

Continues on next page

[\PollRate]

Polling Rate**Data type:** num

The polling rate in seconds for checking if the condition in argument Cond is TRUE. This means that WaitUntil first check the condition at once, and if not TRUE, then after the specified time until TRUE. Min. polling rate value 0.004 s. If this argument is not used then the default polling rate is set to 0.1 s.

[\Visualize]

Data type: switch

If selected, the visualization is activated. The visualization consists of a message box with the logical condition that is not fulfilled, icon, header, message lines, and image is displayed according to the programmed arguments.

[\Header]

Data type: string

Header text to be written at the top of the message box. Maximum 40 characters. If no \Header argument is used a default message will be displayed.

[\Message]

Data type: string

One text line to be written on the display. Maximum 50 characters.

[\MsgArray]

(Message Array)**Data type:** string

Several text lines from an array to be written on the display. Only one of the parameters \Message or \MsgArray can be used at the same time.

Maximum layout space is 5 lines with 50 characters each.

[\Wrap]

Data type: switch

If selected, all the specified strings in the argument \MsgArray will be concatenated to one string with a single space between each individual string and spread out on as few lines as possible.

Default, each string in the argument \MsgArray will be on separate lines on the display.

[\Icon]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 1652](#).

Default, no icon.

[\Image]

Data type: string*Continues on next page*

1 Instructions

1.321 WaitUntil - Waits until a condition is met

RobotWare Base

Continued

The name of the image that should be used. To launch your own images, the images have to be placed in the *HOME:* directory in the active system or directly in the active system.

The recommendation is to place the files in the *HOME:* directory so that they are saved if a backup and restore is done.

A restart is required and then the FlexPendant will load the images.

The image that will be shown can have the width of 185 pixels and the height of 300 pixels. If the image is larger, then only 185 * 300 pixels of the image will be shown starting at the top left of the image.

No exact value can be specified on the size that an image can have or the amount of images that can be loaded to the FlexPendant. It depends on the size of other files loaded to the FlexPendant. The program execution will just continue if an image is used that has not been loaded to the FlexPendant.

[*\VisualizeTime*]

Data type: num

The waiting time before the message box should appear on the FlexPendant. If using the arguments *\VisualizeTime* and *\MaxTime*, the time used in argument *\MaxTime* needs to be bigger than the time used in argument *\VisualizeTime*.

The default time for the visualization if not using the argument *\VisualizeTime* is 5 s. Minimum value 1 s. Maximum value no limit. Resolution 0.001 s.

[*\UIActiveSignal*]

Data type: signaldo

The digital output signal used in optional argument *UIActiveSignal* is set to 1 when the visualization message box is activated on the FlexPendant. When the message box is removed (when the condition is met), the signal is set to 0 again.

No supervision of stop or restart exist. The signal is set to 0 when the instruction is ready, or when PP is moved.

[*\ErrorNumber*]

Error number

Data type: errnum

A variable (before used it is set to 0 by the system) that will hold the error constant if the instruction ends before the signal has the desired value.

If this optional variable is omitted then the error handler will be executed. The constants *ERR_GO_LIM*, *ERR_NO_ALIASIO_DEF*, *ERR_NORUNUNIT*, *ERR_SIG_NOT_VALID*, and *ERR_WAIT_MAXTIME* can be used to select the reason.



Note

If using signals in the *Cond* argument and you get any error when reading signal values, these errors must be handled in an error handler. It can not be handled with use of the *ErrorNumber* optional argument. The reason for this is that the condition is evaluated before entering the actual *WaitUntil* instruction.

Continues on next page

[\TimeOutSignal]

Data type: signaldo

If `TimeOutSignal` is used, the signal is set to 0 when entering the `Wait` instruction. It is set to 1 if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the `Wait` instruction.

This argument can only be used if the argument `MaxTime` is used.

[\TimeOutGOSignal]

Data type: signalgo

If `TimeOutGOSignal` is used, the signal is set to 0 when entering the `Wait` instruction. It is set to the value used in the argument `TimeOutGOValue` if the instruction times out after waiting. The signal is also set to 0 when the program pointer is moved out from the `Wait` instruction.

The optional arguments `TimeOutGOSignal` and `TimeOutGOValue` must be used together.

This argument can only be used if the argument `MaxTime` is used.

[\TimeOutGOValue]

Data type: dnum

The argument `TimeOutGOValue` holds the value that the signal in argument `TimeOutGOSignal` will be set to, if the instruction times out after waiting.

The optional arguments `TimeOutGOSignal` and `TimeOutGOValue` must be used together.

This argument can only be used if the argument `MaxTime` is used.

Program execution

If the programmed condition is not met on execution of a `WaitUntil` instruction then condition is checked again every 100 ms (or according value specified in argument `Pollrate`).

When the robot is waiting, the time is supervised. By default, the robot can wait forever, but the maximal waiting time can be specified with the optional argument `\MaxTime`. If this maximum time is exceeded, an error is raised.

In manual mode, after waiting more than 3 s, an alert box will pop up asking if the instruction should be simulated. It is possible to configure the alert to not appear, by setting the system parameter *SimulateMenu* to NO, see *Technical reference manual - System parameters*, topic *Controller*, type *General RAPID*.

If the switch `\Visualize` is used, a message box is displayed on the FlexPendant according to the programmed arguments. If no `\Header` argument is used a default header text will be displayed. When the execution of the `WaitUntil` instruction is ready, the message box will be removed from the FlexPendant.

New message box on trap level takes the focus from the message box on the basic level.

Continues on next page

1 Instructions

1.321 WaitUntil - Waits until a condition is met

RobotWare Base

Continued

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_GO_LIM	The programmed <code>TimeOutGOValue</code> argument for the specified digital group output signal <code>TimeOutGOSignal</code> is out of limit.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in <code>RAPID</code> . It has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).
ERR_WAIT_MAXTIME	There is a time-out (parameter <code>\MaxTime</code>) before the condition has changed to the right value.

More examples

More examples of how to use the instruction `WaitUntil` are illustrated below.

Example 1

```
VAR bool timeout;
WaitUntil start_input = 1 AND grip_status = 1 \MaxTime := 60
      \TimeFlag := timeout;
IF timeout THEN
  TPWrite "No start order received within expected time";
ELSE
  start_next_cycle;
ENDIF
```

If the two input conditions are not met within 60 seconds then an error message will be written on the display of the FlexPendant.

Example 2

```
WaitUntil \Inpos, di4 = 1;
```

Program execution waits until the robot has come to a standstill and the `di4` input has been set.

Example 3

```
WaitUntil di4 = 1 \MaxTime:=5.5;
..
ERROR
ERROR
  IF ERRNO = ERR_WAIT_MAXTIME THEN
    RAISE;
  ELSE
    Stop;
  ENDIF
```

Program execution waits until the `di4` input has been set. If the I/O device has been disabled, or the waiting time expires, the execution continues in the error handler.

Continues on next page

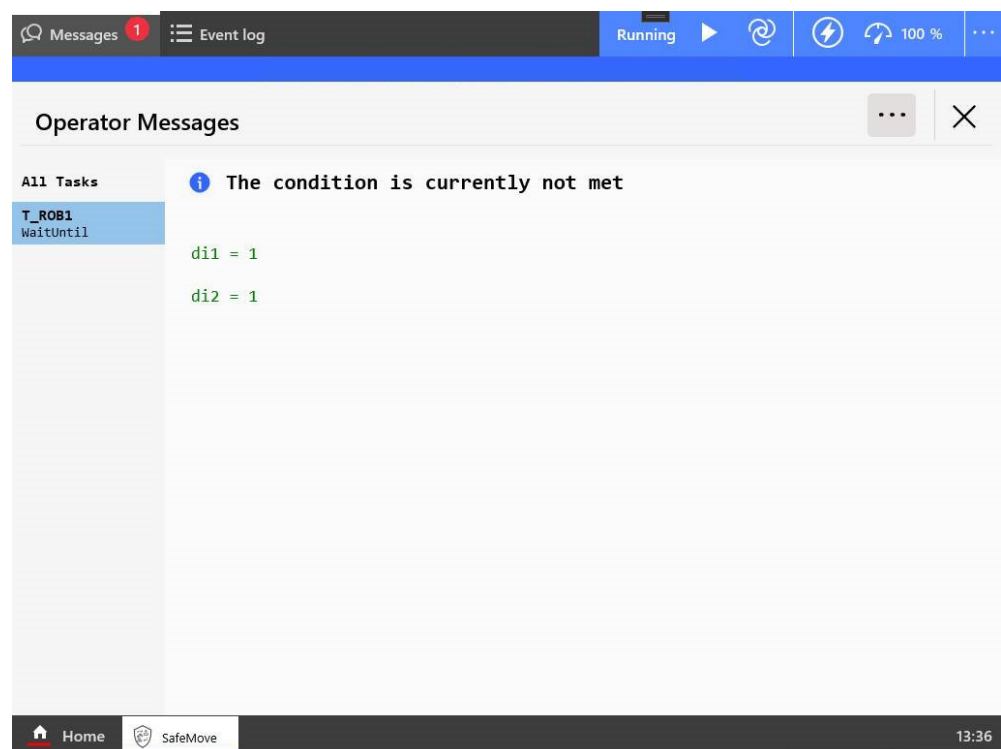
Example 4

```

WaitUntil di1 = 1 AND di2 = 1 \MaxTime := 60 \Visualize;
..
ERROR
  IF ERRNO = ERR_WAIT_MAXTIME THEN
    RAISE;
  ELSE
    Stop;
  ENDIF

```

If the two input conditions are not met within 5 seconds then a message will be written on the display of the FlexPendant. If the conditions is not met within 60 seconds the execution continues in the error handler.



xx2100000704

Example 5

```

WaitUntil di1 = 1 AND di2 = 1 \Visualize \Header:="Waiting for
  signals" \MsgArray:=["Movement will not start until",
    "conditions below are TRUE"] \Icon:=iconError;
MoveL p40, v500, z20, L10tip;
..

```

If the two input conditions are not met then the header and message specified in the optional arguments \Header and \MsgArray will be written on the display of the FlexPendant together with the conditions that are not met.

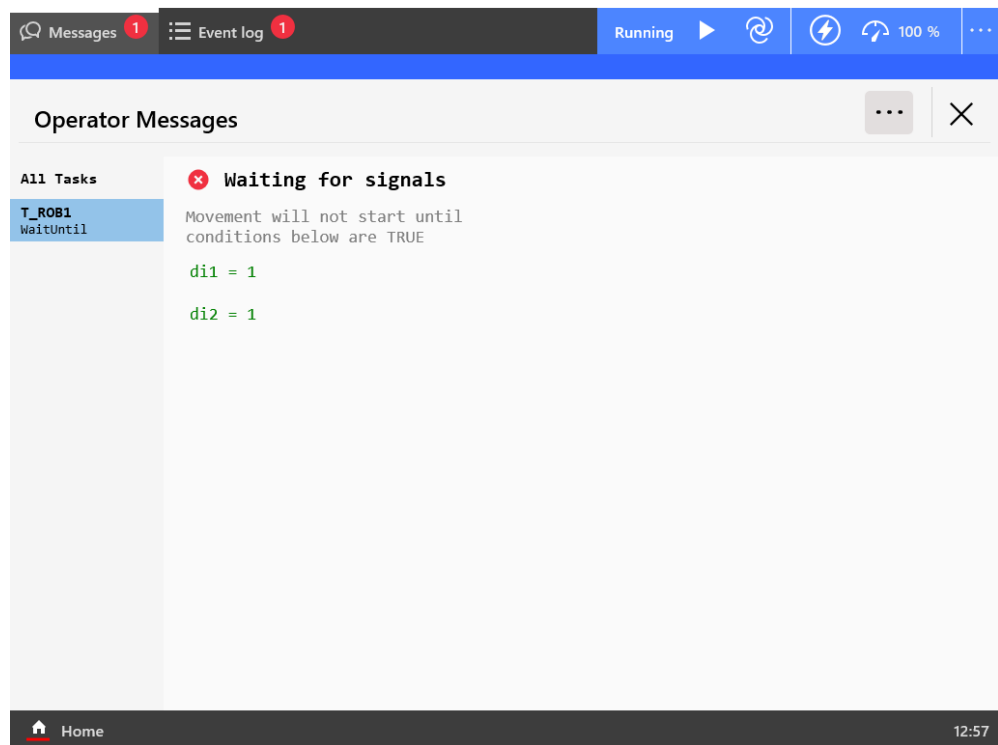
Continues on next page

1 Instructions

1.321 WaitUntil - Waits until a condition is met

RobotWare Base

Continued



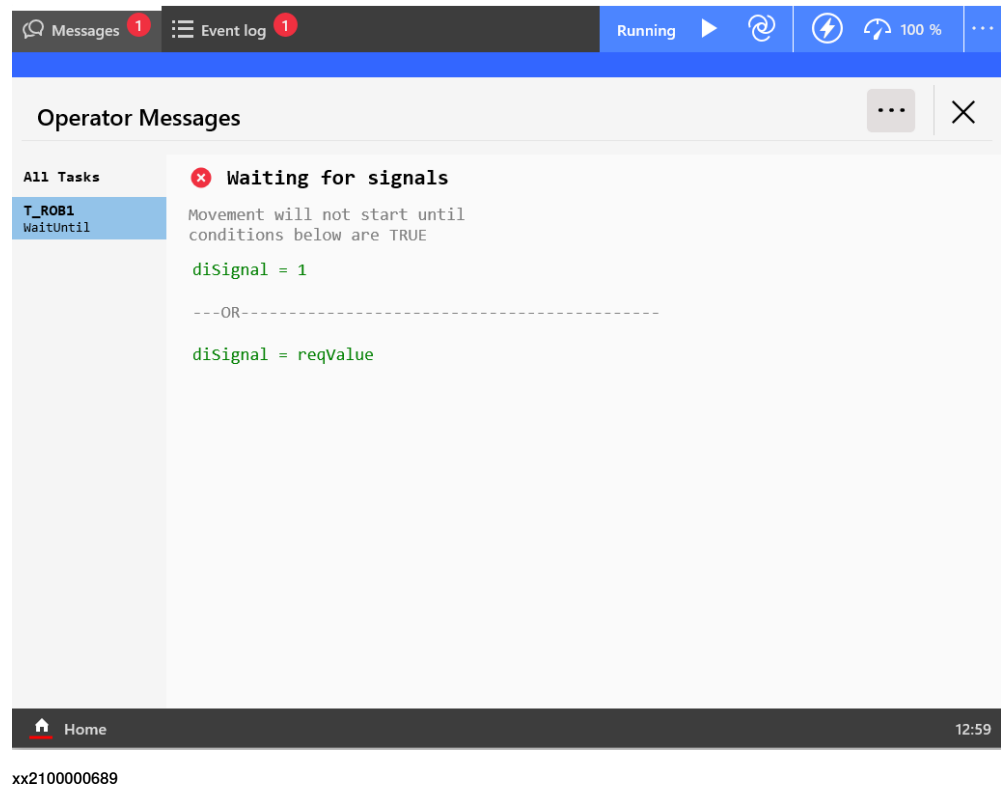
xx2100000688

Example 6

```
VAR num reqValue:=1;  
Waituntil diSignal = 1 OR diSignal = reqValue\Visualize;
```

If a variable is used in the condition with \Visualize, the variable, and not its value, will be displayed if the input conditions are not met.

Continues on next page



Limitation

The argument `\Inpos` cannot be used together with *SoftServo*.

If this instruction is preceded by a Move instruction then that Move instruction must be programmed with a stop point (zonedata fine), not a fly-by point. Otherwise it will not be possible to restart after a power failure.

`WaitUntil \Inpos` cannot be executed in a RAPID routine connected to any of the following special system events: `PowerOn`, `Stop`, `QStop`, `Restart`, or `Step`.

`WaitUntil \Inpos` cannot be used together with `StopMove` to detect if the movement has been stopped. The `WaitUntil` instruction can be hanging forever in that case. It does not detect that the movement has stopped, it detects that the robot and external axes has reached the last programmed `ToPoint` (`MoveX`, `SearchX`, `TriggX`).

Syntax

```
WaitUntil
['\ ' InPos ', ' ]
[Cond ':=' ] <expression (IN) of bool>
['\ ' MaxTime ':=' <expression (IN) of num>]
['\ ' TimeFlag ':=' <variable (VAR) of bool>]
['\ ' PollRate ':=' <expression (IN) of num>]
['\ ' Visualize]
['\ ' Header ':=' <expression (IN) of string>]]
['\ ' Message ':=' <expression (IN) of string>]
| ['\ ' MsgArray ':=' <array {*} (IN) of string>]
['\ ' Wrap]
```

Continues on next page

1 Instructions

1.321 WaitUntil - Waits until a condition is met

RobotWare Base

Continued

```
['\' Icon ':=' <expression (IN) of icondata>]  
['\' Image ':=' <expression (IN) of string>]  
['\' VisualizeTime ':=' <expression (IN) of num>]  
['\' UIActiveSignal ':=' <variable (VAR) of signaldo>]  
['\' ErrorNumber ':=' <variable or persistent (INOUT) of errnum>]  
['\' TimeOutSignal '= ' <variable (VAR) of signaldo>]  
['\' TimeOutGOSignal '= ' <variable (VAR) of signalgo>]  
['\' TimeOutGOValue '= ' <expression (IN) of dnum>'];'
```

Related information

For information about	See
Waiting until an input is set/reset	WaitDI - Waits until a digital input signal is set on page 1003
Waiting a given amount of time	WaitTime - Waits a given amount of time on page 1044
Expressions	<i>Technical reference manual - RAPID Overview</i>

1.322 WaitWObj - Wait for work object on conveyor

Usage

WaitWObj (*Wait Work Object*) connects to a work object in the start window on the conveyor mechanical unit.

Basic examples

The following example illustrates the instruction WaitWObj:

See also [More examples on page 1056](#).

Example 1

```
WaitWObj wobj_on_cnv1;
```

The program connects to the first object in the object queue that is within the start window on the conveyor. If there is no object in the start window then execution waits for an object.

Arguments

```
WaitWObj WObj [ \RelDist ][\MaxTime][\TimeFlag]
```

WObj

Work Object

Data type: wobjdata

The moving work object (coordinate system) to which the robot position in the instruction is related. The mechanical unit conveyor is to be specified by the `ufmec` in the work object.

[\RelDist]

Relative Distance

Data type: num

Waits for an object to enter the start window and go beyond the distance specified by the argument. If the work object is already connected then execution waits until the object passes the given distance. If the object has already gone past the `\RelDist` then execution continues.

[\MaxTime]

Maximum Time

Data type: num

The maximum period of waiting time permitted, expressed in seconds. If this time runs out before the object connection or `\RelDist` reached then the error handler will be called, if there is one, with the error code `ERR_WAIT_MAXTIME`. If there is no error handler then the execution will be stopped.

[\TimeFlag]

Timeout Flag

Data type: bool

The output parameter that contains the value `TRUE` if the maximum permitted waiting time runs out before the object connection or `\RelDist` is reached. If this

Continues on next page

1 Instructions

1.322 WaitWObj - Wait for work object on conveyor

Conveyor Tracking

Continued

parameter is included in the instruction then it is not considered to be an error if the max. time runs out. This argument is ignored if the MaxTime argument is not included in the instruction.

Program execution

If there is no object in the start window then program execution waits. If an object is present then the work object is connected to the conveyor and execution continues.

If a second WaitWObj instruction is issued while connected then an error is returned unless the \RelDist optional argument is used.

Error handling

If the following errors occur during execution of the WaitWObj instruction then the system variable ERRNO will be set. These errors can then be handled in the error handler.

Name	Cause of error
ERR_CNV_NOT_ACT	The conveyor is not activated.
ERR_CNV_CONNECT	The WaitWObj instruction is already connected.
ERR_CNV_DROPPED	The object that the instruction WaitWObj was waiting for has been dropped by another task.
ERR_WAIT_MAXTIME	The object did not come in time and there is no Timeflag.
ERR_CNV_OBJ_LOST	The object has passed the StartwindowWidth without being connected.

More examples

More examples of the instruction WaitWObj are illustrated below.

Example 1

```
WaitWObj wobj_on_cnv1\RelDist:=500.0;
```

If not connected then wait for the object to enter the start window and then wait for the object to pass the 500 mm point on the conveyor.

If already connected to the object then wait for the object to pass 500 mm.

If not connected then wait for an object in the start window.

Example 2

```
WaitWObj wobj_on_cnv1\RelDist:=0.0;
```

If already connected then continue execution as the object has already gone past 0.0 mm.

Example 3

```
WaitWObj wobj_on_cnv1;  
WaitWObj wobj_on_cnv1\RelDist:=0.0;
```

The first WaitWObj connects to the object in the start window. The second WaitWObj will return immediately if the object is still connected. But it will wait for the next object if the previous object had moved past the maximum distance or was dropped.

Continues on next page

1.322 WaitWObj - Wait for work object on conveyor

Conveyor Tracking

Continued

Example 4

```
WaitWObj wobj_on_cnv1\RelDist:=500.0\MaxTime:=0.1 \Timeflag:=flag1;
```

The WaitWObj will return immediately if the object has passed 500 mm but otherwise will wait 0.1 sec for an object. If no object passes 500 mm during this 0.1 sec the instruction will return with flag1 =TRUE.

Limitations

It requires 50 ms to connect to the first object in the start window. Once connected, a second WaitWObj with \RelDist optional argument will take only normal RAPID instruction execution time.

Syntax

```
WaitWObj
[ WObj ']:='] < persistent (PERS) of wobjdata> ';'
[ '\ ' RelDist ']:= ' < expression (IN) of num > ]
[ '\ ' MaxTime ']:= ' <expression (IN) of num>]
[ '\ ' TimeFlag ']:= ' <variable (VAR) of bool>] ';
```

Related information

For information about	See
Drop workobject on conveyor	DropWObj - Drop work object on conveyor on page 184
Conveyor tracking	<i>Application manual - Conveyor tracking</i>

1 Instructions

1.323 WarmStart - Restart the controller

RobotWare Base

1.323 WarmStart - Restart the controller

Usage

WarmStart is used to restart the controller.

The system parameters can be changed from RAPID with the instruction WriteCfgData. You must restart the controller in order for a change to have effect on some of the system parameters. The restart can be done with this instruction WarmStart.

Basic examples

The following example illustrates the instruction WarmStart:

Example 1

```
WriteCfgData "/MOC/MOTOR_CALIB/rob1_1", "cal_offset", offset1;  
WarmStart;
```

Writes the value of the num variable offset1 as calibration offset for axis 1 on rob1 and generates a restart of the controller.

Program execution

Warmstart takes effect at once and the program pointer is set to the next instruction.

Syntax

```
WarmStart ';' ;
```

Related information

For information about	See
Write attribute of a system parameter	WriteCfgData - Writes attribute of a system parameter on page 1074
Configuration	<i>Technical reference manual - System parameters</i>
<i>Advanced RAPID</i>	<i>Product specification - OmniCore C line, Product specification - OmniCore E line, Product specification - OmniCore V line</i>

1.324 WHILE - Repeats as long as ...

Usage

WHILE is used when a number of instructions are to be repeated as long as a given condition expression evaluates to a TRUE value.



Tip

If it is possible to determine the number of repetitions then the FOR instruction can be used.

Basic examples

The following example illustrates the instruction WHILE:

Example 1

```
WHILE reg1 < reg2 DO
  ...
  reg1 := reg1 + 1;
ENDWHILE
```

Repeats the instructions in the WHILE-block as long as `reg1 < reg2`.

Arguments

```
WHILE Condition DO ... ENDWHILE
```

Condition

Data type: `bool`

The condition that must be evaluated to a TRUE value for the instructions in the WHILE-block to be executed.

Program execution

- 1 The condition expression is evaluated. If the expression evaluates to a TRUE value then the instructions in the WHILE-block are executed.
- 2 The condition expression is then evaluated again, and if the result of this evaluation is TRUE then the instructions in the WHILE-block are executed again.
- 3 This process continues until the result of the expression evaluation becomes FALSE.
- 4 If a Break is executed in the WHILE loop, the loop is interrupted and the execution continues after the WHILE loop.
- 5 If a Continue is executed in the WHILE loop, the rest of the statements in the loop are disregarded, and the execution continues in the beginning of the WHILE loop.

The iteration is then terminated and the program execution continues from the instruction after the WHILE-block.

Continues on next page

1 Instructions

1.324 WHILE - Repeats as long as ...

RobotWare Base

Continued

If the result of the expression evaluation is FALSE at the very outset then the instructions in the WHILE-block are not executed at all, and the program control transfers immediately to the instruction that follows after the WHILE-block.

Syntax

```
WHILE <conditional expression> DO
  <statement list>
ENDWHILE
```

Related information

For information about	See
Expressions	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Expressions</i>
Repeats a given number of times	<i>FOR - Repeats a given number of times on page 216</i>
Break the WHILE loop	<i>Break - Break a loop on page 49</i>
Skip the rest of the WHILE loop	<i>Continue - Skip the rest of the loop on page 162</i>

1.325 WorldAccLim - Control acceleration in world coordinate system

Usage

WorldAccLim (*World Acceleration Limitation*) is used to limit the acceleration/deceleration of the tool (and payload) in the world coordinate system. The limitation will be achieved all together in the gravity center point of the actual tool, actual payload (if present), and the mounting flange of the robot.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following examples illustrate the instruction WorldAccLim:

Example 1

```
WorldAccLim \On := 3.5;
```

Acceleration/deceleration is limited to 3.5 m/s².

Example 2

```
WorldAccLim \Off;
```

The acceleration/deceleration is reset to maximum (default).

Arguments

```
WorldAccLim [\On] | [\Off]
```

[\On]

Data type: num

The absolute value of the acceleration/deceleration limitation in m/s².

[\Off]

Data type: switch

No limit. Maximum acceleration (default).

Program execution

The acceleration limitations applies for the next executed robot movement instruction and is valid until a new WorldAccLim instruction is executed.

The maximum acceleration (WorldAccLim \Off) is automatically set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

Continues on next page

1 Instructions

1.325 WorldAccLim - Control acceleration in world coordinate system

RobotWare Base

Continued

It is recommended to use just one type of limitation of the acceleration. If a combination of instructions WorldAccLim, AccSet, and PathAccLim are done then the system reduces the acceleration/deceleration in the following order:

- according WorldAccLim
- according AccSet
- according PathAccLim

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_ACC_TOO_LOW	The argument On is set to a value that is too low.

Limitations

The minimum acceleration allowed is 0.1 m/s^2 .

The following robot models are not supported and cannot use the WorldAccLim instruction:

- Delta robots

Syntax

```
WorldAccLim  
[ '\ ' On ' := ' <expression (IN) of num> ] | [ '\ ' Off ] ';' ;
```

Related information

For information about	See
Positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Motion settings data	motsetdata - Motion settings data on page 1674
Reduction of acceleration	AccSet - Reduces the acceleration on page 23
Limitation of acceleration along the path	PathAccLim - Reduce TCP acceleration along the path on page 515

1.326 WristOpt - Optimization of calibration for wrist axes

Usage

WristOpt (*Wrist Optimization*) is used to improve TCP reorientation performance by identifying optimized calibration positions for the wrist axes.

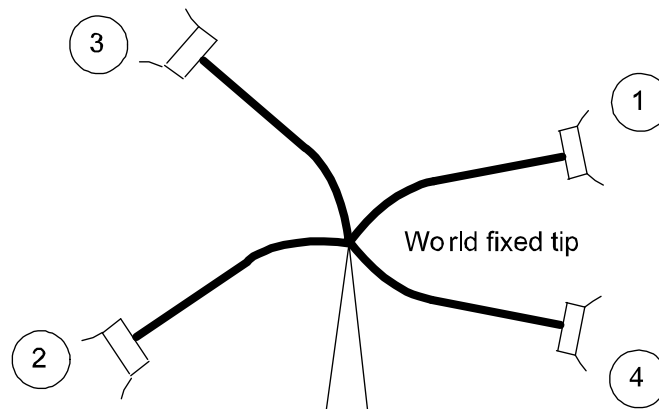
Wrist optimization is usually done using a service routine, see *Operating manual - OmniCore*. The WristOpt RAPID instruction can be used as an advanced alternative to the service routine if, for example, TCP calibration targets are already available.

For more information on how and when to run wrist optimization, see the product manual for the manipulator.

Description

To run the wrist optimization you need a world fixed tip within the robot's working space.

- 1 Jog the TCP of the actual tool as close as possible to the world fixed tip (origin of the tool coordinate system) and define a jointtarget for the reference point RefTip.
 - 2 Define the three more positions (p2, p3, and p4), all with different orientation.
- Definition of 4 jointtargets p1....p4, see figure below.



xx0500002191

Basic examples

The following examples illustrate the instruction WristOpt:

Example 1

```
! Created with actual TCP pointing at a world fixed tip
CONST jointtarget p1 := [...];
CONST jointtarget p2 := [...];
CONST jointtarget p3 := [...];
CONST jointtarget p4 := [...];
VAR num CalPosAx4;
VAR num CalPosAx5;
```

Continues on next page

1 Instructions

1.326 WristOpt - Optimization of calibration for wrist axes

Continued

```
VAR jointtarget calibTarget;

! Load Wrist Optimization module into system
Load \Dynamic, "RELEASE:/system/calwrist_proc.sysx";

! Optimize axis 4 and 5 with 4 jointtargets (from TCP-calibration)
%"WristOpt"% p1, p2, p3, p4, CalPosAx4, CalPosAx5;

! Unload Wrist Optimization module
Unload "RELEASE:/system/calwrist_proc.sysx";

! Move to target calibration position for axis 4 and 5
calibTarget := CJointT();
calibTarget.robax.rax_4 := CalPosAx4;
calibTarget.robax.rax_5 := CalPosAx5;

! If robot has coupled wrist, axis 6 also needs to be calibrated
calibTarget.robax.rax_6 := 0;
MoveAbsJ calibTarget \NoEOffs,v100,fine,tool0\WObj:=wobj0;

! Manually fine calibrate axis 4 and 5 (and 6) from FlexPendant
```

Example 2

This example is for the GoFa robots, CRB 15000.

```
! Created with actual TCP pointing at a world fixed tip
CONST jointtarget p1 := [...];
CONST jointtarget p2 := [...];
CONST jointtarget p3 := [...];
CONST jointtarget p4 := [...];
VAR num CalPosAx4;
VAR num CalPosAx5;
VAR jointtarget calibTarget;

! Load Wrist Optimization module into system
Load \Dynamic, "RELEASE:/system/calwrist_proc.sysx";

! Optimize axis 4 and 5 with 4 jointtargets (from TCP-calibration)
%"WristOpt"% p1, p2, p3, p4, CalPosAx4, CalPosAx5;

! Unload Wrist Optimization module
Unload "RELEASE:/system/calwrist_proc.sysx";

! For CRB15000 the manipulator is not recalibrated,
! adjustment is added to parameter cal_position
! Convert result to radians and write to CFG
! NOTE negative sign on adjustment
WriteCfgData "/MOC/ARM/rob1_4", "cal_position", -CalPosAx4*pi/180;
WriteCfgData "/MOC/ARM/rob1_5", "cal_position", -CalPosAx5*pi/180;

! Reboot controller to apply changes
WarmStart;
```

Continues on next page

Arguments

```
WristOpt Pos1 Pos2 Pos3 Pos4 CalPosAx4 CalPosAx5 [\OptTool]
[\OptMaxErr] [\OptMeanErr]
```

Pos1

Data type: jointtarget

The first approach point.

Pos2

Data type: jointtarget

The second approach point.

Pos3

Data type: jointtarget

The third approach point.

Pos4

Data type: jointtarget

The fourth approach point.

CalPosAx4

Data type: num

Variable for the calibration position of axis 4 to be used after the optimization.

CalPosAx5

Data type: num

Variable for the calibration position of axis 5 to be used after the optimization.

[\OptTool]

Data type: tooldata

Persistent variable of the tool that is identified after the optimization.

This is an optional argument if the identified tooldata should be saved.

[\OptMaxErr]

Data type: num

The optimized maximum error in mm for one approach point.

[\OptMeanErr]

Data type: num

The optimized average distance that the approach points are from the calculated TCP, that is, how accurately the robot was positioned relative to the tip.

Syntax

```
WristOpt
[ Pos1 ':'<expression (IN) of jointtarget>' , '
[ Pos2 ':'<expression (IN) of jointtarget>' , '
[ Pos3 ':'<expression (IN) of jointtarget>' , '
[ Pos4 ':'<expression (IN) of jointtarget>' , '
[ CalPosAx4 ':'<expression (IN) of num>' , '
[ CalPosAx5 ':'<expression (IN) of num>' , '
[ \OptTool ]
[ \OptMaxErr ]
[ \OptMeanErr ]
```

Continues on next page

1 Instructions

1.326 WristOpt - Optimization of calibration for wrist axes

Continued

```
[ CalPosAx5 ':='] <expression (IN) of num>','  
[ \OptTool ':='] <persistent (PERS) of tooldata>  
[ \OptMaxErr ':='] <variable (VAR) of num>  
[ \OptMeanErr ':='] <variable (VAR) of num>;'
```

Related information

For information about	See
Service routines	<i>Operating manual - OmniCore</i> Product manual for the manipulator

1.327 Write - Writes to a character-based file or I/O device

Usage

Write is used to write to a character-based file or I/O device. The value of certain data can be written as well as text.

Basic examples

The following examples illustrate the instruction Write:

Example 1

```
Write logfile, "Execution started";
```

The text `Execution started` is written to the file with reference name `logfile`.

Example 2

```
VAR num reg1:=5;
...
Write logfile, "No of produced parts="\Num:=reg1;
```

The text `No of produced parts=5`, is written to the file with the reference name `logfile`.

Arguments

```
Write IODevice String [\Num] | [\Bool] | [\Pos] | [\Orient] |
[\Dnum] [\NoNewLine] [\ISOLatin1Encoding]
```

IODevice

Data type: `iodev`

The name (reference) of the current file or I/O device.

String

Data type: `string`

The text to be written.

[\Num]

Numeric

Data type: `num`

The data whose numeric values are to be written after the text string.

[\Bool]

Boolean

Data type: `bool`

The data whose logical values are to be written after the text string.

[\Pos]

Position

Data type: `pos`

The data whose position is to be written after the text string.

[\Orient]

Orientation

Continues on next page

1 Instructions

1.327 Write - Writes to a character-based file or I/O device

RobotWare Base

Continued

Data type: orient

The data whose orientation is to be written after the text string.

[**\Dnum**]

Numeric

Data type: dnum

The data whose numeric values are to be written after the text string.

[**\NoNewLine**]

Data type: switch

Omits the line-feed character that normally indicates the end of the text, i.e. next write instruction will continue on the same line.

[**\ISOLatin1Encoding**]

Data type: switch

If using this switch the Write instruction converts the data used in the argument String to ISO 8859-1 (Latin-1) encoding before writing to the character-based file or I/O device.

Program execution

The text string is written to a specified file or I/O device. A line-feed character (LF) is also written, but can be omitted if the argument **\NoNewLine** is used.

If one of the arguments **\Num**, **\Bool**, **\Pos**, or **\Orient** is used then its value is first converted to a text string before being added to the first string. The conversion from value to text string takes place as follows:

Argument	Value	Text string
\Num	23	"23"
\Num	1.141367	"1.14137"
\Bool	TRUE	"TRUE"
\Pos	[1817.3,905.17,879.11]	"[1817.3,905.17,879.11]"
\Orient	[0.96593,0,0.25882,0]	"[0.96593,0,0.25882,0]"
\Dnum	4294967295	"4294967295"

The value is converted to a string with standard RAPID format. This means in principle 6 significant digits. If the decimal part is less than 0.000005 or greater than 0.999995, the number is rounded to an integer.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type `iodev` will be reset.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_FILEACC</code>	An error occurs during writing.

Continues on next page

Limitations

The arguments \Num, \Dnum, \Bool, \Pos, and \Orient are mutually exclusive and thus cannot be used simultaneously in the same instruction.

This instruction can only be used for files or I/O devices that have been opened for writing.

Syntax

```

Write
[ IODevice ':=' ] <variable (VAR) of iodev> ', '
[ String ':=' ] <expression (IN) of string>
[ '\ ' Num ':=' <expression (IN) of num> ]
| [ '\ ' Bool ':=' <expression (IN) of bool> ]
| [ '\ ' Pos ':=' <expression (IN) of pos> ]
| [ '\ ' Orient ':=' <expression (IN) of orient> ]
| [ '\ ' Dnum ':=' <expression (IN) of dnum> ]
[ '\ ' NoNewLine]
[ '\ ' ISOLatin1Encoding] ';'

```

Related information

For information about	See
Opening a file or I/O device	<i>Technical reference manual - RAPID Overview</i>
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>

1 Instructions

1.328 WriteAnyBin - Writes data to a binary file or I/O device

RobotWare Base

1.328 WriteAnyBin - Writes data to a binary file or I/O device

Usage

WriteAnyBin (*Write Any Binary*) is used to write any type of data to a binary file or I/O device.

Basic examples

The following example illustrates the instruction WriteAnyBin:

Example 1

```
VAR iodev file1;  
VAR orient quat1 := [1, 0, 0, 0];  
...  
Open "HOME:" \File:= "FILE1.DOC", file1 \Bin;  
WriteAnyBin file1, quat1;
```

The orient data quat1 is written to the channel referred to by channel1.

Arguments

WriteAnyBin IODevice Data

IODevice

Data type: iodev

The name (reference) of the binary file or I/O device for the writing operation.

Data

Data type: anytype

Data to be written.

Program execution

As many bytes as required for the specified data are written to the specified binary file or I/O device.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type iodev will be reset.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	An error occurs during writing.

Limitations

This instruction can only be used for files or I/O devices that have been opened for binary writing.

The data to be written by this instruction WriteAnyBin must be value data type such as num, bool, or string. Record, record component, array, or array element of these value data types can also be used. Entire data or partial data with semi-value or non-value data types cannot be used.

Continues on next page

1.328 WriteAnyBin - Writes data to a binary file or I/O device

RobotWare Base

Continued

Because WriteAnyBin-ReadAnyBin is designed to only send internal controller data between robot controllers, no data protocol is released and the data cannot be interpreted on any PC.

**Note**

Control software development can break the compatibility, and therefore it might not be possible to use WriteAnyBin-ReadAnyBin between different software versions of RobotWare.

Syntax

```
WriteAnyBin
[ IODevice '[:='] <variable (VAR) of iodev> ', '
[ Data '[:='] <expression (IN) of anytype> ';' ]
```

Related information

For information about	See
Opening of I/O devices or files	<i>Technical reference manual - RAPID Overview</i>
Read data from a binary I/O device or file	ReadAnyBin - Read data from a binary I/O device or file on page 567
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>

1 Instructions

1.329 WriteBin - Writes to a binary I/O device

RobotWare Base

1.329 WriteBin - Writes to a binary I/O device

Usage

WriteBin is used to write a number of bytes to a binary I/O device.

Basic examples

The following example illustrates the instruction WriteBin:

Example 1

```
WriteBin channel2, text_buffer, 10;
```

10 characters from the text_buffer list are written to the channel referred to by channel2.

Arguments

```
WriteBin IODevice Buffer NChar
```

IODevice

Data type: iodev

Name (reference) of the current I/O device.

Buffer

Data type: array of num

The list (array) containing the numbers (characters) to be written.

NChar

Number of Characters

Data type: num

The number of characters to be written from the Buffer.

Program execution

The specified number of numbers (characters) in the list is written to the I/O device.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type iodev will be reset.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	An error occurs during writing.

Limitations

This instruction can only be used for I/O devices that have been opened for binary writing.

Syntax

```
WriteBin  
[ IODevice '[:=' ] <variable (VAR) of iodev> ', '
```

Continues on next page

```
[ Buffer ':='] <array {*} (IN) of num> ','
[ NChar ':='] <expression (IN) of num> ';'

```

Related information

For information about	See
Opening, etc. of I/O devices	<i>Technical reference manual - RAPID Overview</i>
Convert a string to a byte data	StrToByte - Converts a string to a byte data on page 1487
Byte data	byte - Integer values 0-255 on page 1597
File and I/O device handling	<i>Application manual - Controller software Omni-Core</i>

1 Instructions

1.330 WriteCfgData - Writes attribute of a system parameter *RobotWare Base*

1.330 WriteCfgData - Writes attribute of a system parameter

Usage

WriteCfgData is used to write one attribute of a system parameter (configuration data).

Besides writing named parameters, it is also possible to search and update unnamed parameters

Basic examples

The following examples illustrate the instruction WriteCfgData. Both of these examples show how to write named parameter data.

Example 1

```
VAR num offset1 := 1.2;
...
WriteCfgData "/MOC/MOTOR_CALIB/rob1_1", "cal_offset", offset1;
```

Written in the num variable offset1, the calibration offset for axis 1 on rob_1.

Example 2

```
VAR string io_device := "my_device";
...
WriteCfgData "/EIO/EIO_SIGNAL/process_error", "Device", io_device;
```

Written in the string variable io_device, the name of the I/O device where the signal process_error is defined.

Arguments

WriteCfgData InstancePath Attribute CfgData [\ListNo]

InstancePath

Data type: string

Specifies the path to the parameter to be accessed.

For named parameters, the format of this string is /DOMAIN/TYPE/ParameterName.

For unnamed parameters, the format of this string is /DOMAIN/TYPE/Attribute/AttributeValue.

Attribute

Data type: string

The name of the attribute of the parameter to be written.

CfgData

Data type: anytype

The data object from which the new data to store is read. Depending on the attribute type, valid types are bool, num, dnum, or string.

[\ListNo]

Data type: num

Variable holding the instance number of the Attribute + AttributeValue to be found and updated.

Continues on next page

First occurrence of the `Attribute + AttributeValue` has instance number 0. If there are more instances to search for then the returned value in `\ListNo` will be incremented with 1. Otherwise if there are no more instance then the returned value will be -1. The predefined constant `END_OF_LIST` can be used for check if there are more instances to search for.

Program execution

The value of the attribute specified by the `Attribute` argument is set according to the value of the data object specified by the `CfgData` argument.

If using format `/DOMAIN/TYPE/ParameterName` in `InstancePath` then only named parameters can be accessed, i.e. parameters where the first attribute is name, Name, or NAME.

For unnamed parameters, use the optional parameter `\ListNo` to specify which instance to write the attribute value to. It is updated after each successful write to the next available instance to write to.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_CFG_NOTFND</code>	It is not possible to find the data specified with "InstancePath + Attribute" in the configuration database.
<code>ERR_CFG_ILLTYPE</code>	The data type for parameter <code>CfgData</code> is not equal to the real data type for the found data specified with "InstancePath + Attribute" in the configuration database.
<code>ERR_CFG_LIMIT</code>	The data for parameter <code>CfgData</code> is outside limits (max./min. value).
<code>ERR_CFG_INTERNAL</code>	Trying to write internally written protected data.
<code>ERR_CFG_OUTOFBOUNDS</code>	Variable in argument <code>\ListNo</code> has a value outside range of available instances (0 ... n) when executing the instruction.

More examples

More examples of the instruction `WriteCfgdata` are illustrated below. Both of these examples show how to write to unnamed parameters.

Example 1

```
VAR num read_index;
VAR num write_index;
VAR string read_str;
...
read_index:=0;
write_index:=0;
ReadCfgData "/EIO/EIO_CROSS/Act1/do_13", "Res", read_str,
  \ListNo:=read_index;
WriteCfgData "/EIO/EIO_CROSS/Act1/do_13", "Res", "my"+read_str,
  \ListNo:=write_index;
```

Continues on next page

1 Instructions

1.330 WriteCfgData - Writes attribute of a system parameter

RobotWare Base

Continued

Reads the resultant signal for the unnamed digital actor signal do_13 and places the name in the string variable read_str. Then update the name to di_13 with prefix "my".

In this example, domain EIO has the following cfg code:

EIO_CROSS:

```
-Name "Cross_di_1_do_2" -Res "di_1" -Act1 "do_2"  
-Name "Cross_di_2_do_2" -Res "di_2" -Act1 "do_2"  
-Name "Cross_di_13_do_13" -Res "di_13" -Act1 "do_13"
```

Example 2

```
VAR num read_index;  
VAR num write_index;  
VAR string read_str;  
...  
read_index:=0;  
write_index:=0;  
WHILE read_index <> END_OF_LIST DO  
    ReadCfgData "/EIO/EIO_SIGNAL/Device/USERIO", "Name", read_str,  
        \ListNo:=read_index;  
    IF read_index <> END_OF_LIST THEN  
        WriteCfgData "/EIO/EIO_SIGNAL/Device/USERIO", "Name",  
            "my"+read_str, \ListNo:=write_index;  
    ENDIF  
ENDWHILE
```

Read the names of all signals defined for the I/O device USERIO. Change the names on the signals to the read name with the prefix "my".

In this example, domain EIO has the following cfg code:

```
EIO_SIGNAL:  
-Name "USERD01" -SignalType "D0" -Device "USERIO" -DeviceMap "0"  
-Name "USERD02" -SignalType "D0" -Device "USERIO" -DeviceMap "1"  
-Name "USERD03" -SignalType "D0" -Device "USERIO" -DeviceMap "2"
```

Limitations

The conversion from RAPID program units (mm, degree, second etc.) to system parameter units (m, radian, second etc.) for CfgData of data type num and dnum must be done by the user in the RAPID program.

For most system parameters, you must manually restart the controller or execute the instruction WarmStart in order for the change to have effect. System parameters that can be changed from RobotStudio or FlexPendant without a restart does not require a restart when changed from RAPID either.

If using format /DOMAIN/TYPE/ParameterName in InstancePath then only named parameters can be accessed, i.e. parameters where the first attribute is name, Name, or NAME.

RAPID strings are limited to 80 characters. In some cases, this can be in theory too small for the definition of InstancePath, Attribute, or CfgData.

Continues on next page

Predefined data

The predefined constant END_OF_LIST with value -1 can be used to stop writing when no more instances can be found.

Syntax

```
WriteCfgData
[ InstancePath ':' ] < expression (IN) of string > ','
[ Attribute ':' ] < expression (IN) of string > ','
[ CfgData ':' ] < expression (IN) of anytype >
[ '\\' ListNo ':' < variable (VAR) of num > ] ';' ;
```

Related information

For information about	See
Definition of string	string - Strings on page 1739
Read attribute of a system parameter	ReadCfgData - Reads attribute of a system parameter on page 569
Get robot name in current task	RobName - Get the TCP robot name on page 1433
Configuration	<i>Technical reference manual - System parameters</i>
Restart of the system	WarmStart - Restart the controller on page 1058
<i>Advanced RAPID</i>	<i>Product specification - OmniCore C line, Product specification - OmniCore E line, Product specification - OmniCore V line</i>

1 Instructions

1.331 WriteRawBytes - Write rawbytes data

RobotWare Base

1.331 WriteRawBytes - Write rawbytes data

Usage

WriteRawBytes is used to write data of type rawbytes to a device opened with Open\Bin.

Basic examples

The following example illustrates the instruction WriteRawBytes:

Example 1

```
VAR iODEV io_device;
VAR rawbytes raw_data_out;
VAR rawbytes raw_data_in;
VAR num float := 0.2;
VAR string answer;

ClearRawBytes raw_data_out;
PackDNHeader "10", "20 1D 24 01 30 64", raw_data_out;
PackRawBytes float, raw_data_out, (RawBytesLen(raw_data_out)+1)
    \Float4;

Open "/FCI1:/dsqc328_1", io_device \Bin;
WriteRawBytes io_device, raw_data_out;
ReadRawBytes io_device, raw_data_in \Time:=1;
Close io_device;
UnpackRawBytes raw_data_in, 1, answer \ISOLatin1Encoding=10;
```

In this example raw_data_out is cleared and then packed with DeviceNet header and a float with value 0.2.

A device, "/FCI1:/dsqc328_1", is opened and the current valid data in raw_data_out is written to the device. Then the program waits for at most 1 second to read from the device, which is stored in the raw_data_in.

After having closed the device "/FCI1:/dsqc328_1", then the read data is unpacked as a string of 10 characters and stored in answer.

Arguments

WriteRawBytes IODEV RawData [\NoOfBytes]

IODEV

Data type: iODEV

IODEV is the identifier of the device to which RawData shall be written.

RawData

Data type: rawbytes

RawData is the data container to be written to IODEV.

[\NoOfBytes]

Data type: num

Continues on next page

\NoOfBytes tells how many bytes of RawData should be written to IODevice, starting at index 1.

If \NoOfBytes is not present then the current length of valid bytes in the variable RawData is written to device IODevice.

Program execution

During program execution, data is written to the device indicated by IODevice.

If using WriteRawBytes for fieldbus commands, then the fieldbus always sends an answer. The answer must be handled in RAPID with the ReadRawBytes instruction.

The length of valid bytes in the RawData variable is not changed.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type iODEV will be reset.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	An error occurs during writing.

Syntax

```
WriteRawBytes
  [ IODevice ':' ] < variable (VAR) of iODEV> ','
  [ RawData ':' ] < variable (VAR) of rawbytes>
  [ '\ ' NoOfBytes ':' < expression (IN) of num> ] ';' ;
```

Related information

For information about	See
rawbytes data	rawbytes - Raw data on page 1702
Get the length of rawbytes data	RawBytesLen - Get the length of rawbytes data on page 1404
Clear the contents of rawbytes data	ClearRawBytes - Clear the contents of rawbytes data on page 140
Copy the contents of rawbytes data	CopyRawBytes - Copy the contents of rawbytes data on page 165
Pack DeviceNet header into rawbytes data	PackDNHeader - Pack DeviceNet Header into rawbytes data on page 506
Pack data into rawbytes data	PackRawBytes - Pack data into rawbytes data on page 509
Read rawbytes data	ReadRawBytes - Read rawbytes data on page 576
Unpack data from rawbytes data	UnpackRawBytes - Unpack data from rawbytes data on page 981
File and I/O device handling	Application manual - Controller software Omni-Core

1 Instructions

1.332 WriteStrBin - Writes a string to a binary I/O device

RobotWare Base

1.332 WriteStrBin - Writes a string to a binary I/O device

Usage

WriteStrBin (*Write String Binary*) is used to write a string to a binary I/O device or binary file.

Basic examples

The following example illustrates the instruction WriteStrBin:

Example 1

```
WriteStrBin channel2, "Hello World\0A";
```

The string "Hello World\0A" is written to the channel referred to by channel2. The string is in this case ended with new line \0A. All characters and hexadecimal values written with WriteStrBin will be unchanged by the system.

Arguments

```
WriteStrBin IODevice Str [\ISOLatin1Encoding]
```

IODevice

Data type: iODEV

Name (reference) of the current I/O device.

Str

String

Data type: string

The text to be written.

[\ISOLatin1Encoding]

Data type: switch

If using this switch the WriteStrBin instruction converts the data used in the argument Str to ISO 8859-1 (Latin-1) encoding before writing to the binary I/O device or binary file.

Program execution

The text string is written to the specified I/O device or file.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type iODEV will be reset.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	An error occurs during writing.

Limitations

This instruction can only be used for I/O devices or files that have been opened for binary reading and writing.

Continues on next page

Syntax

```
WriteStrBin
[ IODevice ':='] <variable (VAR) of iODEV> ','
[ Str ':='] <expression (IN) of string>
[ '\\' ISOLatin1Encoding] ';'

```

Related information

For information about	See
Opening, etc. of I/O devices	<i>Technical reference manual - RAPID Overview</i>
Read binary sting	ReadStrBin - Reads a string from a binary I/O device or file on page 1424
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>

1 Instructions

1.333 WriteVar - Write variable

Sensor Interface

1.333 WriteVar - Write variable

Usage

WriteVar is used to write a variable to a device connected to the sensor interface.
The sensor interface communicates with sensors via I/O devices.

Configuration example

This is an example of a sensor channel configuration.
These parameters belong to the type *Transmission Protocol* in the topic *Communication*.

Name	Type	Remote Address	Remote Port
sen1:	SOCKDEV	192.168.125.101	6344

Basic examples

The following example illustrates the instruction WriteVar:

Example 1

```
! Define variable numbers
CONST num SensorOn := 6;
CONST num XCoord := 8;
CONST num YCoord := 9;
CONST num ZCoord := 10;
VAR pos SensorPos;

! Connect to the sensor device" sen1:" (defined in sio.cfg).
SenDevice "sen1:";

! Request start of sensor measurements
WriteVar "sen1:", SensorOn, 1;

! Read a cartesian position from the sensor.
SensorPos.x := ReadVar "sen1:", XCoord;
SensorPos.y := ReadVar "sen1:", YCoord;
SensorPos.z := ReadVar "sen1:", ZCoord;

! Stop sensor
WriteVar "sen1:", SensorOn, 0;
```

Arguments

WriteVar device VarNo VarData [\TaskName]

device

Data type: string

The I/O device name configured in sio.cfg for the sensor used.

VarNo

Data type: num

The argument VarNo is used to select the sensor variable.

Continues on next page

VarData

Data type: num

The argument VarData defines the data which is to be written to the variable selected by the VarNo argument.

[\TaskName]

Data type: string

The argument TaskName makes it possible to access devices in other RAPID tasks.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Error constant (ERRNO value)	Description
SEN_NO_MEAS	Measurement failure
SEN_NOREADY	Sensor unable to handle command
SEN_GENERRO	General sensor error
SEN_BUSY	Sensor bus
SEN_UNKNOWN	Unknown sensor
SEN_EXALARM	External sensor error
SEN_CAALARM	Internal sensor error
SEN_TEMP	Sensor temperature error
SEN_VALUE	Illegal communication value
SEN_CAMCHECK	Sensor check failure
SEN_TIMEOUT	Communication error

Syntax

```
WriteVar
[device ':='] <expression (IN) of string> ', '
[VarNo ':='] <expression (IN) of num> ', '
[VarData ':='] <expression (IN) of num> ', '
['\ ' TaskName ':=' <expression (IN) of string>] ';'

```

Related information

For information about	See
Connect to a sensor device	SenDevice - connect to a sensor device on page 666
Read a sensor variable	ReadVar - Read variable from a device on page 1426
Configuration of sensor communication	<i>Technical reference manual - System parameters</i>

1 Instructions

1.334 WriteVarArr - Write multiple variables to a sensor device

Sensor Interface

1.334 WriteVarArr - Write multiple variables to a sensor device

Usage

WriteVarArr is used to write up to six variables to a sensor device at the same time.

The sensor must be configured and communicating via the RobotWare option *Sensor Interface*.

Basic examples

The following example illustrates the instruction WriteVarArr:

Example 1

```
! Define variable numbers
CONST num jointno := 16;
CONST num unit := 19;
VAR sensorvardata writeData{3};

! Connect to the sensor device "sen1:" (defined in sio.cfg).
SenDevice "sen1:";

! Setup two variables to write
writeData{1}:=[jointno, 0, false, 1, 5];
writeData{2}:=[unit, 0, false, 1, 1];
! A varNumber of -1 will be ignored
writeData{3}:=[-1, 0, false, 1, 1];

WriteVarArr "sen1:", writeData;
```

The example shows a write request of the variables jointno and unit.

Arguments

WriteVarArr Device, Data, [\taskName]

Device

Data type: string

The I/O device name configured in sio.cfg for the sensor used.

Data

Data type: sensorvardata

An array variable that refers to a data definition of the variables to be written.

[\TaskName]

Data type: string

The argument TaskName makes it possible to access devices in other RAPID tasks.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
SEN_NO_MEAS	Measurement failure
SEN_NOREADY	Sensor unable to handle command
SEN_GENERRO	General sensor error
SEN_BUSY	Sensor busy
SEN_UNKNOWN	Unknown sensor
SEN_EXALARM	External sensor error
SEN_CAALARM	Internal sensor error
SEN_TEMP	Sensor temperature error
SEN_VALUE	Illegal communication value
SEN_CAMCHECK	Sensor check failure
SEN_TIMEOUT	Communication error

Syntax

```
WriteVarArr
[Device ':='] <expression(IN) of string> ', '
[Data ':=' ] < array variable {*} (INOUT) of sensorvardata > ', '
['\' TaskName ':=' <expression (IN) of string> ] ';'

```

Related information

For information about	See
Connect to a sensor device	SenDevice - connect to a sensor device on page 666
Read multiple variables from a device	ReadVarArr - Read multiple variables from a sensor device on page 579
Write a sensor variable	WriteVar - Write variable on page 1082
Read a sensor variable	ReadVar - Read variable from a device on page 1426
Multiple variable setup data for sensor interface	sensorvardata - Multiple variable setup data for sensor interface on page 1719
Configuration of sensor communication	Technical reference manual - System parameters

1 Instructions

1.335 WZBoxDef - Define a box-shaped world zone

World Zones

1.335 WZBoxDef - Define a box-shaped world zone

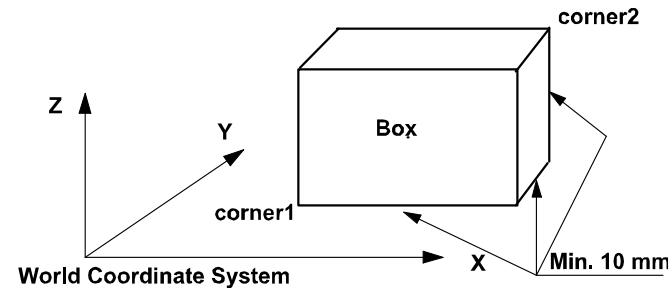
Usage

WZBoxDef (*World Zone Box Definition*) is used to define a world zone that has the shape of a straight box with all its sides parallel to the axes of the World Coordinate System.

Basic examples

The following example illustrates the instruction WZBoxDef:

Example 1



xx0500002205

```
VAR shapedata volume;  
CONST pos corner1:=[200,100,100];  
CONST pos corner2:=[600,400,400];  
...  
WZBoxDef \Inside, volume, corner1, corner2;
```

Define a straight box with coordinates parallel to the axes of the world coordinate system and defined by the opposite corners corner1 and corner2.

Arguments

WZBoxDef [\Inside] | [\Outside] Shape LowPoint HighPoint

[\Inside]

Data type: switch
Define the volume inside the box.

[\Outside]

Data type: switch
Define the volume outside the box (inverse volume).
One of the arguments \Inside or \Outside must be specified.

Shape

Data type: shapedata
Variable for storage of the defined volume (private data for the system).

LowPoint

Data type: pos

Continues on next page

Position (x,y,z) in mm defining one lower corner of the box.

HighPoint

Data type: pos

Position (x,y,z) in mm defining the corner diagonally opposite to the previous one.

Program execution

The definition of the box is stored in the variable of type shapedata (argument Shape), for future use in WZLimSup or WZD0Set instructions.

Limitations

The LowPoint and HighPoint positions must be valid for opposite corners (with different x, y, and z coordinate values).

If the robot is used to point out the LowPoint or HighPoint then work object wobj0 must be active (use of component trans in robtarget e.g. p1.trans as argument).

Syntax

```
WZBoxDef
[ ['\ ' Inside] | ['\ ' Outside] ', '
[ LowPoint ':='] <expression (IN) of pos> ', '
[ Shape ':='] <variable (VAR) of shapedata> ', '
[ HighPoint ':='] <expression (IN) of pos> ';'

```

Related information

For information about	See
World Zones	<i>Technical reference manual - RAPID Overview, section Motion and I/O programming, World Zones</i>
World zone shape	shapedata - World zone shape data on page 1721
Define sphere-shaped world zone	WZSphDef - Define a sphere-shaped world zone on page 1112
Define cylinder-shaped world zone	WZCylDef - Define a cylinder-shaped world zone on page 1088
Define a world zone for home joints	WZHomeJointDef - Define a world zone for home joints on page 1102
Define a world zone for limit joints	WZLimJointDef - Define a world zone for limitation in joints on page 1105
Activate world zone limit supervision	WZLimSup - Activate world zone limit supervision on page 1109
Activate world zone digital output set	WZD0Set - Activate world zone to set digital output on page 1093

1 Instructions

1.336 WZCylDef - Define a cylinder-shaped world zone

World Zones

1.336 WZCylDef - Define a cylinder-shaped world zone

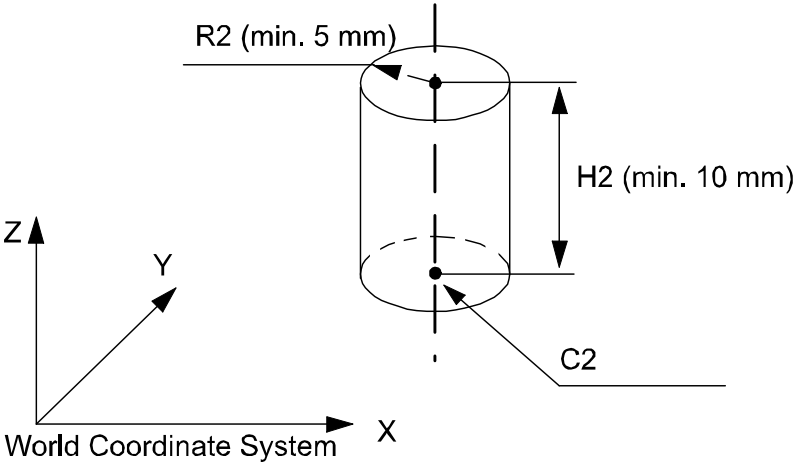
Usage

`WZCylDef` (*World Zone Cylinder Definition*) is used to define a world zone that has the shape of a cylinder with the cylinder axis parallel to the z-axis of the World Coordinate System.

Basic examples

The following example illustrates the instruction `WZCylDef`:

Example 1



xx0500002206

```
VAR shapedata volume;  
CONST pos C2:=[300,200,200];  
CONST num R2:=100;  
CONST num H2:=200;  
...  
WZCylDef \Inside, volume, C2, R2, H2;
```

Define a cylinder with the center of the bottom circle in C2, radius R2, and height H2.

Arguments

`WZCylDef` [`\Inside`] | [`\Outside`] Shape CentrePoint Radius Height

[`\Inside`]

Data type: switch

Define the volume inside the cylinder.

[`\Outside`]

Data type: switch

Define the volume outside the cylinder (inverse volume).

One of the arguments `\Inside` or `\Outside` must be specified.

Continues on next page

1.336 WZCylDef - Define a cylinder-shaped world zone

World Zones

Continued

Shape

Data type: shapedata

Variable for storage of the defined volume (private data for the system).

CentrePoint

Data type: pos

Position (x,y,z) in mm defining the center of one circular end of the cylinder.

Radius

Data type: num

The radius of the cylinder in mm.

Height

Data type: num

The height of the cylinder in mm. If it is positive (+z direction), the CentrePoint argument is the center of the lower end of the cylinder (as in the above example). If it is negative (-z direction) then the CentrePoint argument is the center of the upper end of the cylinder.

Program execution

The definition of the cylinder is stored in the variable of type shapedata (argument Shape) for future use in WZLimSup or WZD0Set instructions.

Limitations

If the robot is used to point out the CentrePoint then the work object wobj0 must be active (use of component trans in robtarget e.g. p1.trans as argument).

Syntax

```
WZCylDef
[ '\ ' Inside ] | [ '\ ' Outside ] ', '
[ Shape ':='] <variable (VAR) of shapedata> ', '
[ CentrePoint ':='] <expression (IN) of pos> ', '
[ Radius ':='] <expression (IN) of num> ', '
[ Height ':='] <expression (IN) of num> ';'

```

Related information

For information about	See
World Zones	<i>Technical reference manual - RAPID Overview, section Motion and I/O programming, World Zones</i>
World zone shape	shapedata - World zone shape data on page 1721
Define box-shaped world zone	WZBoxDef - Define a box-shaped world zone on page 1086
Define sphere-shaped world zone	WZSphDef - Define a sphere-shaped world zone on page 1112
Define a world zone for home joints	WZHomeJointDef - Define a world zone for home joints on page 1102

Continues on next page

1 Instructions

1.336 WZCylDef - Define a cylinder-shaped world zone

World Zones

Continued

For information about	See
Define a world zone for limit joints	<i>WZLimJointDef - Define a world zone for limitation in joints on page 1105</i>
Activate world zone limit supervision	<i>WZLimSup - Activate world zone limit supervision on page 1109</i>
Activate world zone digital output set	<i>WZDOSet - Activate world zone to set digital output on page 1093</i>

1.337 WZDisable - Deactivate temporary world zone supervision

Usage

WZDisable (*World Zone Disable*) is used to deactivate the supervision of a temporary world zone previously defined either to stop the movement or to set an output.

Basic examples

The following example illustrates the instruction WZDisable:

Example 1

```
VAR wztemporary wzone;
...
PROC...
  WZLimSup \Temp, wzone, volume;
  MoveL p_pick, v500, z40, tool1;
  WZDisable wzone;
  MoveL p_place, v200, z30, tool1;
ENDPROC
```

When moving to p_pick, the position of the robot's TCP is checked so that it will not go inside the specified volume wzone. This supervision is not performed when going to p_place.

Arguments

WZDisable WorldZone

WorldZone

Data type: wztemporary

Variable or persistent variable of type wztemporary, which contains the identity of the world zone to be deactivated.

Program execution

The temporary world zone is deactivated. This means that the supervision of the robot's TCP, relative to the corresponding volume, is temporarily stopped. It can be re-activated via the WZEnable instruction.

Limitations

Only a temporary world zone can be deactivated. A stationary world zone is always active.

Syntax

```
WZDisable
  [ WorldZone '[:='] <variable or persistent (INOUT) of wztemporary>
  ';' ]
```

Continues on next page

1 Instructions

1.337 WZDisable - Deactivate temporary world zone supervision

World Zones

Continued

Related information

For information about	See
World Zones	<i>Technical reference manual - RAPID Overview, section Motion and I/O programming, World Zones</i>
World zone shape	<i>shapedata - World zone shape data on page 1721</i>
Temporary world zone data	<i>wztemporary - Temporary world zone data on page 1781</i>
Activate world zone limit supervision	<i>WZLimSup - Activate world zone limit supervision on page 1109</i>
Activate world zone set digital output	<i>WZDOSet - Activate world zone to set digital output on page 1093</i>
Activate world zone	<i>WZEnable - Activate temporary world zone supervision on page 1098</i>
Erase world zone	<i>WZFree - Erase temporary world zone supervision on page 1100</i>

1.338 WZDOSet - Activate world zone to set digital output

Usage

WZDOSet (*World Zone Digital Output Set*) is used to define the action and to activate a world zone for supervision of the robot movements.

After this instruction is executed, when the robot's TCP or the robot/external axes (zone in joints) is inside the defined world zone or is approaching close to it, a digital output signal is set to the specified value.

Basic examples

The following example illustrates the instruction WZDOSet:

See also [More examples on page 1095](#).

Example 1

```
VAR wztemporary service;

PROC zone_output()
  VAR shapedata volume;
  CONST pos p_service:=[500,500,700];
  ...
  WZSphDef \Inside, volume, p_service, 50;
  WZDOSet \Temp, service \Inside, volume, do_service, 1;
ENDPROC
```

Definition of temporary world zone service in the application program that sets the signal do_service when the robot's TCP is inside the defined sphere during program execution or when jogging.

Arguments

WZDOSet [\Temp] | [\Stat] WorldZone [\Inside] | [\Before] Shape
Signal SetValue

[\Temp]

Temporary

Data type: switch

The world zone to define is a temporary world zone.

[\Stat]

Stationary

Data type: switch

The world zone to define is a stationary world zone.

One of the arguments \Temp or \Stat must be specified.

WorldZone

Data type: wztemporary or wzstationary

Variable or persistent variable, that will be updated with the identity (numeric value) of the world zone.

Continues on next page

1 Instructions

1.338 WZDOSet - Activate world zone to set digital output

World Zones

Continued

If using the switch `\Temp`, the data type must be `wztemporary`. If using the switch `\Stat`, the data type must be `wzstationary`.

`[\Inside]`

Data type: `switch`

The digital output signal will be set when the robot's TCP or specified axes are inside the defined volume.

`[\Before]`

Data type: `switch`

The digital output signal will be set before the robot's TCP or specified axes reaches the defined volume (as soon as possible before the volume).

One of the arguments `\Inside` or `\Before` must be specified.

`Shape`

Data type: `shapedata`

The variable that defines the volume of the world zone.

`Signal`

Data type: `signaldo`

The name of the digital output signal that will be changed.

If a stationary worldzone is used then the signal must have the correct *internal* access level. The access level is set in the signal definition in the I/O system parameters. These concepts are further described in *Technical reference manual - System parameters*, see the types *Signal* and *Access Level*. The access level must be protected for access from the user (RAPID, FlexPendant), so the predefined internal access level can be used, or a custom access level can be defined by the user.

`SetValue`

Data type: `dionum`

Desired value of the signal (0 or 1) when the robot's TCP is inside the volume or just before it enters the volume.

When outside or just outside the volume then the signal is set to the opposite value.

Program execution

The defined world zone is activated. From this moment the robot's TCP position (or robot/external joint position) is supervised, and the output will be set when the robot's TCP position (or robot/external joint position) is inside the volume (`\Inside`) or comes close to the border of the volume (`\Before`).

If using `WZHomeJointDef` or `WZLimJointDef` together with `WZDOSet` then the digital output signal is set only if all active axes with joint space supervision are before or inside the joint space.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

More examples

More examples of how to use the instruction `WZDOSet` are illustrated below.

Example 1

```

VAR wztemporary home;
VAR wztemporary service;
PERS wztemporary equip1:=[];

PROC main()
...
! Definition of all temporary world zones
zone_output;
...
! equip1 in robot work area
WZEnable equip1;
...
! equip1 out of robot work area
WZDisable equip1;
...
! No use for equip1 any more
WZFree equip1;
...
ENDPROC

PROC zone_output()
VAR shapedata volume;
CONST pos p_home:=[800,0,800];
CONST pos p_service:=[800,800,800];
CONST pos p_equip1:=[-800,-800,0];
...
WZSphDef \Inside, volume, p_home, 50;
WZDOSet \Temp, home \Inside, volume, do_home, 1;
WZSphDef \Inside, volume, p_service, 50;
WZDOSet \Temp, service \Inside, volume, do_service, 1;
WZCylDef \Inside, volume, p_equip1, 300, 1000;
WZLimSup \Temp, equip1, volume;
! equip1 not in robot work area
WZDisable equip1;

```

Continues on next page

1 Instructions

1.338 WZDOSet - Activate world zone to set digital output

World Zones

Continued

ENDPROC

Definition of temporary world zones home and service in the application program, that sets the signals do_home and do_service, when the robot is inside the sphere home or service respectively during program execution or when jogging.

Also, definition of a temporary world zone equip1, which is active only in the part of the robot program when equip1 is inside the working area for the robot. At that time the robot stops before entering the equip1 volume, both during program execution and manual jogging. equip1 can be disabled or enabled from other program tasks by using the persistent variable equip1 value.

Limitations

A world zone cannot be redefined by using the same variable in the argument WorldZone.

A stationary world zone cannot be deactivated, activated again, or erased in the RAPID program.

A temporary world zone can be deactivated (WZDisable), activated again (WZEnable), or erased (WZFree) in the RAPID program.

Syntax

```
WZDOSet
  [['\ ' Temp] | [['\ ' Stat] ', ' ]
  [WorldZone ' := ' ] <variable or persistent (INOUT) of wztemporary>
  [['\ ' Inside] | [['\ ' Before] ', ' ]
  [Shape ' := ' ] <variable (VAR) of shapedata> ', ' ]
  [Signal ' := ' ] <variable (VAR) of signaldo> ', ' ]
  [SetValue ' := ' ] <expression (IN) of dionum> ' ; ' ]
```

Related information

For information about	See
World Zones	<i>Technical reference manual - RAPID Overview, section Motion and I/O programming, World Zones</i>
World zone shape	shapedata - World zone shape data on page 1721
Temporary world zone	wztemporary - Temporary world zone data on page 1781
Stationary world zone	wzstationary - Stationary world zone data on page 1779
Define straight box-shaped world zone	WZBoxDef - Define a box-shaped world zone on page 1086
Define sphere-shaped world zone	WZSphDef - Define a sphere-shaped world zone on page 1112
Define cylinder-shaped world zone	WZCylDef - Define a cylinder-shaped world zone on page 1088
Define a world zone for home joints	WZHomeJointDef - Define a world zone for home joints on page 1102
Activate world zone limit supervision	WZLimSup - Activate world zone limit supervision on page 1109

Continues on next page

1.338 WZDOSet - Activate world zone to set digital output

World Zones

Continued

For information about	See
Signal access level	<i>Technical reference manual - System parameters</i>

1 Instructions

1.339 WZEnable - Activate temporary world zone supervision

World Zones

1.339 WZEnable - Activate temporary world zone supervision

Usage

WZEnable (*World Zone Enable*) is used to re-activate the supervision of a temporary world zone, previously defined either to stop the movement or to set an output.

Basic examples

The following example illustrates the instruction WZEnable:

Example 1

```
VAR wztemporary wzzone;
...
PROC ...
  WZLimSup \Temp, wzzone, volume;
  MoveL p_pick, v500, z40, tool1;
  WZDisable wzzone;
  MoveL p_place, v200, z30, tool1;
  WZEnable wzzone;
  MoveL p_home, v200, z30, tool1;
ENDPROC
```

When moving to p_pick, the position of the robot's TCP is checked so that it will not go inside the specified volume wzzone. This supervision is not performed when going to p_place but is reactivated before going to p_home.

Arguments

WZEnable WorldZone

WorldZone

Data type: wztemporary

Variable or persistent variable of the type wztemporary, which contains the identity of the world zone to be activated.

Program execution

The temporary world zone is re-activated. Please note that a world zone is automatically activated when it is created. It need only be re-activated when it has previously been deactivated by WZDisable.

Limitations

Only a temporary world zone can be deactivated and reactivated. A stationary world zone is always active.

Syntax

```
WZEnable
  [ WorldZone '[:='] <variable or persistent (INOUT) of wztemporary>
  ';
```

Continues on next page

1.339 WZEnable - Activate temporary world zone supervision

World Zones

Continued

Related information

For information about	See
World Zones	<i>Technical reference manual - RAPID Overview, section Motion and I/O programming, World Zones</i>
World zone shape	<i>shapedata - World zone shape data on page 1721</i>
Temporary world zone data	<i>wztemporary - Temporary world zone data on page 1781</i>
Activate world zone limit supervision	<i>WZLimSup - Activate world zone limit supervision on page 1109</i>
Activate world zone set digital output	<i>WZDOSet - Activate world zone to set digital output on page 1093</i>
Deactivate world zone	<i>WZDisable - Deactivate temporary world zone supervision on page 1091</i>
Erase world zone	<i>WZFree - Erase temporary world zone supervision on page 1100</i>

1 Instructions

1.340 WZFree - Erase temporary world zone supervision

World Zones

1.340 WZFree - Erase temporary world zone supervision

Usage

WZFree (*World Zone Free*) is used to erase the definition of a temporary world zone, previously defined either to stop the movement or to set an output.

Basic examples

The following example illustrates the instruction WZFree:

Example 1

```
VAR wztemporary wzzone;  
...  
PROC ...  
  WZLimSup \Temp, wzzone, volume;  
  MoveL p_pick, v500, z40, tool1;  
  WZDisable wzzone;  
  MoveL p_place, v200, z30, tool1;  
  WZEnable wzzone;  
  MoveL p_home, v200, z30, tool1;  
  WZFree wzzone;  
ENDPROC
```

When moving to p_pick, the position of the robot's TCP is checked so that it will not go inside a specified volume wzzone. This supervision is not performed when going to p_place but is reactivated before going to p_home. When this position is reached then the world zone definition is erased.

Arguments

WZFree WorldZone

WorldZone

Data type: wztemporary

Variable or persistent variable of the type wztemporary, which contains the identity of the world zone to be erased.

Program execution

The temporary world zone is first deactivated and then its definition is erased. Once erased, a temporary world zone cannot be re-activated or deactivated.

Limitations

Only a temporary world zone can be deactivated, reactivated, or erased. A stationary world zone is always active.

Syntax

```
WZFree  
  [ WorldZone ':' '=' ] <variable or persistent (INOUT) of wztemporary>  
  ';' ;
```

Continues on next page

Related information

For information about	See
World Zones	<i>Technical reference manual - RAPID Overview, section Motion and I/O programming, World Zones</i>
World zone shape	<i>shapedata - World zone shape data on page 1721</i>
Temporary world zone data	<i>wztemporary - Temporary world zone data on page 1781</i>
Activate world zone limit supervision	<i>WZLimSup - Activate world zone limit supervision on page 1109</i>
Activate world zone set digital output	<i>WZDOSet - Activate world zone to set digital output on page 1093</i>
Deactivate world zone	<i>WZDisable - Deactivate temporary world zone supervision on page 1091</i>
Activate world zone	<i>WZEnable - Activate temporary world zone supervision on page 1098</i>

1 Instructions

1.341 WZHomeJointDef - Define a world zone for home joints

World Zones

1.341 WZHomeJointDef - Define a world zone for home joints

Usage

WZHomeJointDef (*World Zone Home Joint Definition*) is used to define a world zone in joints coordinates for both the robot and external axes to be used as a HOME or SERVICE position.

Basic examples

The following example illustrates the instruction WZHomeJointDef:

Example 1

```
VAR wzstationary home;
...
PROC power_on()
  VAR shapedata joint_space;
  CONST jointtarget home_pos := [ [ 0, 0, 0, 0, 0, -45], [ 0, 9E9,
    9E9, 9E9, 9E9, 9E9] ];
  CONST jointtarget delta_pos := [ [ 2, 2, 2, 2, 2, 2], [ 5, 9E9,
    9E9, 9E9, 9E9, 9E9] ];
  ...
  WZHomeJointDef \Inside, joint_space, home_pos, delta_pos;
  WZD0Set \Stat, home \Inside, joint_space, do_home, 1;
ENDPROC
```

Definition and activation of stationary world zone home, that sets the signal do_home to 1, when all robot axes and the external axis extax.eax_a are at the joint position home_pos (within +/- delta_pos for each axis) during program execution and jogging. The variable joint_space of data type shapedata are used to transfer data from the instruction WZHomeJointDef to the instruction WZD0Set.

Arguments

WZHomeJointDef [\Inside] | [\Outside] Shape MiddleJointVal
DeltaJointVal

[\Inside]

Data type: switch

Define the joint space inside the MiddleJointVal +/- DeltaJointVal.

[\Outside]

Data type: switch

Define the joint space outside the MiddleJointVal +/- DeltaJointVal (inverse joint space).

Shape

Data type: shapedata

Variable for storage of the defined joint space (private data for the system).

MiddleJointVal

Data type: jointtarget

Continues on next page

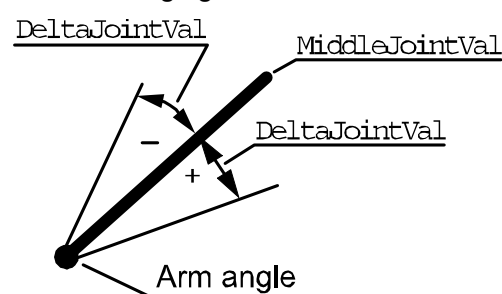
The position in joint coordinates for the center of the joint space to define. Specifies for each robot axis and external axis (degrees for rotational axes and mm for linear axes). Specifies in absolute joints (not in offset coordinate system EOffsSet - EOffsOn for external axes). **Value 9E9 for some axis means that the axis should not be supervised.** Non-active external axis also gives 9E9 at programming time.

DeltaJointVal

Data type: jointtarget

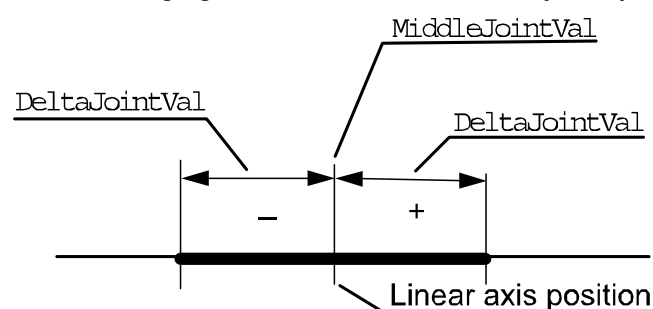
The +/- delta position in joint coordinates from the center of the joint space. The value must be greater than 0 for all axes to supervise.

The following figure shows the definition of joint space for rotational axis.



xx0500002208

The following figure shows the definition of joint space for linear axis.



xx0500002209

Program execution

The definition of the joint space is stored in the variable of type shapedata (argument Shape) for future use in WZLimSup or WZD0Set instructions.

If use of WZHomeJointDef together with WZD0Set then the digital output signal is set but only if all active axes with joint space supervision are before or inside the joint space.

If use of WZHomeJointDef with outside joint space (argument \Outside) together with WZLimSup then the robot is stopped as soon as one active axes with joint space supervision reach the joint space.

If use of WZHomeJointDef with inside joint space (argument \Inside) together with WZLimSup then the robot is stopped as soon as the last active axes with joint space supervision reach the joint space. That means that one or several axes, but not all active and supervised axes, can be inside the joint space at the same time.

Continues on next page

1 Instructions

1.341 WZHomeJointDef - Define a world zone for home joints

World Zones

Continued

At execution of the instruction `ActUnit` or `DeactUnit` for activation or deactivation of mechanical units, the supervision status for HOME position or work area limitation will be updated.

Limitations



xx0100000002

Only active mechanical units and their active axes at activation time of the world zone (with instruction `WZD0Set` respectively `WZLimSup`), are included in the supervision of the HOME position respectively to the limitation of the working area. Besides that, the mechanical unit and its axes must still be active at the program movement or jogging to be supervised.

For example, if one axis with supervision is outside its HOME joint position but is deactivated then it does not prevent the digital output signal for the HOME joint position to be set if all other active axes with joint space supervision are inside the HOME joint position. At activation of that axis again it will be included in the supervision and the robot system will then be outside the HOME joint position and the digital output will be reset.

Syntax

```
WZHomeJointDef
[ ['\ ' Inside] | ['\ ' Outside] ', ' ]
[ Shape ' := ' ] <variable (VAR) of shapedata> ', '
[ MiddleJointVal ' := ' ] <expression (IN) of jointtarget> ', '
[ DeltaJointVal ' := ' ] <expression (IN) of jointtarget> ' ; '
```

Related information

For information about	See
World Zones	<i>Technical reference manual - RAPID Overview, section Motion and I/O programming, World Zones</i>
World zone shape	shapedata - World zone shape data on page 1721
Define box-shaped world zone	WZBoxDef - Define a box-shaped world zone on page 1086
Define cylinder-shaped world zone	WZCylDef - Define a cylinder-shaped world zone on page 1088
Define sphere-shaped world zone	WZSphDef - Define a sphere-shaped world zone on page 1112
Define a world zone for limit joints	WZLimJointDef - Define a world zone for limitation in joints on page 1105
Activate world zone limit supervision	WZLimSup - Activate world zone limit supervision on page 1109
Activate world zone digital output set	WZD0Set - Activate world zone to set digital output on page 1093

1.342 WZLimJointDef - Define a world zone for limitation in joints

Usage

WZLimJointDef (*World Zone Limit Joint Definition*) is used to define a world zone in joints coordinates for both the robot and external axes, to be used for limitation of the working area.

With WZLimJointDef it is possible to limit the working area for each robot and external axes in the RAPID program, besides the limitation that can be done with system parameters *Motion - Arm - robx_y - Upper Joint Bound ... Lower Joint Bound*.

Basic examples

The following example illustrates the instruction WZLimJointDef:

Example 1

```
VAR wzstationary work_limit;
...
PROC power_on()
  VAR shapedata joint_space;
  CONST jointtarget low_pos:= [ [ -90, 9E9, 9E9, 9E9, 9E9, 9E9],
    [ -1000, 9E9, 9E9, 9E9, 9E9, 9E9]];
  CONST jointtarget high_pos := [ [ 90, 9E9, 9E9, 9E9, 9E9, 9E9],
    [ 9E9, 9E9, 9E9, 9E9, 9E9, 9E9] ];
  ...
  WZLimJointDef \Outside, joint_space, low_pos, high_pos;
  WZLimSup \Stat, work_limit, joint_space;
ENDPROC
```

Definition and activation of stationary world zone *work_limit*, that limit the working area for robot axis 1 to -90 and +90 degrees and the external axis *extax.eax_a* to -1000 mm during program execution and jogging. The variable *joint_space* of data type *shapedata* are used to transfer data from the instruction WZLimJointDef to the instruction WZLimSup.

Arguments

WZLimJointDef [\Inside] | [\Outside] Shape LowJointVal HighJointVal

[\Inside]

Data type: switch

Define the joint space inside the LowJointVal ... HighJointVal.

[\Outside]

Data type: switch

Define the joint space outside the LowJointVal ... HighJointVal (inverse joint space).

Shape

Data type: shapedata

Variable for storage of the defined joint space (private data for the system).

Continues on next page

1 Instructions

1.342 WZLimJointDef - Define a world zone for limitation in joints

World Zones

Continued

LowJointVal

Data type: jointtarget

The position in joint coordinates for the low limit of the joint space to define. Specifies for each robot axes and external axes (degrees for rotational axes and mm for linear axes). Specifies in absolute joints (not in offset coordinate system EOffsSet or EOffsOn for external axes). Value 9E9 for some axis means that the axis should not be supervised for low limit. Non-active external axis also gives 9E9 at programming time.

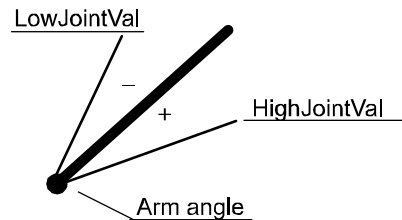
HighJointVal

Data type: jointtarget

The position in joint coordinates for the high limit of the joint space to define. Specifies for each robot axes and external axes (degrees for rotational axes and mm for linear axes). Specifies in absolute joints (not in offset coordinate system EOffsSet or EOffsOn for external axes). Value 9E9 for an axis means that the axis should not be supervised for high limit. Non-active external axis also gives 9E9 at programming time.

HighJointVal minus LowJointVal for each axis must be greater than 0 for all axes to supervise.

The figure below shows definition of joint space for rotating axis.



xx0500002281

The figure below shows definition of joint space for linear axis.



xx0100000002

Program execution

The definition of the joint space is stored in the variable of type shapedata (argument Shape) for future use in WZLimSup or WZD0Set instructions.

If using WZLimJointDef together with WZD0Set then the digital output signal is set, only if all active axes with joint space supervision are before or inside the joint space.

If using WZLimJointDef with outside joint space (argument \Outside) together with WZLimSup then the robot is stopped as soon as one active axes with joint space supervision reaches the joint space.

Continues on next page

1.342 WZLimJointDef - Define a world zone for limitation in joints

*World Zones**Continued*

If using WZLimJointDef with inside joint space (argument \Inside) together with WZLimSup then the robot is stopped as soon as the last active axes with joint space supervision reaches the joint space. That means that one or several axes but not all active and supervised axes can be inside the joint space at the same time.

At execution of the instruction ActUnit or DeactUnit the supervision status will be updated.

Limitations

xx0100000002

WARNING!

Only active mechanical units and its active axes at activation time of the world zone (with instruction WZD0Set respective to WZLimSup), are included in the supervision of the HOME position respectively the limitation of the working area. Besides that, the mechanical unit and its axes must still be active at the program movement or jogging to be supervised.

For example, if one axis with supervision is outside its HOME joint position but is deactivated then it does not prevent the digital output signal for the HOME joint position to be set if all other active axes with joint space supervision are inside the HOME joint position. At activation of that axis again, it will be included in the supervision and the robot system will be outside the HOME joint position and the digital output will be reset.

Syntax

```
WZLimJointDef
[ ['\ ' Inside] | ['\ ' Outside] ', ' ]
[ Shape ' := ' ] <variable (VAR) of shapedata> ', '
[ LowJointVal ' := ' ] <expression (IN) of jointtarget> ', '
[ HighJointVal ' := ' ] <expression (IN) of jointtarget> ' ; '
```

Related information

For information about	See
World Zones	<i>Technical reference manual - RAPID Overview, section Motion and I/O programming, World Zones</i>
World zone shape	shapedata - World zone shape data on page 1721
Define box-shaped world zone	WZBoxDef - Define a box-shaped world zone on page 1086
Define cylinder-shaped world zone	WZCylDef - Define a cylinder-shaped world zone on page 1088
Define sphere-shaped world zone	WZSphDef - Define a sphere-shaped world zone on page 1112
Define a world zone for home joints	WZHomeJointDef - Define a world zone for home joints on page 1102

Continues on next page

1 Instructions

1.342 WZLimJointDef - Define a world zone for limitation in joints

World Zones

Continued

For information about	See
Activate world zone limit supervision	<i>WZLimSup - Activate world zone limit supervision on page 1109</i>
Activate world zone digital output set	<i>WZDOSet - Activate world zone to set digital output on page 1093</i>

1.343 WZLimSup - Activate world zone limit supervision

Usage

WZLimSup (*World Zone Limit Supervision*) is used to define the action and to activate a world zone for supervision of the working area of the robot or external axes.

After this instruction is executed, when the robot's TCP reaches the defined world zone or when the robot/external axes reaches the defined world zone in joints, then the movement is stopped both during program execution and when jogging.

Basic examples

The following example illustrates the instruction WZLimSup:

See also [More examples on page 1110](#).

Example 1

```
VAR wzstationary max_workarea;
...
PROC POWER_ON()
  VAR shapedata volume;
  ...
  WZBoxDef \Outside, volume, corner1, corner2;
  WZLimSup \Stat, max_workarea, volume;
ENDPROC
```

Definition and activation of stationary world zone max_workarea, with the shape of the area outside a box (temporarily stored in volume) and the action work-area supervision. The robot stops with an error message before entering the area outside the box.

Arguments

WZLimSup [\Temp] | [\Stat] WorldZone Shape

[\Temp]

Temporary

Data type: switch

The world zone to define is a temporary world zone.

[\Stat]

Stationary

Data type: switch

The world zone to define is a stationary world zone.

One of the arguments \Temp or \Stat must be specified.

WorldZone

Data type: wztemporary or wzstationary

Variable or persistent variable that will be updated with the identity (numeric value) of the world zone.

Continues on next page

1 Instructions

1.343 WZLimSup - Activate world zone limit supervision

World Zones

Continued

If using switch \Temp, the data type must be wztemporary. If using switch \Stat, the data type must be wzstationary.

Shape

Data type: shapedata

The variable that defines the volume of the world zone.

Program execution

The defined world zone is activated. From this moment the robot's TCP position or the robot/external axes joint position are supervised. If it reaches the defined area then the movement is stopped.

If using WZLimJointDef or WZHomeJointDef with outside joint space (argument \Outside) together with WZLimSup then the robot is stopped as soon as one active axes with joint space supervision reaches the joint space.

If using WZLimJointDef or WZHomeJointDef with inside joint space (argument \Inside) together with WZLimSup then the robot is stopped as soon as the last active axes with joint space supervision reaches the joint space. That means that one or several axes but not all active and supervised axes can be inside the joint space at the same time.

At execution of the instruction ActUnit or DeactUnit the supervision status will be updated.

More examples

More examples of how to use the instruction WZLimSup are illustrated below.

Example 1

```
VAR wzstationary box1_invers;
VAR wzstationary box2;

PROC wzone_power_on()
  VAR shapedata volume;
  CONST pos box1_c1:=[500,-500,0];
  CONST pos box1_c2:=[-500,500,500];
  CONST pos box2_c1:=[500,-500,0];
  CONST pos box2_c2:=[200,-200,300];
  ...
  WZBoxDef \Outside, volume, box1_c1, box1_c2;
  WZLimSup \Stat, box1_invers, volume;
  WZBoxDef \Inside, volume, box2_c1, box2_c2;
  WZLimSup \Stat, box2, volume;
ENDPROC
```

Limitation of work area for the robot with the following stationary world zones:

- Outside working area when outside box1_invers
- Outside working area when inside box2

If this routine is connected to the system event POWER ON then these world zones will always be active in the system, both for program movements and manual jogging.

Continues on next page

Limitations

A world zone cannot be redefined using the same variable in argument `WorldZone`.

A stationary world zone cannot be deactivated, activated again, or erased in the RAPID program.

A temporary world zone can be deactivated (`WZDisable`), activated again (`WZEnable`), or erased (`WZFree`) in the RAPID program.

Syntax

```
WZLimSup
[ ['\ ' Temp] | ['\Stat' ,']
[ WorldZone ':='] <variable or persistent (INOUT) of wztemporary>
', '
[ Shape ':='] <variable (VAR) of shapedata> ';'

```

Related information

For information about	See
World Zones	<i>Technical reference manual - RAPID Overview, section Motion and I/O programming, World Zones</i>
World zone shape	shapedata - World zone shape data on page 1721
Temporary world zone	wztemporary - Temporary world zone data on page 1781
Stationary world zone	wzstationary - Stationary world zone data on page 1779
Define straight box-shaped world zone	WZBoxDef - Define a box-shaped world zone on page 1086
Define sphere-shaped world zone	WZSphDef - Define a sphere-shaped world zone on page 1112
Define cylinder-shaped world zone	WZCylDef - Define a cylinder-shaped world zone on page 1088
Define a world zone for home joints	WZHomeJointDef - Define a world zone for home joints on page 1102
Define a world zone for limit joints	WZLimJointDef - Define a world zone for limitation in joints on page 1105
Activate world zone digital output set	WZDOSet - Activate world zone to set digital output on page 1093

1 Instructions

1.344 WZSphDef - Define a sphere-shaped world zone

World Zones

1.344 WZSphDef - Define a sphere-shaped world zone

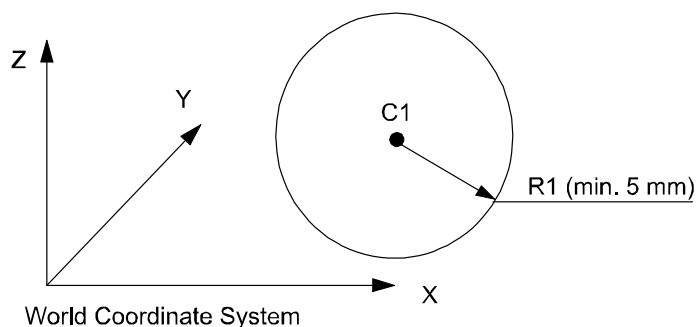
Usage

WZSphDef (*World Zone Sphere Definition*) is used to define a world zone that has the shape of a sphere.

Basic examples

The following example illustrates the instruction WZSphDef:

Example 1



xx0500002207

```
VAR shapedata volume;  
CONST pos C1:=[300,300,200];  
CONST num R1:=200;  
...  
WZSphDef \Inside, volume, C1, R1;
```

Define a sphere named volume by its center C1 and its radius R1.

Arguments

WZSphDef [\Inside] | [\Outside] Shape CentrePoint Radius

[\Inside]

Data type: switch

Define the volume inside the sphere.

[\Outside]

Data type: switch

Define the volume outside the sphere (inverse volume).

One of the arguments \Inside or \Outside must be specified.

Shape

Data type: shapedata

Variable for storage of the defined volume (private data for the system).

CentrePoint

Data type: pos

Position (x,y,z) in mm defining the center of the sphere.

Continues on next page

1.344 WZSphDef - Define a sphere-shaped world zone

World Zones

Continued

Radius

Data type: num

The radius of the sphere in mm.

Program execution

The definition of the sphere is stored in the variable of type shapedata (argument Shape), for future use in WZLimSup or WZDOSet instructions.

Limitations

If the robot is used to point out the CentrePoint then the work object wobj0 must be active (use of component trans in robtarget e.g. p1.trans as argument).

Syntax

```
WZSphDef
[ ['\ ' Inside] | ['\ ' Outside] ', ' ]
[ Shape ' := ' ] <variable (VAR) of shapedata> ', '
[ CentrePoint ' := ' ] <expression (IN) of pos> ', '
[ Radius ' := ' ] <expression (IN) of num> ' ; '
```

Related information

For information about	See
World Zones	<i>Technical reference manual - RAPID Overview, section Motion and I/O programming, World Zones</i>
World zone shape	shapedata - World zone shape data on page 1721
Define box-shaped world zone	WZBoxDef - Define a box-shaped world zone on page 1086
Define cylinder-shaped world zone	WZCylDef - Define a cylinder-shaped world zone on page 1088
Define a world zone for home joints	WZHomeJointDef - Define a world zone for home joints on page 1102
Define a world zone for limit joints	WZLimJointDef - Define a world zone for limitation in joints on page 1105
Activate world zone limit supervision	WZLimSup - Activate world zone limit supervision on page 1109
Activate world zone digital output set	WZDOSet - Activate world zone to set digital output on page 1093

This page is intentionally left blank

2 Functions

2.1 Abs - Gets the absolute value

Usage

Abs is used to get the absolute value, that is, a positive value of numeric data.

Basic examples

The following example illustrates the function Abs.

See also [More examples on page 1115](#).

Example 1

```
reg1 := Abs(reg2);
```

Reg1 is assigned the absolute value of reg2.

Return value

Data type: num

The absolute value, that is, a positive numeric value, for example:

Input value	Returned value
3	3
-3	3
-2.53	2.53

Arguments

Abs (Value)

Value

Data type: num

The input value.

More examples

More examples of the function Abs are illustrated below.

Example 1

```
TPReadNum no_of_parts, "How many parts should be produced? ";
no_of_parts := Abs(no_of_parts);
```

The operator is asked to input the number of parts to be produced. To ensure that the value is greater than zero, the value given by the operator is made positive.

Syntax

```
Abs '('
  [ Value ':= ' ] < expression (IN) of num > ')'
```

A function with a return value of the data type num.

Continues on next page

2 Functions

2.1 Abs - Gets the absolute value

RobotWare Base

Continued

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2.2 AbsDnum - Gets the absolute value of a dnum

Usage

AbsDnum is used to get the absolute value, that is, a positive value of a dnum numeric value.

Basic examples

The following example illustrates the function AbsDnum.

See also [More examples on page 1117](#).

Example 1

```
VAR dnum value1;
VAR dnum value2:=-20000000;
value1 := AbsDnum(value2);
```

Value1 is assigned the absolute value of value2.

Return value

Data type: dnum

The absolute value, that is, a positive numeric value, for example:

Input value	Returned value
3	3
-3	-3
-2.53	2.53
-4503599627370496	4503599627370496

Arguments

AbsDnum (Value)

Value

Data type: dnum

The input value.

More examples

More examples of the function AbsDnum are illustrated below.

Example 1

```
TPReadDnum no_of_parts, "How many parts should be produced? ";
no_of_parts := AbsDnum(no_of_parts);
```

The operator is asked to input the number of parts to be produced. To ensure that the value is greater than zero, the value given by the operator is made positive.

Syntax

```
AbsDnum '('
[ Value ':=' ] < expression (IN) of dnum > ')'
```

A function with a return value of the data type dnum.

Continues on next page

2 Functions

2.2 AbsDnum - Gets the absolute value of a dnum

RobotWare Base

Continued

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2.3 ACos - Calculates the arc cosine value

Usage

ACos (*Arc Cosine*) is used to calculate the arc cosine value on data types num..

Basic examples

The following example illustrates the function ACos.

Example 1

```
VAR num angle;  
VAR num value;  
...  
...  
angle := ACos(value);  
angle will get the arc cosine value of value.
```

Return value

Data type: num

The arc cosine value, expressed in degrees, range [0, 180].

Arguments

ACos (Value)

Value

Data type: num

The argument value must be in range [-1, 1].

Limitations

The execution of the function ACos(x) will give an error if x is outside the range [-1, 1].

Syntax

```
ACos '('  
  [Value ':='] <expression (IN) of num>')'  
A function with a return value of the data type num.
```

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.4 ACosDnum - Calculates the arc cosine value

RobotWare Base

2.4 ACosDnum - Calculates the arc cosine value

Usage

ACosDnum (*Arc Cosine dnum*) is used to calculate the arc cosine value on data types dnum.

Basic examples

The following example illustrates the function ACosDnum.

Example 1

```
VAR dnum angle;  
VAR dnum value;  
...  
...  
angle := ACosDnum(value);  
angle will get the arc cosine value of value.
```

Return value

Data type: dnum

The arc cosine value, expressed in degrees, range [0, 180].

Arguments

ACosDnum (Value)

Value

Data type: dnum

The argument value must be in range [-1, 1].

Limitations

The execution of the function ACosDnum(x) will give an error if x is outside the range [-1, 1].

Syntax

```
ACosDnum '('  
    [Value ':=' ] <expression (IN) of dnum>')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2.5 AInput - Reads the value of an analog input signal

Usage

AInput is used to read the current value of an analog input signal.

Basic examples

The following example illustrates the function AInput.

See also [More examples on page 1121](#).

Example 1

```
IF AInput(ai1) < 1.5 THEN ...
...
IF ai1 < 1.5 THEN ...
```

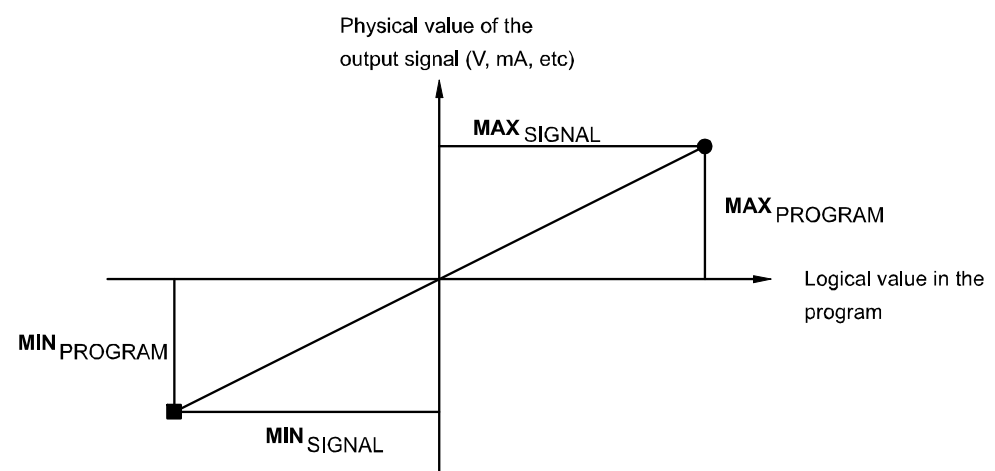
If the current value of the signal ai1 is less than 1.5, then ...

Return value

Data type: num

The current value of the signal.

The current value is scaled (in accordance with the system parameters) before it is read by the RAPID program. A diagram of how analog signal values are scaled is shown in the following figure:



xx0500002408

Arguments

AInput (Signal)

Signal

Data type: signalai

The name of the analog input to be read.

More examples

More examples of how to use the function AInput are illustrated below.

Continues on next page

2 Functions

2.5 AInput - Reads the value of an analog input signal

RobotWare Base

Continued

Example 1

```
WHILE AInput(current) > 35 DO ...  
...  
WHILE current > 35 DO ...
```

As long as the current value of the signal current is greater than 35, execute ...

Example 2

```
deviation := 3 * AInput(sensor) + 10;  
...  
deviation := 3 * sensor + 10;
```

The deviation is calculated based on the value of the signal sensor and stored in the variable deviation.

Syntax

```
AInput '('  
  [ Signal ':= ' ] < variable (VAR) of signalai > ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Input/Output instructions	<i>Technical reference manual - RAPID Overview, section RAPID Summary - Input and Output Signals</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview, section Motion and I/O Principles - I/O principles</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

2.6 AND - Evaluates a logical value

Usage

AND is a function used to evaluate two conditional expressions (true/false).

Basic examples

The following examples illustrate the function AND.

Example 1

```
VAR num a;
VAR num b;
VAR bool c;
...
c := a>5 AND b=3;
```

The return value of c is TRUE if a is larger than 5 and b equals 3. Otherwise the return value is FALSE.

Example 2

```
VAR num mynum;
VAR string mystring;
VAR bool mybool;
VAR bool result;
...
result := mystring="Hello" AND mynum<15 OR mybool;
```

The return value of result is TRUE if both mystring is "Hello" and mynum is smaller than 15. Or if mybool is TRUE. Otherwise the return value is FALSE.

The AND statement is evaluated first, thereafter the OR statement. This is illustrated by the parentheses in the below row.

```
result := (mystring="Hello" AND mynum<15) OR mybool;
```

Return value

Data type: bool

The return value is TRUE if both conditional expressions are correct, otherwise the return value is FALSE.

Syntax

```
<expression of bool> AND <expression of bool>
```

A function with a return value of data type bool.

Related information

For information about	See
Logical bitwise AND - operation on byte data	BitAnd - Logical bitwise AND - operation on byte data on page 1136
Logical bitwise AND - operation on dnum data	BitAndDnum - Logical bitwise AND - operation on dnum data on page 1138
OR	OR - Evaluates a logical value on page 1367
XOR	XOR - Evaluates a logical value on page 1588

Continues on next page

2 Functions

2.6 AND - Evaluates a logical value

RobotWare Base

Continued

For information about	See
NOT	NOT - Inverts a logical value on page 1358
Expressions	<i>Technical reference manual - RAPID Overview</i>

2.7 AOutput - Reads the value of an analog output signal

Usage

AOutput is used to read the current value of an analog output signal.

Basic examples

The following example illustrates the function AOutput.

Example 1

```
IF AOutput(ao4) > 5 THEN ...
```

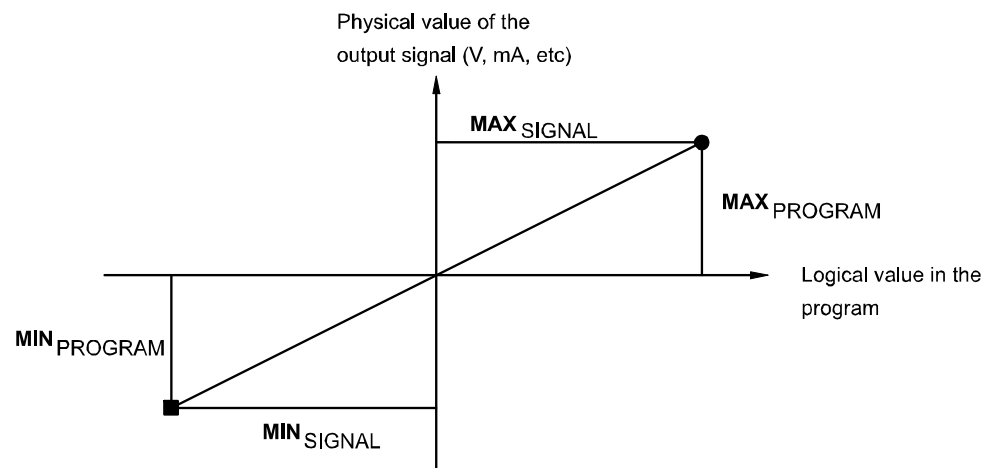
If the current value of the signal ao4 is greater than 5, then ...

Return value

Data type: num

The current value of the signal.

The current value is scaled (in accordance with the system parameters) before it is read by the RAPID program. A diagram of how analog signal values are scaled is shown in the following figure:



xx0500002408

Arguments

AOutput (Signal)

Signal

Data type: signalao

The name of the analog output to be read.

Continues on next page

2 Functions

2.7 AOutput - Reads the value of an analog output signal

RobotWare Base

Continued

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Syntax

```
AOutput '('  
  [ Signal ':=' ] < variable (VAR) of signalao > ')'
```

A function with a return value of data type num.

Related information

For information about	See
Set an analog output signal	SetAO - Changes the value of an analog output signal on page 672
Input/Output instructions	<i>Technical reference manual - RAPID Overview, section RAPID Summary - Input and Output Signals</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview, section Motion and I/O Principles - I/O principles</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

2.8 ArgName - Gets argument name

Usage

ArgName (*Argument Name*) is used to get the name of the original data object for the current argument or the current data.

Basic examples

The following example illustrates the function ArgName.

See also [More examples on page 1128](#).

Example 1

```
VAR num chales :=5;
...
proc1 chales;
PROC proc1 (num par1)
  VAR string name;
  ...
  name:=ArgName(par1);
  TPWrite "Argument name "+name+" with value "\Num:=par1;
ENDPROC
```

The variable name is assigned the string value "chales" and on FlexPendant the following string is written: "Argument name chales with value 5".

Return value

Data type: string

The original data object name.

Arguments

ArgName (Parameter [\ErrorNumber])

Parameter

Data type: anytype

The formal parameter identifier (for the routine in which ArgName is located) or the data identity.

All types of data with structure atomic, record, record component, array, or array element can be used.

ErrorNumber

Data type: errnum

A variable (before used it is set to 0 by the system) that will hold the error code when the argument is an expression value, argument is not present or argument is of type switch. If this optional variable is omitted then the error handler will be executed.

Program execution

The function returns the original data object name for an entire object of the type constant, variable, or persistent. The original data object can be global, local in the program module, or local in a routine (normal RAPID scope rules).

Continues on next page

2 Functions

2.8 ArgName - Gets argument name

RobotWare Base

Continued

If it is a part of a data object then the name of the whole data object is returned.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_ARGNAME	- Argument is expression value - Argument is not present - Argument is of type switch

More examples

More examples of the function `ArgName` are illustrated below.

Convert from identifier to string

This function can also be used to convert from identifier to string, by specifying the identifier in the argument `Parameter` for any data object with global, local in module, or local in routine scope:

```
VAR num chales :=5;
...
proc1;

PROC proc1 ()
  VAR string name;
  ...
  name:=ArgName(chales);
  TPWrite "Global data object "+name+" has value "\Num:=chales;
ENDPROC
```

The variable name is assigned the string value "chales" and on FlexPendant the following string is written: "Global data object chales has value 5".

Routine call in several steps

Note that the function returns the original data object name:

```
VAR num chales :=5;
...
proc1 chales;
...
PROC proc1 (num parameter1)
  ...
  proc2 parameter1;
  ...
ENDPROC

PROC proc2 (num par1)
  VAR string name;
  ...
  name:=ArgName(par1);
  TPWrite "Original data object name "+name+" with value"
    \Num:=par1;
ENDPROC
```

Continues on next page

The variable name is assigned the string value "chaless" and on FlexPendant the following string is written: "Original data object name chaless with value 5".

Suppress execution in error handler

```
PROC main()
  VAR string mystring:="DUMMY";
  proc1 mystring;
  proc1 "This is a test";
  ...
ENDPROC

PROC proc1 (string par1)
  VAR string name;
  VAR errnum myerrnum;

  name := ArgName(par1 \ErrorNumber:=myerrnum);
  IF myerrnum=ERR_ARGNAME THEN
    TPWrite "The argument par1 is an expression value";
    TPWrite "The name of the argument can not be evaluated";
  ELSE
    TPWrite "The name on the argument is "+name;
  ENDIF
ENDPROC
```

The variable name is assigned the string value "mystring" when the first call to proc1 is done. When the second call to proc1 is done, an empty string is assigned to name. On the FlexPendant the following string is written: "The argument par1 is an expression value" and "The name of the argument can not be evaluated".

Syntax

```
ArgName '('
  [ Parameter ':' ] < reference (REF) of anytype>
  ['\ ' ErrorNumber ':' ] <variable or persistent (INOUT) of errnum>
  ')'
```

A function with a return value of the data type string.

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview</i>
<i>Advanced RAPID</i>	<i>Advanced RAPID</i>

2 Functions

2.9 ASin - Calculates the arc sine value

RobotWare Base

2.9 ASin - Calculates the arc sine value

Usage

ASin (*Arc Sine*) is used to calculate the arc sine value on data types num.

Basic examples

The following example illustrates the function ASin

Example 1

```
VAR num angle;  
VAR num value;  
...  
...  
angle := ASin(value);  
angle will get the arc sine value of value
```

Return value

Data type: num

The arc sine value, expressed in degrees, range [-90, 90].

Arguments

ASin (Value)

Value

Data type: num

The argument value must be in range [-1, 1].

Limitations

The execution of the function ASin(x) will give an error if x is outside the range [-1, 1].

Syntax

```
ASin '('  
    [Value ':=' ] <expression (IN) of num> ')'  
A function with a return value of the data type num.
```

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2.10 ASinDnum - Calculates the arc sine value

Usage

ASinDnum (*Arc Sine dnum*) is used to calculate the arc sine value on data types dnum.

Basic examples

The following example illustrates the function ASinDnum

Example 1

```
VAR dnum angle;  
VAR dnum value;  
...  
...  
angle := ASinDnum(value);  
angle will get the arc sine value of value
```

Return value

Data type: dnum

The arc sine value, expressed in degrees, range [-90, 90].

Arguments

ASinDnum (Value)

Value

Data type: dnum

The argument value must be in range [-1, 1].

Limitations

The execution of the function ASinDnum(x) will give an error if x is outside the range [1, -1].

Syntax

```
ASinDnum '('  
[Value ':=' ] <expression (IN) of dnum> ')'  
A function with a return value of the data type dnum.
```

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.11 ATan - Calculates the arc tangent value

RobotWare Base

2.11 ATan - Calculates the arc tangent value

Usage

ATan (*Arc Tangent*) is used to calculate the arc tangent value on data types num.

Basic examples

The following example illustrates the function ATan.

Example 1

```
VAR num angle;  
VAR num value;  
...  
...  
angle := ATan(value);  
angle will get the arc tangent value of value.
```

Return value

Data type: num
The arc tangent value, expressed in degrees, range [-90, 90].

Arguments

ATan (Value)

Value

Data type: num
The argument value.

Syntax

```
ATan '('  
    [Value ':='] <expression (IN) of num> ')'  
A function with a return value of the data type num.
```

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>
Arc tangent with a return value in the range [-180, 180]	ATan2 - Calculates the arc tangent2 value on page 1134

2.12 ATanDnum - Calculates the arc tangent value

Usage

ATanDnum (*Arc Tangent dnum*) is used to calculate the arc tangent value on data types dnum.

Basic examples

The following example illustrates the function ATanDnum.

Example 1

```
VAR dnum angle;  
VAR dnum value;  
...  
...  
angle := ATanDnum(value);  
angle will get the arc tangent value of value.
```

Return value

Data type: dnum

The arc tangent value, expressed in degrees, range [-90, 90].

Arguments

ATanDnum (Value)

Value

Data type: dnum

The argument value.

Syntax

```
ATanDnum '('  
  [Value ':=' ] <expression (IN) of dnum> ')'  
A function with a return value of the data type dnum.
```

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>
Arc tangent with a return value in the range [-180, 180]	ATan2 - Calculates the arc tangent2 value on page 1134

2 Functions

2.13 ATan2 - Calculates the arc tangent2 value

RobotWare Base

2.13 ATan2 - Calculates the arc tangent2 value

Usage

ATan2 (*Arc Tangent2*) is used to calculate the arc tangent2 value on data types num.

Basic examples

The following example illustrates the function ATan2.

Example 1

```
VAR num angle;  
VAR num x_value;  
VAR num y_value;  
...  
...  
angle := ATan2(y_value, x_value);  
angle will get the arc tangent value of y_value/x_value.
```

Return value

Data type: num

The arc tangent value, expressed in degrees, range [-180, 180]. The value will be equal to ATan(y/x) but in the range of [-180, 180] since the function uses the sign of both arguments to determine the quadrant of the return value.

Arguments

ATan2 (Y X)

Y

Data type: num

The numerator argument value.

X

Data type: num

The denominator argument value.

Syntax

```
ATan2 '('  
  [Y ':='] <expression (IN) of num> ','  
  [X ':='] <expression (IN) of num> ')'  
A function with a return value of the data type num.
```

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>
Arc tangent with only one argument	ATan - Calculates the arc tangent value on page 1132

2.14 ATan2Dnum - Calculates the arc tangent2 value

Usage

ATan2Dnum (*Arc Tangent2 dnum*) is used to calculate the arc tangent2 value on data types dnum.

Basic examples

The following example illustrates the function ATan2Dnum.

Example 1

```
VAR dnum angle;
VAR dnum x_value;
VAR dnum y_value;
...
...
angle := ATan2Dnum(y_value, x_value);
angle will get the arc tangent value of y_value/x_value.
```

Return value

Data type: dnum

The arc tangent value, expressed in degrees, range [-180, 180]. The value will be equal to ATanDnum(y/x) but in the range of [-180, 180] since the function uses the sign of both arguments to determine the quadrant of the return value.

Arguments

ATan2Dnum (Y X)

Y

Data type: dnum

The numerator argument value.

X

Data type: dnum

The denominator argument value.

Syntax

```
ATan2Dnum '('
  [Y ':=' ] <expression (IN) of dnum> ', '
  [X ':=' ] <expression (IN) of dnum> ')'
A function with a return value of the data type dnum.
```

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>
Arc tangent with only one argument	ATan - Calculates the arc tangent value on page 1132

2 Functions

2.15 BitAnd - Logical bitwise AND - operation on byte data

RobotWare Base

2.15 BitAnd - Logical bitwise AND - operation on byte data

Usage

BitAnd is used to execute a logical bitwise AND - operation on data types byte.

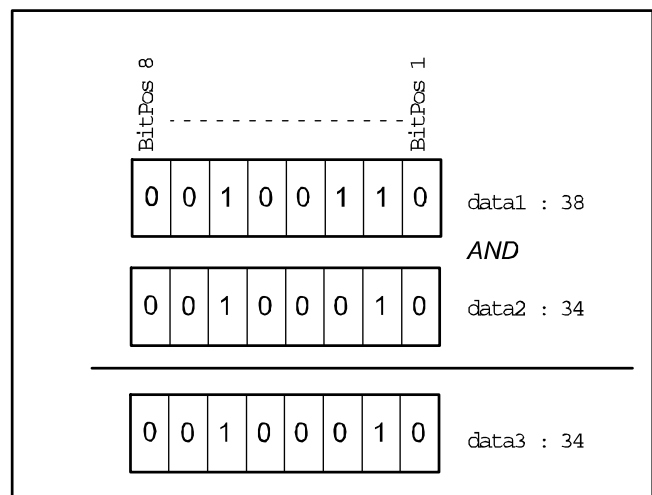
Basic examples

The following example illustrates the function BitAnd.

Example 1

```
VAR byte data1 := 38;  
VAR byte data2 := 34;  
VAR byte data3;  
  
data3 := BitAnd(data1, data2);
```

The logical bitwise AND - operation (see following figure) is executed on the data1 and data2. The result is returned to data3 (integer representation).



xx0500002454

Return value

Data type: byte

The result of the logical bitwise AND - operation in integer representation.

Arguments

BitAnd (BitData1 BitData2)

BitData1

Data type: byte

The bit data 1, in integer representation.

BitData2

Data type: byte

The bit data 2, in integer representation.

Continues on next page

Limitations

The range for a data type byte is 0 - 255.

Syntax

```
BitAnd '('  
  [BitData1 ':='] <expression (IN) of byte> ','  
  [BitData2 ':='] <expression (IN) of byte> ')'
```

A function with a return value of the data type byte.

Related information

For information about	See
Logical bitwise OR - operation on byte data	BitOr - Logical bitwise OR - operation on byte data on page 1152
Logical bitwise XOR - operation on byte data	BitXOr - Logical bitwise XOR - operation on byte data on page 1160
Logical bitwise NEGATION - operation on byte data	BitNeg - Logical bitwise NEGATION - operation on byte data on page 1148
Other bit functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.16 BitAndDnum - Logical bitwise AND - operation on dnum data

RobotWare Base

2.16 BitAndDnum - Logical bitwise AND - operation on dnum data

Usage

BitAndDnum is used to execute a logical bitwise AND - operation on data types dnum.

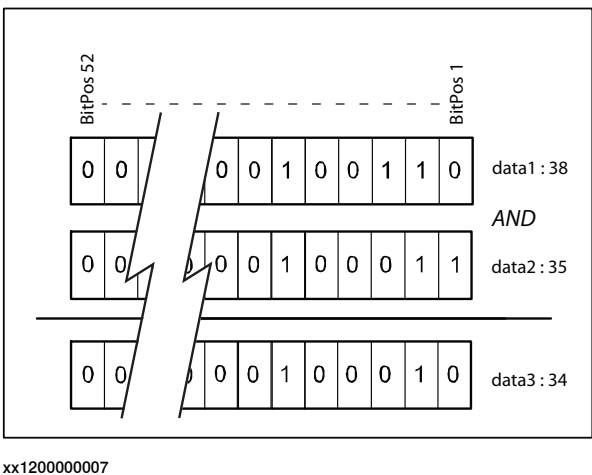
Basic examples

The following example illustrates the function BitAndDnum.

Example 1

```
VAR dnum data1 := 38;  
VAR dnum data2 := 35;  
VAR dnum data3;  
  
data3 := BitAndDnum(data1, data2);
```

The logical bitwise AND - operation (see figure below) will be executed on the data1 and data2. The result will be returned to data3 (integer representation).



Return value

Data type: dnum

The result of the logical bitwise AND - operation in integer representation.

Arguments

BitAndDnum (Value1 Value2)

Value1

Data type: dnum

The first bit data value, in integer representation.

Value2

Data type: dnum

The second bit data value, in integer representation.

Continues on next page

Limitations

The range for a data type dnum is 0 - 4503599627370495.

Syntax

```
BitAndDnum '('
  [Value1 ':='] <expression (IN) of dnum> ','
  [Value2 ':='] <expression (IN) of dnum> ')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
Logical bitwise AND - operation on byte data	BitAnd - Logical bitwise AND - operation on byte data on page 1136
Data type dnum	dnum - Double numeric values on page 1630
Logical bitwise OR - operation on dnum data	BitOrDnum - Logical bitwise OR - operation on dnum data on page 1154
Logical bitwise XOR - operation on dnum data	BitXOrDnum - Logical bitwise XOR - operation on dnum data on page 1162
Logical bitwise NEGATION - operation on dnum data	BitNegDnum - Logical bitwise NEGATION - operation on dnum data on page 1150
Other bit functions	Technical reference manual - RAPID Overview

2 Functions

2.17 BitCheck - Check if a specified bit in a byte data is set

RobotWare Base

2.17 BitCheck - Check if a specified bit in a byte data is set

Usage

BitCheck is used to check if a specified bit in a defined byte data is set to 1.

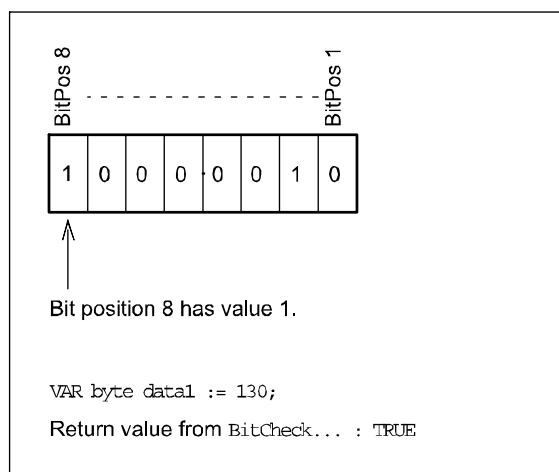
Basic examples

The following example illustrates the function BitCheck.

Example 1

```
CONST num parity_bit := 8;  
VAR byte data1 := 130;  
  
IF BitCheck(data1, parity_bit) = TRUE THEN  
    ...  
ELSE  
    ...  
ENDIF
```

Bit number 8 (parity_bit) in the variable data1 is checked, for example, if the specified bit is set to 1 in the variable data1 then this function will return to TRUE. Bit check of data type byte is illustrated in the following figure.



xx0500002442

Return value

Data type: bool

TRUE if the specified bit is set to 1, FALSE if the specified bit is set to 0.

Arguments

BitCheck (BitData BitPos)

BitData

Data type: byte

The bit data, in integer representation, to be checked.

Continues on next page

BitPos

Bit Position

Data type: num

The bit position (1-8) in the BitData to be checked.

Limitations

The range for a data type byte is 0 - 255 decimal.

The bit position is valid from 1 - 8.

Syntax

```

BitCheck '('
  [BitData ':='] <expression (IN) of byte> ', '
  [BitPos ':='] <expression (IN) of num> ')'

```

A function with a return value of the data type bool.

Related information

For information about	See
Set a specified bit in a byte data	BitSet - Set a specified bit in a byte or dnum data on page 44
Clear a specified bit in a byte data	BitClear - Clear a specified bit in a byte or dnum data on page 41
Other bit functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.18 BitCheckDnum - Check if a specified bit in a dnum data is set

RobotWare Base

2.18 BitCheckDnum - Check if a specified bit in a dnum data is set

Usage

BitCheckDnum is used to check if a specified bit in a defined dnum data is set to 1.

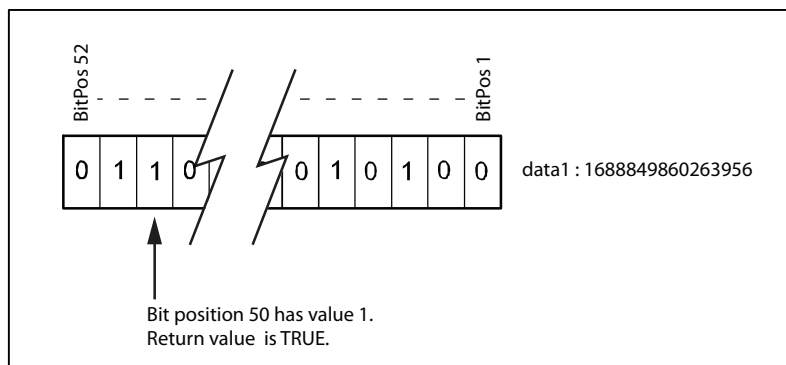
Basic examples

The following example illustrates the function BitCheckDnum.

Example 1

```
CONST num check_bit := 50;  
VAR dnum data1 := 1688849860263956;  
  
IF BitCheckDnum(data1, check_bit) = TRUE THEN  
    ...  
ELSE  
    ...  
ENDIF
```

Bit number 50 (check_bit) in the variable data1 will be checked, for example, if the specified bit is 1 in the variable data1 then this function will return to TRUE. Bit check of data type dnum is illustrated in the figure below.



xx1200000016

Return value

Data type: bool

TRUE if the specified bit is set to 1, FALSE if the specified bit is set to 0.

Arguments

BitCheckDnum (Value BitPos)

Value

Data type: dnum

The bit data, in integer representation, to be checked.

BitPos

Bit Position

Data type: num

Continues on next page

2.18 BitCheckDnum - Check if a specified bit in a dnum data is set

RobotWare Base

Continued

The bit position (1-52) in Value to be checked.

Limitations

The range for a data type dnum is 0 - 4503599627370495 decimal.

The bit position is valid from 1 - 52.

Syntax

```
BitCheckDnum '('
  [Value ':=' ] <expression (IN) of dnum> ','
  [BitPos ':=' ] <expression (IN) of num> ')'

```

A function with a return value of the data type bool.

Related information

For information about	See
Check if a specified bit in a byte data is set	BitCheck - Check if a specified bit in a byte data is set on page 1140
Data type dnum	dnum - Double numeric values on page 1630
Set a specified bit in a byte or dnum data	BitSet - Set a specified bit in a byte or dnum data on page 44
Clear a specified bit in a byte or dnum data	BitClear - Clear a specified bit in a byte or dnum data on page 41
Other bit functions	Technical reference manual - RAPID Overview

2 Functions

2.19 BitLSh - Logical bitwise LEFT SHIFT - operation on byte

RobotWare Base

2.19 BitLSh - Logical bitwise LEFT SHIFT - operation on byte

Usage

BitLSh (*Bit Left Shift*) is used to execute a logical bitwise LEFT SHIFT-operation on data types byte.

Basic examples

The following example illustrates the function BitLSh.

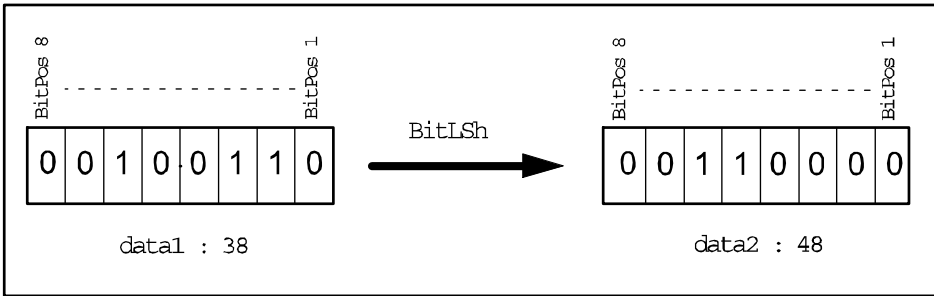
Example 1

```
VAR num left_shift := 3;
VAR byte data1 := 38;
VAR byte data2;

data2 := BitLSh(data1, left_shift);
```

The logical bitwise LEFT SHIFT- operation will be executed on the data1 with 3 (left_shift) steps of left shift, and the result will be returned to data2 (integer representation).

The following figure shows logical bitwise LEFT SHIFT-operation.



xx0500002457

Return value

Data type: byte

The result of the logical bitwise LEFT SHIFT-operation in integer representation.
The right bit cells will be filled up with 0-bits.

Arguments

BitLSh (BitData ShiftSteps)

BitData

Data type: byte

The bit data, in integer representation, to be shifted.

ShiftSteps

Data type: num

Number of the logical shifts (0 - 8) to be executed.

Use of 0 will return the value in the BitData argument.

Continues on next page

Limitations

The range for a data type byte is 0 - 255.

The ShiftSteps argument is valid from 1 - 8 according to one byte.

Syntax

```
BitLSh '('  
  [BitData ':='] <expression (IN) of byte> ','  
  [ShiftSteps ':='] <expression (IN) of num> ')'
```

A function with a return value of the data type byte.

Related information

For information about	See
Logical bitwise RIGHT SHIFT-operation on byte data	BitRSh - Logical bitwise RIGHT SHIFT - operation on byte on page 1156
Other bit functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.20 BitLShDnum - Logical bitwise LEFT SHIFT - operation on dnum *RobotWare Base*

2.20 BitLShDnum - Logical bitwise LEFT SHIFT - operation on dnum

Usage

BitLShDnum (*Bit Left Shift dnum*) is used to execute a logical bitwise LEFT SHIFT-operation on data types dnum.

Basic examples

The following example illustrates the function BitLShDnum.

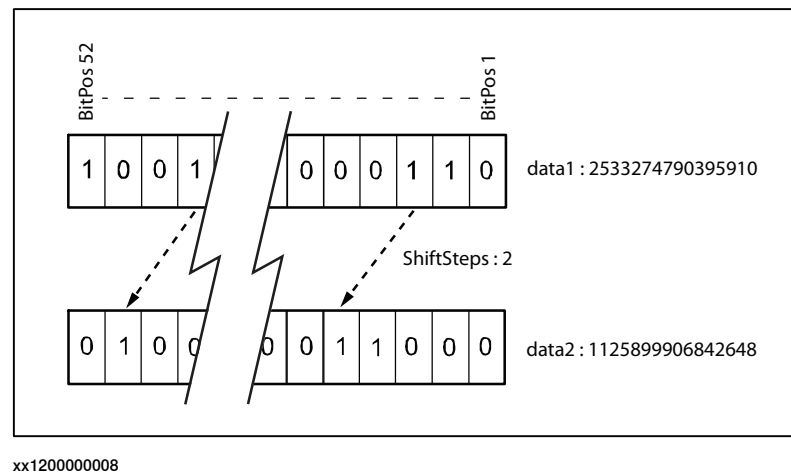
See also [More examples on page 1147](#).

Example 1

```
VAR num left_shift := 2;  
VAR dnum data1 := 2533274790395910;  
VAR dnum data2;  
  
data2 := BitLShDnum(data1, left_shift);
```

The logical bitwise LEFT SHIFT- operation will be executed on the data1 with 2 (left_shift) steps of left shift, and the result will be returned to data2 (integer representation).

The following figure shows logical bitwise LEFT SHIFT-operation.



Return value

Data type: dnum

The result of the logical bitwise LEFT SHIFT-operation in integer representation.
The right bit cells will be filled up with 0-bits.

Arguments

BitLShDnum (Value ShiftSteps [\Size])

Value

Data type: dnum

The bit data, in integer representation, to be shifted.

Continues on next page

ShiftSteps

Data type: num

Number of the logical shifts (0 - 52) to be executed.

Use of 0 will return the value in the Value argument.

Size

Data type: num

The size (number of bits) that should be considered when doing the logical bitwise LEFT SHIFT-operation on argument Value. The size is valid from 1 - 52.

More examples

More examples of the function BitLshDnum are illustrated below.

Example 1

```
VAR dnum result;
VAR dnum data1:=221;
! Only consider the 8 lowest bits
result := BitLshDnum(data1, 4 \Size:=8);
TPWrite "" \Dnum:=result;
! Consider all 52 bits in the dnum datatype
result := BitLshDnum(data1, 4);
TPWrite "" \Dnum:=result;
```

The logical bitwise LEFT SHIFT- operation will be executed on the data1, and the result will be returned to result (integer representation). The first value to be written on the FlexPendant is 208. The second value to be written on the FlexPendant is 3536.

Limitations

The range for a data type dnum is 0 - 4503599627370495.

The ShiftSteps argument is valid from 1 - 52 since one dnum is 52 bits.

Syntax

```
BitLshDnum '('
  [Value ':=' ] <expression (IN) of dnum> ', '
  [ShiftSteps ':=' ] <expression (IN) of num>
  ['\ ' Size ':=' < expression (IN) of num>]
  ')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
Logical bitwise LEFT SHIFT-operation on byte data	BitLSh - Logical bitwise LEFT SHIFT - operation on byte on page 1144
Data type dnum	dnum - Double numeric values on page 1630
Logical bitwise RIGHT SHIFT-operation on dnum data	BitRShDnum - Logical bitwise RIGHT SHIFT - operation on dnum on page 1158
Other bit functions	Technical reference manual - RAPID Overview

2 Functions

2.21 BitNeg - Logical bitwise NEGATION - operation on byte data *RobotWare Base*

2.21 BitNeg - Logical bitwise NEGATION - operation on byte data

Usage

BitNeg (*Bit Negation*) is used to execute a logical bitwise NEGATION - operation (one's complement) on data types byte.

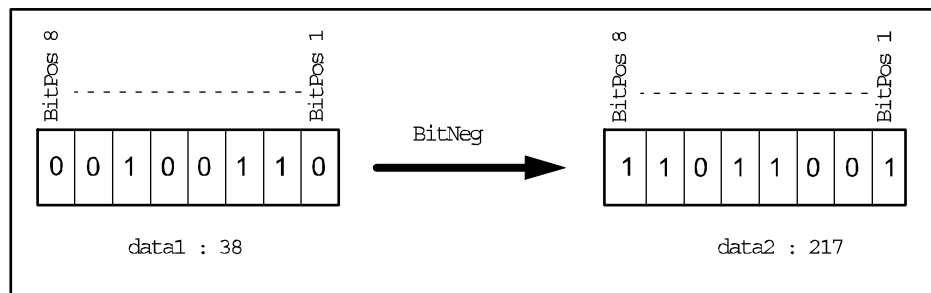
Basic examples

The following example illustrates the function BitNeg.

Example 1

```
VAR byte data1 := 38;  
VAR byte data2;  
  
data2 := BitNeg(data1);
```

The logical bitwise NEGATION - operation (see figure below) will be executed on the data1, and the result will be returned to data2 (integer representation).



xx0500002456

Return value

Data type: byte

The result of the logical bitwise NEGATION - operation in integer representation.

Arguments

BitNeg (BitData)

BitData

Data type: byte

The byte data, in integer representation.

Limitations

The range for a data type byte is 0 - 255.

Syntax

```
BitNeg '('  
  [BitData ':='] <expression (IN) of byte>  
  ')'
```

A function with a return value of the data type byte.

Continues on next page

2.21 BitNeg - Logical bitwise NEGATION - operation on byte data

RobotWare Base

Continued

Related information

For information about	See
Logical bitwise AND - operation on byte data	BitAnd - Logical bitwise AND - operation on byte data on page 1136
Logical bitwise OR - operation on byte data	BitOr - Logical bitwise OR - operation on byte data on page 1152
Logical bitwise XOR - operation on byte data	BitXOr - Logical bitwise XOR - operation on byte data on page 1160
Other bit functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.22 BitNegDnum - Logical bitwise NEGATION - operation on dnum data

RobotWare Base

2.22 BitNegDnum - Logical bitwise NEGATION - operation on dnum data

Usage

BitNegDnum (*Bit Negation dnum*) is used to execute a logical bitwise NEGATION - operation (one's complement) on data types dnum.

Basic examples

The following example illustrates the function BitNegDnum.

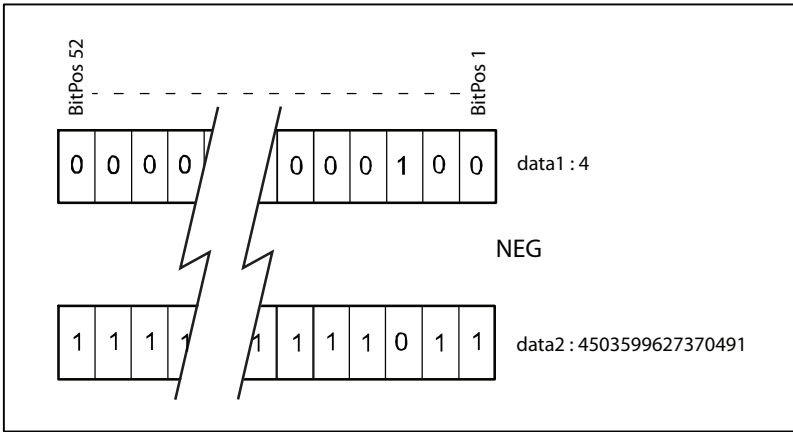
See also [More examples on page 1151](#).

Example 1

```
VAR dnum data1 := 4;
VAR dnum data2;

data2 := BitNegDnum(data1);
```

The logical bitwise NEGATION - operation (see figure below) will be executed on the data1, and the result will be returned to data2 (integer representation).



xx1200000012

Return value

Data type: dnum

The result of the logical bitwise NEGATION - operation in integer representation.

Arguments

BitNegDnum (Value [\Size])

Value

Data type: dnum

The dnum data, in integer representation.

Size

Data type: num

The size (number of bits) that should be considered when doing the logical bitwise NEGATION-operation on argument Value. The size is valid from 1 - 52.

Continues on next page

More examples

More examples of the function BitNegDnum are illustrated below.

Example 1

```
VAR dnum result;
VAR dnum data1:=38;
! Only consider the 16 lowest bits
result := BitNegDnum(data1 \Size:=16);
TPWrite "" \Dnum:=result;
! Consider all 52 bits in the dnum datatype
result := BitNegDnum(data1);
TPWrite "" \Dnum:=result;
```

The logical bitwise NEGATION - operation will be executed on the data1, and the result will be returned to result (integer representation). The first value to be written on the FlexPendant is 65497. The second value to be written on the FlexPendant is 4503599627370457.

Limitations

The range for a data type dnum is 0 - 4503599627370495.

Syntax

```
BitNegDnum '('
  [Value ':='] <expression (IN) of dnum>
  ['\Size ':='] <expression (IN) of num>
  ')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
Logical bitwise NEGATION - operation on byte data	BitNeg - Logical bitwise NEGATION - operation on byte data on page 1148
Data type dnum	dnum - Double numeric values on page 1630
Logical bitwise AND - operation on dnum data	BitAndDnum - Logical bitwise AND - operation on dnum data on page 1138
Logical bitwise OR - operation on dnum data	BitOrDnum - Logical bitwise OR - operation on dnum data on page 1154
Logical bitwise XOR - operation on dnum data	BitXorDnum - Logical bitwise XOR - operation on dnum data on page 1162
Other bit functions	Technical reference manual - RAPID Overview

2 Functions

2.23 BitOr - Logical bitwise OR - operation on byte data

RobotWare Base

2.23 BitOr - Logical bitwise OR - operation on byte data

Usage

BitOr (*Bit inclusive Or*) is used to execute a logical bitwise OR-operation on data types byte.

Basic examples

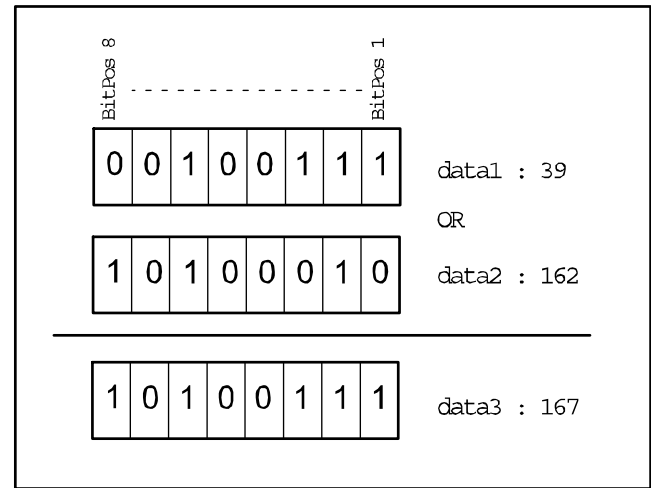
The following example illustrates the function BitOr.

Example 1

```
VAR byte data1 := 39;  
VAR byte data2 := 162;  
VAR byte data3;  
  
data3 := BitOr(data1, data2);
```

The logical bitwise OR-operation will be executed on the data1 and data2, and the result will be returned to data3 (integer representation).

The following figure shows logical bitwise OR-operation.



xx0500002458

Return value

Data type: byte

The result of the logical bitwise OR-operation in integer representation.

Arguments

BitOr (BitData1 BitData2)

BitData1

Data type: byte

The bit data 1, in integer representation.

BitData2

Data type: byte

Continues on next page

The bit data 2, in integer representation.

Limitations

The range for a data type byte is 0 - 255.

Syntax

```
BitOr '('  
  [BitData1 ':='] <expression (IN) of byte> ','  
  [BitData2 ':='] <expression (IN) of byte>  
  ')'
```

A function with a return value of the data type byte.

Related information

For information about	See
Logical bitwise AND - operation on byte data	BitAnd - Logical bitwise AND - operation on byte data on page 1136
Logical bitwise XOR - operation on byte data	BitXOr - Logical bitwise XOR - operation on byte data on page 1160
Logical bitwise NEGATION - operation on byte data	BitNeg - Logical bitwise NEGATION - operation on byte data on page 1148
Other bit functions	Technical reference manual - RAPID Overview

2 Functions

2.24 BitOrDnum - Logical bitwise OR - operation on dnum data

RobotWare Base

2.24 BitOrDnum - Logical bitwise OR - operation on dnum data

Usage

BitOrDnum (*Bit inclusive Or dnum*) is used to execute a logical bitwise OR-operation on data types dnum.

Basic examples

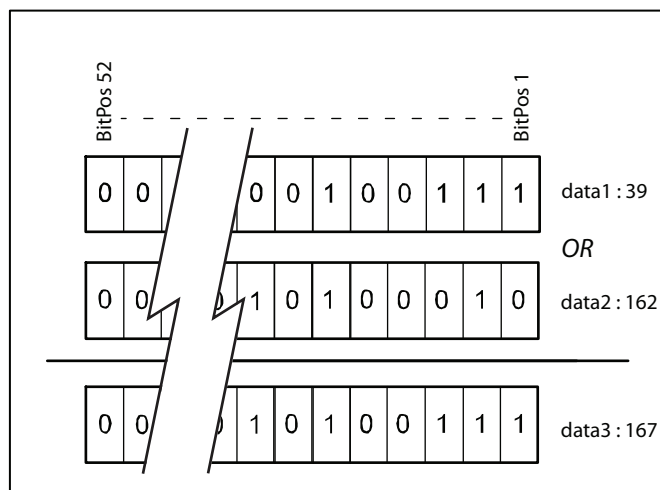
The following example illustrates the function BitOrDnum.

Example 1

```
VAR dnum data1 := 39;  
VAR dnum data2 := 162;  
VAR dnum data3;  
  
data3 := BitOrDnum(data1, data2);
```

The logical bitwise OR-operation will be executed on the data1 and data2, and the result will be returned to data3 (integer representation).

The following figure shows logical bitwise OR-operation.



Return value

Data type: dnum

The result of the logical bitwise OR-operation in integer representation.

Arguments

BitOrDnum (Value1 Value2)

Value1

Data type: dnum

The first bit data value, in integer representation.

Value2

Data type: dnum

The second bit data value, in integer representation.

Continues on next page

Limitations

The range for a data type dnum is 0 - 4503599627370495.

Syntax

```
BitOrDnum '('
  [Value1 ':='] <expression (IN) of dnum> ', '
  [Value2 ':='] <expression (IN) of dnum>
  ')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
Logical bitwise OR - operation on byte data	BitOr - Logical bitwise OR - operation on byte data on page 1152
Data type dnum	dnum - Double numeric values on page 1630
Logical bitwise AND - operation on dnum data	BitAndDnum - Logical bitwise AND - operation on dnum data on page 1138
Logical bitwise XOR - operation on dnum data	BitXOrDnum - Logical bitwise XOR - operation on dnum data on page 1162
Logical bitwise NEGATION - operation on dnum data	BitNegDnum - Logical bitwise NEGATION - operation on dnum data on page 1150
Other bit functions	Technical reference manual - RAPID Overview

2 Functions

2.25 BitRSh - Logical bitwise RIGHT SHIFT - operation on byte *RobotWare Base*

2.25 BitRSh - Logical bitwise RIGHT SHIFT - operation on byte

Usage

BitRSh (*Bit Right Shift*) is used to execute a logical bitwise RIGHT SHIFT-operation on data types byte.

Basic examples

The following example illustrates the function BitRSh.

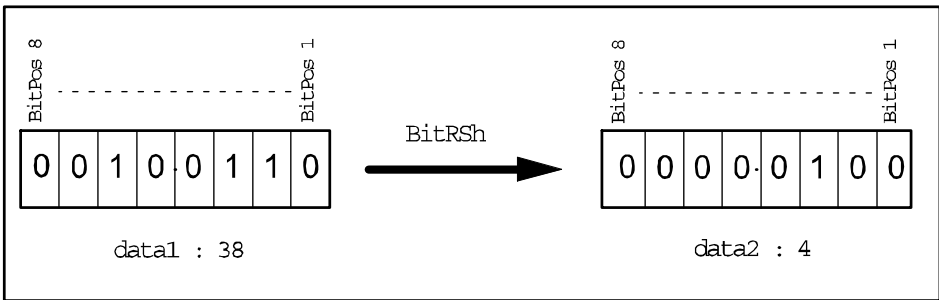
Example 1

```
VAR num right_shift := 3;
VAR byte data1 := 38;
VAR byte data2;

data2 := BitRSh(data1, right_shift);
```

The logical bitwise RIGHT SHIFT-operation will be executed on the data1 with 3 (right_shift) steps of right shift, and the result will be returned to data2 (integer representation)

The following figure shows logical bitwise RIGHT SHIFT-operation.



xx0500002455

Return value

Data type: byte

The result of the logical bitwise RIGHT SHIFT-operation in integer representation.
The left bit cells will be filled up with 0-bits.

Arguments

BitRSh (BitData ShiftSteps)

BitData

Data type: byte

The bit data, in integer representation, to be shifted.

ShiftSteps

Data type: num

Number of the logical shifts (0 - 8) to be executed.

Use of 0 will return the value in the BitData argument.

Continues on next page

Limitations

The range for a data type byte is 0 - 255.

The ShiftSteps argument is valid from 1 - 8 according to one byte.

Syntax

```
BitRSh '('  
  [BitData ':=' ] <expression (IN) of byte> ','  
  [ShiftSteps ':=' ] <expression (IN) of num>  
  ')'
```

A function with a return value of the data type byte.

Related information

For information about	See
Logical bitwise LEFT SHIFT-operation on byte data	BitLSh - Logical bitwise LEFT SHIFT - operation on byte on page 1144
Other bit functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.26 BitRShDnum - Logical bitwise RIGHT SHIFT - operation on dnum

RobotWare Base

2.26 BitRShDnum - Logical bitwise RIGHT SHIFT - operation on dnum

Usage

BitRShDnum (*Bit Right Shift dnum*) is used to execute a logical bitwise RIGHT SHIFT-operation on data types dnum.

Basic examples

The following example illustrates the function BitRShDnum.

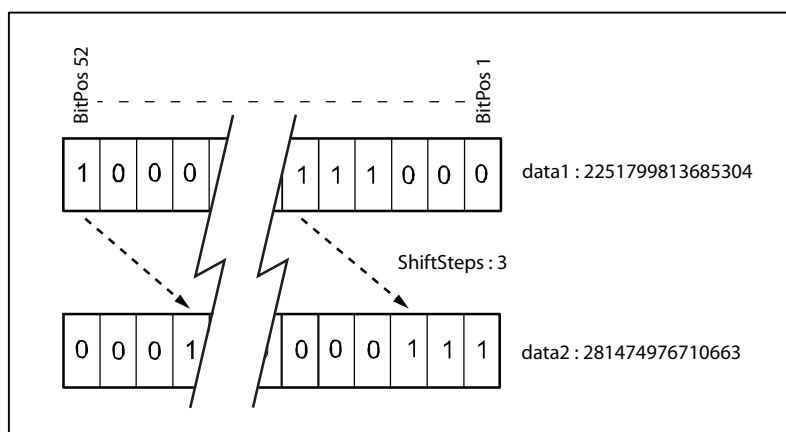
Example 1

```
VAR num right_shift := 3;
VAR dnum data1 := 2251799813685304;
VAR dnum data2;

data2 := BitRShDnum(data1, right_shift);
```

The logical bitwise RIGHT SHIFT-operation will be executed on the data1 with 3 (right_shift) steps of right shift, and the result will be returned to data2 (integer representation)

The following figure shows logical bitwise RIGHT SHIFT-operation.



Return value

Data type: dnum

The result of the logical bitwise RIGHT SHIFT-operation in integer representation. The left bit cells will be filled up with 0-bits.

Arguments

BitRShDnum (Value ShiftSteps)

Value

Data type: dnum

The bit data, in integer representation, to be shifted.

ShiftSteps

Data type: num

Continues on next page

Number of the logical shifts (0 - 52) to be executed.

Use of 0 will return the value in the Value argument.

Limitations

The range for a data type dnum is 0 - 4503599627370495.

The ShiftSteps argument is valid from 1 - 52 since one dnum is 52 bits.

Syntax

```
BitRShDnum '('  
  [Value ':=' ] <expression (IN) of dnum> ','  
  [ShiftSteps ':=' ] <expression (IN) of num>  
  ')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
Logical bitwise RIGHT SHIFT-operation on byte data	BitRSh - Logical bitwise RIGHT SHIFT - operation on byte on page 1156
Data type dnum	dnum - Double numeric values on page 1630
Logical bitwise LEFT SHIFT-operation on dnum data	BitLShDnum - Logical bitwise LEFT SHIFT - operation on dnum on page 1146
Other bit functions	Technical reference manual - RAPID Overview

2 Functions

2.27 BitXOr - Logical bitwise XOR - operation on byte data

RobotWare Base

2.27 BitXOr - Logical bitwise XOR - operation on byte data

Usage

BitXOr (*Bit eXclusive Or*) is used to execute a logical bitwise XOR-operation on data types byte.

Basic examples

The following example illustrates the function BitXOr.

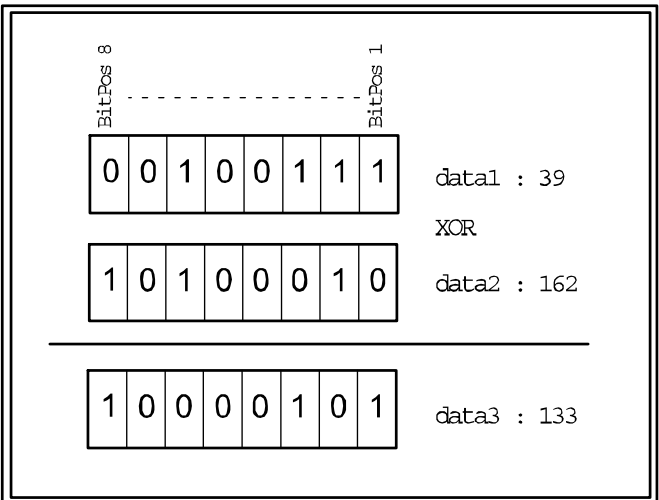
Example 1

```
VAR byte data1 := 39;
VAR byte data2 := 162;
VAR byte data3;

data3 := BitXOr(data1, data2);
```

The logical bitwise XOR -operation will be executed on the data1 and data2, and the result will be returned to data3 (integer representation).

The following figure shows logical bitwise XOR-operation.



xx0500002459

Return value

Data type: byte

The result of the logical bitwise XOR-operation in integer representation.

Arguments

BitXOr (BitData1 BitData2)

BitData1

Data type: byte

The bit data 1, in integer representation.

BitData2

Data type: byte

Continues on next page

The bit data 2, in integer representation.

Limitations

The range for a data type byte is 0 - 255.

Syntax

```
BitXOr '('  
  [BitData1 ':=' ] <expression (IN) of byte> ','  
  [BitData2 ':=' ] <expression (IN) of byte>  
  ')'
```

A function with a return value of the data type byte.

Related information

For information about	See
Logical bitwise AND - operation on byte data	BitAnd - Logical bitwise AND - operation on byte data on page 1136
Logical bitwise OR - operation on byte data	BitOr - Logical bitwise OR - operation on byte data on page 1152
Logical bitwise NEGATION - operation on byte data	BitNeg - Logical bitwise NEGATION - operation on byte data on page 1148
Other bit functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.28 BitXOrDnum - Logical bitwise XOR - operation on dnum data

RobotWare Base

2.28 BitXOrDnum - Logical bitwise XOR - operation on dnum data

Usage

BitXOrDnum (*Bit eXclusive Or dnum*) is used to execute a logical bitwise XOR-operation on data types dnum.

Basic examples

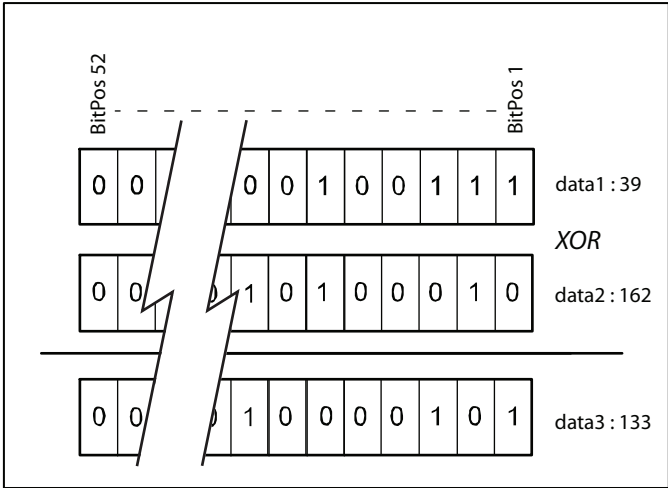
The following example illustrates the function BitXOrDnum.

Example 1

```
VAR dnum data1 := 39;  
VAR dnum data2 := 162;  
VAR dnum data3;  
  
data3 := BitXOrDnum(data1, data2);
```

The logical bitwise XOR -operation will be executed on the data1 and data2, and the result will be returned to data3 (integer representation).

The following figure shows logical bitwise XOR-operation.



Return value

Data type: dnum

The result of the logical bitwise XOR-operation in integer representation.

Arguments

BitXOrDnum (Value1 Value2)

Value1

Data type: dnum

The first bit data value, in integer representation.

Value2

Data type: dnum

Continues on next page

The second bit data value, in integer representation.

Limitations

The range for a data type dnum is 0 - 4503599627370495.

Syntax

```
BitXOrDnum '('
  [Value1 ':='] <expression (IN) of dnum> ', '
  [Value2 ':='] <expression (IN) of dnum>
  ')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
Logical bitwise XOR - operation on byte data	BitXOr - Logical bitwise XOR - operation on byte data on page 1160
Data type dnum	dnum - Double numeric values on page 1630
Logical bitwise AND - operation on dnum data	BitAndDnum - Logical bitwise AND - operation on dnum data on page 1138
Logical bitwise OR - operation on dnum data	BitOrDnum - Logical bitwise OR - operation on dnum data on page 1154
Logical bitwise NEGATION - operation on dnum data	BitNegDnum - Logical bitwise NEGATION - operation on dnum data on page 1150
Other bit functions	Technical reference manual - RAPID Overview

2 Functions

2.29 ByteToStr - Converts a byte to a string data

RobotWare Base

2.29 ByteToStr - Converts a byte to a string data

Usage

ByteToStr (*Byte To String*) is used to convert a byte into a string data with a defined byte data format.

Basic examples

The following example illustrates the function ByteToStr.

Example 1

```
VAR string con_data_buffer{5};  
VAR byte data1 := 122;
```

```
con_data_buffer{1} := ByteToStr(data1);
```

The content of the array component con_data_buffer{1} will be "122" after the ByteToStr ... function.

```
con_data_buffer{2} := ByteToStr(data1\Hex);
```

The content of the array component con_data_buffer{2} will be "7A" after the ByteToStr ... function.

```
con_data_buffer{3} := ByteToStr(data1\Okt);
```

The content of the array component con_data_buffer{3} will be "172" after the ByteToStr ... function.

```
con_data_buffer{4} := ByteToStr(data1\Bin);
```

The content of the array component con_data_buffer{4} will be "01111010" after the ByteToStr ... function.

```
con_data_buffer{5} := ByteToStr(data1\Char);
```

The content of the array component con_data_buffer{5} will be "z" after the ByteToStr ... function.

Return value

Data type: string

The result of the conversion operation with the following format:

Format	Characters	String length	Range
Dec	'0' - '9'	1-3	"0" - "255"
Hex	'0' - '9', 'A' - 'F'	2	"00" - "FF"
Okt	'0' - '7'	3	"000" - "377"
Bin	'0' - '1'	8	"00000000" - "11111111"
Char	Any ASCII char (*)	1	One ASCII char

(*) If it is a non-writable ASCII character then the return format will be RAPID character code format (for example, "\07" for BEL control character).

Arguments

ByteToStr (BitData [\Hex] | [\Okt] | [\Bin] | [\Char])

Continues on next page

BitData

Data type: byte

The bit data to be converted.

If the optional switch argument is omitted then the data will be converted in decimal (Dec) format.

[\Hex]

Hexadecimal

Data type: switch

The data will be converted in hexadecimal format.

[\Okt]

Octal

Data type: switch

The data will be converted in octal format.

[\Bin]

Binary

Data type: switch

The data will be converted in binary format.

[\Char]

Character

Data type: switch

The data will be converted in ASCII character format.

Limitations

The range for a data type byte is 0 to 255 decimal.

Syntax

```
ByteToStr '('
  [BitData ':='] <expression (IN) of byte>
  ['\' Hex ' | ['\' Okt'] | ['\' Bin'] | ['\' Char']
  ')'
```

A function with a return value of the data type string.

Related information

For information about	See
Convert a string to a byte data	StrToByte - Converts a string to a byte data on page 1487
Other bit (byte) functions	<i>Technical reference manual - RAPID Overview</i>
Other string functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.30 BytesToVal - Converts a byte array to a value

RobotWare Base

2.30 BytesToVal - Converts a byte array to a value

Usage

BytesToVal (*Bytes To Value*) is used to convert a byte array to any value data type. The byte array consists of the ASCII value representation of the characters.

Basic examples

The following example illustrates the function BytesToVal.

See also [More examples on page 1167](#).

Example 1

```
VAR byte bytearray{5}:=[34,65,50,66,34];
VAR string mystring;
..
IF BytesToVal(bytearray,mystring) = TRUE THEN
    TPWrite mystring;
ELSE
    TPWrite "BytesToVal failed";
ENDIF
```

In the example above, the bytearray consist of the ASCII value representation of the RAPID string A2B.

The function BytesToVal converts the byte array to a RAPID string.

Return value

Data type: bool

The function returns TRUE if BytesToVal was able to convert the data in the byte array to the specified value data type, if not, FALSE is returned.

Arguments

BytesToVal (ByteArray [\StartIndex] [\ToIndex] Value)

ByteArray

Data type: array of byte

The byte array that consists of ASCII value representation of any data type.

[\StartIndex]

Data type: num

The index in the byte array where to read the first byte.

[\ToIndex]

Data type: num

The index in the byte array where to read the last byte.

Value

Data type: anytype

A value of any data type.

Continues on next page

Program execution

BytesToStr converts the byte array that consists of ASCII values to any data type.

More examples

More examples of the function BytesToVal are illustrated below.

Example 1

```
VAR robtarget robtarr{10};
VAR byte bytearray{5000};
!..
SocketReceive socket1 \Data := bytearray;
IF BytesToVal(bytearray, robtarr) = FALSE THEN
    TPWrite "Incorrect data received!";
    Stop;
ELSE
    ! Here we can use the array with robtargets received from the remote
      computer
    MoveJ robtarr{1}, v500, z30, tool2;
    MoveJ robtarr{2}, v500, z30, tool2;
    ..
```

In the example above data is received in an byte array from a remote computer. The data is then converted to correct data type, which in this case is a robtarget array with dimension 10. Then the robtargets are used in movement instructions.

Example 2

```
VAR num myinteger1;
VAR num myinteger2;
VAR robtarget myrobt;
VAR byte bytearray{5000};
..
IF BytesToVal(bytearray \StartIndex:=1 \ToIndex:=1, myinteger1) =
  TRUE THEN
    IF BytesToVal(bytearray \StartIndex:=2 \ToIndex:=2, myinteger2) =
      TRUE THEN
        IF BytesToVal(bytearray \StartIndex:=3, myrobt) = TRUE THEN
            ! Here we can use myinteger1, myinteger2 and myrobt
        ELSE
            TPWrite "Not a robtarget value";
        ENDIF
    ELSE
        TPWrite "Not a num value";
    ENDIF
ELSE
    TPWrite "Not a num value";
ENDIF
```

In the example above the function BytesToVal reads out the first two bytes from the bytearray and place the values in myinteger1 and myinteger2. Then a robtarget is read from the byte array and placed in the variable myrobt.

Continues on next page

2 Functions

2.30 BytesToVal - Converts a byte array to a value

RobotWare Base

Continued

Syntax

```
BytesToVal '('  
  [ ByteArr ':= ' ] < <array {*} (IN) of byte> >  
  [ '\ ' StartIndex ':= ' < expression (IN) of num > ]  
  [ '\ ' ToIndex ':= ' < expression (IN) of num > ]  
  [ Value ':= ' ] < variable or persistent (INOUT) of anytype >  
' )'
```

A function with a return value of the data type bool.

Related information

For information about	See
byte	byte - Integer values 0-255 on page 1597
ValToBytes	ValToBytes - Converts a value to a byte array on page 1582
Bit functions	<i>Technical reference manual - RAPID Overview</i>
<i>MathLibMemSize</i>	Topic Controller, type General Rapid, in <i>Technical reference manual - System parameters</i>

2.31 CalcJointT - Calculates joint angles from robtarget

Usage

CalcJointT (*Calculate Joint Target*) is used to calculate joint angles of the robot axes and external axes from a specified robtarget data.

The input robtarget data should be specified in the same coordinate system as specified in argument for Tool, WObj, and at execution time active program displacement (ProgDisp) and external axes offset (EOffs). The returned jointtarget data is expressed in the calibration coordinate system.

If MultiMove application type semicoordinated or synchronized coordinated mode with the coordinated workobject, and is moved by some mechanical unit located in another program task, then the function CalcJointT can be used if:

- It is appropriate that the current position of the coordinated work object moved by the mechanical unit is used in the calculation (current user frame). All other data will be fetched from the RAPID program.
- The mechanical unit located in another program task is standing still.
- The argument \UseCurWObjPos is used.

Basic examples

The following examples illustrate the function CalcJointT.

Example 1

```
VAR jointtarget jointpos1;
CONST robtarget p1 := [...];
jointpos1 := CalcJointT(p1, tool1 \WObj:=wobj1);
```

The jointtarget value corresponding to the robtarget value p1 is stored in jointpos1. The tool tool1 and work object wobj1 are used for calculating the joint angles jointpos1.

Example 2

```
VAR jointtarget jointpos2;
CONST robtarget p2 := [...];
jointpos2 := CalcJointT(\UseCurWObjPos, p2, tool2 \WObj:=orb1);
```

The jointtarget value corresponding to the robtarget value p2 is stored in jointpos2. The tool tool2 and work object orb1 are used for calculating the joint angles jointpos2. The current position of the standing still manipulator orb1 is not located in the same program task as the TCP robot but is used for the calculation.

Example 3

```
VAR jointtarget jointpos3;
CONST robtarget p3 := [...];
VAR errnum myerrnum;
jointpos3 := CalcJointT(p3, tool2 \WObj:=orb1
    \ErrorNumber:=myerrnum);
IF myerrnum = ERR_ROBLIMIT THEN
    TPWrite "Joint jointpos3 can not be reached.";
    TPWrite "jointpos3.robax.rax_1: "+ValToStr(jointpos3.robax.rax_1);
```

Continues on next page

2 Functions

2.31 CalcJointT - Calculates joint angles from robtarget

RobotWare Base

Continued

```
..
..
TPWrite "jointpos3.extax.eax_f"+ValToStr(jointpos3.extax.eax_f);
ELSEIF myerrnum = ERR_OUTSIDE_REACH THEN
TPWrite "Joint jointpos3 is outside reach.";
TPWrite "jointpos3.robax.rax_1: "+ValToStr(jointpos3.robax.rax_1);
..
..
TPWrite "jointpos3.extax.eax_f"+ValToStr(jointpos3.extax.eax_f);
ELSE
MoveAbsJ jointpos3, v100, fine, tool2 \WObj:=orb1;
ENDIF
```

The jointtarget value corresponding to the robtarget value p3 is stored in jointpos3. If the position can be reached, it is used, otherwise the jointtarget value is written on the FlexPendant.

Return value

Data type: jointtarget

The angles in degrees for the axes of the robot on the arm side.

The values for the external axes, in mm for linear axes, in degrees for rotational axes.

The returned values are always related to the calibration position.

Arguments

```
CalcJointT ( [\UseCurWObjPos] Rob_target Tool [\WObj]
             [\ErrorNumber])
```

[\UseCurWObjPos]

Data type: switch

Use current position of the coordinated work object moved by the mechanical unit in another task for the calculation (current user frame). All other data is fetched from the RAPID program.

Rob_target

Data type: robtarget

The position of the robot and external axes in the outermost coordinate system, related to the specified tool and work object and at execution time active program displacement (ProgDisp) and/or external axes offset (EOffs).

Tool

Data type: tooldata

The tool used for calculation of the robot joint angles.

[\WObj]

Work Object

Data type: wobjdata

The work object (coordinate system) to which the robot position is related.

Continues on next page

2.31 CalcJointT - Calculates joint angles from robtarget

*RobotWare Base**Continued*

If this argument is omitted then the work object `wobj0` is used. This argument must be specified when using stationary tool, coordinated external axes, or conveyor.

[\ErrorNumber]

*Error number*Data type: `errnum`

A variable (VAR or PERS) that will hold the error constant `ERR_ROBLIMIT` if at least one axis is outside the joint limits or if the limits are exceeded for at least one coupled joint, or `ERR_OUTSIDE_REACH` if the position (robtarget) is outside the robot's working area. If this optional argument is used and the variable is set to `ERR_ROBLIMIT` or `ERR_OUTSIDE_REACH` after the execution of the function, the return value will be a `jointtarget` value corresponding to the used robtarget. If this optional variable is omitted then the error handler will be executed and the `jointtarget` returned will not be updated if an axis is outside the working area or the limits are exceeded.

Program execution

The returned `jointtarget` is calculated from the input robtarget. If the argument `\UseCurWobjPos` is used, then the position that is used comes from the current position of the mechanical unit that controls the user frame. To calculate the robot joint angles, the specified `Tool`, `Wobj` (including coordinated user frame), and the `ProgDisp` active at execution time are taken into consideration. To calculate the external axes position at the execution time, active `EOffs` is taken into consideration.

The calculation always selects the robot configuration according to the specified configuration data in the input robtarget data. Instructions `ConfL` and `ConfJ` do not affect this calculation principle. When wrist singularity is used, robot axis 4 will be set to 0 degrees.

If there is any active program displacement (`ProgDisp`) and/or external axis offset (`EOffs`) at the time the robtarget is stored then the same program displacement and/or external axis offset must be active when `CalcJointT` is executed.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_ROBLIMIT</code>	The position is reachable, but at least one axis is outside the joint limits or the limits are exceeded for at least one coupled joint.
<code>ERR_OUTSIDE_REACH</code>	The position (robtarget) is outside the robot's working range.
<code>ERR_WOBJ_MOVING</code>	The mechanical unit that controls the work object (user frame) isn't standing still at execution time of <code>CalcJointT</code> <code>\UseCurWobjPos</code> .

Continues on next page

2 Functions

2.31 CalcJointT - Calculates joint angles from robtarget

RobotWare Base

Continued

Limitation

If a coordinate frame is used then the coordinated unit has to be activated before using CalcJointT.

The mechanical unit that controls the user frame in the work object must normally be available in the same program task as the TCP robot which executes CalcJointT.

Normally CalcJointT uses robtarget, tooldata, and wobjdata from the RAPID program to calculate jointtarget. For coordinated workobjects, the position of the mechanical unit is given as external axes position in the robtarget. That is not the case if the mechanical unit is controlled by another program task (MultiMove system) or the mechanical unit is not controlled by the control system (Conveyor). For the MultiMove System but not for the conveyor it is possible to use the argument \UseCurWObjPos if the mechanical unit is standing still at the execution time of CalcJointT.

Syntax

```
CalcJointT '('  
  [ '\UseCurWObjPos ',']  
  [ Rob_target ':=' ] <expression (IN) of robtarget> ', '  
  [ Tool ':=' ] <persistent (PERS) of tooldata>  
  [ '\ WObj ':=' <persistent (PERS) of wobjdata>  
  [ '\ ErrorNumber ':=' <variable or persistent (INOUT) of errnum>  
  ')'
```

A function with a return value of the data type jointtarget.

Related information

For information about	See
Calculate robtarget from jointtarget	CalcRobT - Calculates robtarget from jointtarget on page 1173
Definition of position	robtarget - Position data on page 1715
Definition of joint position	jointtarget - Joint position data on page 1661
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Program displacement coordinate system	PDispOn - Activates program displacement on page 543
External axis offset coordinate system	EOffsOn - Activates an offset for additional axes on page 186

2.32 CalcRobT - Calculates robtarget from jointtarget

Usage

CalcRobT (*Calculate Robot Target*) is used to calculate a robtarget data from a given jointtarget data.

This function returns a robtarget value with position (x, y, z), orientation (q1 ... q4), robot axes configuration, and external axes position.

The input jointtarget data should be specified in the calibration coordinate system.

The returned robtarget data is expressed in the outermost coordinate system. It takes the specified tool, work object, and at execution time active program displacement (ProgDisp) and external axis offset (EOffs) into consideration.

Basic examples

The following example illustrates the function CalcRobT.

Example 1

```

VAR robtarget p1;
CONST jointtarget jointpos1 := [...];

p1 := CalcRobT(jointpos1, tool1 \WObj:=wobj1);

```

The robtarget value corresponding to the jointtarget value jointpos1 is stored in p1. The tool tool1 and work object wobj1 are used for calculating the position of p1.

Return value

Data type: robtarget

The robot and external axes position is returned in data type robtarget and expressed in the outermost coordinate system. It takes the specified tool, work object, and at execution time active program displacement (ProgDisp) and external axes offset (EOffs) into consideration.

If there is no active ProgDisp then the robot position is expressed in the object coordinate system. If there are no active EOffs then the external axis position is expressed in the calibration coordinate system.

Arguments

CalcRobT(Joint_target Tool [\WObj])

Joint_target

Data type: jointtarget

The joint position for the robot axes and external axes related to the calibration coordinate system.

Tool

Data type: tooldata

The tool used for calculation of the robot position.

Continues on next page

2 Functions

2.32 CalcRobT - Calculates robtarget from jointtarget

RobotWare Base

Continued

[\Wobj]

Work Object

Data type: wobjdata

The work object (coordinate system) to which the robot position returned by the function is related.

If this argument is omitted the work object wobj0 is used. This argument must be specified when using stationary tool, coordinated external axes, or conveyor.

Program execution

The returned robtarget is calculated from the input jointtarget. To calculate the cartesian robot position the specified Tool, Wobj (including coordinated user frame), and at the execution time active ProgDisp, are taken into consideration.

To calculate the external axes position, the EOffs active at execution time is also taken into consideration.

Limitation

If a coordinate frame is used then the coordinated unit has to be activated before using CalcRobT. The coordinated unit also has to be situated in the same task as the robot.

Syntax

```
CalcRobT '('  
  [Joint_target ':=' ] <expression (IN) of jointtarget> ','  
  [Tool ':=' ] <persistent (PERS) of tooldata>  
  [ '\ ' Wobj ':=' <persistent (PERS) of wobjdata> ] ')'
```

A function with a return value of the data type robtarget.

Related information

For information about	See
Calculate jointtarget from robtarget	CalcJointT - Calculates joint angles from robtarget on page 1169
Definition of position	robtarget - Position data on page 1715
Definition of joint position	jointtarget - Joint position data on page 1661
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Program displacement coordinate system	PDispOn - Activates program displacement on page 543
External axes offset coordinate system	EOffsOn - Activates an offset for additional axes on page 186

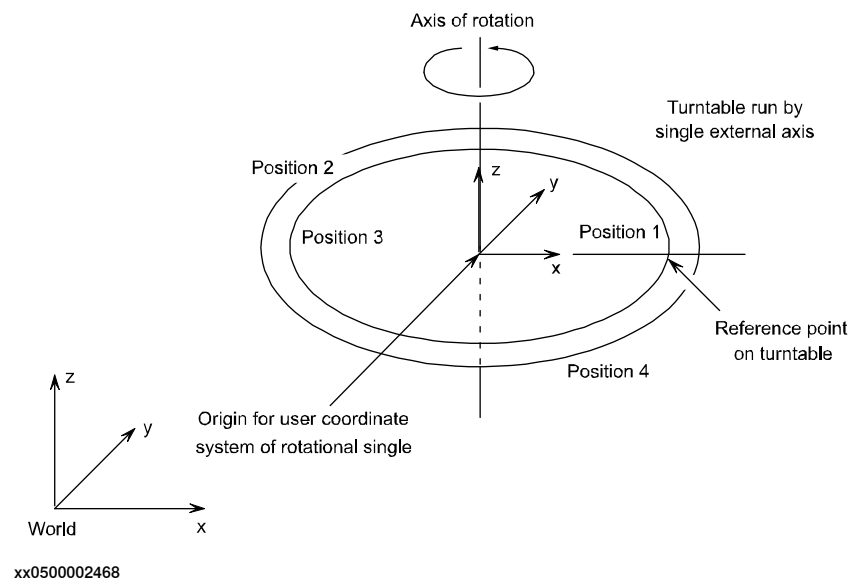
2.33 CalcRotAxFrameZ - Calculate a rotational axis frame

Usage

CalcRotAxFrameZ (*Calculate Rotational Axis Frame with positive Z-point*) is used to calculate the user coordinate system of a mechanical unit that is of the type rotational axis. This function is to be used when the master robot and the additional axis are located in different RAPID tasks. If they are in the same task then the function CalcRotAxisFrame should be used.

Description

The definition of a user frame for a rotational external axis requires that the turntable (or similar mechanical structure) on the external axis has a marked reference point. Moreover, the TCP robot's base frame and TCP must be calibrated. The calibration procedure consists of a number of positions for the robot's TCP on the reference point when the turntable is rotated to different angles. A positioning of the robot TCP in the positive z direction is also needed. For definition of points for a rotational axis, see the figure below.



The user coordinate system for the rotational axis has its origin in the center of the turntable. The z direction coincides with the axis of rotation and the x axis goes through the reference point.

The figure below shows the user coordinate system for two different positions of the turntable (turntable seen from above).

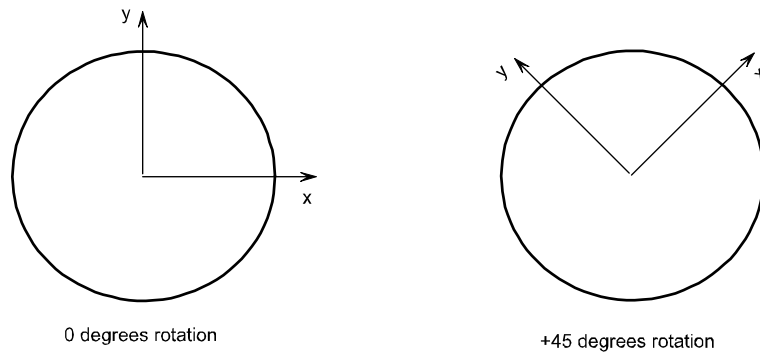
Continues on next page

2 Functions

2.33 CalcRotAxFrameZ - Calculate a rotational axis frame

RobotWare Base

Continued



xx0500002469

Basic examples

The following example illustrates the function CalcRotAxFrameZ.

Example 1

```
CONST robtarget pos1 := [...];
CONST robtarget pos2 := [...];
CONST robtarget pos3 := [...];
CONST robtarget pos4 := [...];
CONST robtarget zpos;
VAR robtarget targetlist{10};
VAR num max_err := 0;
VAR num mean_err := 0;
VAR pose resFr:= [...];
PERS tooldata tMyTool:= [...];

! Instructions for creating/ModPos pos1 - pos4 with TCP pointing
! at the turntable.
MoveJ pos1, v10, fine, tMyTool;
MoveJ pos2, v10, fine, tMyTool;
MoveJ pos3, v10, fine, tMyTool;
MoveJ pos4, v10, fine, tMyTool;

! Instruction for creating/ModPos zpos with TCP pointing at a point
! in positive z direction
MoveJ zpos, v10, fine, tMyTool;

! Add the targets to the array
targetlist{1}:= pos1;
targetlist{2}:= pos2;
targetlist{3}:= pos3;
targetlist{4}:= pos4;

resFr:=CalcRotAxFrameZ(targetlist, 4, zpos, max_err, mean_err);

! Update the system parameters.
IF (max_err < 1.0) AND (mean_err < 0.5) THEN
  WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_pos_x",
    resFr.trans.x/1000;
```

Continues on next page

2.33 CalcRotAxFrameZ - Calculate a rotational axis frame

RobotWare Base

Continued

```

WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_pos_y",
    resFr.trans.y/1000;
WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_pos_z",
    resFr.trans.z/1000;
WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_orient_u0",
    resFr.rot.q1;
WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_orient_u1",
    resFr.rot.q2;
WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_orient_u2",
    resFr.rot.q3;
WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_orient_u3",
    resFr.rot.q4;
TPReadFK reg1,"Warmstart required for calibration to take
    effect.", stEmpty, stEmpty, stEmpty, stEmpty,"OK";
WarmStart;
ENDIF

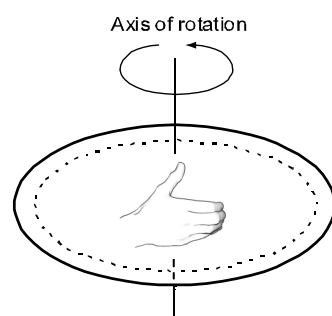
```

Four positions, pos1 - pos4, are created/modposed so that the robot's tool tMyTool points to the same reference point on the external axis STN_1 but with different external axis rotations. Position, zpos, is created/modposed so that the robot's tool tMyTool points in the positive z direction according to the definition of the positive z-direction of an external rotational mechanical unit. Using the definition of the positive z-direction of an external rotational mechanical unit, see [Description on page 1175](#). The points are then used for calculating the external axis base frame, resFr, in relation to the world coordinate system. Finally, the frame is written to the configuration file and a WarmStart instruction is executed to let the change take effect.

**Note**

Definition of the positive z-direction of an external rotational mechanical unit:

Let the right hand's fingers coincide with the positive rotation axis of the rotational axis. The direction of the thumb then defines the positive z-direction. See the following figure.



xx0500002472

Return value

Data type: pose

The calculated frame.

Continues on next page

2 Functions

2.33 CalcRotAxFrameZ - Calculate a rotational axis frame

RobotWare Base

Continued

Arguments

CalcRotAxFrameZ (TargetList TargetsInList PositiveZPoint
MaxErrMeanErr)

TargetList

Data type: robtarget

Array of robtargets holding the positions defined by pointing out the turntable.

Minimum number of robtargets is 4, maximum 10.

TargetsInList

Data type: num

Number of robtargets in an array.

PositiveZPoint

Data type: robtarget

robtarget holding the position defined by pointing out a point in the positive z direction. Using the definition of the positive z-direction of an external rotational mechanical unit, see [Description on page 1175](#).

MaxErr

Maximum Error

Data type: num

The estimated maximum error in mm.

MeanErr

Mean Error

Data type: num

The estimated mean error in mm.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FRAME	The positions don't have the required relation or are not specified with enough accuracy.

Syntax

```
CalcRotAxFrameZ '('  
  [TargetList ':=' ] <array {*} (IN) of robtarget> ','  
  [TargetsInList ':=' ] <expression (IN) of num> ','  
  [PositiveZPoint ':=' ] <expression (IN) of robtarget> ','  
  [MaxErr ':=' ] <variable (VAR) of num> ','  
  [MeanErr ':=' ] <variable (VAR) of num> ')'
```

A function with a return value of the data type pose.

Continues on next page

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.34 CalcRotAxisFrame - Calculate a rotational axis frame

RobotWare Base

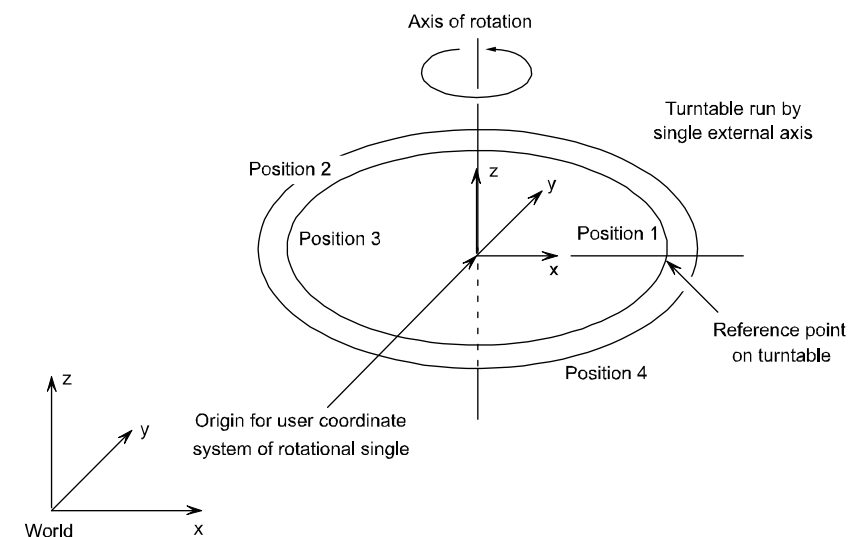
2.34 CalcRotAxisFrame - Calculate a rotational axis frame

Usage

CalcRotAxisFrame (*Calculate Rotational Axis Frame*) is used to calculate the user coordinate system of a mechanical unit that is of type rotational axis. This function is to be used when the master robot and the additional axis are located in the same RAPID task. If they are in different tasks the function CalcRotAxFrameZ should be used.

Description

The definition of a user frame for a rotational external axis requires that the turntable (or similar mechanical structure) on the external axis has a marked reference point. Moreover, the master robot's base frame and TCP must be calibrated. The calibration procedure consists of a number of positions for the robot's TCP on the reference point when the turntable is rotated to different angles. Definition of points for a rotational axis is illustrated in the figure below.

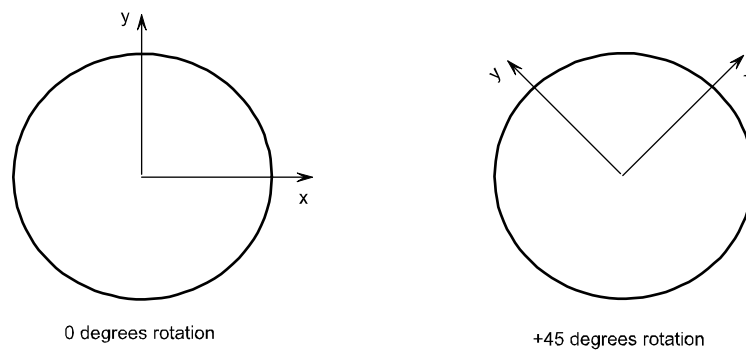


xx0500002468

The user coordinate system for the rotational axis has its origin in the center of the turntable. The z direction coincides with the axis of rotation and the x axis goes through the reference point.

The figure below shows the user coordinate system for two different positions of the turntable (turntable seen from above).

Continues on next page



xx0500002469

Basic examples

The following example illustrates the function CalcRotAxisFrame.

Example 1

```

CONST robtarget pos1 := [...];
CONST robtarget pos2 := [...];
CONST robtarget pos3 := [...];
CONST robtarget pos4 := [...];
VAR robtarget targetlist{10};
VAR num max_err := 0;
VAR num mean_err := 0;
VAR pose resFr:= [...];
PERS tooldata tMyTool:= [...];

! Instructions needed for creating/ModPos pos1 - pos4 with TCP
  pointing at the turntable.
MoveJ pos1, v10, fine, tMyTool;
MoveJ pos2, v10, fine, tMyTool;
MoveJ pos3, v10, fine, tMyTool;
MoveJ pos4, v10, fine, tMyTool;

! Add the targets to the array
targetlist{1}:= pos1;
targetlist{2}:= pos2;
targetlist{3}:= pos3;
targetlist{4}:= pos4;

resFr:=CalcRotAxisFrame(STN_1 , targetlist, 4, max_err, mean_err);

! Update the system parameters.
IF (max_err < 1.0) AND (mean_err < 0.5) THEN
  WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_pos_x",
    resFr.trans.x/1000;
  WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_pos_y",
    resFr.trans.y/1000;
  WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_pos_z",
    resFr.trans.z/1000;
  WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_orient_u0",
    resFr.rot.q1;

```

Continues on next page

2 Functions

2.34 CalcRotAxisFrame - Calculate a rotational axis frame

RobotWare Base

Continued

```
WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_orient_u1",
resFr.rot.q2;
WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_orient_u2",
resFr.rot.q3;
WriteCfgData "/MOC/SINGLE/STN_1", "base_frame_orient_u3",
resFr.rot.q4;
TPReadFK reg1,"Warmstart required for calibration to take
effect.", stEmpty, stEmpty, stEmpty, stEmpty, "OK";
WarmStart;
ENDIF
```

Four positions, pos1 - pos4, are created/modposed so that the robot's tool tMyTool points to the same reference point on the external axis STN_1 but with different external axis rotations. The points are then used for calculating the external axis base frame, resFr, in relation to the world coordinate system. Finally, the frame is written to the configuration file and a WarmStart instruction is executed to let the change take effect.

Return value

Data type: pose

The calculated frame.

Arguments

```
CalcRotAxisFrame (MechUnit [\AxisNo] TargetList TargetsInList MaxErr
MeanErr)
```

MechUnit

Mechanical Unit

Data type: mecunit

Name of the mechanical unit to be calibrated.

[\AxisNo]

Data type: num

Optional argument defining the axis number for which a frame should be determined. Default value is 1 applying to single rotational axis. For mechanical units with several axes, the axis number should be supplied with this argument.

TargetList

Data type: robtarget

Array of robtargets holding the positions defined by pointing out the turntable. Minimum number of robtargets is 4, maximum is 10.

TargetsInList

Data type: num

Number of robtargets in an array.

MaxErr

Maximum Error

Data type: num

The estimated maximum error in mm.

Continues on next page

MeanErr

Mean Error

Data type: num

The estimated mean error in mm.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FRAME	The positions don't have the required relation or are not specified with enough accuracy.

Syntax

```
CalcRotAxisFrame '('
  [MechUnit ':='] <variable (VAR) of mecunit>
  [\AxisNo ':=' <expression (IN) of num> ] ', '
  [TargetList ':='] <array {*} (IN) of robtarget> ', '
  [TargetsInList ':='] <expression (IN) of num> ', '
  [MaxErr ':='] <variable (VAR) of num> ', '
  [MeanErr ':='] <variable (VAR) of num> ')'
```

A function with a return value of the data type pose.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.35 CamGetExposure - Get camera specific data

Integrated Vision

2.35 CamGetExposure - Get camera specific data

Usage

CamGetExposure (Camera Get Exposure) is a function that reads the current settings for a camera. With this function and with the instruction CamSetExposure it is possible to adapt the camera images depending on environment in runtime.

Basic examples

The following example illustrates the function CamGetExposure.

Example 1

```
VAR num exposuretime;  
...  
exposuretime:=CamGetExposure(mycamera \ExposureTime);  
IF exposuretime = 10 THEN  
    CamSetExposure mycamera \ExposureTime:=9.5;  
ENDIF
```

Order camera mycamera to change the exposure time to 9.5 ms if the current setting is 10 ms.

Return value

Data type: num

One of the settings exposure time, brightness, or contrast returned from the camera as a numerical value.

Arguments

```
CamGetExposure (Camera [\ExposureTime] | [\Brightness] |  
                [\Contrast])
```

Camera

Data type: cameradev

The name of the camera.

[\ExposureTime]

Data type: num

Returns the cameras exposure time. The value is in milliseconds (ms).

[\Brightness]

Data type: num

Returns the brightness setting of the camera

[\Contrast]

Data type: num

Returns the contrast setting of the camera

Continues on next page

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CAM_BUSY	The camera is busy with some other request and cannot perform the current order.
ERR_CAM_COM_TIMEOUT	Communication error with camera. The camera is probably disconnected.
ERR_CAM_NOT_ON_NETWORK	The camera is not connected.

Syntax

```
CamGetExposure '('  
  [ Camera ':= ' ] < variable (VAR) of cameradev >  
  ['\ 'ExposureTime]  
  | ['\ 'Brightness]  
  | ['\ 'Contrast ' )'
```

A function with a return value of the data type num.

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

2 Functions

2.36 CamGetLoadedJob - Get name of the loaded camera task

Integrated Vision

2.36 CamGetLoadedJob - Get name of the loaded camera task

Usage

CamGetLoadedJob (*Camera Get Loaded Job*) is a function that reads the name of the current loaded job from the camera and returns it in a string.

Basic examples

The following example illustrates the function CamGetLoadedJob.

Example 1

```
VAR string currentjob;  
...  
currentjob:=CamGetLoadedJob(mycamera);  
IF CurrentJob = "" THEN  
    TPWrite "No job loaded in camera "+CamGetName(mycamera);  
ELSE  
    TPWrite "Job "+CurrentJob+" is loaded in camera "  
        "+CamGetName(mycamera);  
ENDIF
```

Write the loaded job name on the FlexPendant.

Return value

Data type: string

The current loaded job name for the specified camera.

Arguments

CamGetLoadedJob (Camera)

Camera

Data type: cameradev

The name of the camera.

Program execution

The function CamGetLoadedJob gets the current loaded job name from the camera. If no job is loaded into the camera, an empty string is returned.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CAM_BUSY	The camera is busy with some other request and cannot perform the current order.
ERR_CAM_COM_TIMEOUT	Communication error with camera. The camera is probably disconnected.
ERR_CAM_NOT_ON_NETWORK	The camera is not connected.

Syntax

CamGetLoadedJob '(' '

Continues on next page

2.36 CamGetLoadedJob - Get name of the loaded camera task

Integrated Vision

Continued

```
[ Camera ':' = ' ] < variable (VAR) of cameradev > ' )'
```

A function with a return value of the data type string.

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

2 Functions

2.37 CamGetMode - Get current mode of camera

Integrated Vision

2.37 CamGetMode - Get current mode of camera

Usage

CamGetMode returns the current mode of a camera.

Basic examples

The following example illustrates the function CamGetMode.

Example 1

```
VAR camerastatus curr_camerastatus;  
...  
curr_camerastatus:=CamGetMode(mycamera);  
IF curr_camerastatus = CAMERA_DISCON THEN  
    TPWrite "The camera is disconnected. Check cabling for camera  
           "+CamGetName(mycamera);  
ENDIF
```

Get current mode of the camera. If the camera is disconnected, write that on the FlexPendant.

Return value

Data type: camerastatus

The current status of the camera.

Only the predefined symbolic constants of type camerastatus can be used to check the state.

Arguments

CamGetMode(Camera)

Camera

Data type: cameradev

The camera which status is of interest.

Program execution

The function returns one of the following predefined states of camerastatus:

Syntax

```
CamGetMode '('  
    [Camera ':=' ] <variable (VAR) of cameradev>')'
```

A function with a return value of the data type camerastatus.

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>
Data type camerastatus	camerastatus - Camera communication status on page 1599
Data type cameradev	cameradev - camera device on page 1598

2.38 CamGetName - Get the name of the used camera

Usage

CamGetName (Camera Get Name) is used to get the configured name of the camera.

Basic examples

The following example illustrates the function CamGetName.

Example 1

```

...
logcameraname camera1;
CamReqImage camera1;
...
logcameraname camera2;
CamReqImage camera2;
...
PROC logcameraname(VAR cameradev camdev)
  TPWrite "Now using camera: "+CamGetName(camdev);
ENDPROC

```

The procedure logs the name of the currently used camera to the FlexPendant.

Return value

Data type: string

The name of the currently used camera returned as a string.

Arguments

CamGetName(Camera)

Camera

Data type: cameradev

The name of the camera.

Syntax

```

CamGetName( '('
  [ Camera ':= ' ] < variable (VAR) of cameradev > ')' )

```

A function with a return value of the data type string.

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

2 Functions

2.39 CamNumberOfResults - Get number of available results

Integrated Vision

2.39 CamNumberOfResults - Get number of available results

Usage

CamNumberOfResults (Camera Number of Results) is a function that reads the number of available vision results and returns it as a numerical value.

Basic examples

The following example illustrates the function CamNumberOfResults.

Example 1

```
VAR num foundparts;  
...  
CamReqImage mycamera;  
WaitTime 1;  
FoundParts := CamNumberOfResults(mycamera);  
TPWrite "Number of identified parts in the camera image:  
        "\Num:=foundparts;
```

Acquire an image. Wait for the image processing to complete, in this case 1 second.
Read the number of identified parts and write it to the FlexPendant.

Return value

Data type: num

Returns the number of results in the collection for the specified camera.

Arguments

CamNumberOfResults (Camera [\SceneId])

Camera

Data type: cameradev

The name of the camera.

[\SceneId]

Scene Identification

Data type: num

The SceneId is an identifier that specifies from which image to read the number of identified parts.

Program execution

CamNumberOfResults is a function that reads the number of available vision results and returns it as a numerical value. Can be used to loop through all available results.

The function returns the queue level directly when the function is executed. If the function is executed directly after requesting an image, the result is often 0 because the camera has not yet finished processing the image.

Continues on next page

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_CAM_BUSY	The camera is busy with some other request and cannot perform the current order.

Syntax

```
CamNumberOfResults '('  
  [ Camera ':=' ] < variable (VAR) of cameradev >  
  [ '\\SceneId ':=' < expression (IN) of num > ] ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

2 Functions

2.40 CDate - Reads the current date as a string

RobotWare Base

2.40 CDate - Reads the current date as a string

Usage

CDate (*Current Date*) is used to read the current system date.

This function can be used to present the current date to the operator on the FlexPendant display or to paste the current date into a text file that the program writes to.

Basic examples

The following example illustrates the function CDate.

See also [More examples on page 1192](#).

Example 1

```
VAR string date;  
date := CDate();
```

The current date is stored in the variable date.

Return value

Data type: string

The current date in a string.

The standard date format is “year-month-day”, for example, “1998-01-29”.

More examples

More examples of the function CDate are illustrated below.

Example 1

```
VAR string date;  
date := CDate();  
TPWrite "The current date is: "+date;  
Write logfile, date;
```

The current date is written to the FlexPendant display and into a text file.

Syntax

```
CDate '(' ' ' )'
```

A function with a return value of the type string.

Related information

For information about	See
Time instructions	<i>Technical reference manual - RAPID Overview</i>
Setting the system clock	<i>Operating manual - OmniCore</i>

2.41 CJointT - Reads the current joint angles

Usage

CJointT (*Current Joint Target*) is used to read the current angles of the robot axes and external axes.

Basic examples

The following example illustrates the function CJointT.

See also [More examples on page 1194](#).

Example 1

```
VAR jointtarget joints;
joints := CJointT();
```

The current angles of the axes for a robot and external axes are stored in joints.

Return value

Data type: jointtarget

The current angles in degrees for the axes of the robot on the arm side.

The current values for the external axes, in mm for linear axes, in degrees for rotational axes.

The returned values are related to the calibration position.

Arguments

CJointT ([\TaskRef][\TaskName])

[\TaskRef]

Task Reference

Data type: taskid

The program task identity from which the jointtarget should be read.

For all program tasks in the system, predefined variables of the data type taskid will be available. The variable identity will be "taskname"+"Id", for example, for the T_ROB1 task, and the variable identity will be T_ROB1Id.

[\TaskName]

Data type: string

The program task name from which the jointtarget should be read.

If none of the arguments \TaskRef or \TaskName are specified then the current task is used.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_TASKNAME	The program task name in argument \TaskName cannot be found in the system.

Continues on next page

2 Functions

2.41 CJointT - Reads the current joint angles

RobotWare Base

Continued

Name	Cause of error
ERR_NOT_MOVETASK	Argument \TaskRef or \TaskName specify some non-motion task.

No error will be generated if argument \TaskRef or \TaskName specifies the non-motion task that executes this function CJointT (reference to my own non-motion task). The position will then be fetched from the connected motion task.

More examples

More examples of the function CJointT are illustrated below.

Example 1

```
! In task T_ROB1
VAR jointtarget joints;
joints := CJointT(\TaskRef:=T_ROB2Id);
```

The current position of the robot and external axes in task T_ROB2 are stored in joints in task T_ROB1.

Note that the robot in task T_ROB2 may be moving when the position is read. To ensure that the robot stands still, a stop point fine in the preceding movement instruction in task T_ROB2 could be programmed and instruction WaitSyncTask could be used to synchronize the instructions in task T_ROB1.

Example 2

```
! In task T_ROB1
VAR jointtarget joints;
joints := CJointT(\TaskName:="T_ROB2");
```

The same effect as Example 1 above.

Syntax

```
CJointT '('
  ['\ ' TaskRef ':= ' <variable (VAR) of taskid>]
  |['\ ' TaskName ':= ' <expression (IN) of string>] ')'

```

A function with a return value of the data type jointtarget.

Related information

For information about	See
Definition of joint	jointtarget - Joint position data on page 1661
Reading the current motor angle	ReadMotor - Reads the current motor angles on page 1414

2.42 ClkRead - Reads a clock used for timing

Usage

ClkRead is used to read a clock that functions as a stop-watch used for timing.

Basic examples

The following examples illustrate the function ClkRead.

Example 1

```
reg1:=ClkRead(clock1);
```

The clock clock1 is read and the time in seconds is stored in the variable reg1.

Example 2

```
reg1:=ClkRead(clock1 \HighRes);
```

The clock clock1 is read and the time in seconds is stored with high resolution in the variable reg1.

Return value

Data type: num

The time in seconds stored in the clock. Resolution is normally 0.001 seconds. If using HighRes switch it is possible to get a resolution of 0.000001 seconds.

Argument

ClkRead (Clock \HighRes)

Clock

Data type: clock

The name of the clock to read.

[\HighRes]

High Resolution

Data type: switch

Specifies that the time should be read with a higher resolution. If this switch is used it is possible to read the time with resolution 0.000001.

Due to the precision of the data type num, you can only get the micro second resolution as long as the read value is less than 1 second.

Program execution

A clock can be read when it is stopped or running.

Once a clock is read it can be read again, started again, stopped, or reset.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_OVERFLOW	The clock runs for 4,294,967 seconds (49 days 17 hours 2 minutes 47 seconds) then it becomes overflowed.

Continues on next page

2 Functions

2.42 ClkRead - Reads a clock used for timing

RobotWare Base

Continued

If using the HighRes switch, then the error ERR_OVERFLOW can not occur, but the clock will wrap around after approximately 49700 days.

Syntax

```
ClkRead '('  
  [ Clock ':' = ] < variable (VAR) of clock >  
  [ '\\' HighRes ] ')'
```

A function with a return value of the type num.

Related information

For information about	See
Clock instructions	<i>Technical reference manual - RAPID Overview</i>
More examples	ClkStart - Starts a clock used for timing on page 143

2.43 Concat - Concatenates two strings to one

Usage

Concat is used to concatenate two strings into one.

Basic examples

The following examples illustrate the function Concat:

Example 1

```
PERS string mystring;
mystring := Concat ("ABCD", "EFGH");
```

mystring will get the value: "ABCDEFGH"

This is the same as:

```
mystring := "ABCD"+"EFGH";
```

Example 2

```
PERS string mystring;
PERS string restOfTruncatedString;
mystring := Concat
("1234567890ABCDEFGHIJ1234567890ABCDEFGHIJ1234567890ABCDEFGHIJ1234567890"
"KLMNOPQRSTUVWXYZ", \Remaining :=restOfTruncatedString );
```

mystring will get the value:
"1234567890ABCDEFGHIJ1234567890ABCDEFGHIJ1234567890ABCDEFGHIJ1234567890KLMNOPQRST"

restOfTruncatedString will get the value: "UVWXYZ"

Return value

Data type: string

Arguments

Concat Str1 Str2 [\Remaining]

Str1

Data type: string
First string.

Str2

Data type: string
Second string.

[\Remaining]

Data type: string
Remaining string if truncated.

Syntax

```
Concat '('
  [Str1 ':='] <expression (IN) of string>','
  [Str2 ':='] <expression (IN) of string>
  ['\Remaining' :=> <variable or persistent (INOUT) of string>]')'
```

Continues on next page

2 Functions

2.43 Concat - Concatenates two strings to one

RobotWare Base

Continued

A function with a return value of the type string.

2.44 CorrRead - Reads the current total offsets

Usage

CorrRead is used to read the total corrections delivered by all connected correction generators.

CorrRead can be used to:

- find out how much the current path differs from the original path.
- take actions to reduce the difference.

Basic examples

The following example illustrates the function CorrRead.

See also [More examples on page 1199](#).

Example 1

```
VAR pos offset;
...
offset := CorrRead();
```

The current offsets delivered by all connected correction generators are available in the variable offset.

Return value

Data type: pos

The total absolute offsets delivered from all connected correction generators so far.

More examples

For more examples of the function CorrRead, see instruction CorrCon.

Syntax

```
CorrRead '(' ' ')
```

A function with a return value of the data type pos.

Related information

For information about	See
Connects to a correction generator	CorrCon - Connects to a correction generator on page 170
Disconnects from a correction generator	CorrDiscon - Disconnects from a correction generator on page 175
Writes to a correction generator	CorrWrite - Writes to a correction generator on page 176
Removes all correction generators	CorrClear - Removes all correction generators on page 169
Correction descriptor	corrdescr - Correction generator descriptor on page 1625

2 Functions

2.45 Cos - Calculates the cosine value

RobotWare Base

2.45 Cos - Calculates the cosine value

Usage

Cos (*Cosine*) is used to calculate the cosine value from an angle value on data types num.

Basic examples

The following example illustrates the function Cos.

Example 1

```
VAR num angle;  
VAR num value;  
...  
...  
value := Cos(angle);  
value will get the cosine value of angle.
```

Return value

Data type: num

The cosine value, range = [-1, 1] .

Arguments

Cos (Angle)

Angle

Data type: num

The angle value, expressed in degrees.

Syntax

```
Cos '('  
  [Angle ':='] <expression (IN) of num> ')'  
A function with a return value of the data type num.
```

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2.46 CosDnum - Calculates the cosine value

Usage

CosDnum (*Cosine dnum*) is used to calculate the cosine value from an angle value on data types dnum.

Basic examples

The following example illustrates the function CosDnum.

Example 1

```
VAR dnum angle;  
VAR dnum value;  
...  
...  
value := CosDnum(angle);  
value will get the cosine value of angle.
```

Return value

Data type: dnum
The cosine value, range = [-1, 1] .

Arguments

CosDnum (Angle)

Angle

Data type: dnum
The angle value, expressed in degrees.

Syntax

```
CosDnum '('  
  [Angle ':=' ] <expression (IN) of dnum> ')'  
A function with a return value of the data type dnum.
```

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.47 CPos - Reads the current position (pos) data RobotWare Base

2.47 CPos - Reads the current position (pos) data

Usage

CPos (*Current Position*) is used to read the current position of the robot.
This function returns the x, y, and z values of the robot TCP as data of type pos.
If the complete robot position (robtargt) is to be read then use the function CRobT instead.

Basic examples

The following example illustrates the function CPos.
See also [More examples on page 1203](#).

Example 1

```
VAR pos pos1;  
  
MoveL *, v500, fine \Inpos := inpos50, tool1;  
pos1 := CPos(\Tool:=tool1 \WObj:=wobj0);
```

The current position of the robot TCP is stored in variable pos1. The tool tool1 and work object wobj0 are used for calculating the position.

Note that the robot is standing still before the position is read and calculated. This is achieved by using the stop point fine within position accuracy inpos50 in the preceding movement instruction.

Return value

Data type: pos

The current position (pos) of the robot with x, y, and z in the outermost coordinate system, taking the specified tool, work object, and active ProgDisp coordinate system into consideration.

Arguments

CPos([\Tool] [\WObj])

[\Tool]

Data type: tooldata

The tool used for calculation of the current robot position.

If this argument is omitted then the current active tool is used.

[\WObj]

Work Object

Data type: wobjdata

The work object (coordinate system) to which the current robot position returned by the function is related.

If this argument is omitted then the current active work object is used.

Continues on next page

**WARNING**

It is advised to always specify the arguments \Tool and \WObj during programming. The function will then always return the wanted position even if another tool or work object are activated.

Program execution

The coordinates returned represent the TCP position in the ProgDisp coordinate system.

More examples

More examples of the function CPos are illustrated below.

```
VAR pos pos2;
VAR pos pos3;
VAR pos pos4;

pos2 := CPos(\Tool:=grip3 \WObj:=fixture);
...
pos3 := CPos(\Tool:=grip3 \WObj:=fixture);
pos4 := pos3-pos2;
```

The x, y, and z position of the robot is captured at two places within the program using the CPos function. The tool grip3 and work object fixture are used for calculating the position. The x, y, and z distances travelled between these positions are then calculated and stored in variable pos4.

Syntax

```
CPos '('
  ['\ ' Tool ':'<persistent (PERS) of tooldata>]
  ['\ ' WObj ':'<persistent (PERS) of wobjdata>'] ')'
```

A function with a return value of the data type pos.

Related information

For information about	See
Definition of position	pos - Positions (only X, Y and Z) on page 1696
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
ProgDisp coordinate system	PDispOn - Activates program displacement on page 543
Coordinate systems	Technical reference manual - RAPID Overview
Reading the current robtarget	CRobT - Reads the current position (robtarget) data on page 1204

2 Functions

2.48 CRobT - Reads the current position (robtargt) data *RobotWare Base*

2.48 CRobT - Reads the current position (robtargt) data

Usage

CRobT(*Current Robot Target*) is used to read the current position of a robot and external axes.

This function returns a robtarget value with position (x, y, z), orientation (q1 ... q4), robot axes configuration, and external axes position. If only the x, y, and z values of the robot TCP (pos) are to be read then use the function CPos instead.

Basic examples

The following example illustrates the function CRobT.

See also [More examples on page 1205](#).

Example 1

```
VAR robtarget p1;  
MoveL *, v500, fine \Inpos := inpos50, tool1;  
p1 := CRobT(\Tool:=tool1 \Wobj:=wobj0);
```

The current position of the robot and external axes is stored in p1. The tool tool1 and work object wobj0 are used for calculating the position.

Note that the robot is standing still before the position is read and calculated. This is achieved by using the stop point fine within position accuracy inpos50 in the preceding movement instruction.

Return value

Data type: robtarget

The current position of a robot and external axes in the outermost coordinate system, taking the specified tool, work object, and active ProgDisp/ExtOffs coordinate system into consideration.

Arguments

CRobT ([\TaskRef][\TaskName] [\Tool] [\Wobj])

[\TaskRef]

Task Reference

Data type: taskid

The program task identity from which the robtarget should be read.

For all program tasks in the system, predefined variables of the data type taskid will be available. The variable identity will be "taskname"+"Id", for example, for the T_ROB1 task the variable identity will be T_ROB1Id.

[\TaskName]

Data type: string

The program task name from which the robtarget should be read.

If none of the arguments \TaskRef or \TaskName are specified then the current task is used.

Continues on next page

[\Tool]

Data type: tooldata

The persistent variable for the tool used to calculate the current robot position.

If this argument is omitted then the current active tool is used.

[\WObj]

Work Object

Data type: wobjdata

The persistent variable for the work object (coordinate system) to which the current robot position returned by the function is related.

If this argument is omitted then the current active work object is used.

**WARNING**

It is advised to always specify the arguments \Tool and \WObj during programming. The function will then always return the wanted position even if another tool or work object are activated.

Program execution

The coordinates returned represent the TCP position in the ProgDisp coordinate system. External axes are represented in the ExtOffs coordinate system.

If one of the arguments \TaskRef or \TaskName are used but arguments Tool and WObj are not used then the current tool and work object in the specified task will be used.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_TASKNAME	The program task name in argument \TaskName cannot be found in the system.
ERR_NOT_MOVETASK	Argument \TaskRef or \TaskName specify some non-motion task.

No error will be generated if the arguments \TaskRef or \TaskName specify the non-motion task that executes this function CRobT (reference to my own non-motion task). The position will then be fetched from the connected motion task.

More examples

More examples of the function CRobT are illustrated below.

Example 1

```
VAR robtarget p2;
p2 := ORobT( CRobT(\Tool:=grip3 \WObj:=fixture) );
```

The current position in the object coordinate system (without any ProgDisp or ExtOffs) of the robot and external axes is stored in p2. The tool grip3 and work object fixture are used for calculating the position.

Continues on next page

2 Functions

2.48 CRobT - Reads the current position (robtargt) data

RobotWare Base

Continued

Example 2

```
! In task T_ROB1
VAR robtarget p3;
p3 := CRobT(\TaskRef:=T_ROB2Id \Tool:=tool1 \Wobj:=wobj0);
```

The current position of the robot and external axes in task T_ROB2 are stored in p3 in task T_ROB1. The tool tool1 and work object wobj0 are used for calculating the position.

Note that the robot in task T_ROB2 may be moving when the position is read and calculated. To make sure the robot stands still, a stop point fine in the preceding movement instruction in task T_ROB2 could be programmed and instruction WaitSyncTask could be used to synchronize the instructions in task T_ROB1.

Example 3

```
! In task T_ROB1
VAR robtarget p4;
p4 := CRobT(\TaskName:="T_ROB2");
```

The current position of the robot and external axes in task T_ROB2 are stored in p4 in task T_ROB1. The current tool and work object in task T_ROB2 are used for calculating the position.

Syntax

```
CRobT '('
  ['\' TaskRef ':=<variable (VAR) of taskid>]
  ['\' TaskName ':=<expression (IN) of string>]
  ['\' Tool ':=<persistent (PERS) of tooldata>]
  ['\' WObj ':=<persistent (PERS) of wobjdata>'] ')'

```

A function with a return value of the data type robtarget.

Related information

For information about	See
Definition of position	robtargt - Position data on page 1715
Definition of tools	tooldata - Tool data on page 1753
Definition of work objects	wobjdata - Work object data on page 1775
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
ProgDisp coordinate system	PDispOn - Activates program displacement on page 543
ExtOffs coordinate system	EOffsOn - Activates an offset for additional axes on page 186
Reading the current pos (x, y, z only)	CPos - Reads the current position (pos) data on page 1202

2.49 CrossProd - Cross product of two pos vectors

Usage

CrossProd (*Cross Product*) is used to calculate the cross product (or vector product) of two pos vectors.

The cross product of two vectors **A** and **B** is a vector, perpendicular to both argument vectors. The length of the result vector is equal to the products of the length of **A** and **B** and the sine of the angle between them θ_{AB} .

$$|A \times B| = |A||B| \sin \theta_{AB}$$



Note

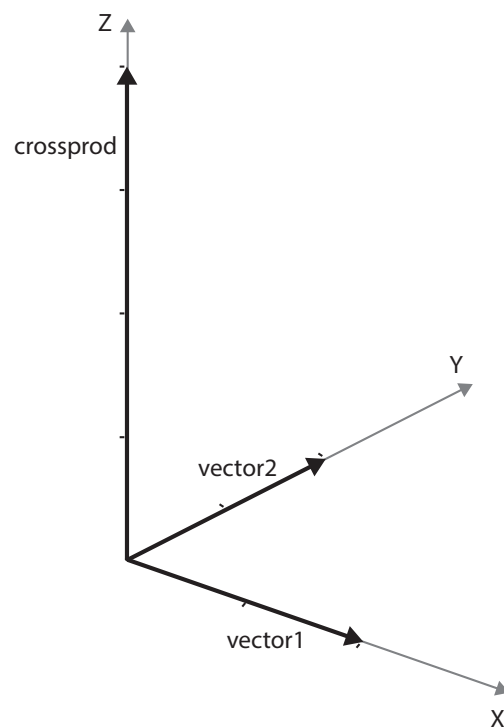
- The magnitude of the cross product equals the area of a parallelogram with the vectors as sides.
- The cross product of two parallel vectors is zero.
- $A \times B = -B \times A$

Basic examples

The following example illustrates the function CrossProd with perpendicular vectors.

For other examples, see [More examples on page 1208](#).

Example 1



xx1700001570

```
VAR pos crossprod_1;
```

Continues on next page

2 Functions

2.49 CrossProd - Cross product of two pos vectors

RobotWare Base

Continued

```
VAR pos vector1;  
VAR pos vector2;  
...  
...  
vector1 := [2,0,0];  
vector2 := [0,2,0];  
crossprod_1 := CrossProd(vector1, vector2);
```

In this example, vector1 is parallel to the x axis, vector2 is parallel to the y axis. The cross product is perpendicular to both of them, i.e. parallel to the z axis.

Since the angle between vector1 and vector2 is 90° , the magnitude of the cross product is: $2 * 2 * \sin 90^\circ = 4$

Return value

Data type: pos

A vector that is the result of the cross product of the two vectors.

Arguments

CrossProd (Vector1 Vector2)

Vector1

Data type: pos

The first vector described by the pos data type.

Vector2

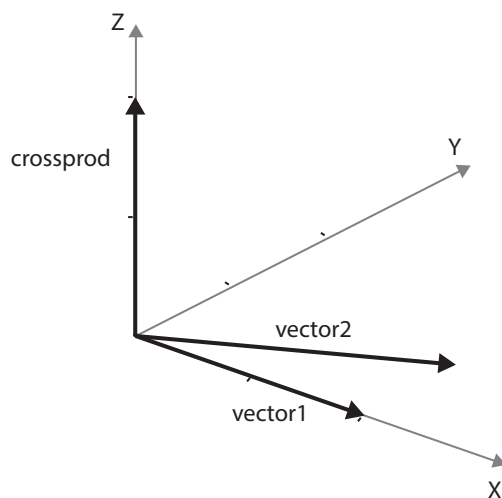
Data type: pos

The second vector described by the pos data type.

More examples

More examples of the function CrossProd are illustrated below.

Example 2



xx1700001571

```
VAR pos crossprod_1;  
VAR pos vector1;
```

Continues on next page

```

VAR pos vector2;
...
...
vector1 := [2,0,0];
vector2 := [2,1,0];
crossprod_1 := CrossProd(vector1, vector2);

```

In this example, vector1 and vector2 are both in the xy plane. The cross product is perpendicular to both of them, i.e. parallel to the z axis.

The magnitude of vector1 is 2. The magnitude of vector2 is $\sqrt{5}$. The angle between vector1 and vector2 is 26.565° . The magnitude of the cross product is: $2 * \sqrt{5} * \sin 26.565^\circ = 2$

Syntax

```

CrossProd '('
  [Vector1 ':='] <expression (IN) of pos>', '
  [Vector2 ':='] <expression (IN) of pos>
  ')'

```

A function with a return value of the data type pos.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview, section RAPID summary - Mathematics</i>

2 Functions

2.50 CSpeedOverride - Reads the current override speed

RobotWare Base

2.50 CSpeedOverride - Reads the current override speed

Usage

CSpeedOverride is used to read the speed override set by the operator from the FlexPendant. The return value is displayed as a percentage where 100% corresponds to the programmed speed.

In applications with instruction SpeedRefresh, this function can also be used to read current speed override value for this or connected motion program tasks.

Note! Must not be mixed up with the argument Override in the RAPID instruction VelSet.

Basic examples

The following example illustrates the function CSpeedOverride.

Example 1

```
VAR num myspeed;  
myspeed := CSpeedOverride();
```

The current override speed will be stored in the variable myspeed. For example, if the value is 100 then this is equivalent to 100%.

Return value

Data type: num

The override speed value in percent of the programmed speed. This will be a numeric value in the range of 0 - 100.

Arguments

CSpeedOverride ([\CTask])

[\CTask]

Data type: switch

Get current speed override value for this or connected motion program task. Used together with the instruction SpeedRefresh.

If this argument is not used then the function returns current speed override for the whole system (all motion program tasks). Meaning the manual speed override, set from FlexPendant.

Syntax

```
CSpeedOverride '('  
  [ '\' CTask ] ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Changing the Override Speed	<i>Operating manual - OmniCore</i> , section <i>Programming and Testing Production Running - Quickset menu, Speed</i>

Continues on next page

2.50 CSpeedOverride - Reads the current override speed

RobotWare Base

Continued

For information about	See
Update speed override from RAPID	SpeedRefresh - Update speed override for ongoing movement on page 752

2 Functions

2.51 CTime - Reads the current time as a string

RobotWare Base

2.51 CTime - Reads the current time as a string

Usage

CTime is used to read the current system time.

This function can be used to present the current time to the operator on the FlexPendant display or to paste the current time into a text file that the program writes to.

Basic examples

The following example illustrates the function CTime.

See also [More examples on page 1212](#).

Example 1

```
VAR string time;  
time := CTime();
```

The current time is stored in the variable time.

Return value

Data type: string

The current time in a string.

The standard time format is "hours:minutes:seconds", for example, "18:20:46".

More examples

More examples of the function CTime are illustrated below.

Example 1

```
VAR string time;  
time := CTime();  
TPWrite "The current time is: "+time;  
Write logfile, time;
```

The current time is written to the FlexPendant display and written into a text file.

Syntax

```
CTime '(' ' ')
```

A function with a return value of the type string.

Related information

For information about	See
Time and date instructions	<i>Technical reference manual - RAPID Overview</i> , section <i>RAPID summary - System & Time</i>
Setting the system clock	<i>Operating manual - OmniCore</i> , section <i>Changing FlexPendant settings</i>

2.52 CTool - Reads the current tool data

Usage

CTool (*Current Tool*) is used to read the data of the current tool.

Basic examples

The following example illustrates the function CTool.

Example 1

```
PERS tooldata temp_tool:= [ TRUE, [ [0, 0, 0], [1, 0, 0, 0] ],
                             [0.001, [0, 0, 0.001], [1, 0, 0, 0], 0, 0, 0] ];
temp_tool := CTool();
```

The value of the current tool is stored in the variable temp_tool.

Return value

Data type: tooldata

This function returns a tooldata value holding the value of the current tool, that is, the tool last used in a movement instruction.

The value returned represents the TCP position and orientation in the wrist centre coordinate system. See tooldata.

Arguments

CTool ([\TaskRef][\TaskName])

[\TaskRef]

Task Reference

Data type: taskid

The program task identity from which the data of the current tool should be read. For all program tasks in the system, predefined variables of the data type taskid will be available. The variable identity will be "taskname"+"Id", for example, for the T_ROB1 task the variable identity will be T_ROB1Id.

[\TaskName]

Data type: string

The program task name from which the data of the current tool should be read.

If none of the arguments \TaskRef or \TaskName are specified then the current task is used.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_TASKNAME	The program task name in argument \TaskName cannot be found in the system.
ERR_NOT_MOVETASK	Argument \TaskRef or \TaskName specify some non-motion task.

Continues on next page

2 Functions

2.52 CTool - Reads the current tool data

RobotWare Base

Continued

No error will be generated if the arguments \TaskRef or \TaskName specify the non-motion task that executes this function CTool (reference to my own non-motion task). The tool data will then be fetched from the connected motion task.

Syntax

```
CTool '('  
  ['\' TaskRef ':' <variable (VAR) of taskid>]  
  | ['\' TaskName ':' <expression (IN) of string>'] ')'
```

A function with a return value of the data type tooldata.

Related information

For information about	See
Definition of tools	tooldata - Tool data on page 1753
Coordinate systems	<i>Technical reference manual - RAPID Overview, section Motion and I/O principles - Coordinate Systems</i>

2.53 CWOBJ - Reads the current work object data

Usage

CWOBJ (*Current Work Object*) is used to read the data of the current work object.

Basic examples

The following example illustrates the function CWOBJ.

Example 1

```
PERS wobjdata temp_wobj:= [FALSE, TRUE, "", [[0,0,0], [1,0,0,0]],
    [[0,0,0], [1,0,0,0]]];
temp_wobj := CWOBJ();
```

The value of the current work object is stored in the variable temp_wobj.

Return value

Data type: wobjdata

This function returns a wobjdata value holding the value of the current work object, that is, the work object last used in a movement instruction.

The value returned represents the work object position and orientation in the world coordinate system. See wobjdata.

Arguments

CWOBJ ([\TaskRef][\TaskName])

[\TaskRef]

Task Reference

Data type: taskId

The program task identity from which the data of the current work object should be read.

For all program tasks in the system, predefined variables of the data type taskId will be available. The variable identity will be "taskname"+"Id", for example, for the T_ROB1 task the variable identity will be T_ROB1Id.

[\TaskName]

Data type: string

The program task name from which the data of the current work object should be read.

If none of the arguments \TaskRef or \TaskName are specified then the current task is used.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_TASKNAME	The program task name in argument \TaskName cannot be found in the system.

Continues on next page

2 Functions

2.53 CWOBJ - Reads the current work object data

RobotWare Base

Continued

Name	Cause of error
ERR_NOT_MOVETASK	Argument \TaskRef or \TaskName specify some non-motion task.

No error will be generated if the arguments \TaskRef or \TaskName specify the non-motion task that executes this function CWOBJ (reference to my own non-motion task). The work object data will then be fetched from the connected motion task.

Syntax

```
CWOBJ '('  
  ['\' TaskRef ':' <variable (VAR) of taskid>]  
  | ['\' TaskName ':' <expression (IN) of string>] ')'
```

A function with a return value of the data type wobjdata.

Related information

For information about	See
Definition of work objects	wobjdata - Work object data on page 1775
Coordinate systems	<i>Technical reference manual - RAPID Overview, section Motion and I/O Principles - Coordinate Systems</i>

2.54 DecToHex - Convert from decimal to hexadecimal

Usage

DecToHex is used to convert a number specified in a readable string in the base 10 to the base16.

The resulting string is constructed from the character set [0-9,A-F,a-f].

This routine handle numbers from 0 up to 9223372036854775807dec or 7FFFFFFFFFFFFFFF hex.

Basic examples

The following example illustrates the function DecToHex.

Example 1

```
VAR string str;
```

```
str := DecToHex("99999999");
```

The variable str is given the value "5F5E0FF".

Return value

Data type: string

The string converted to a hexadecimal representation of the given number in the inparameter string.

Arguments

DecToHex (Str)

Str

String

Data type: string

The string to convert.

Syntax

```
DecToHex '('  
  [ Str ':' ] <expression (IN) of string> ')'
```

A function with a return value of the data type string.

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview, section RAPID summary - String functions</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Basic elements</i>

2 Functions

2.55 DefAccFrame - Define an accurate frame

RobotWare Base

2.55 DefAccFrame - Define an accurate frame

Usage

DefAccFrame (*Define Accurate Frame*) is used to define a frame from three to ten original positions and the same number of displaced positions.

Description

A frame can be defined when a set of targets are known at two different locations. Thus, *the same physical positions* are used but expressed differently.

Consider it in two different approaches:

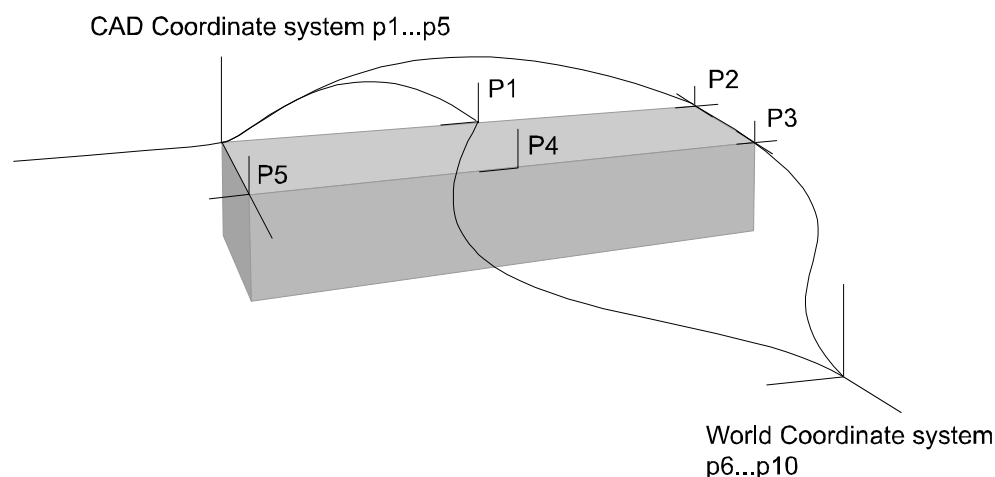
- 1 The same physical positions are expressed in relation to different coordinate systems. For example, a number of positions are retrieved from a CAD drawing, thus the positions are expressed in a CAD local coordinate system. The same positions are then expressed in robot world coordinate system. From these two sets of positions the frame between CAD coordinate system and robot world coordinate system is calculated.
- 2 A number of positions are related to an object in an original position. After a displacement of the object, the positions are determined again (often searched for). From these two sets of positions (old positions, new positions) the displacement frame is calculated.

Three targets are enough to define a frame, but to improve accuracy several points should be used.

Basic examples

The following example illustrates the function DefAccFrame.

Example 1



xx0500002179

```
CONST robtarget p1 := [...];  
CONST robtarget p2 := [...];  
CONST robtarget p3 := [...];  
CONST robtarget p4 := [...];  
CONST robtarget p5 := [...];
```

Continues on next page

```

VAR robtarget p6 := [...];
VAR robtarget p7 := [...];
VAR robtarget p8 := [...];
VAR robtarget p9 := [...];
VAR robtarget p10 := [...];
VAR robtarget pWCS{5};
VAR robtarget pCAD{5};

VAR pose frame1;
VAR num max_err;
VAR num mean_err;

! Add positions to robtarget arrays
pCAD{1}:=p1;
...
pCAD{5}:=p5;

pWCS{1}:=p6;
...
pWCS{5}:=p10;
frame1 := DefAccFrame (pCAD, pWCS, 5, max_err, mean_err);

```

Five positions p1- p5 related to an object have been stored. The five positions are also stored in relation to world coordinate system as p6-p10. From these 10 positions the frame, frame1, between the object and the world coordinate system is calculated. The frame will be the CAD frame expressed in the world coordinate system. If the input order of the targetlists is exchanged, that is, DefAccFrame (pWCS, pCAD . . .) then the world frame will be expressed in the CAD coordinate system.

Return value

Data type: pose

The calculated TargetListOne frame expressed in the TargetListTwo coordinate system.

Arguments

```

DefAccFrame (TargetListOne TargetListTwo TargetsInList
             MaxErrMeanErr)

```

TargetListOne

Data type: robtarget

Array of robtargets holding the positions defined in coordinate system one. Minimum number of robtargets is 3, maximum is 10.

TargetListTwo

Data type: robtarget

Array of robtargets holding the positions defined in coordinate system two. Minimum number of robtargets is 3, maximum is 10.

Continues on next page

2 Functions

2.55 DefAccFrame - Define an accurate frame

RobotWare Base

Continued

TargetsInList

Data type: num

Number of robtargets in an array.

MaxErr

Data type: num

The estimated maximum error in mm.

MeanErr

Data type: num

The estimated mean error in mm.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FRAME	The positions don't have the required relation or are not specified with enough accuracy.

Syntax

```
DefAccFrame '('  
  [TargetListOne ':=' ] <array {*} (IN) of robtarget> ','  
  [TargetListTwo ':=' ] <array {*} (IN) of robtarget> ','  
  [TargetsInList ':=' ] <expression (IN) of num> ','  
  [MaxErr ':=' ] <variable (VAR) of num> ','  
  [MeanErr ':=' ] <variable (VAR) of num> ')'
```

A function with a return value of the data type pose.

Related information

For information about	See
Calculating a frame from three positions	DefFrame - Define a frame on page 1224
Calculate a frame from 6 positions	DefDFrame - Define a displacement frame on page 1221

2.56 DefDFrame - Define a displacement frame

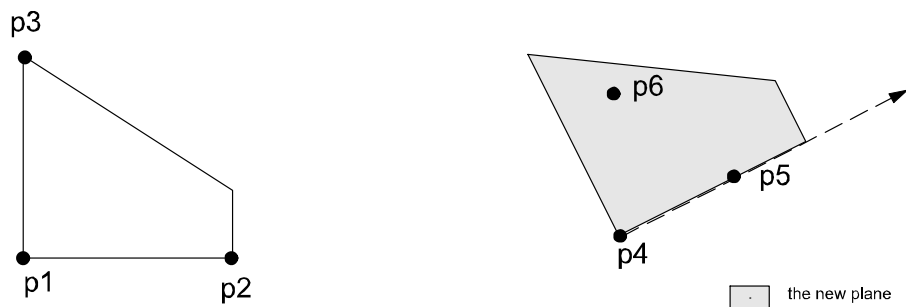
Usage

DefDFrame(*Define Displacement Frame*) is used to calculate a displacement frame from three original positions and three displaced positions.

Basic examples

The following example illustrates the function DefDFrame.

Example 1



xx0500002177

```

CONST robtarget p1 := [...];
CONST robtarget p2 := [...];
CONST robtarget p3 := [...];
VAR robtarget p4;
VAR robtarget p5;
VAR robtarget p6;
VAR pose frame1;
...
!Search for the new positions
SearchL sen1, p4, *, v50, tool1;
...
SearchL sen1, p5, *, v50, tool1;
...
SearchL sen1, p6, *, v50, tool1;
frame1 := DefDframe (p1, p2, p3, p4, p5, p6);
...
!Activation of the displacement defined by frame1
PDispSet frame1;

```

Three positions p1-p3 related to an object in an original position have been stored. After a displacement of the object, three new positions are searched for and stored as p4-p6. The displacement frame is calculated from these six positions. Then the calculated frame is used to displace all the stored positions in the program.

Return value

Data type: pose

The displacement frame.

Continues on next page

2 Functions

2.56 DefDFrame - Define a displacement frame

RobotWare Base

Continued

Arguments

DefDFrame (OldP1 OldP2 OldP3 NewP1 NewP2 NewP3)

OldP1

Data type: robtarget

The first original position.

OldP2

Data type: robtarget

The second original position.

OldP3

Data type: robtarget

The third original position.

NewP1

Data type: robtarget

The first displaced position. The difference between OldP1 and NewP1 will define the translation part of the frame and must be measured and determined with great accuracy.

NewP2

Data type: robtarget

The second displaced position. The line NewP1 . . . NewP2 will define the rotation of the old line OldP1 . . . OldP2.

NewP3

Data type: robtarget

The third displaced position. This position will define the rotation of the plane, for example, it should be placed on the new plane of NewP1, NewP2, and NewP3.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FRAME	It is not possible to calculate the frame because of bad accuracy in the positions.

Syntax

```
DefDFrame '('  
  [OldP1 ':='] <expression (IN) of robtarget> ','  
  [OldP2 ':='] <expression (IN) of robtarget> ','  
  [OldP3 ':='] <expression (IN) of robtarget> ','  
  [NewP1 ':='] <expression (IN) of robtarget> ','  
  [NewP2 ':='] <expression (IN) of robtarget> ','  
  [NewP3 ':='] <expression (IN) of robtarget> ')'
```

A function with a return value of the data type pose.

Continues on next page

Related information

For information about	See
Activation of displacement frame	<i>PDispSet - Activates program displacement using known frame on page 548</i>
Manual definition of displacement frame	<i>Operating manual - OmniCore, section Calibrating</i>

2 Functions

2.57 DefFrame - Define a frame

RobotWare Base

2.57 DefFrame - Define a frame

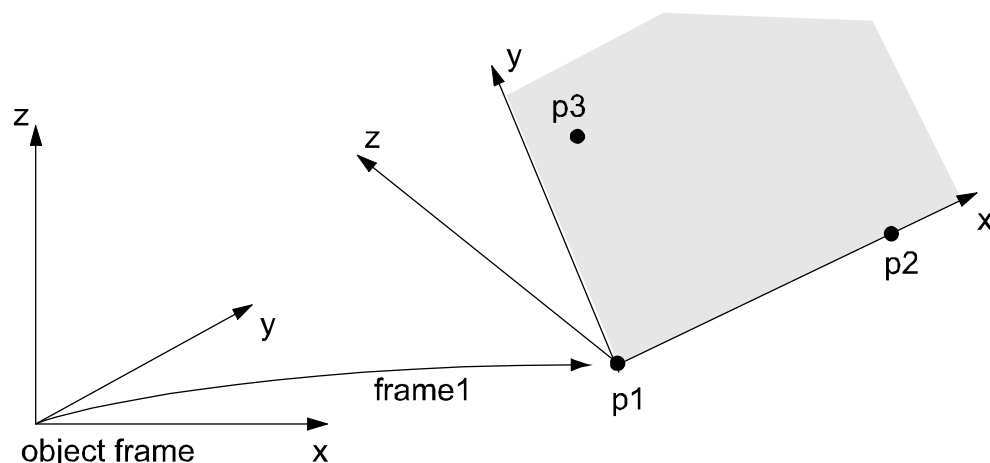
Usage

DefFrame (*Define Frame*) is used to calculate a frame, from three positions defining the frame.

Basic examples

The following example illustrates the function DefFrame.

Example 1



Three positions, p1- p3 related to the object coordinate system are used to define the new coordinate system, frame1. The first position, p1, is defining the origin of the new coordinate system. The second position, p2, is defining the direction of the x-axis. The third position, p3, is defining the location of the xy-plane. The defined frame1 may be used as a displacement frame, as shown in the example below:

```
CONST robtarg p1 := [...];
CONST robtarg p2 := [...];
CONST robtarg p3 := [...];
VAR pose frame1;
...
...
frame1 := DefFrame (p1, p2, p3);
...
...
!Activation of the displacement defined by frame1
PDispSet frame1;
```

Return value

Data type: pose

The calculated frame.

The calculation is related to the active object coordinate system.

Continues on next page

Arguments

DefFrame (NewP1 NewP2 NewP3 [\Origin])

NewP1

Data type: robtarget

The first position, which will define the origin of the new coordinate system.

NewP2

Data type: robtarget

The second position, which will define the direction of the x-axis of the new coordinate frame.

NewP3

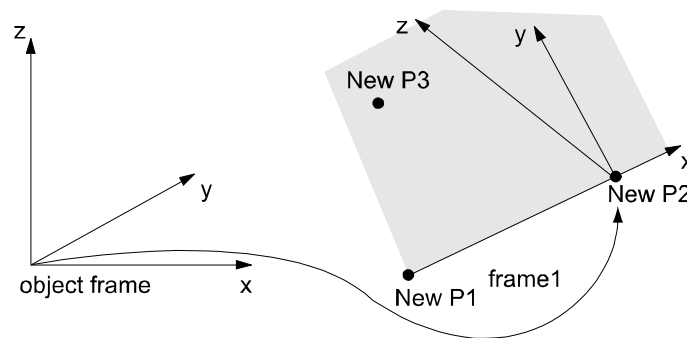
Data type: robtarget

The third position, which will define the xy-plane of the new coordinate system. The position of point 3 will be on the positive y side, see the figure above.

[\Origin]

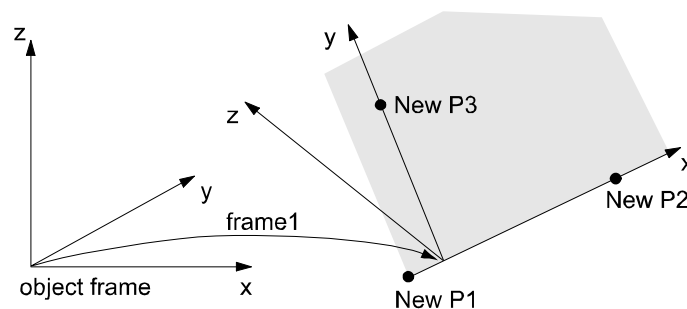
Data type: num

Optional argument, which will define how the origin of the new coordinate system will be placed. `Origin = 1` means that the origin is placed in NewP1, that is, the same as if this argument is omitted. `Origin = 2` means that the origin is placed in NewP2. See the figure below.



xx0500002178

`Origin = 3` means that the origin is placed on the line going through NewP1 and NewP2 and so that NewP3 will be placed on the y axis. See the figure below.



xx0500002180

Other values, or if `Origin` is omitted, will place the origin in NewP1.

Continues on next page

2 Functions

2.57 DefFrame - Define a frame

RobotWare Base

Continued

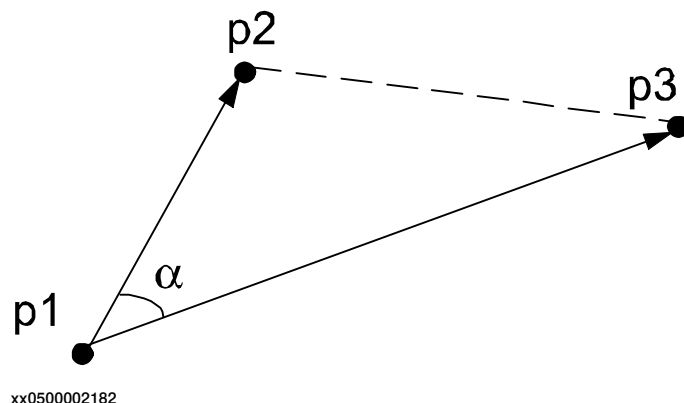
Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FRAME	The frame cannot be calculated because of the below limitations.

Limitations

The three positions p1 - p3, defining the frame, must define a well shaped triangle. The most well shaped triangle is the one with all sides of equal length.



The triangle is not considered to be well shaped if the angle α is too small. The angle α is too small if:

$$|\cos \alpha| < 1 - 10^{-4}$$

The triangle p1, p2, p3 must not be too small, that is, the positions cannot be too close. The distances between the positions p1 - p2 and p1 - p3 must not be less than 0.1 mm.

Syntax

```
DefFrame '('  
  [NewP1 ':=' ] <expression (IN) of robtarger> ','  
  [NewP2 ':=' ] <expression (IN) of robtarger> ','  
  [NewP3 ':=' ] <expression (IN) of robtarger>  
  ['\ ' Origin ':=' <expression (IN) of num > ' ' )'
```

A function with a return value of the data type pose.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i> , section <i>RAPID summary - Mathematics</i>
Activation of displacement frame	PDispSet - Activates program displacement using known frame on page 548

2.58 Dim - Obtains the size of an array

Usage

`Dim` (*Dimension*) is used to obtain the number of elements in an array.

Basic examples

The following example illustrates the function `Dim`.

See also [More examples on page 1227](#).

Example 1

```
PROC arrmul(VAR num array{*}, num factor)
  FOR index FROM 1 TO Dim(array, 1) DO
    array{index} := array{index} * factor;
  ENDFOR
ENDPROC
```

All elements of a num array are multiplied by a factor. This procedure can take any one-dimensional array of data type num as an input.

Return value

Data type: num

The number of array elements of the specified dimension.

Arguments

`Dim` (ArrPar DimNo)

ArrPar

Array Parameter

Data type: anytype

The name of the array.

DimNo

Dimension Number

Data type: num

The desired array dimension:

1 = first dimension

2 = second dimension

3 = third dimension

More examples

More examples of how to use the function `Dim` are illustrated below.

Example 1

```
PROC add_matrix(VAR num array1{*,*,*}, num array2{*,*,*})

  IF Dim(array1,1) <> Dim(array2,1) OR Dim(array1,2) <>
    Dim(array2,2) OR Dim(array1,3) <> Dim(array2,3) THEN
    TPWrite "The size of the matrices are not the same";
    Stop;
```

Continues on next page

2 Functions

2.58 Dim - Obtains the size of an array

RobotWare Base

Continued

```
ELSE
  FOR i1 FROM 1 TO Dim(array1, 1) DO
    FOR i2 FROM 1 TO Dim(array1, 2) DO
      FOR i3 FROM 1 TO Dim(array1, 3) DO
        array1{i1,i2,i3} := array1{i1,i2,i3} + array2{i1,i2,i3};
      ENDFOR
    ENDFOR
  ENDFOR
ENDIF
RETURN;

ENDPROC
```

Two matrices are added. If the size of the matrices differs then the program stops and an error message appears.

This procedure can take any three-dimensional array of data type num as an input.

Syntax

```
Dim '('
  [ArrPar ':=' ] <reference (REF) of anytype> ', '
  [DimNo ':=' ] <expression (IN) of num> ')'
```

A REF parameter requires that the corresponding argument be either a constant, a variable, or an entire persistent. The argument could also be an IN parameter, a VAR parameter, or an entire PERS parameter.

A function with a return value of the data type num.

Related information

For information about	See
Array parameters	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Routines</i>
Array declaration	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Data</i>

2.59 DInput - Reads the value of a digital input signal

Usage

DInput is used to read the current value of a digital input signal.

Basic examples

The following example illustrates the function DInput.

See also [More examples on page 1229](#).

Example 1

```

IF DInput(di2) = 1 THEN ...
...
IF di2 = 1 THEN ...

```

If the current value of the signal di2 is equal to 1, then ...

Return value

Data type: num

The current value of the signal (0 or 1).

Arguments

DInput (Signal)

Signal

Data type: signal di

The name of the digital input to be read.

Program execution

The value read depends on the configuration of the signal. If the signal is inverted in the system parameters, the value returned by this function is the opposite of the value of the physical channel.

More examples

More examples of how to use the function DInput are illustrated below.

Example 1

```

weld_flag := DInput(weld);
...
weld_flag := weld;

```

The variable weld_flag is set to the same value as the current value of the signal weld.



Note

Note that, in this case, the weld_flag reflects the current value of the signal. Thus, if weld_flag is used later in the program, you cannot be certain that it will reflect the current value of the signal.

Continues on next page

2 Functions

2.59 DInput - Reads the value of a digital input signal

RobotWare Base

Continued

Syntax

```
DInput '('  
    [Signal ':='] <variable (VAR) of signaladi>')'
```

A function with a return value of the data type `dionum`.

Related information

For information about	See
Input/Output instructions	<i>Technical reference manual - RAPID Overview, section RAPID Summary - Input and Output Signals</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview, section Motion and I/O Principles - I/O principles</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

2.60 Distance - Distance between two points

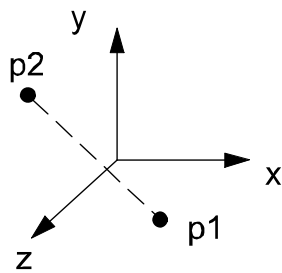
Usage

Distance is used to calculate the distance between two points in the space.

Basic examples

The following example illustrates the function Distance.

Example 1



xx0500002321

```
VAR num dist;  
CONST pos p1 := [4,0,4];  
CONST pos p2 := [-4,4,4];  
...  
dist := Distance(p1, p2);
```

The distance in space between the points p1 and p2 is calculated and stored in the variable dist.

Return value

Data type: num

The distance (always positive) in mm between the points.

Arguments

Distance (Point1 Point2)

Point1

Data type: pos

The first point described by the pos data type.

Point2

Data type: pos

The second point described by the pos data type.

Continues on next page

2 Functions

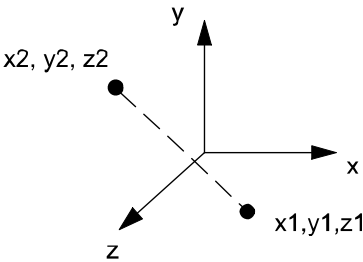
2.60 Distance - Distance between two points

RobotWare Base

Continued

Program execution

Calculation of the distance between the two points:



xx0500002322

$$\text{distance} = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

xx0500002323

Syntax

```
Distance '('  
  [Point1 ':=' ] <expression (IN) of pos> ','  
  [Point2 ':=' ] <expression (IN) of pos> ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i> , section <i>RAPID Summary - Mathematics</i>
Definition of pos	pos - Positions (only X, Y and Z) on page 1696

2.61 DIV - Evaluates an integer division

Usage

DIV is a conditional expression used to evaluate a division of integers.

Basic examples

The following examples illustrate the function DIV.

Example 1

```
reg1 := 14 DIV 4;
```

The return value is 3 because 14 can be divided by 4 for 3 times.

Example 2

```
VAR dnum mydnum1 := 10;  
VAR dnum mydnum2 := 5;  
VAR dnum mydnum3;  
...  
mydnum3 := mydnum1 DIV mydnum2;
```

The return value is 2 because 10 can be divided by 5 for 2 times.

Return value

Data type: num, dnum

Returns the integer, whole number, from a division of integers.

Syntax

<expression of num> DIV <expression of num>

A function with a return value of data type num.

<expression of dnum> DIV <expression of dnum>

A function with a return value of data type dnum.

Related information

For information about	See
num - Numeric values	num - Numeric values on page 1680
dnum - Double numeric values	dnum - Double numeric values on page 1630
MOD	MOD - Evaluates an integer modulo on page 1350
Expressions	Technical reference manual - RAPID Overview

2 Functions

2.62 DnumToNum - Converts dnum to num

RobotWare Base

2.62 DnumToNum - Converts dnum to num

Usage

DnumToNum converts a dnum to a num if possible, otherwise it generates a recoverable error.

Basic examples

The following example illustrates the function DnumToNum.

Example 1

```
VAR num mynum:=0;
VAR dnum mydnum:=8388607;
VAR dnum testFloat:=8388609;
VAR dnum anotherdnum:=4294967295;
! Works OK
mynum:=DnumToNum(mydnum);
! Accept floating point value
mynum:=DnumToNum(testFloat);
! Cause error recovery error
mynum:=DnumToNum(anotherdnum \Integer);
```

The dnum value 8388607 is returned by the function as the num value 8388607.

The dnum value 8388609 is returned by the function as the num value 8.38861E+06.

The dnum value 4294967295 generates the recoverable error ERR_ARGVALERR.

Return value

Data type: num

The input dnum value can be in the range -8388607 to 8388608 and return the same value as a num. If the \Integer switch is not used, the input dnum value can be in the range -3.40282347E+38 to 3.40282347E+38 and the return value might become a floating point value.

Arguments

DnumToNum (Value [\Integer])

Value

Data type: dnum

The numeric value to be converted.

[\Integer]

Data type: switch

Only integer values.

If the switch \Integer is not used, a down cast is made even if the value becomes a floating point value. If it is used, a check is made whether the value is an integer between -8388607 to 8388608. If the value is not in the interval, a recoverable error is generated.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_ARGVALERR	Value is above 8388608 or below -8388607 or not an integer (if optional argument Integer is used)
ERR_NUM_LIMIT	Value is above 3.40282347E+38 or below -3.40282347E+38
ERR_INT_NOTVAL	Value is not an integer

Syntax

```
DnumToNum '('  
  [ Value ':=' ] < expression (IN) of dnum >  
  ['\' Integer ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Dnum data type	dnum - Double numeric values on page 1630.
Num data type	num - Numeric values on page 1680.

2 Functions

2.63 DnumToStr - Converts numeric value to string

RobotWare Base

2.63 DnumToStr - Converts numeric value to string

Usage

DnumToStr (*Numeric To String*) is used to convert a numeric value to a string.

Basic examples

The following examples illustrate the function DnumToStr.

Example 1

```
VAR string str;  
str := DnumToStr(0.3852138754655357,3);
```

The variable str is given the value "0.385".

Example 2

```
VAR dnum val;  
val:= 0.3852138754655357;  
str := DnumToStr(val, 2\Exp);
```

The variable str is given the value "3.85E-01".

Example 3

```
VAR dnum val;  
val := 0.3852138754655357;  
str := DnumToStr(val, 15);
```

The variable str is given the value "0.385213875465536".

Example 4

```
VAR dnum val;  
val:=4294967295.385215;  
str := DnumToStr(val, 4);
```

The variable str is given the value "4294967295.3852".

Example 5

```
reg1 := 0.38521;  
str := DnumToStr(reg1, 2\Compact);
```

The variable str is given the value "0.39".

Return value

Data type: str

The numeric value converted to a string with the specified number of decimals, with exponent if so requested. The numeric value is rounded if necessary. The decimal point is suppressed if no decimals are included.

Arguments

DnumToStr (Val Dec [\Exp] | [\Compact])

Val

Value

Data type: dnum

The numeric value to be converted.

Continues on next page

Dec

Decimals

Data type: num

Number of decimals. The number of decimals must not be negative or greater than the available precision for numeric values.

Max number of decimals that can be used is 15.

[\Exp]

Exponent

Data type: switch

To use exponent in return value.

[\Compact]

Compact

Data type: switch

To be used to get a short format in the return value.

Syntax

```
DnumToStr '('
  [ Val ':' '=' ] <expression (IN) of dnum>
  [ Dec ':' '=' ] <expression (IN) of num>
  ['\ ' Exp ] | ['\ ' Compact ]')'
```

A function with a return value of the data type string.

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview, section RAPID summary - String functions</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Basic elements</i>
Convert a num numeric value to a string	NumToStr - Converts numeric value to string on page 1362

2 Functions

2.64 DotProd - Dot product of two pos vectors RobotWare Base

2.64 DotProd - Dot product of two pos vectors

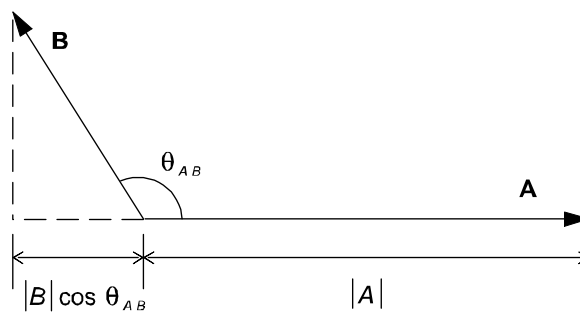
Usage

DotProd (*Dot Product*) is used to calculate the dot (or scalar) product of two pos vectors. The typical use is to calculate the projection of one vector upon the other or to calculate the angle between the two vectors.

Basic examples

The following example illustrates the function DotProd.

Example 1



xx0500002449

The dot or scalar product of two vectors **A** and **B** is a scalar, which equals the products of the magnitudes of **A** and **B** and the cosine of the angle between them.

$$A \cdot B = |A||B| \cos \theta_{AB}$$

The dot product:

- is less than or equal to the product of their magnitudes.
- can be either a positive or a negative quantity, depending on whether the angle between them is smaller or larger than 90 degrees.
- is equal to the product of the magnitude of one vector and the projection of the other vector upon the first one.
- is zero when the vectors are perpendicular to each other.

The vectors are described by the data type pos and the dot product by the data type num:

```
VAR num dotprod;  
VAR pos vector1;  
VAR pos vector2;  
...  
...  
vector1 := [1,1,1];  
vector2 := [1,2,3];  
dotprod := DotProd(vector1, vector2);
```

Return value

Data type: num

Continues on next page

The value of the dot product of the two vectors.

Arguments

DotProd (Vector1 Vector2)

Vector1

Data type: pos

The first vector described by the pos data type.

Vector2

Data type: pos

The second vector described by the pos data type.

Syntax

```
DotProd '('  
  [Vector1 ':='] <expression (IN) of pos>','  
  [Vector2 ':='] <expression (IN) of pos>  
  ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i> , section <i>RAPID summary - Mathematics</i>

2 Functions

2.65 DOutput - Reads the value of a digital output signal

RobotWare Base

2.65 DOutput - Reads the value of a digital output signal

Usage

DOutput is used to read the current value of a digital output signal.

Basic examples

The following example illustrates the function DOutput.

See also [More examples on page 1240](#).

Example 1

```
IF DOutput(do2) = 1 THEN ...  
...  
IF do2 = 1 THEN ...
```

If the current value of the signal do2 is equal to 1, then . . .

Return value

Data type: `dionum`

The current value of the signal (0 or 1).

Arguments

DOutput (Signal)

Signal

Data type: `signaldo`

The name of the signal to be read.

Program execution

The value read depends on the configuration of the signal. If the signal is inverted in the system parameters then the value returned by this function is the opposite of the true value of the physical channel.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_NO_ALIASIO_DEF</code>	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
<code>ERR_NORUNUNIT</code>	If there is no contact with the I/O device.
<code>ERR_SIG_NOT_VALID</code>	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

More examples

More examples of the function DOutput are illustrated below.

Example 1

```
IF DOutput(auto_on) <> active THEN ...
```

Continues on next page

```
...
IF auto_on <> active THEN ...
```

If the current value of the system signal `auto_on` is not `active` then ..., that is, if the robot is in the manual operating mode, then ...

**Note**

The signal must first be defined as a system output in the system parameters.

Syntax

```
DOutput '('
  [ Signal ':= ' ] < variable (VAR) of signaldo > ')'
```

A function with a return value of the data type `dionum`.

Related information

For information about	See
Set a digital output signal	SetDO - Changes the value of a digital output signal on page 682
Input/Output instructions	<i>Technical reference manual - RAPID Overview, section RAPID Summary - Input and Output Signals</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview, section Motion and I/O Principles - I/O Principles</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

2 Functions

2.66 EulerZYX - Gets euler angles from orient *RobotWare Base*

2.66 EulerZYX - Gets euler angles from orient

Usage

EulerZYX (*Euler ZYX rotations*) is used to get an Euler angle component from an orient type variable.

Basic examples

The following example illustrates the function EulerZYX.

Example 1

```
VAR num anglex;  
VAR num angley;  
VAR num anglez;  
VAR pose object;  
...  
...  
anglex := EulerZYX(\X, object.rot);  
angley := EulerZYX(\Y, object.rot);  
anglez := EulerZYX(\Z, object.rot);
```

Return value

Data type: num

The corresponding Euler angle, expressed in degrees, range from [-180, 180].

Arguments

EulerZYX ([\X] | [\Y] | [\Z] Rotation)

[\X]

Data type: switch

Gets the rotation around the X axis.

[\Y]

Data type: switch

Gets the rotation around the Y axis.

[\Z]

Data type: switch

Gets the rotation around the Z axis.

Note!

The arguments \X, \Y, and \Z are mutually exclusive. If none of these are specified then a run-time error is generated.

Rotation

Data type: orient

The rotation in its quaternion representation.

Syntax

EulerZYX '('

Continues on next page

```
['\ ' X ','] | ['\ ' Y ','] | ['\ ' Z ',']  
[Rotation ':='] <expression (IN) of orient> ' )'
```

A function with a return value of the data type num.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i> , section <i>RAPID summary - Mathematics</i>

2 Functions

2.67 EventType - Get current event type inside any event routine *RobotWare Base*

2.67 EventType - Get current event type inside any event routine

Usage

EventType can be used in any event routine and then returns the current executed event type.

If EventType is called from any program task routine then EventType always returns 0 meaning EVENT_NONE.

Basic examples

The following example illustrates the function EventType.

Example 1

```
TEST EventType()  
CASE EVENT_NONE:  
    ! Not executing any event  
CASE EVENT_POWERON:  
    ! Executing POWER ON event  
CASE EVENT_START:  
    ! Executing START event  
CASE EVENT_STOP:  
    ! Executing STOP event  
CASE EVENT_QSTOP:  
    ! Executing QSTOP event  
CASE EVENT_RESTART:  
    ! Executing RESTART event  
CASE EVENT_RESET:  
    ! Executing RESET event  
CASE EVENT_STEP:  
    ! Executing STEP event  
ENDTEST
```

Use of function EventType inside any event routine to find out which system event, if any, is executing now.

Return value

Data type: event_type

The current executed event type 1 ... 7, or 0 if no event routine is executed.

Predefined data

The following predefined symbolic constants of type event_type can be used to check the return value:

```
CONST event_type EVENT_NONE := 0;  
CONST event_type EVENT_POWERON := 1;  
CONST event_type EVENT_START := 2;  
CONST event_type EVENT_STOP := 3;  
CONST event_type EVENT_QSTOP := 4;  
CONST event_type EVENT_RESTART := 5;  
CONST event_type EVENT_RESET := 6;  
CONST event_type EVENT_STEP := 7;
```

Continues on next page

2.67 EventType - Get current event type inside any event routine

RobotWare Base

Continued

Syntax

EventType '(' ' ')

A function with a return value of the data type event_type.

Related information

For information about	See
Event routines in general	<i>Technical reference manual - System parameters</i> , section <i>Controller - Event Routine</i>
Data type event_type, predefined constants	event_type - Event routine type on page 1644

2 Functions

2.68 ExecHandler - Get type of execution handler

RobotWare Base

2.68 ExecHandler - Get type of execution handler

Usage

ExecHandler can be used to find out if the actual RAPID code is executed in any RAPID program routine handler.

Basic examples

The following example illustrates the function ExecHandler.

Example 1

```
TEST ExecHandler()  
CASE HANDLER_NONE:  
    ! Not executing in any routine handler  
CASE HANDLER_BWD:  
    ! Executing in routine BACKWARD handler  
CASE HANDLER_ERR:  
    ! Executing in routine ERROR handler  
CASE HANDLER_UNDO:  
    ! Executing in routine UNDO handler  
ENDTEST
```

Use of function ExecHandler to find out if the code is executing in some type of routine handler or not.

HANDLER_ERR will be returned even if the call is executed in a submethod to the error handler.

Return value

Data type: handler_type

The current executed handler type 1 ... 3, or 0 if not executing in any routine handler.

Predefined data

The following predefined symbolic constants of type handler_type can be used to check the return value:

```
CONST handler_type HANDLER_NONE := 0;  
CONST handler_type HANDLER_BWD := 1;  
CONST handler_type HANDLER_ERR := 2;  
CONST handler_type HANDLER_UNDO := 3;
```

Syntax

```
ExecHandler '(' ')'
```

A function with a return value of the data type handler_type.

Related information

For information about	See
Type of execution handler	handler_type - Type of execution handler on page 1651

2.69 ExecLevel - Get execution level

Usage

ExecLevel can be used to find out current execution level for the RAPID code that currently is executed.

Basic examples

The following example illustrates the function ExecLevel.

Example 1

```
TEST ExecLevel()  
CASE LEVEL_NORMAL:  
  ! Execute on base level  
CASE LEVEL_TRAP:  
  ! Execute in TRAP routine  
CASE LEVEL_SERVICE:  
  ! Execute in service, event or system input interrupt routine  
ENDTEST
```

Use of function ExecLevel to find out the current execution level.

Return value

Data type: exec_level

The current execution level 0... 2.

Predefined data

The following predefined symbolic constants of type exec_level can be used to check the return value:

```
CONST exec_level LEVEL_NORMAL := 0;  
CONST exec_level LEVEL_TRAP := 1;  
CONST exec_level LEVEL_SERVICE := 2;
```

Syntax

```
ExecLevel '(' ')'
```

A function with a return value of the data type exec_level.

Related information

For information about	See
Data type for execution level	exec_level - Execution level on page 1645

2 Functions

2.70 Exp - Calculates the exponential value

RobotWare Base

2.70 Exp - Calculates the exponential value

Usage

Exp (*Exponential*) is used to calculate the exponential value, e^x .

Basic examples

The following example illustrates the function Exp.

Example 1

```
VAR num x;  
VAR num value;  
...  
value:= Exp( x);
```

value will get the exponential value of x.

Return value

Data type: num

The exponential value e^x .

Arguments

Exp (Exponent)

Exponent

Data type: num

The exponent argument value.

Syntax

```
Exp '('  
  [Exponent ':=' ] <expression (IN) of num> ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i> , section <i>RAPID Summary - Mathematics</i>

2.71 FileSize - Retrieve the size of a file

Usage

FileSize is used to retrieve the size of the specified file.

Basic examples

The following example illustrates the function FileSize.

See also [More examples on page 1249](#).

Example 1

```
PROC listfile(string filename)
  VAR num size;
  size := FileSize(filename);
  TPWrite filename+" size: "+NumToStr(size,0)+" Bytes";
ENDPROC
```

This procedure prints out the name of specified file together with a size specification.

Return value

Data type: num

The size in bytes.

Arguments

FileSize (Path)

Path

Data type: string

The file name specified with full or relative path.

Program execution

This function returns a numeric that specifies the size in bytes of the specified file. It is also possible to get the same information about a directory.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	The file does not exist.

More examples

Basic example of the function is illustrated below.

Example 1

This example lists all files bigger than 1 KByte under the "HOME:" directory structure, including all subdirectories.

```
PROC searchdir(string dirname, string actionproc)
  VAR dir directory;
  VAR string filename;
```

Continues on next page

2 Functions

2.71 FileSize - Retrieve the size of a file

RobotWare Base

Continued

```
IF IsFile(dirname \Directory) THEN
  OpenDir directory, dirname;
  WHILE ReadDir(directory, filename) DO
    ! .. and . is the parent and resp. this directory
    IF filename <> ".." AND filename <> "." THEN
      searchdir dirname+"/"+filename, actionproc;
    ENDIF
  ENDWHILE
  CloseDir directory;
ELSE
  %actionproc% dirname;
ENDIF
ERROR
RAISE;
ENDPROC

PROC listfile(string filename)
  IF FileSize(filename) > 1024 THEN
    TPWrite filename;
  ENDIF
ENDPROC

PROC main()
  ! Execute the listfile routine for all files found under the
  ! tree of HOME:
  searchdir "HOME:", "listfile";
ENDPROC
```

This program traverses the directory structure under "HOME:" and for each file found it calls the listfile procedure. The searchdir is a generic part that knows nothing about the start of the search or which routine should be called for each file. It uses IsFile to check whether it has found a subdirectory or a file and it uses the late binding mechanism to call the procedure specified in actionproc for all files found. The actionproc routine listfile checks whether the file is bigger than 1KBytes.

Syntax

```
FileSize '('
  [ Path ':= ' ] < expression (IN) of string> ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Make a directory	MakeDir - Create a new directory on page 343
Remove a directory	RemoveDir - Delete a directory on page 585
Rename a file	RenameFile - Rename a file on page 588
Remove a file	RemoveFile - Delete a file on page 587
Copy a file	CopyFile - Copy a file on page 163

Continues on next page

For information about	See
Check file type	IsFile - Check the type of a file on page 1324
Check file system size	FSSize - Retrieve the size of a file system on page 1255
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

2 Functions

2.72 FileTimeDnum - Retrieve time information about a file

RobotWare Base

2.72 FileTimeDnum - Retrieve time information about a file

Usage

FileTimeDnum is used to retrieve the last time for modification, access or file status change of a file. The time is measured in seconds since 00:00:00 GMT, Jan. 1 1970. The time is returned as a dnum.

Basic example

The following example illustrates the function FileTimeDnum.

See also [More examples on page 1253](#).

Example 1

```
IF FileTimeDnum ("HOME:/mymod.modx" \ModifyTime) > ModTimeDnum
  ("mymod") THEN
  UnLoad "HOME:/mymod.modx";
  Load \Dynamic, "HOME:/mymod.modx";
ENDIF
```

This program reloads a module if the source file is newer. It uses the ModTimeDnum to retrieve the latest modify time for the specified module, and compares it to the FileTimeDnum ("HOME:/mymod.modx" \ModifyTime) at the source. Then, if the source is newer, the program unloads and loads the module again.

Return value

Data type: dnum

The time measured in seconds since 00:00:00 GMT, Jan. 1 1970.

Arguments

```
FileTimeDnum ( Path [\ModifyTime] | [\AccessTime] | [\StatCTime])
```

Path

Data type: string

The file specified with a full or relative path.

[\ModifyTime]

Data type: switch

Last modification time.

[\AccessTime]

Data type: switch

Time of last access (read, execute or modify).

[\StatCTime]

Data type: switch

Last file status (access qualification) change time.

Continues on next page

Program execution

For the specified file or directory, this function returns a numeric that specifies the time since the last:

- Modification
- Access
- File status change

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	The file does not exist.

More examples

More examples of the function FileTimeDnum are illustrated below.

This is a complete example that implements an alert service for maximum 10 files.

```
LOCAL RECORD falert
  string filename;
  dnum ftime;
ENDRECORD

LOCAL VAR falert myfiles[10];
LOCAL VAR num currentpos:=0;
LOCAL VAR intnum timeint;

PROC alertInit(num freq)
  currentpos:=0;
  CONNECT timeint WITH mytrap;
  ITimer freq,timeint;
ENDPROC

LOCAL TRAP mytrap
  VAR num pos:=1;
  WHILE pos <= currentpos DO
    IF FileTimeDnum(myfiles{pos}.filename \ModifyTime) >
      myfiles{pos}.ftime THEN
      TPWrite "The file "+myfiles{pos}.filename+" is changed";
    ENDIF
    pos := pos+1;
  ENDWHILE
ENDTRAP

PROC alertNew(string filename)
  currentpos := currentpos+1;
  IF currentpos <= 10 THEN
    myfiles{currentpos}.filename := filename;
    myfiles{currentpos}.ftime := FileTimeDnum (filename
      \ModifyTime);
```

Continues on next page

2 Functions

2.72 FileTimeDnum - Retrieve time information about a file

RobotWare Base

Continued

```
ENDIF
ENDPROC

PROC alertFree()
  IDelete timeint;
ENDPROC
```

Syntax

```
FileTimeDnum '('
[Path ':' ] <expression (IN) of string>
['\ ' ModifyTime] |
['\ ' AccessTime] |
['\ ' StatCTime]
```

A function with a return value of the data type dnum.

Related information

For information about	See
Last modify time of a loaded module	ModTimeDnum - Get file modify time for the loaded module on page 1352
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

2.73 FSSize - Retrieve the size of a file system

Usage

FSSize (*File System Size*) is used to retrieve the size of the file system in which a specified file resides. The size in bytes, kilo bytes or mega bytes are returned as a num.

Basic example

The following example illustrates the function FSSize.

See also [More examples on page 1256](#).

Example 1

```
PROC main()
  VAR num totalsyssize;
  VAR num freesyssize;
  freesyssize := FSSize("HOME:/spy.log" \Free);
  totalsyssize := FSSize("HOME:/spy.log" \Total);
  TPWrite NumToStr(((totalsyssize -
    freesyssize)/totalsyssize)*100,0) +" percent used";
ENDPROC
```

This procedure prints out the amount of disk space used on the HOME: file system as a percentage.

Return value

Data type: num

The size in bytes.

Arguments

FSSize (Name [\Total] | [\Free] [\Kbyte] [\Mbyte])

Name

Data type: string

The name of a file in the file system, specified with full or relative path.

[\Total]

Data type: switch

Retrieves the total amount of space in the file system.

[\Free]

Data type: switch

Retrieves the amount of free space in the file system.

[\Kbyte]

Data type: switch

Convert the number of bytes read to kilobytes, for example, divide the size with 1024.

Continues on next page

2 Functions

2.73 FSSize - Retrieve the size of a file system

RobotWare Base

Continued

[\Mbyte]

Data type: switch

Convert the number of bytes read to megabytes, for example, divide the size with 1048576 (1024*1024).

Program execution

This function returns a numeric that specifies the size of the file system in which the specified file resides.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	The file system does not exist
ERR_FILESIZE	The size exceeds the max integer value for a num, 8388608

More examples

More examples of the function FSSize are illustrated below.

Example 1

```
LOCAL VAR intnum timeint;

LOCAL TRAP mytrap
  IF FSSize("HOME:/spy.log" \Free)/FSSize("HOME:/spy.log" \Total)
    <= 0.1 THEN
    TPWrite "The disk is almost full";
    alertFree;
  ENDIF
ENDTRAP

PROC alertInit(num freq)
  CONNECT timeint WITH mytrap;
  ITimer freq,timeint;
ENDPROC

PROC alertFree()
  IDelete timeint;
ENDPROC
```

This is a complete example for implementing an alert service that prints a warning on the FlexPendant when the remaining free space in the "HOME:" file system is less than 10%.

Syntax

```
FSSize '('
  [ Name ':' '=' ] < expression (IN) of string>
  [ '\ ' Total ] | [ '\ ' Free ]
  [ '\ ' Kbyte ]
  [ '\ ' Mbyte ] ')'
```

Continues on next page

A function with a return value of the data type num.

Related information

For information about	See
Make a directory	MakeDir - Create a new directory on page 343
Remove a directory	RemoveDir - Delete a directory on page 585
Rename a file	RenameFile - Rename a file on page 588
Remove a file	RemoveFile - Delete a file on page 587
Copy a file	CopyFile - Copy a file on page 163
Check file type	IsFile - Check the type of a file on page 1324
Check file size	FileSize - Retrieve the size of a file on page 1249
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

2 Functions

2.74 GetAxisDistance - Get the traversed distance counter of the axis

RobotWare Base

2.74 GetAxisDistance - Get the traversed distance counter of the axis

Usage

GetAxisDistance is used to read the current distance the axis has been moving since the last reset. If the axis is rotational the distance will be in degrees and if the axis is linear the distance will be in meters.

Basic examples

The following examples illustrate the function GetAxisDistance.

Example 1

```
PERS dnum distance;  
distance := GetAxisDistance(Track,1);
```

The total distance that axis 1 on mechanical unit Track has been moving since the last reset is stored in distance.

Example 2

```
PERS dnum distanceLimit := 1000;  
PERS dnum remaining;  
remaining := distanceLimit - GetAxisDistance(Track,1);
```

The remaining distance for axis 1 on mechanical unit Track is stored in remaining.

Return value

Data type: dnum

The return value is the distance, in meters or degrees, that the axis has moved since the last reset.

Arguments

GetAxisDistance (MechUnit AxisNo)

MechUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

AxisNo

Data type: num

The number of the axis for which the traversed distance is to be read.

Prerequisites

GetAxisDistance can only return a value if the *Service Information System* configuration is done.

Example configuration

For the robot itself, configure the *SIS Parameters*.

For additional axes, configure the *SIS Single Parameters*.

Configure the type *Robot* to use the SIS configuration, with the parameter *use_sis*.

Continues on next page

2.74 GetAxisDistance - Get the traversed distance counter of the axis

RobotWare Base

Continued

Syntax

```
GetAxisDistance '('
  [ MechUnit ':' ] < variable (VAR) of mecunit > ','
  [ AxisNo ':' ] < variable (VAR) of num > ')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
ResetAxisDistance	ResetAxisDistance - Reset the traversed distance information for the axis on page 592
ResetAxisMoveTime	ResetAxisMoveTime - Reset the move time counter of the axis on page 594
GetAxisMoveTime	GetAxisMoveTime - Get the move time counter of the axis on page 1260

2 Functions

2.75 GetAxisMoveTime - Get the move time counter of the axis

RobotWare Base

2.75 GetAxisMoveTime - Get the move time counter of the axis

Usage

GetAxisMoveTime is used to read the current amount of time the axis has been moving since the last reset.

Basic examples

The following examples illustrate the function GetAxisMoveTime.

Example 1

```
PERS dnum movetime;  
movetime := GetAxisMoveTime(Track,1);
```

The total amount of time that axis 1 on mechanical unit Track has been moving since the last reset is stored in movetime.

Example 2

```
PERS dnum timeLimit := 1000;  
PERS dnum remaining;  
remaining := timeLimit - GetAxisMoveTime(Track,1);
```

The remaining time for axis 1 on mechanical unit Track is stored in remaining.

Return value

Data type: dnum

The return value is the total amount of time in hours that the axis has been moving since the last reset.

Arguments

GetAxisMoveTime (MechUnit AxisNo)

MechUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

AxisNo

Data type: num

The number of the axis for which the move time is to be read.

Syntax

```
GetAxisMoveTime '('  
  [ MechUnit ':= ' ] < variable (VAR) of mecunit > ','  
  [ AxisNo ':= ' ] < variable (VAR) of num > ')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
ResetAxisDistance	ResetAxisDistance - Reset the traversed distance information for the axis on page 592

Continues on next page

2.75 GetAxisMoveTime - Get the move time counter of the axis

RobotWare Base

Continued

For information about	See
ResetAxisMoveTime	ResetAxisMoveTime - Reset the move time counter of the axis on page 594
GetAxisDistance	GetAxisDistance - Get the traversed distance counter of the axis on page 1258

2 Functions

2.76 GetMaxNumberOfCyclicBool - Get the maximum number of Cyclic bool conditions

RobotWare Base

2.76 GetMaxNumberOfCyclicBool - Get the maximum number of Cyclic bool conditions

Usage

GetMaxNumberOfCyclicBool is used for retrieving the maximum number of Cyclic bool conditions that can be connected at the same time.

Basic examples

The following example illustrates the function GetMaxNumberOfCyclicBool.

Example 1

```
VAR num maxno := 0;  
maxno := GetMaxNumberOfCyclicBool();  
TPWrite "Maximum cyclic bool: " \Num:=maxno;
```

The maximum number of Cyclic bool conditions is displayed on the FlexPendant.

Return value

Data type: num

Syntax

```
GetMaxNumberOfCyclicBool '(' ' ')
```

A function with a return value of the data type num.

Related information

For information about	See
Setup a Cyclic bool condition	SetupCyclicBool - Setup a Cyclic bool condition on page 692
Remove a Cyclic bool condition	RemoveCyclicBool - Remove a Cyclic bool condition on page 583
Remove all Cyclic bool conditions	RemoveAllCyclicBool - Remove all Cyclic bool conditions on page 581
Cyclically evaluated logical conditions, <i>Cyclic bool</i>	<i>Application manual - Controller software Omni-Core</i>
Configuring <i>Cyclic bool</i>	<i>Technical reference manual - System parameters</i>

2.77 GetMecUnitName - Get the name of the mechanical unit

Usage

GetMecUnitName is used to get the name of a mechanical unit with one of the installed mechanical units as the argument. This function returns the mechanical units name as a string.

Basic examples

The following example illustrates the function GetMecUnitName.

Example 1

```
VAR string mecname;
mecname:= GetMecUnitName(ROB1);
```

mecname is assigned the value "ROB1" as a string. All mechanical units (data type mecunit) such as ROB1 are predefined in the system.

Return value

Data type: string

The return value will be the mechanical unit name as a string.

Arguments

```
GetMecUnitName ( MechUnit )
```

MechUnit

Mechanical Unit

Data type: mecunit

MechUnit takes one of the predefined mechanical units found in the configuration.

Syntax

```
GetMecUnitName '('
[ MechUnit ':' ] < variable (VAR) of mecunit > ')'
```

A function with a return value of the data type string.

Related information

For information about	See
Mechanical unit	mecunit - Mechanical unit on page 1672

2 Functions

2.78 GetModalPayloadMode - Get the ModalPayloadMode value

RobotWare Base

2.78 GetModalPayloadMode - Get the ModalPayloadMode value

Usage

GetModalPayloadMode is used to get the ModalPayloadMode.

Basic examples

The following example illustrates the function GetModalPayloadMode.

Example 1

```
IF GetModalPayloadMode() = 1 THEN
  GripLoad piece1;
  MoveL p1, v1000, fine, gripper;
ELSE
  MoveL p1, v1000, fine, tool2 \TLoad:=gripperpiece1;
ENDIF
```

Read the ModalPayloadMode value from the system and depending on value, use different code to specify the load used in the movement instruction.

Return value

Data type: num

The return value will be the ModalPayloadMode setting as a num.

Syntax

```
GetModalPayloadMode '(' ' ')
```

A function with a return value of the data type num.

Related information

For information about	See
System parameter <i>ModalPayloadMode</i> for activating and deactivating payload.	<i>Technical reference manual - System parameters</i>
Using payload in motion instructions.	MoveL - Moves the robot linearly on page 457

2.79 GetMotorTorque - Reads the current motor torque

Usage

GetMotorTorque is used to read the current torque of the robot and external axes motors.

GetMotorTorque is primarily used to detect if a servo gripper holds a load or not.

Basic examples

The following example illustrates the function GetMotorTorque.

See also [More examples on page 1266](#).

Example 1

```
VAR num motor_torque2;  
motor_torque2 := GetMotorTorque(2);
```

The current motor torque of the second axis of the robot is stored in motor_torque2.

Return value

Data type: num

The current motor torque in newton metre (Nm) of the stated axis of the robot or external axes.

Arguments

GetMotorTorque [\MecUnit] AxisNo

MecUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit for which an axis is to be read. If this argument is omitted, the axis for the connected robot is read.

AxisNo

Data type: num

The number of the axis to be read (1 - 6).

Program execution

The function reads the current filtered motor torque applied on the motors of the robot and external axes.

The motor torque value can also be seen as test signal number 2000 when using *TuneMaster*.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AXIS_PAR	Parameter axis in function is wrong.

Continues on next page

2 Functions

2.79 GetMotorTorque - Reads the current motor torque

RobotWare Base

Continued

More examples

The following examples illustrates the function GetMotorTorque.

Example 1

```
VAR num torque_value;  
torque_value := GetMotorTorque(\MecUnit:=STN1, 1);
```

The current motor torque of the first axis of STN1 is stored in torque_value.

Example 2

```
VAR num pre_grip_torque;  
VAR num post_grip_torque;  
..  
MoveJ p10, v1000, fine, Gripper;  
! Read the torque for axis 5 before gripping the piece  
pre_grip_torque:=GetMotorTorque(5);  
! Grip the piece  
grip_piece;  
! Read the torque for axis 5 after gripping the piece  
post_grip_torque:=GetMotorTorque(5);  
! Compare torque for axis 5 before and after gripping the piece  
piece_gripped:=check_gripped_piece(pre_grip_torque,  
    post_grip_torque);  
IF piece_gripped = TRUE THEN  
    GripLoad piece1;  
ELSE  
    TPWrite "Failed to grip the piece";  
    Stop;  
ENDIF  
..
```

The current motor torque of axis 5 of the robot is read before gripping the piece. The piece is then gripped. The torque is read once again and the torques are compared to detect if there is an actual extra load in the gripper.

Limitations

The result of GetMotorTorque will vary depending on the gear friction, motor temperature etc. Two measurements in the same position can differ. As an example gearbox temperature can change the friction and thus the result.

The limitations described above can make it impossible to detect very small changes in the torque.

It is only possible to read the current torque for the mechanical units that are controlled from current program task. For a non-motion task, it is possible to read the torque for the mechanical units controlled by the connected motion task.

Syntax

```
GetMotorTorque '('  
    ['\' MecUnit ':=' < variable (VAR) of mecunit> ',']  
    [AxisNo ':=' ] < expression (IN) of num> ')'
```

A function with a return value of the data type num.

Continues on next page

2.79 GetMotorTorque - Reads the current motor torque

RobotWare Base

Continued

Related information

For information about	See
Reads the current motor angles	ReadMotor - Reads the current motor angles on page 1414

2 Functions

2.80 GetNextCyclicBool - Get the names of all Cyclic bools

RobotWare Base

2.80 GetNextCyclicBool - Get the names of all Cyclic bools

Usage

GetNextCyclicBool is used for retrieving the names of all Cyclic bools.

Basic examples

The following examples illustrates the function GetNextCyclicBool.

Example 1

```
VAR num listno := 0;
VAR string name;
...
WHILE GetNextCyclicBool(listno, name) DO
  TPWrite "Cyclic bool: "+name;
  ! listno := listno + 1 is done by GetNextCyclicBool
ENDWHILE
```

The names of all connected Cyclic bools in the system will be displayed on the FlexPendant.

Example 2

```
PERS bool cyclicflag1;
TASK PERS bool cyclicflag2;

PROC main()
  SetupCyclicBool cyclicflag1, di1=1 AND do2=1;
  SetupCyclicBool cyclicflag2, di3=1 AND do4=0;
  WHILE GetNextCyclicBool(listno, name) DO
    TPWrite name;
    ! listno := listno + 1 is done by GetNextCyclicBool
  ENDWHILE
  ...
```

cyclicflag1 and T_ROB1/cyclicflag1 will be displayed on the FlexPendant if the RAPID code is executed in T_ROB1 RAPID task.

Return value

Data type: bool

The return value is TRUE if a Cyclic bool name was found, otherwise FALSE.

Arguments

GetNextCyclicBool(ListNumber Name)

ListNumber

Data type: num

This specifies which Cyclic bool in the system internal list of Cyclic bool names that should be retrieved. At return, this variable is always incremented by one by the system to make it easy to access the next Cyclic bool name in the list. The first Cyclic bool name in the list has index 0.

Continues on next page

Name

Data type: string

The name of the Cyclic bool persistent variable. If the persistent variable is defined as a TASK PERS, the name retrieved will be "TASK name/persistent boolean variable name".

Syntax

```
GetNextCyclicBool '('
  [ ListNumber ':' ] < variable (VAR) of num> ','
  [ Name ':' ] < variable (VAR) of string>
  ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Check if a persistent variable is a Cyclic bool	IsCyclicBool - Checks if a persistent variable is a Cyclic bool on page 1321
Setup a Cyclic bool condition	SetupCyclicBool - Setup a Cyclic bool condition on page 692
Remove a Cyclic bool condition	RemoveCyclicBool - Remove a Cyclic bool condition on page 583
Remove all Cyclic bool conditions	RemoveAllCyclicBool - Remove all Cyclic bool conditions on page 581
Cyclically evaluated logical conditions, <i>Cyclic bool</i>	<i>Application manual - Controller software Omni-Core</i>
Configuring <i>Cyclic bool</i>	<i>Technical reference manual - System parameters</i>

2 Functions

2.81 GetNextMechUnit - Get name and data for mechanical units

RobotWare Base

2.81 GetNextMechUnit - Get name and data for mechanical units

Usage

GetNextMechUnit (*Get Next Mechanical Unit*) is used for retrieving the name of mechanical units in the robot system. Besides the mechanical unit name, several optional properties of the mechanical unit can be retrieved.

Basic examples

The following example illustrates the function GetNextMechUnit.

See also [More examples on page 1271](#).

Example 1

```
VAR num listno := 0;
VAR string name := "";

TPWrite "List of mechanical units:";
WHILE GetNextMechUnit(listno, name) DO
  TPWrite name;
  ! listno := listno + 1 is done by GetNextMechUnit
ENDWHILE
```

The name of all mechanical units available in the system, will be displayed on the FlexPendant.

Return value

Data type: bool

TRUE if a mechanical unit was found, otherwise FALSE.

Arguments

```
GetNextMechUnit( ListNumber UnitName [\MecRef] [\TCPRob] [\NoOfAxes]
                [\MecTaskNo] [\MotPlanNo] [\Active] [\DriveModule]
                [\OKToDeact])
```

ListNumber

Data type: num

This specifies which items in the system internal list of mechanical units are to be retrieved. At return, this variable is always incremented by one by the system to make it easy to access the next unit in the list. The first mechanical unit in the list has index 0.

UnitName

Data type: string

The name of the mechanical unit.

[\MecRef]

Data type: mecunit

The system reference to the mechanical unit.

[\TCPRob]

Data type: bool

Continues on next page

TRUE if the mechanical unit is a TCP robot, otherwise FALSE.

`[\NoOfAxes]`

Data type: num

Number of axes for the mechanical unit. Integer value.

`[\MecTaskNo]`

Data type: num

The program task number that controls the mechanical unit. Integer value in range 1-20. If not controlling by any program task, -1 is returned.

This actual connection is defined in the system parameters domain controller (can in some application be redefined at runtime).

`[\MotPlanNo]`

Data type: num

The motion planner number that controls the mechanical unit. Integer value in range 1-6. If not controlling by any motion planner, -1 is returned.

This connection is defined in the system parameters domain controller.

`[\Active]`

Data type: bool

TRUE if the mechanical unit is active, otherwise FALSE.

`[\DriveModule]`

Data type: num

The Drive Module number 1 - 4 used by this mechanical unit.

`[\OKToDeact]`

Data type: bool

Return TRUE, if allowed to deactivate the mechanical unit from RAPID program.

More examples

More examples of the instruction `GetNextMechUnit` are illustrated below.

Example 1

```
VAR num listno := 4;
VAR string name := "";
VAR bool found := FALSE;
```

```
found := GetNextMechUnit (listno, name);
```

If `found` is set to TRUE, the name of mechanical unit number 4 will be in the variable `name`, else `name` contains only an empty string.

Syntax

```
GetNextMechUnit '('
  [ ListNumber ':= ' ] < variable (VAR) of num> ',',
  [ UnitName ':= ' ] < variable (VAR) of string> ',',
  [ '\ ' MecRef ':= ' ] < variable (VAR) of mecunit> ]
  [ '\ ' TCPRob ':= ' ] < variable (VAR) of bool> ]
```

Continues on next page

2 Functions

2.81 GetNextMechUnit - Get name and data for mechanical units

RobotWare Base

Continued

```
[ '\ ' NoOfAxes ':=' < variable (VAR) of num> ]  
[ '\ ' MecTaskNo ':=' < variable (VAR) of num> ]  
[ '\ ' MotPlanNo ':=' < variable (VAR) of num> ]  
[ '\ ' Active ':=' < variable (VAR) of bool>]  
[ '\ ' DriveModule ':=' < variable (VAR) of num>]  
[ '\ ' OKToDeact ':=' < variable (VAR) of bool>]  
' )'
```

A function with a return value of the data type bool.

Related information

For information about	See
Mechanical unit	mecunit - Mechanical unit on page 1672
Activating/Deactivating mechanical units	ActUnit - Activates a mechanical unit on page 28 DeactUnit - Deactivates a mechanical unit on page 180
Characteristics of non-value data types	<i>Technical reference manual - RAPID Overview</i> , section <i>Basic Characteristics - Data types</i>

2.82 GetNextOption - Get name of options installed

Usage

GetNextOption is for retrieving the options installed in the robot system.

Basic examples

The following example illustrates the function GetNextOption.

Example 1

```

VAR num listno:=0;
VAR string name;

TPWrite "List of options:";
WHILE GetNextOption(listno, name) DO
  TPWrite " listno: "\Num:=listno;
  TPWrite " Option: "+name;
  ! listno := listno + 1 is done by GetNextOption
ENDWHILE

```

The names of all options in the system will be displayed on the FlexPendant.

Return value

Data type: bool

TRUE if an option was found, otherwise FALSE.

Arguments

GetNextOption (ListNumber OptionName)

ListNumber

Data type: num

This specifies which item in the system-internal list of options that should be retrieved. On return, this variable is always incremented by one by the system, to make it easy to access the next option in the list. The first option in the list has index 0.

OptionName

Data type: string

The name of the option.

Syntax

```

GetNextOption '('
  [ ListNumber ':= ' ] < variable (VAR) of num> ', '
  [ OptionName ':= ' ] < variable (VAR) of string> ')'

```

A function with a return value of the data type bool.

Continues on next page

2 Functions

2.82 GetNextOption - Get name of options installed

RobotWare Base

Continued

Related information

For information about	See
Get names of installed products	GetNextProduct - Get name of products installed on page 1275

2.83 GetNextProduct - Get name of products installed

Usage

GetNextProduct is used for retrieving the products installed in the robot system.

Basic examples

The following example illustrates the function GetNextProduct.

Example 1

```
VAR num listno:=0;
VAR string name;
VAR string version;

TPWrite "List of products:";
WHILE GetNextProduct(listno, name \VersionName:=version) DO
  TPWrite " listno: "\Num:=listno;
  TPWrite " Product: "+name;
  TPWrite " Version: "+version;
  ! listno := listno + 1 is done by GetNextProduct
ENDWHILE
```

The names of all the products in the system and the versions of them will be displayed on the FlexPendant.

Return value

Data type: bool

TRUE if a product was found, otherwise FALSE.

Arguments

GetNextProduct (ListNumber ProductName [\VersionName])

ListNumber

Data type: num

This specifies which item in the system internal list of products that should be retrieved. At return, this variable is always incremented by one by the system to make it easy to access the next product in the list. The first product in the list has index 0.

ProductName

Data type: string

The name of the product.

[\VersionName]

Data type: string

The version name of the product.

Syntax

```
GetNextProduct '('
  [ ListNumber ':= ' ] < variable (VAR) of num> ',',
  [ ProductName ':= ' ] < variable (VAR) of string>
```

Continues on next page

2 Functions

2.83 GetNextProduct - Get name of products installed

RobotWare Base

Continued

['\\' VersionName ':= '] < variable (**VAR**) of string> ')'

A function with a return value of the data type bool.

Related information

For information about	See
Get name of installed option	GetNextOption - Get name of options installed on page 1273

2.84 GetNextSym - Get next matching symbol

Usage

GetNextSym (*Get Next Symbol*) is used together with SetDataSearch to retrieve data objects from the system.

Basic examples

The following example illustrates the function GetNextSym.

Example 1

```
VAR datapos block;
VAR string name;
VAR bool truevar:=TRUE;
...
SetDataSearch "bool" \Object:="my.*" \InMod:="mymod"\LocalSym;
WHILE GetNextSym(name,block) DO
    SetDataVal name\Block:=block,truevar;
ENDWHILE
```

This session will set all local bool data objects that begin with my in the module mymod to TRUE.

Return value

Data type: bool

TRUE if a new object has been retrieved, the object name and its enclosed block is then returned in its arguments.

FALSE if no more objects match.

Arguments

GetNextSym (Object Block [\Recursive])

Object

Data type: string

Variable (VAR or PERS) to store the name of the data object that will be retrieved.

Block

Data type: datapos

The enclosed block to the object.

[\Recursive]

Data type: switch

This will force the search to enter the block below, for example, if the search session has begun at the task level, it will also search modules and routines below the task.

Syntax

```
GetNextSym '('
    [ Object ':= ' ] < variable or persistent (INOUT) of string > ','
    [ Block ':= ' ] <variable (VAR) of datapos>
```

Continues on next page

2 Functions

2.84 GetNextSym - Get next matching symbol

RobotWare Base

Continued

['\ ' Recursive] ') '

A function with a return value of the data type bool.

Related information

For information about	See
Define a symbol set in a search session	SetDataSearch - Define the symbol set in a search sequence on page 674
Get the value of a data object	GetDataVal - Get the value of a data object on page 225
Set the value of a data object	SetDataVal - Set the value of a data object on page 679
Set the value of many data objects	SetAllDataVal - Set a value to all data objects in a defined set on page 670
The related data type datapos	datapos - Enclosing block for a data object on page 1627

2.85 GetNumberOfCyclicBool - Get the number of Cyclic bool conditions

Usage

GetNumberOfCyclicBool is used for retrieving the number of connected Cyclic bool conditions.

Basic examples

The following example illustrates the function GetNumberOfCyclicBool.

Example 1

```
VAR num listno := 0;
listno := GetNumberOfCyclicBool();
TPWrite "Connected Cyclic bool: " \Num:=listno;
```

The number of connected Cyclic bool conditions is displayed on the FlexPendant.

Return value

The number of connected Cyclic bool conditions.

Syntax

GetNumberOfCyclicBool '(' ' ')

A function with a return value of the data type num.

Related information

For information about	See
Setup a Cyclic bool condition	SetupCyclicBool - Setup a Cyclic bool condition on page 692
Remove a Cyclic bool condition	RemoveCyclicBool - Remove a Cyclic bool condition on page 583
Remove all Cyclic bool conditions	RemoveAllCyclicBool - Remove all Cyclic bool conditions on page 581
Cyclically evaluated logical conditions, Cyclic bool	<i>Application manual - Controller software Omni-Core</i>
Configuring Cyclic bool	<i>Technical reference manual - System parameters</i>

2 Functions

2.86 GetServiceInfo - Get service information from the system *RobotWare Base*

2.86 GetServiceInfo - Get service information from the system

Usage

GetServiceInfo is used to read service information from the system. This function returns the service information as a string.

Basic examples

The following example illustrates the function GetServiceInfo.

See also [More examples on page 1281](#).

Example 1

```
VAR string mystring;
VAR num mynum;
IF TaskRunRob() THEN
  mystring:=GetServiceInfo(ROB_ID \DutyTimeCnt);
  IF StrToVal(mystring, mynum) = FALSE THEN
    TPWrite "Conversion failed!";
    Stop;
  ENDIF
ENDIF
```

If the task controls a robot, use the predefined variable ROB_ID to read the duty time counter. Then convert the string value to a numeric value.

Return value

Data type: string

The value of the service information for the specified mechanical unit. Read more about the return values in *Arguments* below.

Arguments

GetServiceInfo (MechUnit [*\DutyTimeCnt*])

MechUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit to get information for.

[*\DutyTimeCnt*]

Duty Time Counter

Data type: switch

Returns the duty time counter for the mechanical unit used in argument MechUnit. A string with "0" is returned if this option is used in the Virtual Controller.

The duty time counter is the value in hours that the mechanical unit has been in motors on and brakes have been released.

Program execution

Service information is read for the used optional parameter.

Continues on next page

More examples

More examples of how to use the function GetServiceInfo are illustrated below.

Example 1

```
VAR string mystring;
mystring:=GetServiceInfo(ROB_1 \DutyTimeCnt);
TPWrite "DutyTimeCnt for ROB_1: " + mystring;
mystring:=GetServiceInfo(ROB_2 \DutyTimeCnt);
TPWrite "DutyTimeCnt for ROB_2: " + mystring;
mystring:=GetServiceInfo(INTERCH \DutyTimeCnt);
TPWrite "DutyTimeCnt for INTERCH: " + mystring;
mystring:=GetServiceInfo(STN_1 \DutyTimeCnt);
TPWrite "DutyTimeCnt for STN_1: " + mystring;
mystring:=GetServiceInfo(STN_2 \DutyTimeCnt);
TPWrite "DutyTimeCnt for STN_2: " + mystring;
```

Get information about the duty time counter for all mechanical units in a multimove system, and write the values on the FlexPendant.

Syntax

```
GetServiceInfo '('
  [MechUnit ':=' ] <variable (VAR) of mecunit> ','
  ['\ ' DutyTimeCnt] ')'
```

A function with a return value of the data type string.

Related information

For information about	See
Mechanical unit	mecunit - Mechanical unit on page 1672.

2 Functions

2.87 GetSignalOrigin - Get information about the origin of an I/O signal *RobotWare Base*

2.87 GetSignalOrigin - Get information about the origin of an I/O signal

Usage

GetSignalOrigin is used to get information about the origin of an I/O signal.

Basic examples

The following examples illustrate the function GetSignalOrigin:

Example 1

```
VAR signalorigin myorig;
VAR string signalname;
...
myorig:=GetSignalOrigin(mysignal, signalname);
IF myorig = SIGORIG_NONE THEN
    TPWrite "Signal cannot be used. AliasIO needed.";
ELSEIF myorig = SIGORIG_CFG THEN
    TPWrite "Signal "+signalname+" is defined in I/O configuration.";
ELSEIF myorig = SIGORIG_ALIAS THEN
    TPWrite "Signal is declared in RAPID.";
    TPWrite "Name according to the I/O configuration: "+signalname;
ENDIF
```

The code above can be used to determine the origin of the signal named mysignal.

Return value

Data type: signalorigin

The signalorigin as described in the table below.

Return value	Symbolic constant	Comment
0	SIGORIG_NONE	The I/O signal variable is declared in RAPID and has no alias coupling.
1	SIGORIG_CFG	The signal is configured in I/O configuration.
2	SIGORIG_ALIAS	The I/O signal variable is declared in RAPID and has an alias coupling to an I/O signal configured in I/O configuration.

Arguments

GetSignalOrigin Signal SignalName

Signal

Data type: signalxx

The signal name. Must be of data type signaldo, signaldi, signalgo, signalgi, signalao, or signalai.

SignalName

Data type: string

The signal name according to the I/O configuration, or empty string.

Continues on next page

Program execution

The function returns one of the following predefined signal origins: SIGORIG_NONE, SIGORIG_CFG, or SIGORIG_ALIAS.

If SIGORIG_NONE is returned, SignalName consists of an empty string.

If SIGORIG_CFG or SIGORIG_ALIAS is returned, the argument SignalName contains the I/O signal name according to the I/O configuration.

GetSignalOrigin can be used in generic programs to check if a signal has an alias coupling and if it is a coupling to the right physical I/O signal.

Syntax

```
GetSignalOrigin
[Signal ':='] <variable (VAR) of anytype>', '
[SignalName ':='] <variable (VAR) of string>;'
```

Related information

For information about	See
Input/Output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>
Defining I/O signals with alias name	AliasIO - Define I/O signal with alias name on page 34
Resetting IO signal with alias name	AliasIOReset - Resetting I/O signal with alias name on page 37
Data type signalorigin	signalorigin - Describes the I/O signal origin on page 1723

2 Functions

2.88 GetSysInfo - Get information about the system

RobotWare Base

2.88 GetSysInfo - Get information about the system

Usage

GetSysInfo is used to read information about the system. The available information includes serial number, software version, software version name, robot type, controller ID, WAN IP address, controller language, and system name.

Basic examples

The following example illustrates the function GetSysInfo.

Example 1

```
VAR string serial;  
VAR string version;  
VAR string versionname;  
VAR string rtype;  
VAR string cid;  
VAR string lanip;  
VAR string clang;  
VAR string sysname;  
serial := GetSysInfo(\SerialNo);  
version := GetSysInfo(\SWVersion);  
versionname := GetSysInfo(\SWVersionName);  
rtype := GetSysInfo(\RobotType);  
cid := GetSysInfo(\CtrlId);  
lanip := GetSysInfo(\LanIp);  
clang := GetSysInfo(\CtrlLang);  
sysname := GetSysInfo(\SystemName);
```

Examples of returned strings:

Description	Variable	Return value
Serial number	serial	11-12345
Software version	version	7.0.0+416
Software version name	versionname	7.0.0
Robot number	rtype	IRB 2400-16/1.5 Type A
Controller ID	cid	MyRobot
WAN IP address	lanip	192.168.8.103
Controller language	clang	en
Active system	sysname	MySystem

Return value

Data type: string

The return value is a string with serial number, software version, software version name, robot type, controller ID, WAN IP address, controller language, and system name. Read more about the return values in [Arguments on page 1285](#) below.

Continues on next page

Arguments

```
GetSysInfo ([\SerialNo] | [\SWVersion] | [\SWVersionName] |
            [\RobotType] | [\CtrlId] | [\LanIp] | [\CtrlLang] |
            [\SystemName])
```

At least one of the arguments must be present.

[\SerialNo]

Serial Number

Data type: switch

Returns the serial number.

[\SWVersion]

Software Version

Data type: switch

Returns the version of the product RobotControl.

[\SWVersionName]

Software Version Name

Data type: switch

Returns the version display name of RobotControl.

[\RobotType]

Data type: switch

Returns the robot type in the current or connected task. If the mechanical unit is not a TCP-robot, a dash (-) is returned.

[\CtrlId]

Controller ID

Data type: switch

Returns the controller ID. Returns an empty string if no controller ID is specified. The string VC is returned if used on a virtual controller.

[\LanIp]

Lan Ip address

Data type: switch

Returns the WAN IP address for the controller. The string VC is returned if used on a virtual controller. An empty string is returned if no WAN IP address is configured in the system.

[\CtrlLang]

Controller Language

Data type: switch

Returns the language used on the controller.

Return value	Language
cs	Czech
zh	Chinese (simplified Chinese, mainland Chinese)

Continues on next page

2 Functions

2.88 GetSysInfo - Get information about the system

RobotWare Base

Continued

Return value	Language
da	Danish
nl	Dutch
en	English
fi	Finnish
fr	French
de	German
hu	Hungarian
it	Italian
ja	Japanese
ko	Korean
pl	Polish
pt	Portuguese (Brazilian Portuguese)
ro	Romanian
ru	Russian
sl	Slovenian
es	Spanish
sv	Swedish
tr	Turkish
vi	Vietnamese

[SystemName]

Data type: switch

The controller name will be mirrored into the system name.

The controller name is set in the installer.

Syntax

```
GetSysInfo '('  
  ['\'SerialNo]  
  |['\' SWVersion]  
  |['\' SWVersionName]  
  |['\' RobotType]  
  |['\' CtrlId]  
  |['\' LanIp]  
  |['\' CtrlLang]  
  |['\' SystemName']')'
```

A function with a return value of the data type string.

Related information

For information about	See
Test the identity of the system	IsSysId - Test system identity on page 1339

2.89 GetTaskName - Gets the name and number of current task

Usage

GetTaskName is used to get the identity of the current program task, with its name and number.

It is also possible from some *Non Motion Task* to get the name and number of its connected *Motion Task*. For *MultiMove System* the system parameter *Controller/Tasks/Use Mechanical Unit Group* define the connected *Motion Task* and in a base system the main task is always the connected *Motion Task* from any other task.

Basic examples

The following examples illustrate the function GetTaskName.

Example 1

```
VAR string taskname;
...
taskname := GetTaskName();
```

The current task name is returned in the variable taskname.

Example 2

```
VAR string taskname;
VAR num taskno;
...
taskname := GetTaskName(\TaskNo:=taskno);
```

The current task name is returned in the variable taskname. The integer identity of the task is stored in the variable taskno.

Example 3

```
VAR string taskname;
VAR num taskno;
...
taskname := GetTaskName(\MecTaskNo:=taskno);
```

If current task is a *Non Motion Task* task, the name of the connected motion task is returned in the variable taskname. The numerical identity of the connected motion task is stored in the variable taskno.

If current task controls some mechanical units, current task name is returned in the variable taskname. The numerical identity of the task is stored in the variable taskno.

Return value

Data type: string

The name of the task in which the function is executed or the name of the connected motion task.

Arguments

```
GetTaskName ( [\TaskNo] | [\MecTaskNo] )
```

Continues on next page

2 Functions

2.89 GetTaskName - Gets the name and number of current task

RobotWare Base

Continued

[\TaskNo]

Data type: num

Return current task name (same functionality if none of the switch \TaskNo or \MecTaskNo is used). Also get the identity of the current task represented as a integer value. The numbers returned will be in the range 1-20.

[\MecTaskNo]

Data type: num

Return connected motion task name or current motion task name. Also get the identity of connected or current motion task represented as a integer value. The numbers returned will be in the range 1-20.

Syntax

```
GetTaskName '('  
  [ \TaskNo ':= ' ] < variable (VAR) of num >  
  [ \MecTaskNo ':= ' ] < variable (VAR) of num > ')'
```

A function with a return value of the data type string.

Related information

For information about	See
Check if task run some TCP robot	TaskRunRob - Check if task controls some robot on page 1494
Multitasking	<i>Technical reference manual - RAPID Overview, section</i> RAPID Overview - RAPID summary Multitasking <i>Technical reference manual - RAPID Overview, section</i> Basic characteristics - Multitasking

2.90 GetTime - Reads the current time as a numeric value

Usage

GetTime is used to read a specified component of the current system time as a numeric value.

GetTime can be used to:

- have the program perform an action at a certain time
- perform certain activities on a weekday
- abstain from performing certain activities on the weekend
- respond to errors differently depending on the time of day.

Basic examples

The following example illustrates the function GetTime.

See also [More examples on page 1290](#).

Example 1

```
hour := GetTime(\Hour);
```

The current hour is stored in the variable hour.

Return value

Data type: num

One of the four time components specified below.

Arguments

```
GetTime ( [\WDay] | [\Hour] | [\Min] | [\Sec] | [\MSec] )
```

[\WDay]

Data type: switch

Return the current weekday. Range: 1 to 7 (Monday to Sunday).

[\Hour]

Data type: switch

Return the current hour. Range: 0 to 23.

[\Min]

Data type: switch

Return the current minute. Range: 0 to 59.

[\Sec]

Data type: switch

Return the current second. Range: 0 to 59.

[\MSec]

Data type: switch

Return the current millisecond. Range: 0 to 999.

One of the arguments must be specified, otherwise program execution stops with an error message.

Continues on next page

2 Functions

2.90 GetTime - Reads the current time as a numeric value

RobotWare Base

Continued

More examples

More examples of the function GetTime are illustrated below.

Example 1

```
weekday := GetTime(\WDay);
hour := GetTime(\Hour);
IF weekday < 6 AND hour >6 AND hour < 16 THEN
  production;
ELSE
  maintenance;
ENDIF
```

If it is a weekday and the time is between 7:00 and 15:59 the robot performs production. At all other times, the robot is in the maintenance mode.

Syntax

```
GetTime '('
  [ '\ ' WDay ]
  | [ '\ ' Hour ]
  | [ '\ ' Min ]
  | [ '\ ' Sec ]
  | [ '\ ' MSec ] ')'

```

A function with a return value of the type num.

Related information

For information about	See
Time and date instructions	<i>Technical reference manual - RAPID Overview</i> , section <i>RAPID summary - System & time</i>
Setting the system clock	<i>Operating manual - OmniCore</i> , section <i>Changing FlexPendant settings</i>

2.91 GetTorqueMargin - Reads the least torque margin

Usage

GetTorqueMargin is used to read the least torque margin since ResetTorqueMargin was executed and can be used on both robot and external axes.

Basic examples

The following examples illustrate the function GetTorqueMargin.

Example 1

```
VAR num torque_margin;
ResetTorqueMargin \AxisNo:=5;
! Insert Program Here
! ...
! ...
torque_margin := GetTorqueMargin (5);
```

The least torque margin, since the last execution of ResetTorqueMargin 5, from the axis 5 of the robot is stored in torque_margin.

Example 2

```
VAR num torque_margin1;
VAR num torque_margin2;
VAR num torque_margin3;

ResetTorqueMargin \AxisNo:=5;
! Insert Program Here
! ...
! ...
torque_margin1 := GetTorqueMargin (5);
ResetTorqueMargin 5;
! Change arm config
! Insert Program Here
! ...
! ...
torque_margin2 := GetTorqueMargin (5);
ResetTorqueMargin 5;
! Change arm config
! Insert Program Here
! ...
! ...
torque_margin3 := GetTorqueMargin (5);

! compare torque_margin1, torque_margin2, torque_margin3 etc
```

Return value

Data type: num

The least torque margin in % available torque since ResetTorqueMargin was executed.

Continues on next page

2 Functions

2.91 GetTorqueMargin - Reads the least torque margin

RobotWare Base

Continued

Arguments

GetTorqueMargin [\MecUnit] AxisNo

[\MecUnit]

Data type: mecunit

The name of the mechanical unit for which an axis is to be read. If this argument is omitted, the axis for the connected robot is read.

AxisNo

Data type: num

The number of the axis to be read (1 - 6).

Program execution

The function reads the least motor torque from the last ResetTorqueMargin.

The motor torque margin can also be read by the test signal number 4040. (This signal always shows the current torque margin.)

Limitations

When external forces affect the robot, care need to be taken not to overstress the structure. This method only reads the torque value on the motors.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_AXIS_PAR	Parameter axis in function is wrong.

Syntax

```
GetTorqueMargin '('  
  [ '\ ' MechUnit ':= ' ] < variable (VAR) of mecunit > ', '  
  [ '\ ' AxisNo ':= ' < expression (IN) of num > ] ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Reset torque margin	ResetTorqueMargin - Reset least torque margin on page 599

2.92 GetTSPStatus - Get current task selection panel status

Usage

GetTSPStatus is used to check if a task is checked or unchecked in the **Task Selection Panel** on the FlexPendant.

Basic examples

The following example illustrates the function GetTSPStatus.

Example 1

```

VAR tsp_status tspstatus;
...
tspstatus:=GetTSPStatus("MYTASK");
IF tspstatus >= TSP_NORMAL_UNCHECKED AND tspstatus <=
    TSP_SEMISTATIC_UNCHECKED THEN
    TPWrite "Task MYTASK is unchecked in the Task Selection Panel";
ELSEIF tspstatus >= TSP_NORMAL_CHECKED THEN
    TPWrite "Task MYTASK is checked in the Task Selection Panel";
ELSE
    TPWrite "Task MYTASK is unchecked in TSP due to execution in
        service routine";
ENDIF

```

Check if program task MYTASK is checked or unchecked in the **Task Selection Panel** on the FlexPendant.

Return value

Data type: tsp_status

The current task selection panel status.

Arguments

GetTSPStatus (TaskRef | TaskName)

TaskRef

Data type: taskId

The program task identity of the task that should be checked.

The predefined variables of the data type taskId is available for all program tasks in the system.

The variable identity is "*taskname*"+"Id", for example the variable identity for the T_ROB1 task is T_ROB1Id.

TaskName

Data type: string

The program task name of the task that should be checked.

Predefined data

The following predefined symbolic constants of type tsp_status can be used to check the return value:

```
CONST tsp_status TSP_UNCHECKED_RUN_SERV_ROUT := 10;
```

Continues on next page

2 Functions

2.92 GetTSPStatus - Get current task selection panel status

RobotWare Base

Continued

```
CONST tsp_status TSP_NORMAL_UNCHECKED := 11;
CONST tsp_status TSP_STATIC_UNCHECKED := 12;
CONST tsp_status TSP_SEMISTATIC_UNCHECKED := 13;
CONST tsp_status TSP_NORMAL_CHECKED := 14;
CONST tsp_status TSP_STATIC_CHECKED := 15;
CONST tsp_status TSP_SEMISTATIC_CHECKED := 16;
```

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

ERR_TASKNAME	The program task name in argument <code>\TaskName</code> cannot be found in the system.

Syntax

```
GetTSPStatus '('
  [ TaskRef ':= ' ] <variable (VAR) of taskid>
  |[ TaskName ':= ' ] <expression (IN) of string> ')'
```

A function with a return value of the data type `tsp_status`.

Related information

For information about	See
Task selection panel status	tsp_status - Task selection panel status on page 1769
Check if a normal task is active	TaskIsActive - Check if a normal task is active on page 1497

2.93 GetUASUserName - Get user name of logged in user

Usage

GetUASUserName is used to get the user name of the user currently logged in from the FlexPendant.

Basic examples

The following example illustrates the function GetUASUserName.

Example 1

```
VAR string strUser;
...
strUser := GetUASUserName();
```

The user name of the currently logged in user is returned in the variable strUser.

Return value

Data type: string

The user name of the currently logged in user.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_TP_NO_CLIENT	There is no user logged in on the FlexPendant, i.e no FlexPendant is currently in use.

More examples

The following example illustrates the function GetUASUserName.

See also [More examples on page 1295](#).

Example 1

```
VAR string user_name:="No user";
...
IF UIClientExist() = TRUE THEN
  user_name:=GetUASUserName();
ENDIF
```

The user name of the currently logged in user is returned in the variable user_name. If running without any FlexPendant, the user_name contains the string "No user".

Syntax

```
GetUASUserName(' ')
```

A function with a return value of the data type string.

Related information

For information about	See
User Authorization System (UAS)	<i>Operating manual - RobotStudio</i>

Continues on next page

2 Functions

2.93 GetUASUserName - Get user name of logged in user

RobotWare Base

Continued

For information about	See
Check if user client exists	UIClientExist - Exist User Client on page 1531

2.94 GInput - Read value of group input signal

Usage

GInput is used to read the current value of a group of digital input signals.

Basic examples

The following example illustrates the function GInput.

Example 1

```
IF GInput(gi2) = 5 THEN ...
...
IF gi2 = 5 THEN ...
```

If the current value of the signal gi2 is equal to 5, then ...

Return value

Data type: num

The current value of the signal (a positive integer).

The values of each signal in the group are read and interpreted as an unsigned binary number. This binary number is then converted to an integer.

The value returned lies within a range that is dependent on the number of signals in the group.

Number of signals	Allowed value
1	0-1
2	0-3
3	0-7
4	0-15
5	0-31
6	0-63
7	0-127
8	0-255
9	0-511
10	0-1023
11	0-2047
12	0-4095
13	0-8191
14	0-16383
15	0-32767
16	0-65535
17	0-131071
18	0-262143
19	0-524287
20	0-1048575

Continues on next page

2 Functions

2.94 GInput - Read value of group input signal

RobotWare Base

Continued

Number of signals	Allowed value
21	0-2097151
22	0-4194303
23	0-8388607

Arguments

GInput (Signal)

Signal

Data type: signalgi

The name of the signal group to be read.

Syntax

```
GInput '('  
  [Signal ':='] <variable (VAR) of signalgi>')'
```

A function with a return value of data type num.

Related information

For information about	See
Read value of group input signal with more than 23 bits	GInputDnum - Read value of group input signal on page 1299
Input/Output instructions	<i>Technical reference manual - RAPID Overview, section RAPID Summary - Input and Output Signals</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview, section Motion and I/O Principles - I/O principles</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

2.95 GInputDnum - Read value of group input signal

Usage

GInputDnum is used to read the current value of a group of digital input signals larger than 23 bits.

Basic examples

The following examples illustrate the function GInputDnum.

Example 1

```
IF GInputDnum(gi2) = 55 THEN ...
```

If the current value of the signal gi2 is equal to 55, then ...

Example 2

```
IF GInputDnum(gi2) = 4294967295 THEN ...
```

If the current value of the signal gi2 is equal to 4294967295, then ...

Return value

Data type: dnum

The current value of the signal (a positive integer).

The values of each signal in the group are read and interpreted as an unsigned binary number. This binary number is then converted to an integer.

The value returned lies within a range that is dependent on the number of signals in the group.

Number of signals	Allowed value
1	0-1
2	0-3
3	0-7
4	0-15
5	0-31
6	0-63
7	0-127
8	0-255
9	0-511
10	0-1023
11	0-2047
12	0-4095
13	0-8191
14	0-16383
15	0-32767
16	0-65535
17	0-131071
18	0-262143

Continues on next page

2 Functions

2.95 GInputDnum - Read value of group input signal

RobotWare Base

Continued

Number of signals	Allowed value
19	0-524287
20	0-1048575
21	0-2097151
22	0-4194303
23	0-8388607
24	0-16777215
25	0-33554431
26	0-67108863
27	0-134217727
28	0-268435455
29	0-536870911
30	0-1073741823
31	0-2147483647
32	0-4294967295

Arguments

GInputDnum (Signal)

Signal

Data type: signalgi

The name of the signal group to be read.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Syntax

```
GInputDnum '('  
  [ Signal ':' '=' ] < variable (VAR) of signalgi > ')'
```

A function with a return value of data type dnum.

Related information

For information about	See
Read value of group input signal	GInput - Read value of group input signal on page 1297

Continues on next page

2.95 GInputDnum - Read value of group input signal

RobotWare Base

Continued

For information about	See
Input/Output instructions	<i>Technical reference manual - RAPID Overview, section RAPID Summary - Input and Output Signals</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview, section Motion and I/O Principles - I/O principles</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

2 Functions

2.96 GOutput - Reads the value of a group of digital output signals

RobotWare Base

2.96 GOutput - Reads the value of a group of digital output signals

Usage

GOutput is used to read the current value of a group of digital output signals.

Basic examples

The following example illustrates the function GOutput.

Example 1

```
IF GOutput(go2) = 5 THEN ...
```

If the current value of the signal go2 is equal to 5, then ...

Return value

Data type: num

The current value of the signal (a positive integer).

The values of each signal in the group are read and interpreted as an unsigned binary number. This binary number is then converted to an integer.

The value returned lies within a range that is dependent on the number of signals in the group.

No. of signals	Permitted value
1	0-1
2	0-3
3	0-7
4	0-15
5	0-31
6	0-63
7	0-127
8	0-255
9	0-511
10	0-1023
11	0-2047
12	0-4095
13	0-8191
14	0-16383
15	0-32767
16	0-65535
17	0-131071
18	0-262143
19	0-524287
20	0-1048575
21	0-2097151

Continues on next page

2.96 GOutput - Reads the value of a group of digital output signals

RobotWare Base

Continued

No. of signals	Permitted value
22	0-4194303
23	0-8388607

Arguments

GOutput (Signal)

Signal

Data type: signalgo

The name of the signal group to be read.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Syntax

```
GOutput '('
  [ Signal ':' ] < variable (VAR) of signalgo > ')'
```

A function with a return value of data type num.

Related information

For information about	See
Set an output signal group	SetGO - Changes the value of a group of digital output signals on page 684
Read a group of output signals	GOutputDnum - Read value of group output signal on page 1304
Read a group of input signals	GInputDnum - Read value of group input signal on page 1299
Input/Output instructions	Technical reference manual - RAPID Overview, section RAPID Summary - Input and Output Signals
Input/Output functionality in general	Technical reference manual - RAPID Overview, section Motion and I/O Principles - I/O Principles
Configuration of I/O	Technical reference manual - System parameters

2 Functions

2.97 GOutputDnum - Read value of group output signal RobotWare Base

2.97 GOutputDnum - Read value of group output signal

Usage

GOutputDnum is used to read the current value of a group of digital output signals larger than 23 bits.

Basic examples

The following examples illustrate the function GOutputDnum.

Example 1

```
IF GOutputDnum(go2) = 55 THEN ...
```

If the current value of the signal go2 is equal to 55, then ...

Example 2

```
IF GOutputDnum(go2) = 4294967295 THEN ...
```

If the current value of the signal go2 is equal to 4294967295, then ...

Return value

Data type: dnum

The current value of the signal (a positive integer).

The values of each signal in the group are read and interpreted as an unsigned binary number. This binary number is then converted to an integer.

The value returned lies within a range that is dependent on the number of signals in the group.

Number of signals	Allowed value
1	0-1
2	0-3
3	0-7
4	0-15
5	0-31
6	0-63
7	0-127
8	0-255
9	0-511
10	0-1023
11	0-2047
12	0-4095
13	0-8191
14	0-16383
15	0-32767
16	0-65535
17	0-131071
18	0-262143

Continues on next page

2.97 GOutputDnum - Read value of group output signal

RobotWare Base

Continued

Number of signals	Allowed value
19	0-524287
20	0-1048575
21	0-2097151
22	0-4194303
23	0-8388607
24	0-16777215
25	0-33554431
26	0-67108863
27	0-134217727
28	0-268435455
29	0-536870911
30	0-1073741823
31	0-2147483647
32	0-4294967295

Arguments

GOutputDnum (Signal)

Signal

Data type: signalgo

The name of the signal group to be read.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Syntax

```
GOutputDnum '('
  [ Signal ':' ] < variable (VAR) of signalgo > ')'
```

A function with a return value of data type dnum.

Related information

For information about	See
Set an output signal group	SetGO - Changes the value of a group of digital output signals on page 684

Continues on next page

2 Functions

2.97 GOutputDnum - Read value of group output signal

RobotWare Base

Continued

For information about	See
Input/Output instructions	<i>Technical reference manual - RAPID overview, section RAPID Summary - Input and Output Signals</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID overview, section Motion and I/O Principles</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

2.98 HexToDec - Convert from hexadecimal to decimal

Usage

HexToDec is used to convert a number specified in a readable string in the base 16 to the base10.

The input string should be constructed from the character set [0-9,A-F,a-f].

This routine handle numbers from 0 up to 9223372036854775807dec or 7FFFFFFFFFFFFFFF hex.

Basic examples

The following example illustrates the function HexToDec.

Example 1

```
VAR string str;
```

```
str := HexToDec("5F5E0FF");
```

The variable str is given the value "99999999".

Return value

Data type: string

The string converted to a decimal representation of the given number in the inparameter string.

Arguments

```
HexToDec ( Str )
```

Str

String

Data type: string

The string to convert.

Syntax

```
HexToDec '('  
[ Str ':' ] <expression (IN) of string> ')'
```

A function with a return value of the data type string.

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview</i> , section <i>RAPID summary - String functions</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview</i> , section <i>Basic characteristics - Basic elements</i>

2 Functions

2.99 IndInpos - Independent axis in position status

Independent Axis

2.99 IndInpos - Independent axis in position status

Usage

IndInpos is used to test whether an independent axis has reached the selected position.

Basic examples

The following example illustrates the function IndInpos.

Example 1

```
IndAMove Station_A,1\ToAbsNum:=90,20;  
WaitUntil IndInpos(Station_A,1) = TRUE;  
WaitTime 0.2;
```

Wait until axis 1 of Station_A is in the 90 degrees position.

Return value

Data type: bool

The table describes the return values from IndInpos:

Return value	Axis status
TRUE	In position and has zero speed.
FALSE	Not in position and/or has not zero speed.

Arguments

IndInpos (MecUnit Axis)

MecUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

Axis

Data type: num

The number of the current axis for the mechanical unit (1-6).

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AXIS_ACT	The axis is not activated.
ERR_AXIS_IND	The axis is not in independent mode.

Limitations

An independent axis executed with the instruction IndCMove always returns the value FALSE, even when the speed is set to zero.

Continues on next page

A wait period of 0.2 seconds should be added after the instruction, to ensure that the correct status has been achieved. This time period should be longer for external axes with poor performance.

Syntax

```
IndInpos '('
  [MecUnit ':='] <variable (VAR) of mecunit>','
  [Axis ':='] <expression (IN) of num>')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Independent axes in general	<i>Technical reference manual - RAPID Overview, section Motion and I/O Principles - Positioning during program execution</i>
Other independent instruction and functions	<i>Technical reference manual - RAPID Overview, section RAPID summary - Motion</i>
Check the speed status for independent axes	<i>IndSpeed - Independent speed status on page 1310</i>
Activating independent joints	<i>Technical reference manual - System parameters, topic Motion, type Arm</i>

2 Functions

2.100 IndSpeed - Independent speed status

Independent Axis

2.100 IndSpeed - Independent speed status

Usage

IndSpeed is used to test whether an independent axis has reached the selected speed.

Basic examples

The following example illustrates the function IndSpeed.

Example 1

```
IndCMove Station_A, 2, 3.4;  
WaitUntil IndSpeed(Station_A,2 \InSpeed) = TRUE;  
WaitTime 0.2;
```

Wait until axis 2 of Station_A has reached the speed 3.4 degrees/s.

Return value

Data type: bool

The table describes the return values from IndSpeed \IndSpeed:

Return value	Axis status
TRUE	Has reached the selected speed.
FALSE	Has not reached the selected speed.

The table describes the return values from IndSpeed \ZeroSpeed:

Return value	Axis status
TRUE	Zero speed.
FALSE	Not zero speed

Arguments

IndSpeed (MecUnit Axis [\InSpeed] | [\ZeroSpeed])

MecUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

Axis

Data type: num

The number of the current axis for the mechanical unit (1-6).

[\InSpeed]

Data type: switch

IndSpeed returns value TRUE if the axis has reached the selected speed otherwise FALSE.

[\ZeroSpeed]

Data type: switch

Continues on next page

IndSpeed returns value TRUE if the axis has zero speed otherwise FALSE.

If both the arguments \InSpeed and \ZeroSpeed are omitted, an error message will be displayed.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AXIS_ACT	The axis is not activated.
ERR_AXIS_IND	The axis is not in independent mode.

Limitation

The function IndSpeed\InSpeed will always return the value FALSE in the following situations:

- The robot is in manual mode with reduced speed.
- The speed is reduced using the VelSet instruction.
- The speed is reduced from the production window.

A wait period of 0.2 seconds should be added after the instruction to ensure that the correct status is obtained. This time period should be longer for external axes with poor performance.

Syntax

```
IndSpeed '('
  [MecUnit ':='] <variable (VAR) of mecunit>','
  [Axis ':='] <expression (IN) of num>
  ['\ ' InSpeed] | ['\ ' ZeroSpeed]')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Independent axes in general	<i>Technical reference manual - RAPID Overview, section Motion and I/O principles - Positioning during program execution</i>
Other independent instruction and functions	<i>Technical reference manual - RAPID Overview, section RAPID summary - Motion</i>
More examples	IndCMove - Independent continuous movement on page 264
Check the position status for independent axes	IndInpos - Independent axis in position status on page 1308
Activating independent joints	<i>Technical reference manual - System parameters, topic Motion, type Arm</i>

2 Functions

2.101 IODeviceState - Get current state of I/O device

RobotWare Base

2.101 IODeviceState - Get current state of I/O device

Usage

IODeviceState is used to find out the current state of an I/O device. It is physical state and logical state define the status for an I/O device.

Basic examples

The following examples illustrate the function IODeviceState.

Example 1

```
IF (IODeviceState("UNIT1" \Phys)=IO_DEVICE_PHYS_STATE_ACCESSIBLE)
    THEN
        ! Possible to access some signal on the I/O device
    ELSE
        ! Read/Write some signal on the I/O device result in error
    ENDIF
```

Test is done to see if the I/O device UNIT1 is up and running.

Example 2

```
IF (IODeviceState("UNIT1" \Logic)=IO_DEVICE_LOG_STATE_DEACTIVATED)
    THEN
        ! Device is deactivated by user from RAPID or FlexPendant
    ELSE
        ! Device is enabled.
    ENDIF
```

Test is done to see if the I/O device UNIT1 is deactivated.

Return value

Data type: iodevice_state

The return value has different values depending on if the optional arguments \Phys or \Logic is used. If neither \Phys or \Logic is used, the physical state is returned.

\Phys

The state of the I/O device as defined in the table below when using optional argument \Phys.

Return value	Symbolic constant	Comment
1	IO_DEVICE_PHYS_STATE_INIT	The I/O device is created, no communication with the I/O device.
2	IO_DEVICE_PHYS_STATE_ACCESSIBLE	The communication with the I/O device is established.
3	IO_DEVICE_PHYS_STATE_REMOVED	No communication with the I/O device, it has been removed from the network.
4	IO_DEVICE_PHYS_STATE_DEACTIVATED	No communication with the I/O device, it has been deactivated by the user.

Continues on next page

Return value	Symbolic constant	Comment
5	IO_DEVICE_PHYS_STATE_FAULTY	Recoverable or unrecoverable error discovered on the I/O device.

\Logic

The I/O device logical states describes the state a user can order the I/O device into. The state of the I/O device as defined in the table below when using optional argument \Logic.

Return value	Symbolic constant	Comment
10	IO_DEVICE_LOG_STATE_DEACTIVATED	The I/O device is ordered to de-establish communication by user.
11	IO_DEVICE_LOG_STATE_ACTIVATED	The I/O device is ordered to establish communication by user.

Arguments

IODeviceState (DeviceName [\Phys] | [\Logic])

DeviceName

Data type: string

The name of the I/O device to be checked (with same name as configured).

[\Phys]

Physical

Data type: switch

If using this parameter the physical state of the I/O device is read.

[\Logic]

Logical

Data type: switch

If using this parameter the logical state of the I/O device is read.

Syntax

```
IODeviceState '('
  [DeviceName ':='] <expression (IN) of string>
  ['\' Phys] | ['\' Logic']')'
```

A function with a return value of the data type `iodevice_state`.

Related information

For information about	See
State of I/O device	iodevice_state - State of I/O device on page 1659
Activate an I/O device	IOActivate - Activate an I/O device on page 282
Deactivate an I/O device	IODeactivate - Deactivate an I/O device on page 285
Input/output instructions	Technical reference manual - RAPID Overview

Continues on next page

2 Functions

2.101 IODeviceState - Get current state of I/O device

RobotWare Base

Continued

For information about	See
Input/output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

2.102 IONetworkState - Get current state of I/O network

Usage

IONetworkState is used to read the state of a certain I/O network. Its physical state and logical state define the status for an I/O network.

Basic examples

The following examples illustrate the instruction IONetworkState:

Example 1

```
VAR ionetwork_state nwstate;

nwstate:=IONetworkState("IBS" \Phys);
TEST nwstate
CASE IO_NETWORK_PHYS_STATE_ACCESSIBLE:
    ! Possible to access the signals on the IBS network
DEFAULT:
    ! Actions for not up and running IBS network
ENDTEST
```

The instruction returns the physical I/O network state of IBS in the `nwstate` variable of type `ionetwork_state`.

Example 2

```
VAR ionetwork_state nwstate;

nwstate:=IONetworkState("IBS" \Logic);
TEST nwstate
CASE IO_NETWORK_LOG_STATE_ACTIVATED:
    ! The IBS network is started
DEFAULT:
    ! Actions for stopped IBS network
ENDTEST
```

The instruction returns the logical I/O network state of IBS in the `nwstate` variable of type `ionetwork_state`.

Return value

Data type: `ionetwork_state`

The return value has different values depending on if the optional arguments `\Phys` or `\Logic` is used. If neither `\Phys` or `\Logic` is used, the physical state is returned.

\Phys

The I/O network physical state describes the state that the fieldbus driver can order the bus into. The state of the I/O network is defined in the table below when using optional argument `\Phys`.

Return value	Symbolic constant	Comment
1	IO_NETWORK_PHYS_STATE_STOPPED	The communication on the network is stopped.

Continues on next page

2 Functions

2.102 IONetworkState - Get current state of I/O network

RobotWare Base

Continued

Return value	Symbolic constant	Comment
2	IO_NETWORK_PHYS_STATE_ACCESSIBLE	The communication on the network is established.
3	IO_NETWORK_PHYS_STATE_FAULTY	Recoverable or unrecoverable error discovered on the network.

\Logic

The I/O network logical states describe the state a user can order the network into. The state of the I/O network is defined in the table below when using optional argument \Logic.

Return value	Symbolic constant	Comment
10	IO_NETWORK_LOG_STATE_DEACTIVATED	The network is NOT ordered to its running operation mode. Trouble with the network hardware might be reported, but no communication is possible.
11	IO_NETWORK_LOG_STATE_ACTIVATED	The network is ordered to its running operation mode. Any trouble with the network hardware or communication is reported.

Arguments

IONetworkState (NetworkName [\Phys] | [\Logic])

NetworkName

Data type: string

The name of I/O network to get state about.

[\Phys]

Physical

Data type: switch

If using this parameter the physical state of the I/O network is read.

[\Logic]

Logical

Data type: switch

If using this parameter the logical state of the I/O network is read.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NAME_INVALID	The I/O network name does not exist.

Continues on next page

Syntax

```
IONetworkState '('  
  [NetworkName ':='] <expression (IN) of string>  
  ['\' Phys' | ['\' Logic']')'
```

A function with a return value of the data type `ionetwork_state`.

Related information

For information about	See
Definition of I/O network state	ionetwork_state - State of I/O network on page 1660
Input/output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

2 Functions

2.103 IsBrakeCheckActive - Test if brake check is running

RobotWare Base

2.103 IsBrakeCheckActive - Test if brake check is running

Usage

IsBrakeCheckActive is used to test if there is an ongoing brake test, i.e. if any of the `CyclicBrakeCheck` or `BrakeCheck` procedures are active (executing or stopped) on any execution level.

Basic examples

The following example illustrates the function `IsBrakeCheckActive`.

Example 1

```
WHILE IsBrakeCheckActive() = TRUE THEN
  WaitTime 1;
ENDWHILE
...
```

Test to see if a brake test routine is active. If it is active, then wait until it is ready.

Return value

Data type: `bool`

The function returns `TRUE` if there is an ongoing brake test.

Syntax

```
IsBrakeCheckActive '(' ' ')
```

A function with a return value of the data type `bool`.

Related information

For information about	See
BrakeCheck	<i>Operating manual - OmniCore</i>

2.104 IsCollFree - Checks if position would collide

Usage

IsCollFree is used to test whether the robot would collide if positioned in a joint position, provided as an argument to the function. In *MultiMove* systems, several joint positions for different robots can be provided.

Basic examples

The following example illustrates the function IsCollFree.

Example 1

```
IF IsCollFree(testpos) THEN
  MoveAbsJ testpos, v50, fine, tool1;
ENDIF
```

Checks if the position (jointtarget) testpos is a collision free position before moving there.

Example 2

```
IF IsCollFree(testpos1 \Rob2Pos:=testpos2 \Rob3Pos:=testpos3) THEN
  TPWrite "No collisions"
ENDIF
```

Assumed that the calling RAPID task controls Rob1. Checks if the positions testpos1 for Rob1, testpos2 for Rob2 and testpos3 for Rob3 will result in a collision or not.

Return value

Data type: bool

The function returns TRUE if the specified joint positions will not result in a collision, otherwise FALSE.

Arguments

```
IsCollFree ThisRobotPos [\Rob1Pos] [\Rob2Pos] [\Rob3Pos] [\Rob4Pos]
```

ThisRobotPos

Data type: jointtarget

The position that is checked whether it is collision free or not. For the robot controlled by the calling RAPID task.

Rob1Pos

Data type: jointtarget

Checking if collision when also Rob1 has position Rob1Pos in *MultiMove* systems. Cannot be set if the calling RAPID task controls Rob1, since then ThisRobotPos specifies the position of that robot.

Rob2Pos

Data type: jointtarget

Continues on next page

2 Functions

2.104 IsCollFree - Checks if position would collide

RobotWare Base

Continued

Checking if collision when also Rob2 has position Rob2Pos in *MultiMove* systems. Cannot be set if the calling RAPID task controls Rob2, since then ThisRobotPos specifies the position of that robot.

Rob3Pos

Data type: jointtarget

Checking if collision when also Rob3 has position Rob3Pos in *MultiMove* systems. Cannot be set if the calling RAPID task controls Rob3, since then ThisRobotPos specifies the position of that robot.

Rob4Pos

Data type: jointtarget

Checking if collision when also Rob4 has position Rob4Pos in *MultiMove* systems. Cannot be set if the calling RAPID task controls Rob4, since then ThisRobotPos specifies the position of that robot.

Limitations

- If *MultiMove* system and an optional argument is not provided, the function will use the measured position of the robot. To get reliable results, the robots not provided in IsCollFree should be standing still.
- Does not check if the movement to the position provided will result in a collision. As in Example 1 above, the position testpos can be collision free, but the movement towards that position can result in a collision.

Syntax

```
IsCollFree '('  
  [ ThisRobotPos ':' < expression (IN) of jointtarget > ','  
  [ '\ ' Rob1Pos ':' < expression (IN) of jointtarget >]  
  [ '\ ' Rob2Pos ':' < expression (IN) of jointtarget >]  
  [ '\ ' Rob3Pos ':' < expression (IN) of jointtarget >]  
  [ '\ ' Rob4Pos ':' < expression (IN) of jointtarget >]  
)'
```

A function with a return value of the data type bool.

Related information

For information about	See
Collision prediction	<i>Application manual - Controller software Omni-Core</i>

2.105 IsCyclicBool - Checks if a persistent variable is a Cyclic bool

Usage

IsCyclicBool is used to test if a persistent boolean is a Cyclic bool or not, i.e. if a logical condition has been connected to the persistent boolean variable with the instruction SetupCyclicBool.

Basic examples

The following examples illustrate the function IsCyclicBool.

Example 1

```
PERS bool cyclicflag1;

PROC main()
  TPWrite "cyclicflag1 is a cyclic bool:
    \"Bool:=IsCyclicBool(cyclicflag1);
  SetupCyclicBool cyclicflag1, di1=1 AND do2=1;
  TPWrite "cyclicflag1 is a cyclic bool:
    \"Bool:=IsCyclicBool(cyclicflag1);
  ...
```

The text cyclicflag1 is a cyclic bool: FALSE is first written on the FlexPendant. After execution of SetupCyclicBool the persistent boolean variable is a Cyclic bool, and the second text will be cyclicflag1 is a cyclic bool: TRUE.

Example 2

```
TASK PERS bool cyclicflag1;

PROC main()
  SetupCyclicBool cyclicflag1, di1=1 AND do2=1;
  TPWrite "cyclicflag1 is a cyclic bool: "
    \"Bool:=IsCyclicBool("cyclicflag1");
  ...
```

Using a text string as input to specify the cyclic bool name in IsCyclicBool function. The text written to the FlexPendant will be cyclicflag1 is a cyclic bool: TRUE.

Example 3

```
..
TPWrite "cyclicflag1 is a cyclic bool: "
  \"Bool:=IsCyclicBool("cyclicflag1", \"TaskName:=\"T_ROB1");
..
```

Using a text string as input to specify the cyclic bool name in IsCyclicBool function. The text written to the FlexPendant will be cyclicflag1 is a cyclic bool: TRUE if the cyclicflag1 has been connected to a logical condition with instruction SetupCyclicBool in T_ROB1 RAPID task, otherwise the text written to the FlexPendant will be cyclicflag1 is a cyclic bool: FALSE.

Continues on next page

2 Functions

2.105 IsCyclicBool - Checks if a persistent variable is a Cyclic bool

RobotWare Base

Continued

Return value

Data type: bool

The function will return TRUE if a logical condition has been connected to the persistent boolean with instruction SetupCyclicBool, otherwise FALSE.

Arguments

IsCyclicBool (Flag | Name [\TaskRef] | [\TaskName])

Flag

Data type: bool

The persistent boolean variable that should be checked.

Name

Data type: string

The name of the persistent boolean variable that should be checked.

[\TaskRef]

Task Reference

Data type: taskId

The program task identity where the SetupCyclicBool instruction has been executed. This argument should only be used for a Cyclic bool that is declared as TASK PERS and when using IsCyclicBool function from a RAPID task that has not connected the logical condition to the persistent boolean variable with SetupCyclicBool instruction.

For all program tasks in the system, predefined variables of the data type taskId will be available. The variable identity will be "taskname"+"Id", for example, for the T_ROB1 task the variable identity will be T_ROB1Id.

[\TaskName]

Data type: string

The program task name where the SetupCyclicBool instruction has been executed. This argument should only be used for a Cyclic bool that is declared as TASK PERS and when using IsCyclicBool function from a RAPID task that has not connected the logical condition to the persistent boolean variable with SetupCyclicBool instruction.

If none of the arguments \TaskRef or \TaskName are specified then the current task is used.

Program execution

The names of the Cyclic bools are stored in the system as a character string. For a PERS bool m1 the name stored is m1. For a TASK PERS bool m2 the name will be "T_ROB1/m2" if the setup is done with instruction SetupCyclicBool in RAPID task T_ROB1.

If the function is used with argument Flag or Name it checks first if the persistent name exist in the list of Cyclic bools to see if it is a PERS declared variable that has been connected to a condition with SetupCyclicBool. If it did not find any

Continues on next page

Cyclic bool with that name, it also test if it is a TASK PERS with adding current executing task before the name of the persistent name ("T_R0B1/name").

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_TASKNAME	The program task name in argument \TaskName cannot be found in the system.

Syntax

```
IsCyclicBool '('
  [ [ Flag ':= ' ] <persistent (PERS) of bool>
  | [ [ Name ':= ' ] <expression (IN) of string> ', '
  | ['\ ' TaskRef ':= ' <variable (VAR) of taskid>]
  | ['\ ' TaskName ':= ' <expression (IN) of string> ] ')'

```

A function with a return value of the data type bool.

Related information

For information about	See
Setup a Cyclic bool condition	SetupCyclicBool - Setup a Cyclic bool condition on page 692
Remove a Cyclic bool condition	RemoveCyclicBool - Remove a Cyclic bool condition on page 583
Remove all Cyclic bool conditions	RemoveAllCyclicBool - Remove all Cyclic bool conditions on page 581
Cyclically evaluated logical conditions, <i>Cyclic bool</i>	<i>Application manual - Controller software Omni-Core</i>
Configuring <i>Cyclic bool</i>	<i>Technical reference manual - System parameters</i>

2 Functions

2.106 IsFile - Check the type of a file

RobotWare Base

2.106 IsFile - Check the type of a file

Usage

The `IsFile` function obtains information about the named file or directory and checks whether it is the same as the specified type. If no type is specified, only an existence check is performed.

The path argument specifies the file. Read, write or execute permission for the named file is not required, but all directories listed in the path name leading to the file must be searchable.

Basic examples

The following example illustrates the function `IsFile`.

See also [More examples on page 1325](#).

Example 1

```
PROC printFT(string filename)
  IF IsFile(filename \Directory) THEN
    TPWrite filename+" is a directory";
    RETURN;
  ENDIF
  IF IsFile(filename \Fifo) THEN
    TPWrite filename+" is a fifo file";
    RETURN;
  ENDIF
  IF IsFile(filename \RegFile) THEN
    TPWrite filename+" is a regular file";
    RETURN;
  ENDIF
  IF IsFile(filename \BlockSpec) THEN
    TPWrite filename+" is a block special file";
    RETURN;
  ENDIF
  IF IsFile(filename \CharSpec) THEN
    TPWrite filename+" is a character special file";
    RETURN;
  ENDIF
ENDPROC
```

This example prints out the filename and the type of the specified file on the FlexPendant.

Return value

Data type: `bool`

The function will return `TRUE` if the specified type and actual type match, otherwise `FALSE`. When no type is specified, it returns `TRUE` if the file exists and otherwise `FALSE`.

Continues on next page

Arguments

IsFile (Path [\Directory] [\Fifo] [\RegFile] [\BlockSpec]
 [\CharSpec])

Path

Data type: string

The file specified with a full or relative path.

[\Directory]

Data type: switch

Is the file a directory.

[\Fifo]

Data type: switch

Is the file a fifo file.

[\RegFile]

Data type: switch

Is the file a regular file, that is, a normal binary, ISO 8859-1 (Latin-1) or UTF8 file.

[\BlockSpec]

Data type: switch

Is the file a block special file.

[\CharSpec]

Data type: switch

Is the file a character special file.

Program execution

This function returns a bool that specifies match or not.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	The file does not exist and there is a type specified.

More examples

More examples of the function IsFile are illustrated below.

Example 1

This example implements a generic traverse of a directory structure function.

```
PROC searchdir(string dirname, string actionproc)
  VAR dir directory;
  VAR string filename;
  IF IsFile(dirname \Directory) THEN
    OpenDir directory, dirname;
    WHILE ReadDir(directory, filename) DO
```

Continues on next page

2 Functions

2.106 IsFile - Check the type of a file

RobotWare Base

Continued

```
        ! .. and . is the parent and resp. this directory
        IF filename <> ".." AND filename <> "." THEN
            searchdir dirname+"/"+filename, actionproc;
        ENDIF
    ENDWHILE
    CloseDir directory;
ELSE
    %actionproc% dirname;
ENDIF
ERROR
    RAISE;
ENDPROC

PROC listfile(string filename)
    TPWrite filename;
ENDPROC

PROC main()
    ! Execute the listfile routine for all files found under the
    ! tree of HOME:
    searchdir "HOME:", "listfile";
ENDPROC
```

This program traverses the directory structure under the "HOME:" and for each file found, it calls the listfile procedure. The searchdir is the generic part that knows nothing about the start of the search or which routine should be called for each file. It uses IsFile to check whether it has found a subdirectory or a file and it uses the late binding mechanism to call the procedure specified in actionproc for all files found. The actionproc routine should be a procedure with one parameter of the type string.

Limitations

This function is not possible to use against field buses.

If using against FTP or NFS mounted discs, the file existence or type information is not always updated. To get correct information an explicit order may be needed against the search path (with instruction Open) before using IsFile.

Syntax

```
Isfile '('
    [ Path ':' = ' ] < expression (IN) of string>
    [ '\\' Directory ]
    | [ '\\' Fifo ]
    | [ '\\' RegFile ]
    | [ '\\' BlockSpec ]
    | [ '\\' CharSpec ] ')'

```

A function with a return value of the data type bool.

Continues on next page

Related information

For information about	See
Directory	dir - File directory structure on page 1629
Open a directory	OpenDir - Open a directory on page 504
Close a directory	CloseDir - Close a directory on page 147
Read a directory	ReadDir - Read next entry in a directory on page 1408
Make a directory	MakeDir - Create a new directory on page 343
Remove a directory	RemoveDir - Delete a directory on page 585
Rename a file	RenameFile - Rename a file on page 588
Remove a file	RemoveFile - Delete a file on page 587
Copy a file	CopyFile - Copy a file on page 163
Check file size	FileSize - Retrieve the size of a file on page 1249
Check file system size	FSSize - Retrieve the size of a file system on page 1255
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

2 Functions

2.107 IsLeadThrough - Check lead-through status

YuMi, GoFa

2.107 IsLeadThrough - Check lead-through status

Usage

IsLeadThrough is used to get information about the lead-through status for a TCP robot.

Basic examples

The following examples illustrate the function IsLeadThrough.

Example 1

```
VAR bool leadthrough:=FALSE;  
leadthrough:=IsLeadThrough();
```

Checks if lead-through is set for the active TCP robot in this task. For example, if executed in RAPID task T_ROB_L it checks if lead-through is set for the TCP robot ROB_L.

Example 2

```
VAR bool leadthrough:=FALSE;  
leadthrough:=IsLeadThrough(\MechUnit:=ROB_R);
```

Checks if lead-through is set for the TCP robot ROB_R.

Example 3

```
VAR bool leadthrough:=FALSE;  
leadthrough:=IsLeadThrough(\MechUnit:=ROB_R \Active);
```

Checks if lead-through is active for the TCP robot ROB_R.

Example 4

```
SetLeadThrough \On \NoStopMove;  
TPWrite "Set: "+ValToStr(IsLeadThrough(\MechUnit:=ROB_R \Set));  
TPWrite "Active: "+ValToStr(IsLeadThrough(\MechUnit:=ROB_R  
    \Active));  
..  
StopMove;  
TPWrite "Set: "+ValToStr(IsLeadThrough(\MechUnit:=ROB_R \Set));  
TPWrite "Active: "+ValToStr(IsLeadThrough(\MechUnit:=ROB_R  
    \Active));
```

Checks if lead-through is set and active for the TCP robot ROB_R. The lead-through is not active until a StopMove instruction has been executed or the program execution has been stopped.

The print out will be:

Set: TRUE

Active: FALSE

Set: TRUE

Active: TRUE

Return value

Data type: bool

Continues on next page

Arguments

IsLeadThrough (\MechUnit \Active | \Set)

\MechUnit

Mechanical unit

Data type: mecunit

The name of the TCP robot.

The argument \MechUnit is optional. If it is omitted, the check will be done for the mechanical unit represented by the predefined RAPID variable ROB_ID, which is a reference to the TCP robot in the current program task.

If \MechUnit is omitted and IsLeadThrough is used from a non-motion task, the check will be done for the TCP robot in the connected motion task.

\Active

Data type: switch

TRUE if lead-through has been activated.

FALSE if lead-through has been deactivated with SetLeadThrough \Off.

FALSE can also be returned if a SetLeadThrough \On \NoStopMove has been executed. It is the StopMove order, or stop of program execution that activates lead-through.

\Set

Data type: switch

TRUE if lead-through has been set.

FALSE if lead-through has been reset.

If neither of the switches are used, the default behavior is \Set.

Limitations

The mechanical unit has to be a TCP robot.

The function IsLeadThrough can only be used for YuMi and GoFa robots.

Syntax

```
IsLeadThrough '('
  ['\MechUnit ':=' < variable (VAR) of mecunit> ',']
  ['\Active'] | ['\Set']')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Activate and deactivate lead-through	SetLeadThrough - Activate and deactivate lead-through on page 687

2 Functions

2.108 IsMechUnitActive - Is mechanical unit active

RobotWare Base

2.108 IsMechUnitActive - Is mechanical unit active

Usage

IsMechUnitActive (*Is Mechanical Unit Active*) is used to check whether a mechanical unit is activated or not.

Basic examples

The following example illustrates the function IsMechUnitActive.

Example 1

```
IF IsMechUnitActive(SGUN_1)
  CloseGun SGUN_1;
```

If the mechanical unit SpotWeldGun is active, the routine CloseGun will be invoked in which the gun is closed.

Return value

Data type: bool

The function returns:

- TRUE, if the mechanical unit is active
 - FALSE, if the mechanical unit is deactivated
-

Arguments

IsMechUnitActive (MechUnit)

MechUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit.

Syntax

```
IsMechUnitActive '('  
  [ MechUnit ':='] < variable (VAR) of mecunit> ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Activating mechanical units	ActUnit - Activates a mechanical unit on page 28
Deactivating mechanical units	DeactUnit - Deactivates a mechanical unit on page 180
Mechanical units	mecunit - Mechanical unit on page 1672

2.109 IsPers - Is persistent

Usage

IsPers is used to test if a data object is a persistent variable or not.

Basic examples

The following example illustrates the function IsPers.

Example 1

```

PROC procedure1 (INOUT num parameter1)
  IF IsVar(parameter1) THEN
    ! For this call reference to a variable
    ...
  ELSEIF IsPers(parameter1) THEN
    ! For this call reference to a persistent variable
    ...
  ELSE
    ! Should not happen
    EXIT;
  ENDIF
ENDPROC

```

The procedure procedure1 will take different actions depending on whether the actual parameter parameter1 is a variable or a persistent variable.

Return value

Data type: bool

TRUE if the tested actual INOUT parameter is a persistent variable. FALSE if the tested actual INOUT parameter is not a persistent variable.

Arguments

IsPers (DatObj)

DatObj

Data Object

Data type: anytype

The name of the formal INOUT parameter.

Syntax

```

IsPers '('
  [ DatObj ':' ] < variable or persistent (INOUT) of anytype >
  ')'

```

A function with a return value of the data type bool.

Related information

For information about	See
Test if variable	IsVar - Is variable on page 1340

Continues on next page

2 Functions

2.109 IsPers - Is persistent

RobotWare Base

Continued

For information about	See
Types of parameters (access modes)	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Routines</i>

2.110 IsStopMoveAct - Is stop move flags active

Usage

IsStopMoveAct is used to get the status of the stop move flags for a current or connected motion task.

Basic examples

The following examples illustrate the function IsStopMoveAct.

Example 1

```
stopflag2:= IsStopMoveAct(\FromNonMoveTask);
```

stopflag2 will be TRUE if the stop move flag from non-motion tasks is set in current or connected motion task, else it will be FALSE.

Example 2

```
IF IsStopMoveAct(\FromMoveTask) THEN
  StartMove;
ENDIF
```

If the stop move flag from motion task is set in the current motion task, it will be reset by the StartMove instruction.

Return value

Data type: bool

The return value will be TRUE if the selected stop move flag is set, else the return value will be FALSE.

Arguments

IsStopMoveAct ([\FromMoveTask] | [\FromNonMoveTask])

[\FromMoveTask]

Data type: switch

FromMoveTask is used to get the status of the stop move flag of type private motion task.

This type of stop move flag can only be set by:

- The motion task itself with instruction StopMove
- After leaving the RestoPath level in the program
- At execution in an asynchronous error handler for process- or motion errors before any StorePath and after any RestoPath

[\FromNonMoveTask]

Data type: switch

FromNonMoveTask is used to get the status of the stop move flag of type any non-motion tasks. This type of stop move flag can only be set by any non-motion task in connected or all motion tasks with the instruction StopMove.

Syntax

IsStopMoveAct '('

Continues on next page

2 Functions

2.110 IsStopMoveAct - Is stop move flags active

RobotWare Base

Continued

```
[ '\ ' FromMoveTask]  
| [ '\ ' FromNonMoveTask] ' )'
```

A function with a return value of the data type bool.

Related information

For information about	See
Stop robot movement	StopMove - Stops robot movement on page 792
Restart robot movement	StartMove - Restarts robot movement on page 763

2.111 IsStopStateEvent - Test whether moved program pointer

Usage

IsStopStateEvent returns information about the movement of the Program Pointer (PP) in current program task.

Basic examples

The following example illustrates the function IsStopStateEvent.

Example 1

```

IF IsStopStateEvent (\PPMoved) = TRUE THEN
  ! PP has been moved during the last program stop
ELSE
  ! PP has not been moved during the last program stop
ENDIF

IF IsStopStateEvent (\PPToMain) THEN
  ! PP has been moved to main routine during the last program stop
ENDIF

```

Return value

Data type: bool

Status if and how PP has been moved during the last stop state.

TRUE if PP has been moved during the last stop.

FALSE if PP has not been moved during the last stop.

If PP has been moved to the main routine, both \PPMoved and \PPToMain will return TRUE.

If PP has been moved to a routine, both \PPMoved and \PPToMain will return TRUE.

If PP has been moved within a list of a routine, \PPMoved will return TRUE and \PPToMain will return FALSE.

After calling a service routine (keep execution context in main program sequence) \PPMove will return FALSE and \PPToMain will return FALSE.

Arguments

IsStopStateEvent ([\PPMoved] | [\PPToMain])

[\PPMoved]

Data type: switch

Test whether PP has been moved.

[\PPToMain]

Data type: switch

Test whether PP has been moved to main or to a routine.

Continues on next page

2 Functions

2.111 IsStopStateEvent - Test whether moved program pointer

RobotWare Base

Continued

Limitations

This function in most cases cannot be used during forward or backward execution because the system is in stop state between every single step.

Syntax

```
IsStopStateEvent '('  
    ['\' PPMoved] | ['\' PPToMain] ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Making own instructions	<i>Technical reference manual - RAPID Overview</i>

2.112 IsSyncMoveOn - Test if in synchronized movement mode

Usage

IsSyncMoveOn is used to test if the current program task of type Motion Task is in synchronized movement mode or not.

It is also possible from some Non Motion Task to test if the connected Motion Task is in synchronized movement mode or not. The system parameter *Controller/Tasks/Use Mechanical Unit Group* define the connected Motion Task. When the Motion Task is executing at StorePath level IsSyncMoveOn will test if the task is in synchronized mode on that level, independently of the synchronized mode on the original level.

The instruction IsSyncMoveOn is usually used in a *MultiMove* system with option *Coordinated Robots* but can be used in any system and in any program task.

Basic examples

The following example illustrates the function IsSyncMoveOn.

Example 1

Program example in task T_ROB1

```
PERS tasks task_list{2} := [ ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync1;
VAR syncident sync2;
VAR syncident sync3;
```

```
PROC main()
...
MoveL p_zone, vmax, z50, tcp1;
WaitSyncTask sync1, task_list;
MoveL p_fine, v1000, fine, tcp1;
syncmove;
...
ENDPROC
```

```
PROC syncmove()
SyncMoveOn sync2, task_list;
MoveL * \ID:=10, v100, z10, tcp1 \WOBJ:= rob2_obj;
MoveL * \ID:=20, v100, fine, tcp1 \WOBJ:= rob2_obj;
SyncMoveOff sync3;
UNDO
SyncMoveUndo;
ENDPROC
```

Program example in task BCK1

```
PROC main()
...
IF IsSyncMoveOn() THEN
! Connected Motion Task is in synchronized movement mode
ELSE
! Connected Motion Task is in independent mode
```

Continues on next page

2 Functions

2.112 IsSyncMoveOn - Test if in synchronized movement mode

RobotWare Base

Continued

```
ENDIF
...
ENDPROC
```

At the execution time of IsSyncMoveOn, in the background task BCK1, we test if the connected motion task at that moment is in synchronized movement mode or not.

Return value

Data type: bool

TRUE if current or connected program task is in synchronized movement mode at the moment, otherwise FALSE.

Program execution

Test if current or connected program task is in synchronized movement mode at the moment or not. If the MotionTask is executing at StorePath level, the SyncMoveOn will test if the task is in synchronized movement on the StorePath level, not on the original level.

Syntax

```
IsSyncMoveOn '(' ' ')
```

A function with a return value of the data type bool.

Related information

For information about	See
Specify cooperated program tasks	tasks - RAPID program tasks on page 1749
Identity for synchronization point	syncident - Identity for synchronization point on page 1745
Start coordinated synchronized movements	SyncMoveOn - Start coordinated synchronized movements on page 811
End coordinated synchronized movements	SyncMoveOff - End coordinated synchronized movements on page 805
Set independent movements	SyncMoveUndo - Set independent movements on page 821
Store path and execute on new level	StorePath - Stores the path when an interrupt occurs on page 798

2.113 IsSysId - Test system identity

Usage

IsSysId (*System Identity*) can be used to test the system identity using the system serial number.

Basic examples

The following example illustrates the function IsSysId.

Example 1

```
IF NOT IsSysId("6400-1234") THEN
  ErrWrite "System identity fault", "Faulty system identity for
  this program";
  EXIT;
ENDIF
```

The program is made for a special robot system with serial number 6400-1234 and cannot be used by another robot system.

Return value

Data type: bool

TRUE = The robot system serial number is the same as specified in the test.

FALSE = The robot system serial number is not the same as specified in the test.

Arguments

IsSysId (SystemId)

SystemId

Data type: string

The robot system serial number, marking the system identity.

Syntax

```
IsSysId '('
  [ SystemId ':= ' ] < expression (IN) of string> ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Read system information	GetSysInfo - Get information about the system on page 1284

2 Functions

2.114 IsVar - Is variable

RobotWare Base

2.114 IsVar - Is variable

Usage

IsVar is used to test whether a data object is a variable or not.

Basic examples

The following example illustrates the function IsVar.

Example 1

```
PROC procedure1 (INOUT num parameter1)
  IF IsVAR(parameter1) THEN
    ! For this call reference to a variable
    ...
  ELSEIF IsPers(parameter1) THEN
    ! For this call reference to a persistent variable
    ...
  ELSE
    ! Should not happen
    EXIT;
  ENDIF
ENDPROC
```

The procedure procedure1 will take different actions, depending on whether the actual parameter parameter1 is a variable or a persistent variable.

Return value

Data type: bool

TRUE if the tested actual INOUT parameter is a variable. FALSE if the tested actual INOUT parameter is not a variable.

Arguments

IsVar (DatObj)

DatObj

Data Object

Data type: anytype

The name of the formal INOUT parameter.

Syntax

```
IsVar '('
  [ DatObj ':' ] < variable or persistent (INOUT) of anytype >
  ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Test if persistent	IsPers - Is persistent on page 1331

Continues on next page

For information about	See
Types of parameters (access modes)	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Routines</i>

2 Functions

2.115 Max - Get the largest of two values

RobotWare Base

2.115 Max - Get the largest of two values

Usage

Max returns the largest of two arguments.

Basic examples

The following example illustrates the function Max.

Example 1

```
reg1 := Max(reg2, reg3)
```

reg1 is assigned the largest value of reg2 and reg3.

Return value

Data type: num

Returns the largest of the two arguments.

Arguments

Max (A, B)

A

Data type: num

First numeric value.

B

Data type: num

Second numeric value.

Syntax

```
Max '('  
  [A ':=' ] < expression (IN) of num > ',' '  
  [B ':=' ] < expression (IN) of num > ')' '
```

A function with a return value of the data type num.

Related information

For information about	See
Min function	Min - Get the smallest of two values on page 1347
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2.116 MaxExtLinearSpeed - Maximum additional axis speed

Usage

MaxExtLinearSpeed (Maximum Additional Axis Linear Speed) returns the maximum linear speed for the additional axes in the current motion task.

Basic examples

The following example illustrates the function MaxExtLinearSpeed.

Example 1

```
TPWrite "Max. Linear speed in mm/s for my axis="\Num:=  
    MaxExtLinearSpeed ();
```

The message Max. Linear speed in mm/s for my axis = 5000 is written on the FlexPendant (value depends on the configuration).

Return value

Data type: num

Returns the maximum (vmax) linear speed in mm/s for the additional axes in this task.

Syntax

```
MaxExtLinearSpeed '(' ' ')
```

A function with a return value of the data type num.

Related information

For information about	See
Definition of vmax velocity	speeddata - Speed data on page 1729
Configuring max additional axis linear speed	<i>Technical reference manual - System parameters, parameter Ext. Axis Linear Max Speed (m/s)</i>

2 Functions

2.117 MaxExtReorientSpeed - Maximum additional axis rotational speed

RobotWare Base

2.117 MaxExtReorientSpeed - Maximum additional axis rotational speed

Usage

MaxExtReorientSpeed (Maximum Additional Axis Rotational Speed) returns the maximum rotational speed for the additional axes in the current motion task.

Basic examples

The following example illustrates the function MaxExtReorientSpeed.

Example 1

```
TPWrite "Max. Rotational speed in deg/s for my axis="\Num:=  
    MaxExtReorientSpeed ();
```

The message Max. Rotational speed in deg/s for my axis = 1000 is written on the FlexPendant (value depends on the configuration).

Return value

Data type: num

Returns the maximum (vmax) rotational speed in deg/s for the additional axes in this task.

Syntax

```
MaxExtReorientSpeed '(' ' ')
```

A function with a return value of the data type num.

Related information

For information about	See
Definition of vmax velocity	speeddata - Speed data on page 1729
Configuring max additional axis rotational speed	<i>Technical reference manual - System parameters, parameter Ext. Axis Rotational Max Speed (deg/s)</i>

2.118 MaxRobReorientSpeed - Maximum reorient speed of robot

Usage

MaxRobReorientSpeed (Maximum Robot Reorient Speed) returns the maximum TCP reorient speed for the robot.

Basic examples

The following example illustrates the function MaxRobReorientSpeed.

Example 1

```
TPWrite "TCP Reorient Max Speed in deg/s for my robot="\Num:=  
MaxRobReorientSpeed ();
```

The message TCP Reorient Max Speed in deg/s for my robot = 500 is written on the FlexPendant (value depends on the configuration).

Return value

Data type: num

Returns the maximum (vmax) TCP reorient speed in deg/s for the used robot and normal practical TCP values.

If extremely large TCP values are used in the tool frame, you can create your own speeddata with lower TCP reorient speed than returned by MaxRobReorientSpeed.

Syntax

```
MaxRobReorientSpeed '(' ' ')
```

A function with a return value of the data type num.

Related information

For information about	See
Definition of vmax velocity	speeddata - Speed data on page 1729
Configuring max TCP reorientation speed	<i>Technical reference manual - System parameters, parameter TCP Reorient Max Speed (deg/s)</i>

2 Functions

2.119 MaxRobSpeed - Maximum robot speed

RobotWare Base

2.119 MaxRobSpeed - Maximum robot speed

Usage

MaxRobSpeed (*Maximum Robot Speed*) returns the maximum TCP speed for the robot.

Basic examples

The following example illustrates the function MaxRobSpeed.

Example 1

```
TPWrite "Max. TCP speed in mm/s for my robot="\Num:=MaxRobSpeed();
```

The message Max. TCP speed in mm/s for my robot = 7000 is written on the FlexPendant (value depends on the configuration).

Return value

Data type: num

Returns the maximum (v_{max}) TCP speed in mm/s for the used robot and normal practical TCP values.

If extremely large TCP values are used in the tool frame, you can create your own speeddata with bigger TCP speed than returned by MaxRobSpeed and use VelSet to allow larger speed.

Syntax

```
MaxRobSpeed '(' ' ' )'
```

A function with a return value of the data type num.

Related information

For information about	See
Definition of v_{max} velocity	speeddata - Speed data on page 1729
Definition of maximum velocity	VelSet - Changes the programmed velocity on page 987
Configuring max TCP speed	<i>Technical reference manual - System parameters, parameter TCP Linear Max Speed (m/s)</i>

2.120 Min - Get the smallest of two values

Usage

Min returns the smallest of two arguments.

Basic examples

The following example illustrates the function Min.

Example 1

```
reg1 := Min(reg2, reg3)
```

reg1 is assigned the smallest value of reg2 and reg3.

Return value

Data type: num

Returns the smallest of the two arguments.

Arguments

Min (A, B)

A

Data type: num

First numeric value.

B

Data type: num

Second numeric value.

Syntax

```
Min '('  
  [A ':='] < expression (IN) of num > ',' '  
  [B ':='] < expression (IN) of num > ')' '
```

A function with a return value of the data type num.

Related information

For information about	See
Max function	Max - Get the largest of two values on page 1342
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.121 MirPos - Mirroring of a position

RobotWare Base

2.121 MirPos - Mirroring of a position

Usage

MirPos (*Mirror Position*) is used to mirror the translation and rotation parts of a position.

Basic examples

The following example illustrates the function MirPos.

Example 1

```
CONST robtarget p1:= [...];  
VAR robtarget p2;  
PERS wobjdata mirror:= [...];  
...  
p2 := MirPos(p1, mirror);
```

p1 is a robtarget storing a position of the robot and an orientation of the tool. This position is mirrored in the xy-plane of the frame defined by mirror, relative to the world coordinate system. The result is new robtarget data, which is stored in p2.

Return value

Data type: robtarget

The new position which is the mirrored position of the input position.

Arguments

MirPos (Point MirPlane [\WObj] [\MirY])

Point

Data type: robtarget

The input robot position. The orientation part of this position defines the current orientation of the tool coordinate system.

MirPlane

Mirror Plane

Data type: wobjdata

The work object data defining the mirror plane. The mirror plane is the xy-plane of the object frame defined in MirPlane. The location of the object frame is defined relative to the user frame (also defined in MirPlane) which in turn is defined relative to the world frame.

[\WObj]

Work Object

Data type: wobjdata

The work object data defining the object frame and user frame relative to which the input position *Point* is defined. If this argument is left out the position is defined relative to the World coordinate system.

NOTE!

Continues on next page

If the position is created with an active work object, this work object must be referred to in the argument.

[\MirY]

Mirror Y

Data type: switch

If this switch is left out, which is the default behavior, the tool frame will be mirrored with regards to the x-axis and the z-axis. If the switch is specified the tool frame will be mirrored with regards to the y-axis and the z-axis.

Limitations

No recalculation is done of the robot configuration part of the input robtarget data. If a coordinate frame is used, the coordinated unit has to be situated in the same task as the robot.

Syntax

```
MirPos '('
  [ Point ':' ] < expression (IN) of robtarget> ','
  [ MirPlane ':' ] <expression (IN) of wobjdata> ','
  [ '\ ' WObj ':' <expression (IN) of wobjdata> ]
  [ '\ ' MirY ] ')'
```

A function with a return value of the data type robtarget.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview, section RAPID Summary - Mathematics</i>
Position data	robtarget - Position data on page 1715
Work object data	wobjdata - Work object data on page 1775

2 Functions

2.122 MOD - Evaluates an integer modulo

RobotWare Base

2.122 MOD - Evaluates an integer modulo

Usage

MOD is a conditional expression used to evaluate the modulo, the remainder, of a division of integers.

Basic examples

The following examples illustrate the function MOD.

Example 1

```
reg1 := 14 MOD 4;
```

The return value is 2 because 14 divided by 4 gives the modulo 2.

Example 2

```
VAR dnum mydnum1 := 11;  
VAR dnum mydnum2 := 5;  
VAR dnum mydnum3;  
...  
mydnum3 := mydnum1 MOD mydnum2;
```

The return value is 1 because 11 divided by 5 gives the modulo 1.

Return value

Data type: num, dnum

Returns the modulo, the remainder, of a division of integers.

Syntax

<expression of num> MOD <expression of num>

A function with a return value of data type num.

<expression of dnum> MOD <expression of dnum>

A function with a return value of data type dnum.

Related information

For information about	See
num - Numeric values	num - Numeric values on page 1680
dnum - Double numeric values	dnum - Double numeric values on page 1630
DIV	DIV - Evaluates an integer division on page 1233
Expressions	Technical reference manual - RAPID Overview

2.123 ModExist - Check if program module exist

Usage

ModExist (*Module Exist*) is used to check whether a given module exists or not in the program task.

Searching is first done for loaded modules and afterward, if none is found, for installed modules.

Basic examples

The following example illustrates the function ModExist.

Example 1

```
VAR bool mod_exist;  
mod_exist:=ModExist ("MyModule");
```

If module MyModule exists within the task, the function will return TRUE. If not, the function will return FALSE.

Return value

Data type: bool

TRUE if the module was found, FALSE if not.

Arguments

ModExist (ModuleName)

ModuleName

Data type: string

Name of the module to search for.

Syntax

```
ModExist '('  
  [ ModuleName ':' ] < expression (IN) of string > ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Find modify time for loaded module	ModTimeDnum - Get file modify time for the loaded module on page 1352

2 Functions

2.124 ModTimeDnum - Get file modify time for the loaded module

RobotWare Base

2.124 ModTimeDnum - Get file modify time for the loaded module

Usage

ModTimeDnum (*Modify Time*) is used to retrieve the last file modification time for the loaded module. The module is specified by its name and must be in the task memory. The time is measured in seconds since 00:00:00 GMT, Jan. 1 1970. The time is returned as a dnum.

Basic examples

The following example illustrates the function ModTimeDnum.

See also [More examples on page 1352](#).

Example 1

```
MODULE mymod
  VAR dnum mytime;
  PROC printMyTime()
    mytime := ModTimeDnum("mymod");
    TPWrite "My time is "+ValToStr(mytime);
  ENDPROC
ENDMODULE
```

Return value

Data type: dnum

The time measured in seconds since 00:00:00 GMT, Jan. 1 1970.

Arguments

ModTimeDnum (Object)

Object

Data type: string

The name of the module.

Program execution

This function returns a numeric value that specifies the last time a file was modified before it was loaded as a program module in the system.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_MOD_NOT_LOADED	No module with specified name is in the program task.

More examples

More examples of the function ModTimeDnum are illustrated below.

Example 1

```
IF FileTimeDnum ("HOME:/mymod.modx" \ModifyTime) > ModTimeDnum
  ("mymod") THEN
```

Continues on next page

2.124 ModTimeDnum - Get file modify time for the loaded module

RobotWare Base

Continued

```
UnLoad "HOME:/mymod.modx";  
Load \Dynamic, "HOME:/mymod.modx";  
ENDIF
```

This program reloads a module if the source file is newer. It uses the ModTimeDnum to retrieve the latest modify time for the specified module, and compares it to the FileTimeDnum ("HOME:/mymod.modx" \ModifyTime) at the source. Then, if the source is newer, the program unloads and loads the module again.

Limitations

This function will always return 0 if used on a module that is encoded or installed shared.

Syntax

```
ModTimeDnum '('  
  [Object ':='] <expression (IN) of string>  
A function with a return value of the data type dnum.
```

Related information

For information about	See
Retrieve time information about a file	FileTimeDnum - Retrieve time information about a file on page 1252

2 Functions

2.125 MotionPlannerNo - Get connected motion planner number

RobotWare Base

2.125 MotionPlannerNo - Get connected motion planner number

Usage

MotionPlannerNo returns the connected motion planner number. If executing MotionPlannerNo in a motion task, it returns its planner number. Else if executing MotionPlannerNo in a non-motion task it returns the connected motion planner number according to the setup in the system parameters.

Basic examples

The following example illustrates the function MotionPlannerNo.

Example 1

```
!Motion task T_ROB1
PERS string buffer{6} := ["", "", "", "", "", ""];
VAR num motion_planner;

PROC main()
...
MoveL point, v1000, fine, tcp1;
motion_planner := MotionPlannerNo();
buffer{motion_planner} := "READY";
...
ENDPROC

!Background task BCK1
PERS string buffer{6};
VAR num motion_planner;
VAR string status;

PROC main()
...
motion_planner := MotionPlannerNo();
status := buffer{motion_planner};
...
ENDPROC

!Motion T_ROB2
PERS string buffer{6};
VAR num motion_planner;

PROC main()
...
MoveL point, v1000, fine, tcp1;
motion_planner := MotionPlannerNo();
buffer{motion_planner} := "READY";
...
ENDPROC

!Background task BCK2
PERS string buffer{6};
```

Continues on next page

2.125 MotionPlannerNo - Get connected motion planner number

RobotWare Base

Continued

```
VAR num motion_planner;  
VAR string status;  
  
PROC main()  
...  
  motion_planner := MotionPlannerNo();  
  status := buffer{motion_planner};  
...  
ENDPROC
```

Use the function MotionPlannerNo to find out which motion planner number is connected to the task. The exact same code can be implemented in all motion tasks and background tasks. Then each background task can check the status for their connected motion task.

Return value

Data type: num

The number of the connected motion planner. For non-motion tasks, the motion planner number of the associated mechanical unit will be returned.

The return value range is 1 ... 6.

Syntax

MotionPlannerNo '(' ' ')

A function with a return value of the data type num.

Related information

For information about	See
Specify cooperated program tasks	<i>Technical reference manual - System parameters, section Controller - Task</i>

2 Functions

2.126 NonMotionMode - Read the Non-Motion execution mode

RobotWare Base

2.126 NonMotionMode - Read the Non-Motion execution mode

Usage

NonMotionMode (*Non-Motion Execution Mode*) is used to read the current Non-Motion execution mode of the program task. Non-motion execution mode is selected or removed from the FlexPendant under the menu *ABB\Control Panel\Supervision*.

Basic examples

The following example illustrates the function NonMotionMode.

Example 1

```
IF NonMotionMode() =TRUE THEN
    ...
ENDIF
```

The program section is executed only if the robot is in Non-Motion execution mode.

Return value

Data type: bool

The current Non-motion mode as defined in the table below.

Return value	Symbolic constant	Comment
0	FALSE	Non-Motion execution is not used
1	TRUE	Non-Motion execution is used

Arguments

NonMotionMode ([\Main])

[\Main]

Data type: switch

Return current running mode for connected motion task. Used in a multi-tasking system to get the current running mode for the actual task, if it is a motion task or connected motion task, if function NonMotionMode is executed in a nonmotion task.

If this argument is omitted, the return value always mirrors the current running mode for the program task that executes the function NonMotionMode.

Note that the execution mode is connected to the system and not any task. This means that all tasks in a system will give the same return value from NonMotionMode.

Syntax

```
NonMotionMode '(' ['\ ' Main] ')'
```

A function with a return value of the data type bool.

Continues on next page

2.126 NonMotionMode - Read the Non-Motion execution mode

RobotWare Base

Continued

Related information

For information about	See
Reading operating mode	OpMode - Read the operating mode on page 1366

2 Functions

2.127 NOT - Inverts a logical value

RobotWare Base

2.127 NOT - Inverts a logical value

Usage

NOT is a conditional expression used to invert a logical value (true/false).

Basic examples

The following examples illustrate the conditional expression NOT.

Example 1

```
VAR bool mybool;  
mybool := NOT mybool;
```

If mybool is TRUE, the return value is FALSE.

If mybool is FALSE, the return value is TRUE.

Example 2

```
VAR bool a;  
VAR bool b;  
VAR bool c;  
...  
c := a AND (NOT b);
```

The return value c is TRUE if a is TRUE and b is FALSE

Return value

Data type: bool

Returns the inverted value.

Syntax

NOT <logical term>

Related information

For information about	See
AND	AND - Evaluates a logical value on page 1123
OR	OR - Evaluates a logical value on page 1367
XOR	XOR - Evaluates a logical value on page 1588
Expressions	<i>Technical reference manual - RAPID Overview</i>

2.128 NOrient - Normalize orientation

Usage

NOrient (*Normalize Orientation*) is used to normalize un-normalized orientation (quaternion).

Description

An orientation must be normalized, that is, the sum of the squares must equal 1:

$$q_1^2 + q_2^2 + q_3^2 + q_4^2 = 1$$

xx0500002452

If the orientation is slightly un-normalized, it is possible to normalize it. The normalization error is the absolute value of the sum of the squares of the orientation components. The orientation is considered to be slightly un-normalized if the normalization error is greater than 0.00001 and less than 0.1. If the normalization error is greater than 0.1 the orient is unusable.

$$ABS(\sqrt{q_1^2 + q_2^2 + q_3^2 + q_4^2} - 1) = \text{normerr}$$

xx0500002453

normerr > 0.1 Unusable

normerr > 0.00001 AND normerr <= 0.1 Slightly un-normalized

normerr <= 0.00001 Normalized

Basic examples

The following example illustrates the function NOrient.

Example 1

We have a slightly un-normalized position (0.707170, 0, 0, 0.707170)

$$ABS(\sqrt{0.707170^2 + 0^2 + 0^2 + 0.707170^2} - 1) = 0.0000894$$

0.0000894 > 0.00001 $\Rightarrow$ unnormalized

xx0500002451

```
VAR orient unnormorient := [0.707170, 0, 0, 0.707170];
VAR orient normorient;
...
...
normorient := NOrient(unnormorient);
```

The normalization of the orientation (0.707170, 0, 0, 0.707170) becomes (0.707107, 0, 0, 0.707107).

Return value

Data type: orient

The normalized orientation.

Continues on next page

2 Functions

2.128 NOrient - Normalize orientation

RobotWare Base

Continued

Arguments

NOrient (Rotation)

Rotation

Data type: orient

The orientation to be normalized.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_ORIENT_VALUE	Wrong orientation value in NOrient function.

Syntax

```
NOrient '('  
    [Rotation ':='] <expression (IN) of orient> ')'
```

A function with a return value of the data type orient.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview, section RAPID summary - Mathematics</i>

2.129 NumToDnum - Converts num to dnum

Usage

NumToDnum converts a num to a dnum.

Basic examples

The following example illustrates the function NumToDnum.

Example 1

```
VAR num mynum:=55;
VAR dnum mydnum:=0;
mydnum:=NumToDnum(mynum);
```

The num value 55 is returned by the function as the dnum value 55.

Return value

Data type: dnum

The return value of type dnum will have the same value as the input value of type num.

Arguments

NumToDnum (Value)

Value

Data type: num

The numeric value to be converted.

Syntax

```
NumToDnum '('
  [ Value ':= ' ] < expression (IN) of num > ')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
Num data type	num - Numeric values on page 1680
Dnum data type	dnum - Double numeric values on page 1630

2 Functions

2.130 NumToStr - Converts numeric value to string

RobotWare Base

2.130 NumToStr - Converts numeric value to string

Usage

NumToStr (*Numeric To String*) is used to convert a numeric value to a string.

Basic examples

The following examples illustrate the function NumToStr.

Example 1

```
VAR string str;  
str := NumToStr(0.38521,3);
```

The variable str is given the value "0.385".

Example 2

```
reg1 := 0.38521;  
str := NumToStr(reg1, 2\Exp);
```

The variable str is given the value "3.85E-01".

Example 3

```
reg1 := 0.38521;  
str := NumToStr(reg1, 2\Compact);
```

The variable str is given the value "0.39".

Return value

Data type: string

The numeric value converted to a string with the specified number of decimals, with exponent if so requested. The numeric value is rounded if necessary. The decimal point is suppressed if no decimals are included.

Arguments

NumToStr (Val Dec [\Exp] | [\Compact])

Val

Value

Data type: num

The numeric value to be converted.

Dec

Decimals

Data type: num

Number of decimals or significant figures for Compact.

[\Exp]

Exponent

Data type: switch

To use exponent in return value.

Continues on next page

[\Compact]

Compact

Data type: switch

To be used to get a short format in the return value.

Syntax

```

NumToStr '('
  [ Val ':= ' ] <expression (IN) of num>
  [ Dec ':= ' ] <expression (IN) of num>
  ['\ ' Exp ] | ['\ ' Compact ]')'

```

A function with a return value of the data type string.

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview, section RAPID summary - String functions</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Basic elements</i>
Convert a dnum numeric value to a string	DnumToStr - Converts numeric value to string on page 1236

2 Functions

2.131 Offs - Displaces a robot position

RobotWare Base

2.131 Offs - Displaces a robot position

Usage

`Offs` is used to add an offset in the object coordinate system to a robot position.

Basic examples

The following examples illustrate the function `Offs`.

See also [More examples on page 1364](#).

Example 1

```
MoveL Offs(p2, 0, 0, 10), v1000, z50, tool1;
```

The robot is moved to a point 10 mm from the position `p2` (in the z-direction).

Example 2

```
p1 := Offs (p1, 5, 10, 15);
```

The robot position `p1` is displaced 5 mm in the x-direction, 10 mm in the y-direction and 15 mm in the z-direction.

Return value

Data type: `robtarget`

The displaced position data.

Arguments

`Offs (Point XOffset YOffset ZOffset)`

Point

Data type: `robtarget`

The position data to be displaced.

XOffset

Data type: `num`

The displacement in the x-direction, in the object coordinate system.

YOffset

Data type: `num`

The displacement in the y-direction, in the object coordinate system.

ZOffset

Data type: `num`

The displacement in the z-direction, in the object coordinate system.

More examples

More examples of the function `Offs` are illustrated below.

Example 1

```
PROC pallet (num row, num column, num distance, PERS tooldata tool,  
            PERS wobjdata wobj)  
VAR robtarget palletpos:=[[0, 0, 0], [1, 0, 0, 0], [0, 0, 0, 0],  
                        [9E9, 9E9, 9E9, 9E9, 9E9, 9E9]];
```

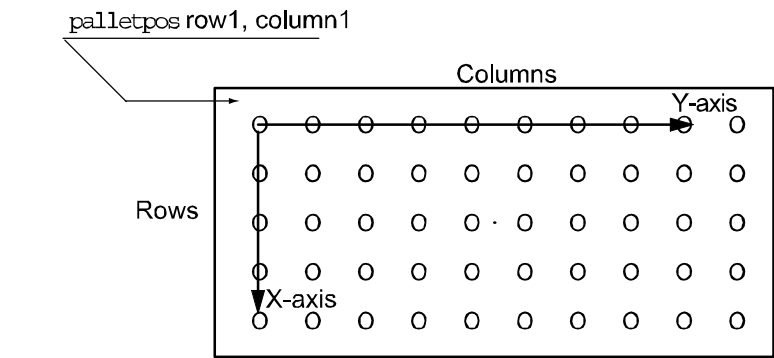
Continues on next page

2.131 Offs - Displaces a robot position
RobotWare Base
Continued

```
palettpos := Offs (palettpos, (row-1)*distance, (column-1)*distance,  
0);  
MoveL palettpos, v100, fine, tool\WObj:=wobj;  
ENDPROC
```

A routine for picking parts from a pallet is made. Each pallet is defined as a work object (see figure below). The part to be picked (row and column) and the distance between the parts are given as input parameters. Incrementing the row and column index is performed outside the routine.

The figure shows the position and orientation of the pallet is specified by defining a work object.



xx050002300_

Syntax

```
Offs '('  
[Point ':='] <expression (IN) of robtarget> ', '  
[XOffset ':='] <expression (IN) of num> ', '  
[YOffset ':='] <expression (IN) of num> ', '  
[ZOffset ':='] <expression (IN) of num> ')'
```

A function with a return value of the data type robtarget.

Related information

For information about	See
Position data	robtarget - Position data on page 1715
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview, section RAPID Summary - Mathematics</i>
Positioning instructions	<i>Technical reference manual - RAPID Overview, section RAPID summary - Motion</i>

2 Functions

2.132 OpMode - Read the operating mode *RobotWare Base*

2.132 OpMode - Read the operating mode

Usage

OpMode(*Operating Mode*) is used to read the current operating mode of the system.

Basic examples

The following example illustrates the function OpMode.

Example 1

```
TEST OpMode()  
CASE OP_AUTO:  
    ...  
CASE OP_MAN_PROG:  
    ...  
CASE OP_MAN_TEST:  
    ...  
DEFAULT:  
    ...  
ENDTEST
```

Different program sections are executed depending on the current operating mode.

Return value

Data type: symnum

The current operating mode as defined in the table below.

Return value	Symbolic constant	Comment
0	OP_UNDEF	Undefined operating mode
1	OP_AUTO	Automatic operating mode
2	OP_MAN_PROG	Manual operating mode max. 250 mm/s
3	OP_MAN_TEST	Manual operating mode full speed, 100 %

Syntax

OpMode '(' ' ')

A function with a return value of the data type symnum.

Related information

For information about	See
Different operating modes	<i>Operating manual - OmniCore</i>
Reading running mode	RunMode - Read the running mode on page 1440

2.133 OR - Evaluates a logical value

Usage

OR is a conditional expression used to evaluate a logical value (true/false).

Basic examples

The following examples illustrate the function OR.

Example 1

```
VAR num a;  
VAR num b;  
VAR bool c;  
...  
c := a>5 OR b=3;
```

The return value of c is **TRUE** if a is larger than 5 or b equals 3. Otherwise the return value is **FALSE**.

Example 2

```
VAR num mynum;  
VAR string mystring;  
VAR bool mybool;  
VAR bool result;  
...  
result := mystring="Hello" OR mynum<15 AND mybool;
```

The return value of result is **TRUE** if mystring is "Hello". Or if both mynum is smaller than 15 and mybool is **TRUE**. Otherwise the return value is **FALSE**.

The **AND** statement is evaluated first, thereafter the **OR** statement. This is illustrated by the parentheses in the below row.

```
result := mystring="Hello" OR (mynum<15 AND mybool);
```

Return value

Data type: **bool**

The return value is **TRUE** if one or both of the conditional expressions are correct, otherwise the return value is **FALSE**.

Syntax

<expression of bool> OR <expression of bool>

A function with a return value of data type **bool**.

Related information

For information about	See
AND	AND - Evaluates a logical value on page 1123
XOR	XOR - Evaluates a logical value on page 1588
NOT	NOT - Inverts a logical value on page 1358
Expressions	Technical reference manual - RAPID Overview

2 Functions

2.134 OrientZYX - Builds an orient from Euler angles

RobotWare Base

2.134 OrientZYX - Builds an orient from Euler angles

Usage

`OrientZYX` (*Orient from Euler ZYX angles*) is used to build an orient type variable out of Euler angles.

Basic examples

The following example illustrates the function `OrientZYX`.

Example 1

```
VAR num anglex;  
VAR num angley;  
VAR num anglez;  
VAR pose object;  
...  
object.rot := OrientZYX(anglez, angley, anglex)
```

Return value

Data type: `orient`

The orientation made from the Euler angles.

Arguments

`OrientZYX` (`ZAngle` `YAngle` `XAngle`)



Note

The rotations will be performed in the following order:

- 1 rotation around the z axis
- 2 rotation around the new y axis
- 3 rotation around the new x axis

ZAngle

Data type: `num`

The rotation, in degrees, around the Z axis.

YAngle

Data type: `num`

The rotation, in degrees, around the Y axis.

XAngle

Data type: `num`

The rotation, in degrees, around the X axis.

Syntax

```
OrientZYX '('  
  [ZAngle ':='] <expression (IN) of num> ','  
  [YAngle ':='] <expression (IN) of num> ','  
  [XAngle ':='] <expression (IN) of num> ')'
```

Continues on next page

2.134 OrientZYX - Builds an orient from Euler angles

RobotWare Base
Continued

A function with a return value of the data type `orient`.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i> , section <i>Mathematics</i>

2 Functions

2.135 ORobT - Removes the program displacement from a position

RobotWare Base

2.135 ORobT - Removes the program displacement from a position

Usage

ORobT (*Object Robot Target*) is used to transform a robot position from the program displacement coordinate system to the object coordinate system and/or to remove an offset for the external axes.

Basic examples

The following example illustrates the function ORobT.

See also [More examples on page 1371](#).

Example 1

```
VAR robtarget p10;  
VAR robtarget p11;  
VAR num wobj_diameter;  
  
p10 := CRobT(\Tool:=tool1 \WObj:=wobj_diameter);  
p11 := ORobT(p10);
```

The current positions of the robot and the external axes are stored in p10 and p11. The values stored in p10 are related to the ProgDisp/ExtOffs coordinate system. The values stored in p11 are related to the object coordinate system without any program displacement and any offset on the external axes.

Return value

Data type: robtarget

The transformed position data.

Arguments

ORobT (OrgPoint [\InPDisp] | [\InEOffs])

OrgPoint

Original Point

Data type: robtarget

The original point to be transformed.

[\InPDisp]

In Program Displacement

Data type: switch

Returns the TCP position in the ProgDisp coordinate system, that is, removes external axes offset only.

[\InEOffs]

In External Offset

Data type: switch

Returns the external axes in the offset coordinate system, that is, removes program displacement for the robot only.

Continues on next page

More examples

More examples of how to use the function ORobT are illustrated below.

Example 1

```
p10 := ORobT(p10 \InEOffs );
```

The ORobT function will remove any program displacement that is active, leaving the TCP position relative to the object coordinate system. The external axes will remain in the offset coordinate system.

Example 2

```
p10 := ORobT(p10 \InPDisp );
```

The ORobT function will remove any offset of the external axes. The TCP position will remain in the ProgDisp coordinate system.

Syntax

```
ORobT '('  
  [ OrgPoint ':' ] < expression (IN) of robtarget >  
  ['\' InPDisp] | ['\' InEOffs] ')'
```

A function with a return value of the data type robtarget.

Related information

For information about	See
Definition of program displacement for the robot	PDispOn - Activates program displacement on page 543 PDispSet - Activates program displacement using known frame on page 548
Definition of offset for external axes	EOffsOn - Activates an offset for additional axes on page 186 EOffsSet - Activates an offset for additional axes using known values on page 188
Coordinate systems	<i>Technical reference manual - RAPID Overview, section Motion and I/O principles - Coordinate systems</i>

2 Functions

2.136 ParIdPosValid - Valid robot position for parameter identification

RobotWare Base

2.136 ParIdPosValid - Valid robot position for parameter identification

Usage

ParIdPosValid (*Parameter Identification Position Valid*) checks whether the robot position is valid for the current parameter identification, such as load identification of tool or payload.

This instruction can only be used in the main task or, if in a *MultiMove* system, in motion tasks.

Basic examples

The following example illustrates the function ParIdPosValid.

Example 1

```
VAR jointtarget joints;
VAR bool valid_joints{12};

! Check if valid robot type
IF ParIdRobValid(TOOL_LOAD_ID) <> ROB_LOAD_VAL THEN
  EXIT;
ENDIF
! Read the current joint angles
joints := CJointT();
! Check if valid robot position
IF ParIdPosValid (TOOL_LOAD_ID, joints, valid_joints) = TRUE THEN
  ! Valid position for load identification
  ! Continue with LoadId
  ...
ELSE
  ! Not valid position for one or several axes for load
  ! identification
  ! Move the robot to the output data given in variable joints
  ! and do ParIdPosValid once again
  ...
ENDIF
```

Check whether robot position is valid before doing load identification of tool.

Return value

Data type: bool

TRUE if robot position is valid for current parameter identification.

FALSE if robot position is not valid for current parameter identification.

Arguments

ParIdPosValid (ParIdType Pos AxValid [\ConfAngle])

Continues on next page

2.136 ParIdPosValid - Valid robot position for parameter identification

RobotWare Base

Continued

ParIdType

Data type: paridnum

Type of parameter identification as defined in table below

Value	Symbolic constant	Comment
1	TOOL_LOAD_ID	Identify tool load
2	PAY_LOAD_ID	Identify payload (Ref. instruction GripLoad)
3	IRBP_K	Identify External Manipulator IRBP K load
4	IRBP_L	Identify External Manipulator IRBP L load
4	IRBP_C	Identify External Manipulator IRBP C load
4	IRBP_C_INDEX	Identify External Manipulator IRBP C_INDEX load
4	IRBP_T	Identify External Manipulator IRBP T load
5	IRBP_R	Identify External Manipulator IRBP R load
6	IRBP_A	Identify External Manipulator IRBP A load
6	IRBP_B	Identify External Manipulator IRBP B load
6	IRBP_D	Identify External Manipulator IRBP D load

Pos

Data type: jointtarget

Variable specifies the actual joint angles for all robot and external axes. The variable is updated by ParIdPosValid according to the table below.

Input axis joint value	Output axis joint value
Valid	Not changed
Not valid	Changed to suitable value

AxValid

Data type: bool

Array variable with 12 elements corresponding to 6 robot and 6 external axes. The variable is updated by ParIdPosValid according to the table below.

Input axis joint value in Pos	Output status in AxValid
Valid	TRUE
Not valid	FALSE

[\ConfAngle]

Data type: num

Optional argument for specification of specific configuration angle +/- degrees to be used for parameter identification.

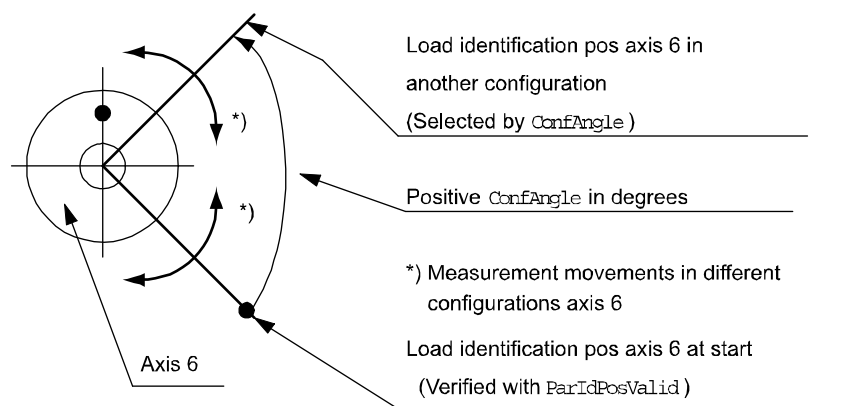
Continues on next page

2 Functions

2.136 ParIdPosValid - Valid robot position for parameter identification

RobotWare Base

Continued



xx0500002493

Default + 90 degrees if this argument is not specified.

Min. + or - 30 degrees. Optimum + or - 90 degrees.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_PID_RAISE_PP	An error occurs.

Syntax

```
ParIdPosValid '('  
  [ ParIdType ':= ' ] <expression (IN) of paridnum> ', '  
  [ Pos ':= ' ] <variable (VAR) of jointtarget> ', '  
  [ AxValid ':= ' ] <array variable {*} (VAR) of bool>  
  [ '\ ' ConfAngle ':= ' <expression (IN) of num> ] ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Type of parameter identification	paridnum - Type of parameter identification on page 1688
Valid robot type	ParIdRobValid - Valid robot type for parameter identification on page 1375
Load identification of tool or payload	LoadId - Load identification of tool or payload on page 337
Load identification of positioners (IRBP)	ManLoadIdProc - Load identification of IRBP manipulators on page 344

2.137 ParIdRobValid - Valid robot type for parameter identification

Usage

ParIdRobValid (*Parameter Identification Robot Valid*) checks whether the robot or manipulator type is valid for the current parameter identification, such as load identification of tool or payload.

This instruction can only be used in the main task T_ROB1 or, if in a *MultiMove* system, in Motion tasks.

Basic examples

The following example illustrates the function ParIdRobValid.

Example 1

```
TEST ParIdRobValid (TOOL_LOAD_ID)
CASE ROB_LOAD_VAL:
    ! Possible to do load identification of tool in actual robot
    type
    ...
CASE ROB_LM1_LOAD_VAL:
    ! Only possible to do load identification of tool with
    ! IRB 6400FHD if actual load < 200 kg
    ...
CASE ROB_NOT_LOAD_VAL:
    ! Not possible to do load identification of tool in actual
    robot type
    ...
ENDTEST
```

Return value

Data type: paridvalidnum

Whether the specified parameter identification can be performed with the current robot or manipulator type, as defined in the table below.

Value	Symbolic constant	Comment
10	ROB_LOAD_VAL	Valid robot or manipulator type for the actual parameter identification
11	ROB_NOT_LOAD_VAL	Not valid type for the actual parameter identification
12	ROB_LM1_LOAD_VAL	Valid robot type IRB 6400FHD for the actual parameter identification if actual load < 200 kg

Arguments

ParIdRobValid(ParIdType [\MechUnit] [\AxisNo])

ParIdType

Data type: paridnum

Type of parameter identification as defined in table below.

Value	Symbolic constant	Comment
1	TOOL_LOAD_ID	Identify robot tool load

Continues on next page

2 Functions

2.137 ParIdRobValid - Valid robot type for parameter identification

RobotWare Base

Continued

Value	Symbolic constant	Comment
2	PAY_LOAD_ID	Identify robot payload (Ref. instruction GripLoad)
3	IRBP_K	Identify External Manipulator IRBP K load
4	IRBP_L	Identify External Manipulator IRBP L load
4	IRBP_C	Identify External Manipulator IRBP C load
4	IRBP_C_INDEX	Identify External Manipulator IRBP C_INDEX load
4	IRBP_T	Identify External Manipulator IRBP T load
5	IRBP_R	Identify External Manipulator IRBP R load
6	IRBP_A	Identify External Manipulator IRBP A load
6	IRBP_B	Identify External Manipulator IRBP B load
6	IRBP_D	Identify External Manipulator IRBP D load

[\MechUnit]

Mechanical Unit

Data type: mecunit

Mechanical Unit used for the load identification. Only to be specified for external manipulator. If this argument is omitted the TCP-robot in the task is used.

[\AxisNo]

Axis number

Data type: num

Axis number within the mechanical unit which holds the load to be identified. Only to be specified for external manipulator.

When the argument \MechUnit is used, then \AxisNo must be used. The argument \AxisNo can not be used without \MechUnit.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_PID_RAISE_PP	An error occurs.

Syntax

```
ParIdRobValid '('  
  [ParIdType ':='] <expression (IN) of paridnum>  
  ['\MechUnit ':='] <variable (VAR) of mecunit>  
  ['\AxisNo ':='] <expression (IN) of num>] ')'
```

A function with a return value of the data type paridvalidnum.

Related information

For information about	See
Type of parameter identification	paridnum - Type of parameter identification on page 1688

Continues on next page

2.137 ParIdRobValid - Valid robot type for parameter identification

RobotWare Base

Continued

For information about	See
Mechanical unit to be identified	<i>mecunit - Mechanical unit on page 1672</i>
Result of this function	<i>paridvalidnum - Result of ParIdRobValid on page 1690</i>
Valid robot position	<i>ParIdPosValid - Valid robot position for parameter identification on page 1372</i>
Load identification of robot tool load or payload	<i>LoadId - Load identification of tool or payload on page 337</i>
Load identification of positioner loads	<i>ManLoadIdProc - Load identification of IRBP manipulators on page 344</i>

2 Functions

2.138 PathLengthGet - Reads the current path-length value of the counter
RobotWare Base

2.138 PathLengthGet - Reads the current path-length value of the counter

Usage

PathLengthGet is used to read the current value of the counter that measures the path-length travelled by the robot's TCP. The returned value is in millimeters and is always measured relative the work object.

This function can be called at any time, but it is advisable that it is called when the robot is standing still to get a predictable behavior.

The path-length value is read for the TCP robot in actual or connected motion task.

Basic examples

The following example illustrates the function PathLengthGet.

Example 1

```
PathLengthStart;  
MoveJ p10, v1000, z50, L10tip;  
...  
MoveL p40, v1000, fine, L10tip;  
PathLengthStop;  
TPWrite "PathLengthGet: "+ValToStr(PathLengthGet());  
PathLengthReset;
```

This example read out the value of the counter that measures the path-length travelled by the robot's TCP. The value is then written to the FlexPendant.

Program execution

The path-length measurement applies for the next executed robot movement instruction of any type and is valid until a PathLengthStop instruction is executed. Path-length measurement is set to off, and the path-length measurement counter is set to zero when a PathLengthReset instruction is executed. The default value, path-length measurement off is automatically set:

- when using the restart mode *Reset RAPID*.
- when loading a new program or a new module.
- when starting program execution from the beginning.
- when moving the program pointer to Main routine.
- when moving the program pointer to a routine.
- when moving the program pointer in such a way that the execution order is lost.

Limitations

Path-length measurements are only applicable for TCP-robots.

Syntax

```
PathLengthGet '(' ' ')
```

A function with a return value of the data type num.

Continues on next page

2.138 PathLengthGet - Reads the current path-length value of the counter

RobotWare Base

Continued

Related information

For information about	See
PathLengthReset	<i>PathLengthReset - Resets the current path-length value of the counter on page 519</i>
PathLengthStart	<i>PathLengthStart - Activates the counter that monitors the path-length on page 521</i>
PathLengthStop	<i>PathLengthStop - Stops the counter that monitors the path-length on page 523</i>

2 Functions

2.139 PathLevel - Get current path level

RobotWare Base

2.139 PathLevel - Get current path level

Usage

PathLevel is used to get the current path level. This function will show whether the task is executing on the original level or if the original movement path has been stored and a new temporary movement is executing. Read more about *Path Recovery* in *Application manual - Controller software OmniCore*.

Basic examples

The following example illustrates the function PathLevel.

See also [More examples on page 1380](#).

Example 1

```
VAR num level;  
level:= PathLevel();
```

Variable level will be 1 if executed in an original movement path or 2 if executed in a temporary new movement path.

Return value

Data type: num

There are two possible return values.

Return value	Description
1	Executing in original movement path.
2	Executing in StorePath level, a temporary new movement path.

More examples

One more example of how to use the function PathLevel is illustrated below.

Example 1

```
...  
MoveL p100, v100, z10, tool1;  
StopMove;  
StorePath;  
p:= CRobT(\Tool:=tool1);  
!New temporary movement  
MoveL p1, v100, fine, tool1;  
...  
level:= PathLevel();  
...  
MoveL p, v100, fine, tool1;  
RestoPath;  
StartMove;  
...
```

Variable level will be 2.

Continues on next page

Limitations

RobotWare option Path Recovery must be installed to be able to use function PathLevel at path level 2

Syntax

PathLevel '(' ' ')

A function with a return value of the data type num.

Related information

For information about	See
Path recovery	<i>Application manual - Controller software OmniCore</i>
Store and restore path	StorePath - Stores the path when an interrupt occurs on page 798 RestoPath - Restores the path after an interrupt on page 600
Stop and start move	StartMove - Restarts robot movement on page 763 StopMove - Stops robot movement on page 792

2 Functions

2.140 PathRecValidBwd - Is there a valid backward path recorded

Path Recovery

2.140 PathRecValidBwd - Is there a valid backward path recorded

Usage

PathRecValidBwd is used to check if the path recorder is active and if a recorded backward path is available.

Basic examples

The following example illustrates the function PathRecValidBwd.

See also [More examples on page 1383](#).

Example 1

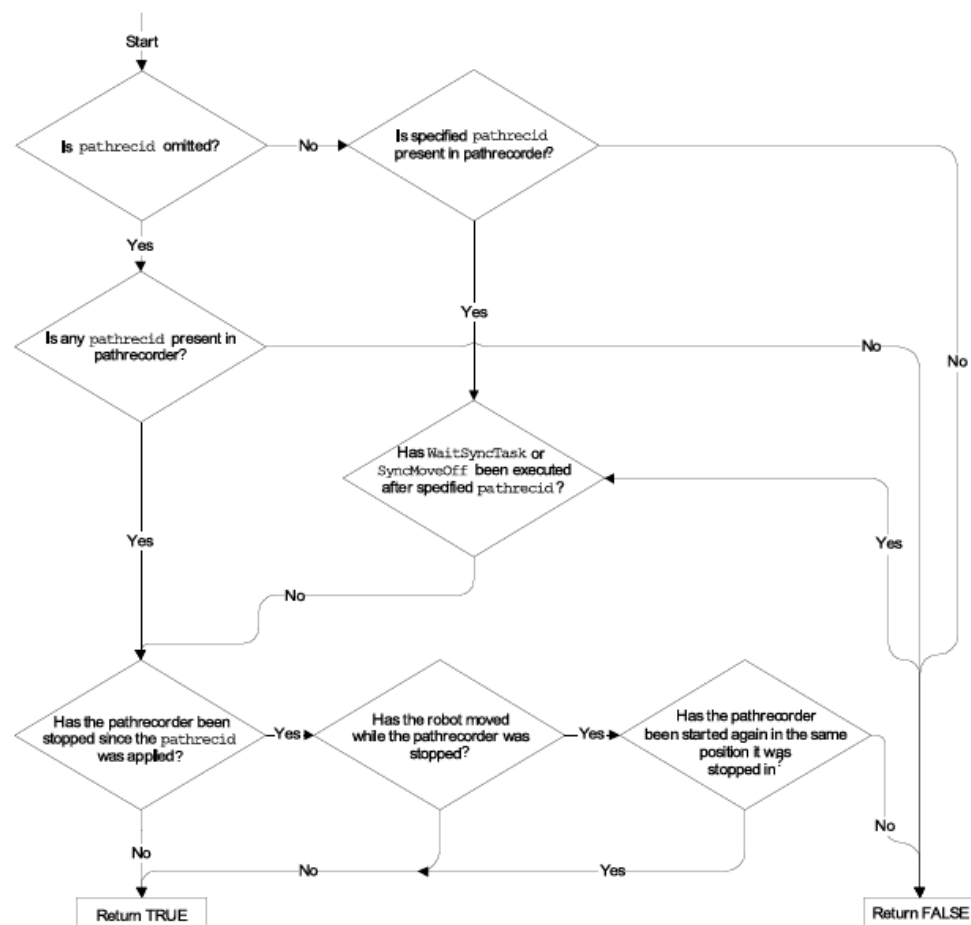
```
VAR bool bwd_path;  
VAR pathrecid fixture_id;  
bwd_path := PathRecValidBwd (\ID:=fixture_id);
```

The variable bwd_path is set to TRUE if it is possible to back-up to the position with identifier fixture_id. If not, bwd_path is set to FALSE.

Return value

Data type: bool

The return value of the function can be determined from following flow chart:



xx0500002132

Continues on next page

2.140 PathRecValidBwd - Is there a valid backward path recorded

Path Recovery
Continued

Arguments

PathRecValidBwd ([\ID])

[\ID]

Identifier

Data type: pathrecid

Variable that specifies the name of the recording start position. Data type pathrecid is a non-value type, only used as an identifier for naming the recording position.

Program execution

Before the path recorder is ordered to move backwards with PathRecMoveBwd it is possible to check whether a valid recorded path is present with PathRecValidBwd.

More examples

The following examples illustrate the function PathRecValidBwd.

Example 1

```
PathRecStart id1;
MoveL p1, vmax, z50, tool1;
MoveL p2, vmax, z50, tool1;
bwd_path := PathRecValidBwd (\ID := id1);
```

The path recorder is started and two move instructions are executed. PathRecValidBwd will return TRUE and the available backup path will be: From p2 to p1 to the start position.

Example 2

```
PathRecStart id1;
MoveL p1, vmax, z50, tool1;
MoveL p2, vmax, z50, tool1;
PathRecStop \Clear;
bwd_path:= PathRecValidBwd (\ID := id1);
```

The path recorder is started and two move instructions are executed. Then the path recorder is stopped and cleared. PathRecValidBwd will return FALSE.

Example 3

```
PathRecStart id1;
MoveL p1, vmax, z50, tool1;
PathRecStart id2;
MoveL p2, vmax, z50, tool1;
bwd_path := PathRecValidBwd ();
```

The path recorder is started and one move instruction is executed. Then, an additional path identifier is started followed by a move instruction. PathRecValidBwd will return TRUE and the backup path will be: From p2 to p1.

Example 4

```
PathRecStart id1;
MoveL p1, vmax, z50, tool1;
```

Continues on next page

2 Functions

2.140 PathRecValidBwd - Is there a valid backward path recorded

Path Recovery

Continued

```
WaitSyncTask sync101, tasklist_r101;  
MoveL p2, vmax, z50, tool1;  
bwd_path1 := PathRecValidBwd ();  
bwd_path2 := PathRecValidBwd (\ID := id1);
```

Executing above program will result in that the boolean variable bwd_path1 will be assigned TRUE since a valid backwards path to the WaitSyncTask statement exists. The boolean variable bwd_path2 will be assigned FALSE since it isn't possible to back up above a WaitSyncTask statement.

Syntax

```
PathRecValidBwd '('  
  ['\' ID ':= ' < variable (VAR) of pathrecid >] ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Path recorder	<i>Application manual - Controller software OmniCore</i>
Path Recorder Identifiers	pathrecid - Path recorder identifier on page 1692
Start - stop the path recorder	PathRecStart - Start the path recorder on page 534 PathRecStop - Stop the path recorder on page 537
Play the path recorder backward	PathRecMoveBwd - Move path recorder backwards on page 525
Check if a valid forward path exists	PathRecValidFwd - Is there a valid forward path recorded on page 1385
Play the path recorder forward	PathRecMoveFwd - Move path recorder forward on page 531
Motion in general	<i>Technical reference manual - RAPID Overview</i>

2.141 PathRecValidFwd - Is there a valid forward path recorded

Usage

PathRecValidFwd is used to check if the path recorder can be used to move forward. The ability to move forward with the path recorder implies that the path recorder must have been ordered to move backwards earlier.

Basic examples

The following example illustrates the function PathRecValidFwd.

See also [More examples on page 1386](#).

Example 1

```
VAR bool fwd_path;  
VAR pathrecid fixture_id;  
  
fwd_path:= PathRecValidFwd (\ID:=fixture_id);
```

The variable fwd_path is set to TRUE if it is possible to move forward to the position with the with identifier fixture_id. If not, fwd_path is set to FALSE.

Return value

Data type: bool

The return value of PathRecValidFwd **without** specified \ID is:

TRUE if:

- The path recorder has moved the robot backwards, using PathRecMoveBwd.
- The robot has not moved away from the path executed by PathRecMoveBwd.

FALSE if:

- The above stated conditions are not met.

The return value of PathRecValidFwd **with** specified \ID is:

TRUE if:

- The path recorder has moved the robot backwards, using PathRecMoveBwd.
- The robot has not moved away from the path executed by PathRecMoveBwd.
- The specified \ID was passed during the backward motion.

FALSE if:

- The above stated conditions are not met.

Arguments

PathRecValidFwd ([\ID])

[\ID]

Identifier

Data type: pathrecid

Variable that specifies the name of the recording start position. Data type pathrecid is a non-value type, only used as an identifier for naming the recording position.

Continues on next page

2 Functions

2.141 PathRecValidFwd - Is there a valid forward path recorded

Path Recovery

Continued

Program execution

After the path recorder has been ordered to move backwards using PathRecMoveBwd it is possible to check if a valid recorded path to move the robot forward exists. If the identifier \ID is omitted PathRecValidFwd returns if it is possible to move forward to the position where the backwards movement was initiated.

More examples

The following example illustrates the function PathRecValidFwd.

Example 1

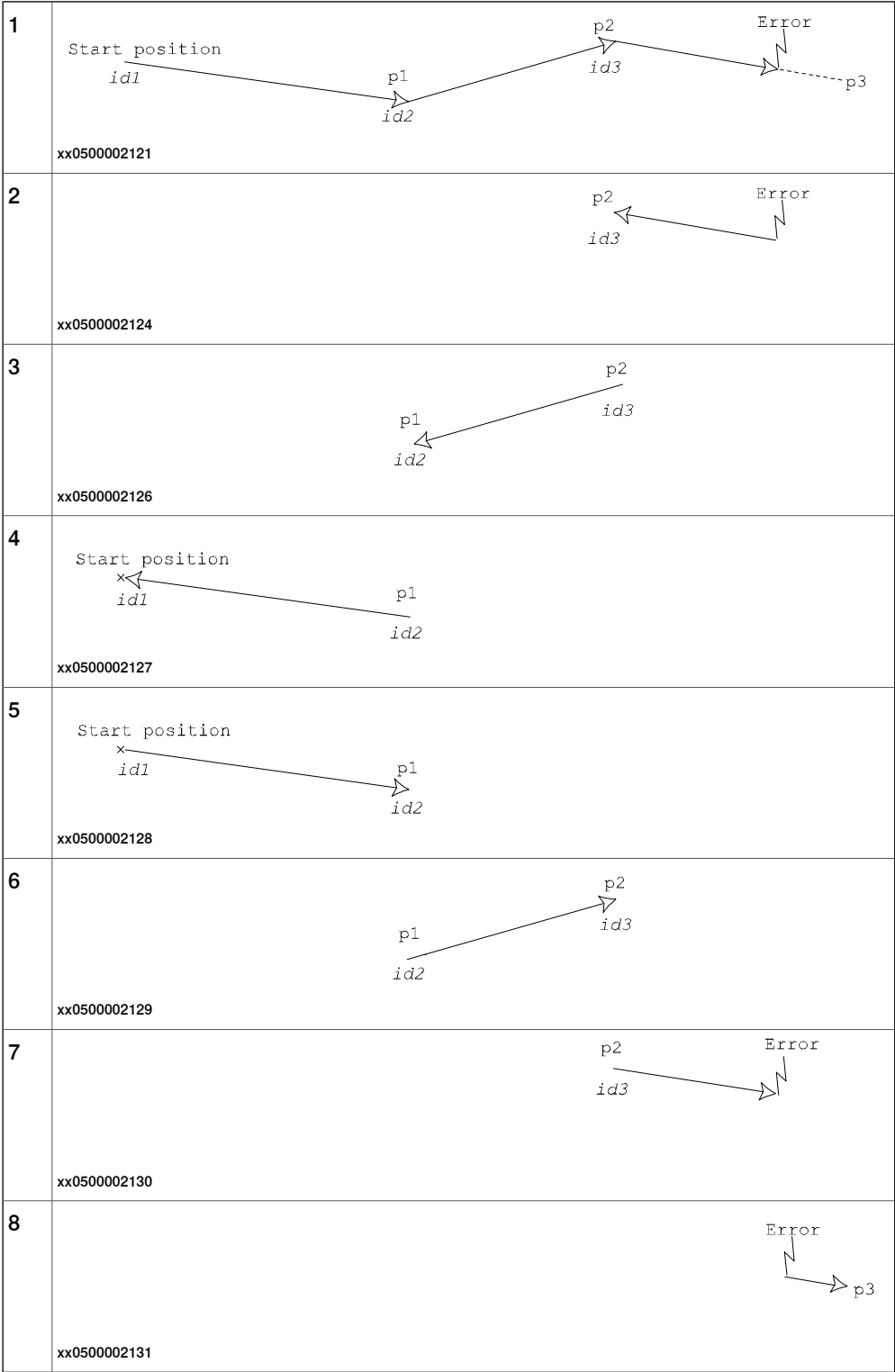
```
VAR pathrecid id1;
VAR pathrecid id2;
VAR pathrecid id3;

PathRecStart id1;
MoveL p1, vmax, z50, tool1;
PathRecStart id2;
MoveL p2, vmax, z50, tool1;
PathRecStart id3;
!See figures 1 and 8 in the following table.
MoveL p3, vmax, z50, tool1;
ERROR
  StorePath;
  IF PathRecValidBwd(\ID:=id3) THEN
    !See figure 2 in the following table.
    PathRecMoveBwd \ID:=id3;
    ! Do some other operation
  ENDIF
  IF PathRecValidBwd(\ID:=id2) THEN
    !See figure 3 in the following table.
    PathRecMoveBwd \ID:=id2;
    ! Do some other operation
  ENDIF
  !See figure 4 in the following table.
  PathRecMoveBwd;
  ! Do final service action
  IF PathRecValidFwd(\ID:=id2) THEN
    !See figure 5 in the following table.
    PathRecMoveFwd \ID:=id2;
    ! Do some other operation
  ENDIF
  IF PathRecValidFwd(\ID:=id3) THEN
    !See figure 6 in the following table.
    PathRecMoveFwd \ID:=id3;
    ! Do some other operation
  ENDIF
  !See figure 7 in the following table.
  PathRecMoveFwd;
  RestoPath;
```

Continues on next page

2.141 PathRecValidFwd - Is there a valid forward path recorded
Path Recovery
Continued

StartMove;
RETRY;



The example above will start the path recorder and add identifiers at three different locations along the executed path. The picture above references the example code and describes how the robot will move in the case of an error while executing towards point p3. The PathRecValidBwd and PathRecValidFwd are used

Continues on next page

2 Functions

2.141 PathRecValidFwd - Is there a valid forward path recorded

Path Recovery

Continued

respectively as it is not possible in advance to determine where in the program a possible error occurs.

Syntax

```
PathRecValidFwd '('  
    ['\' ID ' := ' < variable (VAR) of pathrecid >] ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Path recorder	<i>Application manual - Controller software Omni-Core</i>
Path Recorder Identifiers	pathrecid - Path recorder identifier on page 1692
Start - stop the path recorder	PathRecStart - Start the path recorder on page 534 PathRecStop - Stop the path recorder on page 537
Check if valid backward path exists	PathRecValidBwd - Is there a valid backward path recorded on page 1382
Play the path recorder backward	PathRecMoveBwd - Move path recorder backwards on page 525
Play the path recorder forward	PathRecMoveFwd - Move path recorder forward on page 531
Motion in general	<i>Technical reference manual - RAPID Overview</i>

2.142 PFRestart - Check interrupted path after power failure

Usage

PFRestart (*Power Failure Restart*) is used to check if the path has been interrupted at power failure. If so, some specific actions might be needed. The function checks the path on current level, base level, or on interrupt level.

Basic examples

The following example illustrates the function PFRestart.

Example 1

```
IF PFRestart() = TRUE THEN
```

It is checked, if an interrupted path exists on the current level. If so the function will return TRUE.

Return value

Data type: bool

TRUE if an interrupted path exists on the specified path level, otherwise FALSE.

Arguments

```
PFRestart([\Base] | [\Irpt])
```

[\Base]

Base Level

Data type: switch

Returns TRUE if an interrupted path exists on base level.

[\Irpt]

Interrupt Level

Data type: switch

Returns TRUE if an interrupted path exists on StorePath level.

If no argument is given, the function will return TRUE if an interrupted path exists on current level.

Syntax

```
PFRestart '('  
  ['\ ' Base] | ['\ ' Irpt] ')'
```

A function with a return value of the data type bool.

2 Functions

2.143 PoseInv - Inverts pose data

RobotWare Base

2.143 PoseInv - Inverts pose data

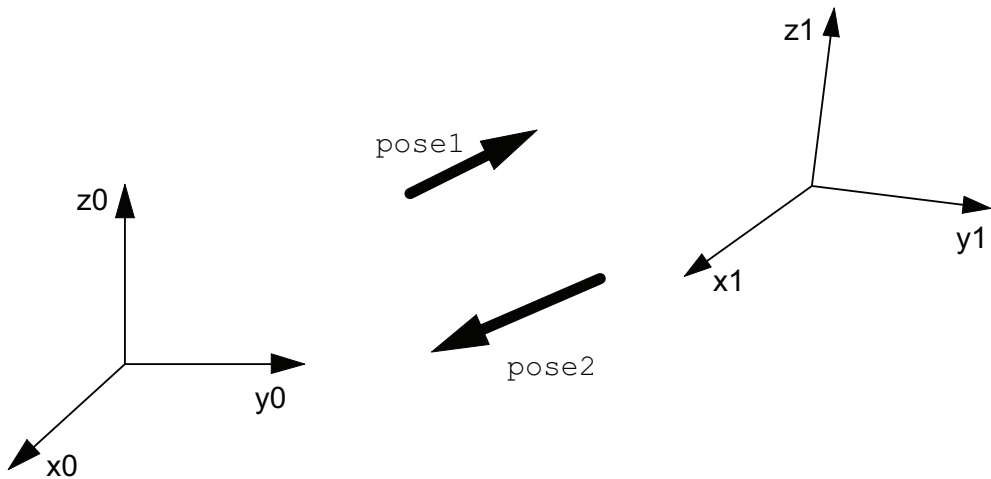
Usage

PoseInv (*Pose Invert*) calculates the reverse transformation of a pose.

Basic examples

The following example illustrates the function PoseInv.

Example 1



xx0500002443

pose1 represents the coordinates system 1 related to the coordinate system 0. The transformation giving the coordinate system 0 related to the coordinate system 1 is obtained by the reverse transformation, stored in pose2.

```
VAR pose pose1;  
VAR pose pose2;  
...  
pose2 := PoseInv(pose1);
```

Return value

Data type: pose
The value of the reverse pose.

Arguments

PoseInv (Pose)

Pose

Data type: pose
The pose to invert.

Syntax

```
PoseInv(''  
[Pose ':='] <expression (IN) of pose>  
'')
```

A function with a return value of the data type pose.

Continues on next page

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.144 PoseMult - Multiplies pose data

RobotWare Base

2.144 PoseMult - Multiplies pose data

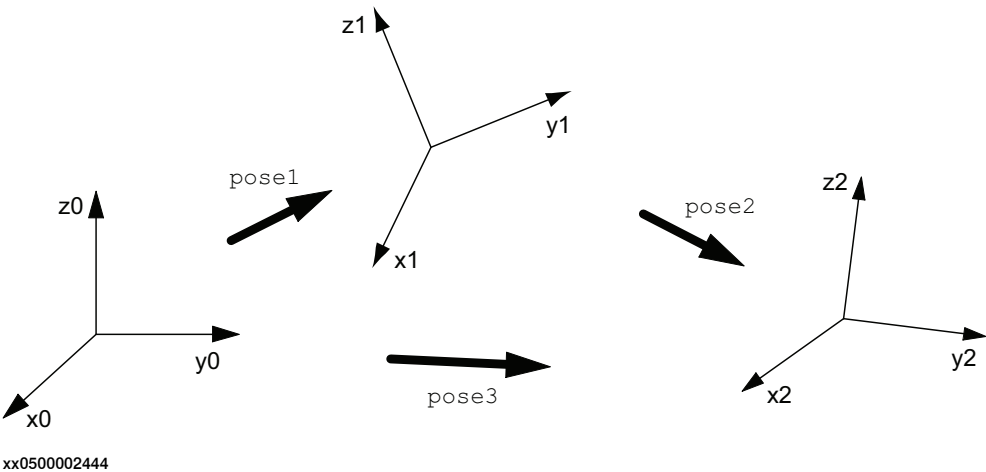
Usage

PoseMult (*Pose Multiply*) is used to calculate the product of two pose transformations. A typical use is to calculate a new pose as the result of a displacement acting on an original pose.

Basic examples

The following example illustrates the function PoseMult.

Example 1



pose1 represents the coordinate system 1 related to the coordinate system 0. pose2 represents the coordinate system 2 related to the coordinate system 1. The transformation giving pose3, the coordinate system 2 related to the coordinate system 0, is obtained by the product of the two transformations:

```
VAR pose pose1;  
VAR pose pose2;  
VAR pose pose3;  
...  
pose3 := PoseMult(pose1, pose2);
```

Return value

Data type: pose
The value of the product of the two poses.

Arguments

PoseMult (Pose1 Pose2)

Pose1

Data type: pose
The first pose.

Pose2

Data type: pose

Continues on next page

The second pose.

Syntax

```
PoseMult '('  
  [Pose1 ':='] <expression (IN) of pose> ','  
  [Pose2 ':='] <expression (IN) of pose> ')'
```

A function with a return value of the data type pose.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.145 PoseVect - Applies a transformation to a vector

RobotWare Base

2.145 PoseVect - Applies a transformation to a vector

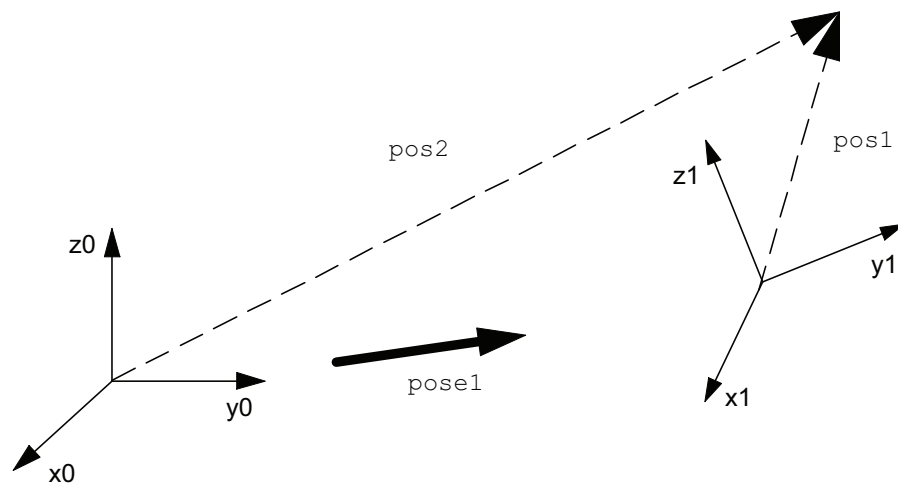
Usage

PoseVect (*Pose Vector*) is used to calculate the product of a pose and a vector. It is typically used to calculate a vector as the result of the effect of a displacement on an original vector.

Basic examples

The following example illustrates the function PoseVect.

Example 1



pose1 represents the coordinates system 1 related to the coordinate system 0.
pos1 is a vector related to coordinate system 1. The corresponding vector related to coordinate system 0 is obtained by the product;

```
VAR pose pose1;  
VAR pos pos1;  
VAR pos pos2;  
...  
...  
pos2:= PoseVect(pose1, pos1);
```

Return value

Data type: pos

The value of the product of the pose and the original pos.

Arguments

PoseVect (Pose Pos)

Pose

Data type: pose

The transformation to be applied.

Continues on next page

Pos

Data type: pos

The pos to be transformed.

Syntax

```
PoseVect '('  
  [Pose ':='] <expression (IN) of pose> ', '  
  [Pos ':='] <expression (IN) of pos> ')'
```

A function with a return value of the data type pos.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.146 Pow - Calculates the power of a value

RobotWare Base

2.146 Pow - Calculates the power of a value

Usage

Pow (*Power*) is used to calculate the exponential value in any base.

Basic examples

The following example illustrates the function Pow.

Example 1

```
VAR num x;  
VAR num y  
VAR num reg1;  
...  
reg1:= Pow(x, y);  
reg1 is assigned the value  $x^y$ .
```

Return value

Data type: num

The value of the Base raised to the power of the Exponent, that is, $\text{Base}^{\text{Exponent}}$.

Arguments

Pow (Base Exponent)

Base

Data type: num

The base argument value.

Exponent

Data type: num

The exponent argument value.

Limitations

The execution of the function x^y will give an error if:

- $x < 0$ and y is not an integer;
- $x = 0$ and $y \leq 0$.

Syntax

```
Pow '('  
  [Base ':=' ] <expression (IN) of num> ','  
  [Exponent ':=' ] <expression (IN) of num> ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2.147 PowDnum - Calculates the power of a value

Usage

PowDnum (*Power Dnum*) is used to calculate the exponential value in any base.

Basic examples

The following example illustrates the function PowDnum.

Example 1

```

VAR dnum x;
VAR num y
VAR dnum value;
...
value:= PowDnum(x, y);
value is assigned the value  $x^y$ .

```

Return value

Data type: dnum

The value of the Base raised to the power of the Exponent, that is, $\text{Base}^{\text{Exponent}}$.

Arguments

PowDnum (Base Exponent)

Base

Data type: dnum

The base argument value.

Exponent

Data type: num

The exponent argument value.

Limitations

The execution of the function x^y will give an error if:

- $x < 0$ and y is not an integer;
- $x = 0$ and $y \leq 0$.

Syntax

```

PowDnum '('
  [Base ':=' ] <expression (IN) of dnum> ', '
  [Exponent ':=' ] <expression (IN) of num> ')'

```

A function with a return value of the data type dnum.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.148 PPMovedInManMode - Test whether the program pointer is moved in manual mode

RobotWare Base

2.148 PPMovedInManMode - Test whether the program pointer is moved in manual mode

Usage

PPMovedInManMode returns TRUE if the user has moved the program pointer while the controller is in manual mode - that is, operator key is at Man Reduced Speed or Man Full Speed. The program pointer moved state is reset when the key is switched from Auto to Man, or when using the instruction ResetPPMoved.

Basic examples

The following example illustrates the function PPMovedInManMode.

Example 1

```
IF PPMovedInManMode() THEN
  WarnUserOfPPMovement;
  DoJob;
ELSE
  DoJob;
ENDIF
```

Return value

Data type: bool

TRUE if the program pointer has been moved by the user while in manual mode.

Program execution

Test if the program pointer for the current program task has been moved in manual mode.

Syntax

PPMovedInManMode '(' ' ')

A function with a return value of the data type bool.

Related information

For information about	See
Test whether program pointer has moved	IsStopStateEvent - Test whether moved program pointer on page 1335
Reset state of moved program pointer in manual mode	ResetPPMoved - Reset state for the program pointer moved in manual mode on page 597

2.149 Present - Tests if an optional parameter is used

Usage

Present is used to test if an optional argument has been used when calling a routine.

An optional parameter may not be used if it was not specified when calling the routine. This function can be used to test if a parameter has been specified, in order to prevent errors from occurring.

Basic examples

The following example illustrates the function Present.

See also [More examples on page 1399](#).

Example 1

```
PROC feeder (\switch on | switch off)
  IF Present (on) Set do1;
  IF Present (off) Reset do1;
ENDPROC
```

The output do1, which controls a feeder, is set or reset depending on the argument used when calling the routine.

Return value

Data type: bool

TRUE = The parameter value or a switch has been defined when calling the routine.

FALSE = The parameter value or a switch has not been defined.

Arguments

Present (OptPar)

OptPar

Optional Parameter

Data type: anytype

The name of the optional parameter to be tested.

More examples

The following example illustrates the function Present.

Example 1

```
PROC glue (\switch on, num glueflow, robtarget topoint, speeddata
  speed, zonedata zone, PERS tooldata tool, \PERS wobjdata wobj)
  IF Present (on) PulseD0 glue_on;
  SetAO gluesignal, glueflow;
  IF Present (wobj) THEN
    MoveL topoint, speed, zone, tool \WObj:=wobj;
  ELSE
    MoveL topoint, speed, zone, tool;
  ENDIF
ENDPROC
```

Continues on next page

2 Functions

2.149 Present - Tests if an optional parameter is used

RobotWare Base

Continued

A glue routine is made. If the argument `\on` is specified when calling the routine, a pulse is generated on the signal `glue_on`. The robot then sets an analog output `gluesignal`, which controls the glue gun, and moves to the end position. As the `wobj` parameter is optional, different `MoveL` instructions are used depending on whether this argument is used or not.

Syntax

```
Present '('  
  [OptPar ':='] <reference (REF) of anytype> ')'
```

A REF parameter requires, in this case, the optional parameter name.

A function with a return value of the data type `bool`.

Related information

For information about	See
Routine parameters	<i>Technical reference manual - RAPID Overview</i>

2.150 ProgMemFree - Get the size of free program memory

Usage

ProgMemFree (*Program Memory Free*) is used to get the size of free program memory.

Basic examples

The following example illustrates the function ProgMemFree.

Example 1

```

FUNC dnum module_size(string file_path)
  VAR dnum pgmfree_before;
  VAR dnum pgmfree_after;

  pgmfree_before:=ProgMemFree();
  Load \Dynamic, file_path;
  pgmfree_after:=ProgMemFree();
  Unload file_path;
  RETURN (pgmfree_before-pgmfree_after);
ENDFUNC

```

ProgMemFree is used in a function that returns the value for how much memory a module allocates in the program memory.

Return value

Data type: dnum

The size of free program memory in bytes.

Syntax

ProgMemFree '(' ' ')

A function with a return value of the data type dnum.

Related information

For information about	See
Load a program module	Load - Load a program module during execution on page 332
Unload a program module	UnLoad - Unload a program module during execution on page 978

2 Functions

2.151 Rand - Generate a random number

RobotWare Base

2.151 Rand - Generate a random number

Usage

Rand is used to generate a random integer number between 0 and RAND_MAX.

Basic examples

The following example illustrates the function Rand.

Example 1

```
VAR num myrandomnumber;  
..  
myrandomnumber:=Rand();
```

Generate a random number and assign it to the variable myrandomnumber.

Return value

Data type: num

A random number between 0 and RAND_MAX. For a real robot controller, RAND_MAX is 65535, and for a virtual controller RAND_MAX is 32767.

Arguments

Rand ([\Seed] [\SeedEachNTime])

\Seed

Data type: switch

The current time is used to seed the random number generator if this switch is used. If the switch is not used the seed is done at first call to the function Rand, and the sequence of numbers generated will always be the same.

\SeedEachNTime

Data type: num

Sets up an internal counter that is decreased each time the Rand function is executed with optional argument SeedEachNTime. When the internal counter is 0 a new seed is done (with current time), and the internal counter is set to the value used in the optional argument SeedEachNTime.

Program execution

Rand is used to generate a random integer number between 0 and RAND_MAX.

In reality, pseudorandom numbers are not random at all. The numbers are computed using a fixed deterministic algorithm. The *seed* (argument Seed) is the starting point for a sequence of random numbers. If starting from the same seed, you will get the very same sequence.

The Rand function is using the current time as seed the first time it is executed.

To make it more random it is possible to specify that it should use a new time as seed each time it is executed (with switch Seed), or after a number of times it has been executed (optional argument SeedEachNTime).

Continues on next page

If you never seed with a new starting point (time) for the random numbers and generate many numbers with Rand, you can see that the same number sequence is repeated.

More examples

More examples of the function Rand are illustrated below.

Example 1

```
VAR num random_numbers{6};  
FOR i FROM 1 TO 6 DO  
  random_numbers{i} := Rand()/RAND_MAX;  
ENDFOR
```

In the example above Rand function generates 6 random numbers between 0 and 1, and stores them in the random_numbers array.

Example 2

```
VAR num rand_no;  
Open "HOME:" \File:= "LOGFILE.txt", logfile \Write;  
FOR i FROM 1 TO 5000 DO  
  rand_no := Rand(\SeedEachNTime:=30);  
  Write logfile, "\"Num:=rand_no";  
ENDFOR
```

In the example above Rand function generates 5000 random numbers and writes them to a file. Optional argument SeedEachNTime is used with value 30. Then a new seed is done to create a new random number series for every 30 times Rand function is executed.

Syntax

```
Rand '('  
  ['\' Seed]  
  ['\' SeedEachNTime' := ' <expression (IN) of num> '])'
```

A function with a return value of the data type num.

2 Functions

2.152 RawBytesLen - Get the length of rawbytes data

RobotWare Base

2.152 RawBytesLen - Get the length of rawbytes data

Usage

RawBytesLen is used to get the current length of valid bytes in a rawbytes variable.

Basic examples

The following example illustrates the function RawBytesLen.

Example 1

```
VAR rawbytes from_raw_data;  
VAR rawbytes to_raw_data;  
VAR num integer := 8  
VAR num float := 13.4;  
ClearRawBytes from_raw_data;  
PackRawBytes integer, from_raw_data, 1 \IntX := INT;  
PackRawBytes float, from_raw_data, (RawBytesLen(from_raw_data)+1)  
  \Float4;  
CopyRawBytes from_raw_data, 1, to_raw_data, 3;
```

In this example the variable `from_raw_data` of type `rawbytes` is first cleared, that is, all bytes set to 0 (same as default at declaration). Then the value of `integer` is placed in the first 2 bytes and with help of the function `RawBytesLen` the value of `float` is placed in the next 4 bytes (starting at index 3).

After having filled `from_raw_data` with data, the contents (6 bytes) is copied to `to_raw_data`, starting at position 3.

Return value

Data type: `num`

The length of valid bytes in a variable of type `rawbytes`.

In general, the current length of valid bytes in a `rawbytes` variable is updated by the system to be the last written byte in the `rawbytes` structure.

For details, see data type `rawbytes`, instruction `ClearRawBytes`, `CopyRawBytes`, `PackDNHeader`, `PackRawBytes`, and `ReadRawBytes`.

Arguments

RawBytesLen (RawData)

RawData

Data type: `rawbytes`

RawData is the data container whose current length of valid bytes shall be returned.

Program execution

During program execution the current length of valid bytes is returned.

Syntax

```
RawBytesLen '('  
[RawData ':='] < variable (VAR) of rawbytes> ')'
```

A function with a return value of the data type `num`.

Continues on next page

Related information

For information about	See
rawbytes data	rawbytes - Raw data on page 1702
Clear the contents of rawbytes data	ClearRawBytes - Clear the contents of rawbytes data on page 140
Copy the contents of rawbytes data	CopyRawBytes - Copy the contents of rawbytes data on page 165
Pack DeviceNet header into rawbytes data	PackDNHeader - Pack DeviceNet Header into rawbytes data on page 506
Pack data into rawbytes data	PackRawBytes - Pack data into rawbytes data on page 509
Read rawbytes data	ReadRawBytes - Read rawbytes data on page 576
Unpack data from rawbytes data	UnpackRawBytes - Unpack data from rawbytes data on page 981
Write rawbytes data	WriteRawBytes - Write rawbytes data on page 1078
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>

2 Functions

2.153 ReadBin - Reads a byte from a file or I/O device

RobotWare Base

2.153 ReadBin - Reads a byte from a file or I/O device

Usage

ReadBin (*Read Binary*) is used to read a byte (8 bits) from a file or I/O device. This function works on both binary and character-based files or I/O devices.

Basic examples

The following example illustrates the function ReadBin.

See also [More examples on page 1407](#).

Example 1

```
VAR num character;  
VAR iodev file1;  
...  
Open "HOME:", \File:= "FILE1.DOC", file1\Bin;  
character := ReadBin(file1);
```

A byte is read from the binary file file1.

Return value

Data type: num

A byte (8 bits) is read from a specified file or I/O device. This byte is converted to the corresponding positive numeric value and returned as a num data type. If a file is empty (end of file), EOF_BIN (the number -1) is returned.

Arguments

ReadBin (IODevice [\Time])

IODevice

Data type: iodev

The name (reference) of the file or I/O device to be read.

[\Time]

Data type: num

The max. time for the reading operation (timeout) in seconds. If this argument is not specified, the max. time is set to 60 seconds. To wait forever, use the predefined constant WAIT_MAX.

If this time runs out before the reading operation is finished, the error handler will be called with the error code ERR_DEV_MAXTIME. If there is no error handler, the execution will be stopped.

The timeout function is in use also during program stop and will be noticed by the RAPID program at program start.

Program execution

Program execution waits until a byte (8 bits) can be read from the file or I/O device.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type iodev will be reset.

Continues on next page

Predefined data

The constant EOF_BIN can be used to stop reading at the end of the file.

```
CONST num EOF_BIN := -1;
```

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	An error occurs during reading.
ERR_DEV_MAXTIME	Time-out before the read operation is finished.

More examples

The following example illustrates the function ReadBin.

Example 1

```
VAR num bindata;
VAR iodev file;

Open "HOME:/myfile.bin", file \Read \Bin;
bindata := ReadBin(file);
WHILE bindata <> EOF_BIN DO
  TPWrite ByteToStr(bindata\Char);
  bindata := ReadBin(file);
ENDWHILE
```

Read the contents of a binary file myfile.bin from the beginning to the end and displays the received binary data converted to chars on the FlexPendant (one char on each line).

Limitations

The function can only be used for files and I/O devices that have been opened with read access (\Read for character based files, \Bin or \Append \Bin for binary files).

Syntax

```
ReadBin '('
  [IODevice ':='] <variable (VAR) of iodev>
  ['\ ' Time ':='] <expression (IN) of num> ] ')'
```

A function with a return value of the type num.

Related information

For information about	See
Opening, etc. files or I/O devices	<i>Technical reference manual - RAPID Overview</i>
Convert a byte to a string data	ByteToStr - Converts a byte to a string data on page 1164
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>

2 Functions

2.154 ReadDir - Read next entry in a directory

RobotWare Base

2.154 ReadDir - Read next entry in a directory

Usage

ReadDir is used to retrieve the name of the next file or subdirectory under a directory that has been opened with the instruction OpenDir.

As long as the function returns TRUE, there can be more files or subdirectories to retrieve.

Basic examples

The following example illustrates the function ReadDir.

See also [More examples on page 1409](#).

Example 1

```
PROC lsdire(string dirname)
  VAR dir directory;
  VAR string filename;
  OpenDir directory, dirname;
  WHILE ReadDir(directory, filename) DO
    TPWrite filename;
  ENDWHILE
  CloseDir directory;
ENDPROC
```

This example prints out the names of all files or subdirectories under the specified directory.

Return value

Data type: bool

The function will return TRUE if it has retrieved a name, otherwise FALSE.

Arguments

ReadDir (Dev FileName)

Dev

Data type: dir

A variable with reference to the directory, fetched by instruction OpenDir.

FileName

Data type: string

The retrieved file or subdirectory name.

Program execution

This function returns a bool that specifies if the retrieving of a name was successful or not.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	The directory is not opened (see OpenDir). The filename read consists of more bytes than the maximum length of a RAPID string. The string variable used in argument FileName will not be updated.

More examples

More examples of the function ReadDir are illustrated below

Example 1

This example implements a generic traverse of a directory structure function.

```

PROC searchdir(string dirname, string actionproc)
  VAR dir directory;
  VAR string filename;
  IF IsFile(dirname \Directory) THEN
    OpenDir directory, dirname;
    WHILE ReadDir(directory, filename) DO
      ! .. and . is the parent and resp. this directory
      IF filename <> ".." AND filename <> "." THEN
        searchdir dirname+"/"+filename, actionproc;
      ENDIF
    ENDWHILE
    CloseDir directory;
  ELSE
    %actionproc% dirname;
  ENDIF
ERROR
  RAISE;
ENDPROC

PROC listfile(string filename)
  TPWrite filename;
ENDPROC

PROC main()
  ! Execute the listfile routine for all files found under the
  ! tree in HOME:
  searchdir "HOME:", "listfile";
ENDPROC

```

This program traverses the directory structure under "HOME:", and for each file found it calls the listfile procedure. The searchdir is the generic part that knows nothing about the start of the search or which routine should be called for each file. It uses IsFile to check whether it has found a subdirectory or a file and it uses the late binding mechanism to call the procedure specified in actionproc for all files found. The actionproc routine should be a procedure with one parameter of the type string.

Continues on next page

2 Functions

2.154 ReadDir - Read next entry in a directory

RobotWare Base

Continued

Syntax

```
ReadDir '('  
  [ Dev ':= ' ] < variable (VAR) of dir> ', '  
  [ FileName ':= ' ] < variable or persistent (INOUT) of string>  
  ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Directory	dir - File directory structure on page 1629
Make a directory	MakeDir - Create a new directory on page 343
Open a directory	OpenDir - Open a directory on page 504
Close a directory	CloseDir - Close a directory on page 147
Remove a directory	RemoveDir - Delete a directory on page 585
Remove a file	RemoveFile - Delete a file on page 587
Rename a file	RenameFile - Rename a file on page 588
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>
Path references and the directory structure	<i>Operating manual - OmniCore</i> , section Directory structure on OmniCore

2.155 ReadDnum - Reads a number from a file or I/O device

Usage

ReadDnum (*Read dnum Numeric*) is used to read a number from a character-based file or I/O device.

Basic examples

The following example illustrates the function ReadDnum.

See also [More examples on page 1412](#).

Example 1

```
VAR iodev infile;
VAR dnum mydnum;
...
Open "HOME:/file.log", infile\Read;
mydnum := ReadDnum(infile);
mydnum is assigned a number read from the file file.log.
```

Return value

Data type: dnum

The numeric value read from a specified file or I/O device. If the file is empty (end of file), a number greater than EOF_DNUM (9.998E36) is returned.

Arguments

ReadDnum (IODevice [\Delim] [\Time] [\ISOLatin1Encoding])

IODevice

Data type: iodev

The name (reference) of the file or I/O device to be read.

[\Delim]***Delimiters***

Data type: string

A string containing the delimiters to use when parsing a line in the file or I/O device. By default (without \Delim), the file is read line by line and the line-feed character (\0A) is the only delimiter considered by the parsing. When the \Delim argument is used, any character in the specified string argument will be considered to determine the significant part of the line.

When using the argument \Delim, the control system always adds the characters carriage return (\0D) and line-feed (\0A) to the delimiters specified by the user.

To specify non-alphanumeric characters, use \xx, where xx is the hexadecimal representation of the ASCII code of the character (example: TAB is specified by \09).

[\Time]

Data type: num

Continues on next page

2 Functions

2.155 ReadDnum - Reads a number from a file or I/O device

RobotWare Base

Continued

The max. time for the reading operation (timeout) in seconds. If this argument is not specified, the max. time is set to 60 seconds. To wait forever, use the predefined constant WAIT_MAX.

If this time runs out before the read operation is finished, the error handler will be called with the error code ERR_DEV_MAXTIME. If there is no error handler, the execution will be stopped.

The timeout function is also in use during program stop and will be noticed by the RAPID program at program start.

[\ISOLatin1Encoding]

Data type: switch

This switch makes it possible to read a string from a file or I/O device that has characters that are ISO8859-1 encoded.

Program execution

Starting at the current file position, the function reads and discards any heading delimiters. A heading delimiter without the argument \Delim is a line-feed character. Heading delimiters with the argument \Delim are any characters specified in the \Delim argument plus carriage return and line-feed characters. It then reads everything up to and including the next delimiter character (will be discarded), but not more than 80 bytes. If the significant part exceeds 80 bytes, the remainder of the characters will be read on the next reading.

The string that is read is then converted to a numeric value; for example, "234.12345678912" is converted to the dnum numeric value 234.12345678912.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type iODEV will be reset.

Predefined data

The constant EOF_DNUM can be used to stop reading, at the end of the file.

```
CONST num EOF_DNUM := 9.998E36;
```

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	An access error occurs during reading.
ERR_RCVDATA	There is an attempt to read non-numeric data.
ERR_DEV_MAXTIME	Time-out before the read operation is finished.

More examples

The following example illustrates the function ReadDnum.

Example 1

```
mydnum := ReadDnum(infile\Delim:="\09");  
IF mydnum > EOF_DNUM THEN  
  TPWrite "The file is empty";
```

Continues on next page

...

Reads a number in a line where numbers are separated by TAB ("\09") or SPACE (" ") characters. Before using the number read from the file, a check is performed to make sure that the file is not empty.

**Note**

Use < or > (smaller than or greater than) when checking if the file is empty. Do not use = (equal to).

Limitations

The function can only be used for character based files that have been opened for reading.

Syntax

```
ReadDnum '('
  [IODevice ':='] <variable (VAR) of iodev>
  ['\' Delim ':='] <expression (IN) of string>]
  ['\' Time ':='] <expression (IN) of num>]
  ['\' ISOLatin1Encoding']')'
```

A function with a return value of the type dnum.

Related information

For information about	See
ReadNum	ReadNum - Reads a number from a file or I/O device on page 1416
Opening, etc. files or I/O devices	<i>Technical reference manual - RAPID Overview</i>
File and I/O device handling	<i>Application manual - Controller software Omni-Core</i>

2 Functions

2.156 ReadMotor - Reads the current motor angles

RobotWare Base

2.156 ReadMotor - Reads the current motor angles

Usage

ReadMotor is used to read the current angles of the different motors of the robot and external axes. The primary use of this function is in the calibration procedure of the robot.

Basic examples

The following example illustrates the function ReadMotor.

See also [More examples on page 1415](#).

Example 1

```
VAR num motor_angle2;  
motor_angle2 := ReadMotor(2);
```

The current motor angle of the second axis of the robot is stored in motor_angle2.

Return value

Data type: num

The current motor angle in radians of the stated axis of the robot or external axes.

Arguments

ReadMotor [\MecUnit] Axis

MecUnit

Mechanical Unit

Data type: mecunit

The name of the mechanical unit for which an axis is to be read. If this argument is omitted, the axis for the connected robot is read.

Axis

Data type: num

The number of the axis to be read (1 - 6).

Program execution

The motor angle returned represents the current position in radians for the motor without any calibration offset. The value is not related to a fix position of the robot, only to the resolver internal zero position, that is, normally the resolver zero position closest to the calibration position (the difference between the resolver zero position and the calibration position is the calibration offset value). The value represents the full movement of each axis, although this may be several turns.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_AXIS_PAR	Parameter axis in function is wrong.

Continues on next page

More examples

The following example illustrates the function ReadMotor.

Example 1

```
VAR num motor_angle;  
motor_angle := ReadMotor(\MecUnit:=STN1, 1);
```

The current motor angle of the first axis of STN1 is stored in motor_angle.

Limitations

It is only possible to read the current motor angles for the mechanical units that are controlled from current program task. For a non-motion task, it is possible to read the angles for the mechanical units controlled by the connected motion task.

Syntax

```
ReadMotor '('  
  ['\' MecUnit ':= ' < variable (VAR) of mecunit> ',']  
  [Axis ':=' ] < expression (IN) of num> ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Reading the current joint angle	CJointT - Reads the current joint angles on page 1193

2 Functions

2.157 ReadNum - Reads a number from a file or I/O device

RobotWare Base

2.157 ReadNum - Reads a number from a file or I/O device

Usage

ReadNum (*Read Numeric*) is used to read a number from a character-based file or I/O device.

Basic examples

The following example illustrates the function ReadNum.

See also [More examples on page 1417](#).

Example 1

```
VAR iodev infile;
...
Open "HOME:/file.doc", infile\Read;
reg1 := ReadNum(infile);
```

reg1 is assigned a number read from the file file.doc.

Return value

Data type: num

The numeric value read from a specified file or I/O device. If the file is empty (end of file), a number greater than EOF_NUM (9.998E36) is returned.

Arguments

ReadNum (IODevice [\Delim] [\Time] [\ISOLatin1Encoding])

IODevice

Data type: iodev

The name (reference) of the file or I/O device to be read.

[\Delim]

Delimiters

Data type: string

A string containing the delimiters to use when parsing a line in the file or I/O device. By default (without \Delim), the file is read line by line and the line-feed character (\0A) is the only delimiter considered by the parsing. When the \Delim argument is used, any character in the specified string argument will be considered to determine the significant part of the line.

When using the argument \Delim, the control system always adds the characters carriage return (\0D) and line-feed (\0A) to the delimiters specified by the user.

To specify non-alphanumeric characters, use \xx, where xx is the hexadecimal representation of the ASCII code of the character (example: TAB is specified by \09).

[\Time]

Data type: num

Continues on next page

The max. time for the reading operation (timeout) in seconds. If this argument is not specified, the max. time is set to 60 seconds. To wait forever, use the predefined constant WAIT_MAX.

If this time runs out before the read operation is finished, the error handler will be called with the error code ERR_DEV_MAXTIME. If there is no error handler, the execution will be stopped.

The timeout function is also in use during program stop and will be noticed by the RAPID program at program start.

[\ISOLatin1Encoding]

Data type: switch

This switch makes it possible to read a string from a file or I/O device that has characters that are ISO8859-1 encoded.

Program execution

Starting at the current file position, the function reads and discards any heading delimiters. A heading delimiter without the argument \Delim is a line-feed character. Heading delimiters with the argument \Delim are any characters specified in the \Delim argument plus carriage return and line-feed characters. It then reads everything up to and including the next delimiter character (will be discarded), but not more than 80 bytes. If the significant part exceeds 80 bytes, the remainder of the characters will be read on the next reading.

The string that is read is then converted to a numeric value; for example, "234.4" is converted to the numeric value 234.4.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type iODEV will be reset.

Predefined data

The constant EOF_NUM can be used to stop reading, at the end of the file.

```
CONST num EOF_NUM := 9.998E36;
```

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_FILEACC	An access error occurs during reading.
ERR_RCVDATA	There is an attempt to read non-numeric data.
ERR_DEV_MAXTIME	Time-out before the read operation is finished.

More examples

The following example illustrates the function ReadNum.

Example 1

```
reg1 := ReadNum(infile\Delim:="\09");
IF reg1 > EOF_NUM THEN
  TPWrite "The file is empty";
```

Continues on next page

2 Functions

2.157 ReadNum - Reads a number from a file or I/O device

RobotWare Base

Continued

...

Reads a number in a line where numbers are separated by TAB ("\09") or SPACE (" ") characters. Before using the number read from the file, a check is performed to make sure that the file is not empty.



Note

Use < or > (smaller than or greater than) when checking if the file is empty. Do not use = (equal to).

Limitations

The function can only be used for character based files that have been opened for reading.

Syntax

```
ReadNum '('  
  [IODevice ']:='] <variable (VAR) of iodev>  
  ['\' Delim ']:='] <expression (IN) of string>  
  ['\' Time ']:='] <expression (IN) of num>  
  ['\' ISOLatin1Encoding']')'
```

A function with a return value of the type num.

Related information

For information about	See
Opening, etc. files or I/O devices	<i>Technical reference manual - RAPID Overview</i>
File and I/O device handling	<i>Application manual - Controller software Omni-Core</i>

2.158 ReadStr - Reads a string from a file or I/O device

Usage

ReadStr (*Read String*) is used to read a string from a character-based file or I/O device.

Basic examples

The following example illustrates the function ReadStr.

See also [More examples on page 1421](#).

Example 1

```
VAR string text;
VAR iodev infile;
...
Open "HOME:/file.doc", infile\Read;
text := ReadStr(infile);
text is assigned a string read from the file file.doc.
```

Return value

Data type: string

The string read from the specified file or I/O device. If the file is empty (end of file), the string "EOF" is returned.

Arguments

```
ReadStr (IODevice [\Delim] [\RemoveCR] [\DiscardHeaders] [\Time]
        [\Line] [\ISOLatin1Encoding] [\Status])
```

IODevice

Data type: iodev

The name (reference) of the file or I/O device to be read.

[\Delim]

Delimiters

Data type: string

A string containing the delimiters to use when parsing a line in the file or I/O device. By default the file is read line by line and the line-feed character (\0A) is the only delimiter considered by the parsing. When the \Delim argument is used, any character in the specified string argument plus by default line-feed character will be considered to determine the significant part of the line.

To specify non-alphanumeric characters, use \xx, where xx is the hexadecimal representation of the ASCII code of the character (example: TAB is specified by \09).

[\RemoveCR]

Data type: switch

A switch used to remove the trailing carriage return character when reading PC files. In PC files, a new line is specified by carriage return and line feed (CRLF).

Continues on next page

2 Functions

2.158 ReadStr - Reads a string from a file or I/O device

RobotWare Base

Continued

When reading a line in such files, the carriage return character is by default read into the return string. When using this argument, the carriage return character will be read from the file but not included in the return string.

[\DiscardHeaders]

Data type: switch

This argument specifies whether the heading delimiters (specified in `\Delim` plus default line-feed) are skipped or not before transferring data to the return string. By default, if the first character at the current file position is a delimiter, it is read but not transferred to the return string, the line parsing is stopped and the return will be an empty string. If this argument is used, all delimiters included in the line will be read from the file but discarded, and no return will be done until the return string will contain the data starting at the first non-delimiter character in the line.

[\Time]

Data type: num

The max. time for the reading operation (timeout) in seconds. If this argument is not specified, the max. time is set to 60 seconds. To wait forever, use the predefined constant `WAIT_MAX`.

If this time runs out before the read operation is finished, the error handler will be called with the error code `ERR_DEV_MAXTIME`. If there is no error handler, the execution will be stopped.

The timeout function is in use also during program stop and will be noticed in the RAPID program at program start.

[\Line]

Data type: num

Specifies which line in the file that should be read.

If the line does not exist, the string "EOF" is returned.

[\ISOLatin1Encoding]

Data type: switch

This switch makes it possible to read a string from a character-based file or I/O device that has characters that are ISO8859-1 encoded.

[\Status]

Data type: string

The argument `Status` tells the user the reason why `ReadStr` interrupted the reading.

One of the following strings can be returned in the optional argument `Status`: EOF, EOL, REMAIN, or DELIM.

Status	Description
EOF	End of file has been reached. No more characters to read.
EOL	End of line has been reached. More characters to be read.
REMAIN	Exact 80 characters has been read. More characters to be read.

Continues on next page

Status	Description
DELIM	A delimiter has been found (see optional argument <code>Delim</code>). More characters to be read.

Program execution

Starting at the current file position, if the `\DiscardHeaders` argument is used, the function reads and discards any heading delimiters (line-feed characters and any character specified in the `\Delim` argument). In all cases, it then reads everything up to the next delimiter character, but not more than 80 bytes. If the significant part exceeds 80 bytes, the remainder of the characters will be read on the next reading. The delimiter that caused the parsing to stop is read from the file but not transferred to the return string. If the last character in the string is a carriage return character and the `\RemoveCR` argument is used, this character will be removed from the string.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type `iodev` will be reset.

Predefined data

The constant `EOF` can be used to check if the file was empty when trying to read from the file or to stop reading at the end of the file.

```
CONST string EOF := "EOF";
```

The constants `EOF`, `EOL`, `REMAIN`, and `DELIM` can be used to see why `ReadStr` interrupted the reading (see optional argument `Status`).

```
CONST string EOL := "EOL";
```

```
CONST string REMAIN := "REMAIN";
```

```
CONST string DELIM := "DELIM";
```

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_FILEACC</code>	An error occurs during reading.
<code>ERR_DEV_MAXTIME</code>	Time-out before the read operation is finished.

More examples

The following examples illustrate the function `ReadStr`.

Example 1

```
text := ReadStr(infile);
IF text = EOF THEN
  TPWrite "The file is empty";
...
```

Before using the string read from the file, a check is performed to make sure that the file is not empty.

Example 2

Consider a file containing:

Continues on next page

2 Functions

2.158 ReadStr - Reads a string from a file or I/O device

RobotWare Base

Continued

```
<LF><SPACE><TAB>Hello<SPACE><SPACE>World<CR><LF>
text := ReadStr(infile);
```

text will be an empty string: the first character in the file is the default <LF> delimiter.

```
text := ReadStr(infile\DiscardHeaders);
```

text will contain <SPACE><TAB>Hello<SPACE><SPACE>World<CR>: the first character in the file, the default <LF> delimiter, is discarded.

```
text := ReadStr(infile\RemoveCR\DiscardHeaders);
```

text will contain <SPACE><TAB>Hello<SPACE><SPACE>World: the first character in the file, the default <LF> delimiter, is discarded; the final carriage return character is removed

```
text := ReadStr(infile\Delim:=" \09"\RemoveCR\DiscardHeaders);
```

text will contain "Hello": the first characters in the file that match either the default <LF> delimiter or the character set defined by \Delim (space and tab) are discarded. Data is then transferred up to the first delimiter that is read from the file but not transferred into the string. A new invocation of the same statement will return "World".

Example 3

Consider a file containing:

```
<CR><LF>Hello<CR><LF>
text := ReadStr(infile);
```

text will contain the <CR> (\0d) character: <CR> and <LF> characters are read from the file, but only <CR> is transferred to the string. A new invocation of the same statement will return "Hello\0d".

```
text := ReadStr(infile\RemoveCR);
```

text will contain an empty string: <CR> and <LF> characters are read from the file; <CR> is transferred but removed from the string. A new invocation of the same statement will return "Hello".

```
text := ReadStr(infile\Delim:="\0d");
```

text will contain an empty string: <CR> is read from the file but not transferred to the return string. A new invocation of the same instruction will return an empty string again: <LF> is read from the file but not transferred to the return string.

```
text := ReadStr(infile\Delim:="\0d"\DiscardHeaders);
```

text will contain "Hello". A new invocation of the same instruction will return "EOF" (end of file).

Example 4

```
VAR iodev myfile;

PROC test_readstr()
VAR string readstring;
VAR string status;

TPERase;
Open "HOME:" \File:= "MyReadFile.log", myfile \Write;
Write myfile, "This robot is a fast robot, and it is an ABB Robot."
\NoNewLine;
```

Continues on next page

```

Write myfile, "The robot is white, and has 6 axes.";
Close myfile;
Open "HOME:" \File:= "MyReadFile.log", myfile \Read;
WHILE readstring <> EOF DO
  readstring:=ReadStr(myfile \Delim:=", " \Status:=status);
  IF status <> EOF THEN
    TPWrite readstring;
    TPWrite status;
  ENDIF
ENDWHILE

```

The output on the FlexPendant will be:

```

This robot is a fast robot
DELIM
and it is an ABB Robot. The robot is white
DELIM
and has 6 axes.
EOL

```

Limitations

The function can only be used for files or I/O devices that have been opened for reading in a character-based mode.

Syntax

```

ReadStr '('
  [IODevice ':='] <variable (VAR) of iodev>
  ['\' Delim ':='] <expression (IN) of string>]
  ['\' RemoveCR]
  ['\' DiscardHeaders]
  ['\' Time ':='] <expression (IN) of num>]
  ['\' Line ':='] <expression (IN) of num>]
  ['\' ISOLatin1Encoding]
  [ ' \' Status ':='] < variable or persistent (INOUT) of string >
] ')'

```

A function with a return value of the type string.

Related information

For information about	See
Opening, etc. files or I/O devices	<i>Technical reference manual - RAPID Overview</i>
File and I/O device handling	<i>Application manual - Controller software Omni-Core</i>

2 Functions

2.159 ReadStrBin - Reads a string from a binary I/O device or file

RobotWare Base

2.159 ReadStrBin - Reads a string from a binary I/O device or file

Usage

ReadStrBin (*Read String Binary*) is used to read a string from a binary I/O device or file.

Basic examples

The following example illustrates the function ReadStrBin.

Example 1

```
VAR iodev file1;
VAR string text;
...
Open "HOME:", \File:= "FILE1.DOC", file1 \Read \Bin;
text := ReadStrBin (file1, 10);
IF text = EOF THEN
```

The variable text is assigned a 10 characters text string read from the file file1. Before using the string read from the file, a check is performed to make sure that the file is not empty.

Return value

Data type: string

The text string read from the specified I/O device or file. If the file is empty (end of file), the string "EOF" is returned.

Arguments

ReadStrBin (IODevice NoOfChars [\Time] [\ISOLatin1Encoding])

IODevice

Data type: iodev

The name (reference) of the binary I/O device or file to be read.

NoOfChars

Number of Characters

Data type: num

The number of characters to be read from the binary I/O device or file.

[\Time]

Data type: num

The max. time for the reading operation (timeout) in seconds. If this argument is not specified, the max. time is set to 60 seconds. To wait forever, use the predefined constant WAIT_MAX.

If this time runs out before the read operation is finished, the error handler will be called with the error code ERR_DEV_MAXTIME. If there is no error handler, the execution will be stopped.

The timeout function is in use also during program stop and will be noticed by the RAPID program at program start.

Continues on next page

`[\ISOLatin1Encoding]`

Data type: switch

This switch makes it possible to read a string from a binary I/O device or file that has characters that are ISO8859-1 encoded.

Program execution

The function reads the specified number of characters from the binary I/O device or file.

At power fail restart, any open file or I/O device in the system will be closed and the I/O descriptor in the variable of type `iodev` will be reset.

Predefined data

The constant EOF can be used to check if the file was empty, when trying to read from the file or to stop reading at the end of the file.

```
CONST string EOF := "EOF";
```

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_FILEACC</code>	An error occurs during reading.
<code>ERR_DEV_MAXTIME</code>	Time-out before the read operation is finished.

Limitations

The function can only be used for I/O devices or files that have been opened for reading in a binary mode.

Syntax

```
ReadStrBin '('
  [IODevice ':='] <variable (VAR) of iodev> ', '
  [NoOfChars ':='] <expression (IN) of num>
  ['\ ' Time ':='] <expression (IN) of num>
  [\ISOLatin1Encoding] ')'
```

A function with a return value of the type string.

Related information

For information about	See
Opening, etc. I/O devices or files	<i>Technical reference manual - RAPID Overview</i>
Write binary string	WriteStrBin - Writes a string to a binary I/O device on page 1080
File and I/O device handling	<i>Application manual - Controller software Omni-Core</i>

2 Functions

2.160 ReadVar - Read variable from a device

Sensor Interface

2.160 ReadVar - Read variable from a device

Usage

ReadVar is used to read a variable from a device connected to the sensor interface.

Configuration example

This is an example of a sensor channel configuration.

These parameters belong to the type *Transmission Protocol* in the topic *Communication*.

Name	Type	Remote Address	Remote Port
sen1:	SOCKDEV	192.168.125.101	6344

Basic examples

The following example illustrates the function ReadVar.

Example 1

```
CONST num XCoord := 8;
CONST num YCoord := 9;
CONST num ZCoord := 10;

VAR pos SensorPos;

! Connect to the sensor device "sen1:" (defined in sio.cfg)
SenDevice "sen1:";

! Read a cartesian position from the sensor.

SensorPos.x := ReadVar ("sen1:", XCoord);
SensorPos.y := ReadVar ("sen1:", YCoord);
SensorPos.z := ReadVar ("sen1:", ZCoord);
```

Arguments

ReadVar (device, VarNo, [\TaskName])

device

Data type: string

The I/O device name configured in sio.cfg for the sensor used.

VarNo

Data type: num

The argument VarNo is used to select variable to be read.

[\TaskName]

Data type: string

The argument TaskName makes it possible to access devices in other RAPID tasks.

Continues on next page

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
SEN_NO_MEAS	Measurement failure
SEN_NOREADY	Sensor unable to handle command
SEN_GENERRO	General sensor error
SEN_BUSY	Sensor busy
SEN_UNKNOWN	Unknown sensor
SEN_EXALARM	External sensor error
SEN_CAALARM	Internal sensor error
SEN_TEMP	Sensor temperature error
SEN_VALUE	Illegal communication value
SEN_CAMCHECK	Sensor check failure
SEN_TIMEOUT	Communication error

Syntax

```
ReadVar '('
  [device ':='] <expression(IN) of string> ','
  [VarNo ':='] <expression (IN) of num> ','
  ['\' TaskName ':=' <expression (IN) of string> ] ')'

```

A function with a return value of the data type `num`.

Related information

For information about	See
Connect to a sensor device	SenDevice - connect to a sensor device on page 666
Write a sensor variable	WriteVar - Write variable on page 1082
Configuration of sensor communication	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.161 RelTool - Make a displacement relative to the tool

RobotWare Base

2.161 RelTool - Make a displacement relative to the tool

Usage

RelTool (*Relative Tool*) is used to add a displacement and/or a rotation, expressed in the active tool coordinate system, to a robot position.

Basic examples

The following examples illustrate the function RelTool.

Example 1

```
MoveL RelTool (p1, 0, 0, 100), v100, fine, tool1;
```

The robot is moved to a position that is 100 mm from p1 in the z direction of the tool.

Example 2

```
MoveL RelTool (p1, 0, 0, 0 \Rz:= 25), v100, fine, tool1;
```

The tool is rotated 25° around its z-axis.

Return value

Data type: robtarget

The new position with the addition of a displacement and/or a rotation, if any, relative to the active tool.

Arguments

```
RelTool (Point Dx Dy Dz [\Rx] [\Ry] [\Rz])
```



Note

The rotations will be performed in the following order if two or three rotations are specified at the same time:

- 1 rotation around the x axis
- 2 rotation around the new y axis
- 3 rotation around the new z axis

Point

Data type: robtarget

The input robot position. The orientation part of this position defines the current orientation of the tool coordinate system.

Dx

Data type: num

The displacement in mm in the x direction of the tool coordinate system.

Dy

Data type: num

The displacement in mm in the y direction of the tool coordinate system.

Continues on next page

Dz

Data type: num

The displacement in mm in the z direction of the tool coordinate system.

[\Rx]

Data type: num

The rotation in degrees around the x axis of the tool coordinate system.

[\Ry]

Data type: num

The rotation in degrees around the y axis of the tool coordinate system.

[\Rz]

Data type: num

The rotation in degrees around the z axis of the tool coordinate system.

Syntax

```

RelTool '('
  [ Point ':' '=' ] < expression (IN) of robtarget> ','
  [ Dx ':' '=' ] < expression (IN) of num> ','
  [ Dy ':' '=' ] < expression (IN) of num> ','
  [ Dz ':' '=' ] < expression (IN) of num>
  [ '\ ' Rx ':' '=' < expression (IN) of num> ]
  [ '\ ' Ry ':' '=' < expression (IN) of num> ]
  [ '\ ' Rz ':' '=' < expression (IN) of num> ] ')'

```

A function with a return value of the data type robtarget.

Related information

For information about	See
Position data	robtarget - Position data on page 1715
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>
Positioning instructions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.162 RemainingRetries - Remaining retries left to do

RobotWare Base

2.162 RemainingRetries - Remaining retries left to do

Usage

`RemainingRetries` is used to find out how many `RETRY` that is left to do from the error handler in the program. The maximum number of retries is defined in the configuration.

Basic examples

The following example illustrates the function `RemainingRetries`.

Example 1

```
...
ERROR
  IF RemainingRetries() > 0 THEN
    RETRY;
  ELSE
    TRYNEXT;
  ENDIF
...
```

This program will retry the instruction, in spite of the error, until the maximum number of retries is done and then try the next instruction.

Return value

Data type: `num`

The return value shows how many of the maximum number of retries that is left to do.

Syntax

`RemainingRetries '(' ' ')`

A function with a return value of the data type `num`.

Related information

For information about	See
Error handlers	<i>Technical reference manual - RAPID Overview</i>
Resume execution after an error	RETRY - Resume execution after an error on page 602
Configure maximum number of retries	<i>Technical reference manual - System parameters, section General RAPID</i>
Reset the number of retries counted	ResetRetryCount - Reset the number of retries on page 598

2.163 RMQGetSlotName - Get the name of an RMQ client

RobotStudio Connect or Multitasking

2.163 RMQGetSlotName - Get the name of an RMQ client

Usage

RMQGetSlotName (*RAPID Mesasage Queue Get Slot Name*) is used to get the slot name of an RMQ or an SDK client from a given slot identity - that is, from a given rmqslot.

Basic examples

The following example illustrates the function RMQGetSlotName.

Example 1

```
VAR rmqslot slot;
VAR string client_name;
RMQFindSlot slot, "RMQ_T_ROB1";
...
client_name := RMQGetSlotName(slot);
TPWrite "Name of the client: " + client_name;
```

The example illustrates how to get the name of a client using the identity of the client.

Return value

Data type: string

The name of the client is returned. This can be an RMQ name, or the name of a Robot Application Builder client using the RMQ functionality.

Arguments

RMQGetSlotName (Slot)

Slot

Data type: rmqslot

The identity slot number of the client to find the name.

Program execution

The instruction RMQGetSlotName is used to find the name of the client with the specified identity number specified in argument Slot. The client can be another RMQ, or an SDK client.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_RMQ_INVALID	The destination slot has not been connected or the destination slot is no longer available. If not connected, a call to RMQFindSlot must be done. If not available, the reason is that a remote client has been disconnected from the controller.

Continues on next page

2 Functions

2.163 RMQGetSlotName - Get the name of an RMQ client

RobotStudio Connect or Multitasking

Continued

Syntax

```
RMQGetSlotName '('  
    [ Slot ':=' ] < variable (VAR) of rmqslot > ')'
```

A function with a return value of the data type string.

Related information

For information about	See
Description of the RAPID Message Queue functionality	<i>Application manual - Controller software OmniCore</i> , section <i>RAPID Message Queue</i> .
Find the identity number of a RAPID Message Queue task or SDK client	RMQFindSlot - Find a slot identity from the slot name on page 608
Send data to the queue of a RAPID task or SDK client	RMQSendMessage - Send an RMQ data message on page 622
Get the first message from a RAPID Message Queue.	RMQGetMessage - Get an RMQ message on page 610
Send data to the queue of a RAPID task or an SDK client, and wait for an answer from the client	RMQSendWait - Send an RMQ data message and wait for a response on page 626
Extract the header data from an rmqmessage	RMQGetMsgHeader - Get header information from an RMQ message on page 616
Extract the data from an rmqmessage	RMQGetMsgData - Get the data part from an RMQ message on page 613
Order and enable interrupts for a specific data type	IRMQMessage - Orders RMQ interrupts for a data type on page 291
RMQ Slot	rmqslot - Identity number of an RMQ client on page 1713

2.164 RobName - Get the TCP robot name

Usage

RobName (*Robot Name*) is used to get the name of the TCP robot in some program task. If the task doesn't control any TCP robot, this function returns an empty string.

Basic examples

The following example illustrates the function RobName.

See also [More examples on page 1433](#).

Example 1

```
VAR string my_robot;
...
my_robot := RobName();
IF my_robot="" THEN
  TPWrite "This task does not control any TCP robot";
ELSE
  TPWrite "This task controls TCP robot with name "+ my_robot;
ENDIF
```

Write to FlexPendant the name of the TCP robot which is controlled from this program task. If no TCP robot is controlled, write that the task controls no robot.

Return value

Data type: string

The mechanical unit name for the TCP robot that is controlled from this program task. Return empty string if no TCP robot is controlled.

More examples

More examples of how to use the instruction RobName are illustrated below.

Example 1

```
VAR string my_robot;
...
IF TaskRunRob() THEN
  my_robot := RobName();
  TPWrite "This task controls robot with name "+ my_robot;
ENDIF
```

If this program task controls any TCP robot, write to FlexPendant the name of that TCP robot.

Syntax

```
RobName '(' ')''
```

A function with a return value of the data type string.

Continues on next page

2 Functions

2.164 RobName - Get the TCP robot name

RobotWare Base

Continued

Related information

For information about	See
Check if task run some TCP robot	TaskRunRob - Check if task controls some robot on page 1494
Check if task run some mechanical unit	TaskRunMec - Check if task controls any mechanical unit on page 1493
Get the name of mechanical units in the system	GetNextMechUnit - Get name and data for mechanical units on page 1270
String functions	<i>Technical reference manual - RAPID Instructions, Functions and Data types</i>
Definition of string	string - Strings on page 1739

2.165 RobOS - Check if execution is on RC or VC

Usage

RobOS (*Robot Operating System*) can be used to check if the execution is performed on Robot Controller RC or Virtual Controller VC.

Basic examples

The following example illustrates the function RobOS.

Example 1

```
IF RobOS() THEN
  ! Execution statements in RC
ELSE
  ! Execution statements in VC
ENDIF
```

Return value

Data type: bool

TRUE if execution runs on Robot Controller RC, FALSE otherwise.

Syntax

```
RobOS '(' ' ')
```

A function with a return value of the data type bool.

2 Functions

2.166 Round - Round a numeric value

RobotWare Base

2.166 Round - Round a numeric value

Usage

Round is used to round a numeric value to a specified number of decimals or to an integer value.

Basic examples

The following examples illustrate the function Round.

Example 1

```
VAR num val;  
val := Round(0.3852138\Dec:=3);
```

The variable val is given the value 0.385.

Example 2

```
val := Round(0.3852138\Dec:=1);
```

The variable val is given the value 0.4.

Example 3

```
val := Round(0.3852138);
```

The variable val is given the value 0.

Example 4

```
val := Round(0.3852138\Dec:=6);
```

The variable val is given the value 0.385214.

Return value

Data type: num

The numeric value rounded to the specified number of decimals.

Arguments

Round (Val [\Dec])

Val

Value

Data type: num

The numeric value to be rounded.

[\Dec]

Decimals

Data type: num

Number of decimals.

If the specified number of decimals is 0 or if the argument is omitted, the value is rounded to an integer.

The number of decimals must not be negative or greater than the available precision for numeric values.

Max number of decimals that can be used is 6.

Continues on next page

Syntax

```
Round '('  
  [ Val ':= ' ] <expression (IN) of num>  
  [ \Dec ':= ' <expression (IN) of num> ] ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>
Truncating a value	Trunc - Truncates a numeric value on page 1518

2 Functions

2.167 RoundDnum - Round a numeric value

RobotWare Base

2.167 RoundDnum - Round a numeric value

Usage

RoundDnum is used to round a numeric value to a specified number of decimals or to an integer value.

Basic examples

The following examples illustrate the function RoundDnum.

Example 1

```
VAR dnum val;  
val := RoundDnum(0.3852138754655357\Dec:=3);
```

The variable val is given the value 0.385.

Example 2

```
val := RoundDnum(0.3852138754655357\Dec:=1);
```

The variable val is given the value 0.4.

Example 3

```
val := RoundDnum(0.3852138754655357);
```

The variable val is given the value 0.

Example 4

```
val := RoundDnum(0.3852138754655357\Dec:=15);
```

The variable val is given the value 0.385213875465536.

Example 5

```
val := RoundDnum(1000.3852138754655357\Dec:=15);
```

The variable val is given the value 1000.38521387547.

Return value

Data type: dnum

The numeric value rounded to the specified number of decimals.

Arguments

RoundDnum (Val [\Dec])

Val

Value

Data type: dnum

The numeric value to be rounded.

[\Dec]

Decimals

Data type: num

Number of decimals.

If the specified number of decimals is 0 or if the argument is omitted, the value is rounded to an integer.

Continues on next page

The number of decimals must not be negative or greater than the available precision for numeric values.

Max number of decimals that can be used is 15.

Syntax

```
RoundDnum '('  
  [ Val ':=' ] <expression (IN) of dnum>  
  [ \Dec ':=' <expression (IN) of num> ] ')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>
Rounding a value	Round - Round a numeric value on page 1436
Truncating a value	Trunc - Truncates a numeric value on page 1518
Truncating a value	TruncDnum - Truncates a numeric value on page 1520

2 Functions

2.168 RunMode - Read the running mode

RobotWare Base

2.168 RunMode - Read the running mode

Usage

RunMode (*Running Mode*) is used to read the current running mode of the program task.

Basic examples

The following example illustrates the function RunMode.

Example 1

```
IF RunMode() = RUN_CONT_CYCLE THEN
...
ENDIF
```

The program section is executed only for continuous or cycle running.

Return value

Data type: symnum

The current running mode is defined as described in the table below.

Return value	Symbolic constant	Comment
0	RUN_UNDEF	Undefined running mode
1	RUN_CONT_CYCLE	Continuous or cycle running mode
2	RUN_INSTR_FWD	Instruction forward running mode
3	RUN_INSTR_BWD	Instruction backward running mode
4	RUN_SIM	Simulated running mode. Not yet released.
5	RUN_STEP_MOVE	Move instructions in forward running mode and logical instructions in continuous running mode

Arguments

RunMode ([\Main])

[\Main]

Data type: switch

Return current mode for the task if it is a motion task. If used in a non-motion task, it will return the current mode of the motion task that the non-motion task is connected to.

If this argument is omitted, the return value always mirrors the current running mode for the program task which executes the function RunMode.

Syntax

```
RunMode '('
      ['\ ' Main] ')'

```

A function with a return value of the data type symnum.

Continues on next page

Related information

For information about	See
Reading operating mode	OpMode - Read the operating mode on page 1366

2 Functions

2.169 **SafetyControllerGetChecksum** - Get the checksum for the user configuration file
SafeMove Premium, SafeMove Premium+, PROFIsafe

2.169 **SafetyControllerGetChecksum** - Get the checksum for the user configuration file

Usage

SafetyControllerGetChecksum is used to get the safety controller checksum for the user configuration file.

Basic examples

The following example illustrates the function **SafetyControllerGetChecksum**.

Example 1

```
VAR string mystring;  
...  
mystring:=SafetyControllerGetChecksum();
```

Get the checksum for the user configuration file and store it in the variable **mystring**.

Return value

Data type: string

The checksum for the user configuration.

Syntax

```
SafetyControllerGetChecksum '(' ' ')
```

A function with a return value of the data type string.

Related information

For information about	See
SafetyControllerGetOpModePinCode	SafetyControllerGetOpModePinCode - Get the operating mode pin code on page 1446
SafetyControllerGetUserChecksum	SafetyControllerGetUserChecksum - Get the checksum for protected parameters on page 1448
SafetyControllerGetSWVersion	SafetyControllerGetSWVersion - Get the safety controller firmware version on page 1447
SafetyControllerSyncRequest	SafetyControllerSyncRequest - Initiation of hardware synchronization procedure on page 631

2.170 SafetyControllerGetGroupChecksum - Get the protected group checksum

Usage

SafetyControllerGetGroupChecksum is used to get the checksum for the protected group given as input to the function.

Basic examples

The following example illustrates the function SafetyControllerGetGroupChecksum.

Example 1

```

MODULE MainModule
  PERS string protectedGroupChecksum := "";
  PROC main()
    protectedGroupChecksum := SafetyControllerGetGroupChecksum
      ("MyProtectedGroup");
  ENDPROC
ENDMODULE

```

The function returns the checksum for the protected group named *MyProtectedGroup*.

Return value

Data type: string

The checksum for the protected group.

Arguments

SafetyControllerGetGroupChecksum (GroupName)

GroupName

Data type: string

The name of the protected group.

Limitations

A protected group must exist in the safety configuration.

Syntax

```

SafetyControllerGetGroupChecksum '('
  [GroupName ':='] <expression (IN) of string>')'

```

A function with a return value of the data type string.

Related information

For information about	See
SafetyControllerGetChecksum	SafetyControllerGetChecksum - Get the checksum for the user configuration file on page 1442
SafeMove safety configuration	<i>Application manual - Functional safety and SafeMove</i>

2 Functions

2.171 SafetyControllerGetNextGroupName - Get the name of the next protected group
RobotWare Base

2.171 SafetyControllerGetNextGroupName - Get the name of the next protected group

Usage

SafetyControllerGetNextGroupName is used to get the name for the protected group given as input to the function.

Basic examples

The following example illustrates the function SafetyControllerGetNextGroupName.

Example 1

```
VAR string group_name;
VAR string group_checksum;
VAR num listno := 0;

WHILE SafetyControllerGetNextGroupName(listno, group_name) DO
    ! listno is increased for each successful call.
    ! group_name is fetched from safety controller
    ! SafetyControllerGetNextGroupName return false when listno is
    ! out of range, i.e when no more items can be read.
    !
    ! Get checksum for received group_name
    group_checksum := SafetyControllerGetGroupChecksum(group_name);
ENDWHILE
```

The function returns the name for the protected group.

Return value

Data type: bool

TRUE if a protected group was found, otherwise FALSE.

Arguments

SafetyControllerGetNextGroupName (listno group_name)

listno

Data type: num

This specifies which item in the system-internal list of protected groups that should be retrieved. On return, this variable is always incremented by one by the system, to make it easy to access the next group in the list. The first group in the list has index 0.

group_name

Data type: string

The name of the protected group.

Limitations

A protected group must exist in the safety configuration.

Continues on next page

2.171 SafetyControllerGetNextGroupName - Get the name of the next protected group
RobotWare Base
Continued

Syntax

```
SafetyControllerGetNextGroupName '('  
  [ listno ':=' ] < variable (VAR) of num> ','  
  [ group_name ':=' ] < variable (VAR) of string> ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
SafetyControllerGetGroupChecksum	SafetyControllerGetGroupChecksum - Get the protected group checksum on page 1443
SafeMove safety configuration	<i>Application manual - Functional safety and SafeMove</i>

2 Functions

2.172 SafetyControllerGetOpModePinCode - Get the operating mode pin code
SafeMove Premium, SafeMove Premium+, PROFIsafe

2.172 SafetyControllerGetOpModePinCode - Get the operating mode pin code

Usage

SafetyControllerGetOpModePinCode is used to get the operating mode pin code for the keyless mode selector.

Basic examples

The following example illustrates the function SafetyControllerGetOpModePinCode.

Example 1

```
VAR string mystring;  
...  
mystring:=SafetyControllerGetOpModePinCode();
```

Get the operating mode pin code for the for the keyless mode selector and store it in the variable mystring.

Return value

Data type: string

The pin code for the for the keyless mode selector.

Syntax

```
SafetyControllerGetOpModePinCode '(' '')
```

A function with a return value of the data type string.

Related information

For information about	See
SafetyControllerGetChecksum	SafetyControllerGetChecksum - Get the checksum for the user configuration file on page 1442
SafetyControllerGetUserChecksum	SafetyControllerGetUserChecksum - Get the checksum for protected parameters on page 1448
SafetyControllerGetSWVersion	SafetyControllerGetSWVersion - Get the safety controller firmware version on page 1447
SafetyControllerSyncRequest	SafetyControllerSyncRequest - Initiation of hardware synchronization procedure on page 631

2.173 SafetyControllerGetSWVersion - Get the safety controller firmware version *SafeMove Premium, SafeMove Premium+, PROFIsafe*

2.173 SafetyControllerGetSWVersion - Get the safety controller firmware version

Usage

SafetyControllerGetSWVersion is used to get the safety controller firmware version.

Basic examples

The following example illustrates the function SafetyControllerGetSWVersion.

Example 1

```
VAR string mystring;
...
mystring:=SafetyControllerGetSWVersion();
```

Get the safety controller firmware version and store it in the variable mystring.

Return value

Data type: string

The safety controller firmware version. A string with "VC" is returned if this function is used on the Virtual Controller.

Syntax

```
SafetyControllerGetSWVersion '(' ' ')
```

A function with a return value of the data type string.

Related information

For information about	See
SafetyControllerGetOpModePinCode	SafetyControllerGetOpModePinCode - Get the operating mode pin code on page 1446
SafetyControllerGetUserChecksum	SafetyControllerGetUserChecksum - Get the checksum for protected parameters on page 1448
SafetyControllerGetSWVersion	SafetyControllerGetSWVersion - Get the safety controller firmware version on page 1447
SafetyControllerSyncRequest	SafetyControllerSyncRequest - Initiation of hardware synchronization procedure on page 631

2 Functions

2.174 SafetyControllerGetUserChecksum - Get the checksum for protected parameters

SafeMove Premium, SafeMove Premium+, PROFIsafe

2.174 SafetyControllerGetUserChecksum - Get the checksum for protected parameters

Usage

SafetyControllerGetUserChecksum is used to get the safety controller checksum for the area with protected parameters in the user configuration file.

Basic examples

The following example illustrates the function SafetyControllerGetUserChecksum.

Example 1

```
VAR string mystring;  
...  
mystring:=SafetyControllerGetUserChecksum();
```

Get the checksum for the area with protected parameters in the user configuration file and store it in the variable mystring.

Return value

Data type: string

The checksum for the area with protected parameters.

Syntax

SafetyControllerGetUserChecksum '(' ' ')

A function with a return value of the data type string.

Related information

For information about	See
SafetyControllerGetOpModePinCode	SafetyControllerGetOpModePinCode - Get the operating mode pin code on page 1446
SafetyControllerGetChecksum	SafetyControllerGetChecksum - Get the checksum for the user configuration file on page 1442
SafetyControllerGetSWVersion	SafetyControllerGetSWVersion - Get the safety controller firmware version on page 1447
SafetyControllerSyncRequest	SafetyControllerSyncRequest - Initiation of hardware synchronization procedure on page 631

2.175 Sin - Calculates the sine value

Usage

`Sin(Sine)` is used to calculate the sine value from an angle value.

Basic examples

The following example illustrates the function `Sin`.

Example 1

```
VAR num angle;  
VAR num value;  
...  
...  
value := Sin(angle);  
value will get the sine value of angle.
```

Return value

Data type: num
The sine value, range [-1, 1] .

Arguments

`Sin (Angle)`

Angle

Data type: num
The angle value, expressed in degrees.

Syntax

```
Sin '('  
  [Angle ':='] <expression (IN) of num> ')'  
A function with a return value of the data type num.
```

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.176 SinDnum - Calculates the sine value

RobotWare Base

2.176 SinDnum - Calculates the sine value

Usage

SinDnum (*Sine dnum*) is used to calculate the sine value from an angle value on data types dnum.

Basic examples

The following example illustrates the function SinDnum.

Example 1

```
VAR dnum angle;  
VAR dnum value;  
...  
...  
value := SinDnum(angle);  
value will get the sine value of angle.
```

Return value

Data type: dnum
The sine value, range [-1, 1] .

Arguments

SinDnum (Angle)

Angle

Data type: dnum
The angle value, expressed in degrees.

Syntax

```
SinDnum '('  
  [Angle ':='] <expression (IN) of dnum> ')'  
A function with a return value of the data type dnum.
```

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2.177 SocketGetStatus - Get current socket state

Usage

SocketGetStatus returns the current state of a socket.

Basic examples

The following example illustrates the function SocketGetStatus.

See also [More examples on page 1451](#).

Example 1

```
VAR socketdev socket1;
VAR socketstatus state;
...
SocketCreate socket1;
state := SocketGetStatus( socket1 );
```

The socket status SOCKET_CREATED will be stored in the variable state.

Return value

Data type: socketstatus

The current state of the socket.

Only the predefined symbolic constants of type socketstatus can be used to check the state.

Arguments

SocketGetStatus(Socket)

Socket

Data type: socketdev

The socket variable which state is of interest.

Program execution

The function returns one of the following predefined states of socketstatus:

SOCKET_CREATED, SOCKET_CONNECTED, SOCKET_BOUND, SOCKET_LISTENING
or SOCKET_CLOSED.

More examples

The following example illustrates the function SocketGetStatus.

Example 1

```
VAR socketstatus status;
VAR socketdev my_socket;
...
SocketCreate my_socket;
SocketConnect my_socket, "192.168.0.1", 1025;
! A lot of RAPID code
status := SocketGetStatus( my_socket );
!Check which instruction that was executed last, not the state of
!the socket
```

Continues on next page

2 Functions

2.177 SocketGetStatus - Get current socket state

RobotWare Base

Continued

```
IF status = SOCKET_CREATED THEN
  TPWrite "Instruction SocketCreate has been executed";
ELSEIF status = SOCKET_CLOSED THEN
  TPWrite "Instruction SocketClose has been executed";
ELSEIF status = SOCKET_BOUND THEN
  TPWrite "Instruction SocketBind has been executed";
ELSEIF status = SOCKET_LISTENING THEN
  TPWrite "Instruction SocketListen or SocketAccept has been
    executed";
ELSEIF status = SOCKET_CONNECTED THEN
  TPWrite "Instruction SocketConnect, SocketReceive or SocketSend
    has been executed";
ELSE
  TPWrite "Unknown socket status";
ENDIF
```

A client socket is created and connected to a remote computer. Before the socket is used in a SocketSend instruction the state of the socket is checked so that it is still connected.

Limitations

The state of a socket can only be changed by executing RAPID socket instruction. For example, if the socket is connected and later the connection is broken, this will not be reported by the SocketGetStatus function. Instead there will be an error returned when the socket is used in a SocketSend or SocketReceive instruction.

Syntax

```
SocketGetStatus '('  
  [Socket ':='] <variable (VAR) of socketdev>')'
```

A function with a return value of the data type socketstatus.

Related information

For information about	See
Socket communication in general	<i>Application manual - Controller software Omni-Core</i>
Create a new socket	SocketCreate - Create a new socket on page 712
Connect to remote computer (only client)	SocketConnect - Connect to a remote computer on page 709
Send data to remote computer	SocketSend - Send data to remote computer on page 728
Receive data from remote computer	SocketReceive - Receive data from remote computer on page 717
Close the socket	SocketClose - Close a socket on page 707
Bind a socket (only server)	SocketBind - Bind a socket to my IP-address and port on page 704
Listening connections (only server)	SocketListen - Listen for incoming connections on page 715

Continues on next page

2.177 SocketGetStatus - Get current socket state

RobotWare Base

Continued

For information about	See
Accept connections (only server)	SocketAccept - Accept an incoming connection on page 700

2 Functions

2.178 SocketPeek - Test for the presence of data on a socket

RobotWare Base

2.178 SocketPeek - Test for the presence of data on a socket

Usage

SocketPeek is used to test for the presence of data on a socket. It returns the number of bytes that can be received on the specified socket.

Basic examples

The following example illustrates the function SocketPeek.

Example 1

```
VAR socketdev socket1;
VAR socketdev client_socket;
VAR num peek_value;
...
SocketCreate socket1;
SocketBind socket1, "192.168.0.1", 1025;
SocketListen socket1;
SocketAccept socket1, client_socket;
..
peek_value := SocketPeek( client_socket );
IF peek_value >= 64 THEN
    SocketReceive client_socket \Str := str_data \ReadNoOfBytes:=64;
..
ELSE
    ! Not enough data to receive. Do something else.
ENDIF
```

First a server socket is created and bound to port 1025 on the controller network address 192.168.0.1. Then SocketPeek is used to check if there are 64 bytes of data available to receive on the socket.

Return value

Data type: num

The number of bytes available on a specific socket.

Arguments

SocketPeek (Socket)

Socket

Data type: socketdev

The socket variable which should be peeked.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_SOCK_CLOSED	The socket is closed. Broken connection.

Continues on next page

2.178 SocketPeek - Test for the presence of data on a socket

RobotWare Base

Continued

Name	Cause of error
ERR_SOCKET_EXEC_LEVEL	Use of socket instructions on different RAPID execution levels at the same time, that is, normal execution level and TRAP level.
ERR_SOCKET_NOT_BOUND	The socket has not been bound to an address. When using the type datagram protocol UDP/IP.
ERR_SOCKET_NOT_CONN	The socket is not connected

Limitations

All sockets are closed after power fail restart. This problem can be handled by error recovery.

The maximum size of data that can be received in one call is limited to 5000 bytes (this limit can be configured with the system parameter *RapidSocketMemSize*, topic *Controller*, type *General Rapid*). Therefore, the max value that can be returned from SocketPeek is 5000 (or as configured in *RapidSocketMemSize*).

Syntax

```
SocketPeek '('
  [Socket ':='] <variable (VAR) of socketdev>')'
```

A function with a return value of the data type num.

Related information

For information about	See
Socket communication in general	<i>Application manual - Controller software Omni-Core</i>
Create a new socket	SocketCreate - Create a new socket on page 712
Connect to remote computer (only client)	SocketConnect - Connect to a remote computer on page 709
Send data to remote computer	SocketSend - Send data to remote computer on page 728
Send data to remote computer	SocketSendTo - Send data to remote computer on page 733
Close the socket	SocketClose - Close a socket on page 707
Bind a socket (only server)	SocketBind - Bind a socket to my IP-address and port on page 704
Listening connections (only server)	SocketListen - Listen for incoming connections on page 715
Accept connections (only server)	SocketAccept - Accept an incoming connection on page 700
Get current socket state	SocketGetStatus - Get current socket state on page 1451
Example client socket application	SocketSend - Send data to remote computer on page 728
Receive data from remote computer	SocketReceive - Receive data from remote computer on page 717

Continues on next page

2 Functions

2.178 SocketPeek - Test for the presence of data on a socket

RobotWare Base

Continued

For information about	See
Receive data from remote computer	SocketReceiveFrom - Receive data from remote computer on page 723
<i>RapidSocketMemSize</i>	<i>Technical reference manual - System parameters</i>

2.179 Sqrt - Calculates the square root value

Usage

Sqrt (*Square root*) is used to calculate the square root value.

Basic examples

The following example illustrates the function Sqrt.

Example 1

```

VAR num x_value;
VAR num y_value;
...
...
y_value := Sqrt( x_value);

```

y-value will get the square root value of x_value, that is, $\sqrt{x\_value}$.

Return value

Data type: num

The square root value ($\sqrt{}$).

Arguments

Sqrt (Value)

Value

Data type: num

The argument value for square root, that is, $\sqrt{\text{value}}$.

Value needs to be ≥ 0 .

Limitations

The execution of the function Sqrt(x) will give an error if $x < 0$.

Syntax

```

Sqrt '('
  [Value ':=' ] <expression (IN) of num> ')'

```

A function with a return value of the data type num.

Related information

For information about	See
Calculate the square root value of a dnum numeric value	SqrtDnum - Calculates the square root value on page 1458
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.180 SqrtDnum - Calculates the square root value

RobotWare Base

2.180 SqrtDnum - Calculates the square root value

Usage

SqrtDnum (*Square root dnum*) is used to calculate the square root value.

Basic examples

The following example illustrates the function SqrtDnum.

Example 1

```
VAR dnum x_value;  
VAR dnum y_value;  
...  
...  
y_value := SqrtDnum(x_value);  
y_value will get the square root value of x_value, that is,  $\sqrt{x\_value}$ .
```

Return value

Data type: dnum
The square root value ($\sqrt{}$).

Arguments

SqrtDnum (Value)

Value

Data type: dnum
The argument value for square root, that is, $\sqrt{value}$.
Value needs to be ≥ 0 .

Limitations

The execution of the function Sqrt(x) will give an error if $x < 0$.

Syntax

```
SqrtDnum '('  
  [ Value ':' '=' ] < expression (IN) of dnum > ')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
Calculate the square root value of a numeric value	Sqrt - Calculates the square root value on page 1457
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2.181 STCalcForce - Calculate the tip force for a Servo Tool

Usage

STCalcForce is used to calculate the tip force for a Servo Tool. This function is used, for example, to find the max allowed tip force for a servo tool.

Basic examples

The following example illustrates the function STCalcForce.

Example 1

```
VAR num tip_force;
tip_force := STCalcForce("SGUN_1", 7);
```

Calculate the tip force when the desired motor torque is 7 Nm.

Return value

Data type: num
The calculated tip force [N].

Arguments

STCalcForce ToolName MotorTorque

ToolName

Data type: string
The name of the mechanical unit.

MotorTorque

Data type: num
The desired motor torque [Nm].

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_SGUN	The specified servo tool name is not a configured servo tool.

Syntax

```
STCalcForce '('
  [ ToolName ':=' ] < expression (IN) of string > ','
  [ MotorTorque ':=' ] < expression (IN) of num > ';'
  )
```

A function with a return value of the data type num.

Related information

For information about	See
Open a servo tool	STOpen - Open a Servo Tool on page 790
Close a servo tool	STClose - Close a Servo Tool on page 773

Continues on next page

2 Functions

2.181 STCalcForce - Calculate the tip force for a Servo Tool

Servo tool control

Continued

For information about	See
Calculate the motor torque	STCalcTorque - Calculate the motor torque for a servo tool on page 1461

2.182 STCalcTorque - Calculate the motor torque for a servo tool

Servo tool control

2.182 STCalcTorque - Calculate the motor torque for a servo tool

Usage

STCalcTorque is used to calculate the motor torque for a Servo Tool. This function is used, for example, when a force calibration is performed.

Basic examples

The following example illustrates the function STCalcTorque.

Example 1

```
VAR num curr_motortorque;
curr_motortorque := STCalcTorque( "SGUN_1", 1000);
```

Calculate the motor torque when the desired tip force is 1000 N.

Return value

Data type: num

The calculated motor torque [Nm].

Arguments

STCalcTorque ToolName TipForce

ToolName

Data type: string

The name of the mechanical unit.

TipForce

Data type: num

The desired tip force [N].

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_SGUN	The specified servo tool name is not a configured servo tool.

Syntax

```
STCalcTorque '('
  [ ToolName ':=' ] < expression (IN) of string > ','
  [ TipForce ':=' ] < expression (IN) of num > ';'
```

A function with a return value of the data type num.

Related information

For information about	See
Open a servo tool	STOpen - Open a Servo Tool on page 790
Close a servo tool	STClose - Close a Servo Tool on page 773

Continues on next page

2 Functions

2.182 STCalcTorque - Calculate the motor torque for a servo tool

Servo tool control

Continued

For information about	See
Calculate the tip force	<i>STCalcForce - Calculate the tip force for a Servo Tool on page 1459</i>

2.183 STIsCalib - Tests if a servo tool is calibrated

Usage

STIsCalib is used to test if a servo tool is calibrated - that is, check if the gun tips are calibrated or synchronized.

Basic examples

The following examples illustrate the function STIsCalib.

Example 1

```
IF STIsCalib("SGUN_1" \sguninit) THEN
  ...
ELSE
  !Start the gun calibration
  STCalib "SGUN_1" \TipChg;
ENDIF
```

Example 2

```
IF STIsCalib("SGUN_1" \sgunsynch) THEN
  ...
ELSE
  !Start the gun calibration to synchronize the gun position with
  the revolution counter
  STCalib "SGUN_1" \ToolChg;
ENDIF
```

Return value

Data type: bool

TRUE if the tested tool is calibrated - that is, the distance between the tool tips is calibrated, or if the tested tool is synchronized - that is, the position of the tool tips is synchronized with the revolution counter of the tool.

FALSE if the tested tool is not calibrated or synchronized.

Arguments

STIsCalib ToolName [\sguninit] | [\sgunsynch]

ToolName

Data type: string

The name of the mechanical unit.

[\sguninit]

Data type: switch

This argument is used to check if the gun position is initialized and calibrated.

[\sgunsynch]

Data type: switch

This argument is used to check if the gun position is synchronized with the revolution counter.

Continues on next page

2 Functions

2.183 STIsCalib - Tests if a servo tool is calibrated

Servo Tool Control

Continued

Syntax

```
STIsCalib '('  
  [ ToolName ':=' ] < expression (IN) of string >  
  [ '\\' sguninit ] | [ '\\'sgunsynch ] ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Calibrating a servo tool	STCalib - Calibrate a Servo Tool on page 769

2.184 STIsClosed - Tests if a servo tool is closed

Usage

STIsClosed is used to test if a servo tool is closed.

Basic examples

The following examples illustrate the function STIsClosed.

Example 1

```

IF STIsClosed("SGUN_1") THEN
  !Start the weld process
  Set do_weld_start;
ELSE
  ...
ENDIF

```

Check if the gun is closed or not.

Example 2

```

STClose "SGUN_1", 1000, 3 \Conc;
WHILE NOT(STIsClosed("SGUN_1"\RetThickness:=thickness)) DO
  WaitTime 0.1;
ENDWHILE
IF thickness > max_thickness THEN...

```

Start to close the gun named "SGUN_1". Continue immediately with the next instruction in which the program waits for the gun to be closed. Read the achieved thickness value when the instruction STIsClosed has returned TRUE.

Example 3

Examples of non valid combinations:

```

STClose "SGUN_1", 1000, 3 \RetThickness:=thickness \Conc;
WHILE NOT(STIsClosed("SGUN_1"\RetThickness:=thickness_2)) DO;
...

```

Close the gun. The parameter thickness will **not** hold any valid value since the \Conc switch is used. Wait until the gun is closed. When the gun is closed and STIsClosed returns TRUE, the parameter thickness_2 will hold a valid value since the \Conc switch was used for the STClose.

```

STClose "SGUN_1", 1000, 3 \RetThickness:=thickness;
WHILE NOT(STIsClosed("SGUN_1"\RetThickness:=thickness_2)) DO;
...

```

Close the gun. The parameter thickness will hold a valid value when the gun has been closed since the \Conc switch is not used. The parameter thickness_2 will not hold any valid value since the \Conc switch was not used in the STClose instruction.

Return value

Data type: bool

TRUE if the tested tool is closed, that is, the desired tip force is achieved.

FALSE if the tested tool is not closed.

Continues on next page

2 Functions

2.184 STIsClosed - Tests if a servo tool is closed

Servo Tool Control

Continued

Arguments

STIsClosed ToolName [\RetThickness]

ToolName

Data type: string

The name of the mechanical unit.

[\RetThickness]

Data type: num

The achieved thickness [mm].

NOTE! Only valid if \Conc has been used in a preceding STClose instruction.

Syntax

```
STIsClosed '('  
  [ ToolName ':=' ] < expression (IN) of string > ')'  
  ['\RetThickness ':=' < variable or persistent (INOUT) of num  
    > ] ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Open a servo tool	STOpen - Open a Servo Tool on page 790
Close a servo tool	STClose - Close a Servo Tool on page 773
Test if a servo tool is open	STIsOpen - Tests if a servo tool is open on page 1468

2.185 STIsIndGun - Tests if a servo tool is in independent mode

Usage

STIsIndGun is used to test if a servo tool is in independent mode.

Basic examples

The following example illustrates the function STIsIndGun.

Example 1

```

IF STIsIndGun("SGUN_1") THEN
  ! Start the gun calibration
  STCalib "SGUN_1" \TipChg;
ELSE
  ...
ENDIF

```

Return value

Data type: bool

TRUE if the tested tool is in independent mode - that is, the gun can be moved independently of the robot movements.

FALSE if the tested tool is *not* in independent mode.

Arguments

STIsIndGun ToolName

ToolName

Data type: string

The name of the mechanical unit.

Syntax

```

STIsIndGun '('
  [ ToolName ':=' ] < expression (IN) of string > ')'

```

A function with a return value of the data type bool.

Related information

For information about	See
Calibrating a servo tool	STCalib - Calibrate a Servo Tool on page 769
Setting the gun in independent mode	STIndGun - Sets the servo tool in independent mode on page 778
Resetting the gun from independent mode	STIndGunReset - Resets the servo tool from independent mode on page 780

2 Functions

2.186 STIsOpen - Tests if a servo tool is open *Servo Tool Control*

2.186 STIsOpen - Tests if a servo tool is open

Usage

STIsOpen is used to test if a servo tool is open.

Basic examples

The following examples illustrate the function STIsOpen.

Example 1

```
IF STIsOpen("SGUN_1") THEN
  !Start the motion
  MoveL ...
ELSE
  ...
ENDIF
```

Check if the gun is open or not.

Example 2

```
STCalib "SGUN_1" \TipWear \Conc;
WHILE NOT(STIsOpen("SGUN_1") \RetTipWear:=tipwear
  \RetPosAdj:=posadj) DO;
  WaitTime 0.1;
ENDWHILE
```

IF tipwear > 20...

IF posadj > 25...

Perform a tip wear calibration. Wait until the gun "SGUN_1" is open. Read the tip wear and positional adjustment values.

Example 3

Examples of non valid combinations:

```
STCalib "SGUN_1" \TipWear \RetTipWear:=tipwear_1 \Conc;
WHILE NOT(STIsOpen("SGUN_1") \RetTipWear:=tipwear_2) DO;
  WaitTime 0.1;
ENDWHILE
```

Start a tip wear calibration. The parameter tipwear_1 will **not** hold any valid value since the \Conc switch is used. When the calibration is ready and the STIsOpen returns TRUE, the parameter tipwear_2 will hold a valid value.

```
STCalib "SGUN_1" \TipWear \RetTipWear:=tipwear_1;

WHILE NOT(STIsOpen("SGUN_1") \RetTipWear:=tipwear_2) DO;
  WaitTime 0.1;
ENDWHILE
```

Perform a tip wear calibration. The parameter tipwear_1 will hold a valid value since the \Conc switch is not used. When STIsOpen returns TRUE, the parameter tipwear_2 will not hold any valid value since the \Conc switch was not used in STCalib.

Continues on next page

Return value

Data type: bool

TRUE if the tested tool is open, that is, the tool arm is in the programmed open position.

FALSE if the tested tool is not open.

Arguments

STIsOpen ToolName [\RetTipWear] [\RetPosAdj]

ToolName

Data type: string

The name of the mechanical unit.

[\RetTipWear]

Data type: num

The achieved tip wear [mm].

NOTE! Only valid if \Conc has been used in a preceding STCalib instruction and if STIsOpen returns TRUE.

[\RetPosAdj]

Data type: num

The positional adjustment since the last calibration [mm].

NOTE! Only valid if \Conc has been used in a preceding STCalib instruction and if STIsOpen returns TRUE.**Syntax**

```
STIsOpen '('
  [ ToolName ':= ' ] < expression (IN) of string > ')'
  [ '\ ' RetTipWear ':= ' < variable or persistent(INOUT) of num >
    ] ';'
  [ '\ ' RetPosAdj ':= ' < variable or persistent(INOUT) of num > ]
```

A function with a return value of the data type bool.

Related information

For information about	See
Open a servo tool	STOpen - Open a Servo Tool on page 790
Close a servo tool	STClose - Close a Servo Tool on page 773
Test if a servo tool is closed	STIsClosed - Tests if a servo tool is closed on page 1465

2 Functions

2.187 StrFind - Searches for a character in a string

RobotWare Base

2.187 StrFind - Searches for a character in a string

Usage

StrFind (*String Find*) is used to search in a string, starting at a specified position, for a character that belongs to a specified set of characters.

Basic examples

The following example illustrates the function StrFind.

Example 1

```
VAR num found;  
found := StrFind("Robotics",1,"aeiou");
```

The variable found is given the value 2.

```
found := StrFind("Robotics",1,"aeiou"\NotInSet);
```

The variable found is given the value 1.

```
found := StrFind("IRB 6710",1,STR_DIGIT);
```

The variable found is given the value 5.

```
found := StrFind("IRB 6710",1,STR_WHITE);
```

The variable found is given the value 4.

Return value

Data type: num

The character position of the first character at or past the specified position that belongs to the specified set. If no such character is found, string length +1 is returned.

Arguments

StrFind (Str ChPos Set [\NotInSet])

Str

String

Data type: string

The string to search in.

ChPos

Character Position

Data type: num

Start character position.

Set

Data type: string

Set of characters to test against. See also [Predefined data on page 1471](#).

[\NotInSet]

Data type: switch

Search for a character not in the set of characters presented in Set.

Continues on next page

Syntax

```
StrFind '('
  [Str ':='] <expression (IN) of string>', '
  [ChPos ':='] <expression (IN) of num>', '
  [Set ':='] <expression (IN) of string>
  ['\' NotInSet']')'
```

A function with a return value of the data type num.

Predefined data

A number of predefined string constants are available in the system and can be used together with string functions.

Name	Character set
STR_DIGIT	<digit> ::= 0 1 2 3 4 5 6 7 8 9
STR_UPPER	<upper case letter> ::= A B C D E F G H I J K L M N O P Q R S T U V W X Y Z Ä Á Â Ã Ä Å Æ Ç È É Ê Ë Ì Í Î Ï 1) Ñ Ò Ó Ô Õ Ö Ø Ù Ú Û Ü 2) 3)
STR_LOWER	<lower case letter> ::= a b c d e f g h i j k l m n o p q r s t u v w x y z à á â ã ä å æ ç è é ê ë ì í î ï 1) ñ ò ó ô õ ö ø ù ú û ü 2) 3) ß ÿ-
STR_WHITE	<blank character> ::=

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.188 StrFormat - Format a string

Path Recovery

2.188 StrFormat - Format a string

Usage

StrFormat is used to format a text string.

Basic examples

The following example illustrates the function StrFormat:

See also [More examples on page 1473](#).

Example 1

```
VAR string text1 := "This is a {1} and this is {2}";  
...  
TPWrite StrFormat(text1 \Arg1:="robot" \Arg2:="fast");
```

The strings used in optional arguments Arg1 and Arg2 will replace {1} and {2}.

The result will then be:

This is a robot and this is fast

Return value

Data type: string

Arguments

```
StrFormat ( Text [\Arg1] [\Arg2] [\Arg3] [\Arg4] [\Arg5] [\Arg6]  
            [\Remaining] [\SmartTruncate])
```

Text

Data type: string

The string to format.

[\Arg1]

Data type: string

If the string contains {1}, the {1} is replaced with the string used in this argument.

[\Arg2]

Data type: string

If the string contains {2}, the {2} is replaced with the string used in this argument.

[\Arg3]

Data type: string

If the string contains {3}, the {3} is replaced with the string used in this argument.

[\Arg4]

Data type: string

If the string contains {4}, the {4} is replaced with the string used in this argument.

[\Arg5]

Data type: string

If the string contains {5}, the {5} is replaced with the string used in this argument.

Continues on next page

[\\Arg6]

Data type: string

If the string contains {6}, the {6} is replaced with the string used in this argument.

[\\Remaining]

Data type: string

Remaining string if the formatted string exceeds 80 characters.

[\\SmartTruncate]

Data type: string

With the optional argument SmartTruncate it is possible to specify where to truncate the string that is returned from the StrFormat function. This can be useful if the strings returned should be used in UI functions, and you want to end returned string at a blank space or other specific character. The SmartTruncate argument is considered only if the optional argument Remaining is used and the returned string exceeds 80 bytes.

Limitations

The total string length in RAPID is 80. This is the same for all inputs as result of the function.

More examples

More examples of the function StrFormat are illustrated below.

Example 1

```
VAR string stTemp:="I have a {1} {2}. My {2} {3} {2} in my town,  
and {4}.";  
VAR string str1;  
VAR string stRemaining1;  
  
str1:=StrFormat(stTemp\\Arg1:="yellow and orange" \\Arg2:="motorbike"  
\\Arg3:="is the fastest" \\Arg4:="it has an electric engine"  
\\Remaining:=stRemaining1);  
TPWrite str1;  
TPWrite stRemaining1;  
  
str1:=StrFormat(stTemp\\Arg1:="yellow and orange" \\Arg2:="motorbike"  
\\Arg3:="is the fastest" \\Arg4:="it has an electric engine"  
\\Remaining:=stRemaining1 \\SmartTruncate:=stSpace);  
TPWrite str1;  
TPWrite stRemaining1;
```

The first output to FlexPendant will be:

I have a yellow and orange motorbike. My motorbike is the fastest motorbike in my town, and it has an electric engine.

The second output to FlexPendant will be:

I have a yellow and orange motorbike. My motorbike is the fastest motorbike in my town, and it has an electric engine.

Continues on next page

2 Functions

2.188 StrFormat - Format a string

Path Recovery

Continued

Syntax

```
StrFormat
[Text ':='] <expression (IN) of string>
['\' Arg1 ':='] <expression (IN) of string>]
['\' Arg2 ':='] <expression (IN) of string>]
['\' Arg3 ':='] <expression (IN) of string>]
['\' Arg4 ':='] <expression (IN) of string>]
['\' Arg5 ':='] <expression (IN) of string>]
['\' Arg6 ':='] <expression (IN) of string>]
['\'Remaining ':='] <variable or persistent (INOUT) of string>]
['\'SmartTruncate ':='] <expression (IN) of string>['\']'
```

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview</i>
Data type string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview</i>

2.189 StrLen - Gets the string length

Usage

StrLen (*String Length*) is used to find the current length of a string.

Basic examples

The following example illustrates the function StrLen.

Example 1

```
VAR num len;  
len := StrLen("Robotics");
```

The variable len is given the value 8.

Return value

Data type: num

The number of characters in the string (≥ 0).

Arguments

StrLen (Str)

Str

String

Data type: string

The string in which the number of characters is to be counted.

Syntax

```
StrLen '('  
[Str ':=' ] <expression (IN) of string> ')'
```

A function with a return value of the data type num.

Related information

For information about	See
StrSize	StrSize - Gets the string size on page 1486
String functions	<i>Technical reference manual - RAPID Instructions, Functions and Data types</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Instructions, Functions and Data types</i>

2 Functions

2.190 StrMap - Maps a string

RobotWare Base

2.190 StrMap - Maps a string

Usage

StrMap (*String Mapping*) is used to create a copy of a string in which all characters are translated according to a specified mapping.

Basic examples

The following examples illustrate the function StrMap.

Example 1

```
VAR string str;  
str := StrMap("Robotics","aeiou","AEIOU");
```

The variable str is given the value RObOtIcs.

Example 2

```
str := StrMap("Robotics",STR_LOWER, STR_UPPER);
```

The variable str is given the value ROBOTICS.

Return value

Data type: string

The string created by translating the characters in the specified string, as specified by the "from" and "to" strings. Each character from the specified string that is found in the "from" string is replaced by the character at the corresponding position in the "to" string. Characters for which no mapping is defined are copied unchanged to the resulting string.

Arguments

StrMap (Str FromMap ToMap)

Str

String

Data type: string

The string to translate.

FromMap

Data type: string

Index part of mapping. See also [Predefined data on page 1477](#).

ToMap

Data type: string

Value part of mapping. See also [Predefined data on page 1477](#).

Syntax

```
StrMap '('  
  [ Str ':= ' ] <expression (IN) of string> ','  
  [ FromMap ':= ' ] <expression (IN) of string> ','  
  [ ToMap ':= ' ] <expression (IN) of string> ')'
```

A function with a return value of the data type string.

Continues on next page

Predefined data

A number of predefined string constants are available in the system and can be used together with string functions.

Name	Character set
STR_DIGIT	<digit> ::= 0 1 2 3 4 5 6 7 8 9
STR_UPPER	<upper case letter> ::= A B C D E F G H I J K L M N O P Q R S T U V W X Y Z À Á Â Ã Ä Å Æ Ç È É Ê Ë Ì Í Î Ï 1) Ñ Ò Ó Ô Õ Ö Ø Ù Ú Û Ü 2) 3)
STR_LOWER	<lower case letter> ::= a b c d e f g h i j k l m n o p q r s t u v w x y z à á â ã ä å æ ç è é ê ë ì í î ï 1) ñ ò ó ô õ ö ø ù ú û ü 2) 3) ß ÿ-
STR_WHITE	<blank character> ::=

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.191 StrMatch - Search for pattern in string

RobotWare Base

2.191 StrMatch - Search for pattern in string

Usage

StrMatch (*String Match*) is used to search in a string, starting at a specified position, for a specified pattern.

Basic examples

The following example illustrates the function StrMatch.

Example 1

```
VAR num found;  
  
found := StrMatch("Robotics",1,"bo");
```

The variable found is given the value 3.

Return value

Data type: num

The character position of the first substring, at or past the specified position, that is equal to the specified pattern string. If no such substring is found, string length +1 is returned.

Arguments

StrMatch (Str ChPos Pattern)

Str

String

Data type: string

The string to search in.

ChPos

Character Position

Data type: num

Start character position.

Pattern

Data type: string

Pattern string to search for.

Syntax

```
StrMatch '('  
  [ Str ':' ] <expression (IN) of string> ','  
  [ ChPos ':' ] <expression (IN) of num> ','  
  [ Pattern ':' ] <expression (IN) of string> ')'
```

A function with a return value of the data type num.

Continues on next page

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.192 StrMemb - Checks if a character belongs to a set *RobotWare Base*

2.192 StrMemb - Checks if a character belongs to a set

Usage

StrMemb (*String Member*) is used to check whether a specified character in a string belongs to a specified set of characters.

Basic examples

The following example illustrates the function StrMemb.

Example 1

```
VAR bool memb;  
memb := StrMemb("Robotics",2,"aeiou");
```

The variable memb is given the value TRUE, as o is a member of the set "aeiou".

```
memb := StrMemb("Robotics",3,"aeiou");
```

The variable memb is given the value FALSE, as b is not a member of the set "aeiou".

```
memb := StrMemb("S-721 68 VÄSTERÅS",3,STR_DIGIT);
```

The variable memb is given the value TRUE, as 7 is a member of the set STR_DIGIT.

Return value

Data type: bool

TRUE if the character at the specified position in the specified string belongs to the specified set of characters.

FALSE if the character is not belonging to the specified set, or if ChPos position is outside the string (Str).

Arguments

StrMemb (Str ChPos Set)

Str

String

Data type: string

The string to check in.

ChPos

Character Position

Data type: num

The character position to check.

Set

Data type: string

Set of characters to test against.

Continues on next page

Predefined data

A number of predefined string constants are available in the system and can be used together with string functions.

Name	Character set
STR_DIGIT	<digit> ::= 0 1 2 3 4 5 6 7 8 9
STR_UPPER	<upper case letter> ::= A B C D E F G H I J K L M N O P Q R S T U V W X Y Z À Á Â Ã Î Ï 1) Ñ Ò Ó Ô Õ Ö Ø Ù Ú Û Ü 2) 3)
STR_LOWER	<lower case letter> ::= a b c d e f g h i j k l m n o p q r s t u v w x y z à á â ã ä å æ ç è é ê ë ì í î ï 1) ñ ò ó ô õ ö ø ù ú û ü 2) 3) ß ÿ-
STR_WHITE	<blank character> ::=

Syntax

```
StrMemb '('
  [ Str ':= ' ] <expression (IN) of string> ', '
  [ ChPos ':= ' ] <expression (IN) of num> ', '
  [ Set ':= ' ] <expression (IN) of string> ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.193 StrOrder - Checks if strings are ordered

RobotWare Base

2.193 StrOrder - Checks if strings are ordered

Usage

StrOrder (*String Order*) compares two strings (character by character) and returns a boolean indicating whether the two strings are in order according to a specified character ordering sequence.

Basic examples

The following examples illustrate the function StrOrder.

Example 1

```
VAR bool le;  
  
le := StrOrder("FIRST", "SECOND", STR_UPPER);
```

The variable `le` is given the value `TRUE`, because "F" comes before "S" in the character ordering sequence `STR_UPPER`.

Example 2

```
VAR bool le;  
  
le := StrOrder("FIRST", "FIRSTB", STR_UPPER);
```

The variable `le` is given the value `TRUE`, because "FIRSTB" has an additional character in the character ordering sequence (no character compared to "B").

Example 3

```
VAR bool le;  
  
le := StrOrder("FIRSTB", "FIRST", STR_UPPER);
```

The variable `le` is given the value `FALSE`, because "FIRSTB" has an additional character in the character ordering sequence ("B" compared to no character).

Return value

Data type: `bool`

`TRUE` if the first string comes before the second string (`Str1 <= Str2`) when characters are ordered as specified.

Characters that are not included in the defined ordering are all assumed to follow the present ones.

Arguments

StrOrder (Str1 Str2 Order)

Str1

String 1

Data type: `string`

First string value.

Str2

String 2

Continues on next page

Data type: string

Second string value.

Order

Data type: string

Sequence of characters that define the ordering. See also [Predefined data on page 1483](#).

Predefined data

A number of predefined string constants are available in the system and can be used together with string functions.

Name	Character set
STR_DIGIT	<digit> ::= 0 1 2 3 4 5 6 7 8 9
STR_UPPER	<upper case letter> ::= A B C D E F G H I J K L M N O P Q R S T U V W X Y Z À Á Â Ã Ä Å Æ Ç È É Ê Ë Ì Í Î Ï 1) Ñ Ò Ó Ô Õ Ö Ø Ù Ú Û Ü 2) 3)
STR_LOWER	<lower case letter> ::= a b c d e f g h i j k l m n o p q r s t u v w x y z à á â ã ä å æ ç è é ê ë ì í î ï 1) ñ ò ó ô õ ö ø ù ú û ü 2) 3) ß ÿ-
STR_WHITE	<blank character> ::=

Syntax

```
StrOrder '('
  [ Str1 ':= ' ] <expression (IN) of string> ', '
  [ Str2 ':= ' ] <expression (IN) of string> ', '
  [ Order ':= ' ] <expression (IN) of string> ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.194 StrPart - Finds a part of a string

RobotWare Base

2.194 StrPart - Finds a part of a string

Usage

StrPart (*String Part*) is used to find a part of a string, as a new string.

Basic examples

The following example illustrates the function StrPart.

Example 1

```
VAR string part;  
part := StrPart("Robotics",1,5);
```

The variable part is given the value "Robot".

Return value

Data type: string

The substring of the specified string which has the specified length and starts at the specified character position.

Arguments

StrPart (Str ChPos Len)

Str

String

Data type: string

The string in which a part is to be found.

ChPos

Character Position

Start character position. A runtime error is generated if the position is outside the string.

Len

Length

Data type: num

Length of string part. A runtime error is generated if the length is negative or greater than the length of the string, or if the substring is (partially) outside the string.

Syntax

```
StrPart '('  
  [ Str ':= ' ] <expression (IN) of string> ','  
  [ ChPos ':= ' ] <expression (IN) of num> ','  
  [ Len ':= ' ] <expression (IN) of num> ')'
```

A function with a return value of the data type string.

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview</i>

Continues on next page

For information about	See
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.195 StrSize - Gets the string size

RobotWare Base

2.195 StrSize - Gets the string size

Usage

StrSize (*String Size*) is used to find the current size of a string.

Basic examples

The following example illustrates the function StrSize.

Example 1

```
VAR num size;  
size := StrSize("Robotics");
```

The variable size is given the value 8.

Return value

Data type: num

The number of bytes in the string (≥ 0).

Arguments

StrSize (Str)

Str

String

Data type: string

The string in which the number of bytes is to be counted.

Syntax

```
StrSize '('  
  [Str ':=' ] <expression (IN) of string> ')'
```

A function with a return value of the data type num.

Related information

For information about	See
StrLen	StrLen - Gets the string length on page 1475
String functions	<i>Technical reference manual - RAPID Instructions, Functions and Data types</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Instructions, Functions and Data types</i>

2.196 StrToByte - Converts a string to a byte data

Usage

StrToByte (*String To Byte*) is used to convert a string with a defined byte data format into a byte data.

Basic examples

The following example illustrates the function StrToByte.

Example 1

```
VAR string con_data_buffer{5} := ["10", "AE", "176", "00001010",  
    "A"];
```

```
VAR byte data_buffer{5};
```

```
data_buffer{1} := StrToByte(con_data_buffer{1});
```

The content of the array component data_buffer{1} will be 10 decimal after the StrToByte ... function.

```
data_buffer{2} := StrToByte(con_data_buffer{2}\Hex);
```

The content of the array component data_buffer{2} will be 174 decimal after the StrToByte ... function.

```
data_buffer{3} := StrToByte(con_data_buffer{3}\Okt);
```

The content of the array component data_buffer{3} will be 126 decimal after the StrToByte ... function.

```
data_buffer{4} := StrToByte(con_data_buffer{4}\Bin);
```

The content of the array component data_buffer{4} will be 10 decimal after the StrToByte ... function.

```
data_buffer{5} := StrToByte(con_data_buffer{5}\Char);
```

The content of the array component data_buffer{5} will be 65 decimal after the StrToByte ... function.

Return value

Data type: byte

The result of the conversion operation in decimal representation.

Arguments

StrToByte (ConStr [\Hex] | [\Okt] | [\Bin] | [\Char])

ConStr

Convert String

Data type: string

The string data to be converted.

If the optional switch argument is omitted, the string to be converted has decimal (Dec) format.

[\Hex]

Hexadecimal

Data type: switch

Continues on next page

2 Functions

2.196 StrToByte - Converts a string to a byte data

RobotWare Base

Continued

The string to be converted has hexadecimal format.

`[\Okt]`

Octal

Data type: switch

The string to be converted has octal format.

`[\Bin]`

Binary

Data type: switch

The string to be converted has binary format.

`[\Char]`

Character

Data type: switch

The string to be converted has ASCII character format.

Limitations

Depending on the format of the string to be converted, the following string data is valid:

Format	String length	Range
Dec: '0' - '9'	3	"0" - "255"
Hex: '0' - '9', 'a' - 'f', 'A' - 'F'	2	"0" - "FF"
Okt: '0' - '7'	3	"0" - "377"
Bin: '0' - '1'	8	"0" - "11111111"
Char: Any ASCII character	1	One ASCII char

RAPID character codes (for example, "\07" for BEL control character) can be used as arguments in ConStr.

Syntax

```
StrToByte '('  
  [ConStr ':= ' ] <expression (IN) of string>  
  ['\' Hex ] | ['\' Okt] | ['\' Bin] | ['\' Char]  
)'
```

A function with a return value of the data type byte.

Related information

For information about	See
Convert a byte to a string data	ByteToStr - Converts a byte to a string data on page 1164
Other bit (byte) functions	<i>Technical reference manual - RAPID Overview</i>
Other string functions	<i>Technical reference manual - RAPID Overview</i>

2.197 StrToVal - Converts a string to a value

Usage

StrToVal (*String To Value*) is used to convert a string to a value of any data type.

Basic examples

The following example illustrates the function StrToVal.

See also [More examples on page 1489](#).

Example 1

```
VAR bool ok;  
VAR num nval;  
ok := StrToVal("3.85", nval);
```

The variable ok is given the value TRUE and nval is given the value 3.85.

Return value

Data type: bool

TRUE if the requested conversion succeeded, FALSE otherwise.

Arguments

StrToVal (Str Val)

Str

String

Data type: string

A string value containing literal data with format corresponding to the data type used in argument Val. Valid format as for RAPID literal aggregates.

Val

Value

Data type: anytype

Name of the variable or persistent of any data type for storage of the result from the conversion.

All type of value data with structure atomic, record, record component, array or array element can be used. The data is unchanged if the requested conversion failed because the format don't correspond to the data used in argument Str.

More examples

More examples of the function StrToVal are illustrated below.

Example 1

```
VAR string str15 := "[600, 500, 225.3]";  
VAR bool ok;  
VAR pos pos15;  
  
ok := StrToVal(str15, pos15);
```

Continues on next page

2 Functions

2.197 StrToVal - Converts a string to a value

RobotWare Base

Continued

The variable `ok` is given the value `TRUE` and the variable `pos15` is given the value that are specified in the string `str15`.

Syntax

```
StrToVal '('  
  [ Str ':= ' ] <expression (IN) of string> ', '  
  [ Val ':= ' ] <variable or persistent (INOUT) of anytype>  
  ')'
```

A function with a return value of the data type `bool`.

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview</i>

2.198 Tan - Calculates the tangent value

Usage

Tan (*Tangent*) is used to calculate the tangent value from an angle value.

Basic examples

The following example illustrates the function Tan.

Example 1

```

VAR num angle;
VAR num value;
...
...
value := Tan(angle);
value will get the tangent value of angle.

```

Return value

Data type: num
The tangent value.

Arguments

Tan (Angle)

Angle

Data type: num
The angle value, expressed in degrees.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_TAN_DEGREES_NOTVAL	Angle 90 and 270 degrees is undefined for tan().

Syntax

```

Tan '('
  [Angle ':='] <expression (IN) of num>
  ')'

```

A function with a return value of the data type num.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>
Arc tangent with return value in the range [-180,180]	ATan2 - Calculates the arc tangent2 value on page 1134

2 Functions

2.199 TanDnum - Calculates the tangent value *RobotWare Base*

2.199 TanDnum - Calculates the tangent value

Usage

TanDnum (*Tangent*) is used to calculate the tangent value from an angle value on data types dnum.

Basic examples

The following example illustrates the function TanDnum.

Example 1

```
VAR dnum angle;  
VAR dnum value;  
...  
...  
value := TanDnum(angle);  
value will get the tangent value of angle.
```

Return value

Data type: dnum
The tangent value.

Arguments

TanDnum (Angle)

Angle

Data type: dnum
The angle value, expressed in degrees.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_TAN_DEGREES_NOTVAL	Angle 90 and 270 degrees is undefined for tan().

Syntax

```
TanDnum '('  
    [Angle ':=' ] <expression (IN) of dnum>  
    ')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>
Arc tangent with return value in the range [-180,180]	ATan2Dnum - Calculates the arc tangent2 value on page 1135

2.200 TaskRunMec - Check if task controls any mechanical unit

Usage

TaskRunMec is used to check if the program task controls any mechanical units (robot with TCP or manipulator without TCP).

Basic examples

The following example illustrates the function TaskRunMec.

Example 1

```
VAR bool flag;  
...  
flag := TaskRunMec( );
```

If current task controls any mechanical unit `flag` will be TRUE, otherwise FALSE.

Return value

Data type: `bool`

If current task controls any mechanical unit the return value will be TRUE, otherwise FALSE.

Program execution

Check if current program task controls any mechanical unit.

Syntax

```
TaskRunMec ' ( ' ' ) '
```

A function with a return value of the data type `bool`.

Related information

For information about	See
Check if task control some robot	TaskRunRob - Check if task controls some robot on page 1494
Activating and deactivating mechanical units	ActUnit - Activates a mechanical unit on page 28 DeactUnit - Deactivates a mechanical unit on page 180
Configuration of mechanical units	Technical reference manual - System parameters

2 Functions

2.201 TaskRunRob - Check if task controls some robot

RobotWare Base

2.201 TaskRunRob - Check if task controls some robot

Usage

TaskRunRob is used to check if the program task controls some robot (mechanical unit with TCP).

Basic examples

The following example illustrates the function TaskRunRob.

Example 1

```
VAR bool flag;  
...  
flag := TaskRunRob();
```

If current task controls some robot, flag will be set to TRUE, otherwise FALSE.

Return value

Data type: bool

If current task controls some robot, the return value will be TRUE, otherwise FALSE.

Program execution

Check if current program task controls some robot.

Syntax

```
TaskRunRob '(' ' ')
```

A function with a return value of the data type bool.

Related information

For information about	See
Check if task controls any mechanical unit	TaskRunMec - Check if task controls any mechanical unit on page 1493
Activating and deactivating mechanical units	ActUnit - Activates a mechanical unit on page 28 DeactUnit - Deactivates a mechanical unit on page 180
Configuration of mechanical units	Technical reference manual - System parameters

2.202 TasksInSync - Returns the number of synchronized tasks

Usage

TasksInSync is used to retrieve the number of synchronized tasks.

Basic examples

The following example illustrates the function TaskInSync.

Example 1

```

VAR tasks tasksInSyncList{6};
...

PROC main ()
  VAR num noOfSynchTasks;
  ...
  noOfSynchTasks:= TasksInSync (tasksInSyncList);
  TPWrite "No of synchronized tasks = "\Num:=noOfSynchTasks;
ENDPROC

```

The variable noOfSynchTasks is assigned the number of synchronized tasks and the tasksInSyncList will contain the names of the synchronized tasks. In this example the task list is a variable but it can also be a persistent.

Return value

Data type: num

The number of synchronized tasks.

Arguments

TasksInSync (TaskList)

TaskList

Data type: tasks

Inout argument that in a task list (array) will present the name (string) of the program tasks that are synchronized. The task list can be either of type VAR or PERS.

Program execution

The function returns the number of synchronized tasks in the system. The names of the synchronized tasks are presented in the inout argument TaskList. In cases where there are no synchronized tasks, the list will only contain empty strings.

Limitations

Currently only one synch group is supported, so TasksInSync returns the number of tasks that are synchronized in that group.

Syntax

```

TasksInSync '('
  [ TaskList ':= ' ] < variable or persistent array {*} (INOUT) of
  tasks> ')'

```

Continues on next page

2 Functions

2.202 TasksInSync - Returns the number of synchronized tasks

RobotWare Base

Continued

A function with a return value of the data type num.

Related information

For information about	See
Specify cooperated program tasks	tasks - RAPID program tasks on page 1749
Start coordinated synchronized movements	SyncMoveOn - Start coordinated synchronized movements on page 811

2.203 TaskIsActive - Check if a normal task is active

Usage

TaskIsActive is used to check if a normal program task is active in the **Task Selection Panel** on the FlexPendant.

Basic examples

The following example illustrates the function TaskIsActive.

Example 1

```
IF TaskIsActive("T_ROB1") = TSP_STATUS_ACT THEN
  TPWrite "T_ROB1 is active in the Task Selection Panel";
ENDIF
```

Check if program task T_ROB1 is active in the **Task Selection Panel** on the FlexPendant.

Return value

Data type: tsp_status

The current task selection panel status.

Arguments

TaskIsActive (TaskRef | TaskName)

TaskRef

Data type: taskId

The program task identity of the task that should be checked.

The predefined variables of the data type taskId is available for all program tasks in the system.

The variable identity is "taskname"+"Id", for example the variable identity for the T_ROB1 task is T_ROB1Id.

TaskName

Data type: string

The program task name of the task that should be checked.

Predefined data

The following predefined symbolic constants of type tsp_status can be used to check the return value:

```
CONST tsp_status TSP_STATUS_NOT_NORMAL_TASK := 0;
CONST tsp_status TSP_STATUS_DEACT := 1;
CONST tsp_status TSP_STATUS_DEACT_SERV_ROUT := 2;
CONST tsp_status TSP_STATUS_ACT := 3;
```

Continues on next page

2 Functions

2.203 TaskIsActive - Check if a normal task is active

RobotWare Base

Continued

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_TASKNAME	The program task name in argument \TaskName cannot be found in the system.

Syntax

```
TaskIsActive '('  
  [ TaskRef ':= ' ] <variable (VAR) of taskid>  
  |[ TaskName ':= ' ] <expression (IN) of string> ')'
```

A function with a return value of the data type tsp_status.

Related information

For information about	See
Task selection panel status	tsp_status - Task selection panel status on page 1769
Get current task selection panel status	GetTSPStatus - Get current task selection panel status on page 1293
Check if task is executing	TaskIsExecuting - Check if task is executing on page 1499

2.204 TaskIsExecuting - Check if task is executing

Usage

TaskIsExecuting is used to check if a program task is executing.

Basic examples

The following example illustrates the function TaskIsExecuting.

Example 1

```
TPWrite "T_ROB1 is executing: " \Bool:=TaskIsExecuting("T_ROB1");
TPWrite "T_ROB2 is executing: " \Bool:=TaskIsExecuting("T_ROB2");
```

Checks if program task T_ROB1 and T_ROB2 is executing and writes the value on the FlexPendant.

Return value

Data type: bool

If the program task is executing, the return value is TRUE, otherwise FALSE.

Arguments

TaskIsExecuting (TaskRef | TaskName)

TaskRef

Data type: taskId

The program task identity of the task that should be checked.

The predefined variables of the data type taskId is available for all program tasks in the system.

The variable identity is "taskname"+"Id", for example the variable identity for the T_ROB1 task is T_ROB1Id.

TaskName

Data type: string

The program task name of the task that should be checked.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

ERR_TASKNAME	The program task name in argument \TaskName cannot be found in the system.

Syntax

```
TaskIsExecuting '('
  [ TaskRef ':' ] <variable (VAR) of taskId>
  |[ TaskName ':' ] <expression (IN) of string> ')'
```

A function with a return value of the data type bool.

Continues on next page

2 Functions

2.204 TaskIsExecuting - Check if task is executing

RobotWare Base

Continued

Related information

For information about	See
Check if a normal task is active	TaskIsActive - Check if a normal task is active on page 1497

2.205 TestAndSet - Test variable and set if unset

Usage

TestAndSet can be used together with a normal data object of the type `bool`, as a binary semaphore, to retrieve exclusive right to specific RAPID code areas or system resources. The function could be used both between different program tasks and different execution levels (trap or event routines) within the same program task.

Example of resources that can need protection from access at the same time:

- Use of some RAPID routines with function problems when executed in parallel.
- Use of the FlexPendant - Operator Log

Basic examples

The following example illustrates the function TestAndSet.

See also [More examples on page 1502](#).

Example 1

MAIN program task:

```
PERS bool tproutine_inuse := FALSE;
...
WaitUntil TestAndSet(tproutine_inuse);
TPWrite "First line from MAIN";
TPWrite "Second line from MAIN";
TPWrite "Third line from MAIN";
tproutine_inuse := FALSE;
```

BACK1 program task:

```
PERS bool tproutine_inuse := FALSE;
...
WaitUntil TestAndSet(tproutine_inuse);
TPWrite "First line from BACK1";
TPWrite "Second line from BACK1";
TPWrite "Third line from BACK1";
tproutine_inuse := FALSE;
```

To avoid mixing up the lines, in the Operator Log, one from MAIN and one from BACK1, the use of the TestAndSet function guarantees that all three lines from each task are not separated.

If program task MAIN takes the semaphore TestAndSet(tproutine_inuse) first, then program task BACK1 must wait until the program task MAIN has left the semaphore.

Return value

Data type: `bool`

TRUE if the semaphore has been taken by me (executor of TestAndSet function), otherwise FALSE.

Continues on next page

2 Functions

2.205 TestAndSet - Test variable and set if unset

RobotWare Base

Continued

Arguments

TestAndSet Object

Object

Data type: bool

User defined data object to be used as semaphore. The data object could be a variable VAR or a persistent variable PERS. If TestAndSet are used between different program tasks, the object must be a persistent variable PERS or an installed variable VAR (intertask objects).

Program execution

This function will in one indivisible step check the user defined variable and, if it is unset, will set it and return TRUE, otherwise it will return FALSE.

```
IF Object = FALSE THEN
  Object := TRUE;
  RETURN TRUE;
ELSE
  RETURN FALSE;
ENDIF
```

More examples

The following example illustrates the function TestAndSet.

Example 1

```
LOCAL VAR bool doit_inuse := FALSE;
...
PROC doit(...)
  WaitUntil TestAndSet (doit_inuse);
  ...
  doit_inuse := FALSE;
ENDPROC
```

If a module is installed built-in and shared, it is possible to use a local module variable for protection of access from different program tasks at the same time.



Note

In this case with installed built-in modules and when using persistent variable as semaphore object: If program execution is stopped in the routine `doit` and the program pointer is moved to `main`, the variable `doit_inuse` will not be reset. To avoid this, reset the variable `doit_inuse` to FALSE in the START event routine.

Syntax

```
TestAndSet '('
  [ Object ':' ] < variable or persistent (INOUT) of bool> ')'
```

A function with a return value of the data type bool.

Continues on next page

Related information

For information about	See
Wait until variable unset - then set (type wait with interrupt control)	WaitTestAndSet - Wait until variable becomes FALSE, then set on page 1041

2 Functions

2.206 TestDI - Tests if a digital input is set *RobotWare Base*

2.206 TestDI - Tests if a digital input is set

Usage

TestDI is used to test whether a digital input is set.

Basic examples

The following example illustrates the function TestDI.

Example 1

```
IF TestDI (di2) THEN . . .  
If the current value of the signal di2 is equal to 1, then ...  
IF NOT TestDI (di2) THEN . . .  
If the current value of the signal di2 is equal to 0, then ...  
WaitUntil TestDI(di1) AND TestDI(di2);  
Program execution continues only after both the di1 input and the di2 input have  
been set.
```

Return value

Data type: bool
TRUE = The current value of the signal is equal to 1.
FALSE = The current value of the signal is equal to 0.

Arguments

TestDI (Signal)

Signal

Data type: signaldi
The name of the signal to be tested.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).

Syntax

```
TestDI '('  
[ Signal ':' '=' ] < variable (VAR) of signaldi > ')'  
A function with a return value of the data type bool.
```

Continues on next page

Related information

For information about	See
Reading the value of a digital input signal	signalxx - Digital and analog signals on page 1725
Reading the value of a digital output signal	DOutput - Reads the value of a digital output signal on page 1240
Input/Output instructions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.207 TestSignRead - Read test signal value

RobotWare Base

2.207 TestSignRead - Read test signal value

Usage

TestSignRead is used to read the actual test signal value.

This function returns the momentary value or the mean value of the latest samples, depending on channel specification in instruction TestSignDefine.

Basic examples

The following example illustrates the function TestSignRead.

See also [More examples on page 1506](#).

Example 1

```
CONST num speed_channel:=1;
VAR num speed_value;
...
TestSignDefine speed_channel, testsignal_speed, orbit, 1, 0;
...
! During some movements with orbit's axis 1
speed_value := TestSignRead(speed_channel);
...
TestSignReset;
```

speed_value is assigned the mean value of the latest 8 samples generated each 0.5 ms of the test signal testsignal_speed on channel speed_channel defined as channel 1. The channel speed_channel measures the speed of axis 1 on the mechanical unit orbit.

Return value

Data type: num

The numeric value in SI units on the motor side for the specified channel according to the definition in instruction TestSignDefine.

Arguments

TestSignRead (Channel)

Channel

Data type: num

The channel number 1-12 for the test signal to be read. The same number must be used in the definition instruction TestSignDefine.

Program execution

Returns the momentary value or the mean value of the latest samples, depending on the channel specification in the instruction TestSignDefine.

For predefined test signals with valid SI units for external manipulator axes, see data type testsignal.

More examples

The following example illustrates the function TestSignRead.

Continues on next page

Example 1

```

CONST num torque_channel:=2;
VAR num torque_value;
VAR intnum timer_int;
CONST jointtarget psync := [...];
...
PROC main()
  CONNECT timer_int WITH TorqueTrap;
  ITimer \Single, 0.05, timer_int;
  TestSignDefine torque_channel, testsignal_torque_ref, IRBP_K, 2,
    0.001;
  ...
  MoveAbsJ psync \NoEOffs, v5, fine, tool0;
  ...
  IDelete timer_int;
  TestSignReset;

TRAP TorqueTrap
  IF (TestSignRead(torque_channel) > 6) THEN
    TPWrite "Torque pos = " + ValToStr(CJointT());
    Stop;
  ELSE
    IDelete timer_int;
    CONNECT timer_int WITH TorqueTrap;
    ITimer \Single, 0.05, timer_int;
  ENDIF
ENDTRAP

```

When the torque reference for manipulator IRBP_K axis 2 is for the first time greater than 6 Nm on the motor side during the slow movement to position psync, the joint position is displayed on the FlexPendant.

Syntax

```

TestSignRead '('
  [ Channel ':='] <expression (IN) of num> ')'

```

A function with a return value of the type num.

Related information

For information about	See
Test signal	testsignal - Test signal on page 1751
Define test signal	TestSignDefine - Define test signal on page 827
Reset test signals	TestSignReset - Reset all test signal definitions on page 829

2 Functions

2.208 TextGet - Get text from system text tables

RobotWare Base

2.208 TextGet - Get text from system text tables

Usage

TextGet is used to get a text string from the system text tables.

Basic examples

The following examples illustrate the function TextGet.

Example 1

```
VAR string text1;  
...  
text1 := TextGet(14, 5);
```

The variable text1 is assigned the text stored in text resource 14 and index 5.

Example 2

```
...  
TPWrite TextGet(14, 511 \Arg1:="robot" \Arg2:="fast");
```

The text stored in text resource 14 and index 511 is read. The text read from the text tables looks like this: This is a {1} and this {1} is {2}. The strings used in optional arguments Arg1 and Arg2 will replace {1} and {2}. The result will then be:

This is a robot and this robot is fast

Example 3

In this example, the following text is read from the text table (xml-file):

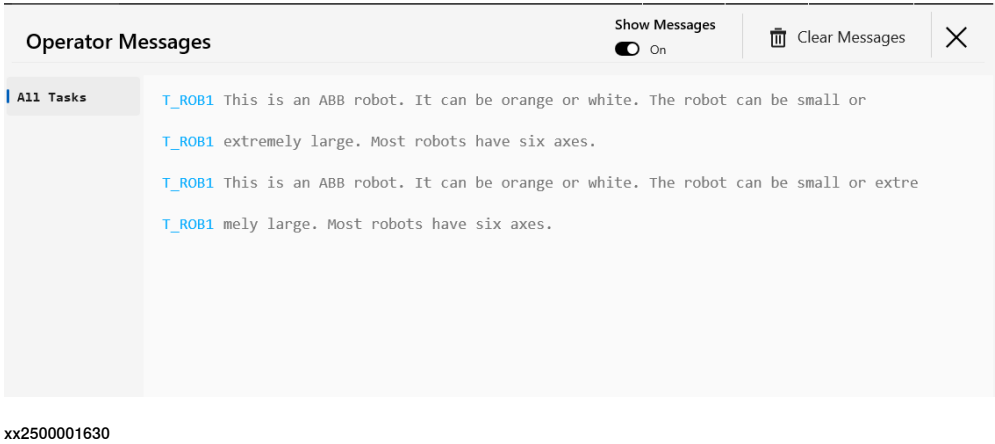
This is an ABB robot. It can be orange or white. The robot can be small or extremely large. Most robots have six axes.

```
! Cut at a SPACE character  
remainstr:=stEmpty;  
text:=TextGet(textresource, 772 \Remaining:=remainstr  
  \SmartTruncate:=stSpace);  
TPWrite text;  
IF remainstr <> stEmpty THEN  
  TPWrite remainstr;  
ENDIF  
! Cut at character "Ö". Will not find it.  
remainstr:=stEmpty;  
text:=TextGet(textresource, 772 \Remaining:=remainstr  
  \SmartTruncate:="Ö");  
TPWrite text;  
IF remainstr <> stEmpty THEN  
  TPWrite remainstr;  
ENDIF
```

The text exceeds 80 characters so by using the argument Remaining the text is truncated. The argument SmartTruncate defines where the truncation is done, in the first version at a blank space, but in the second version at the character "Ö" (which does not exist in the string), so the truncation is done at character 80.

The example code above will produce this output on the FlexPendant:

Continues on next page



Return value

Data type: string
Specified text from the system text tables.

Arguments

TextGet (Table Index \Arg1 \Arg2 \Arg3 \Arg4 \Arg5 \Arg6 \Remaining \SmartTruncate)

Table

Data type: num
The text table number (positive integer).

Index

Data type: num
The index number (positive integer) within the text table.

[\Arg1]

Data type: string
If the string read from the text table contains {1}, the {1} is replaced with the string used in this argument.

[\Arg2]

Data type: string
If the string read from the text table contains {2}, the {2} is replaced with the string used in this argument.

[\Arg3]

Data type: string
If the string read from the text table contains {3}, the {3} is replaced with the string used in this argument.

[\Arg4]

Data type: string
If the string read from the text table contains {4}, the {4} is replaced with the string used in this argument.

Continues on next page

2 Functions

2.208 TextGet - Get text from system text tables

RobotWare Base

Continued

[\\Arg5]

Data type: string

If the string read from the text table contains {5}, the {5} is replaced with the string used in this argument.

[\\Arg6]

Data type: string

If the string read from the text table contains {6}, the {6} is replaced with the string used in this argument.

[\\Remaining]

Data type: string

Remaining string if the text exceeds 80 characters.

[\\SmartTruncate]

Data type: string

With the optional argument SmartTruncate it is possible to specify where to truncate the string that is returned from the TextGet function. This can be useful if the strings returned should be used in UI functions, and you want to end returned string at a blank space or other specific character. The SmartTruncate argument is considered only if the optional argument Remaining is used and the returned string exceeds 80 bytes.

If the character(s) used in the SmartTruncate argument is not found the text is truncated at 80 characters.



Tip

Predefined string constants can be used for the argument SmartTruncate, see [string - Strings on page 1739](#).

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_TXTNOEXIST	Table or index is not valid, and no text string can be fetched from the system text tables.

Limitations

The total string length in RAPID is 80. This is the same for all inputs as result of the function.

If the string length exceeds 80 characters the execution will stop, unless the arguments Remaining and SmartTruncate are used.

Syntax

```
TextGet '('  
  [Table ':=' ] <expression (IN) of num>','
```

Continues on next page

```

[Index ':='] <expression (IN) of num>
['\ ' Arg1 ':= ' <expression (IN) of string>]
['\ ' Arg2 ':= ' <expression (IN) of string>]
['\ ' Arg3 ':= ' <expression (IN) of string>]
['\ ' Arg4 ':= ' <expression (IN) of string>]
['\ ' Arg5 ':= ' <expression (IN) of string>]
['\ ' Arg6 ':= ' <expression (IN) of string>]
['\ 'Remaining ':= ' <variable or persistent (INOUT) of string>]
['\ 'SmartTruncate ':= ' <expression (IN) of string>]')'

```

A function with a return value of the data type string.

Related information

For information about	See
Get text table number	TextTabGet - Get text table number on page 1514
Install text table	TextTabInstall - Installing a text table on page 830
Format text files	<i>Technical reference manual - RAPID kernel</i>
String functions	<i>Technical reference manual - RAPID Overview</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview</i>
<i>Advanced RAPID</i>	<i>Application manual - Controller software OmniCore</i>

2 Functions

2.209 TextTabFreeToUse - Test whether text table is free

RobotWare Base

2.209 TextTabFreeToUse - Test whether text table is free

Usage

TextTabFreeToUse should be used to test whether the text table name (text resource string) is free to use (not already installed in the system), that is, whether it is possible to install the text table in the system or not.

Basic examples

The following example illustrates the function TextTabFreeToUse.

Example 1

```
! System Module with Event Routine to be executed at event
! POWER ON, RESET or START
```

```
PROC install_text()
  IF TextTabFreeToUse("text_table_name") THEN
    TextTabInstall "HOME:/text_file.xml";
  ENDIF
ENDPROC
```

The first time the event routine `install_text` is executed, the function `TextTabFreeToUse` returns `TRUE` and the text file `text_file.xml` is installed in the system. After that the installed text strings can be fetched from the system to **RAPID** by the functions `TextTabGet` and `TextGet`.

Next time the event routine `install_text` is executed, the function `TextTabFreeToUse` returns `FALSE` and the installation is **not** repeated.

Return value

Data type: `bool`

This function returns:

- `TRUE`, if the text table is **not** already installed in the system
- `FALSE`, if the text table is already installed in the system

Arguments

TextTabFreeToUse (TableName)

TableName

Data type: `string`

The text table name. The string length is limited to 20 bytes.

See `<text_resource>` in *Technical reference manual - RAPID kernel*, section *Text files*. The string `text_resource` is the text table name.

Limitations

Limitations for installation of text tables (text resources) in the system:

- It is not possible to install the same text table more than once in the system
- It is not possible to uninstall (free) a single text table from the system. The only way to uninstall text tables from the system is to restart the controller

Continues on next page

using the restart mode **Reset system**. All text tables (both system and user defined) will then be uninstalled.

Syntax

```
TextTabFreeToUse '('  
  [TableName ':=' ] <expression (IN) of string>')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Install text table	TextTabInstall - Installing a text table on page 830
Format of text files	<i>Technical reference manual - RAPID kernel</i>
Get text table number	TextTabGet - Get text table number on page 1514
Get text from system text tables	TextGet - Get text from system text tables on page 1508
String functions	<i>Technical reference manual - RAPID Overview</i>
Definition of string	string - Strings on page 1739

2 Functions

2.210 TextTabGet - Get text table number

RobotWare Base

2.210 TextTabGet - Get text table number

Usage

TextTabGet is used to get the text table number of a user defined text table during run time.

Basic examples

The following examples illustrate the function TextTabGet.

Both examples use a new text table named deburr_part1 for user defined texts.

The new text table has the file name deburr.xml.

Example code in .xml format

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<Resource Language="en" Name="deburr_part1">
  <Text Name="1">
    <Value>Part 1 is not in pos</Value>
    <Comment>Maximum length 80 chars</Comment>
  </Text>
  <Text Name="2">
    <Value>Identity of worked part: XYZ</Value>
    <Comment>Maximum length 80 chars</Comment>
  </Text>
  <Text Name="3">
    <Value>Part error in line 1</Value>
    <Comment>Maximum length 80 chars</Comment>
  </Text>
</Resource>
```

Example 1

```
VAR num text_res_no;
...
text_res_no := TextTabGet("deburr_part1");
```

The variable text_res_no is assigned the text table number for the defined text table deburr_part1.

Example 2

```
ErrWrite TextGet(text_res_no, 1), TextGet(text_res_no, 2);
```

A message is stored in the robot log. The message is also shown on the FlexPendant display. The messages will be taken from the text table deburr_part1 :

Part 1 is not in pos

Identity of worked part: XYZ

Return value

Data type: num

The text table number of the defined text table.

Arguments

TextTabGet (TableName)

Continues on next page

TableName

Data type: string

The text table name.

Syntax

```
TextTabGet '('  
    [TableName '='] <expression (IN) of string>;)
```

A function with a return value of the data type num.

Related information

For information about	See
Get text from system text tables	TextGet - Get text from system text tables on page 1508
Install text table	TextTabInstall - Installing a text table on page 830
Format text files	<i>Technical reference manual - RAPID kernel</i>
String functions	<i>Technical reference manual - RAPID Overview</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview</i>
<i>Advanced RAPID</i>	<i>Application manual - Controller software OmniCore</i>

2 Functions

2.211 TriggDataValid - Check if the content in a triggdata variable is valid

RobotWare Base

2.211 TriggDataValid - Check if the content in a triggdata variable is valid

Usage

TriggDataValid function is used to check if a triggdata variable is valid. A valid triggdata variable is a variable that earlier has been used in the program in one of the instructions TriggIO, TriggEquip, TriggInt, TriggSpeed, TriggCheckIO or TriggRampAO to specify trigger conditions and trigger activity.

Basic examples

The following example illustrates the function TriggDataValid.

Example 1

```
VAR triggdata trigg_array{25};
...
PROC MyTriggProcL(robtarget myrobt, \VAR triggdata T1 \VAR triggdata
    T2 \VAR triggdata T3)
    VAR num triggcnt:=2;
    ! Reset entire trigg_array array before using it
    FOR i FROM 1 TO 25 DO
        TriggDataReset trigg_array{i};
    ENDFOR
    TriggEquip trigg_array{1}, 10 \Start, 0 \DOP:=do1, SetValue:=1;
    TriggEquip trigg_array{2}, 40 \Start, 0 \DOP:=do2, SetValue:=1;
    ! Check if optional argument is present,
    ! and if any trigger condition has been setup in T1
    IF Present(T1) AND TriggDataValid(T1) THEN
        ! Copy actual trigger condition to trigg_array
        TriggDataCopy trigg_array{triggcnt}, T1;
        Incr triggcnt;
    ENDIF
    IF Present(T2) AND TriggDataValid(T2) THEN
        Incr triggcnt;
        TriggDataCopy trigg_array{triggcnt}, T2;
    ENDIF
    IF Present(T3) AND TriggDataValid(T3) THEN
        Incr triggcnt;
        TriggDataCopy trigg_array{triggcnt}, T3;
    ENDIF
    TriggL p1, v500, trigg_array, z30, tool2;
    ...
```

The procedure MyTriggProcL above uses the TriggDataValid instruction to check if any valid data is used in the optional arguments T1, T2 and T3.

Return value

Data type: bool

Continues on next page

2.211 TriggDataValid - Check if the content in a triggdata variable is valid

RobotWare Base

Continued

This function returns:

- TRUE, if the variable is valid, i.e. one of the instructions TriggIO, TriggEquip, TriggInt, TriggSpeed, TriggCheckIO or TriggRampAO has been used to specify trigger conditions and trigger activity.
- FALSE, if the variable has not been used when setting up any trigger condition and trigger activity.

Arguments

TriggDataValid TriggData

TriggData

Data type: triggdata

The triggdata variable to check if valid.

Syntax

```
TriggDataValid
[TriggData '[:=' ] < variable (VAR) of triggdata > ':'
```

A function with a return value of the data type bool.

Related information

For information about	See
Linear movement with triggers	TriggL - Linear robot movements with events on page 902
Joint movement with triggers	TriggJ - Axis-wise robot movements with events on page 894
Circular movement with triggers	TriggC - Circular robot movement with events on page 858
Definition of triggers	TriggIO - Define a fixed position or time I/O event near a stop point on page 888 TriggEquip - Define a fixed position and time I/O event on the path on page 877 TriggInt - Defines a position related interrupt on page 883 TriggCheckIO - Defines I/O check at a fixed position on page 867 TriggRampAO - Define a fixed position ramp AO event on the path on page 927 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event on page 934
Handling triggdata	triggdata - Positioning events, trigg on page 1761 TriggDataReset - Reset the content in a triggdata variable on page 875 TriggDataCopy - Copy the content in a triggdata variable on page 873

2 Functions

2.212 Trunc - Truncates a numeric value

RobotWare Base

2.212 Trunc - Truncates a numeric value

Usage

Trunc (*Truncate*) is used to truncate a numeric value to a specified number of decimals or to an integer value.

Basic examples

The following examples illustrate the function Trunc.

Example 1

```
VAR num val;  
val := Trunc(0.3852138\Dec:=3);
```

The variable val is given the value 0.385.

Example 2

```
reg1 := 0.3852138;  
val := Trunc(reg1\Dec:=1);
```

The variable val is given the value 0.3.

Example 3

```
val := Trunc(0.3852138);
```

The variable val is given the value 0.

Example 4

```
val := Trunc(0.3852138\Dec:=6);
```

The variable val is given the value 0.385213.

Return value

Data type: num

The numeric value truncated to the specified number of decimals.

Arguments

Trunc (Val [\Dec])

Val

Value

Data type: num

The numeric value to be truncated.

[\Dec]

Decimals

Data type: num

Number of decimals.

If the specified number of decimals is 0 or if the argument is omitted, the value is truncated to an integer.

The number of decimals must not be negative or greater than the available precision for numeric values.

Max number of decimals that can be used is 6.

Continues on next page

Syntax

```
Trunc '('  
  [ Val ':= ' ] <expression (IN) of num>  
  [ \Dec ':= ' <expression (IN) of num> ] ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>
Rounding a value	Round - Round a numeric value on page 1436

2 Functions

2.213 TruncDnum - Truncates a numeric value

RobotWare Base

2.213 TruncDnum - Truncates a numeric value

Usage

TruncDnum (*Truncate dnum*) is used to truncate a numeric value to a specified number of decimals or to an integer value.

Basic examples

The following examples illustrate the function TruncDnum.

Example 1

```
VAR dnum val;  
val := TruncDnum(0.3852138754655357\Dec:=3);
```

The variable val is given the value 0.385.

Example 2

```
val := TruncDnum(0.3852138754655357\Dec:=1);
```

The variable val is given the value 0.3.

Example 3

```
val := TruncDnum(0.3852138754655357);
```

The variable val is given the value 0.

Example 4

```
val := TruncDnum(0.3852138754655357\Dec:=15);
```

The variable val is given the value 0.385213875465535.

Example 5

```
val := TruncDnum(1000.3852138754655357\Dec:=15);
```

The variable val is given the value 1000.38521387547.

Return value

Data type: dnum

The numeric value truncated to the specified number of decimals.

Arguments

TruncDnum (Val [\Dec])

Val

Value

Data type: dnum

The numeric value to be truncated.

[\Dec]

Decimals

Data type: num

Number of decimals.

If the specified number of decimals is 0 or if the argument is omitted, the value is truncated to an integer.

Continues on next page

The number of decimals must not be negative or greater than the available precision for numeric values.

Max number of decimals that can be used is 15.

Syntax

```
TruncDnum '('  
  [ Val ':=' ] <expression (IN) of dnum>  
  [ \Dec ':=' <expression (IN) of num> ] ')'
```

A function with a return value of the data type dnum.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>
Truncating a value	Trunc - Truncates a numeric value on page 1518
Rounding a value	Round - Round a numeric value on page 1436
Rounding a value	RoundDnum - Round a numeric value on page 1438

2 Functions

2.214 Type - Get the data type name for a variable

RobotWare Base

2.214 Type - Get the data type name for a variable

Usage

Type is used to get the data type name for the specified variable in argument Data.

Basic examples

The following examples illustrate the function Type.

Example 1

```
VAR string rettype;
VAR intnum intnumtype;
...
PROC main()
  rettype := Type(intnumtype);
  TPWrite "Data type name: " + rettype;
```

The print out will be: "Data type name: intnum"

Example 2

```
VAR string rettype;
VAR intnum intnumtype;
...
PROC main()
  rettype := Type(intnumtype \BaseName);
  TPWrite "Data type name: " + rettype;
```

The print out will be: "Data type name: num"

Example 3

```
VAR string rettype;
VAR num numtype;
...
PROC main()
  rettype := Type(numtype);
  TPWrite "Data type name: " + rettype;
```

The print out will be: "Data type name: num"

Return value

Data type: string

A string with the data type name for the specified variable in argument Data.

Arguments

Type (Data [\BaseName])

Data

Data object name

Data type: anytype

The name of the variable to get the data type name for.

[\BaseName]

Base data type Name

Continues on next page

Data type: switch

If used, then the function returns the underlying data type name, when the specified Data is an ALIAS declared data type.

Syntax

```
Type '('  
  [ Data ':= ' ] < reference (REF) of anytype >  
  [ '\\' BaseName ] ')'
```

A function with a return value of the data type string.

Related information

For information about	See
Definition of Alias types	<i>Technical reference manual - RAPID kernel</i> ALIAS - Assigning an alias data type on page 1591

2 Functions

2.215 UIAlphaEntry - User Alpha Entry

RobotWare Base

2.215 UIAlphaEntry - User Alpha Entry

Usage

UIAlphaEntry (*User Interaction Alpha Entry*) is used to let the operator enter a string from the available user device, such as the FlexPendant. A message is written to the operator, who answers with a text string. The string is then transferred back to the program.

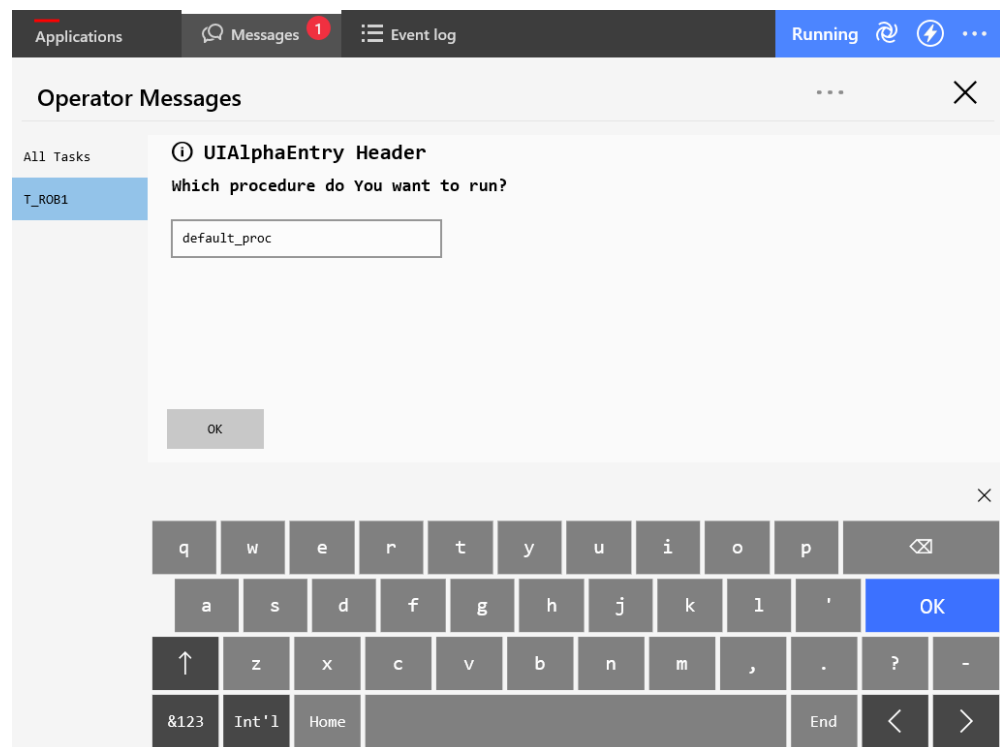
Basic examples

The following example illustrates the function UIAlphaEntry.

See [More examples on page 1529](#).

Example 1

```
VAR string answer;  
...  
answer := UIAlphaEntry(  
  \Header:= "UIAlphaEntry Header",  
  \Message:= "Which procedure do You want to run?"  
  \Icon:=iconInfo  
  \InitString:= "default_proc");  
%answer%;
```



xx1900002214

The message box with icon, header, message, and initial string are shown on the FlexPendant. The user can edit the string or write a new string with the soft keyboard. Program execution waits until OK is tapped and then the string is returned in the variable answer. The program then calls the specified procedure with late binding.

Continues on next page

Return value

Data type: string

This functions returns the input string.

If function breaks via \BreakFlag:

- If parameter \InitString is specified, this string is returned
- If parameter \InitString is not specified, empty string "" is returned.

If function breaks via ERROR handler, no return value will be returned at all.

Arguments

```
UIAlphaEntry ([\Header] [\Message][\MsgArray] [\Wrap] [\Icon]
              [\Image] [\InitString] [\MaxTime] [\DIBreak] [\DIPassive]
              [\DOBreak] [\DOPassive] [\PersBoolBreak] [\PersBoolPassive]
              [\BreakFlag] [\UIActiveSignal])
```

[\Header]

Data type: string

Header text to be written at the top of the message box. Max. 40 characters.

[\Message]

Data type: string

One text line to be written on the display. Max 55 characters.

[\MsgArray]

Message Array

Data type: string

Several text lines from an array to be written on the display.

Only one of parameters \Message or \MsgArray can be used at the same time.

Max. layout space is 55 characters.

[\Wrap]

Data type: switch

If selected, all the specified strings in the argument \MsgArray will be concatenated to one string with single space between each individual strings and spread out on as few lines as possible.

Default, each string in the argument \MsgArray will be on separate line on the display.

[\Icon]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 1528](#).

Default no icon.

[\Image]

Data type: string

Continues on next page

2 Functions

2.215 UIAlphaEntry - User Alpha Entry

RobotWare Base

Continued

The name or full path to the image that should be used. If only a filename is provided, the FlexPendant will look for it in the HOME: directory. The path must follow this format: HOME:/subfolder1/image.png

No restart is required when a new or updated image is added. If an existing image is replaced by a new image with the same filename, then the user needs to log out and log in.

The files are included in backup and restore. If the files are placed directly in the active system, they are not included in backup and restore.

The image can have the width of 250 pixels and the height of 470 pixels. If the image is bigger, only 250x470 pixels of the image are shown, starting at the top left of the image.

The program execution will just continue if an image is used that has not been found in the specified path.

Supported image formats: jpg, png, jpeg, bmp

If other formats are used, it may or may not work.

[\InitString]

Data type: string

An initial string to be display in the text entry box as default.

[\MaxTime]

Data type: num

The maximum amount of time in seconds that program execution waits. If the OK button is not pressed within this time, the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_MAXTIME can be used to test whether or not the maximum time has elapsed.

[\DIBreak]

Digital Input Break

Data type: signal di

The digital input signal that may interrupt the operator dialog. If the OK button is not pressed before the signal is set to 1 (or is already 1), the program continues to execute in the error handler, unless the BreakFlag is used (see below). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\DIPassive]

Digital Input Passive

Data type: switch

This switch overrides the default behavior when using DIBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DIBreak is set to 0 (or already is 0). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\DOBreak]

Digital Output Break

Continues on next page

Data type: signaldo

The digital output signal that may interrupt the operator dialog. If the OK button is not pressed before the signal is set to 1 (or is already 1), the program continues to execute in the error handler, unless the BreakFlag is used (see below). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\DOPassive]

Digital Output Passive

Data type: switch

This switch overrides the default behavior when using DOBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DOBreak is set to 0 (or already is 0). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\PersBoolBreak]

Persistent Boolean Break

Data type: bool

The persistent boolean that may interrupt the operator dialog. If no button is selected when the persistent boolean is set to TRUE (or is already TRUE) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\PersBoolPassive]

Persistent Boolean Passive

Data type: switch

This switch overrides the default behavior when using PersBoolBreak optional argument. Instead of reacting when persistent boolean is set to TRUE (or already TRUE), the instruction should continue in the error handler (if no BreakFlag is used) when the persistent boolean PersBoolBreak is set to FALSE (or already is FALSE). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\BreakFlag]

Data type: errnum

A variable that will hold the error code if MaxTime, DIBreak, DOBreak, or PersBoolBreak is used. If this optional variable is omitted then the error handler will be executed. The constants ERR_TP_MAXTIME, ERR_TP_DIBREAK, ERR_TP_DOBREAK, and ERR_TP_PERSBOOLBREAK can be used to select the reason.

[\UIActiveSignal]

Data type: signaldo

The digital output signal used in optional argument UIActiveSignal is set to 1 when the message box is activated on the FlexPendant. When the user selection has been done and the execution continue, the signal is set to 0 again.

Continues on next page

2 Functions

2.215 UIAlphaEntry - User Alpha Entry

RobotWare Base

Continued

No supervision of stop or restart exist. The signal is set to 0 when the function is ready, or when PP is moved.

Program execution

The alpha message box is displayed according to the programmed arguments. Program execution waits until the user edits or creates a new string and taps OK, or the message box is interrupted by a time-out or signal action. The input string and interrupt reason are transferred back to the program.

New message box on trap level takes the focus from the message box on the basic level.

Predefined data

The following constants of the data type `icondata` are predefined in the system:

Value	Constant	Icon
0	<code>iconNone</code>	No icon
1	<code>iconInfo</code>	Information icon
2	<code>iconWarning</code>	Warning icon
3	<code>iconError</code>	Error icon
4	<code>iconQuestion</code>	Question icon

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_NO_ALIASIO_DEF</code>	The signal variable is a variable declared in RAPID and it has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
<code>ERR_TP_NO_CLIENT</code>	There is no client, for example, a FlexPendant, to take care of the instruction.
<code>ERR_UI_ICON</code>	The argument <code>Icon</code> of type <code>icondata</code> has a not allowed value.

If parameter `\BreakFlag` is not used, these situations can then be dealt with by the error handler:

If there is a time-out (parameter `\MaxTime`) before an input from the operator, the system variable `ERRNO` is set to `ERR_TP_MAXTIME` and the execution continues in the error handler.

If digital input is set (parameter `\DIBreak`) before an input from the operator, the system variable `ERRNO` is set to `ERR_TP_DIBREAK` and the execution continues in the error handler.

If a digital output is set (parameter `\DOBBreak`) before an input from the operator, the system variable `ERRNO` is set to `ERR_TP_DOBREAK` and the execution continues in the error handler.

Continues on next page

If a persistent boolean is set (parameter \PersBoolBreak) before an input from the operator, the system variable ERRNO is set to ERR_TP_PERSB00LBREAK and the execution continues in the error handler.

More examples

The following example illustrates the function UIAlphaEntry.

Example 1

```
VAR errnum err_var;
VAR string answer;
VAR string logfile;
...
answer := UIAlphaEntry (\Header:= "Log file name:"
  \Message:= "Enter the name of the log file to create?"
  \Icon:=iconInfo
  \InitString:= "signal.log"
  \MaxTime:=60
  \DIBreak:=di5\BreakFlag:=err_var);
TEST err_var
CASE ERR_TP_MAXTIME:
CASE ERR_TP_DIBREAK:
  ! No operator answer
  logfile:="signal.log";
CASE 0:
  ! Operator answer
  logfile := answer;
DEFAULT:
  ! No such case defined
ENDTEST
```

The message box is displayed and the operator can enter a string and press OK. The message box can also be interrupted with time out or break by digital input signal. In the program it is possible to find out the reason and take the appropriate action.

Limitations

Avoid using too small a value for the time-out parameter \MaxTime when UIAlphaEntry is frequently executed, for example in a loop. It can result in an unpredictable behavior of the system performance, like slow response of the FlexPendant.

Syntax

```
UIAlphaEntry '('
  ['\' Header ':=' <expression (IN) of string>]
  ['\' Message ':=' <expression (IN) of string>]
  | ['\' MsgArray ':='<array {*} (IN) of string>]
  ['\' Wrap]
  ['\' Icon ':=' <expression (IN) of icondata>]
  ['\' Image ':='<expression (IN) of string>]
  ['\' InitString ':='<expression (IN) of string>]
  ['\' MaxTime ':=' <expression (IN) of num>]
```

Continues on next page

2 Functions

2.215 UIAlphaEntry - User Alpha Entry

RobotWare Base

Continued

```
['\' DIBreak ':=' <variable (VAR) of signaldi>]  
['\' DIPassive]  
['\' DOBreak ':=' <variable (VAR) of signaldo>]  
['\' DOPassive]  
['\' PersBoolBreak ':=' <persistent (PERS) of bool>]  
['\' PersBoolPassive]  
['\' BreakFlag ':=' <variable or persistent (INOUT) of errnum>]  
['\' UIActiveSignal ':=' <variable (VAR) of signaldo>] ')
```

A function with return value of the data type string.

Related information

For information about	See
Icon display data	icondata - Icon display data on page 1652
User interaction message box type basic	UIMsgBox - User Message Dialog Box type basic on page 964
User interaction message box type advanced	UIMessageBox - User Message Box type advanced on page 1556
User interaction number entry	UINumEntry - User Number Entry on page 1565
User interaction number tune	UINumTune - User Number Tune on page 1573
User interaction list view	UICollection - User List View on page 1547
System connected to FlexPendant etc.	UIClientExist - Exist User Client on page 1531
Procedure call with late binding	Technical reference manual - RAPID Overview
Clean up the operator window	TPErase - Erases text printed on the FlexPendant on page 832

2.216 UIClientExist - Exist User Client

Usage

UIClientExist (*User Interaction Client Exist*) is used to check if some User Device such as the FlexPendant is connected to the controller.

Basic examples

The following example illustrates the function UIClientExist.

Example 1

```
IF UIClientExist() THEN
    ! Possible to get answer from the operator
    ! The TPreadFK and UIMsgBox ... can be used
ELSE
    ! Not possible to communicate with any operator
ENDIF
```

The test is done if it is possible to get some answer from the operator of the system.

Return value

Data type: bool

Returns TRUE if a FlexPendant is connected to the system, otherwise FALSE.

Limitations

UIClientExist returns TRUE up to 16 seconds. After that, the FlexPendant is removed. After that time, UIClientExist returns FALSE (i.e when network connection lost from FlexPendant is detected). Same limitation when the FlexPendant is connected again.

Syntax

```
UIClientExist '(' '')
```

A function with return value of the type bool.

Related information

For information about	See
User interaction message box type basic	UIMsgBox - User Message Dialog Box type basic on page 964
User interaction message box type advanced	UIMessageBox - User Message Box type advanced on page 1556
User interaction number entry	UINumEntry - User Number Entry on page 1565
User interaction number tune	UINumTune - User Number Tune on page 1573
User interaction alpha entry	UIAlphaEntry - User Alpha Entry on page 1524
User interaction list view	UIListView - User List View on page 1547
Clean up the operator window	TPERase - Erases text printed on the Flex-Pendant on page 832

2 Functions

2.217 UIDnumEntry - User Number Entry *RobotWare Base*

2.217 UIDnumEntry - User Number Entry

Usage

UIDnumEntry (*User Interaction Number Entry*) is used to let the operator enter a numeric value from the available user device, such as the FlexPendant. A message is written to the operator, who answers with a numeric value. The numeric value is then checked, approved and transferred back to the program.

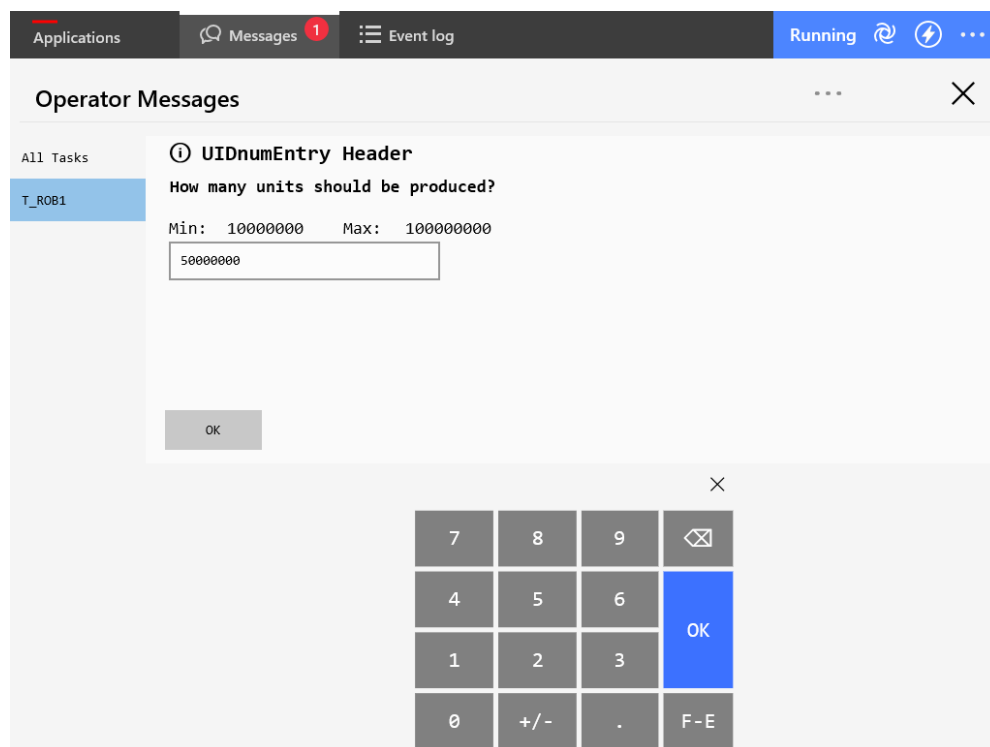
Basic examples

The following example illustrates the function UIDnumEntry.

See also [More examples on page 1537](#).

Example 1

```
VAR dnum answer;  
...  
answer := UIDnumEntry(  
  \Header:="UIDnumEntry Header"  
  \Message:="How many units should be produced?"  
  \Icon:=iconInfo  
  \InitValue:=50000000  
  \MinValue:=10000000  
  \MaxValue:=100000000  
  \AsInteger);
```



xx1900002218

The numeric message box with icon, header, message, initial, maximum, and minimum values are shown on the FlexPendant. The message box checks that the

Continues on next page

operator selects an integer within the value range. Program execution waits until OK is pressed and then the selected numerical value is returned.

Return value

Data type: dnum

This function returns the input numeric value.

If function breaks via \BreakFlag:

- If parameter \InitValue is specified, this value is returned
- If parameter \InitValue is not specified, value 0 is returned.

If function breaks via ERROR handler there is no return value at all.

Arguments

```
UIDnumEntry ( [\Header] [\Message] | [\MsgArray] [\Wrap] [\Icon]
              [\Image] [\InitValue] [\MinValue] [\MaxValue] [\AsInteger]
              [\MaxTime] [\DIBreak] [\DIPassive] [\DOBreak] [\DOPassive]
              [\PersBoolBreak] [\PersBoolPassive] [\BreakFlag]
              [\UIActiveSignal])
```

[\Header]

Data type: string

Header text to be written at the top of the message box. Max. 40 characters.

[\Message]

Data type: string

One text line to be written on the display. Max. 55 characters.

[\MsgArray]

Message Array

Data type: string

Several text lines from an array to be written on the display.

Only one of parameters \Message or \MsgArray can be used at the same time.

Max. layout space is 55 characters.

[\Wrap]

Data type: switch

If selected, all the specified strings in the argument \MsgArray will be concatenated to one string with a single space between each individual string, and spread out on as few lines as possible.

Default, each string in the argument \MsgArray will be on a separate line on the display.

[\Icon]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 1536](#).

Default no icon.

Continues on next page

2 Functions

2.217 UIDnumEntry - User Number Entry

RobotWare Base

Continued

[\\Image]

Data type: string

The name or full path to the image that should be used. If only a filename is provided, the FlexPendant will look for it in the HOME: directory. The path must follow this format: HOME:/subfolder1/image.png

No restart is required when a new or updated image is added. If an existing image is replaced by a new image with the same filename, then the user needs to log out and log in.

The files are included in backup and restore. If the files are placed directly in the active system, they are not included in backup and restore.

The image can have the width of 250 pixels and the height of 470 pixels. If the image is bigger, only 250x470 pixels of the image are shown, starting at the top left of the image.

The program execution will just continue if an image is used that has not been found in the specified path.

Supported image formats: jpg, png, jpeg, bmp

If other formats are used, it may or may not work.

[\\InitValue]

Data type: dnum

Initial value that is displayed in the entry box.

[\\MinValue]

Data type: dnum

The minimum value for the return value.

[\\MaxValue]

Data type: dnum

The maximum value for the return value.

[\\AsInteger]

Data type: switch

This switch removes the decimal point from the number pad to ensure that the return value is an integer. When using this switch, the optional arguments InitValue, MinValue, and MaxValue needs to be between the values -4503599627370496 and 4503599627370496.

[\\MaxTime]

Data type: num

The maximum amount of time in seconds that program execution waits. If the OK button is not pressed within this time, the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_MAXTIME can be used to test whether or not the maximum time has elapsed.

[\\DIBreak]

Digital Input Break

Continues on next page

Data type: signaldi

The digital input signal that may interrupt the operator dialog. If the OK button is not pressed before the signal is set to 1 (or is already 1) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\\DIPassive]

Digital Input Passive

Data type: switch

This switch overrides the default behavior when using DIBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DIBreak is set to 0 (or already is 0). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\\DOBreak]

Digital Output Break

Data type: signaldo

The digital output signal that may interrupt the operator dialog. If the OK button is not pressed before the signal is set to 1 (or is already 1) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\\DOPassive]

Digital Output Passive

Data type: switch

This switch overrides the default behavior when using DOBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DOBreak is set to 0 (or already is 0). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\\PersBoolBreak]

Persistent Boolean Break

Data type: bool

The persistent boolean that may interrupt the operator dialog. If no button is selected when the persistent boolean is set to TRUE (or is already TRUE) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\\PersBoolPassive]

Persistent Boolean Passive

Data type: switch

This switch overrides the default behavior when using PersBoolBreak optional argument. Instead of reacting when persistent boolean is set to TRUE (or already TRUE), the instruction should continue in the error handler (if no BreakFlag is

Continues on next page

2 Functions

2.217 UIDnumEntry - User Number Entry

RobotWare Base

Continued

used) when the persistent boolean PersBoolBreak is set to FALSE (or already is FALSE). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\\BreakFlag]

Data type: errnum

A variable that will hold the error code if MaxTime, DIBreak, DOBreak, or PersBoolBreak is used. If this optional variable is omitted then the error handler will be executed. The constants ERR_TP_MAXTIME, ERR_TP_DIBREAK, ERR_TP DOBREAK, and ERR_TP_PERSBOOLBREAK can be used to select the reason.

[\\UIActiveSignal]

Data type: signaldo

The digital output signal used in optional argument UIActiveSignal is set to 1 when the message box is activated on the FlexPendant. When the user selection has been done and the execution continue, the signal is set to 0 again.

No supervision of stop or restart exist. The signal is set to 0 when the function is ready, or when PP is moved.

Program execution

The numeric message box is displayed according to the programmed arguments. Program execution waits until the user enters an approved numeric value and taps OK or the message box is interrupted by a time-out or signal action. The input numeric value and interrupt reason are transferred back to the program.

New message box on trap level takes the focus from the message box on the basic level.

Predefined data

The following constants of the data type icondata are predefined in the system:

Value	Constant	Icon
0	iconNone	No icon
1	iconInfo	Information icon
2	iconWarning	Warning icon
3	iconError	Error icon
4	iconQuestion	Question icon

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID and it has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_TP_NO_CLIENT	There is no client, for example, a FlexPendant, to take care of the instruction.

Continues on next page

Name	Cause of error
ERR_UI_ICON	The argument Icon of type icondata has a not allowed value.
ERR_UI_INITVALUE	The initial value (parameter \InitValue) is not specified within the range of the minimum and maximum value (parameters \MinValue and \MaxValue).
ERR_UI_MAXMIN	The minimum value (parameter \MinValue) is greater then the maximum value (parameter \MaxValue).
ERR_UI_NOTINT	The initial value (parameter \InitValue) is not an integer as specified in the parameter \AsInteger.

If parameter \BreakFlag is not used, these situations can then be dealt with by the error handler:

- If there is a time-out (parameter \MaxTime) before an input from the operator then the system variable ERRNO is set to ERR_TP_MAXTIME and the execution continues in the error handler.
- If digital input is set (parameter \DIBreak) before an input from the operator then the system variable ERRNO is set to ERR_TP_DIBREAK and the execution continues in the error handler.
- If a digital output is set (parameter \DOBreak) before an input from the operator then the system variable ERRNO is set to ERR_TP_DOBREAK and the execution continues in the error handler.
- If a persistent boolean is set (parameter \PersBoolBreak) before an input from the operator then the system variable ERRNO is set to ERR_TP_PERSBOOLBREAK and the execution continues in the error handler.

This situation can only be dealt with by the error handler:

More examples

The following example illustrates the function UIDnumEntry.

Example 1

```

VAR errnum err_var;
VAR dnum answer;
VAR dnum distance;
...
answer := UIDnumEntry (\Header:= "BWD move on path"
  \Message:="Enter the path overlap?" \Icon:=iconInfo
  \InitValue:=5 \MinValue:=0 \MaxValue:=10
  \MaxTime:=60 \DIBreak:=di5 \BreakFlag:=err_var);
TEST err_var
CASE ERR_TP_MAXTIME:
CASE ERR_TP_DIBREAK:
  ! No operator answer distance := 5;
CASE 0
  ! Operator answer
  distance := answer;
DEFAULT:
  ! No such case defined
ENDTEST

```

Continues on next page

2 Functions

2.217 UIDnumEntry - User Number Entry

RobotWare Base

Continued

The message box is displayed and the operator can enter a numeric value and press OK. The message box can also be interrupted with a time out or break by digital input signal. In the program, it is possible to find out the reason and take the appropriate action.

Limitations

Avoid using too small a value for the timeout parameter \MaxTime when UIDnumEntry is frequently executed, for example, in a loop. It can result in unpredictable behavior from the system performance, like the slow response of the FlexPendant.

Syntax

```
UIDnumEntry '('  
  ['\ ' Header ':' <expression (IN) of string>]  
  [Message ':' <expression (IN) of string> ]  
  | ['\ ' MsgArray ':' <array {*} (IN) of string>]  
  ['\ ' Wrap]  
  ['\ ' Icon ':' <expression (IN) of icondata>]  
  ['\ ' Image ':' <expression (IN) of string>]  
  ['\ ' InitValue ':' <expression (IN) of dnum>]  
  ['\ ' MinValue ':' <expression (IN) of dnum>]  
  ['\ ' MaxValue ':' <expression (IN) of dnum>]  
  ['\ ' AsInteger]  
  ['\ ' MaxTime ':' <expression (IN) of num>]  
  ['\ ' DIBreak ':' <variable (VAR) of signaldi>]  
  ['\ ' DIPassive]  
  ['\ ' DOBreak ':' <variable (VAR) of signaldo>]  
  ['\ ' DOPassive]  
  ['\ ' PersBoolBreak ':' <persistent (PERS) of bool>]  
  ['\ ' PersBoolPassive]  
  ['\ ' BreakFlag ':' <variable or persistent (INOUT) of ernum>]  
  ['\ ' UIActiveSignal ':' <variable (VAR) of signaldo>'] ')'
```

A function with return value of the data type dnum.

Related information

For information about	See
Icon display data	icondata - Icon display data on page 1652
User interaction message box type basic	UIMsgBox - User Message Dialog Box type basic on page 964
User interaction message box type advanced	UIMessageBox - User Message Box type advanced on page 1556
User interaction number entry	UINumEntry - User Number Entry on page 1565
User interaction number tune	UIDnumTune - User Number Tune on page 1540
User interaction number tune	UINumTune - User Number Tune on page 1573
User interaction alpha entry	UIAlphaEntry - User Alpha Entry on page 1524
User interaction list view	UIListView - User List View on page 1547

Continues on next page

For information about	See
System connected to FlexPendant etc.	UIClientExist - Exist User Client on page 1531
Clean up the operator window	TPErase - Erases text printed on the Flex-Pendant on page 832

2 Functions

2.218 UIDnumTune - User Number Tune

RobotWare Base

2.218 UIDnumTune - User Number Tune

Usage

UIDnumTune (*User Interaction Number Tune*) is used to let the operator tune a numeric value from the available user device, such as the FlexPendant. A message is written to the operator, who tunes a numeric value. The tuned numeric value is then checked, approved and transferred back to the program.

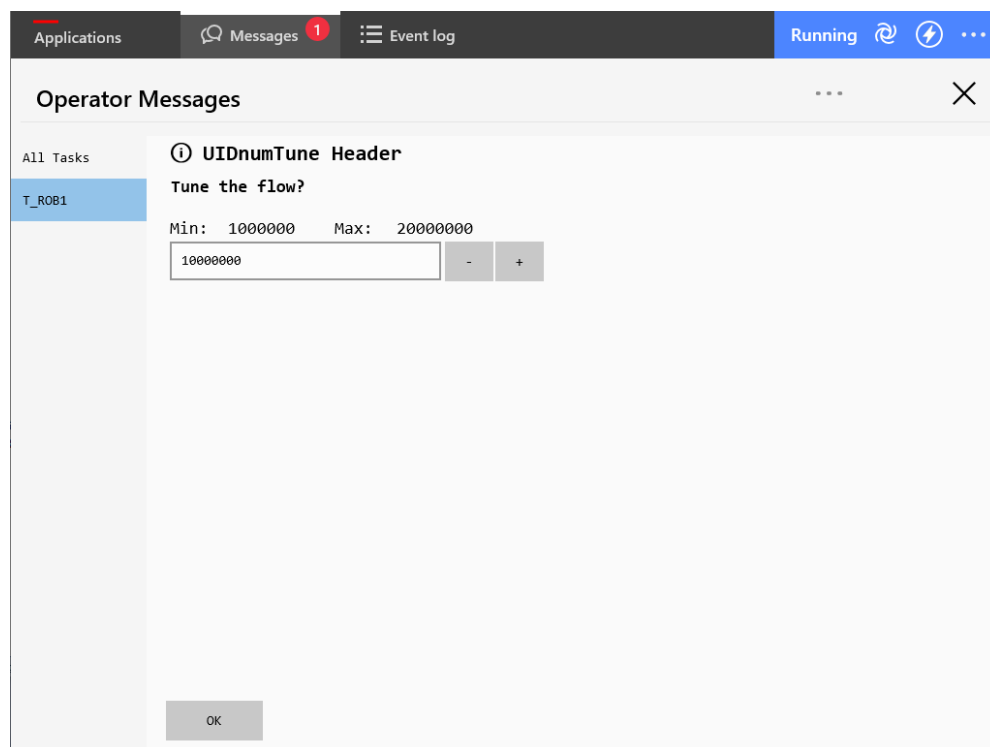
Basic examples

The following example illustrates the function UIDnumTune.

See also [More examples on page 1545](#).

Example 1

```
VAR dnum flow;  
...  
flow := UIDnumTune(  
  \Header:="UIDnumTune Header"  
  \Message:="Tune the flow?"  
  \Icon:=iconInfo,  
  10000000,  
  1000000  
  \MinValue:=1000000  
  \MaxValue:=20000000);
```



xx1900002219

The numeric tune message box with icon, header, message, initial, increment, maximum, and minimum values are shown on the FlexPendant. The message box checks that the operator tunes the f low value with step (increment) 1000000 from

Continues on next page

the initial value 10000000 and is within the value range 1000000-20000000. Program execution waits until OK is pressed and then the selected numerical value is returned and stored in the variable flow.

Return value

Data type: dnum

This function returns the tuned numeric value.

If function breaks via \BreakFlag, the specified InitValue is returned.

If function breaks via ERROR handler, no return value is returned at all.

Arguments

```
UIDnumTune ( [\Header] [\Message] | [\MsgArray] [\Wrap] [\Icon]
             [\Image] InitValue Increment [\MinValue] [\MaxValue]
             [\MaxTime][\DIBreak] [\DIPassive] [\DOBreak] [\DOPassive]
             [\PersBoolBreak] [\PersBoolPassive] [\BreakFlag]
             [\UIActiveSignal])
```

[\Header]

Data type: string

Header text to be written at the top of the message box. Max. 40 characters.

[\Message]

Data type: string

One text line to be written on the display. Max. 55 characters.

[\MsgArray]

Message Array

Data type: string

Several text lines from an array to be written on the display.

Only one of parameters \Message or \MsgArray can be used at the same time.

Max. layout space is 55 characters.

[\Wrap]

Data type: switch

If selected, all the specified strings in the argument \MsgArray will be concatenated to one string with a single space between each individual string and spread out on as few lines as possible.

Default, each string in the argument \MsgArray will be on a separate line on the display.

[\Icon]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 1544](#).

Default no icon.

[\Image]

Data type: string

Continues on next page

2 Functions

2.218 UIDnumTune - User Number Tune

RobotWare Base

Continued

The name or full path to the image that should be used. If only a filename is provided, the FlexPendant will look for it in the HOME: directory. The path must follow this format: HOME:/subfolder1/image.png

No restart is required when a new or updated image is added. If an existing image is replaced by a new image with the same filename, then the user needs to log out and log in.

The files are included in backup and restore. If the files are placed directly in the active system, they are not included in backup and restore.

The image can have the width of 250 pixels and the height of 470 pixels. If the image is bigger, only 250x470 pixels of the image are shown, starting at the top left of the image.

The program execution will just continue if an image is used that has not been found in the specified path.

Supported image formats: jpg, png, jpeg, bmp

If other formats are used, it may or may not work.

InitValue

Initial Value

Data type: dnum

Initial value that is displayed in the entry box.

Increment

Data type: dnum

This parameter specifies how much the value should change when the plus or minus button is pressed.

[MinValue]

Data type: dnum

The minimum value for the return value.

[MaxValue]

Data type: dnum

The maximum value for the return value.

[MaxTime]

Data type: num

The maximum amount of time in seconds that program execution waits. If the OK button is not pressed within this time, the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_MAXTIME can be used to test whether or not the maximum time has elapsed.

[DIBreak]

Digital Input Break

Data type: signal di

The digital input signal that may interrupt the operator dialog. If the OK button is not pressed before the signal is set to 1 (or is already 1) then the program continues

Continues on next page

to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\\DIPassive]

Digital Input Passive

Data type: switch

This switch overrides the default behavior when using DIBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DIBreak is set to 0 (or already is 0). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\\DOBreak]

Digital Output Break

Data type: signaldo

The digital output signal that may interrupt the operator dialog. If the OK button is not pressed before the signal is set to 1 (or is already 1) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\\DOPassive]

Digital Output Passive

Data type: switch

This switch overrides the default behavior when using DOBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DOBreak is set to 0 (or already is 0). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\\PersBoolBreak]

Persistent Boolean Break

Data type: bool

The persistent boolean that may interrupt the operator dialog. If no button is selected when the persistent boolean is set to TRUE (or is already TRUE) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\\PersBoolPassive]

Persistent Boolean Passive

Data type: switch

This switch overrides the default behavior when using PersBoolBreak optional argument. Instead of reacting when persistent boolean is set to TRUE (or already TRUE), the instruction should continue in the error handler (if no BreakFlag is used) when the persistent boolean PersBoolBreak is set to FALSE (or already is FALSE). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

Continues on next page

2 Functions

2.218 UIDnumTune - User Number Tune

RobotWare Base

Continued

[`\BreakFlag`]

Data type: `errnum`

A variable that will hold the error code if `MaxTime`, `DIBreak`, `DOBreak`, or `PersBoolBreak` is used. If this optional variable is omitted then the error handler will be executed. The constants `ERR_TP_MAXTIME`, `ERR_TP_DIBREAK`, `ERR_TP_DOBREAK`, and `ERR_TP_PERSBOOLBREAK` can be used to select the reason.

[`\UIActiveSignal`]

Data type: `signaldo`

The digital output signal used in optional argument `UIActiveSignal` is set to 1 when the message box is activated on the `FlexPendant`. When the user selection has been done and the execution continue, the signal is set to 0 again.

No supervision of stop or restart exist. The signal is set to 0 when the function is ready, or when PP is moved.

Program execution

The numeric tune message box with tune +/- buttons is displayed according to the programmed arguments. Program execution waits until the user has tuned the numeric value and tapped OK or the message box is interrupted by a time-out or signal action. The input numeric value and interrupt reason are transferred back to the program.

New message box on trap level takes the focus from the message box on the basic level.

Predefined data

The following constants of the data type `icondata` are predefined in the system:

Value	Constant	Icon
0	<code>iconNone</code>	No icon
1	<code>iconInfo</code>	Information icon
2	<code>iconWarning</code>	Warning icon
3	<code>iconError</code>	Error icon
4	<code>iconQuestion</code>	Question icon

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_NO_ALIASIO_DEF</code>	The signal variable is a variable declared in <code>RAPID</code> and it has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
<code>ERR_TP_NO_CLIENT</code>	There is no client, for example, a <code>FlexPendant</code> , to take care of the instruction.
<code>ERR_UI_ICON</code>	The argument <code>Icon</code> of type <code>icondata</code> has a not allowed value.

Continues on next page

Name	Cause of error
ERR_UI_INITVALUE	The initial value (parameter \InitValue) is not specified within the range of the minimum and maximum value (parameters \MinValue and \MaxValue).
ERR_UI_MAXMIN	The minimum value (parameter \MinValue) is greater than the maximum value (parameter \MaxValue).

If parameter \BreakFlag is not used then these situations can be dealt with by the error handler:

- If there is a timeout (parameter \MaxTime) before an input from the operator, the system variable ERRNO is set to ERR_TP_MAXTIME and the execution continues in the error handler.
- If a digital input is set (parameter \DIBreak) before an input from the operator, the system variable ERRNO is set to ERR_TP_DIBREAK and the execution continues in the error handler.
- If a digital output is set (parameter \DOBreak) before an input from the operator, the system variable ERRNO is set to ERR_TP_DOBREAK and the execution continues in the error handler.
- If a persistent boolean is set (parameter \PersBoolBreak) before an input from the operator then the system variable ERRNO is set to ERR_TP_PERSBOOLBREAK and the execution continues in the error handler.

More examples

The following example illustrates the function UIDnumTune.

Example 1

```

VAR errnum err_var;
VAR dnum tune_answer;
VAR dnum distance;
...
tune_answer := UIDnumTune (\Header:=" BWD move on path"
  \Message:="Enter the path overlap?" \Icon:=iconInfo,
  5, 1 \MinValue:=0 \MaxValue:=10
  \MaxTime:=60 \DIBreak:=di5 \BreakFlag:=err_var);
TEST err_var
CASE ERR_TP_MAXTIME:
CASE ERR_TP_DIBREAK:
  ! No operator answer
  distance := 5;
CASE 0:
  ! Operator answer
  distance := tune_answer;
DEFAULT:
  ! No such case defined
ENDTEST

```

The tune message box is displayed and the operator can tune the numeric value and press OK. The message box can also be interrupted with timeout or break by digital input signal. In the program, it is possible to find out the reason and take the appropriate action.

Continues on next page

2 Functions

2.218 UIDnumTune - User Number Tune

RobotWare Base

Continued

Limitations

Avoid using too small a value for the timeout parameter \MaxTime when UIDnumTune is frequently executed, for example, in a loop. It can result in unpredictable behavior from the system performance, like a slow response of the FlexPendant.

Syntax

```
UIDnumTune '('  
  ['\ ' Header ':' <expression (IN) of string>]  
  ['\ ' Message ':' <expression (IN) of string> ]  
  | ['\ ' MsgArray ':' <array {*} (IN) of string>]  
  ['\ ' Wrap]  
  ['\ ' Icon ':' <expression (IN) of icondata>]]  
  ['\ ' Image ':' <expression (IN) of string>]  
  [InitValue ':' ] <expression (IN) of dnum> ', '  
  [Increment ':' ] <expression (IN) of dnum>  
  ['\ ' MinValue ':' <expression (IN) of dnum>]  
  ['\ ' MaxValue ':' <expression (IN) of dnum>]  
  ['\ ' MaxTime ':' <expression (IN) of num>]  
  ['\ ' DIBreak ':' <variable (VAR) of signaldi>]  
  ['\ ' DIPassive]  
  ['\ ' DOBreak ':' <variable (VAR) of signaldo>]  
  ['\ ' DOPassive]  
  ['\ ' PersBoolBreak ':' <persistent (PERS) of bool>]  
  ['\ ' PersBoolPassive]  
  ['\ ' BreakFlag ':' <variable or persistent (INOUT) of errnum>]  
  ['\ ' UIActiveSignal ':' <variable (VAR) of signaldo>] ')'
```

A function with return value of the data type dnum.

Related information

For information about	See
Icon display data	icondata - Icon display data on page 1652
User interaction message box type basic	UIMsgBox - User Message Dialog Box type basic on page 964
User interaction message box type advanced	UIMessageBox - User Message Box type advanced on page 1556
User interaction number entry	UIDnumEntry - User Number Entry on page 1532
User interaction number entry	UINumEntry - User Number Entry on page 1565
User interaction number tune	UINumTune - User Number Tune on page 1573
User interaction alpha entry	UIAlphaEntry - User Alpha Entry on page 1524
User interaction list view	UIListView - User List View on page 1547
System connected to FlexPendant etc.	UIClientExist - Exist User Client on page 1531
Clean up the operator window	TPErase - Erases text printed on the Flex-Pendant on page 832

2.219 UICollection - User List View

Usage

UICollection (*User Interaction List View*) is used to define menu lists with text and optional icons on the available User Device such as the FlexPendant. The menu has two different styles, one with validation buttons and one that reacts instantly to the user selection.

Basic examples

The following example illustrates the function UICollection.

See also [More examples on page 1553](#).

Example 1

```
CONST listitem list{3} := [ ["", "Item 1"], ["", "Item 2"],
                             ["", "Item3"] ];
VAR num list_item;
VAR btnres button_answer;
...
list_item := UICollection (
    \Result:=button_answer
    \Header:="UICollection Header",
    list
    \Buttons:=btnOKCancel
    \Icon:=iconInfo
    \DefaultIndex:=1);
IF button_answer = resOK THEN
    IF list_item = 1 THEN
        ! Do item1
    ELSEIF list_item = 2 THEN
        ! Do item 2
    ELSE
        ! Do item3
    ENDIF
ELSE
    ! User has select Cancel
ENDIF
```

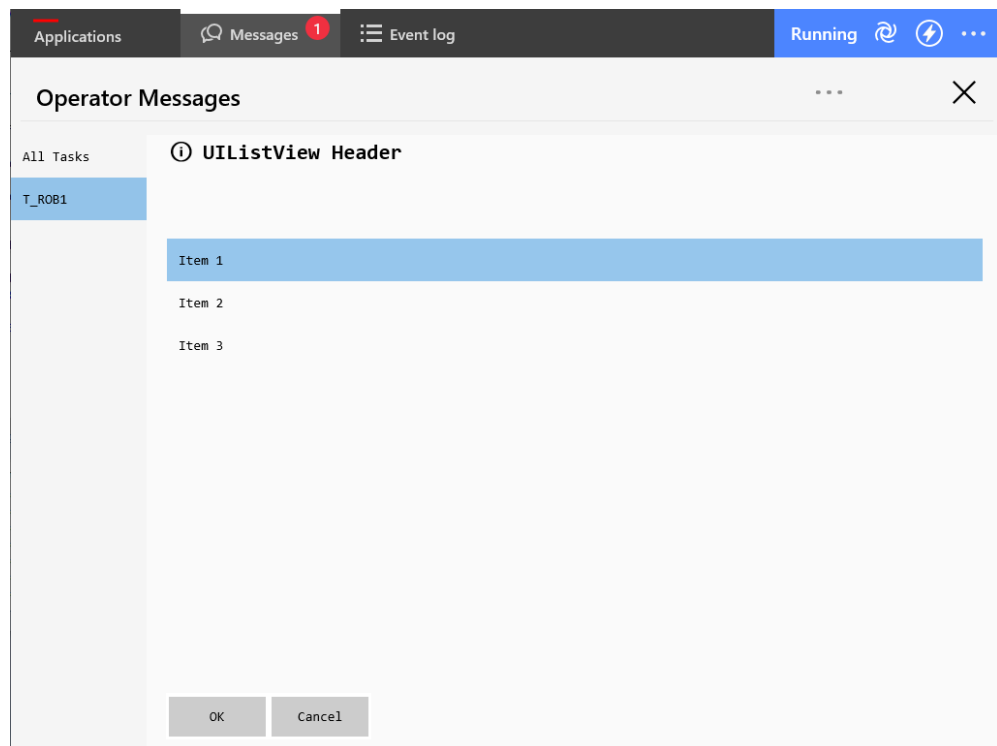
Continues on next page

2 Functions

2.219 UIAlertView - User List View

RobotWare Base

Continued



xx1900002217

The menu list with icon, header, menu Item 1 ... Item 3, and buttons is shown on the FlexPendant. Program execution waits until OK or Cancel is pressed. Both the selection in the list and the pressed button are transferred to the program.

Return value

Data type: num

This function returns the user selection in the list menu corresponding to the index in the array specified in the parameter `ListItems`.

If the function breaks via `\BreakFlag`:

- If parameter `\DefaultIndex` is specified, this index is returned
- If parameter `\DefaultIndex` is not specified, 0 is returned

If function breaks via ERROR handler, no return value is returned at all.

Arguments

```
UIAlertView ( [\Result] [\Header] ListItems [\Buttons] | [\BtnArray]  
              [\Icon] [\DefaultIndex] [\MaxTime] [\DIBreak] [\DIPassive]  
              [\DOBreak] [\DOPassive] [\PersBoolBreak] [\PersBoolPassive]  
              [\BreakFlag] [\UIActiveSignal])
```

`[\Result]`

Data type: btnres

The numeric value of the button that is selected from the list menu box.

If argument `\Buttons` is used, the predefined symbolic constants of type `btnres` is returned. If argument `\BtnArray` is used, the corresponding array index is returned.

Continues on next page

Argument \Result set to resUnkwn equal to 0 if one of following condition:

- none of parameters \Buttons or \BtnArray are used
- argument \Buttons:=btnNone is used
- if the function breaks via \BreakFlag or ERROR handler

See [Predefined data on page 1552](#).

[Header]

Data type: string

Header text to be written at the top of the list menu box. Max. 40 characters.

ListItems

Data type: listitem

An array with one or several list menu items to be displayed consisting of:

Component image of type string:

The name of the icon image that should be used. To launch own images, the images has to be placed in the HOME: directory in the active system or directly in the active system.

The recommendation is to place the files in the HOME: directory so that they are saved if a Backup and Restore is done.

A Restart is required and then the FlexPendant loads the images.

The image that will be shown can have the width and height of 28 pixels. If the image is bigger, then it will be resized to show only 28 * 28 pixels.

No exact value can be specified on the size that an image can have or the amount of images that can be loaded to the FlexPendant. It depends on the size of other files loaded to the FlexPendant. The program execution will just continue if an image is used that has not been loaded to the FlexPendant.

Use empty string "" or stEmpty if no icon to display.

Component text of type string:

- The text for the menu line to display.
- Max. 75 characters for each list menu item.

[Buttons]

Data type: buttondata

Defines the push buttons to be displayed. Only one of the predefined buttons combination of type buttondata can be used. See [Predefined data on page 1552](#).

[BtnArray]

Button Array

Data type: string

Own definition of push buttons stored in an array of strings. This function returns the array index when corresponding string is selected.

Only one of parameter \Buttons or \BtnArray can be used at the same time.

If none of the parameters \Buttons or \BtnArray or argument \Buttons:=btnNone are used then the menu list reacts instantly to the user selection.

Continues on next page

2 Functions

2.219 UListView - User List View

RobotWare Base

Continued

Max. 5 buttons with 42 characters each.

[Icon]

Data type: `icondata`

Defines the icon to be displayed. Only one of the predefined icons of type `icondata` can be used.

Default no icon. See [Predefined data on page 1552](#).

[DefaultIndex]

Data type: `num`

The default user selection in the list menu corresponding to the index in the array specified in the parameter `ListItems`.

[MaxTime]

Data type: `num`

The maximum amount of time in seconds that program execution waits. If no button is pressed or no selection is done within this time then the program continues to execute in the error handler unless the `BreakFlag` is used (see below). The constant `ERR_TP_MAXTIME` can be used to test whether or not the maximum time has elapsed.

[DIBreak]

Digital Input Break

Data type: `signal di`

The digital input signal that may interrupt the operator dialog. If no button is pressed or no selection is done before the signal is set to 1 (or is already 1) then the program continues to execute in the error handler, unless the `BreakFlag` is used (see below). The constant `ERR_TP_DIBREAK` can be used to test whether or not this has occurred.

[DIPassive]

Digital Input Passive

Data type: `switch`

This switch overrides the default behavior when using `DIBreak` optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no `BreakFlag` is used) when the signal `DIBreak` is set to 0 (or already is 0). The constant `ERR_TP_DIBREAK` can be used to test whether or not this has occurred.

[DOBreak]()

Digital Output Break

Data type: `signal do`

The digital output signal that may interrupt the operator dialog. If no button is pressed or no selection is done before the signal is set to 1 (or is already 1) then the program continues to execute in the error handler, unless the `BreakFlag` is used (see below). The constant `ERR_TP_DOBREAK` can be used to test whether or not this has occurred.

Continues on next page

[\\DOPassive]

Digital Output Passive

Data type: switch

This switch overrides the default behavior when using DOBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DOBreak is set to 0 (or already is 0). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\\PersBoolBreak]

Persistent Boolean Break

Data type: bool

The persistent boolean that may interrupt the operator dialog. If no button is selected when the persistent boolean is set to TRUE (or is already TRUE) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\\PersBoolPassive]

Persistent Boolean Passive

Data type: switch

This switch overrides the default behavior when using PersBoolBreak optional argument. Instead of reacting when persistent boolean is set to TRUE (or already TRUE), the instruction should continue in the error handler (if no BreakFlag is used) when the persistent boolean PersBoolBreak is set to FALSE (or already is FALSE). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\\BreakFlag]

Data type: errnum

A variable that will hold the error code if MaxTime, DIBreak, DOBreak, or PersBoolBreak is used. If this optional variable is omitted then the error handler will be executed. The constants ERR_TP_MAXTIME, ERR_TP_DIBREAK, ERR_TP_DOBREAK, and ERR_TP_PERSBOOLBREAK can be used to select the reason.

[\\UIActiveSignal]

Data type: signaldo

The digital output signal used in optional argument UIActiveSignal is set to 1 when the message box is activated on the FlexPendant. When the user selection has been done and the execution continue, the signal is set to 0 again.

No supervision of stop or restart exist. The signal is set to 0 when the function is ready, or when PP is moved.

Program execution

The menu list with icon, header, list items, and default item are displayed according to the programmed arguments. Program execution waits until the operator has

Continues on next page

2 Functions

2.219 UICollection - User List View

RobotWare Base

Continued

done the selection or the menu list is interrupted by time-out or signal action. The selected list item and interrupt reason are transferred back to the program.

New menu list on trap level takes focus from menu list on basic level.

Predefined data

icondata

The following constants of the data type icondata are predefined in the system:

Value	Constant	Icon
0	iconNone	No icon
1	iconInfo	Information icon
2	iconWarning	Warning icon
3	iconError	Error icon
4	iconQuestion	Question icon

buttondata

The following constants of the data type buttondata are predefined in the system.

Value	Constants	Button displayed
-1	btnNone	No button
0	btnOK	OK
1	btnAbtrRtryIgn	Abort, Retry and Ignore
2	btnOKCancel	OK and Cancel
3	btnRetryCancel	Retry and Cancel
4	btnYesNo	Yes and No
5	btnYesNoCancel	Yes, No and Cancel

It is possible to display user defined push buttons with the functions `UIMessageBox` and `UICollection`.



Note

The texts displayed using buttondata are automatically localized to the selected language for the user interface. Other strings are not automatically localized.

btnres

The following constants of the data type btnres are predefined in the system.

Value	Constants	Button answer
0	resUnkwn	Unknown result
1	resOK	OK
2	resAbort	Abort
3	resRetry	Retry
4	resIgnore	Ignore
5	resCancel	Cancel

Continues on next page

Value	Constants	Button answer
6	resYes	Yes
7	resNo	No

It is possible to work with user defined push buttons that answer with the functions `UIAlertView` and `UIAlertView`.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_NO_ALIASIO_DEF</code>	The signal variable is a variable declared in RAPID and it has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
<code>ERR_TP_NO_CLIENT</code>	There is no client, for example, a <code>FlexPendant</code> , to take care of the instruction.
<code>ERR_UI_BUTTONS</code>	The argument <code>Buttons</code> of type <code>buttondata</code> has a not allowed value.
<code>ERR_UI_ICON</code>	The argument <code>Icon</code> of type <code>icondata</code> has a not allowed value.

If parameter `\BreakFlag` is not used, these situations can then be dealt with by the error handler:

- If there is a time-out (parameter `\MaxTime`) before an input from the operator, the system variable `ERRNO` is set to `ERR_TP_MAXTIME` and the execution continues in the error handler.
- If digital input is set (parameter `\DIBreak`) before an input from the operator, the system variable `ERRNO` is set to `ERR_TP_DIBREAK` and the execution continues in the error handler.
- If a digital output is set (parameter `\DOBreak`) before an input from the operator, the system variable `ERRNO` is set to `ERR_TP_DOBREAK` and the execution continues in the error handler.
- If a persistent boolean is set (parameter `\PersBoolBreak`) before an input from the operator then the system variable `ERRNO` is set to `ERR_TP_PERSBOOLBREAK` and the execution continues in the error handler.

More examples

The following example illustrates the function `UIAlertView`.

Example 1

```

CONST listitem list{2} := [ ["", "Calibrate tool1"], ["", "Calibrate
                           tool2"] ];
VAR num list_item;
VAR errnum err_var;
...
list_item := UIAlertView
( \Header:="Select tool ?",
  list \Icon:=iconInfo

```

Continues on next page

2 Functions

2.219 UICollection - User List View

RobotWare Base

Continued

```
\MaxTime:=60
\DIBreak:=di5
\BreakFlag:=err_var);
TEST err_var
CASE ERR_TP_MAXTIME:
CASE ERR_TP_DIBREAK:
    ! No operator answer
CASE 0:
    ! Operator answer
    IF list_item =1 THEN
        ! Calibrate tool1
    ELSEIF list_item=2 THEN
        ! Calibrate tool2
    ENDIF
DEFAULT:
    ! Not such case defined
ENDTEST
```

The message box is displayed and the operator can select an item in the list. The message box can also be interrupted with time out or break by digital input signal. In the program it's possible to find out the reason and take the appropriate action.

Limitations

Avoid using too small a value for the time-out parameter \MaxTime when UICollection is frequently executed, for example in a loop. It can result in unpredictable behavior from the system performance, like slow response of the FlexPendant.

Syntax

```
UICollection '('
    [['\ Result ']:= <variable or persistent (INOUT) of btnres>]
    [['\ Header ']:= <expression (IN) of string>] ', '
    [ListItems '='] <array {*} (IN) of listitem>
    [['\ Buttons ']:= <expression (IN) of buttondata>]
    | [['\ BtnArray ']:= <array {*} (IN) of string>]
    [['\ Icon ']:= <expression (IN) of icondata>]
    [['\ DefaultIndex ']:= <expression (IN) of num>]
    [['\ MaxTime ']:= <expression (IN) of num>]
    [['\ DIBreak ']:= <variable (VAR) of signaldi>]
    [['\ DIPassive]
    [['\ DOBreak ']:= <variable (VAR) of signaldo>]
    [['\ DOPassive]
    [['\ PersBoolBreak ']:= <persistent (PERS) of bool>]
    [['\ PersBoolPassive]
    [['\ BreakFlag ']:= <variable or persistent (INOUT) of errnum>]
    [['\ UIActiveSignal ']:= <variable (VAR) of signaldo>] ')'

```

A function with return value of the data type num.

Continues on next page

Related information

For information about	See
Icon display data	icondata - Icon display data on page 1652
Push button data	buttondata - Push button data on page 1595
Push button result data	btnres - Push button result data on page 1593
List item data structure	listitem - List item data structure on page 1663
User interaction message box type basic	UIMsgBox - User Message Dialog Box type basic on page 964
User interaction message box type advanced	UIMessageBox - User Message Box type advanced on page 1556
User interaction number entry	UINumEntry - User Number Entry on page 1565
User interaction number tune	UINumTune - User Number Tune on page 1573
User interaction alpha entry	UIAlphaEntry - User Alpha Entry on page 1524
System connected to FlexPendant etc.	UIClientExist - Exist User Client on page 1531
Clean up the operator window	TPErase - Erases text printed on the FlexPendant on page 832

2 Functions

2.220 UIAlertView - User Message Box type advanced *RobotWare Base*

2.220 UIAlertView - User Message Box type advanced

Usage

UIAlertView (*User Interaction Message Box*) is used to communicate with the user of the robot system on available user device, such as the FlexPendant. A message is written to the operator, who answers by selecting a button. The user selection is then transferred back to the program.

Basic examples

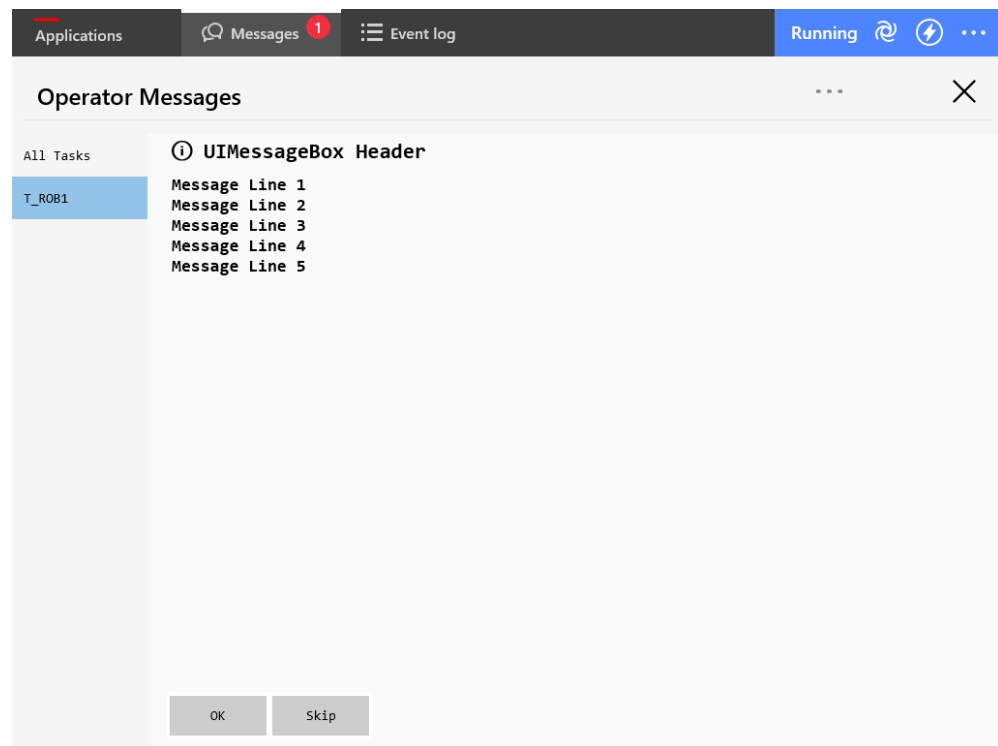
The following example illustrates the function UIAlertView.

See also [More examples on page 1563](#).

Example 1

```
VAR btnres answer;
CONST string my_message{5}:= ["Message Line 1","Message Line 2",
    "Message Line 3","Message Line 4","Message Line 5"];
CONST string my_buttons{2}:=["OK","Skip"];
...
answer:= UIAlertView (
    \Header:="UIAlertView Header"
    \MsgArray:=my_message
    \BtnArray:=my_buttons
    \Icon:=iconInfo);
IF answer = 1 THEN
    ! Operator selection OK
ELSEIF answer = 2 THEN
    ! Operator selection Skip
ELSE
    ! No such case defined
ENDIF
```

Continues on next page



xx1900002220

The message box is with icon, header, message, and user defined push buttons are shown on the FlexPendant. Program execution waits until OK or Skip is pressed. In other words, answer will be assigned 1 (OK) or 2 (Skip) depending on which of the buttons is pressed (corresponding array index).

**Note**

Message Line 1 to Message Line 5 are displayed on separate lines 1 to 5 (the switch \Wrap is not used).

Example 2

```
VAR btnres answer;
...
answer := UIMessageBox (\Header:= "Critical Error"
\Message:="Move the program pointer to continue."
\Buttons:=btnNone);
```

This example will result in a dialog that will stay open until the operator moves the program pointer.

Return value

Data type: btnres

The numeric value of the button that is selected from the message box.

If argument \Buttons is used, the predefined symbolic constants of type btnres is returned.

If argument \BtnArray is used, the corresponding array index is returned.

Continues on next page

2 Functions

2.220 UIMessageBox - User Message Box type advanced

RobotWare Base

Continued

If function breaks via \BreakFlag or if \Buttons:=btnNone:

- If parameter \DefaultBtn is specified, this index is returned.
- If parameter \DefaultBtn is not specified, resUnkwn equal to 0 is returned.

If function breaks via ERROR handler, there is no return value at all.

Arguments

```
UIMessageBox ( [\Header] [\Message] | [\MsgArray] [\Wrap][\Buttons]  
| [\BtnArray] [\DefaultBtn] [\Icon][\Image] [\MaxTime]  
[\DIBreak] [\DIPassive] [\DOBreak] [\DOPassive]  
[\PersBoolBreak] [\PersBoolPassive] [\BreakFlag]  
[\UIActiveSignal])
```

[\Header]

Data type: string

Header text to be written at the top of the message box. Max. 40 characters.

[\Message]

Data type: string

One text line to be written on the display. Max 55 characters.

[\MsgArray]

Message Array

Data type: string

Several text lines from an array to be written on the display.

Only one of parameters \Message or \MsgArray can be used at the same time.

Max. layout space is 55 characters.

[\Wrap]

Data type: switch

If selected, all the specified strings in the argument \MsgArray will be concatenated to one string with single spaces between each individual string and spread out on as few lines as possible.

Default, each string in the argument \MsgArray will be on separate line on the display.

[\Buttons]

Data type: buttondata

Defines the push buttons to be displayed. Only one of the predefined buttons combination of type buttondata can be used. See [Predefined data on page 1561](#).

Default, the system displays the OK button.

[\BtnArray]

Button Array

Data type: string

Own definition of push buttons stored in an array of strings. This function returns the array index when corresponding string is selected.

Only one of parameter \Buttons or \BtnArray can be used at the same time.

Continues on next page

Max. 5 buttons with 42 characters each.

[\DefaultBtn]

Default Button

Data type: btnres

Allows to specify a value that should be returned if the message box is interrupted by \MaxTime, \DIBreak, or \D0Break. It is possible to specify the predefined symbolic constant of type btnres or any user defined value. See [Predefined data on page 1561](#).

[\Icon]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 1561](#).

Default, no icon.

[\Image]

Data type: string

The name or full path to the image that should be used. If only a filename is provided, the FlexPendant will look for it in the HOME: directory. The path must follow this format: HOME:/subfolder1/image.png

No restart is required when a new or updated image is added. If an existing image is replaced by a new image with the same filename, then the user needs to log out and log in.

The files are included in backup and restore. If the files are placed directly in the active system, they are not included in backup and restore.

The image can have the width of 250 pixels and the height of 470 pixels. If the image is bigger, only 250x470 pixels of the image are shown, starting at the top left of the image.

The program execution will just continue if an image is used that has not been found in the specified path.

Supported image formats: jpg, png, jpeg, bmp

If other formats are used, it may or may not work.

[\MaxTime]

Data type: num

The maximum amount of time in seconds that program execution waits. If no button is selected within this time, the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_MAXTIME can be used to test whether or not the maximum time has elapsed.

[\DIBreak]

Digital Input Break

Data type: signaldi

The digital input signal that may interrupt the operator dialog. If no button is selected when the signal is set to 1 (or is already 1) then the program continues to execute

Continues on next page

2 Functions

2.220 UIMessageBox - User Message Box type advanced

RobotWare Base

Continued

in the error handler, unless the BreakFlag is used (see below). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\DIPassive]

Digital Input Passive

Data type: switch

This switch overrides the default behavior when using DIBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DIBreak is set to 0 (or already is 0). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\DOBreak]

Digital Output Break

Data type: signaldo

The digital output signal that may interrupt the operator dialog. If no button is selected when the signal is set to 1 (or is already 1) then the program continues to execute in the error handler, unless the BreakFlag is used (see below). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\DOPassive]

Digital Output Passive

Data type: switch

This switch overrides the default behavior when using DOBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DOBreak is set to 0 (or already is 0). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\PersBoolBreak]

Persistent Boolean Break

Data type: bool

The persistent boolean that may interrupt the operator dialog. If no button is selected when the persistent boolean is set to TRUE (or is already TRUE) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\PersBoolPassive]

Persistent Boolean Passive

Data type: switch

This switch overrides the default behavior when using PersBoolBreak optional argument. Instead of reacting when persistent boolean is set to TRUE (or already TRUE), the instruction should continue in the error handler (if no BreakFlag is used) when the persistent boolean PersBoolBreak is set to FALSE (or already is FALSE). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

Continues on next page

[\BreakFlag]

Data type: errnum

A variable that will hold the error code if MaxTime, DIBreak, DOBreak, or PersBoolBreak is used. If this optional variable is omitted then the error handler will be executed. The constants ERR_TP_MAXTIME, ERR_TP_DIBREAK, ERR_TP_DOBREAK, and ERR_TP_PERSBOOLBREAK can be used to select the reason.

[\UIActiveSignal]

Data type: signaldo

The digital output signal used in optional argument UIActiveSignal is set to 1 when the message box is activated on the FlexPendant. When the user selection has been done and the execution continue, the signal is set to 0 again.

No supervision of stop or restart exist. The signal is set to 0 when the function is ready, or when PP is moved.

Program execution

The message box with icon, header, message lines, image, and buttons are displayed according to the programmed arguments. Program execution waits until the user selects one button or the message box is interrupted by time-out or signal action. The user selection and interrupt reason are transferred back to the program.

New message box on trap level takes the focus from the message box on the basic level.

Predefined data

icondata

The following constants of the data type icondata are predefined in the system:

Value	Constant	Icon
0	iconNone	No icon
1	iconInfo	Information icon
2	iconWarning	Warning icon
3	iconError	Error icon
4	iconQuestion	Question icon

buttondata

The following constants of the data type buttondata are predefined in the system.

Value	Constants	Button displayed
-1	btnNone	No button
0	btnOK	OK
1	btnAbtrRtryIgn	Abort, Retry and Ignore
2	btnOKCancel	OK and Cancel
3	btnRetryCancel	Retry and Cancel
4	btnYesNo	Yes and No

Continues on next page

2 Functions

2.220 UIAlertView - User Message Box type advanced

RobotWare Base

Continued

Value	Constants	Button displayed
5	btnYesNoCancel	Yes, No and Cancel

It is possible to display user defined push buttons with the functions UIAlertView and UITableView.



Note

The texts displayed using `buttondata` are automatically localized to the selected language for the user interface. Other strings are not automatically localized.

btnres

The following constants of the data type `btnres` are predefined in the system.

Value	Constants	Button answer
0	resUnkwn	Unknown result
1	resOK	OK
2	resAbort	Abort
3	resRetry	Retry
4	resIgnore	Ignore
5	resCancel	Cancel
6	resYes	Yes
7	resNo	No

It is possible to work with user defined push buttons that answer with the functions UIAlertView and UITableView.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID and it has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
ERR_TP_NO_CLIENT	There is no client, for example, a FlexPendant, to take care of the instruction.
ERR_UI_BUTTONS	The argument <code>Buttons</code> of type <code>buttondata</code> has a not allowed value.
ERR_UI_ICON	The argument <code>Icon</code> of type <code>icondata</code> has a not allowed value.

If parameter `\BreakFlag` is not used, these situations can then be dealt with by the error handler:

- If there is a time-out (parameter `\MaxTime`) before an input from the operator, the system variable `ERRNO` is set to `ERR_TP_MAXTIME` and the execution continues in the error handler.

Continues on next page

- If digital input is set (parameter \DIBreak) before an input from the operator, the system variable ERRNO is set to ERR_TP_DIBREAK and the execution continues in the error handler.
- If a digital output is set (parameter \DOBreak) before an input from the operator, the system variable ERRNO is set to ERR_TP_DOBREAK and the execution continues in the error handler.
- If a persistent boolean is set (parameter \PersBoolBreak) before an input from the operator then the system variable ERRNO is set to ERR_TP_PERSBOOLBREAK and the execution continues in the error handler.

More examples

The following example illustrates the function UIMessageBox.

Example 1

```

VAR errnum err_var;
VAR btnres answer;
...
answer := UIMessageBox (\Header:= "Cycle step 3"
    \Message:= "Continue with the calibration ?" \Buttons:= btnOKCancel
    \DefaultBtn:= resCancel \Icon:= iconInfo \MaxTime:= 60 \DIBreak:= di5
    \BreakFlag:= err_var);
IF answer = resOK THEN
    ! OK from the operator
ELSE
    ! Cancel from the operator or operation break
    TEST err_var
        CASE ERR_TP_MAXTIME:
            ! Time out
        CASE ERR_TP_DIBREAK:
            ! Input signal break
        DEFAULT:
            ! Not such case defined
    ENDTEST
ENDIF

```

The message box is displayed, and the operator can answer OK or Cancel. The message box can also be interrupted with time out or break by digital input signal. In the program it's possible to find out the reason.

Limitations

Avoid using too small a value for the time-out parameter \MaxTime when UIMessageBox is frequently executed, for example in a loop. It can result in an unpredictable behavior of the system performance, like slow response of the FlexPendant.

Syntax

```

UIMessageBox '('
    ['\' Header ' := ' <expression (IN) of string> ' ,']
    ['\' Message ' := ' <expression (IN) of string> '
    | ['\' MsgArray ' := ' <array {*} (IN) of string> '

```

Continues on next page

2 Functions

2.220 UIMessageBox - User Message Box type advanced

RobotWare Base

Continued

```
['\ ' Wrap]
['\ ' Buttons ':=' <expression (IN) of buttondata>]
| ['\ ' BtnArray ':=' <array {*} (IN) of string>]
['\ ' DefaultBtn ':=' <expression (IN) of btnres>]
['\ ' Icon ':=' <expression (IN) of icondata>]
['\ ' Image ':=' <expression (IN) of string>]
['\ ' MaxTime ':=' <expression (IN) of num>]
['\ ' DIBreak ':=' <variable (VAR) of signaldi>]
['\ ' DIPassive]
['\ ' DOBreak ':=' <variable (VAR) of signaldo>]
['\ ' DOPassive]
['\ ' PersBoolBreak ':=' <persistent (PERS) of bool>]
['\ ' PersBoolPassive]
['\ ' BreakFlag ':=' <variable or persistent (INOUT) of errnum>]
['\ ' UIActiveSignal ':=' <variable (VAR) of signaldo>] ' )'
```

A function with return value of the data type btnres.

Related information

For information about	See
Icon display data	icondata - Icon display data on page 1652
Push button data	buttondata - Push button data on page 1595
Push button result data	btnres - Push button result data on page 1593
User interaction message box type basic	UIMsgBox - User Message Dialog Box type basic on page 964
User interaction number entry	UINumEntry - User Number Entry on page 1565
User interaction number tune	UINumTune - User Number Tune on page 1573
User interaction alpha entry	UIAlphaEntry - User Alpha Entry on page 1524
User interaction list view	UIListView - User List View on page 1547
System connected to FlexPendant etc.	UIClientExist - Exist User Client on page 1531
Clean up the operator window	TPErase - Erases text printed on the FlexPendant on page 832

2.221 UINumEntry - User Number Entry

Usage

UINumEntry (*User Interaction Number Entry*) is used to let the operator enter a numeric value from the available user device, such as the FlexPendant. A message is written to the operator, who answers with a numeric value. The numeric value is then checked, approved and transferred back to the program.

Basic examples

The following example illustrates the function UINumEntry.

See also [More examples on page 1571](#).

Example 1

```
VAR num answer;  
...  
answer := UINumEntry(  
  \Header:="UINumEntry Header"  
  \Message:="How many units should be produced?"  
  \Icon:=iconInfo  
  \InitValue:=5  
  \MinValue:=1  
  \MaxValue:=10  
  \AsInteger);  
FOR i FROM 1 TO answer DO  
  produce_part;  
ENDFOR
```

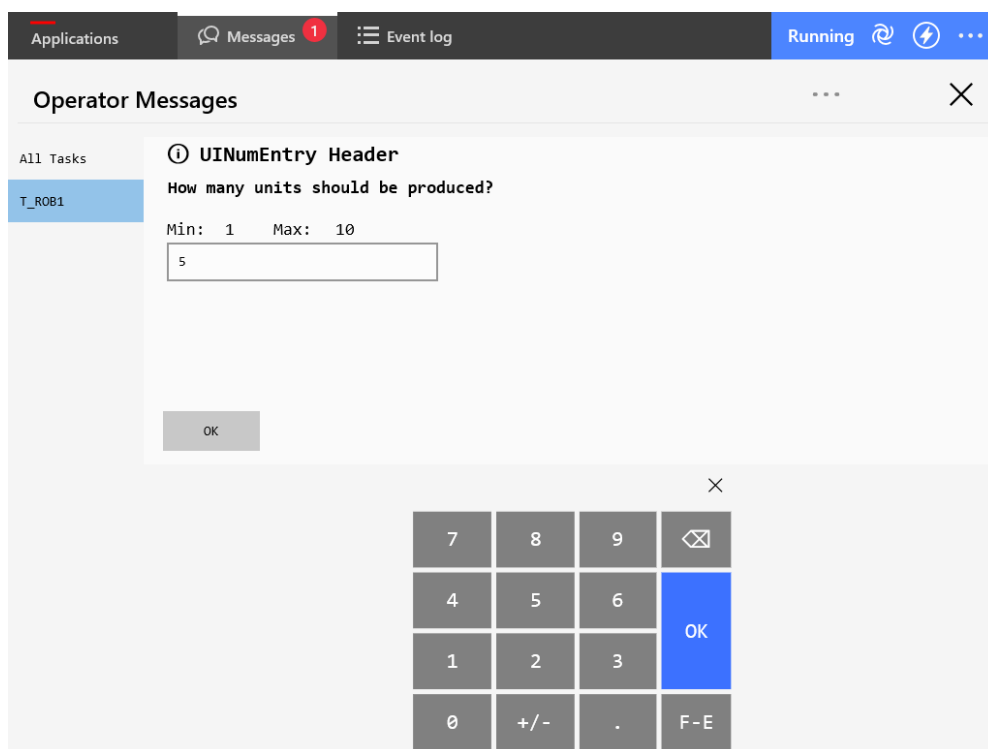
Continues on next page

2 Functions

2.221 UINumEntry - User Number Entry

RobotWare Base

Continued



xx1900002215

The numeric message box with icon, header, message, initial, maximum, and minimum values are shown on the FlexPendant. The message box checks that the operator selects an integer within the value range. Program execution waits until OK is pressed and then the selected numerical value is returned. The routine produce_part is then repeated the number of input times via the FlexPendant.

Return value

Data type: num

This function returns the input numeric value.

If function breaks via \BreakFlag:

- If parameter \InitValue is specified, this value is returned
- If parameter \InitValue is not specified, value 0 is returned.

If function breaks via ERROR handler, no return value at all.

Arguments

```
UINumEntry ( [\Header] [\Message] | [\MsgArray] [\Wrap] [\Icon]  
[\Image] [\InitValue] [\MinValue] [\MaxValue] [\AsInteger]  
[\MaxTime] [\DIBreak] [\DIPassive] [\DOBBreak] [\DOPassive]  
[\PersBoolBreak] [\PersBoolPassive] [\BreakFlag]  
[\UIActiveSignal])
```

[\Header]

Data type: string

Header text to be written at the top of the message box. Max. 40 characters.

Continues on next page

[\Message]

Data type: string

One text line to be written on the display. Max. 55 characters.

[\MsgArray]

Message Array

Data type: string

Several text lines from an array to be written on the display.

Only one of parameters \Message or \MsgArray can be used at the same time.

Max. layout space is 55 characters.

[\Wrap]

Data type: switch

If selected, all the specified strings in the argument \MsgArray will be concatenated to one string with a single space between each individual string, and spread out on as few lines as possible.

Default, each string in the argument \MsgArray will be on a separate line on the display.

[\Icon]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 1570](#).

Default no icon.

[\Image]

Data type: string

The name or full path to the image that should be used. If only a filename is provided, the FlexPendant will look for it in the HOME: directory. The path must follow this format: HOME:/subfolder1/image.png

No restart is required when a new or updated image is added. If an existing image is replaced by a new image with the same filename, then the user needs to log out and log in.

The files are included in backup and restore. If the files are placed directly in the active system, they are not included in backup and restore.

The image can have the width of 250 pixels and the height of 470 pixels. If the image is bigger, only 250x470 pixels of the image are shown, starting at the top left of the image.

The program execution will just continue if an image is used that has not been found in the specified path.

Supported image formats: jpg, png, jpeg, bmp

If other formats are used, it may or may not work.

[\InitValue]

Data type: num

Continues on next page

2 Functions

2.221 UINumEntry - User Number Entry

RobotWare Base

Continued

Initial value that is displayed in the entry box.

[\MinValue]

Data type: num

The minimum value for the return value.

[\MaxValue]

Data type: num

The maximum value for the return value.

[\AsInteger]

Data type: switch

This switch removes the decimal point from the number pad to ensure that the return value is an integer. When using this switch, the optional arguments InitValue, MinValue, and MaxValue needs to be between the values -8388607 and 8388608.

[\MaxTime]

Data type: num

The maximum amount of time in seconds that program execution waits. If the OK button is not pressed within this time, the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_MAXTIME can be used to test whether or not the maximum time has elapsed.

[\DIBreak]

Digital Input Break

Data type: signal di

The digital input signal that may interrupt the operator dialog. If the OK button is not pressed before the signal is set to 1 (or is already 1) then the program continues to execute in the error handler, unless the BreakFlag is used (see below). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\DIPassive]

Digital Input Passive

Data type: switch

This switch overrides the default behavior when using DIBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DIBreak is set to 0 (or already is 0). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\DOBreak]

Digital Output Break

Data type: signal do

The digital output signal that may interrupt the operator dialog. If the OK button is not pressed before the signal is set to 1 (or is already 1) then the program continues

Continues on next page

to execute in the error handler, unless the BreakFlag is used (see below). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\DOPassive]

Digital Output Passive

Data type: switch

This switch overrides the default behavior when using DOBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DOBreak is set to 0 (or already is 0). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\PersBoolBreak]

Persistent Boolean Break

Data type: bool

The persistent boolean that may interrupt the operator dialog. If no button is selected when the persistent boolean is set to TRUE (or is already TRUE) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\PersBoolPassive]

Persistent Boolean Passive

Data type: switch

This switch overrides the default behavior when using PersBoolBreak optional argument. Instead of reacting when persistent boolean is set to TRUE (or already TRUE), the instruction should continue in the error handler (if no BreakFlag is used) when the persistent boolean PersBoolBreak is set to FALSE (or already is FALSE). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\BreakFlag]

Data type: errnum

A variable that will hold the error code if MaxTime, DIBreak, DOBreak, or PersBoolBreak is used. If this optional variable is omitted then the error handler will be executed. The constants ERR_TP_MAXTIME, ERR_TP_DIBREAK, ERR_TP_DOBREAK, and ERR_TP_PERSBOOLBREAK can be used to select the reason.

[\UIActiveSignal]

Data type: signaldo

The digital output signal used in optional argument UIActiveSignal is set to 1 when the message box is activated on the FlexPendant. When the user selection has been done and the execution continue, the signal is set to 0 again.

No supervision of stop or restart exist. The signal is set to 0 when the function is ready, or when PP is moved.

Continues on next page

2 Functions

2.221 UINumEntry - User Number Entry

RobotWare Base

Continued

Program execution

The numeric message box is displayed according to the programmed arguments. Program execution waits until the user enters an approved numeric value and taps OK or the message box is interrupted by a time-out or signal action. The input numeric value and interrupt reason are transferred back to the program.

New message box on trap level takes the focus from the message box on the basic level.

Predefined data

The following constants of the data type `icondata` are predefined in the system:

Value	Constant	Icon
0	<code>iconNone</code>	No icon
1	<code>iconInfo</code>	Information icon
2	<code>iconWarning</code>	Warning icon
3	<code>iconError</code>	Error icon
4	<code>iconQuestion</code>	Question icon

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
<code>ERR_NO_ALIASIO_DEF</code>	The signal variable is a variable declared in RAPID and it has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
<code>ERR_TP_NO_CLIENT</code>	There is no client, for example, a FlexPendant, to take care of the instruction.
<code>ERR_UI_ICON</code>	The argument <code>Icon</code> of type <code>icondata</code> has a not allowed value.
<code>ERR_UI_INITVALUE</code>	The initial value (parameter <code>\InitValue</code>) is not specified within the range of the minimum and maximum value (parameters <code>\MinValue</code> and <code>\MaxValue</code>).
<code>ERR_UI_MAXMIN</code>	The minimum value (parameter <code>\MinValue</code>) is greater than the maximum value (parameter <code>\MaxValue</code>).
<code>ERR_UI_NOTINT</code>	The initial value (parameter <code>\InitValue</code>) is not an integer as specified in the parameter <code>\AsInteger</code> .

If parameter `\BreakFlag` is not used, these situations can then be dealt with by the error handler:

- If there is a time-out (parameter `\MaxTime`) before an input from the operator then the system variable `ERRNO` is set to `ERR_TP_MAXTIME` and the execution continues in the error handler.
- If digital input is set (parameter `\DIBreak`) before an input from the operator then the system variable `ERRNO` is set to `ERR_TP_DIBREAK` and the execution continues in the error handler.

Continues on next page

- If a digital output is set (parameter \DOBreak) before an input from the operator then the system variable ERRNO is set to ERR_TP_DOBREAK and the execution continues in the error handler.
- If a persistent boolean is set (parameter \PersBoolBreak) before an input from the operator then the system variable ERRNO is set to ERR_TP_PERSBOOLBREAK and the execution continues in the error handler.

More examples

The following example illustrates the function UINumEntry.

Example 1

```
VAR errnum err_var;
VAR num answer;
VAR num distance;
...
answer := UINumEntry (\Header:= "BWD move on path"
  \Message:="Enter the path overlap ?" \Icon:=iconInfo
  \InitValue:=5 \MinValue:=0 \MaxValue:=10
  \MaxTime:=60 \DIBreak:=di5 \BreakFlag:=err_var);
TEST err_var
CASE ERR_TP_MAXTIME:
CASE ERR_TP_DIBREAK:
  ! No operator answer distance := 5;
CASE 0
  ! Operator answer
  distance := answer;
DEFAULT:
  ! Not such case defined
ENDTEST
```

The message box is displayed and the operator can enter a numeric value and press OK. The message box can also be interrupted with a time out or break by digital input signal. In the program it's possible to find out the reason and take the appropriate action.

Limitations

Avoid using too small a value for the time-out parameter \MaxTime when UINumEntry is frequently executed, for example in a loop. It can result in unpredictable behavior from the system performance, like slow response of the FlexPendant.

Syntax

```
UINumEntry '('
  ['\ ' Header ':= ' <expression (IN) of string>]
  [Message ':= ' <expression (IN) of string> ]
  | ['\ ' MsgArray ':= ' <array {*} (IN) of string>]
  ['\ ' Wrap]
  ['\ ' Icon ':= ' <expression (IN) of icondata>]
  ['\ ' Image ':= ' <expression (IN) of string>]
  ['\ ' InitValue ':= ' <expression (IN) of dnum>]
```

Continues on next page

2 Functions

2.221 UINumEntry - User Number Entry

RobotWare Base

Continued

```
['\' MinValue ':=' <expression (IN) of dnum>]
['\' MaxValue ':=' <expression (IN) of dnum>]
['\' AsInteger]
['\' MaxTime ':=' <expression (IN) of num>]
['\' DIBreak ':=' <variable (VAR) of signaldi>]
['\' DIPassive]
['\' DOBreak ':=' <variable (VAR) of signaldo>]
['\' DOPassive]
['\' PersBoolBreak ':=' <persistent (PERS) of bool>]
['\' PersBoolPassive]
['\' BreakFlag ':=' <variable or persistent (INOUT) of errnum>]
['\' UIActiveSignal ':=' <variable (VAR) of signaldo>] ')
```

A function with return value of the data type num.

Related information

For information about	See
Icon display data	icondata - Icon display data on page 1652
User interaction message box type basic	UIMsgBox - User Message Dialog Box type basic on page 964
User interaction message box type advanced	UIMessageBox - User Message Box type advanced on page 1556
User interaction number tune	UINumTune - User Number Tune on page 1573
User interaction alpha entry	UIAlphaEntry - User Alpha Entry on page 1524
User interaction list view	UIListView - User List View on page 1547
System connected to FlexPendant etc.	UIClientExist - Exist User Client on page 1531
Clean up the operator window	TPErase - Erases text printed on the Flex-Pendant on page 832

2.222 UINumTune - User Number Tune

Usage

UINumTune (*User Interaction Number Tune*) is used to let the operator tune a numeric value from the available user device, such as the FlexPendant. A message is written to the operator, who tunes a numeric value. The tuned numeric value is then checked, approved and transferred back to the program.

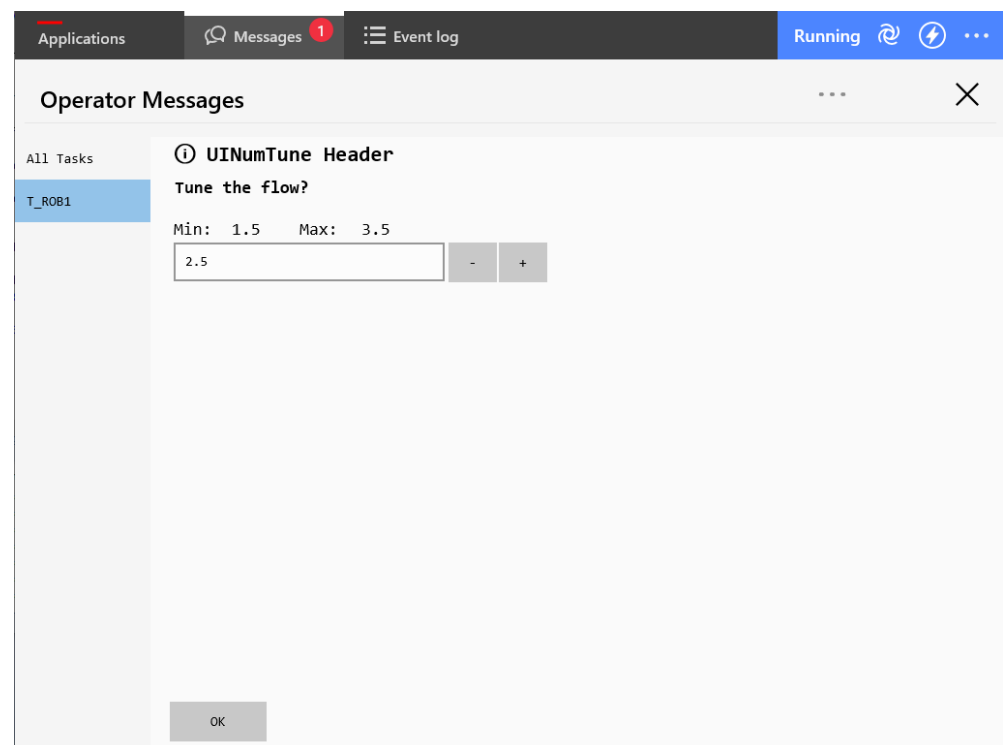
Basic examples

The following example illustrates the function UINumTune.

See also [More examples on page 1578](#).

Example 1

```
VAR num flow;
...
flow := UINumTune(
  \Header:="UINumTune Header"
  \Message:="Tune the flow?"
  \Icon:=iconInfo,
  2.5,
  0.1
  \MinValue:=1.5
  \MaxValue:=3.5);
```



xx1900002216

The numeric tune message box with icon, header, message, initial, increment, maximum, and minimum values are shown on the FlexPendant. The message box checks that the operator tunes the flow value with step 0.1 from the initial value

Continues on next page

2 Functions

2.222 UINumTune - User Number Tune

RobotWare Base

Continued

2.5, within the value range 1.5-3.5. Program execution waits until OK is pressed and then the selected numerical value is returned and stored in the variable flow.

Return value

Data type: num

This function returns the tuned numeric value.

If function breaks via \BreakFlag, the specified \InitValue is returned.

If function breaks via ERROR handler, no return value is returned at all.

Arguments

```
UINumTune ( [\Header] [\Message] | [\MsgArray] [\Wrap] [\Icon]
            [\Image] InitValue Increment [\MinValue] [\MaxValue]
            [\MaxTime] [\DIBreak] [\DIPassive] [\D0Break] [\D0Passive]
            [\PersBoolBreak] [\PersBoolPassive] [\BreakFlag]
            [\UIActiveSignal])
```

[\Header]

Data type: string

Header text to be written at the top of the message box. Max. 40 characters.

[\Message]

Data type: string

One text line to be written on the display. Max. 55 characters.

[\MsgArray]

Message Array

Data type: string

Several text lines from an array to be written on the display.

Only one of parameters \Message or \MsgArray can be used at the same time.

Max. layout space is 55 characters.

[\Wrap]

Data type: switch

If selected, all the specified strings in the argument \MsgArray will be concatenated to one string with a single space between each individual string, and spread out on as few lines as possible.

Default, each string in the argument \MsgArray will be on a separate line on the display.

[\Icon]

Data type: icondata

Defines the icon to be displayed. Only one of the predefined icons of type icondata can be used. See [Predefined data on page 1577](#).

Default no icon.

[\Image]

Data type: string

Continues on next page

The name or full path to the image that should be used. If only a filename is provided, the FlexPendant will look for it in the HOME: directory. The path must follow this format: HOME:/subfolder1/image.png

No restart is required when a new or updated image is added. If an existing image is replaced by a new image with the same filename, then the user needs to log out and log in.

The files are included in backup and restore. If the files are placed directly in the active system, they are not included in backup and restore.

The image can have the width of 250 pixels and the height of 470 pixels. If the image is bigger, only 250x470 pixels of the image are shown, starting at the top left of the image.

The program execution will just continue if an image is used that has not been found in the specified path.

Supported image formats: jpg, png, jpeg, bmp

If other formats are used, it may or may not work.

InitValue

Data type: num

Initial value that is displayed in the entry box.

Increment

Data type: num

This parameter specifies how much the value should change when the plus or minus button is pressed.

[MinValue]

Data type: num

The minimum value for the return value.

[MaxValue]

Data type: num

The maximum value for the return value.

[MaxTime]

Data type: num

The maximum amount of time in seconds that program execution waits. If the OK button is not pressed within this time, the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_MAXTIME can be used to test whether or not the maximum time has elapsed.

[DIBreak]

Digital Input Break

Data type: signal di

The digital input signal that may interrupt the operator dialog. If the OK button is not pressed before the signal is set to 1 (or is already 1) then the program continues

Continues on next page

2 Functions

2.222 UINumTune - User Number Tune

RobotWare Base

Continued

to execute in the error handler, unless the BreakFlag is used (see below). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\DIPassive]

Digital Input Passive

Data type: switch

This switch overrides the default behavior when using DIBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DIBreak is set to 0 (or already is 0). The constant ERR_TP_DIBREAK can be used to test whether or not this has occurred.

[\DOBreak]

Digital Output Break

Data type: signaldo

The digital output signal that may interrupt the operator dialog. If the OK button is not pressed before the signal is set to 1 (or is already 1) then the program continues to execute in the error handler, unless the BreakFlag is used (see below). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\DOPassive]

Digital Output Passive

Data type: switch

This switch overrides the default behavior when using DOBreak optional argument. Instead of reacting when signal is set to 1 (or already 1), the instruction should continue in the error handler (if no BreakFlag is used) when the signal DOBreak is set to 0 (or already is 0). The constant ERR_TP_DOBREAK can be used to test whether or not this has occurred.

[\PersBoolBreak]

Persistent Boolean Break

Data type: bool

The persistent boolean that may interrupt the operator dialog. If no button is selected when the persistent boolean is set to TRUE (or is already TRUE) then the program continues to execute in the error handler unless the BreakFlag is used (see below). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

[\PersBoolPassive]

Persistent Boolean Passive

Data type: switch

This switch overrides the default behavior when using PersBoolBreak optional argument. Instead of reacting when persistent boolean is set to TRUE (or already TRUE), the instruction should continue in the error handler (if no BreakFlag is used) when the persistent boolean PersBoolBreak is set to FALSE (or already is FALSE). The constant ERR_TP_PERSBOOLBREAK can be used to test whether or not this has occurred.

Continues on next page

[\BreakFlag]

Data type: errnum

A variable that will hold the error code if MaxTime, DIBreak, DOBreak, or PersBoolBreak is used. If this optional variable is omitted then the error handler will be executed. The constants ERR_TP_MAXTIME, ERR_TP_DIBREAK, ERR_TP_DOBREAK, and ERR_TP_PERSBOOLBREAK can be used to select the reason.

[\UIActiveSignal]

Data type: signaldo

The digital output signal used in optional argument UIActiveSignal is set to 1 when the message box is activated on the FlexPendant. When the user selection has been done and the execution continue, the signal is set to 0 again.

No supervision of stop or restart exist. The signal is set to 0 when the function is ready, or when PP is moved.

Program execution

The numeric tune message box with tune +/- buttons is displayed according to the programmed arguments. Program execution waits until the user tunes the numeric value and taps OK or the message box is interrupted by a time-out or signal action. The input numeric value and interrupt reason are transferred back to the program. New message box on trap level takes the focus from the message box on the basic level.

Predefined data

The following constants of the data type icondata are predefined in the system:

Value	Constant	Icon
0	iconNone	No icon
1	iconInfo	Information icon
2	iconWarning	Warning icon
3	iconError	Error icon
4	iconQuestion	Question icon

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable ERRNO will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_TP_NO_CLIENT	There is no client, for example, a FlexPendant, to take care of the instruction.
ERR_UI_ICON	The argument Icon of type icondata has a not allowed value.

Continues on next page

2 Functions

2.222 UINumTune - User Number Tune

RobotWare Base

Continued

Name	Cause of error
ERR_UI_INITVALUE	The initial value (parameter \InitValue) is not specified within the range of the minimum and maximum value (parameters \MinValue and \MaxValue).
ERR_UI_MAXMIN	The minimum value (parameter \MinValue) is greater than the maximum value (parameter \MaxValue).

If parameter \BreakFlag is not used, these situations can then be dealt with by the error handler:

- If there is a time-out (parameter \MaxTime) before an input from the operator then the system variable ERRNO is set to ERR_TP_MAXTIME and the execution continues in the error handler.
- If digital input is set (parameter \DIBreak) before an input from the operator then the system variable ERRNO is set to ERR_TP_DIBREAK and the execution continues in the error handler.
- If a digital output is set (parameter \DOBreak) before an input from the operator then the system variable ERRNO is set to ERR_TP_DOBREAK and the execution continues in the error handler.
- If a persistent boolean is set (parameter \PersBoolBreak) before an input from the operator then the system variable ERRNO is set to ERR_TP_PERSBOOLBREAK and the execution continues in the error handler.

More examples

The following example illustrates the function UINumTune.

Example 1

```
VAR errnum err_var;
VAR num tune_answer;
VAR num distance;
...
tune_answer := UINumTune (\Header:=" BWD move on path"
    \Message:="Enter the path overlap ?" \Icon:=iconInfo, 5, 1
    \MinValue:=0 \MaxValue:=10 \MaxTime:=60 \DIBreak:=di5
    \BreakFlag:=err_var);
TEST err_var
CASE ERR_TP_MAXTIME:
CASE ERR_TP_DIBREAK:
    ! No operator answer
    distance := 5;
CASE 0:
    ! Operator answer
    distance := tune_answer;
DEFAULT:
    ! No such case defined
ENDTEST
```

The tune message box is displayed and the operator can tune the numeric value and press OK. The message box can also be interrupted with time-out or break by digital input signal. In the program it's possible to find out the reason and take the appropriate action.

Continues on next page

Limitations

Avoid using too small a value for the time-out parameter \MaxTime when UINumTune is frequently executed, for example in a loop. It can result in unpredictable behavior from the system performance, like slow response of the FlexPendant.

Syntax

```
UINumTune '('
  ['\ ' Header ':= ' <expression (IN) of string>]
  [Message ':= ' <expression (IN) of string> ]
  | ['\ ' MsgArray ':= ' <array {*} (IN) of string>]
  ['\ ' Wrap]
  ['\ ' Icon ':= ' <expression (IN) of icondata>]
  ['\ ' Image ':= ' <expression (IN) of string>]
  [InitValue ':= ' <expression (IN) of num>]
  [Increment ':= ' <expression (IN) of num>]
  ['\ ' MinValue ':= ' <expression (IN) of num>]
  ['\ ' MaxValue ':= ' <expression (IN) of num>]
  ['\ ' MaxTime ':= ' <expression (IN) of num>]
  ['\ ' DIBreak ':= ' <variable (VAR) of signaldi>]
  ['\ ' DIPassive]
  ['\ ' DOBreak ':= ' <variable (VAR) of signaldo>]
  ['\ ' DOPassive]
  ['\ ' PersBoolBreak ':= ' <persistent (PERS) of bool>]
  ['\ ' PersBoolPassive]
  ['\ ' BreakFlag ':= ' <variable or persistent (INOUT) of errnum>]
  ['\ ' UIActiveSignal ':= ' <variable (VAR) of signaldo>] ')'

```

A function with return value of the data type num.

Related information

For information about	See
Icon display data	icondata - Icon display data on page 1652
User interaction message box type basic	UIMsgBox - User Message Dialog Box type basic on page 964
User interaction message box type advanced	UIMessageBox - User Message Box type advanced on page 1556
User interaction number entry	UINumEntry - User Number Entry on page 1565
User interaction alpha entry	UIAlphaEntry - User Alpha Entry on page 1524
User interaction list view	UIListView - User List View on page 1547
System connected to FlexPendant etc.	UIClientExist - Exist User Client on page 1531
Clean up the operator window	TPERase - Erases text printed on the Flex-Pendant on page 832

2 Functions

2.223 ValidIO - Valid I/O signal to access

RobotWare Base

2.223 ValidIO - Valid I/O signal to access

Usage

ValidIO is used to check if the specified I/O signal can be accessed without any error at present.

Basic examples

The following example illustrates the function ValidIO.

Example 1

```
IF ValidIO(mydosignal) SetDO mydosignal, 1;
```

Set the digital output signal mydosignal to 1 if its I/O device is up and running.

Return value

Data type: bool

Returns TRUE if the I/O signal is valid and the I/O device for the signal is up and running.

Returns FALSE if the I/O device is not up and running, or if no AliasIO instruction has been executed to connect a signal variable declared in the RAPID program to a signal defined in I/O configuration.

Arguments

ValidIO (Signal)

Signal

Data type: signalxx

The I/O signal name. Must be of data type signaldo, signaldi, signalgo, signalgi, signalao or signalai.

Program execution

Execution behaviour:

- Check if valid I/O signal
- Check if the I/O device for the signal is up and running.

No error messages are generated.

Syntax

```
ValidIO '('  
  [Signal ':='] <variable (VAR) of anytype> ')'
```

A function with a return value of the data type bool.

Related information

For information about	See
Input/Output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview</i>

Continues on next page

2.223 ValidIO - Valid I/O signal to access RobotWare Base Continued

For information about	See
Configuration of I/O	<i>Technical reference manual - System parameters</i>
Define I/O signal with alias name	<i>AliasIO - Define I/O signal with alias name on page 34</i>
Read attribute of a system parameter	<i>ReadCfgData - Reads attribute of a system parameter on page 569</i>

2 Functions

2.224 ValToBytes - Converts a value to a byte array

RobotWare Base

2.224 ValToBytes - Converts a value to a byte array

Usage

ValToBytes (*Value To Bytes*) is used to convert a value of any data type to a byte array. The byte array will consist of the ASCII value representation of the characters.

Basic examples

The following example illustrates the function ValToBytes.

See also [More examples on page 1582](#).

Example 1

```
VAR num noofbytes;  
VAR byte mybytes{100};  
..  
noofbytes:=ValToBytes("A2B", mybytes);
```

In the example above the function ValToBytes converts the string A2B to ASCII characters and places it in the byte array mybytes. mybytes will have these values: 34, 65, 50, 66, and 34. noofbytes will be 5. This is the number of data transferred to the byte array.

Return value

Data type: num

The number of bytes placed in the byte array.

Arguments

ValToBytes (Value ByteArray [\StartIndex])

Value

Data type: anytype

A value of any data type. All types of value data with structure atomic, record, record component, array, or array element can be used.

ByteArray

Data type: array of byte

This byte array is the ASCII value representation of the characters of the data used in the argument Value.

[\StartIndex]

Data type: num

The index in the byte array where to place the first byte of the converted data.

Program execution

Any type of value is converted to ASCII value representation and placed in the byte array.

More examples

More examples of the function ValToBytes are illustrated below.

Continues on next page

Example 1

```

VAR robtarget robtarr{10};
VAR byte bytearray{5000};
VAR num bytecount;
!..
bytecount:=ValToBytes(robtarr, bytearray);
SocketSend senddev \Data:=bytearray \NoOfBytes:= bytecount;

```

In the example above the ValToBytes converts the robtarget array to ASCII characters and places it in the variable bytearray. Then the instruction SocketSend is used to send bytecount number of bytes to a remote computer.

Example 2

```

VAR byte bytearray{5000};
VAR num bytescnt;
CONST robtarget p15 := [ [600, 500, 225.3], [1, 0, 0, 0], [1, 1,
                        0, 0], [ 9E9, 9E9, 9E9, 9E9, 9E9, 9E9] ];
..
BytesReset bytearray;
bytescnt:=ValToBytes(1, bytearray);
bytescnt:=bytescnt+ValToBytes(2, bytearray \StartIndex:=bytescnt+1);
bytescnt:=bytescnt+ValToBytes(p15, bytearray \StartIndex:=bytescnt+1);

```

In the example above the function ValToBytes places the ASCII values for 1 and 2 in index 1 and index 2 in the bytearray. After the integers, a robtarget is placed in the byte array. bytescnt is the total number of data converted and placed in the bytearray array.

Limitations

The dimensions of the byte array must be at least as big as the number of characters of the value in argument Value.

Syntax

```

ValToBytes '('
  [ Value ':' ] < expression (IN) of anytype> ','
  [ ByteArray ':' ] < variable or persistent (INOUT) array{*} of
    byte >
  [ '\ ' StartIndex ':' ] < expression (IN) of num >
  ')'

```

A function with a return value of the data type num.

Related information

For information about	See
byte	byte - Integer values 0-255 on page 1597
BytesToVal	BytesToVal - Converts a byte array to a value on page 1166
Bit functions	<i>Technical reference manual - RAPID Overview</i>
<i>MathLibMemSize</i>	<i>Topic Controller, type General Rapid, in Technical reference manual - System parameters</i>

2 Functions

2.225 ValToStr - Converts a value to a string

RobotWare Base

2.225 ValToStr - Converts a value to a string

Usage

ValToStr (*Value To String*) is used to convert a value of any data type to a string.

Basic examples

The following examples illustrate the function ValToStr.

Example 1

```
VAR string str;  
VAR pos p := [100,200,300];  
str := ValToStr(p);
```

The variable str is given the value "[100,200,300]".

Example 2

```
str := ValToStr(TRUE);
```

The variable str is given the value TRUE.

Example 3

```
str := ValToStr(1.234567890123456789);
```

The variable str is given the value "1.23456789012346".

Example 4

```
VAR num numtype:=1.234567890123456789;
```

```
str := ValToStr(numtype);
```

The variable str is given the value "1.23457".

Example 5

```
VAR dnum dnumtype:=1.234567890123456789;
```

```
str := ValToStr(dnumtype);
```

The variable str is given the value "1.23456789012346".

Return value

Data type: string

The value is converted to a string with standard RAPID format. This means, in principle, 6 significant digits. Literal value interpreted as a dnum (see example 3) and dnum variabls (see example 5) though have 15 significant digits.

A runtime error is generated if the resulting string is too long.

Arguments

ValToStr (Val)

Val

Value

Data type: anytype

A value of any data type. All types of value data with structure atomic, record, record component, array, or array element can be used.

Continues on next page

Syntax

```
ValToStr '('  
  [ Val ':=' ] <expression (IN) of anytype> ')'
```

A function with a return value of the data type string.

Related information

For information about	See
String functions	<i>Technical reference manual - RAPID Overview</i>
Definition of string	string - Strings on page 1739
String values	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.226 VectMagn - Magnitude of a pos vector RobotWare Base

2.226 VectMagn - Magnitude of a pos vector

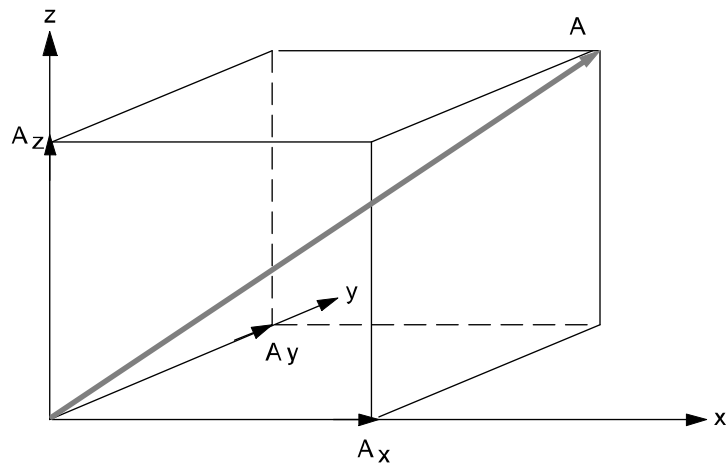
Usage

VectMagn (*Vector Magnitude*) is used to calculate the magnitude of a pos vector.

Basic examples

The following example illustrates the function VectMagn.

Example 1



xx0500002446

A vector **A** can be written as the sum of its components in the three orthogonal directions:

$$\mathbf{A} = A_x \mathbf{x} + A_y \mathbf{y} + A_z \mathbf{z}$$

The magnitude of **A** is:

$$|\mathbf{A}| = \sqrt{A_x^2 + A_y^2 + A_z^2}$$

The vector is described by the data type pos and the magnitude by the data type num:

```
VAR num magnitude;  
VAR pos vector;  
...  
vector := [1,1,1];  
magnitude := VectMagn(vector);
```

Return value

Data type: num

The magnitude of the vector (data type pos).

Arguments

VectMagn (Vector)

Continues on next page

Vector

Data type: pos

The vector described by the data type pos.

Syntax

```
VectMagn '('  
  [Vector ':='] <expression (IN) of pos> ')'
```

A function with a return value of the data type num.

Related information

For information about	See
Mathematical instructions and functions	<i>Technical reference manual - RAPID Overview</i>

2 Functions

2.227 XOR - Evaluates a logical value

RobotWare Base

2.227 XOR - Evaluates a logical value

Usage

XOR (*Exclusive Or*) is a conditional expression used to evaluate a logical value (true/false).

Basic examples

The following examples illustrate the function XOR.

Example 1

```
VAR bool a;  
VAR bool b;  
VAR bool c;  
c := a XOR b;
```

The return value c is TRUE if one, and only one, of a or b are TRUE. Otherwise the return value is FALSE.

Example 2

```
VAR num a;  
VAR num b;  
VAR bool c;  
...  
c := a>5 XOR b=3;
```

The return value of c is TRUE if one, and only one, of the conditions are TRUE. Either a is larger than 5, or b equals 3. Otherwise the return value is FALSE.

Return value

Data type: bool

The return value is TRUE if one, and only one, of the conditional expressions are correct. Otherwise the return value is FALSE.

Syntax

<expression of bool> XOR <expression of bool>

A function with a return value of data type bool.

Related information

For information about	See
AND	AND - Evaluates a logical value on page 1123
OR	OR - Evaluates a logical value on page 1367
NOT	NOT - Inverts a logical value on page 1358
Expressions	Technical reference manual - RAPID Overview

3 Data types

3.1 aiotrigg - Analog I/O trigger condition

Usage

aiotrigg (*Analog I/O Trigger*) is used to define the condition to generate an interrupt for an analog input or output signal.

Description

Data of the type **aiotrigg** defines the way a low and a high threshold will be used to determine whether the logical value of an analog signal satisfies a condition to generate an interrupt.

Basic examples

The following example illustrates the data type **aiotrigg**:

Example 1

```
VAR intnum sig1int;
PROC main()
  CONNECT sig1int WITH iroutine1;
  ISignalAI \Single, ai1, AIO_BETWEEN, 1.5, 0.5, 0, sig1int;
```

Orders an interrupt which is to occur the first time the logical value of the analog input signal **ai1** is between 0.5 and 1.5. A call is then made to the **iroutine1** trap routine.

Predefined data

The following symbolic constants of the data type **aiotrigg** are predefined and can be used when specifying a condition for the instructions **ISignalAI** and **ISignalAO**.

Value	Symbolic constant	Comment
1	AIO_ABOVE_HIGH	Signal will generate interrupts if above specified high value
2	AIO_BELOW_HIGH	Signal will generate interrupts if below specified high value
3	AIO_ABOVE_LOW	Signal will generate interrupts if above specified low value
4	AIO_BELOW_LOW	Signal will generate interrupts if below specified low value
5	AIO_BETWEEN	Signal will generate interrupts if between specified low and high values
6	AIO_OUTSIDE	Signal will generate interrupts if below specified low value or above specified high value
7	AIO_ALWAYS	Signal will always generate interrupts

Characteristics

aiotrigg is an alias data type for **num** and consequently inherits its characteristics.

Continues on next page

3 Data types

3.1 aiotrigger - Analog I/O trigger condition

RobotWare Base

Continued

Related information

For information about	See
Interrupt from analog input signal	<i>ISignalAI - Interrupts from analog input signal on page 295</i>
Interrupt from analog output signal	<i>ISignalAO - Interrupts from analog output signal on page 305</i>
Data types in general, alias data types	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Data types</i>

3.2 ALIAS - Assigning an alias data type

Usage

ALIAS is used to define a data type as being equal to another data type. Alias types provide a means to classify objects. The system may use the alias classification to look up and present type related objects. An alias type is introduced by an alias definition.

The built-in alias types are `errnum` and `intnum`, both aliases for `num`.

`errnum` type

The `errnum` type is an alias for `num` and is used for the representation of error numbers.

`intnum` type

The `intnum` type is an alias for `num` and is used for the representation of interrupt numbers.

Basic examples

The following example illustrates the ALIAS definition.

Example 1

```
ALIAS num level;  
CONST level low := 2.5;  
CONST level high := 4.0;
```

An alias type `level` is defined (alias for `num`).

Limitations

To be recognized by RAPID, any alias definitions must be declared at the very top of the program or system module before all other data declarations. The only data type that is allowed to be declared before alias is `RECORD`.

One alias type cannot be defined upon another alias type.

Syntax

```
ALIAS <type name> <identifier> ';' ;
```

Alias definition.

Related information

For information about	See
<code>errnum</code> - Error number	errnum - Error number on page 1634
<code>intnum</code> - Interrupt identity	intnum - Interrupt identity on page 1656
Lexical elements	<i>Technical reference manual - RAPID kernel</i>

3 Data types

3.3 bool - Logical values

RobotWare Base

3.3 bool - Logical values

Usage

`bool` is used for logical values (true/false).

Description

The value of data of the type `bool` can be either `TRUE` or `FALSE`.

Basic examples

The following examples illustrate the data type `bool` :

Example 1

```
flag1 := TRUE;
```

`flag` is assigned the value `TRUE`.

Example 2

```
VAR bool highvalue;  
VAR num reg1;  
...  
highvalue := reg1 > 100;
```

`highvalue` is assigned the value `TRUE` if `reg1` is greater than 100; otherwise, `FALSE` is assigned.

Example 3

```
IF highvalue Set do1;
```

The `do1` signal is set if `highvalue` is `TRUE`.

Example 4

```
highvalue := reg1 > 100;  
mediumvalue := reg1 > 20 AND NOT highvalue;
```

`mediumvalue` is assigned the value `TRUE` if `reg1` is between 20 and 100.

Related information

For information about	See
Logical expressions	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Expressions</i>
Operations using logical values	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Expressions</i>

3.4 btnres - Push button result data

Usage

btnres (*button result*) is used for representing the user selection of the push button display on the User Device such as the FlexPendant.

Description

A btnres constant is intended to be used when checking the result value from the instruction UIMsgBox and the return value from the functions UIMessageBox and UICollection.

Basic examples

The following example illustrates the data type btnres:

Example 1

```
VAR btnres answer;

UIMsgBox "More ?" \Buttons:=btnYesNo \Result:= answer;
IF answer= resYes THEN
  ...
ELSEIF answer =ResNo THEN
  ...
ENDIF
```

The standard button enumeration btnYesNo will give one Yes and one No push button on the user interface. The user selection will be stored in the variable answer.

Predefined data

The following constants of the data type btnres are predefined in the system.

Value	Constants	Button answer
0	resUnkwn	Unknown result
1	resOK	OK
2	resAbort	Abort
3	resRetry	Retry
4	resIgnore	Ignore
5	resCancel	Cancel
6	resYes	Yes
7	resNo	No

It is possible to work with user defined push buttons that answer with the functions UIMessageBox and UICollection.

Characteristics

btnres is an alias data type for num and consequently inherits its characteristics.

Continues on next page

3 Data types

3.4 btnres - Push button result data

RobotWare Base

Continued

Related information

For information about	See
User Interaction Message Box	UIMsgBox - User Message Dialog Box type basic on page 964
User Interaction Message Box	UIMessageBox - User Message Box type advanced on page 1556
User Interaction List View	UICollection - User List View on page 1547
Alias data type button data	buttondata - Push button data on page 1595

3.5 buttndata - Push button data

Usage

buttndata is used for representing a standard push button combination for display on the User Device such as the FlexPendant.

Description

A buttndata constant is used for representing response push buttons in instruction UIMsgBox and functions UIMessageBox and UIListView.

Basic examples

The following example illustrates the data type buttndata:

Example 1

```
VAR btnres answer;
UIMsgBox "More ?" \Buttons:=btnYesNo \Result:= answer;
IF answer= resYes THEN
...
ELSE
...
ENDIF
```

The standard button enumeration btnYesNo will give one Yes and one No push button.

Predefined data

The following constants of the data type buttndata are predefined in the system.

Value	Constants	Button displayed
-1	btnNone	No button
0	btnOK	OK
1	btnAbtrRtryIgn	Abort, Retry and Ignore
2	btnOKCancel	OK and Cancel
3	btnRetryCancel	Retry and Cancel
4	btnYesNo	Yes and No
5	btnYesNoCancel	Yes, No and Cancel

It is possible to display user defined push buttons with the functions UIMessageBox and UIListView.



Note

The texts displayed using buttndata are automatically localized to the selected language for the user interface. Other strings are not automatically localized.

Characteristics

buttndata is an alias data type for num and consequently inherits its characteristics.

Continues on next page

3 Data types

3.5 buttondata - Push button data

RobotWare Base

Continued

Related information

For information about	See
User Interaction Message Box	UIMsgBox - User Message Dialog Box type basic on page 964
User Interaction Message Box	UIMessageBox - User Message Box type advanced on page 1556
User Interaction List View	UICollection - User List View on page 1547
Alias data type button result	btnres - Push button result data on page 1593
Data types in general, alias data types	<i>Technical reference manual - RAPID Overview, section Basic Characteristics - Data Types</i>

3.6 byte - Integer values 0-255

Usage

byte is used for integer values (0 - 255) according to the range of a byte.

This data type is used in conjunction with instructions and functions that handle the bit manipulations and convert features.

Description

Data of the type byte represents an integer byte value.

Basic examples

The following examples illustrate the data type byte:

Example 1

```
VAR byte data1 := 130;
```

Definition of a variable data1 with a decimal value 130.

Example 2

```
CONST num parity_bit := 8;  
VAR byte data1 := 130;  
BitClear data1, parity_bit;
```

Bit number 8 (parity_bit) in the variable data1 will be set to 0, e.g. the content of the variable data1 will be changed from 130 to 2 (integer representation).

Error handling

If an argument of the type byte has a value that is not in the range between 0 and 255, an error is returned on program execution.

Characteristics

byte is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Alias data types	<i>Technical reference manual - RAPID Overview</i>
Bit functions	<i>Technical reference manual - RAPID Overview</i>

3 Data types

3.7 cameradev - camera device

Integrated Vision

3.7 cameradev - camera device

Usage

cameradev (*camera device*) is used to define the different camera devices which can be controlled and accessed from the RAPID program. The data type cameradev is used for instructions and functions communicating with a camera. The names of the camera devices are defined in the system parameters and, consequently, must not be defined in the program.

Description

Data of the type cameradev only contains a reference to the camera device.

Basic examples

The following example illustrates the data type cameradev.

Example 1

```
CamLoadJob mycamera, "myjob.job";
```

Predefined data

All cameras defined in the system parameters are predefined in every program task.

Limitations

Data of the type cameradev must not be defined in the program. However, if it is then an error message will be displayed as soon as an instruction or function that refers to this cameradev is executed. The data type can, on the other hand, be used as a parameter when declaring a routine.

Characteristics

cameradev is a non-value data type. This means that data of this type does not permit value-oriented operations.

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

3.8 camerastatus - Camera communication status

Usage

camerastatus is used for representing the status of the communication with the camera.

Description

Camera status is fetched with the function CamGetMode and can be used for program flow control or debugging purposes.

Basic examples

The following example illustrates the data type camerastatus:

Example 1

```
VAR camerastatus curr_camerastatus;  
...  
curr_camerastatus:=CamGetMode(mycamera);  
IF curr_camerastatus = CAMERA_DISCON THEN  
    TPWrite "Current mode of camera " + CamGetName(mycamera) + " is  
        CAMERA_DISCON";  
ELSEIF curr_camerastatus = CAMERA_STANDBY THEN  
    TPWrite "Current mode of camera "+CamGetName(mycamera) + " is  
        CAMERA_STANDBY";  
ELSEIF curr_camerastatus = CAMERA_RUNNING THEN  
    TPWrite "Current mode of camera " + CamGetName(mycamera) + " is  
        CAMERA_RUNNING";  
ENDIF
```

Get current mode of the camera, and write the status to the FlexPendant.

Predefined data

Following constants of type camerastatus are predefined:

RAPID constant	Value	
CAMERA_DISCON	1	The camera is disconnected.
CAMERA_STANDBY	2	The camera is in standby mode.
CAMERA_RUNNING	3	The camera is running.

Characteristics

camerastatus is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>
Get camera mode	CamGetMode - Get current mode of camera on page 1188

Continues on next page

3 Data types

3.8 camerastatus - Camera communication status

Integrated Vision

Continued

For information about	See
Data types in general, alias data types	<i>Technical reference manual - RAPID Overview, section Basic Characteristics - Data Types</i>

3.9 cameratarget - camera data

Usage

cameratarget is used to exchange vision data from the camera image to the RAPID program.

Description

Data of the type cameratarget is a user defined collection of data that can be set up to exchange vision data from the camera image to the RAPID program. The data has a range of components that can be set up according to the specific needs in the current vision application. The cframe component is meant for transmitting information about the location of an object whereas the numerical values and the strings are meant to hold inspection data.

Basic examples

The following example illustrates the data type cameratarget.

Example 1

```
VAR cameratarget target1;
...
wobjmycamera.oframe := target1.cframe;
MoveL pickpart, v100, fine, mygripper \WObj:= wobjmycamera;
```

The cframe coordinate transformation is assigned to the object frame of the work object. The robtarget pickpart has previously been tuned to a correct picking position within the object frame of the work object.

Components

The data type has the following components:

name

Data type: string

The name identifier of the cameratarget.

cframe

current frame

Data type: pose

For storing position data which is normally used for guiding the robot by modifying the work object.

val1

value 1

Data type: num

For storing numerical outputs such as measurements.

...

val5

value 5

Continues on next page

3 Data types

3.9 cameratarget - camera data

Integrated Vision

Continued

Data type: num

For storing numerical outputs such as measurements.

string1

Data type: string

For storing numerical vision output such as inspection or identification output.

string2

Data type: string

For storing numerical vision output such as inspection or identification output.

type

Data type: num

A numerical identifier of the camera target. Similar purpose as the name component.

cameraname

Data type: string

The name of the camera.

sceneid

scene identification

Data type: num

The unique identifier of the image used to generate the cameratarget.

Structure

```
< dataobject of cameratarget >  
  < name of string >  
  < cframe of pose >  
    < trans of pos >  
    < rot of orient >  
  < val1 of num >  
  < val2 of num >  
  < val3 of num >  
  < val4 of num >  
  < val5 of num >  
  < string1 of string >  
  < string2 of string >  
  < type of num >  
  < cameraname of string >  
  < sceneid of num >
```

Related information

For information about	See
Integrated Vision	<i>Application manual - Integrated Vision</i>

3.10 capaptrreferencedata - Variable setup data for At-Point-Tracker

Usage

capaptrreferencedata is used to setup the needed information for the At-Point-Tracker correction process setup by the CapAPTrSetupA0, CapAPTrSetupAI, and CapAPTrSetupPERS instructions.

Components

reference_y

Data type: num

Defines the reference for the Y position.

reference_z

Data type: num

Defines the reference for the Z position.

threshold_y

Data type: num

The difference between the input signal and the reference_y value must be greater than the threshold_y value for the regulator to react on the change.

threshold_z

Data type: num

The difference between the input signal and the reference_z value must be greater than the threshold_z value for the regulator to react on the change.

gain_y

Data type: num

The difference between the reference_y value and the input signal value is scaled with the gain_y value.

gain_z

Data type: num

The difference between the reference_z value and the input signal value is scaled with the gain_z value.

Structure

```
< data object of capaptrreferencedata >
  < reference_y of num >
  < reference_z of num >
  < threshold_y of num >
  < threshold_z of num >
  < gain_y of num >
  < gain_z of num >
```

Continues on next page

3 Data types

3.10 capaptrreferencedata - Variable setup data for At-Point-Tracker

Continuous Application Platform

Continued

Related information

For information about	See
Instruction CapAPTrSetupAI	CapAPTrSetupAI - Setup an At-Point-Tracker controlled by analog input signals on page 80
Instruction CapAPTrSetupAO	CapAPTrSetupAO - Setup an At-Point-Tracker controlled by analog output signals on page 83
Instruction CapAPTrSetupPERS	CapAPTrSetupPERS - Setup an At-Point-Tracker controlled by persistent variables on page 86
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
<i>Sensor Interface</i>	<i>Application manual - Controller software Omni-Core</i>

3.11 capdata - CAP data

Usage

capdata contains all data necessary for defining the behavior of the CAP process.

Components

start_fly

Flying start

Data type: bool

Defines whether or not flying start is used:

Value	Consequence
TRUE	flying start is used
FALSE	flying start is NOT used

Flying start means that the robot movement is started before the process is started. The process is then started on the run (see [flypointdata - Data for flying start/end on page 1648](#)).

first_instr

First instruction

Data type: bool

Defines whether or not a CapL/CapC instruction is the first instruction in a sequence of CapL/CapC instructions:

Value	Consequence
TRUE	this is the first instruction in a sequence of CapL/CapC instructions
FALSE	this is not the first instruction in a sequence of CapL/CapC instructions

last_instr

Last instruction

Data type: bool

Defines whether or not a CapL/CapC instruction is the last instruction in a sequence of CapL/CapC instructions:

Value	Consequence
TRUE	this is the last instruction in a sequence of CapL/CapC instructions
FALSE	this is not the last instruction in a sequence of CapL/CapC instructions

restart_dist

Restart distance, unit: mm

Data type: num

Defines the distance the robot has to back along the path, when it is restarted after having encountered a stop when a CAP process was active.

In MultiMove systems all synchronized robots must use the same restart distance.

Continues on next page

3 Data types

3.11 capdata - CAP data

Continuous Application Platform

Continued

speed_data

Speed data for CAP

Data type: capspeeddata

Defines all CAP data concerning speed (see [capspeeddata - Speed data for CAP on page 1608](#)).

start_fly_point

Data type: flypointdata

These data are only taken into account when start_fly is TRUE.

Defines flying start information for the CAP process (see [flypointdata - Data for flying start/end on page 1648](#).)

end_fly_point

Data type: flypointdata

These data are only taken into account when end_fly is TRUE.

Defines flying end information for the CAP process (see [flypointdata - Data for flying start/end on page 1648](#).)

sup_timeouts

Data type: supervtimeouts

Defines the timeouts used for all handshake supervision phases (see [supervtimeouts - Handshake supervision time outs on page 1741](#) and section *Supervision in Application manual - Continuous Application Platform*).

proc_times

Data type: processtimes

Defines the timeouts used for the status supervision phases PRE, POST1, and POST2 (see [processtimes - process times on page 1699](#) and section *Supervision and process phases in Application manual - Continuous Application Platform*).

block_at_restart

Data type: restartblkdata

Defines the behavior of the CAP process during a restart (see [restartblkdata - blockdata for restart on page 1704](#)).

Structure

```
< data object of capdata >
  < start_fly of bool >
  < first_instr of bool >
  < last_instr of bool >
  < restart_dist of num >
  < speed_data of capspeeddata >
    < fly_start of num >
    < start of num >
    < startspeed_time of num >
    < startmove_delay of num >
    < main of num >
    < fly_end of num >
```

Continues on next page

```

< start_fly_point of flypointdata >
  < time_before of num >
  < distance of num >
< end_fly_point of flypointdata >
  < time_before of num >
  < distance of num >
< sup_timeouts of supervtimeouts >
  < pre_cond of num >
  < start_cond of num >
  < end_main_cond of num >
  < end_post1_cond of num >
  < end_post2_cond of num >
< proc_times of processtimes >
  < pre of num >
  < post1 of num >
  < post2 of num >
< block_at_restart of restartblkdata >
  < weave_start of bool >
  < motion_delay of bool >
  < pre_phase of bool >
  < startspeed_phase of bool >
  < post1_phase of bool >
  < post2_phase of bool >

```

Related information

	Described in:
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>
capspeeddata data type	capspeeddata - Speed data for CAP on page 1608
flypointdata data type	flypointdata - Data for flying start/end on page 1648
supervtimeouts data type	supervtimeouts - Handshake supervision time outs on page 1741
processtimes data type	processtimes - process times on page 1699
block_at_restart data type	restartblkdata - blockdata for restart on page 1704
CapL instruction	CapL - Linear CAP movement instruction on page 103
CapC instruction	CapC - Circular CAP movement instruction on page 89

3 Data types

3.12 capspeeddata - Speed data for CAP

Continuous Application Platform

3.12 capspeeddata - Speed data for CAP

Usage

capspeeddata is used to define all data concerning velocity for a CAP process - it is part of capdata and defines all velocity data and process times needed for a CAP process:

- velocity and how long this velocity shall be used at the start of the CAP process,
- delay for the movement of the robot relative the start of the CAP process,
- velocity for the CAP process,

The velocity is restricted by the performance of the robot. This differs, depending on the type of robot and the path of movement.

Components

start

Data type: num

Velocity (in mm/s) used at the start of the CAP process.

startspeed_time

Data type: num

The time (in seconds) to run at start velocity.

startmove_delay

Data type: num

The time (in seconds) that the robot movement is delayed relative the start of the CAP process.

main

Data type: num

The main CAP process velocity (mm/s).

Structure

```
< data object of capspeeddata >  
  < start of num >  
  < startspeed_time of num >  
  < startmove_delay of num >  
  < main of num >
```

Related information

	Described in:
capdata data type	capdata - CAP data on page 1605
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>

3.13 capweavedata - Weavedata for CAP

Usage

capweavedata is used to define weaving for a CAP process during its MAIN phase (see *Application manual - Continuous Application Platform*).

Description of weaving

Weaving is superimposed on the basic path of the process. That means, that the process speed (defined in capspeeddata) is kept as defined, but the TCP speed is increased unless the physical robot limitations are reached.

Available weaving types:

- geometric weaving: most accurate shape
- wrist weaving: only robot axis 6 is used for weaving
- rapid weaving: geometric weaving but specifying weaving frequency instead of length

Available weaving shapes:

- Zig-zag weaving
- V-shaped weaving
- Triangular weaving
- Circular weaving

All capweavedata components apply to the MAIN phase.

Components

The path coordinate system is defined by:

- X: path/movement direction
- Z: tool z-direction
- Y: perpendicular to both X and Z as to build a right-handed coordinate system

active

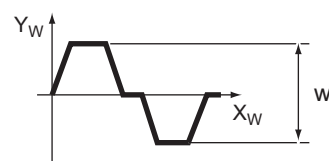
Data type: bool

Value	Description
TRUE	Perform weaving during the MAIN phase of the CAP process
FALSE	Do NOT perform weaving during the MAIN phase of the CAP process

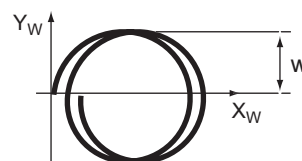
width

Data type: num

For circular weaving, width is the radius of the circle (W in the following figure).
For all other weaving shapes, width is the total amplitude of the weaving pattern.



xx1200000721



Continues on next page

3 Data types

3.13 capweavedata - Weavedata for CAP

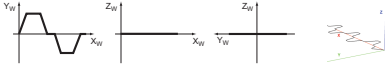
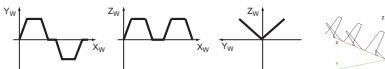
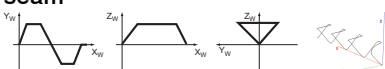
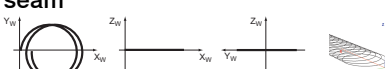
Continuous Application Platform

Continued

shape

Data type: num

The shape of the weaving pattern in the main phase.

Value	Shape geometry	Result
0	No weaving	
1	Zig-zag weaving	Weaving horizontal to the seam  xx1200000714
2	V-shaped weaving	Weaving in the shape of a "V", vertical to the seam  xx1200000715
3	Triangular weaving	A triangular shape, vertical to the seam  xx1200000716
4	Circular weaving (Only available with geometric weaving, weaving type 0)	A circular shape, vertical to the seam  xx1200000717

type

Data type: num

Defines what axes are used for weaving during the MAIN phase

Specified value	Weaving type
0	Geometric weaving. All axes are used during weaving.
1	Wrist weaving. Mainly axis 4, 5 and 6 are used during weaving.
2	Rapid weaving. Mainly axis 1, 2 and 3 are used during weaving, but weaving frequency is specified instead of weaving length.

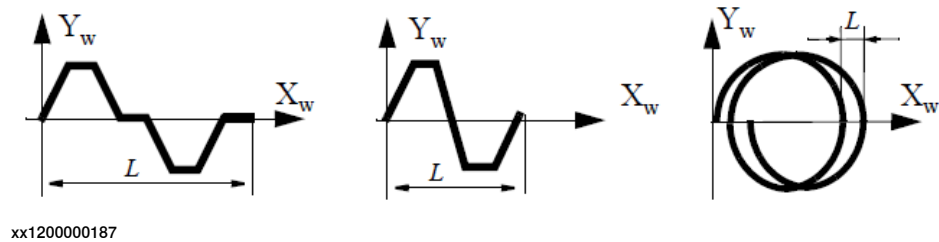
length

Data type: num

Defines the length of the weaving cycle in the MAIN phase for geometric weaving (type = 0) and wrist weaving (type = 1). The length argument is not used for the other weaving types.

For circular weaving the length component defines the distance between two successive circles (L) if the cycle_time argument is set to 0. The TCP rotates left with a positive length value, and right with a negative length value. If cycle_time has a value then length is not used.

Continues on next page

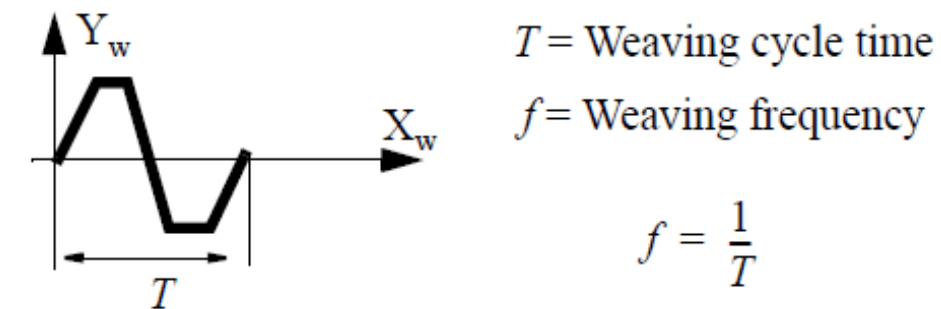


cycle_time

Data type: num

Defines the weaving frequency (in Hz) in the MAIN phase for of Rapid weaving types and for circular weaving. The cycle_time argument is not used for the other weaving types.

For circular weaving the cycle_time argument defines the number of circles per second. The TCP rotates left with a positive cycle_time value, and right with a negative cycle_time value. If cycle_time has a value then length is not used.

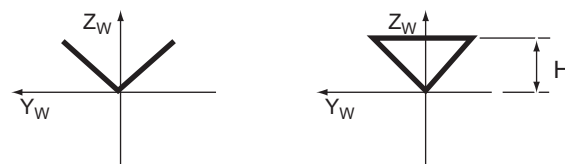


height

Data type: num

Defines the height of the weaving pattern (in mm) during V-shaped and triangular weaving.

Not available for circular weaving.



dwel_left

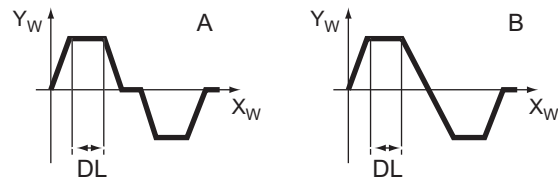
Data type: num

The length of the dwell (DL) used to force the TCP to move only in the direction of the seam at the left turning point of the weave. Not available for circular weaving.

Continues on next page

3 Data types

3.13 capweavedata - Weavedata for CAP Continuous Application Platform Continued



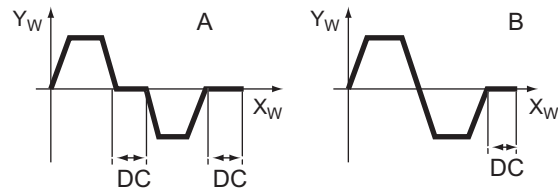
xx1200000723

A	Zigzag and V-shaped weaving
B	Triangular weaving

dwel_center

Data type: num

The length of the dwell (DC) used to force the TCP to move only in the direction of the seam at the center point of the weave. Not available for circular weaving.



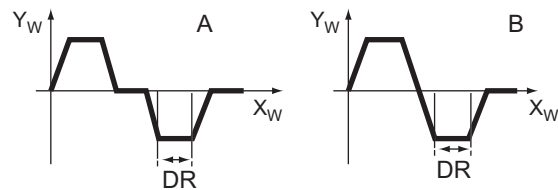
xx1200000724

A	Zigzag and V-shaped weaving
B	Triangular weaving

dwel_right

Data type: num

The length of the dwell (DR) used to force the TCP to move only in the direction of the seam at the right turning point of the weave. Not available for circular weaving.



xx1200000725

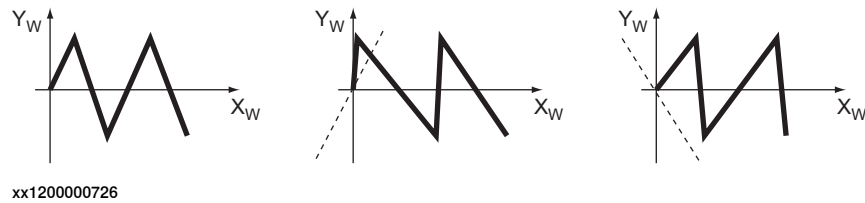
A	Zigzag and V-shaped weaving
B	Triangular weaving

dir

Data type: num

The weave direction angle horizontal to the seam. An angle of zero degrees results in a weave vertical to the seam.

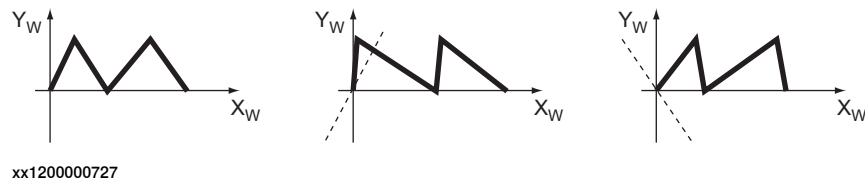
Continues on next page



tilt

Data type: num

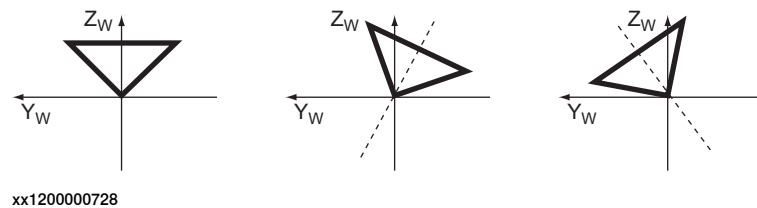
The weave tilt angle, vertical to the seam. An angle of zero degrees results in a weave which is vertical to the seam.



rot

Data type: num

The weave orientation angle, horizontal-vertical to the seam. An angle of zero degrees results in symmetrical weaving.

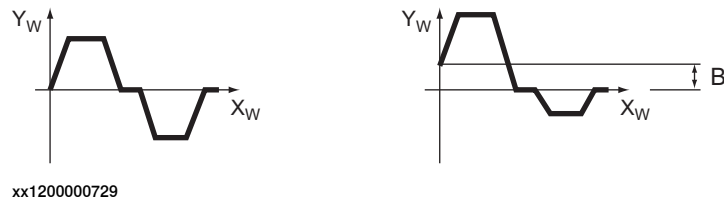


bias

Data type: num

The bias horizontal to the weaving pattern. The bias can only be specified for zig-zag weaving and may not be greater than half the width of the weave. Not available for circular weaving.

The following figure shows zigzag weaving with and without bias (B).



ptrn_sync_on

Data type: bool

Value	Description
TRUE	Send synchronization pulses at the right and left turning points of the weave pattern

Continues on next page

3 Data types

3.13 capweavedata - Weavedata for CAP

Continuous Application Platform

Continued

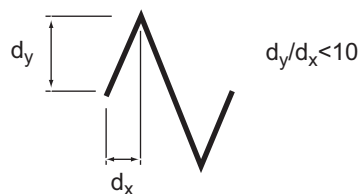
Value	Description
FALSE	Do NOT send synchronization pulses at the right and left turning points of the weave pattern

Limitations

The maximum weaving frequency is 2 Hz.

The inclination of the weaving pattern must not exceed the ratio 1:10 (84 degrees).

See the following figure.



xx1200000730

Change of weave_type in weavedata is not possible in zone points, only in fine points.

Syntax

```
< data object of capweavedata >
  < active of bool >
  < width of num >
  < shape of num >
  < type of num >
  < length of num >
  < cycle_time of num >
  < height of num >
  < dwell_left of num >
  < dwell_center of num >
  < dwell_right of num >
  < dir of num >
  < tilt of num >
  < rot of num >
  < bias of num >
  < ptrn_sync_on of bool >
```

Related information

	Described in:
capdata data type	capdata - CAP data on page 1605
Continuous Application Platform	Application manual - Continuous Application Platform

3.14 cfgdomain - Configuration domain

Usage

cfgdomain (*configuration domain*) is used to specify a configuration domain.

Description

Data of the type cfgdomain is intended to be used to define the configuration domain that shall be saved with instruction SaveCfgData.

Basic examples

The following example illustrates the data type cfgdomain:

Example 1

```
SaveCfgData "SYSPAR" \File:="MYEIO.cfg", EIO_DOMAIN;
```

Saving I/O domain configuration to the file MYEIO.cfg in directory SYSPAR.

Predefined data

The following predefined constants can be used to specify a configuration domain.

Name	Description
EIO_DOMAIN	I/O system configuration
MOC_DOMAIN	Motion configuration
SIO_DOMAIN	Communication domain
PROC_DOMAIN	Process domain
SYS_DOMAIN	Controller domain
MMC_DOMAIN	Man-machine communication
ALL_DOMAINS	All domains listed above

Characteristics

cfgdomain is an alias data type for string and consequently inherits its characteristics.

Related information

For information about	See
Save system parameters to file	SaveCfgData - Save system parameters to file on page 635
System parameters	<i>Technical reference manual - System parameters</i>

3 Data types

3.15 clock - Time measurement

RobotWare Base

3.15 clock - Time measurement

Usage

Clock is used for time measurement. A clock functions like a stopwatch used for timing.

Description

Data of the type `clock` stores a time measurement in seconds and has a resolution of 0.001seconds.

Basic examples

The following example illustrates the data type `clock`:

Example 1

```
VAR clock myclock;  
ClkReset myclock;
```

The clock, `myclock`, is declared and reset. Before using `ClkReset`, `ClkStart`, `ClkStop`, and `ClkRead`, you must declare a variable of data type `clock` in your program.

Limitations

The maximum time that can be stored in a clock variable is approximately 49 days (4,294,967 seconds). The instructions `ClkStart`, `ClkStop`, and `ClkRead` report clock overflows in the very unlikely event that one occurs.

A clock must be declared as a VAR variable type, not as a persistent variable type.

Characteristics

`clock` is a non-value data type and cannot be used in value-oriented operations.

Related information

For information about	See
Summary of Time and Date Instructions	<i>Technical reference manual - RAPID Overview</i> , section <i>RAPID summary - System & time</i>
Non-value data type characteristics	<i>Technical reference manual - RAPID Overview</i> , section <i>Basic characteristics - Data types</i>

3.16 confdata - Robot configuration data

Usage

confdata is used to define the axis configurations of the robot.

Description

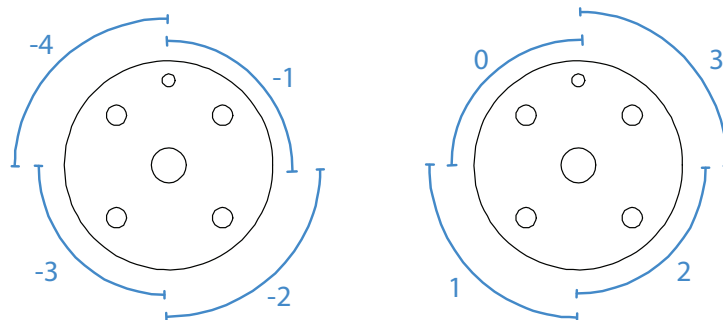
All positions of the robot are defined and stored using rectangular coordinates. When calculating the corresponding axis positions, there will often be two or more possible solutions. This means that the robot is able to achieve the same position, that is, the tool is in the same position and with the same orientation, with several different positions or configurations for the axes of the robot.

Some robots use iterative numerical methods to determine the robot axes positions. In these cases, the configuration parameters may be used to define good starting values for the joints to be used by the iterative procedure.

To unambiguously denote one of these possible configurations, the robot configuration is specified using four axis values. For a rotating axis, the value defines the current quadrant of the robot axis. The quadrants are numbered 0, 1, 2, and so on (they can also be negative). The quadrant number is connected to the current joint angle of the axis.

For 6-axis robots, quadrant 0 is the first quarter revolution, 0° to 90° , in a positive direction from the zero position; quadrant 1 is the next quarter revolution, 90° to 180° , and so on. Quadrant -1 is the quarter revolution 0° to (-90°) , and so on.

The figure shows the configuration quadrants for axis 1, 4, or 6 on a 6-axis robot, where the zero position is straight up.



xx0500002398

For 7-axis robots, quadrant 0 is the quarter revolution centered around the zero position, -45° to $+45^\circ$; quadrant 1 is the next quarter revolution in positive direction, 45° to 135° , and so on. Quadrant -1 is the quarter revolution from -45° to -135° , and so on.

The figure shows the configuration quadrants for axis 1, 4, or 6 on a 7-axis robot, where the zero position is straight up.

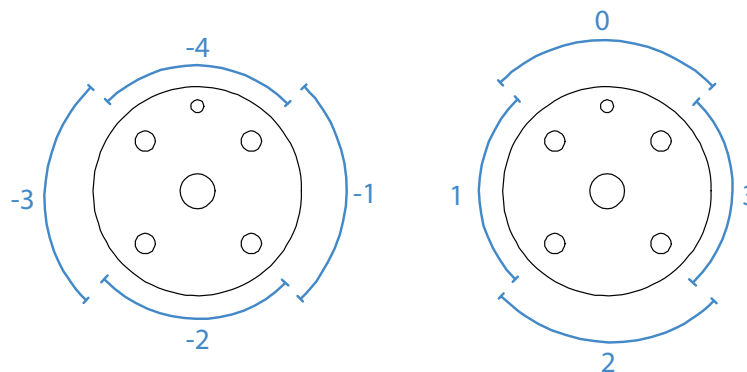
Continues on next page

3 Data types

3.16 confdata - Robot configuration data

RobotWare Base

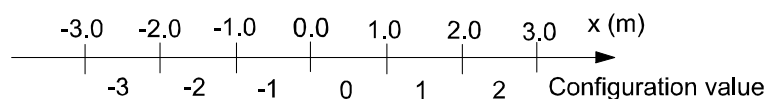
Continued



xx1700001572

For a linear axis, the value defines a meter interval for the robot axis. For each axis, value 0 means a position between 0 and 1 meters, and 1 means a position between 1 and 2 meters. For negative values, -1 means a position between -1 and 0 meters, and so on.

The figure shows configuration values for a linear axis.



xx0500002399

Basic examples

The following example illustrates the data type confdata:

Example 1

```
VAR confdata conf15 := [1, -1, 0, 0]
```

A robot configuration conf15 for a paint robot type is defined as follows:

- The axis configuration of the robot axis 1 is quadrant 1, i.e. 90-180°.
- The axis configuration of the robot axis 4 is quadrant -1, i.e. 0-(-90°).
- The axis configuration of the robot axis 6 is quadrant 0, i.e. 0 - 90°.
- The axis configuration of the robot axis 5 is quadrant 0, i.e. 0 - 90°.

Configuration supervision

For some robot models the configuration data (confdata) is also used to perform supervision of the programmed points for linear movements if ConfL\On is set.

No configuration supervision is performed with ConfJ\On, for more information see [ConfJ - Controls the configuration during joint movement on page 150](#).

Before an ordered movement is started, a verification is made to see if it is possible to achieve the programmed configuration. If it is not possible, the program is stopped. When the movement is finished (in a zone or in a finepoint), it is also verified that the robot has reached the programmed configuration.

The configuration supervision with ConfL\On works differently for different robots. See the following sections for details.

Continues on next page

6-axis serial link robots

The configuration supervision will check that axes 1, 4, and 6 will not move more than 180 degrees, and that the ordered movement does not require a change in cfx.

4-axis serial link robots

The configuration supervision will check that axes 1 and 6 will not move more than 180 degrees.

Parallel arm robots (delta robots)

The configuration supervision will check that axis 4 will not move more than 180 degrees.

SCARA robots

The configuration supervision will check that axes 1 and 4 will not move more than 180 degrees. It will also check the sign of axis 2.

7-axis serial link robots

The configuration supervision will check that axes 1, 4, and 6 will not move more than 180 degrees, and that the ordered movement does not require a change in cfx.

Paint robots

No configuration supervision is done.

Robot configuration data**6-axis serial link robots**

There are three singularities within the working range of the robot. For more information about singularities, see *Technical reference manual - RAPID Overview*.

- cfx1 is the quadrant number for axis 1.
- cfx4 is the quadrant number for axis 4.
- cfx6 is the quadrant number for axis 6.

cfx is used to select one of eight possible robot configurations numbered from 0 through 7. The following table describes each one of them in terms of how the robot is positioned relative to the three singularities.

cfx	Wrist center relative to axis 1	Wrist center relative to lower arm	Axis 5 angle
0	In front of	In front of	Positive
1	In front of	In front of	Negative
2	In front of	Behind	Positive
3	In front of	Behind	Negative
4	Behind	In front of	Positive
5	Behind	In front of	Negative
6	Behind	Behind	Positive
7	Behind	Behind	Negative

Continues on next page

3 Data types

3.16 confdata - Robot configuration data

RobotWare Base

Continued

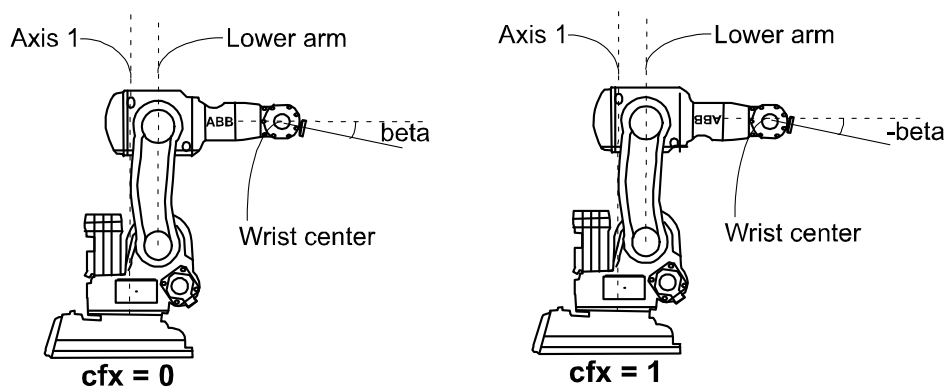


Note

The GoFa and the PoWa robots use the same cfx representation as standard 6-axis serial link manipulators. However, if the joint positions resulting from a MoveJ or MoveL instruction, based on configuration parameters cf4 and cf6, fall outside the limits for joints 4 or 6, the system adjusts the position by adding or subtracting 360 degrees to bring it within the allowable range.

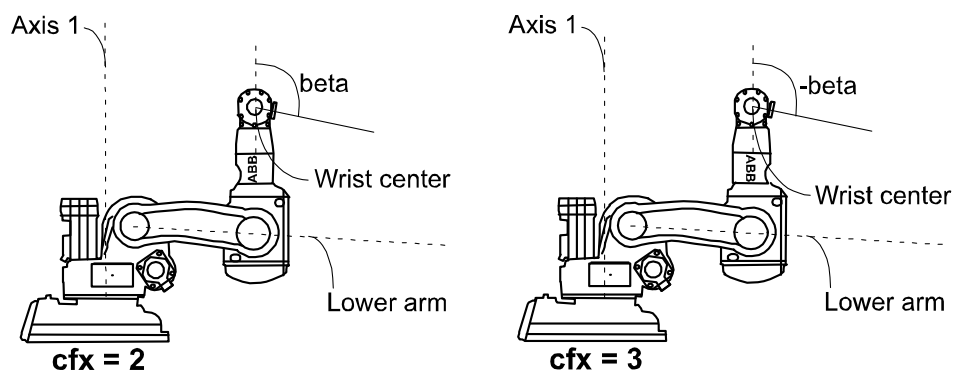
The following figures describe the eight different configurations with the same tool position and orientation.

The following figure shows an example of robot configuration 0 and 1. Note that because changing the sign of axis 5 also changes cfx one should avoid creating or doing ModPos of robtargets with axis 5 really close to zero. With axis 5 at zero, the measurement noise can cause the sign of the measured position of axis 5 to fluctuate and thereby giving an unpredictable value of cfx.



xx0500002400

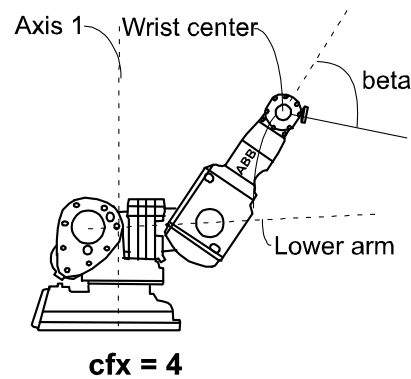
The following figure shows an example of robot configuration 2 and 3. Note the different signs of the axis 5 angle.



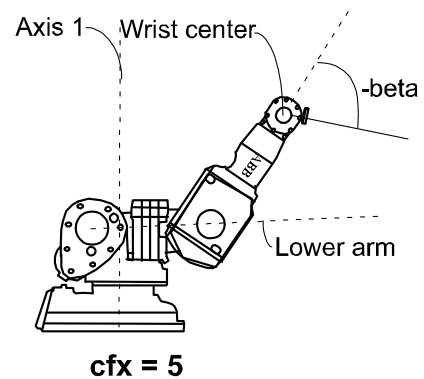
xx0500002401

The following figure shows an example of robot configuration 4 and 5. Note the different signs of the axis 5 angle.

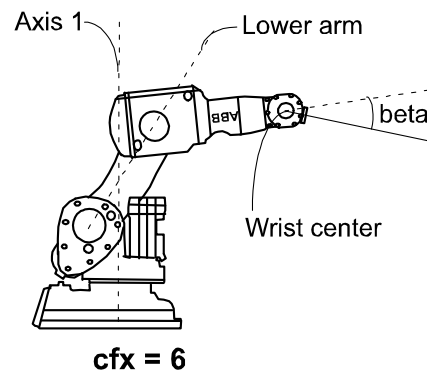
Continues on next page



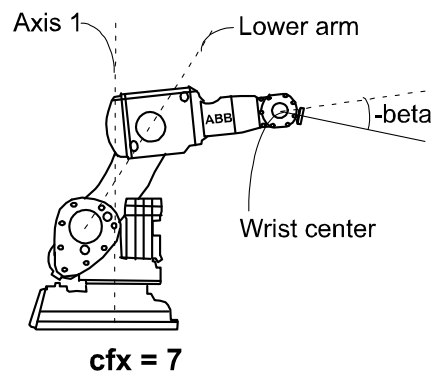
xx0500002402



The following figure shows an example of robot configuration 6 and 7. Note the different signs of the axis 5 angle.



xx0500002403



4-axis serial link robots

Only the configuration parameter **cf6** is used.

Parallel arm robots (delta robots)

Only the configuration parameter **cf4** is used.

SCARA robots (not inverted)

Only the three configuration parameters **cf1**, **cf4**, and **cfx** are used.

The **cfx** value is used to display the sign of the axis 2 angle. **cfx** is 1 if the axis 2 angle is negative, otherwise **cfx** is 0.

Inverted SCARA robots

The **cfx** value is used to display the current quadrant of axis 2, expressed as a positive or negative integer.

Continues on next page

3 Data types

3.16 confdata - Robot configuration data

RobotWare Base

Continued

7-axis serial link robots

All four configuration parameters are used. cf1, cf4, cf6 for joints 1, 4, and 6 respectively. cfx is used to select one of 8 possible robot configurations similar to how it works for other robots.

cfx	Axis 2 angle	Wrist center relative to lower arm	Axis 5 angle
0	Positive	In front of	Positive
1	Positive	In front of	Negative
2	Positive	Behind	Positive
3	Positive	Behind	Negative
4	Negative	In front of	Positive
5	Negative	In front of	Negative
6	Negative	Behind	Positive
7	Negative	Behind	Negative

Paint robots

All four configuration parameters are used. cf1, cf4, cf6 for joints 1, 4, and 6 respectively and cfx for joint 5.

IRB 5500

All four configuration parameters are used. cf1, cf4, cf6 for joints 1, 4, and 6 respectively. The cfx parameter contains a combination of the joint 5 quadrant number and the four possible configurations for axes 2 and 3.

For more information see the *Product Manual - IRB 5500*.

IRB 5350

The robot have two rotation axes (arms 1 and 2) and one linear axis (arm 3).

- cf1 is used for the rotating axis 1
- cfx is used for the rotating axis 2
- cf4 and cf6 are not used

Components

cf1

Data type: num

Rotating axis:

The current quadrant of axis 1, expressed as a positive or negative integer.

Linear axis:

The current meter interval of axis 1, expressed as a positive or negative integer.

cf4

Data type: num

Rotating axis:

The current quadrant of axis 4, expressed as a positive or negative integer.

Linear axis:

Continues on next page

The current meter interval of axis 4, expressed as a positive or negative integer.

cf6

Data type: num

Rotating axis:

The current quadrant of axis 6, expressed as a positive or negative integer.

Linear axis:

The current meter interval of axis 6, expressed as a positive or negative integer.

cfx

Data type: num

Rotating axis:

For serial link robots, the current robot configuration, expressed as an integer in the range from 0 to 7.



Note

The GoFa robot uses the same representation for cfx as 6-axis serial link manipulators.

For SCARA robots (not inverted versions), the current robot configuration, expressed as an integer in the range from 0 to 1, see [SCARA robots \(not inverted\) on page 1621](#).

For inverted SCARA robots, see [Inverted SCARA robots on page 1621](#).

For 7-axis robots, the the current robot configuration, expressed as an integer in the range from 0 to 7, see [7-axis serial link robots on page 1622](#).

For paint robots, the current quadrant of axis 5, expressed as a positive or negative integer. For IRB 5500, see [IRB 5500 on page 1622](#).

For other robots, using the current quadrant of axis 2, expressed as a positive or negative integer.

Linear axis:

The current meter interval of axis 2, expressed as a positive or negative integer.

Structure

```
< dataobject of confdata >
  < cf1 of num >
  < cf4 of num >
  < cf6 of num >
  < cfx of num >
```

Related information

For information about	See
Coordinate systems Handling configuration data Singularities	<i>Technical reference manual - RAPID Overview</i>
Position data	robtargt - Position data on page 1715

Continues on next page

3 Data types

3.16 confdata - Robot configuration data

RobotWare Base

Continued

For information about	See
System parameters	<i>Technical reference manual - System parameters</i>

3.17 corrdescr - Correction generator descriptor

Usage

corrdescr (*Correction generator descriptor*) is used by correction generators. A correction generator adds geometric offsets in the path coordinate system.

Description

Data of the type corrdescr contains a reference to a correction generator.

Connection to a correction generator is done by the instruction CorrCon and the descriptor (the reference to the correction generator) can be used to deliver geometric offsets in the path coordinate system with the instruction CorrWrite.

Offsets provided earlier can be removed by disconnecting a correction generator with the instruction CorrDiscon. All connected correction generators can be removed with the instruction CorrClear.

The function CorrRead returns the sum of all the delivered offsets so far (includes all connected correction generators).

Basic examples

The following example illustrates the data type corrdescr:

Example 1

```
VAR corrdescr id;
VAR pos offset;
...
CorrCon id;
offset := [1, 2 ,3];
CorrWrite id, offset;
```

A correction generator is connected with the instruction CorrCon and referenced by the descriptor id. Offsets are then delivered to the correction generator (with reference id) using the instruction CorrWrite.

Characteristics

corrdescr is a non-value data type.

Related information

For information about	See
Connects to a correction generator	CorrCon - Connects to a correction generator on page 170
Disconnects from a correction generator	CorrDiscon - Disconnects from a correction generator on page 175
Writes to a correction generator	CorrWrite - Writes to a correction generator on page 176
Reads the current total offsets	CorrRead - Reads the current total offsets on page 1199
Removes all correction generators	CorrClear - Removes all correction generators on page 169

Continues on next page

3 Data types

3.17 corrdescr - Correction generator descriptor

Path Corrections

Continued

For information about	See
Characteristics of non-value data types	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Data types</i>

3.18 datapos - Enclosing block for a data object

Usage

datapos is the enclosing block to a data object (internal system data) retrieved with the function `GetNextSym`.

Description

Data of the type `datapos` contains information of where a certain object is defined in the system. It is used for instructions `GetDataVal` and `SetDataVal`.

Basic examples

The following example illustrates the data type `datapos`:

Example 1

```
VAR datapos block;
VAR string name;
VAR bool truevar:=TRUE;
...
SetDataSearch "bool" \Object:="my.*" \InMod:="mymod"\LocalSym;
WHILE GetNextSym(name,block) DO
    SetDataVal name\Block:=block,truevar;
ENDWHILE
```

This session will set all local `bool` data objects that begin with `my` in the module `mymod` to `TRUE`.

Characteristics

`datapos` is a non-value data type.

Related information

For information about	See
Define a symbol set in a search session	SetDataSearch - Define the symbol set in a search sequence on page 674
Get next matching symbol	GetNextSym - Get next matching symbol on page 1277
Get the value of a data object	GetDataVal - Get the value of a data object on page 225
Set the value of a data object	SetDataVal - Set the value of a data object on page 679
Set the value of many object	SetAllDataVal - Set a value to all data objects in a defined set on page 670

3 Data types

3.19 dionum - Digital values (0-1)

RobotWare Base

3.19 dionum - Digital values (0-1)

Usage

`dionum`(*digital input output numeric*) is used for digital values (0 or 1).

This data type is used in conjunction with instructions and functions that handle digital input or output signals.

Description

Data of the type `dionum` represents a digital value 0 or 1.

Basic examples

The following example illustrates the data type `dionum`:

Example 1

```
CONST dionum close := 1;  
SetDO grip1, close;
```

Definition of a constant `close` with a value equal to 1. The signal `grip1` is then set to `close`, i.e. 1.

Predefined data

The constants `high`, `low`, and `edge` are predefined in the system:

```
CONST dionum low:=0;  
CONST dionum high:=1;  
CONST dionum edge:=2;
```

The constants `low` and `high` are designed for I/O instructions.

Edge can be used together with the interrupt instructions `ISignalDI` and `ISignalDO`.

Characteristics

`dionum` is an alias data type for `num` and consequently inherits its characteristics.

Related information

For information about	See
Summary input/output instructions	<i>Technical reference manual - RAPID Overview, section RAPID Summary - Input and output signals</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>
Alias data types	<i>Technical reference manual - RAPID Overview, section Basic Characteristics- Data types</i>

3.20 dir - File directory structure

Usage

`dir` (*directory*) is used to traverse directory structures.

Description

Data of the type `dir` contains a reference to a directory on disk or network. It can be linked to the physical directory by means of the instruction `OpenDir` and then used for reading.

Basic examples

The following example illustrates the data type `dir`:

Example 1

```

PROC lsdire(string dirname)
  VAR dir directory;
  VAR string filename;
  OpenDir directory, dirname;
  WHILE ReadDir(directory, filename) DO
    TPWrite filename;
  ENDWHILE
  CloseDir directory;
ENDPROC

```

This example prints out the names of all files or subdirectories under the specified directory.

Characteristics

`dir` is a non-value data type and cannot be used in value-oriented operations.

Related information

For information about	See
Open a directory	OpenDir - Open a directory on page 504
Make a directory	MakeDir - Create a new directory on page 343
Read a directory	ReadDir - Read next entry in a directory on page 1408
Close a directory	CloseDir - Close a directory on page 147
Remove a directory	RemoveDir - Delete a directory on page 585
Remove a file	RemoveFile - Delete a file on page 587
Rename a file	RenameFile - Rename a file on page 588
Check file type	IsFile - Check the type of a file on page 1324
File and I/O device handling	Application manual - Controller software OmniCore

3 Data types

3.21 dnum - Double numeric values

RobotWare Base

3.21 dnum - Double numeric values

Usage

dnum is used for numeric values, for example counters. It can handle larger integer values than data type num but its characteristics and function is the same as for num.

Description

The value of the dnum data type can be:

- An integer, for example -5
- A decimal number, for example 3.45

It can also be written exponentially, for example 2E3 (= $2 \cdot 10^3 = 2000$), 2.5E-2 (= 0.025).

Integers between -4503599627370496 and +4503599627370496 are always stored as exact integers.

Basic examples

The following examples illustrate the data type dnum:

Example 1

```
VAR dnum reg1;  
...  
reg1:=1000000;  
reg1 is assigned the value 1000000.
```

Example 2

```
VAR dnum hex;  
Var dnum bin;  
VAR dnum oct;  
! Hexadecimal representation of decimal value 4294967295  
hex := 0xFFFFFFFF;  
! Binary representation of decimal value 255  
bin := 0b11111111;  
! Octal representation of decimal value 255  
oct := 0o377;
```

Example 3

```
VAR dnum a:=0;  
VAR dnum b:=0;  
a := 10 DIV 3;  
b := 10 MOD 3;  
Integer division where a is assigned an integer (=3) and b is assigned the remainder (=1).
```

Limitations

Literal values between -4503599627370496 to 4503599627370496 assigned to a dnum variable are stored as exact integers.

Continues on next page

If a literal value that has been interpreted as a num is assigned/used as a dnum, it is automatically converted to a dnum.

Related information

For information about	See
Numeric values using data type num	num - Numeric values on page 1680
Numeric expressions	<i>Technical reference manual - RAPID overview, section Basic RAPID programming</i>
Operations using numeric values	<i>Technical reference manual - RAPID overview, section Basic RAPID programming</i>

3 Data types

3.22 errdomain - Error domain

RobotWare Base

3.22 errdomain - Error domain

Usage

`errdomain` (*error domain*) is used to specify an error domain.

Description

Data of the type `errdomain` represents the domain where the error, warning, or state changed is logged.

Basic examples

The following example illustrates the data type `errdomain`:

Example 1

```
VAR errdomain err_domain;  
VAR num err_number;  
VAR errtype err_type;  
VAR trapdata err_data;  
...  
TRAP trap_err  
  GetTrapData err_data;  
  ReadErrData err_data, err_domain, err_number, err_type;  
ENDTRAP
```

When an error is trapped to the trap routine `trap_err`, the error domain, the error number, and the error type are saved into appropriate variables.

Predefined data

The following predefined constants can be used to specify an error domain.

Name	Error Domain	Value
COMMON_ERR	All error and state changed domains	0
OP_STATE	Operational state change	1
SYSTEM_ERR	System errors	2
HARDWARE_ERR	Hardware errors	3
PROGRAM_ERR	Program errors	4
MOTION_ERR	Motion errors	5
OPERATOR_ERR	Operator errors - Obsolete, not used anymore	6
IO_COM_ERR	I/O and Communication errors	7
USER_DEF_ERR	User defined errors (raised by RAPID)	8
SAFETY_ERR	Safety related events	9
PROCESS_ERR	Process errors	11
CFG_ERR	Configuration error	12

Characteristics

`errdomain` is an alias data type for `num` and consequently inherits its characteristics.

Continues on next page

Related information

For information about	See
Ordering an interrupt on errors	<i>Error - Orders an interrupt on errors on page 253</i>
Error numbers	<i>Technical reference manual - Event logs for RobotWare 7</i>
Alias data types	<i>Technical reference manual - RAPID Overview</i>

3 Data types

3.23 errnum - Error number

RobotWare Base

3.23 errnum - Error number

Usage

errmsg is used to describe all recoverable (non fatal) errors that occur during program execution, such as division by zero.

Description

If the robot detects an error during program execution, this can be dealt with in the error handler of the routine. Examples of such errors are values that are too high and division by zero. The system variable ERRNO, of type errmsg, is thus assigned different values depending on the nature of an error. The error handler may be able to correct an error by reading this variable and then program execution can continue in the correct way.

An error can also be created from within the program using the RAISE instruction. This particular type of error can be detected in the error handler by specifying an error number (within the range 1-90 or booked with instruction BookErrNo) as an argument to RAISE.

Basic examples

The following examples illustrate the data type errmsg:

Example 1

```
reg1 := reg2 / reg3;
...
ERROR
  IF ERRNO = ERR_DIVZERO THEN
    reg3 := 1;
    RETRY;
  ENDIF
```

If reg3 = 0, the robot detects an error when division is taking place. This error, however, can be detected and corrected by assigning reg3 the value 1. Following this, the division can be performed again and program execution can continue.

Example 2

```
CONST errmsg machine_error := 1;
...
IF di1=0 RAISE machine_error;
...
ERROR
  IF ERRNO=machine_error RAISE;
```

An error occurs in a machine (detected by means of the input signal di1). A jump is made to the error handler in the routine which, in turn, calls the error handler of the calling routine where the error may possibly be corrected. The constant, machine_error, is used to let the error handler know exactly what type of error has occurred.

Continues on next page

Predefined data

The system variable `ERRNO` can be used to read the latest error that occurred. A number of predefined constants can be used to determine the type of error that has occurred.

Name	Cause of error
<code>ERR_ACC_TOO_LOW</code>	Too low acceleration/deceleration specified in instruction <code>PathAccLim</code> or <code>WorldAccLim</code> .
<code>ERR_ACTIV_PROF</code>	Error in the activated profile.
<code>ERR_ALIASCAM_DEF</code>	The camera in argument <code>CameraName</code> or the <code>cameradev</code> used in argument <code>FromCamera</code> is not defined in the system parameter <code>Communication</code> configuration. Or the <code>ToCamera</code> is not declared in the RAPID program or is already defined in the system parameter <code>Communication</code> configuration.
<code>ERR_ALIASIO_DEF</code>	The <code>FromSignal</code> is not defined in the I/O configuration or the <code>ToSignal</code> is not declared in the RAPID program or is defined in the I/O configuration. Instruction <code>AliasIO</code> .
<code>ERR_ALIASIO_TYPE</code>	The signal types for the arguments <code>FromSignal</code> and <code>ToSignal</code> is not the same (signalx). Instruction <code>AliasIO</code> .
<code>ERR_ALRDY_MOVING</code>	The robot is already moving when executing a <code>StartMove</code> or <code>StartMoveRetry</code> instruction.
<code>ERR_ALRDYCNT</code>	The interrupt variable is already connected to a trap routine.
<code>ERR_AO_LIM</code>	Analog signal value outside limit
<code>ERR_ARGDUPCND</code>	More than one present conditional argument for the same parameter
<code>ERR_ARGNAME</code>	Argument is an expression, not present, or of type <code>switch</code> when executing <code>ArgName</code> .
<code>ERR_ARGNOTPER</code>	Argument is not a persistent reference.
<code>ERR_ARGNOTVAR</code>	Argument is not a variable reference.
<code>ERR_ARGVALERR</code>	Argument value error.
<code>ERR_AXIS_ACT</code>	Axis is not active.
<code>ERR_AXIS_IND</code>	Axis is not independent.
<code>ERR_AXIS_MOVING</code>	Axis is moving.
<code>ERR_AXIS_PAR</code>	Parameter axis in instruction or function is wrong.
<code>ERR_BWDLIMIT</code>	Limit <code>StepBwdPath</code> .
<code>ERR_CALLPROC</code>	Procedure call error (not procedure) at runtime (late binding).
<code>ERR_CAM_BUSY</code>	The camera is busy with some other request and cannot perform the current order.
<code>ERR_CAM_COM_TIMEOUT</code>	The communication towards the camera timed out. The camera is not responding.
<code>ERR_CAM_GET_MISMATCH</code>	The parameter fetched from the camera with instruction <code>CamGetParameter</code> has the wrong data type.
<code>ERR_CAM_MAXTIME</code>	Timeout when executing a <code>CamLoadJob</code> or a <code>CamGetResult</code> instruction.
<code>ERR_CAM_NO_MORE_DATA</code>	No more vision results can be fetched.

Continues on next page

3 Data types

3.23 errnum - Error number

RobotWare Base

Continued

Name	Cause of error
ERR_CAM_NO_PROGMODE	The camera is not in program mode.
ERR_CAM_NO_RUNMODE	The camera is not in running mode.
ERR_CAM_NOT_ON_NETWORK	The camera is not connected.
ERR_CAM_NOT_VALID_LOAD_JOB	The loaded job is not a valid job, the name is too long or has invalid characters, or the camera is not in program mode
ERR_CAM_SET_MISMATCH	The parameter written to the camera with instruction CamSetParameter has the wrong data type, or the value is out of range.
ERR_CFG_ILL_DOMAIN	The cfgdomain used in instruction SaveCfgData is invalid or not in use.
ERR_CFG_ILLTYPE	Type mismatch - ReadCfgData, WriteCfgData.
ERR_CFG_INTERNAL	Not allowed to read or write internal parameter.
ERR_CFG_LIMIT	Data limit - WriteCfgData.
ERR_CFG_NOTFND	Not found - ReadCfgData, WriteCfgData.
ERR_CFG_OUTOFBOUNDS	If ListNo is -1 at input or bigger then number of available instances - ReadCfgData, WriteCfgData.
ERR_CFG_WRITEFILE	The directory does not exist, or the FilePath and File used is a directory, or some other problem regarding saving the file when using instruction SaveCfgData.
ERR_CNTNOTVAR	CONNECT target is not a variable reference.
ERR_CNV_CONNECT	The WaitWobj instruction is already active.
ERR_CNV_DROPPED	The object that the instruction WaitWobj was waiting for has been dropped.
ERR_CNV_NOT_ACT	The conveyor is not activated.
ERR_CNV_OBJ_LOST	The object that the instruction WaitWobj or WaitSensor was waiting for has passed the StartwindowWidth without being connected.
ERR_COLL_STOP	Stop of the movement because of motion collision.
ERR_CONC_MAX	The number of movement instructions in succession using argument \Conc has been exceeded.
ERR_DEV_MAXTIME	Timeout when executing a ReadBin, ReadNum, ReadStr, ReadStrBin, ReadAnyBin, or a ReadRawBytes instruction.
ERR_DIPLAG_LIM	Too big DipLag in the instruction TriggSpeed connected to current TriggL/TriggC/TriggJ/CapL/CapC.
ERR_DIVZERO	Division by zero.
ERR_EXCRTYMAX	Maximum number of retries exceeded. RAISE or TRYNEXT can be used to handle this error.
ERR_EXECPHR	An attempt was made to execute an instruction using a place holder.
ERR_FILEACC	A file is accessed incorrectly.
ERR_FILEEXIST	A file already exists.
ERR_FILEOPEN	A file cannot be opened.

Continues on next page

Name	Cause of error
ERR_FILNOTFND	File not found.
ERR_FIT_NOT_PLANE	Points are not on a plane. FitPlane and FitCircle instructions.
ERR_FIT_NUMPOINTS	Parameter NumPoints larger than array Points. All FitX instructions.
ERR_FIT_POINTS_IN_LINE	Identical points or collinear points. FitPlane, FitCircle, and FitSphere instructions.
ERR_FIT_POINTS_NOT_LINE	Points are not along a line (planar or spherical distribution). FitLine instruction.
ERR_FIT_POINTS_TOO_CLOSE	Identical points and n=2. FitLine instruction.
ERR_FIT_TOO_FEW_POINTS	Too few points. All FitX instructions.
ERR_FIT_TOO_MANY_POINTS	Too many points. FitCircle and FitSphere instructions.
ERR_FNCNORET	No return value.
ERR_FRAME	Unable to calculate new frame.
ERR_GO_LIM	Digital group signal value outside limit.
ERR_ILLDIM	Incorrect array dimension.
ERR_ILLQUAT	Attempt to use illegal orientation (quaternion) value.
ERR_ILLRAISE	Error number in RAISE out of range.
ERR_INDCNV_ORDER	An instruction requires execution of IndCnvInit before it is executed.
ERR_INOISSAFE	If trying to deactivate a safe interrupt temporarily with ISleep.
ERR_INOMAX	No more interrupt numbers available.
ERR_INT_MAXVAL	Not valid integer, too large or small value.
ERR_INT_NOTVAL	Not valid integer, decimal value.
ERR_INVDIM	Dimensions are not equal.
ERR_IODISABLE	Time-out when executing IODisable.
ERR_IOENABLE	Time-out when executing IOEnable.
ERR_IOERROR	I/O Error from instruction Save, Load and WaitLoad.
ERR_LINKREF	Reference error in the program task.
ERR_LOADED	The program module is already loaded.
ERR_LOADID_FATAL	Only internal use in LoadId and ManLoadIdProc.
ERR_LOADID_RETRY	Only internal use in LoadId.
ERR_LOADNO_INUSE	The load session is in use in StartLoad.
ERR_LOADNO_NOUSE	The load session is not in use in CancelLoad.
ERR_MOD_NOT_LOADED	The module does not exist, the symbol is not a module or the name was too long for being a symbol. Error from function ModTimeDnum.
ERR_MODULE	Incorrect module name in instruction Save and EraseModule.
ERR_NAME_INVALID	The I/O device name does not exist.

Continues on next page

3 Data types

3.23 errnum - Error number

RobotWare Base

Continued

Name	Cause of error
ERR_NETWORKSTATE	An IOActivate is done, but the I/O network is in error state or enters error state before the I/O device is activated.
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction AliasIO.
ERR_NO_SGUN	The specified servo tool name is not a configured servo tool.
ERR_NORUNUNIT	There is no contact with the I/O device.
ERR_NOT_MOVETASK	Specified task is a non-motion task.
ERR_NOTARR	Data is not an array.
ERR_NOTEQDIM	The array dimension used when calling the routine does not coincide with its parameters.
ERR_NOTINTVAL	Not an integer value.
ERR_NOTPRES	A parameter is used, despite the fact that the corresponding argument was not used at the routine call.
ERR_NOTSAVED	Module has been changed since it was loaded into the system.
ERR_NUM_LIMIT	Value is above 3.40282347E+38 or below -3.40282347E+38.
ERR_ORIENT_VALUE	Wrong orientation value in NOrient function.
ERR_OUTOFBND	The array index is outside the permitted limits.
ERR_OUTSIDE_REACH	The position (robtargt) is outside the robot's working area for function CalcJoinT.
ERR_OVERFLOW	Clock overflow.
ERR_PATH	Missing destination path in instruction Save.
ERR_PATH_STOP	Stop of the movement because of some process error.
ERR_PATHDIST	Too long regain distance for StartMove, StartMoveRetry or SetLeadThrough instruction.
ERR_PERSSUPSEARCH	The persistent variable is already TRUE at the beginning of the search process.
ERR_PID_MOVESTOP	Only internal use in LoadId and ManLoadIdProc.
ERR_PID_RAISE_PP	Error from ParIdRobValid, ParIdPosValid, LoadId or ManLoadIdProc.
ERR_PRGMEMFULL	Program memory full.
ERR_PROCSIGNAL_OFF	Process signal is off.
ERR_PROGSTOP	The robot is in program stop state when executing a StartMove, StartMoveRetry or SetLeadThrough instruction.
ERR_RANYBIN_CHK	Check sum error detected at data transfer with instruction ReadAnyBin.
ERR_RANYBIN_EOF	End of file is detected before all bytes are read in instruction ReadAnyBin or ReadRawBytes.
ERR_RCVDATA	An attempt was made to read non-numeric data with ReadNum.
ERR_REFUNKDAT	Reference to entire unknown data object.

Continues on next page

Name	Cause of error
ERR_REFUNKFUN	Reference to unknown function.
ERR_REFUNKPRC	Reference to unknown procedure at linking time or at run time (late binding).
ERR_REFUNKTRP	Reference to unknown trap.
ERR_RMQ_DIM	Wrong dimensions, the dimensions of the given data are not equal to the dimensions of the data in the message.
ERR_RMQ_FULL	Destination message queue is full.
ERR_RMQ_INVALID	Destination slot lost or invalid.
ERR_RMQ_INVMSG	Invalid message, likely sent from other client than a RAPID task.
ERR_RMQ_MSGSIZE	Size of message is too big. Decrease message size.
ERR_RMQ_NAME	The given slot name is not valid or not found.
ERR_RMQ_NOMSG	No message in queue, likely the results of power fail.
ERR_RMQ_TIMEOUT	Time-out occurred while waiting for answer in RMQSendWait or RMQReadWait.
ERR_RMQ_VALUE	The value syntax does not match the data type.
ERR_ROBLIMIT	The position is reachable, but at least one axis is outside the joint limits or limits exceeded for at least one coupled joint (function CalcJoint).
ERR_SGUN_ESTOP	Emergency stop during servo tool movement.
ERR_SGUN_MOTOFF	The instruction is invoked from a background task and the system is in motors off state.
ERR_SGUN_NEGVAL	The argument PrePos is specified with a value less than zero.
ERR_SGUN_NOTACT	The servo tool mechanical unit is not activated.
ERR_SGUN_NOTINIT	The servo tool position is not initialized.
ERR_SGUN_NOTOPEN	The gun is not open when the instruction is invoked.
ERR_SGUN_NOTSYNC	The servo tool tips are not synchronized.
ERR_SIG_NOT_VALID	The I/O signal cannot be accessed. The reasons can be that the I/O device is not running or an error in the configuration (only valid for ICI field bus).
ERR_SIGSUPSEARCH	The signal has already a positive value at the beginning of the search process.
ERR_SOCKET_ADDR_INUSE	The address and port is already in use and can not be used again. Use a different port number or address in SocketBind.
ERR_SOCKET_ADDR_INVALID	The specified address is invalid.
ERR_SOCKET_CLOSED	The socket is closed, or is not created.
ERR_SOCKET_EXEC_LEVEL	Use of socket instructions on different RAPID execution levels at the same time, that is, normal execution level and TRAP level.
ERR_SOCKET_IS_BOUND	The socket has already been bound to an address and cannot be bound again.
ERR_SOCKET_IS_CONN	The socket is connected.

Continues on next page

3 Data types

3.23 errnum - Error number

RobotWare Base

Continued

Name	Cause of error
ERR SOCK_MSG_SIZE	The datagram received is bigger than the buffer used to receive the data in.
ERR SOCK_NET_UNREACH	Network is unreachable or connection is lost after a socket is opened.
ERR SOCK_NOT_BOUND	The socket has not been bound to an address.
ERR SOCK_NOT_CONN	The socket is not connected
ERR SOCK_TIMEOUT	The connection was not established within the time-out time, or no data was received within the time out time.
ERR SOCK_UNSPEC	Unspecified exception from underlying call to the operating system.
ERR_SPEED_REFRESH_LIM	Override out of limit in SpeedRefresh.
ERR_SPEEDLIM_VALUE	The speed used in instructions SpeedLimAxis and SpeedLimCheckPoint is too low.
ERR_STARTMOVE	The robot is in hold state when executing a StartMove, StartMoveRetry or SetLeadThrough instruction.
ERR_STORE_PROF	Error in the stored profile.
ERR_STRTOOLNG	The string is too long.
ERR_SYM_ACCESS	Symbol read/write access error.
ERR_SYMBOL_TYPE	The data object and the variable used in argument Value is of different types. If using ALIAS datatypes, you will also get this ERROR, even though the types might have the same base data type. Instructions GetDataVal, SetDataVal and SetAllDataVal.
ERR_SYNCMOVEOFF	Time-out from SyncMoveOff.
ERR_SYNCMOVEON	Time-out from SyncMoveOn.
ERR_SYNTAX	Syntax error in the loaded module.
ERR_TASKNAME	Task name not found in the system.
ERR_TP_DIBREAK	A read instruction from FlexPendant was interrupted by a digital input.
ERR_TP_DOBREAK	A read instruction from FlexPendant was interrupted by a digital output.
ERR_TP_MAXTIME	Time-out when executing a read instruction from FlexPendant.
ERR_TP_NO_CLIENT	No client to interact with when using a read instruction from FlexPendant.
ERR_TRUSTLEVEL	Not allowed to disable I/O device.
ERR_TXTNOEXIST	Wrong table or index in function TextGet.
ERR_UDPUC_COMM	Communication timeout for the UdpUc device.
ERR_UI_BUTTONS	The argument Buttons of type buttondata has a not allowed value.
ERR_UI_ICON	The argument Icon of type icondata has a not allowed value.
ERR_UI_INITVALUE	Initial value error in function UINumEntry.

Continues on next page

Name	Cause of error
ERR_UI_MAXMIN	Min value is greater then max value in function UINumEntry, UIDnumEntry, UINumTune or UIDnumTune.
ERR_UI_NOTINT	Value is not an integer when specified that an integer should be used when using UINumEntry or UIDnumEntry. The range for integer values for num is -8388607 to 8388608 and for dnum it is -4503599627370496 to 4503599627370496.
ERR_UIDISPLAY_FATAL	Other error in instruction UIDisplay.
ERR_UNIT_PAR	Parameter Mech_unit in TestSignDefine is wrong.
ERR_UNKINO	Unknown interrupt number when executing instructions IWatch or ISleep.
ERR_UNKPROC	Incorrect reference to the load session in instruction WaitLoad.
ERR_UNLOAD	Unload error in instruction UnLoad or WaitLoad.
ERR_USE_PROF	Error in the used profile.
ERR_WAIT_MAXTIME	Time-out when executing a WaitDI, WaitDO, WaitAI, WaitAO, WaitGI, WaitGO, WaitUntil, WaitSensor or WaitWObj instruction.
ERR_WAITSYNCTASK	Time-out from WaitSyncTask.
ERR_WHLSEARCH	No search stop.
ERR_WOBJ_MOVING	The mechanical unit with work object is moving CalcJointT.

Characteristics

errnum is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Error recovery	<i>Technical reference manual - RAPID Overview</i>
Data types in general, alias data types	<i>Technical reference manual - RAPID Overview</i>

3 Data types

3.24 errstr - Error string

RobotWare Base

3.24 errstr - Error string

Usage

errstr is used to write text in error messages.

Basic examples

The following example illustrates the data type errstr:

Example 1

```
VAR errstr arg:= "This is an example";
```

```
ErrLog 4800, \W, ERRSTR_TASK, ERRSTR_CONTEXT, arg, ERRSTR_EMPTY,  
ERRSTR_EMPTY;
```

Predefined data

Name	Description
ERRSTR_EMPTY	Argument is empty, but exists in xml file. This is the case for 4800 to 4815 (see ErrLog - Write an error message on page 192). All these error messages have 5 arguments defined in the xml file.
ERRSTR_UNUSED	Argument is not used (see ErrRaise - Writes a warning and calls an error handler on page 196 , example 2)
ERRSTR_TASK	Name of current task
ERRSTR_CONTEXT	Context

Characteristics

errstr is an alias data type for string and consequently inherits its characteristics.

Related information

For information about	See
Write an error message	ErrLog - Write an error message on page 192
Write a warning and call an error handler	ErrRaise - Writes a warning and calls an error handler on page 196
Data types in general, alias data types	<i>Technical reference manual - RAPID Overview</i> , section <i>Basic characteristics - Data Types</i>

3.25 errtype - Error type

Usage

errtype (*error type*) is used to specify an error type.

Description

Data of the type errtype represents the type (state change, warning, error) of an error message.

Basic examples

The following example illustrates the data type errtype:

Example 1

```
VAR errdomain err_domain;  
VAR num err_number;  
VAR errtype err_type;  
VAR trapdata err_data;  
...  
TRAP trap_err  
  GetTrapData err_data;  
  ReadErrData err_data, err_domain, err_number, err_type;  
ENDTRAP
```

When an error is trapped to the trap routine trap_err, the error domain, the error number, and the error type are saved into appropriate variables.

Predefined data

The following predefined constants can be used to specify an error type.

Name	Error Type	Value
TYPE_ALL	Any type of error (state change, warning, error)	0
TYPE_STATE	State change (operational message)	1
TYPE_WARN	Warning (such as RAPID recoverable error)	2
TYPE_ERR	Error	3

Characteristics

errtype is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Ordering an interrupt on errors	!Error - Orders an interrupt on errors on page 253
Error numbers	<i>Technical reference manual - Event logs for RobotWare 7</i>
Alias data types	<i>Technical reference manual - RAPID Overview</i>

3 Data types

3.26 event_type - Event routine type

RobotWare Base

3.26 event_type - Event routine type

Usage

event_type is used to represent the actual event routine type with a symbolic constant.

Description

With the function EventType, it is possible to check if the actual RAPID code is executed because of some specific system event or not.

Basic examples

The following example illustrates the data type event_type:

Example 1

```
VAR event_type my_type;  
...  
my_type := EventType( );
```

The event routine type that is executed will be stored in the variable my_type.

Predefined data

Following constants of type event_type are predefined:

RAPID constant	Value	Type of event executed
EVENT_NONE	0	No event is executed
EVENT_POWERON	1	POWER_ON event
EVENT_START	2	START event
EVENT_STOP	3	STOP event
EVENT_QSTOP	4	QSTOP event
EVENT_RESTART	5	RESTART event
EVENT_RESET	6	RESET event
EVENT_STEP	7	STEP event

Characteristics

event_type is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Event routines in general	<i>Technical reference manual - System parameters</i> , section <i>Controller - Event Routine</i>
Get event type	EventType - Get current event type inside any event routine on page 1244
Data types in general, alias data types	<i>Technical reference manual - RAPID Overview</i> , section <i>Basic characteristics - Data types</i>

3.27 exec_level - Execution level

Usage

exec_level is used to specify program execution level.

Description

With the function ExecLevel, it is possible to get the actual execution level for the RAPID code that currently is executed.

Predefined data

The following constants of type exec_level are predefined:

RAPID constant	Value	Execution level
LEVEL_NORMAL	0	Execute on base level
LEVEL_TRAP	1	Execute in trap routine
LEVEL_SERVICE	2	Execute in service routine ⁱ

ⁱ With LEVEL_SERVICE means event routine, service routine (including Call Routine) and interrupt routine from system input signal.

Characteristics

exec_level is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Get current execution level	ExecLevel - Get execution level on page 1247

3 Data types

3.28 extjoint - Position of external joints

RobotWare Base

3.28 extjoint - Position of external joints

Usage

`extjoint` is used to define the axis positions of additional axes, positioners, or workpiece manipulators.

Description

The robot can control up to six additional axes in addition to its six internal axes, i.e. a total of twelve axes. The six additional axes are logically denoted: a, b, c, d, e, f. Each such logical axis can be connected to a physical axis and, in this case, the connection is defined in the system parameters.

Data of the type `extjoint` is used to hold position values for each of the logical axes a - f.

For each logical axis connected to a physical axis, the position is defined as follows:

- For rotating axes– the position is defined as the rotation in degrees from the calibration position.
- For linear axes – the position is defined as the distance in mm from the calibration position.

If a logical axis is not connected to a physical one then the value 9E9 is used as a position value, indicating that the axis is not connected. At the time of execution, the position data of each axis is checked and it is checked whether or not the corresponding axis is connected. If the stored position value does not comply with the actual axis connection, the following applies:

- If the position is not defined in the position data (value is 9E9) then the value will be ignored if the axis is connected and not activated. But if the axis is activated, it will result in an error.
- If the position is defined in the position data, although the axis is not connected, then the value will be ignored.

No movement is performed but no error is generated for an axis with valid position data if the axis is not activated.

If an additional axis offset is used (instruction `EOffsOn` or `EOffsSet`) then the positions are specified in the `ExtOffs` coordinate system.

If an additional axis is running in independent mode and a new movement shall be performed by the robot and its additional axes, then the position data for the additional axes in independent mode must not be 9E9. The data must be an arbitrary value that is not used by the system.

Basic examples

The following example illustrates the data type `extjoint`:

Example 1

```
VAR extjoint axpos10 := [ 11, 12.3, 9E9, 9E9, 9E9, 9E9 ] ;
```

The position of an external positioner, `axpos10`, is defined as follows:

- The position of the external logical axis “a” is set to 11, expressed in degrees or mm (depending on the type of axis).

Continues on next page

- The position of the external logical axis“ b” is set to 12 . 3, expressed in degrees or mm (depending on the type of axis).
- Axes c to f are undefined.

Components

eax_a

external axis a

Data type: num

The position of the external logical axis“ a” expressed in degrees or mm (depending on the type of axis).

...

eax_f

external axis f

Data type: num

The position of the external logical axis“ f” expressed in degrees or mm (depending on the type of axis).

Structure

```
< dataobject of extjoint >
  < eax_a of num >
  < eax_b of num >
  < eax_c of num >
  < eax_d of num >
  < eax_e of num >
  < eax_f of num >
```

Related information

For information about	See
Position data	robtargt - Position data on page 1715 jointtarget - Joint position data on page 1661
ExtOffs coordinate system	EOffsOn - Activates an offset for additional axes on page 186

3 Data types

3.29 flypointdata - Data for flying start/end *Continuous Application Platform*

3.29 flypointdata - Data for flying start/end

Usage

flypointdata is used to define all data of flying start or flying end for a CAP process - it is part of capdata for both flying start and flying end.

Definitions

flypointdata defines data for both flying start and flying end:

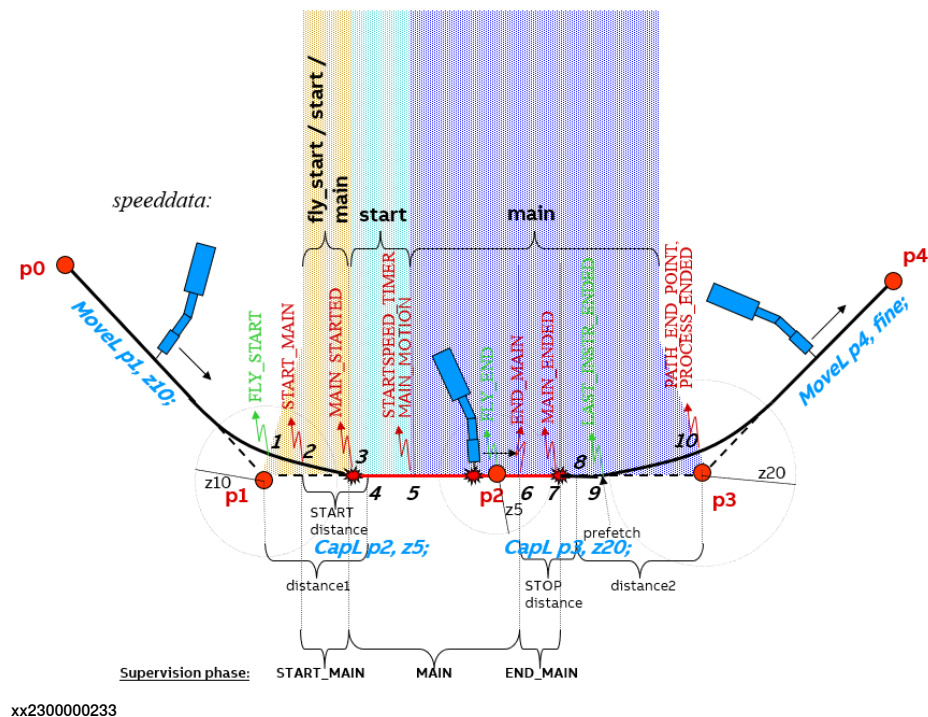
- This functionality is only available for CAP.
- Flying start is triggered by the combination of *first instruction = TRUE* and zone point.
- Flying end is triggered by the combination of *last_instr = TRUE* and zone point.
- Weavestart will be ignored.
- If the starting point is a fine point, no flying start will be performed.
- If the end point is a fine point, no flying end will be performed.
- Motion delay will be ignored.
- Restart after an error will work in the same way as usual: there are no specific features for flying start, scrape start is available, if the application process was active, when the error occurred.
- If weaving is activated, the transition in the zone is made by ramping in the weaving pattern starting at the entrance to the zone until the full pattern is reached when the TCP leaves the zone.
- Supervision is active during START phase (with moving TCP), MAIN phase and END_MAIN phase (with moving TCP).
- Backing on the path will be limited to backing to position 4 (see the following figure).
- The user has to adapt distance and the approach and leaving angle to the application process: for example, for arc welding at the point where the arc shall be established (point 4 in the figure) has to be selected in such a way, that it is possible to ignite.
- The distance between position 4 and 6 must not be = 0.
- The START process_dist must be equal to or shorter than START distance.
- If program execution is stopped and the application process is active (between positions 3 and 6), CAP will behave as usual, that is, backing on path (only if pos. 4 had been passed), weave start, motion delay and movement start timeout are available.
- If program execution is stopped between positions 1 and 3 or between positions 7 and 10, the CapX instruction will behave like a TrigX instruction.
- The first CAP segment with flying start is recommended to be at least START distance long.

Continues on next page

3.29 flypointdata - Data for flying start/end

Continuous Application Platform
Continued

- If the first segment is shorter than START distance, but longer than START process_dist, the positions 2 and 4 will be moved towards position 1.
- If the first segment is shorter than or equal START process_dist, positions 1 and 2 will coincide and position 4 will be at the end of the segment.
- The last CAP segment with flying end is recommended to be at least END distance + END process_dist long.
- If the last segment is shorter than END distance + END process_dist, but longer than END process_dist, the positions 7 and 9 will be moved towards position 10.
- If the last segment is shorter than or equal END process_dist, positions 8 and 10 will coincide and position 6 will be at the start of the segment.
- The START phase timeout specified in capdata will only be used at restart of the application process.
- If a process error occurs after the prefetch request from motion has arrived at the last CAP instruction (after position 9), that is, PGM is released from the CAP instruction and may continue with the next instruction, an error log message is sent, the process is stopped, *but* the robot movement continues.



Components

process_dist

Data type: num

The distance (in mm) within which the process is started (for *flying start*) or ended (for *flying end*).

distance

Data type: num

Continues on next page

3 Data types

3.29 flypointdata - Data for flying start/end

Continuous Application Platform

Continued

Sets the start/end of the supervision of the CAP process as a distance (in mm) from the start/end point.

Structure

```
< databases of flypointdata >  
< process_dist of num >  
< distance of num >
```

Related information

	Described in:
capdata data type	capdata - CAP data on page 1605
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>

3.30 handler_type - Type of execution handler

Usage

handler_type is used to specify type of execution handler in RAPID program routine.

Description

With the function ExecHandler, it is possible to check if the actual RAPID code is executed in some execution handler in RAPID program routine.

Basic examples

The following example illustrates the data type handler_type:

Example 1

```
VAR handler_type my_type;
...
my_type := ExecHandler( );
```

The type of execution handler that the code is executed in, will be stored in the variable my_type.

Predefined data

Following constants of type handler_type are predefined:

RAPID constant	Value	Type of execution handler
HANDLER_NONE	0	Not executed in any handler
HANDLER_BWD	1	Executed in BACKWARD handler
HANDLER_ERR	2	Executed in ERROR handler
HANDLER_UNDO	3	Executed in UNDO handler

Characteristics

handler_type is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Get type of execution handler	ExecHandler - Get type of execution handler on page 1246

3 Data types

3.31 icondata - Icon display data

RobotWare Base

3.31 icondata - Icon display data

Usage

icondata is used for representing standard icons on the User Device such as the FlexPendant.

Description

An icondata enumeration constant may be passed to the Icon argument in the instructions UIMsgBox, UIMsgWrite, WaitAI, WaitAO, WaitDI, WaitDO, WaitGI, WaitGO and WaitUntil and functions UIMessageBox, UINumEntry, UIDnumEntry, UINumTune, UIDnumTune, UIAlphaEntry and UIListView.

Basic examples

The following example illustrates the data type icondata:

Example 1

```
VAR btnres answer;  
  
UIMsgBox "More ?" \Buttons:=btnYesNo \Icon:=iconInfo \Result:=  
    answer;  
IF answer= resYes THEN  
    ...  
ELSEIF answer =ResNo THEN  
    ...  
ENDIF
```

The standard button enumeration constant iconInfo will give an information icon at the head of the message box on the user interface.

Predefined data

The following constants of the data type icondata are predefined in the system:

Value	Constant	Icon
0	iconNone	No icon
1	iconInfo	Information icon
2	iconWarning	Warning icon
3	iconError	Error icon
4	iconQuestion	Question icon

Characteristics

icondata is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
User Interaction Message Box	UIMsgBox - User Message Dialog Box type basic on page 964

Continues on next page

For information about	See
User Interaction Message Box	UIMessageBox - User Message Box type advanced on page 1556
User Interaction Number Entry	UINumEntry - User Number Entry on page 1565
User Interaction Number Tune	UINumTune - User Number Tune on page 1573
User Interaction Alpha Entry	UIAlphaEntry - User Alpha Entry on page 1524
User Interaction List View	UIListView - User List View on page 1547
Data types in general, alias data types	<i>Technical reference manual - RAPID Overview, section Basic Characteristics - Data Types</i>

3 Data types

3.32 identno - Identity for move instructions

MultiMove - Coordinated Robots

3.32 identno - Identity for move instructions

Usage

`identno` (*Identity Number*) is used to control synchronizing of two or more coordinated synchronized movements with each other.

The data type `identno` can only be used in a *MultiMove* system with option *Coordinated Robots* and only in program tasks defined as Motion Task.

Description

Move instructions in a *MultiMove* system must be programmed with parameter `\ID` of data type `identno`, if coordinated synchronized movement, and `\ID` is not allowed in any other cases.

The specified `\ID` number must be the same in all cooperating program tasks. The id number gives a guarantee that the movements are not mixed up at runtime.

In coordinated synchronized mode, there must be the same amount of executed move instructions in all program tasks. The optional parameter `\ID` of data type `identno` will be used to check that associated move instructions are run in parallel before the start of the movements. The `\ID` number must be the same in the move instructions that are run in parallel.

The user does not have to declare any variable of type `identno`, but can use a number directly in the instructions (see *Basic examples*).

Basic examples

The following example illustrates the data type `identno`:

Example 1

```
PERS tasks task_list{2} := ["T_ROB1"],["T_ROB2"];
VAR syncident sync1;
VAR syncident sync2;

PROC proc1()
...
SyncMoveOn sync1, task_list;
MoveL *\ID:=10,v100,z50,mytool;
MoveL *\ID:=20,v100,fine,mytool;
SyncMoveOff sync2;
...
ENDPROC
```

Characteristics

`identno` is an alias data type for `num` and thus inherits its properties.

Related information

For information about	See
Alias data types	<i>Technical reference manual - RAPID Overview</i> , section <i>Basic Characteristics - Data types</i>

Continues on next page

3.32 identno - Identity for move instructions

MultiMove - Coordinated Robots

Continued

For information about	See
Start coordinated synchronized movements	SyncMoveOn - Start coordinated synchronized movements on page 811
End coordinated synchronized movements	SyncMoveOff - End coordinated synchronized movements on page 805

3 Data types

3.33 intnum - Interrupt identity

RobotWare Base

3.33 intnum - Interrupt identity

Usage

`intnum` (*interrupt numeric*) is used to identify an interrupt.

Description

When a variable of type `intnum` is connected to a trap routine, it is given a specific value identifying the interrupt. This variable is then used in all dealings with the interrupt, such as when ordering or disabling an interrupt.

More than one interrupt identity can be connected to the same trap routine. The system variable `INTNO` can thus be used in a trap routine to determine the type of interrupt that occurs.

A variable of the type `intnum` must always be declared global in the module.

Basic examples

The following examples illustrate the data type `intnum`:

Example 1

```
VAR intnum feeder_error;
...
PROC main()
  CONNECT feeder_error WITH correct_feeder;
  ISignalDI di1, 1, feeder_error;
```

An interrupt is generated when the input `di1` is set to 1. When this happens, a call is made to the `correct_feeder` trap routine.

Example 2

```
VAR intnum feeder1_error;
VAR intnum feeder2_error;
...
PROC init_interrupt()
...
  CONNECT feeder1_error WITH correct_feeder;
  ISignalDI di1, 1, feeder1_error;
  CONNECT feeder2_error WITH correct_feeder;
  ISignalDI di2, 1, feeder2_error;
...
ENDPROC
...
TRAP correct_feeder
  IF INTNO=feeder1_error THEN
    ...
  ELSE
    ...
  ENDIF
...
ENDTRAP
```

Continues on next page

An interrupt is generated when either of the inputs di1 or di2 is set to 1. A call is then made to the correct_feeder trap routine. The system variable INTNO is used in the trap routine to find out which type of interrupt has occurred.

Limitations

The maximum number of active variables of type intnum at any one time (between CONNECT and IDelete) is limited to 100. The maximum number of interrupts, in the queue for execution of trap routine at any one time, is limited to 30.

Characteristics

Intnum is an alias data type for num and thus inherits its properties.

Related information

For information about	See
Summary of interrupts	<i>Technical reference manual - RAPID Overview, section RAPID Summary - Interrupts</i>
Alias data types	<i>Technical reference manual - RAPID Overview, section Basic Characteristics - Data Types</i>
Connecting interrupts	<i>CONNECT - Connects an interrupt to a trap routine on page 155</i>

3 Data types

3.34 iODEV - I/O device

RobotWare Base

3.34 iODEV - I/O device

Usage

iODEV (*I/O device*) is used for I/O devices and files.

Description

Data of the type iODEV contains a reference to a file or I/O device. It can be linked to the physical unit by means of the instruction Open and then used for reading and writing.

Basic examples

The following example illustrates the data type iODEV:

Example 1

```
VAR iODEV file;  
...  
Open "HOME:/LOGDIR/INFILE.DOC", file\Read;  
input := ReadNum(file);
```

The file INFILE.DOC is opened for reading. When reading from the file, file is used as a reference instead of the file name.

Characteristics

iODEV is a non-value data type.

Limitations

Any number of I/O devices (iODEV) can be declared but it is only possible to have 12 open I/O devices and files at the same time.

Related information

For information about	See
Communication via I/O devices	<i>Technical reference manual - RAPID Overview, section RAPID Summary - Communication</i>
Configuration of I/O devices	<i>Technical reference manual - System parameters</i>
Characteristics of non-value data types	<i>Technical reference manual - RAPID Overview, section Basic Characteristics - Data Types</i>
File and I/O device handling	<i>Application manual - Controller software Omni-Core</i>

3.35 iodevice_state - State of I/O device

Usage

iodevice_state is used to mirror which state an I/O device is currently in.

Description

An iodevice_state constant is intended to be used when checking the return value from the function IODeviceState.

Basic examples

The following example illustrates the data type iodevice_state:

Example 1

```
IF (IODeviceState ("UNIT1" \Phys) = IO_DEVICE_PHYS_STATE_ACCESSIBLE)
    THEN
        ! Possible to access some signal on the I/O device
    ELSE
        ! Read/Write some signal on the I/O device result in error
    ENDIF
```

Test is done if the I/O device UNIT1 is up and running.

Predefined data

The predefined symbolic constants of the data type iodevice_state are found in the function IODeviceState.

Characteristics

iodevice_state is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Get current state of I/O device	IODeviceState - Get current state of I/O device on page 1312
Input/output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

3 Data types

3.36 ionetwork_state - State of I/O network *RobotWare Base*

3.36 ionetwork_state - State of I/O network

Usage

ionetwork_state is used to mirror which state an I/O network is currently in.

Description

An ionetwork_state constant is intended to be used when checking the return value from the function IONetworkState.

Basic examples

The following example illustrates the data type ionetwork_state:

Example 1

```
IF (IONetworkState ("EthernetIP" \Phys) =  
    IO_NETWORK_PHYS_STATE_ACCESSIBLE) THEN  
    ! Possible to access some signal on the I/O device  
ELSE  
    ! Read/Write some signal on the I/O device result in error  
ENDIF
```

Test is done if the I/O network EthernetIP is up and running.

Predefined data

The predefined symbolic constants of the data type ionetwork_state are found in the function IONetworkState.

Characteristics

ionetwork_state is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Get current state of I/O network	IONetworkState - Get current state of I/O network on page 1315
Input/output instructions	<i>Technical reference manual - RAPID Overview</i>
Input/output functionality in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>

3.37 jointtarget - Joint position data

Usage

jointtarget is used to define the position that the robot and the external axes will move to with the instruction MoveAbsJ.

Description

jointtarget defines each individual axis position, for both the robot and the external axes.

Basic examples

The following example illustrates the data type jointtarget:

Example 1

```
CONST jointtarget calib_pos := [ [ 0, 0, 0, 0, 0, 0], [ 0, 9E9,
                                9E9, 9E9, 9E9, 9E9] ];
```

The normal calibration position for IRB2400 is defined in calib_pos by the data type jointtarget. The normal calibration position 0 (degrees or mm) is also defined for the external logical axis a. The external axes b to f are undefined.

Components

robax

robot axes

Data type: robjoint

Axis positions of the robot axes in degrees.

Axis position is defined as the rotation in degrees for the respective axis (arm) in a positive or negative direction from the axis calibration position.

extax

external axes

Data type: extjoint

The position of the external axes.

The position is defined as follows for each individual axis (eax_a, eax_b . . . eax_f):

- For rotating axes, the position is defined as the rotation in degrees from the calibration position.
- For linear axes, the position is defined as the distance in mm from the calibration position.

External axes eax_a . . . are logical axes. How the logical axis number and the physical axis number are related to each other is defined in the system parameters.

Continues on next page

3 Data types

3.37 jointtarget - Joint position data

RobotWare Base

Continued

The value 9E9 is defined for axes which are not connected. If the axes defined in the position data differ from the axes that are actually connected on program execution, the following applies:

- If the position is not defined in the position data (value 9E9) the value will be ignored, if the axis is connected and not activated. But if the axis is activated it will result in error.
- If the position is defined in the position data, although the axis is not connected, the value is ignored.

No movement is performed but no error is generated for an axis with valid position data, if the axis is not activated. This is the default behavior. To change it, set the system parameter *ReportNonActiveSingles* to *Yes*. Then, the RAPID execution will stop, and an event log is reported.

If some external axis is running in independent mode and some new movement shall be performed by the robot and its external axes then the position data for the external axis in independent mode must not be 9E9 but some arbitrary value (not used but the system).

Structure

```
< dataobject of jointtarget >
  < robax of robjoint >
    < rax_1 of num >
    < rax_2 of num >
    < rax_3 of num >
    < rax_4 of num >
    < rax_5 of num >
    < rax_6 of num >
  < extax of extjoint >
    < eax_a of num >
    < eax_b of num >
    < eax_c of num >
    < eax_d of num >
    < eax_e of num >
    < eax_f of num >
```

Related information

For information about	See
Move to joint position	MoveAbsJ - Moves the robot to an absolute joint position on page 386 MoveExtJ - Move one or several mechanical units without TCP on page 427
<i>ReportNonActiveSingles</i>	<i>Technical reference manual - System parameters, topic Controller, type General Rapid</i>
Positioning instructions	<i>Technical reference manual - RAPID Overview, section RAPID summary - Motion</i>
Configuration of external axes	<i>Application manual - Additional axes</i>

3.38 listitem - List item data structure

Usage

`listitem` is used to define menu lines that include text with optional small icons on the User Device such as the FlexPendant.

Description

Data of the type `listitem` allows the user to define menu lines for the function `UIListView`.

Basic example

The following example illustrates the data type `listitem` :

Example 1

```
CONST listitem list {3}:=[[stEmpty, "Item1"], [stEmpty, "Item2"],  
[stEmpty, "Item3"]];
```

A menu list with Item1....Item3 to use in function `UIListView`.

Components

The data type has the following components:

image

Data type: string

The path including file name for the icon image to display (not implemented in this software release).

Use empty string "" or `stEmpty` if no icon to display.

text

Data type: string

The text for the menu line to display.

Structure

```
<dataobject of listitem>  
  <image of string>  
  <text of string>
```

Related information

For information about	See
User Interaction ListView	UIListView - User List View on page 1547

3 Data types

3.39 loaddata - Load data

RobotWare Base

3.39 loaddata - Load data

Usage

loaddata is used to describe loads attached to the mechanical interface of the robot (the robot's mounting flange).

Load data usually defines the payload or grip load (set up by the instruction GripLoad or MechUnitLoad for positioners) of the robot, that is, the load held in the robot gripper. loaddata is also used as part of tooldata to describe the tool load.

Description

Specified loads are used to set up a dynamic model of the robot so that the robot movements is controlled in the best possible way.



WARNING

It is important to always define the actual tool load and, when used, the payload of the robot (for example, a gripped part). Incorrect definitions of load data can result in overloading of the robot mechanical structure. There is also a risk that the speed in manual reduced speed mode can be exceeded.

When incorrect load data is specified, it can often lead to the following consequences:

- The robot may not use its maximum capacity.
- Impaired path accuracy including a risk of overshooting.
- Risk of overloading the mechanical structure.

The controller continuously monitors the load and writes an event log if the load is higher than expected. This event log is saved and logged in the controller memory.

Basic examples

The following examples illustrate the data type loaddata:

Example 1

```
PERS loaddata piece1 := [ 5, [50, 0, 50], [1, 0, 0, 0], 0, 0, 0];
```

The payload moved by a robot held tool in the figure [Robot held tool on page 1666](#) is described using the following values:

- Weight 5 kg.
- The center of gravity is $x = 50$, $y = 0$, and $z = 50$ mm in the tool or wrist coordinate system (depending on the system parameter *PayLoadsInWrist*)
- The payload is a point mass

Example 2

```
Set gripper;  
WaitTime 0.3;  
GripLoad piece1;
```

Continues on next page

Connection of the payload, piece1, specified at the same time as the robot grips the load.

Example 3

```
Reset gripper;
WaitTime 0.3;
GripLoad load0;
```

Disconnection of the payload, specified at the same time as the robot releases a payload.

Example 4

```
PERS loaddata piece2 := [ 5, [50, 50, 50], [0, 0, 1, 0], 0, 0, 0];
PERS wobjdata wobj2 :=[ TRUE, TRUE, "", [ [0, 0, 0], [1, 0, 0, 0]
], [ [50, -50, 200], [0.5, 0, -0.866, 0] ] ];
```

The payload moved according to the stationary tool in the figure [Stationary tool on page 1667](#) is described using the following values for the loaddata:

- Weight 5 kg
- The center of gravity is $x = 50$, $y = 50$ and $z = 50$ mm in the object coordinate system for work object wobj2
- The payload coordinate system/axes of moments are rotated 180° around Y" according to the object coordinate system
- The payload is a point mass

The following values are used for the wobjdata:

- The robot is holding the work object
- The fixed user coordinate system is used, that is, the user coordinate system is the same as wrist coordinate system
- The object coordinate system is rotated -120° around Y and the coordinates of its origin are $x = 50$, $y = -50$ and $z = 200$ mm in the user coordinate system

Predefined data

The load load0 defines a payload, with the mass equal to 0 kg, that is, no load at all. This load is used as the argument in the instructions GripLoad and MechUnitLoad to disconnect the payload.

The load load0 can always be accessed from the program, but cannot be changed (it is stored in the system module BASE).

```
PERS loaddata load0 := [ 0.001, [0, 0, 0.001], [1, 0, 0, 0], 0, 0
, 0 ];
```

Components



Note

In this description, loaddata is only described as used for payload. As used for tool load, see [tooldata - Tool data on page 1753](#).

mass

Data type: num

Continues on next page

3 Data types

3.39 loaddata - Load data

RobotWare Base

Continued

The mass (weight) of the load in kg.

cog

center of gravity

Data type: pos

The center of gravity of the payload expressed in mm in the tool coordinate system if the robot is holding the tool. If a stationary tool is used then the center of gravity for the payload held by the gripper is expressed in the object frame of the work object coordinate system moved by the robot.

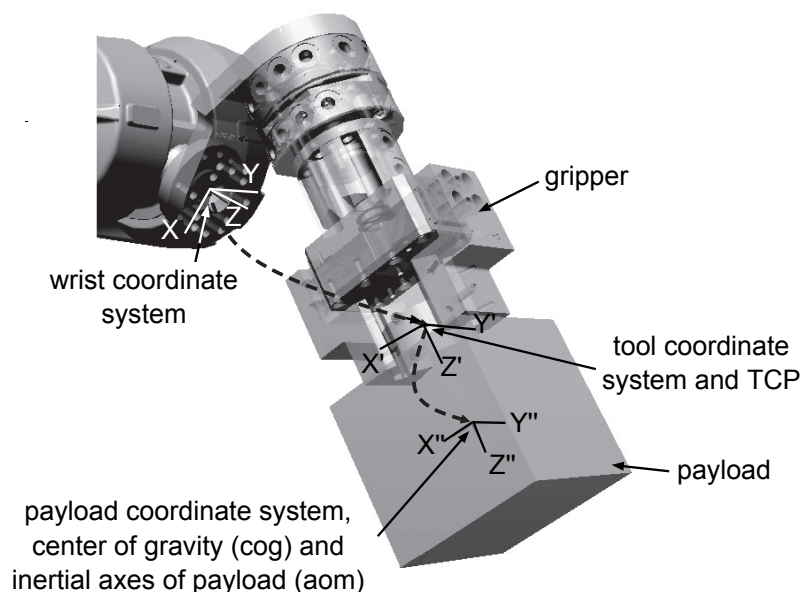
aom

axes of moment

Data type: orient

The orientation of the axes of moment. These are the principal axes of the payload moment of inertia with origin in cog. If the robot is holding the tool, the axes of moment are expressed in the tool coordinate system.

The figure shows the center of gravity and inertial axes of the payload.



xx1100000515

Figure 3.1: Robot held tool

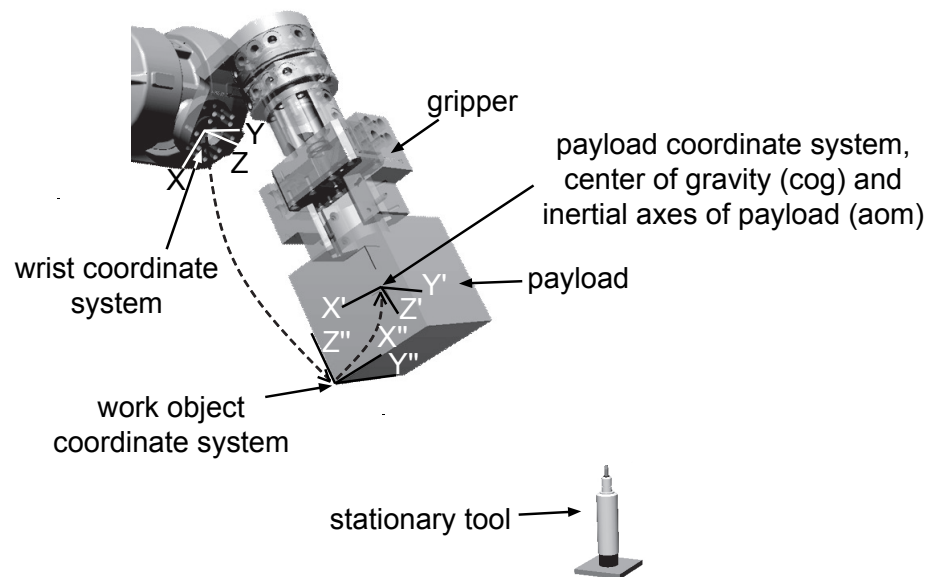


Note

If *PayloadsInWristCoords* is used, the axes of moment for the payload for the robot held tool are expressed in the wrist coordinate system. For more information see *Technical reference manual - System parameters*, section *PayloadsInWristCoords*.

Continues on next page

The axes of moment are expressed in the object coordinate system if a stationary tool is used.



xx1100000516

Figure 3.2: Stationary tool



Note

If *PayloadsInWristCoords* or *StationaryPayloadMode* is used, the axes of moment for the payload for the stationary tool are expressed in the wrist coordinate system. See *Technical reference manual - System parameters*, sections *PayloadsInWristCoords* and *StationaryPayloadMode*.

ix

inertia x

Data type: num

The moment of inertia of the load around the x-axis of moment expressed in kgm^2 .

Correct definition of the moments of inertia will allow optimal utilization of the path planner and axes control. This may be of special importance when handling large sheets of metal, and so on. All moments of inertia *ix*, *iy*, and *iz* equal to 0 kgm^2 imply a point mass.

Normally, the moments of inertia must only be defined when the distance from the mounting flange to the center of gravity is less than the maximal dimension of the load (see the following figure).

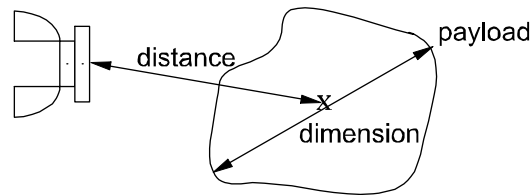
Continues on next page

3 Data types

3.39 loaddata - Load data

RobotWare Base

Continued



xx0500002372

iy

inertia y

Data type: num

The moment of inertia of the load around the y-axis, expressed in kgm^2 .

For more information, see ix.

iz

inertia z

Data type: num

The moment of inertia of the load around the z-axis, expressed in kgm^2 .

For more information, see ix.

Limitations

The payload should only be defined as a persistent variable (PERS) and not within a routine. Current values are then saved when saving the program and are retrieved on loading.

Arguments of the type loaddata in the GripLoad and MechUnitLoad instruction should only be an entire persistent (not array element or record component).

Structure

```
<dataobject of loaddata>
  <mass of num>
  <cog of pos>
    <x of num>
    <y of num>
    <z of num>
  <aom of orient>
    <q1 of num>
    <q2 of num>
    <q3 of num>
    <q4 of num>
  <ix of num>
  <iy of num>
  <iz of num>
```

Continues on next page

Related information

For information about	See
Coordinate systems	<i>Technical reference manual - RAPID Overview</i>
Definition of tool loads	tooldata - <i>Tool data on page 1753</i>
Define payload for robots	GripLoad - <i>Defines the payload for a robot on page 239</i>
Define payload for mechanical units	MechUnitLoad - <i>Defines a payload for a mechanical unit on page 376</i>
Load identification of tool load, payload or arm load	<i>Operating manual - OmniCore</i>
Definition of arm loads	<i>Technical reference manual - System parameters, see How to define arm loads</i>
<i>PayLoadsInWrist</i>	<i>Technical reference manual - System parameters</i>
Definition of work object data	wobjdata - <i>Work object data on page 1775</i>
PayloadsInWristCoords StationaryPayloadMode	<i>Technical reference manual - System parameters, topic Controller, type General Rapid</i>

3 Data types

3.40 loadidnum - Type of load identification

RobotWare Base

3.40 loadidnum - Type of load identification

Usage

loadidnum is used to represent an integer with a symbolic constant.

Description

A loadidnum constant is intended to be used for load identification of tool or payload as arguments in instruction LoadId. See the following example.

Basic examples

The following example illustrates the data type loadidnum:

Example 1

```
! Load modules into the system
Load \Dynamic, "RELEASE:/system/mockit.sysx";
Load \Dynamic, "RELEASE:/system/mockit1.sysx";
%"LoadId"% TOOL_LOAD_ID, MASS_WITH_AX3, gun1;
```

Load identification of tool gun1 with identification of mass with movements of robot axis 3 with use of predefined constant MASS_WITH_AX3 of data type loadidnum.

Predefined data

The following symbolic constants of the data type loadidnum are predefined and is used as arguments in instruction LoadId.

Value	Symbolic constant	Comment
1	MASS_KNOWN	Known mass in tool or payload respectively.
2	MASS_WITH_AX3	Unknown mass in tool or payload. Identification of mass will be done with movements of axis 3

Characteristics

loadidnum is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Predefined program Load Identify	<i>Operating manual - OmniCore</i> , section <i>Programming and testing - Service routines- LoadIdentify</i> , <i>load identification and service routines</i>
Valid robot type	ParldRobValid - <i>Valid robot type for parameter identification on page 1375</i>
Valid robot position	ParldPosValid - <i>Valid robot position for parameter identification on page 1372</i>
Load identification with complete example	LoadId - <i>Load identification of tool or payload on page 337</i>

3.41 loadsession - Program load session

Usage

loadsession is used to define different load sessions of RAPID program modules.

Description

Data of the type loadsession is used in the instructions StartLoad and WaitLoad to identify the load session. loadsession only contains a reference to the load session.

Characteristics

loadsession is a non-value data type and cannot be used in value-oriented operations.

Related information

For information about	See
Loading program modules during execution	StartLoad - Load a program module during execution on page 759 WaitLoad - Connect the loaded module to the task on page 1031
Characteristics of non-value data types	<i>Technical reference manual - RAPID Overview</i> , section <i>Basic characteristics - Data types</i>

3 Data types

3.42 mecunit - Mechanical unit

RobotWare Base

3.42 mecunit - Mechanical unit

Usage

`mecunit` is used to define the different mechanical units which can be controlled and accessed from the program.

The names of the mechanical units are defined in the system parameters and, consequently, must not be defined in the program.

Description

Data of the type `mecunit` only contains a reference to the mechanical unit.

Basic examples

The following example illustrates the data type `mecunit`:

Example 1

```
IF TaskRunRob() THEN
  IndReset ROB_ID, 6;
ENDIF
```

If actual program task controls a robot, reset axis 6 for the robot.

Predefined data

All the mechanical units defined in the system parameters are predefined in every program task. But only the mechanical units that are controlled by the actual program task (defined in system parameters *Controller/Task/Use Mechanical Unit Group*) is used to do any control operations.

Besides that, the predefined variable `ROB_ID` of data type `mecunit` is available in every program task. If an actual program task controls a robot then the alias variable `ROB_ID` contains a reference to one of robot `ROB_1` to `ROB_6`, which can be used to do control operation on the robot. The variable `ROB_ID` is invalid if the actual program task does not control any robot.

Limitations

Data of the type `mecunit` must not be defined in the program. However, if it is then an error message will be displayed as soon as an instruction or function that refers to this `mecunit` is executed. The data type can, on the other hand, be used as a parameter when declaring a routine.

Characteristics

`mecunit` is a *non-value* data type. This means that data of this type does not permit value-oriented operations.

Related information

For information about	See
Check if task run some robot	TaskRunRob - Check if task controls some robot on page 1494

Continues on next page

For information about	See
Check if task run some mechanical unit	TaskRunMec - Check if task controls any mechanical unit on page 1493
Get the name of mechanical units in the system	GetNextMechUnit - Get name and data for mechanical units on page 1270
Activating/Deactivating mechanical units	ActUnit - Activates a mechanical unit on page 28 DeactUnit - Deactivates a mechanical unit on page 180
Configuration of mechanical units	<i>Technical reference manual - System parameters</i>
Characteristics of non-value data types	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Data types</i>

3 Data types

3.43 motsetdata - Motion settings data

RobotWare Base

3.43 motsetdata - Motion settings data

Usage

motsetdata is used to define a number of motion settings that affect all movement instructions in the program:

- Max. velocity and velocity override
- Acceleration data
- Behavior around singular points
- Management of different robot configurations
- Override of path resolution
- Motion supervision
- Limitation of acceleration/deceleration
- Tool reorientation during circle path
- Activation and deactivation of event buffer

This data type does not normally have to be used since these settings can only be set using the instructions VelSet, AccSet, SingArea, ConfJ, ConfL, PathResol, MotionSup, PathAccLim, CirPathMode, WorldAccLim, ActEventBuffer, DeactEventBuffer and CornerPathWarning.

The current values of these motion settings is accessed using the system variable C_MOTSET.

Description

The current motion settings (stored in the system variable C_MOTSET) affect all movements.

Basic examples

The following example illustrates the data type motsetdata:

Example 1

```
IF C_MOTSET.vel.ride > 50 THEN
  ...
ELSE
  ...
ENDIF
```

Different parts of the program are executed depending on the current velocity override.

Predefined data

C_MOTSET describes the current motion settings of the robot and can always be accessed from the program. On the other hand, C_MOTSET can only be changed using a number of instructions, not by assignment.

The following default values for motion parameters are set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning

Continues on next page

- when moving the program pointer to main
- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

```
VAR motsetdata C_MOTSET := [
  [ 100, 5000 ],-> veldata
  [ 100, 100, 100 ],-> accdata
  [ FALSE, FALSE, FALSE, TRUE ],-> singdata
  [ TRUE, TRUE, 30, 45, 90 ]-> confsupdata
  100,-> path resolution
  TRUE,-> motionsup
  100,-> tunevalue
  TRUE,-> backoffaftercoll
  FALSE,-> acclim
  -1,-> accmax
  FALSE,-> decellim
  -1,-> decelmax
  0,-> cirpathreori
  FALSE,-> worldacclim
  -1,-> worldaccmax
  TRUE,-> evtbufferact
  FALSE];-> corner_path_warn_suppress
```



Note

The maximum TCP speed for the used robot type can be changed in the *Motion* configuration system parameters, type *Motion Planner* and attribute *Linear Max Speed*. The RAPID function MaxRobSpeed returns the same value.

Components



Note

Some components are prepared for in the structure but are currently not implemented in the corresponding instructions.

vel.oride

Data type: veldata/num

Velocity override as a percentage of the programmed value.

vel.max

Data type: veldata/num

Maximum velocity in mm/s.

acc.acc

Data type: accdata/num

Acceleration and deceleration as a percentage of the normal values.

Continues on next page

3 Data types

3.43 motsetdata - Motion settings data

RobotWare Base

Continued

acc.ramp

Data type: accdata/num

The rate by which acceleration and deceleration increases as a percentage of the normal values.

acc.finepramp

Data type: accdata/num

The rate at which deceleration decreases as a percentage of the normal values when the robot decelerates towards a finepoint.

sing.wrist

Data type: singdata/bool

The orientation of the tool is allowed to deviate somewhat in order to prevent wrist singularity.

sing.lockaxis4

Data type: singdata/bool

Lock axis 4 on a six-axis robot to 0 or ± 180 degrees to avoid singularity problems when axis 5 is close to 0.

sing.arm

Data type: singdata/bool

The orientation of the tool is allowed to deviate somewhat in order to prevent arm singularity (not implemented).

sing.base

Data type: singdata/bool

The orientation of the tool is not allowed to deviate.

conf.jsup

Data type: confsupdata/bool

During joint movement the robot will reach the programmed robot configuration.

conf.lsup

Data type: confsupdata/bool

Supervision of joint configuration is active during linear and circular movement.

conf.ax1

Data type: confsupdata/num

Maximum permitted deviation in degrees for axis 1 (not implemented).

conf.ax4

Data type: confsupdata/num

Maximum permitted deviation in degrees for axis 4 (not implemented).

conf.ax6

Data type: confsupdata/num

Maximum permitted deviation in degrees for axis 6 (not implemented).

Continues on next page

pathresol

Data type: num

Current override in percentage of the configured path resolution.

motionsup

Data type: bool

Mirror RAPID status (TRUE = On and FALSE = Off) of motion supervision function.

tunevalue

Data type: num

Current RAPID override as a percentage of the configured tunevalue for the motion supervision function.

backoffaftercoll

Data type: bool

Mirror RAPID status of back up to remove any residual forces at motion collision:

TRUE = Back up to remove residual forces at motion collision

FALSE = No back off at motion collision

acclim

Data type: bool

Limitation of tool acceleration along the path. (TRUE = limitation and FALSE = no limitation).

accmax

Data type: num

TCP acceleration limitation in m/s^2 . If acclim is FALSE, the value is always set to -1.

decelim

Data type: bool

Limitation of tool deceleration along the path. (TRUE = limitation and FALSE = no limitation).

decelmax

Data type: num

TCP deceleration limitation in m/s^2 . If decelim is FALSE, the value is always set to -1.

cirpathreori

Data type: num

Tool reorientation during circle path:

0 = Standard method with interpolation in path frame

1 = Modified method with interpolation in object frame

2 = Modified method with programmed tool orientation in CirPoint

Continues on next page

3 Data types

3.43 motsetdata - Motion settings data

RobotWare Base

Continued

worldacclim

Data type: bool

Limitation of acceleration in world coordinate system. (TRUE = limitation and FALSE = no limitation).

worldaccmax

Data type: num

Limitation of acceleration in world coordinate system in m/s^2 . If worldacclim is FALSE, the value is always set to -1.

evtbufferact

Data type: bool

Event buffer active or not active. (TRUE = event buffer active and FALSE = event buffer not active).

corner_path_warn_suppress

Data type: bool

Corner path warning will be reported or not. TRUE = corner path warning is suppressed, FALSE = corner path warning is not suppressed.

Limitations

One and only one of the components sing.wrist, sing.arm or sing.base may have a value equal to TRUE.

Structure

<dataobject of motsetdata>

<vel of veldata>

Affected by instruction VelSet

<oride of num>

<max of num>

<acc of accdata>

Affected by instruction AccSet

<acc of num>

<ramp of num>

<finepramp of num>

<sing of singdata>

Affected by instruction SingArea

<wrist of bool>

<lockaxis4 of bool>

<arm of bool>

<base of bool>

<conf of confsupdata>

Affected by instructions ConfJ and ConfL

<jsup of bool>

<lsup of bool>

<ax1 of num>

<ax4 of num>

<ax6 of num>

<pathresol of num>

Affected by instruction PathResol

<motionsup of bool>

Affected by instruction MotionSup

Continues on next page

<tunevalue of num>	Affected by instruction MotionSup
<backoffaftercoll of bool>	Affected by instruction MotionSup
<acclim of bool>	Affected by instruction PathAccLim
<accmax of num>	Affected by instruction PathAccLim
<decelim of bool>	Affected by instruction PathAccLim
<decelmax of num>	Affected by instruction PathAccLim
<cirpathreori of num>	Affected by instruction CirPathMode
<worldacclim of bool>	Affected by instruction WorldAccLim
<worldaccmax of num>	Affected by instruction WorldAccLim
<evtbufferact of bool>	Affected by instructions ActEventBuffer and DeactEventBuffer
<corner_path_warn_suppress of bool>	Affected by instruction CornerPathWarning

Related information

For information about	See
Reduction of acceleration	AccSet - Reduces the acceleration on page 23
Activation of event buffer	ActEventBuffer - Activation of event buffer on page 26
Tool reorientation during circle path	CirPathMode - Tool reorientation during circle path on page 129
Robot configuration during joint movement	ConfJ - Controls the configuration during joint movement on page 150
Robot configuration during linear movement	ConfL - Monitors the configuration during linear movement on page 152
Suppressing corner path warnings	CornerPathWarning - Show or hide corner path warnings on page 167
Deactivation of event buffer	DeactEventBuffer - Deactivation of event buffer on page 178
Deactivate or activate the motion supervision function	MotionSup - Deactivates/Activates motion supervision on page 383
Limitation of acceleration along the path	PathAccLim - Reduce TCP acceleration along the path on page 515
Override the configured geometric path sample time	PathResol - Override path resolution on page 540
Define interpolation around singular points	SingArea - Defines interpolation around singular points on page 696
Defining maximum velocity	VelSet - Changes the programmed velocity on page 987
Control acceleration in world coordinate system	WorldAccLim - Control acceleration in world coordinate system on page 1061
Instructions for setting motion parameters	Technical reference manual - RAPID Overview, section RAPID summary - Motion settings

3 Data types

3.44 num - Numeric values

RobotWare Base

3.44 num - Numeric values

Usage

num is used for numeric values; e.g. counters.

Description

The value of the num data type may be

- an integer; e.g. -5,
- a decimal number; e.g. 3.45.

It may also be written exponentially; e.g. 2E3 (= $2 \cdot 10^3 = 2000$), 2.5E-2 (= 0.025).

Integers between -8388607 and +8388608 are always stored as exact integers.

Decimal numbers are only approximate numbers and therefore should not be used in *is equal to* or *is not equal to* comparisons. In the case of divisions and operations using decimal numbers, the result will also be a decimal number; that is, not an exact integer. For example:

```
a := 10;  
b := 5;  
IF a/b=2 THEN
```

...

As the result of a/b is not an integer, this condition is not necessarily satisfied.

Basic examples

The following examples illustrate the data type num:

Example 1

```
VAR num reg1;  
...  
reg1 := 3;
```

reg1 is assigned the value 3.

Example 2

```
a := 10 DIV 3;  
b := 10 MOD 3;
```

Integer division where a is assigned an integer (=3) and b is assigned the remainder (=1).

Predefined data

There is some predefined data in the system. For example the constant pi (π) is defined.

```
CONST num pi := 3.1415926;
```

Limitations

Literal values between -8388607 to 8388608 assigned to a num variable are stored as exact integers.

Continues on next page

If a literal that has been interpreted as a dnum is assigned/used as a num, it is automatically converted to a num.

Related information

For information about	See
Numeric values using datatype dnum	dnum - Double numeric values on page 1630
Numeric expressions	<i>Technical reference manual - RAPID Overview, section Basic RAPID programming - Expressions</i>
Operations using numeric values	<i>Technical reference manual - RAPID Overview, section Basic RAPID programming - Expressions</i>

3 Data types

3.45 opnum - Comparison operator

RobotWare Base

3.45 opnum - Comparison operator

Usage

opnum is used to represent an operator for comparisons in arguments to RAPID functions or instructions.

Description

An opnum constant is intended to be used to define the type of comparison when checking values in generic instructions.

Basic examples

The following example illustrates the data type opnum:

Example 1

```
TriggCheckIO checkgrip, 100, airok, EQ, 1, intno1;
```

Predefined data

The following symbolic constants of the data type opnum are predefined and is used to define the type of comparison used, for instance, in instruction TriggCheckIO.

Value	Symbolic constant	Comment
1	LT	Less than
2	LTEQ	Less than or equal to
3	EQ	Equal to
4	NOTEQ	Not equal to
5	GTEQ	Greater than or equal to
6	GT	Greater than

Characteristics

opnum is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Data types in general, alias data types	<i>Technical reference manual - RAPID Overview</i> , section <i>Basic characteristics - Data types</i>
Define I/O check at a fixed position	TriggCheckIO - Defines I/O check at a fixed position on page 867

3.46 orient - Orientation

Usage

`orient` is used for orientations (such as the orientation of a tool) and rotations (such as the rotation of a coordinate system).

Description

The orientation is described in the form of a quaternion which consists of four components: `q1`, `q2`, `q3`, and `q4`.

Basic examples

The following example illustrates the data type `orient`:

Example 1

```
VAR orient orient1;
.
orient1 := [1, 0, 0, 0];
```

The `orient1` orientation is assigned the value `q1=1`, `q2-q4=0`; this corresponds to no rotation.

Components

The data type `orient` has the following components:

`q1`

Data type: `num`
Quaternion 1.

`q2`

Data type: `num`
Quaternion 2.

`q3`

Data type: `num`
Quaternion 3.

`q4`

Data type: `num`
Quaternion 4.

Continues on next page

3 Data types

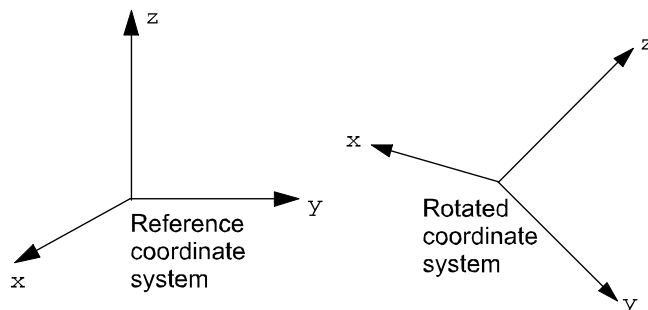
3.46 orient - Orientation

RobotWare Base

Continued

What is a Quaternion?

The orientation of a coordinate system (such as that of a tool) is described by a rotational matrix that describes the direction of the axes of the coordinate system in relation to a reference system (see the following figure).



xx0500002376

The rotated coordinate systems axes (x, y, z) are vectors which can be expressed in the reference coordinate system as follows:

$$\mathbf{x} = (x_1, x_2, x_3)$$

$$\mathbf{y} = (y_1, y_2, y_3)$$

$$\mathbf{z} = (z_1, z_2, z_3)$$

This means that the x-component of the x-vector in the reference coordinate system will be x_1 , the y-component will be x_2 , and so on.

These three vectors can be put together in a matrix (a rotational matrix) where each of the vectors form one of the columns:

$$\begin{bmatrix} x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \\ x_3 & y_3 & z_3 \end{bmatrix}$$

xx0500002381

A quaternion is just a more concise way to describe this rotational matrix; the quaternions are calculated based on the elements of the rotational matrix:

$q1 = \frac{\sqrt{x_1+y_2+z_3+1}}{2}$	
$q2 = \frac{\sqrt{x_1-y_2-z_3+1}}{2}$	sign $q2 = \text{sign}(y_3-z_2)$
$q3 = \frac{\sqrt{y_2-x_1-z_3+1}}{2}$	sign $q3 = \text{sign}(z_1-x_3)$
$q4 = \frac{\sqrt{z_3-x_1-y_2+1}}{2}$	sign $q4 = \text{sign}(x_2-y_1)$

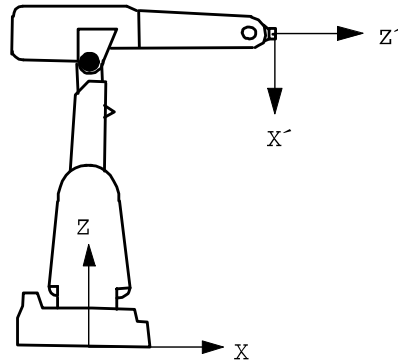
Example 1

A tool is orientated so that its Z'-axis points straight ahead (in the same direction as the X-axis of the base coordinate system). The Y'-axis of the tool corresponds

Continues on next page

to the Y-axis of the base coordinate system (see the following figure). How is the orientation of the tool defined in the position data (robtargt)?

The orientation of the tool in a programmed position is normally related to the coordinate system of the work object used. In this example, no work object is used and the base coordinate system is equal to the world coordinate system. Thus, the orientation is related to the base coordinate system.



xx0500002377

The axes will then be related as follows:

$$x' = -z = (0, 0, -1)$$

$$y' = y = (0, 1, 0)$$

$$z' = x = (1, 0, 0)$$

Which corresponds to the following rotational matrix:

$$\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ -1 & 0 & 0 \end{bmatrix}$$

xx0500002388

The rotational matrix provides a corresponding quaternion:

$q1 = \frac{\sqrt{0+1+0+1}}{2} = \frac{\sqrt{2}}{2} = 0.707$	
$q2 = \frac{\sqrt{0-1-0+1}}{2} = 0$	
$q3 = \frac{\sqrt{1-0-0+1}}{2} = \frac{\sqrt{2}}{2} = 0.707$	sign q3 = sign (1+1) = +
$q4 = \frac{\sqrt{0-0-1+1}}{2} = 0$	

Continues on next page

3 Data types

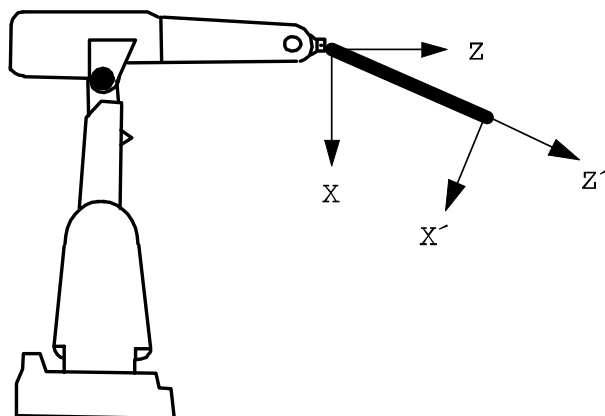
3.46 orient - Orientation

RobotWare Base

Continued

Example 2

The direction of the tool is rotated 30° about the X'- and Z'-axes in relation to the wrist coordinate system (see the following figure). How is the orientation of the tool defined in the tool data?



xx0500002378

The axes will then be related as follows:

$$x' = (\cos 30^\circ, 0, -\sin 30^\circ)$$

$$y' = (0, 1, 0)$$

$$z' = (\sin 30^\circ, 0, \cos 30^\circ)$$

Which corresponds to the following rotational matrix:

$$\begin{bmatrix} \cos 30^\circ & 0 & \sin 30^\circ \\ 0 & 1 & 0 \\ -\sin 30^\circ & 0 & \cos 30^\circ \end{bmatrix}$$

xx0500002393

The rotational matrix provides a corresponding quaternion:

$q1 = \frac{\sqrt{\cos 30^\circ + 1 + \cos 30^\circ + 1}}{2} = 0.965926$	
$q2 = \frac{\sqrt{\cos 30^\circ - 1 - \cos 30^\circ + 1}}{2} = 0$	
$q3 = \frac{\sqrt{1 - \cos 30^\circ - \cos 30^\circ + 1}}{2} = 0.258819$	sign q3 = sign (sin 30° + sin 30°) = +
$q4 = \frac{\sqrt{\cos 30^\circ - \cos 30^\circ - 1 + 1}}{2} = 0$	

Structure

```
< dataobject of orient >
  < q1 of num >
  < q2 of num >
  < q3 of num >
  < q4 of num >
```

Limitations

The orientation must be normalized; that is, the sum of the squares must equal 1:

Continues on next page

$$q_1^2 + q_2^2 + q_3^2 + q_4^2 = 1$$

Related information

For information about	See
Operations on orientations	<i>Technical reference manual - RAPID Overview</i> , section <i>Basic Characteristics - Expressions</i>

3 Data types

3.47 paridnum - Type of parameter identification *RobotWare Base*

3.47 paridnum - Type of parameter identification

Usage

paridnum is used to represent an integer with a symbolic constant.

Description

A paridnum constant is intended to be used for parameter identification such as load identification of tool or payload or external manipulator load.

Basic examples

The following example illustrates the data type paridnum:

Example 1

```
TEST ParIdRobValid (TOOL_LOAD_ID)
CASE ROB_LOAD_VAL:
! Possible to do load identification of tool in actual robot type
...
CASE ROB_LM1_LOAD_VAL:
! Only possible to do load identification of tool with
! IRB 6400FHD if actual load < 200 kg
...
CASE ROB_NOT_LOAD_VAL:
! Not possible to do load identification of tool in actual robot
type
...
ENDTEST
```

Use of predefined constant TOOL_LOAD_ID of data type paridnum.

Predefined data

The following symbolic constants of the data type paridnum are predefined and is used as arguments in the following instructions, ParIdRobValid, ParIdPosValid, LoadId, and ManLoadIdProc.

Value	Symbolic constant	Comment
1	TOOL_LOAD_ID	Identify tool load
2	PAY_LOAD_ID	Identify payload (see instruction GripLoad)
3	IRBP_K	Identify External Manipulator IRBP K load
4	IRBP_L	Identify External Manipulator IRBP L load
4	IRBP_C	Identify External Manipulator IRBP C load
4	IRBP_C_INDEX	Identify External Manipulator IRBP C_INDEX load
4	IRBP_T	Identify External Manipulator IRBP T load
5	IRBP_R	Identify External Manipulator IRBP R load
6	IRBP_A	Identify External Manipulator IRBP A load
6	IRBP_B	Identify External Manipulator IRBP B load
6	IRBP_D	Identify External Manipulator IRBP D load

Continues on next page

**Note**

Only TOOL_LOAD_ID and PAY_LOAD_ID is used in user defined RAPID Programs for load identification of the tool respectively the pay load for the robot.

Characteristics

paridnum is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Predefined program Load Identify	<i>Operating manual - OmniCore</i>
Valid robot type	ParldRobValid - Valid robot type for parameter identification on page 1375
Valid robot position	ParldPosValid - Valid robot position for parameter identification on page 1372
Load identification with complete example	LoadId - Load identification of tool or payload on page 337
Load identification of external manipulators	ManLoadIdProc - Load identification of IRBP manipulators on page 344

3 Data types

3.48 paridvalidnum - Result of ParIdRobValid RobotWare Base

3.48 paridvalidnum - Result of ParIdRobValid

Usage

paridvalidnum is used to represent an integer with a symbolic constant.

Description

A paridvalidnum constant is intended to be used for parameter identification, such as load identification of tool or payload, when checking the return value from function ParIdRobValid.

Basic examples

The following examples illustrate the data type paridvalidnum:

```
TEST ParIdRobValid (PAY_LOAD_ID)
CASE ROB_LOAD_VAL:
! Possible to do load identification of payload in actual robot
! type
...
CASE ROB_LM1_LOAD_VAL:
! Only possible to do load identification of payload
! with IRB 6400FHD if actual load < 200 kg
...
CASE ROB_NOT_LOAD_VAL:
! Not possible to do load identification of payload
! in actual robot type
...
ENDTEST
```

Use of predefined constants ROB_LOAD_VAL, ROB_LM1_LOAD_VAL and ROB_NOT_LOAD_VAL of data type paridvalidnum.

Predefined data

The following symbolic constants of the data type paridvalidnum are predefined and is used for checking the return value from function ParIdRobValid.

Value	Symbolic constant	Comment
10	ROB_LOAD_VAL	Valid robot type for the current parameter identification
11	ROB_NOT_LOAD_VAL	Not valid robot type for the current parameter identification
12	ROB_LM1_LOAD_VAL	Valid robot type IRB 6400FHD for the current parameter identification if actual load < 200 kg

Characteristics

paridvalidnum is an alias data type for num and inherits its characteristics.

Related information

For information about	See
Predefined program Load Identify	<i>Operating manual - OmniCore</i>

Continues on next page

For information about	See
Valid robot type	ParIdRobValid - Valid robot type for parameter identification on page 1375
Valid robot position	ParIdPosValid - Valid robot position for parameter identification on page 1372
Load identification with complete example	LoadId - Load identification of tool or payload on page 337

3 Data types

3.49 pathrecid - Path recorder identifier

Path Recovery

3.49 pathrecid - Path recorder identifier

Usage

pathrecid is used to identify a breakpoint for the path recorder.

Description

The path recorder is a system function for recording the robot's executed path. Data of the type pathrecid can be linked to a specific path location by means of the instruction PathRecStart. The user can then order the recorder to perform a movement back to the path identifier by using the instruction PathRecMoveBwd.

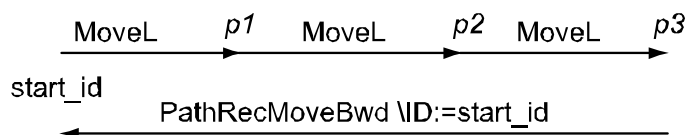
Basic examples

The following example illustrates the data type pathrecid:

Example 1

```
VAR pathrecid start_id;
CONST robtarget p1 := [...];
CONST robtarget p2 := [...];
CONST robtarget p3 := [...];

PathRecStart start_id;
MoveL p1, vmax, z50, tool1;
MoveL p2, vmax, z50, tool1;
MoveL p3, vmax, z50, tool1;
IF(PathRecValidBwd (\ID := start_id)) THEN
  StorePath;
  PathRecMoveBwd \ID:=start_id;
  ...
ENDIF
```



pathrecid_Ex

The preceding example will start the path recorder and the starting point will be tagged with the path identifier start_id. Thereafter, the robot will move forward with traditional move instructions and then move back to the start position again using the recorded path. To be able to run PathRecorder move instructions, the path level has to be changed with StorePath.

Characteristics

pathrecid is an non-value data type.

Related information

For information about	See
Path recorder	<i>Application manual - Controller software Omni-Core</i>

Continues on next page

For information about	See
Start - stop the path recorder	PathRecStart - Start the path recorder on page 534 PathRecStop - Stop the path recorder on page 537
Check for valid recorded path	PathRecValidBwd - Is there a valid backward path recorded on page 1382 PathRecValidFwd - Is there a valid forward path recorded on page 1385
Play the path recorder backward	PathRecMoveBwd - Move path recorder backwards on page 525
Play the path recorder forward	PathRecMoveFwd - Move path recorder forward on page 531
Characteristics of non-value data types	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Data types</i>

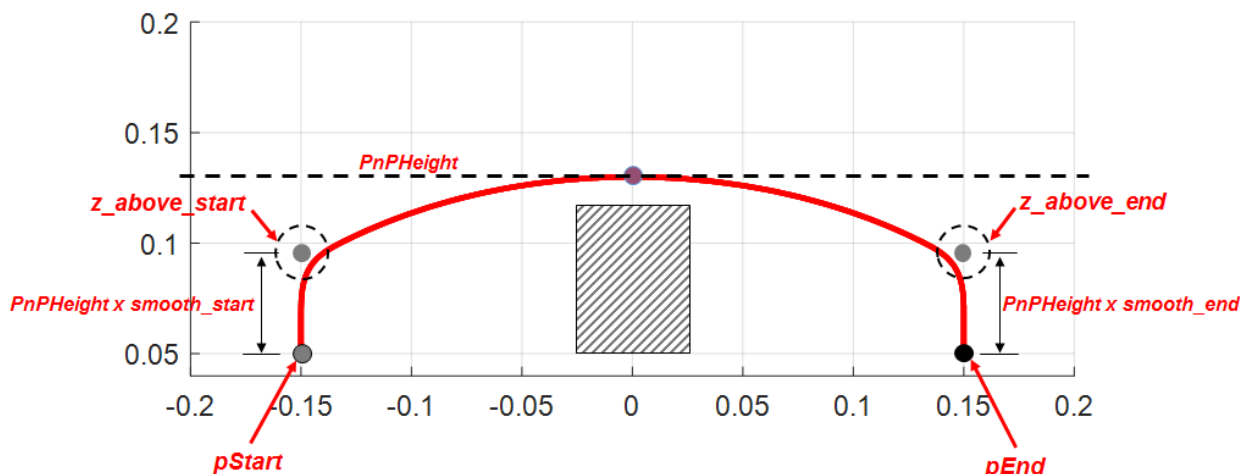
3 Data types

3.50 pnpdata - Configure pick and place paths SCARA robots

3.50 pnpdata - Configure pick and place paths

Usage

pnpdata is used to configure pick and place paths.



xx1700001194

Description

Data of the type pnpdata describes the heights of the vertical movements as a percentage of the total path height, and the zones of the generated corner paths.

Basic examples

See [MovePnP - Moves the robot along a pick and place path on page 484](#).

Components

The data type has the following components:

smooth_start

Data type: num

Percentage of the PnPHeight to describe the height of the vertical motion above the start point.

A lower value can significantly speed up the cycle time.

The default value is 100.

smooth_end

Data type: num

Percentage of the PnPHeight to describe the height of the vertical motion above the end point.

A lower value can significantly speed up the cycle time.

The default value is 100.

z_above_start

Data type: zonedata

Continues on next page

Zone data for the movement. `z_above_start` describes the size of the generated corner path at the end of the vertical motion above the start point.

The default value is `z100`.

`z_above_end`

Data type: `zonedata`

Zone data for the movement. `z_above_end` describes the size of the generated corner path at the beginning of the vertical motion above the end point.

The default value is `z100`.

Structure

```
<dataobject of pnpdata>
  <smooth_start of num>
  <smooth_end of num>
  <z_above_start of zonedata>
  <z_above_end of zonedata>
```

Related information

For information about	See
Moving the robot along a pick and place path	MovePnP - Moves the robot along a pick and place path on page 484
	Technical reference manual - RAPID Overview

3 Data types

3.51 pos - Positions (only X, Y and Z)

RobotWare Base

3.51 pos - Positions (only X, Y and Z)

Usage

pos is used for positions (only X, Y, and Z).

The robtarget data type is used for the robot's position including the orientation of the tool and the configuration of the axes.

Description

Data of the type pos describes the coordinates of a position: X, Y, and Z.

Basic examples

The following examples illustrate the data type pos:

Example 1

```
VAR pos pos1;  
...  
pos1 := [500, 0, 940];
```

The pos1 position is assigned the value: X=500 mm, Y=0 mm, Z=940 mm.

Example 2

```
pos1.x := pos1.x + 50;
```

The pos1 position is shifted 50 mm in the X-direction.

Components

The data type pos has the following components:

x

Data type: num

The X-value of the position.

y

Data type: num

The Y-value of the position.

z

Data type: num

The Z-value of the position.

Structure

```
< dataobject of pos >  
  < x of num >  
  < y of num >  
  < z of num >
```

Continues on next page

Related information

For information about	See
Operations on positions	<i>Technical reference manual - RAPID Overview</i> , section <i>Basic Characteristics - Expressions</i>
Robot position including orientation	robtargt - Position data on page 1715

3 Data types

3.52 pose - Coordinate transformations

RobotWare Base

3.52 pose - Coordinate transformations

Usage

pose is used to change from one coordinate system to another.

Description

Data of the type `pose` describes how a coordinate system is displaced and rotated around another coordinate system. The data can, for example, describe how the tool coordinate system is located and oriented in relation to the wrist coordinate system.

Basic examples

The following examples illustrate the data type `pose`:

```
VAR pose frame1;  
...  
frame1.trans := [50, 0, 40];  
frame1.rot := [1, 0, 0, 0];
```

The `frame1` coordinate transformation is assigned a value that corresponds to a displacement in position, where X=50 mm, Y=0 mm, Z=40 mm; there is, however, no rotation.

Components

The data type has the following components:

`trans`

translation

Data type: `pos`

The displacement in position (x, y, and z) of the coordinate system.

`rot`

rotation

Data type: `orient`

The rotation of the coordinate system.

Structure

```
< dataobject of pose >  
  < trans of pos >  
  < rot of orient >
```

Related information

For information about	See
What is a Quaternion?	orient - Orientation on page 1683

3.53 processtimes - process times

Usage

processtimes is used to define the duration times for all status supervision phases in CAP, except phase MAIN, which is defined by the robot movement (see section *Supervision in Application manual - Continuous Application Platform*).

processtimes is a component of capdata and defines the timeout times for the following status supervision phases in CAP:

- PRE
- POST1
- POST2

The specified timeout time has to be larger than zero, if supervision should be used during the corresponding status supervision phase in CAP (see section *Supervision and process phases in Application manual - Continuous Application Platform*).

Components

pre

Data type: num

Defines the duration of the phase PRE in seconds. During that time all conditions defined for that phase have to be fulfilled.

post1

Data type: num

Defines the duration of the phase POST1 in seconds. During that time all conditions defined for that phase have to be fulfilled.

post2

Data type: num

Defines the duration of the phase POST2 in seconds. During that time all conditions defined for that phase have to be fulfilled.

Syntax

```
< data object of processtimes >
  < pre of num >
  < post1 of num >
  < post2 of num >
```

Related information

	Described in:
capdata data type	capdata - CAP data on page 1605
Continuous Application Platform	Application manual - Continuous Application Platform

3 Data types

3.54 progdisp - Program displacement

RobotWare Base

3.54 progdisp - Program displacement

Usage

progdisp is used to store the current program displacement of the robot and the external axes.

This data type does not normally have to be used since the data is set using the instructions PDispSet, PDispOn, PDispOff, EOffsSet, EOffsOn, and EOffsOff. It is only used to temporarily store the current value for later use.

Description

The current values for program displacement can be accessed using the system variable C_PROGDISP.

For more information, see the instructions PDispSet, PDispOn, EOffsSet, and EOffsOn.

Basic examples

The following example illustrates the data type progdisp:

Example 1

```
VAR progdisp progdisp1;
...
SearchL sen1, psearch, p10, v100, tool1;
PDispOn \ExeP:=psearch, *, tool1;
EOffsOn \ExeP:=psearch, *;
...
progdisp1:=C_PROGDISP;
PDispOff;
EOffsOff;
...
PDispSet progdisp1.pdisp;
EOffsSet progdisp1.eoffs;
```

First, a program displacement is activated from a searched position. Then, the current program displacement values are temporarily stored in the variable progdisp1 and the program displacement is deactivated. Later on, re-activation is done using the instructions PDispSet and EOffsSet.

Predefined data

The system variable C_PROGDISP describes the current program displacement of the robot and external axes, and can always be accessed from the program. On the other hand, it can only be changed using a number of instructions, not by assignment.

The following default values for program displacement are set

- when using the restart mode **Reset RAPID**
- when loading a new program or a new module
- when starting program execution from the beginning
- when moving the program pointer to main

Continues on next page

- when moving the program pointer to a routine
- when moving the program pointer in such a way that the execution order is lost.

```
VAR progdisp C_PROGDISP :=
  [ [ 0, 0, 0], [1, 0, 0, 0]],-> posedata
  [ 0, 0, 0, 0, 0, 0]];-> extjointdata
```

Components

pdisp

program displacement

Data type: pose

The program displacement for the robot, expressed using a translation and an orientation. The translation is expressed in mm.

eoffs

external offset

Data type: extjoint

The offset for each of the external axes. If the axis is linear, the value is expressed in mm; if it is rotating, the value is expressed in degrees.

Structure

```
< dataobject of progdisp >
  < pdisp of pose >
    < trans of pos >
      < x of num >
      < y of num >
      < z of num >
    < rot of orient >
      < q1 of num >
      < q2 of num >
      < q3 of num >
      < q4 of num >
  < eoffs of extjoint >
    < eax_a of num >
    < eax_b of num >
    < eax_c of num >
    < eax_d of num >
    < eax_e of num >
    < eax_f of num >
```

Related information

For information about	See
Instructions for defining program displacement	<i>Technical reference manual - RAPID Overview</i> , section <i>RAPID summary - Motion settings</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i> , section <i>Motion and I/O principles - Coordinate systems</i>

3 Data types

3.55 rawbytes - Raw data

RobotWare Base

3.55 rawbytes - Raw data

Usage

rawbytes is used as a general data container. It can be used for communication with I/O devices.

Description

rawbytes data can be filled with any type of data - num, byte, string - by means of support instructions/functions. In any variable of rawbytes, the system also stores the current length of valid bytes.

Basic examples

The following example illustrates the data type rawbytes:

Example 1

```
VAR rawbytes raw_data;  
VAR num integer := 8;  
VAR num float := 13.4;  
  
ClearRawBytes raw_data;  
PackRawBytes integer, raw_data, 1 \IntX := INT;  
PackRawBytes float, raw_data, (RawBytesLen(raw_data)+1) \Float4;
```

In this example the variable raw_data of type rawbytes is first cleared, that is, all bytes set to 0 (same as default at declaration). Then in the first 2 bytes the value of integer is placed and in the next 4 bytes the value of float.

Structure

rawbytes is a non-value data type.

At declaration of rawbytes variable, all bytes in rawbytes are set to 0 and the current length of valid bytes in the variable is set to 0.

Related information

For information about	See
Get the length of rawbytes data	RawBytesLen - Get the length of rawbytes data on page 1404
Clear the contents of rawbytes data	ClearRawBytes - Clear the contents of rawbytes data on page 140
Copy the contents of rawbytes data	CopyRawBytes - Copy the contents of rawbytes data on page 165
Pack DeviceNet header into rawbytes data	PackDNHeader - Pack DeviceNet Header into rawbytes data on page 506
Pack data into rawbytes data	PackRawBytes - Pack data into rawbytes data on page 509
Write rawbytes data	WriteRawBytes - Write rawbytes data on page 1078
Read rawbytes data	ReadRawBytes - Read rawbytes data on page 576

Continues on next page

For information about	See
Unpack data from rawbytes data	UnpackRawBytes - Unpack data from rawbytes data on page 981
File and I/O device handling	<i>Application manual - Controller software OmniCore</i>

3 Data types

3.56 restartblkdata - blockdata for restart

Continuous Application Platform

3.56 restartblkdata - blockdata for restart

Usage

restartblkdata is used to define the behavior of a CAP process at restart.

restartblkdata is a component of capdata and defines the following for a CAP process at restart, if:

- The robot should execute/block weaving stationary during process restart (weave_start).
- Robot movement restart should be delayed or not relative process restart (motion_delay).
- The phases PRE, PRE_START and END_PRE should be executed/blocked (pre_phase).
- A velocity different from main velocity should be used or not during start of the process (startspeed_phase).
- The phases START_POST1, POST1 and END_POST1 should be executed/blocked (post1_phase).
- The phases START_POST2, POST2 and END_POST2 should be executed/blocked (post2_phase).

Components

weave_start

Data type: bool

Value	Description
FALSE	Stationary weaving at restart until the process has started
TRUE	No stationary weaving at restart until the process has started

motion_delay

Data type: bool

Value	Description
FALSE	Delay of robot movement at restart after the process has started
TRUE	No delay of robot movement at restart after the process has started

pre_phase

Data type: bool

Value	Description
FALSE	Execute the phases START_PRE, PRE and END_PRE phase at restart
TRUE	Do NOT execute the phases START_PRE, PRE and END_PRE phase at restart

Continues on next page

startspeed_phase

Data type: bool

Value	Description
FALSE	Move the robot with start speed in the beginning of a restart
TRUE	Do NOT move the robot with start speed in the beginning of a restart, use main speed directly

post1_phase

Data type: bool

Value	Description
FALSE	Execute the phases START_POST1, POST1 and END_POST1 at restart
TRUE	Do NOT execute the phases START_POST1, POST1 and END_POST1 at restart

post2_phase

Data type: bool

Value	Description
FALSE	Execute the phases START_POST2, POST2 and END_POST2 at restart
TRUE	Do NOT execute the phases START_POST2, POST2 and END_POST2 at restart

Syntax

```

< data object of restartblkdata >
  < weave_start of bool >
  < motion_delay of bool >
  < pre_phase of bool >
  < startspeed_phase of bool >
  < post1_phase of bool >
  < post2_phase of bool >

```

Related information

	Described in:
capdata data type	capdata - CAP data on page 1605
Continuous Application Platform	Application manual - Continuous Application Platform

3 Data types

3.57 restartdata - Restart data for trigg signals

RobotWare Base

3.57 restartdata - Restart data for trigg signals

Usage

restartdata mirrors the pre- and postvalues of specified I/O signals (process signals) at the stop sequence of the robot movements. The I/O signals to supervise are specified in the instruction TriggStopProc.

TriggStopProc and restartdata are intended to be used for restart after program stop (STOP) or emergency stop (QSTOP) of own process instructions defined in RAPID (NOSTEPIN routines).

Description

restartdata mirrors the following data after program execution is stopped:

- valid restart data
- robot stopped on path or not
- prevalue of the I/O signals
- postvalue of the I/O signals
- number of flanks between pretime and posttime of the shadow signal for the ongoing process

Definition

The table shows the definition of the time point for reading the pre- and postvalues for the I/O signals.

Type of stop	Read time for I/O signal pre-value	Read time for I/O signal postvalue
STOP on path	When all robot axes are standing still	About 400 ms after the pretime
QSTOP off path	As soon as possible	About 400 ms after the pretime

Components

restartstop

valid restartdata after stop

Data type: bool

TRUE = Mirror last STOP or QSTOP

FALSE = Invalid restart data. All I/O signals values are set to -1.

stoponpath

stop on path

Data type: bool

TRUE = The robot is stopped on the path (STOP)

FALSE = The robot is stopped but not on the path (QSTOP)

predo1val

pre do1 value

Data type: dionum

Continues on next page

The prevalue of the digital signal “do1” specified in the argument D01 in instruction TriggStopProc.

postdo1val

post do1 value

Data type: dionum

The postvalue of the digital signal “do1” specified in the argument D01 in instruction TriggStopProc.

prego1val

pre go1 value

Data type: num

The prevalue of the digital group signal “go1” specified in the argument G01 in instruction TriggStopProc.

postgo1val

post go1 value

Data type: num

The postvalue of the digital group signal “go1” specified in the argument G01 in instruction TriggStopProc.

prego2val

pre go2 value

Data type: num

The prevalue of the digital group signal “go2” specified in the argument G02 in instruction TriggStopProc.

postgo2val

post go2 value

Data type: num

The postvalue of the digital group signal “go2” specified in the argument G02 in instruction TriggStopProc.

prego3val

pre go3 value

Data type: num

The prevalue of the digital group signal “go3” specified in the argument G03 in instruction TriggStopProc.

postgo3val

post go3 value

Data type: num

The postvalue of the digital group signal “go3” specified in the argument G03 in instruction TriggStopProc.

prego4val

pre go4 value

Continues on next page

3 Data types

3.57 restartdata - Restart data for trigg signals

RobotWare Base

Continued

Data type: num

The prevalue of the digital group signal “go4” specified in the argument G04 in instruction TriggStopProc.

postgo4val

post go4 value

Data type: num

The postvalue of the digital group signal “go4” specified in the argument G04 in instruction TriggStopProc.

preshadowval

pre shadow value

Data type: dionum

The prevalue of the digital signal “shadow” specified in the argument ShadowD0 in instruction TriggStopProc.

shadowflanks

number of shadow flanks

Data type: num

The number of value transitions (flanks) of the digital signal “shadow” between the pretime and the posttime. The signal “shadow” is specified in the argument ShadowD0 in instruction TriggStopProc.

postshadowval

post shadow value

Data type: dionum

The postvalue of the digital signal “shadow” specified in the argument ShadowD0 in instruction TriggStopProc.

Structure

```
< dataobject of restartdata >
  < restartstop of bool >
  < stoponpath of bool >
  < predo1val of dionum >
  < postdo1val of dionum >
  < prego1val of num >
  < postgo1val of num >
  < prego2val of num >
  < postgo2val of num >
  < prego3val of num >
  < postgo3val of num >
  < prego4val of num >
  < postgo4val of num >
  < preshadowval of dionum >
  < shadowflanks of dionum >
  < postshadowval of dionum >
```

Continues on next page

Related information

For information about	See
Predefined process instructions	TriggL - Linear robot movements with events on page 902 TriggC - Circular robot movement with events on page 858
Setup mirror of restart data	TriggStopProc - Generate restart data for trigg signals at stop on page 944
Move backwards on path	StepBwdPath - Move backwards one step on path on page 776

3 Data types

3.58 rmqheader - RAPID Message Queue Message header

RobotStudio Connect or Multitasking

3.58 rmqheader - RAPID Message Queue Message header

Usage

rmqheader (*RAPID Message Queue Header*) is used for reading the data structure of the data in a message of type rmqmessage.

Description

The header part of a non-value data type rmqmessage converted to the value data type rmqheader.

Examples

Basic examples of the data type rmqheader are illustrated below.

Example 1

```
VAR rmqmessage message;  
VAR rmqheader header;  
...  
RMQGetMessage message;  
RMQGetMsgHeader message \Header:=header;
```

Copy and convert the rmqheader information from an rmqmessage message.

Components

datatype

Data type: string

The name of the data type used, e.g num, string or some other value data type.

ndim

Number of Dimensions

Data type: num

Number of array dimensions.

dim1

Size of first dimension

Data type: num

The size of the first dimension. 0 if not used.

dim2

Size of second dimension

Data type: num

The size of the second dimension. 0 if not used.

dim3

Size of third dimension

Data type: num

The size of the third dimension. 0 if not used.

Continues on next page

3.58 rmqheader - RAPID Message Queue Message header

RobotStudio Connect or Multitasking
Continued

Structure

```
<dataobject of rmqheader>  
<datatype of string>  
<ndim of num>  
<dim1 of num>  
<dim2 of num>  
<dim3 of num>
```

Related information

For information about	See
Description of the RAPID Message Queue functionality	<i>Application manual - Controller software Omni-Core</i> , section <i>RAPID Message Queue</i> .
Extract the header data from an rmqmessage	RMQGetMsgHeader - Get header information from an RMQ message on page 616
RMQ Message	rmqmessage - RAPID Message Queue message on page 1712

3 Data types

3.59 rmqmessage - RAPID Message Queue message

RobotStudio Connect or Multitasking

3.59 rmqmessage - RAPID Message Queue message

Usage

rmqmessage (*RAPID Message Queue Message*) is used for temporary storage of communication data.

Description

The data type rmqmessage is the message used to store data in while communicating between different RAPID tasks or Robot Application Builder clients with RMQ functionality. It contains information about the type of data sent, the dimensions of the data, the identity of the sender and the actual data.

An rmqmessage is a big data type (about 5000 bytes big), and it is recommended that the variable is reused to save RAPID memory.

Basic examples

The following example illustrates the data type rmqmessage:

Example 1

```
VAR rmqmessage rmqmessage1;  
VAR string myrecredata;  
...  
RMQGetMsgData rmqmessage1, myrecredata;
```

The variable rmqmessage1 is defined and can be used in an RMQ (RAPID Message Queue) command. In this example, the data part within the rmqmessage1 is copied to the variable myrecredata.

Characteristics

rmqmessage is a non-value data type and cannot be used in value-oriented operations.

Related information

For information about	See
Description of the RAPID Message Queue functionality	<i>Application manual - Controller software OmniCore</i> , section <i>RAPID Message Queue</i> .
RMQ Header	rmqheader - RAPID Message Queue Message header on page 1710
Extract the header data from an rmqmessage	RMQGetMsgHeader - Get header information from an RMQ message on page 616
Order and enable interrupts for a specific data type	IRMQMessage - Orders RMQ interrupts for a data type on page 291
Get the first message from a RAPID Message Queue.	RMQGetMessage - Get an RMQ message on page 610
Send data to the queue of a RAPID task or Robot Application Builder client, and wait for an answer from the client.	RMQSendWait - Send an RMQ data message and wait for a response on page 626
Extract the data from an rmqmessage	RMQGetMsgData - Get the data part from an RMQ message on page 613

3.60 rmqslot - Identity number of an RMQ client

Usage

`rmqslot` (*RAPID Message Queue Slot*) is used when communicating with an RMQ or a Robot Application Builder client.

Description

The `rmqslot` is an identity number of a RAPID Message Queue configured for a RAPID task or the identity number of a Robot Application Builder client.

Basic examples

The following example illustrates the data type `rmqslot`:

Example 1

```
VAR rmqslot rmqslot1;
RMQFindSlot rmqslot1, "RMQ_T_ROB1";
...
```

The variable `rmqslot1` is defined and can be used in the instruction `RMQFindSlot` to get the identity number of the RAPID Message Queue "RMQ_T_ROB1" configured for the RAPID task "T_ROB1".

Characteristics

`rmqslot` is a non-value data type and cannot be used in value-oriented operations.

Related information

For information about	See
Description of the RAPID Message Queue functionality	<i>Application manual - Controller software OmniCore</i> , section <i>RAPID Message Queue</i> .
Find the identity number of a RAPID Message Queue task or Robot Application Builder client.	RMQFindSlot - Find a slot identity from the slot name on page 608
Send data to the queue of a RAPID task or Robot Application Builder client.	RMQSendMessage - Send an RMQ data message on page 622
Send data to a client, and wait for an answer from the client.	RMQSendWait - Send an RMQ data message and wait for a response on page 626
Get the slot name from a specified slot identity	RMQGetSlotName - Get the name of an RMQ client on page 1431

3 Data types

3.61 robjoint - Joint position of robot axes

RobotWare Base

3.61 robjoint - Joint position of robot axes

Usage

robjoint is used to define the position in degrees of the robot axes.

Description

Data of the type robjoint is used to store axis positions in degrees of the robot axis 1 to 6. Axis position is defined as the rotation in degrees for the respective axis (arm) in a positive or negative direction from the axis calibration position.

Components

rax_1

robot axis 1

Data type: num

The position of robot axis 1 in degrees from the calibration position.

...

rax_6

robot axis 6

Data type: num

The position of robot axis 6 in degrees from the calibration position.

Structure

```
< dataobject of robjoint >  
  < rax_1 of num >  
  < rax_2 of num >  
  < rax_3 of num >  
  < rax_4 of num >  
  < rax_5 of num >  
  < rax_6 of num >
```

Related information

For information about	See
Joint position data	jointtarget - Joint position data on page 1661
Move to joint position	MoveAbsJ - Moves the robot to an absolute joint position on page 386

3.62 robtarget - Position data

Usage

robtarget (*robot target*) is used to define the position of the robot and additional axes.

Description

Position data is used to define the position in the move instructions to which the robot and additional axes are to move.

As the robot is able to achieve the same position in several different ways, the axis configuration is also specified. This defines the axis values, if these are in any way ambiguous, for example:

- if the robot is in a forward or backward position,
- if axis 4 points downwards or upwards,
- if axis 6 has a negative or positive revolution.

**WARNING**

The position is defined based on the coordinate system of the work object, including any program displacement. If the position is programmed with some other work object than the one used in the instruction, the robot will not move in the expected way. Make sure that you use the same work object as the one used when programming move instructions. Incorrect use can injure someone or damage the robot or other equipment.

Basic examples

The following examples illustrate the data type robtarget:

Example 1

```
CONST robtarget p15 := [ [600, 500, 225.3], [1, 0, 0, 0], [1, 1,
                        0, 0], [ 11, 12.3, 9E9, 9E9, 9E9, 9E9] ];
```

A position p15 is defined as follows:

- The position of the robot: x = 600, y = 500, and z = 225.3 mm in the object coordinate system.
- The orientation of the tool in the same direction as the object coordinate system.
- The axis configuration of the robot: axes 1 and 4 in position 90-180°, axis 6 in position 0-90°.
- The position of the additional logical axes, a (11) and b (12.3), expressed in degrees or mm (depending on the type of axis). Axes c to f are undefined (9E9).

Example 2

```
VAR robtarget p20;
...
p20 := CRobT(\Tool:=tool\wobj:=wobj0);
p20 := Offs(p20,10,0,0);
```

Continues on next page

3 Data types

3.62 robtarget - Position data

RobotWare Base

Continued

The position p20 is set to the same position as the current position of the robot by calling the function CRobT. The position is then moved 10 mm in the x-direction.

Components

trans

translation

Data type: pos

The position (x, y, and z) of the tool center point expressed in mm.

The position is specified in relation to the current object coordinate system, including program displacement. If no work object is specified then this is the world coordinate system.

rot

rotation

Data type: orient

The orientation of the tool, expressed in the form of a quaternion (q1, q2, q3, and q4).

The orientation is specified in relation to the current object coordinate system including program displacement. If no work object is specified then this is the world coordinate system.

robconf

robot configuration

Data type: confdata

The axis configuration of the robot (cf1, cf4, cf6, and cfX). For articulated robots, this is defined in the form of the current quarter revolution of axis 1, axis 4, and axis 6. The meaning of the component cfX is dependent on robot type. For more information, see data type [confdata - Robot configuration data on page 1617](#).

extax

external axes

Data type: extjoint

The position of the additional axes.

The position is defined as follows for each individual axis (eax_a, eax_b . . . eax_f):

- For rotating axes, the position is defined as the rotation in degrees from the calibration position.
- For linear axes, the position is defined as the distance in mm from the calibration position.

Additional axes eax_a . . . are logical axes. The relationship between the logical axis number and the physical axis number is defined in the system parameters.

Continues on next page

The value 9E9 is defined for axes which are not connected. If the axes defined in the position data differ from the axes that are actually connected at program execution then the following applies:

- If the position is not defined in the position data (value 9E9) then the value will be ignored if the axis is connected and not activated. But if the axis is activated then it will result in an error.
- If the position is defined in the position data although the axis is not connected then the value is ignored.

No movement is performed but no error is generated for an axis with valid position data, if the axis is not activated. This is the default behavior. To change it, set the system parameter *ReportNonActiveSingles* to *Yes*. Then, the RAPID execution will stop, and an event log is reported.

If an additional axis is running in independent mode and a new movement shall be performed by the robot and its additional axes, then the position data for the additional axes in independent mode must not be 9E9. The data must be an arbitrary value that is not used by the system.

Structure

```

< dataobject of robtargt >
  < trans of pos >
    < x of num >
    < y of num >
    < z of num >
  < rot of orient >
    < q1 of num >
    < q2 of num >
    < q3 of num >
    < q4 of num >
  < robconf of confdata >
    < cf1 of num >
    < cf4 of num >
    < cf6 of num >
    < cfx of num >
  < extax of extjoint >
    < eax_a of num >
    < eax_b of num >
    < eax_c of num >
    < eax_d of num >
    < eax_e of num >
    < eax_f of num >

```

Related information

For information about	See
Move instructions	<i>Technical reference manual - RAPID Overview</i> , section <i>RAPID Summary - Motion</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview</i> , section <i>Motion and I/O Principles - Coordinate Systems</i>

Continues on next page

3 Data types

3.62 robtarget - Position data

RobotWare Base

Continued

For information about	See
Handling configuration data	<i>Technical reference manual - RAPID Overview, section Motion and I/O Principles - Robot configuration</i>
Configuration of additional axes	<i>Application manual - Additional axes</i>
<i>ReportNonActiveSingles</i>	<i>Technical reference manual - System parameters, topic Controller, type General Rapid</i>
What is a quaternion?	orient - Orientation on page 1683
confdata	confdata - Robot configuration data on page 1617

3.63 sensorvardata - Multiple variable setup data for sensor interface**Usage**

sensorvardata is used to setup the needed information for the different data points that is handled by the ReadVarArr and WriteVarArr commands.

Components

The data type has the following components:

varnumber

Data type: num

Defines the variable number to be read/written.

sensordatatype

Data type: num

The datatype the value is represented by. The value will be converted to the given type before it is sent or after it is received over the sensor communication link.

Valid values are:

Value	Description
0	INT16
1	UINT16
2	DOUBLE

When using a sensor from ServoRobot® over EtherNet link the sensordatatype 2 (double) will always be used. For all other types of sensors and communication sensordatatype 0 or 1 must be used

raw

Data type: bool

If this flag is true no internal modification of the data is done before or after it is sent over the protocol to/from the device. The value sent/received will have the same bit representation as it had on the communication link.

raw is not available for sensordatatype 2.

scale

Data type: num

Set the scale factor used for scaling data values. Valid values are 1, 10 or 100. A value sent to a device via WriteVarArr will be multiplied by the scale factor before it is sent and a value read from a device via ReadVarArr will be divided by the scale factor before it is returned.

scale is not available for sensordatatype 2.

value

Data type: dnum

The value that shall be read/written to/from the device.

Continues on next page

3 Data types

3.63 sensorvardata - Multiple variable setup data for sensor interface

Sensor Interface

Continued

Structure

```
< data object of sensorvardata >  
  < varnumber of num >  
  < sensordatatype of num >  
  < raw of bool >  
  < scale of num >  
  < value of dnum >
```

Related information

For information about	See
Read multiple variables from a device	ReadVarArr - Read multiple variables from a sensor device on page 579
Write multiple variables to a device	WriteVarArr - Write multiple variables to a sensor device on page 1084
Configuration of sensor communication	<i>Technical reference manual - RAPID Overview</i>
Configuration of sensor communication	<i>Technical reference manual - System parameters</i>

3.64 shapedata - World zone shape data

Usage

shapedata is used to describe the geometry of a world zone.

Description

World zones can be defined in 4 different geometrical shapes:

- a straight box, with all sides parallel to the world coordinate system and defined by a WZBoxDef instruction
- a sphere, defined by a WZSphDef instruction
- a cylinder, parallel to the z axis of the world coordinate system and defined by a WZCylDef instruction
- a joint space area for robot and/or external axes, defined by the instruction WZHomeJointDef or WZLimJointDef

The geometry of a world zone is defined by one of the previous instructions and the action of a world zone is defined by the instruction WZLimSup or WZD0Set.

Basic examples

The following example illustrates the data type shapedata:

Example 1

```

VAR wzstationary pole;
VAR wzstationary conveyor;
...
PROC ...
  VAR shapedata volume;
  ...
  WZBoxDef \Inside, volume, p_corner1, p_corner2;
  WZLimSup \Stat, conveyor, volume;
  WZCylDef \Inside, volume, p_center, 200, 2500;
  WZLimSup \Stat, pole, volume;
ENDPROC

```

A conveyor is defined as a box and the supervision for this area is activated. A pole is defined as a cylinder and the supervision of this zone is also activated. If the robot reaches one of these areas, the motion is stopped.

Characteristics

shapedata is a non-value data type.

Related information

For information about	See
World Zones	<i>Technical reference manual - RAPID Overview, section RAPID summary - Motion settings</i>
Define box-shaped world zone	WZBoxDef - Define a box-shaped world zone on page 1086

Continues on next page

3 Data types

3.64 shapedata - World zone shape data

World Zones

Continued

For information about	See
Define sphere-shaped world zone	<i>WZSphDef - Define a sphere-shaped world zone on page 1112</i>
Define cylinder-shaped world zone	<i>WZCylDef - Define a cylinder-shaped world zone on page 1088</i>
Define a world zone for home joints	<i>WZHomeJointDef - Define a world zone for home joints on page 1102</i>
Define a world zone for limit joints	<i>WZLimJointDef - Define a world zone for limitation in joints on page 1105</i>
Activate world zone limit supervision	<i>WZLimSup - Activate world zone limit supervision on page 1109</i>
Activate world zone digital output set	<i>WZDOSet - Activate world zone to set digital output on page 1093</i>

3.65 signalorigin - Describes the I/O signal origin

Usage

signalorigin is used to represent an integer with a symbolic constant.

Description

The predefined symbolic constants of type signalorigin can be used to check the origin of an I/O signal. It is intended to be used when checking the return value from the function GetSignalOrigin.

Basic examples

The following example illustrates the data type signalorigin:

Example 1

```

VAR signalorigin sigorig;
VAR string signalname;
...
sigorig := GetSignalOrigin(mydo, signalname);
IF sigorig = SIGORIG_NONE THEN
    TPWrite "The signal named "+ArgName(mydo)+" can not be used";
    Stop;
ELSEIF (sigorig = SIGORIG_CFG) OR (sigorig = SIGORIG_ALIAS) THEN
    SetDO mydo, 1;
...
ELSE
    TPWrite "Unknown origin "+ValToStr(sigorig);
    Stop;
ENDIF

```

The signal origin will be stored in the variable sigorig.

Predefined data

Following constants of type signalorigin are predefined:

Return value	Symbolic constant	Comment
0	SIGORIG_NONE	The I/O signal variable is declared in RAPID and has no alias coupling.
1	SIGORIG_CFG	The signal is configured in I/O configuration.
2	SIGORIG_ALIAS	The I/O signal variable is declared in RAPID and has an alias coupling to an I/O signal configured in I/O configuration.

Characteristics

signalorigin is an alias data type for num and thus inherits its properties.

Continues on next page

3 Data types

3.65 signalorigin - Describes the I/O signal origin

RobotWare Base

Continued

Related information

For information about	See
Getting information about the origin of an I/O signal	GetSignalOrigin - Get information about the origin of an I/O signal on page 1282

3.66 signalxx - Digital and analog signals

Usage

Data types within `signalxx` are used for digital and analog input and output signals. The names of the signals are defined in the system parameters and are consequently not to be defined in the program.

Description

Data type	Used for
<code>signalai</code>	analog input signals
<code>signalao</code>	analog output signals
<code>signalai</code>	digital input signals
<code>signaldo</code>	digital output signals
<code>signalgi</code>	groups of digital input signals
<code>signalgo</code>	groups of digital output signals

Variables of the type `signalxo` only contain a reference to the signal. The value is set using the instructions `SetDO`, `SetGO`, and `SetAO`.

Variables of the type `signalxi` contain a reference to a signal as well as the possibility to retrieve the value directly in the program, if used in value context.

The value of an input signal can be read directly in the program, e.g.:

```
! Digital input
IF di1 = 1 THEN ...

! Digital group input
IF gi1 = 5 THEN ...

! Analog input
IF ai1 > 5.2 THEN ...
```

It can also be used in assignments, e.g.:

```
VAR num current_value;
VAR dnum current_dvalue;

! Digital group input
current_dvalue := gi1;

! Analog input
current_value := ai1;
```

Predefined data

The signals defined in the system parameters can always be accessed from the program by using the predefined signal variables (installed data). However, it should be noted that if other data with the same name is defined then these signals cannot be used.

Continues on next page

3 Data types

3.66 signalxx - Digital and analog signals

RobotWare Base

Continued

Limitations

Data of the data type `signalxx` must not be defined in the program. However, if this is in fact done then an error message will be displayed as soon as an instruction or function that refers to this signal is executed. The data type can, on the other hand, be used as a parameter when declaring a routine.

Characteristics

`signalxx` is a semi-value data type that permits value oriented operations.

Error handling

The following recoverable errors are generated and can be handled in an error handler. The system variable `ERRNO` will be set to:

Name	Cause of error
ERR_NO_ALIASIO_DEF	The signal variable is a variable declared in RAPID. It has not been connected to an I/O signal defined in the I/O configuration with instruction <code>AliasIO</code> .
ERR_NORUNUNIT	There is no contact with the I/O device.

Related information

For information about	See
Summary input/output instructions	<i>Technical reference manual - RAPID Overview, section RAPID Summary - Input and output signals</i>
Input/Output functionality in general	<i>Technical reference manual - RAPID Overview, section Motion and I/O Principles - I/O principles</i>
Configuration of I/O	<i>Technical reference manual - System parameters</i>
Characteristics of non-value data types	<i>Technical reference manual - RAPID Overview, section Basic Characteristics - Data types</i>

3.67 socketdev - Socket device

Usage

socketdev (*socket device*) is used to communicate with other computers on a network or between RAPID task.

Description

The socket device is a handle to a communication link to another computer on a network.

Basic examples

The following example illustrates the data type socketdev:

Example 1

```
VAR socketdev socket1;
```

The variable socket1 is defined and can be used in a socket command, e.g. SocketCreate.

Limitations

Any number of sockets can be declared but it is only possible to use 32 sockets at the same time.

Characteristics

socketdev is a non-value data type.

Related information

For information about	See
Socket communication in general	<i>Application manual - Controller software OmniCore</i>
Create a new socket	SocketCreate - Create a new socket on page 712
Characteristics of non-value data types	<i>Technical reference manual - RAPID Overview, section Basic Characteristics - Data Types</i>

3 Data types

3.68 socketstatus - Socket communication status

RobotWare Base

3.68 socketstatus - Socket communication status

Usage

socketstatus is used for representing status of the socket communication.

Description

Socket status is fetched with the function `SocketGetStatus` and can be used for program flow control or debugging purposes.

Basic examples

The following example illustrates the data type `socketstatus`:

Example 1

```
VAR socketdev socket1;  
VAR socketstatus state;  
...  
SocketCreate socket1;  
state := SocketGetStatus( socket1 );
```

The socket status `SOCKET_CREATED` will be stored in the variable `state`.

Predefined data

Following constants of type `socketstatus` are predefined:

RAPID constant	Value	The socket is ...
SOCKET_CREATED	1	Created
SOCKET_CONNECTED	2	Client connected to a remote host
SOCKET_BOUND	3	Server bounded to a local address and port
SOCKET_LISTENING	4	Server listening for incoming connections
SOCKET_CLOSED	5	Closed

Characteristics

`socketstatus` is an alias data type for `num` and consequently inherits its characteristics.

Related information

For information about	See
Socket communication in general	<i>Application manual - Controller software Omni-Core</i>
Get socket status	SocketGetStatus - Get current socket state on page 1451
Data types in general, alias data types	<i>Technical reference manual - RAPID Overview, section Basic Characteristics - Data Types</i>

3.69 speeddata - Speed data

Usage

speeddata is used to specify the velocity at which both the robot and the external axes move.

Description

Speed data defines the velocity:

- at which the tool center point moves,
- the reorientation speed of the tool,
- at which linear or rotating external axes move.

When several different types of movement are combined, one of the velocities often limits all movements. The velocity of the other movements will be reduced in such a way that all movements will finish executing at the same time.

The velocity is also restricted by the performance of the robot. This differs, depending on the type of robot and the path of movement.

Basic examples

The following example illustrates the data type speeddata:

Example 1

```
VAR speeddata vmedium := [ 1000, 30, 200, 15 ];
```

The speed data vmedium is defined with the following velocities:

- 1000 mm/s for the TCP.
- 30 degrees/s for reorientation of the tool.
- 200 mm/s for linear external axes.
- 15 degrees/s for rotating external axes.

```
vmedium.v_tcp := 900;
```

The velocity of the TCP is changed to 900 mm/s.

Predefined data

A number of speed data are already defined in the system.

Predefined speed data to be used for moving the robot and the external axes:

Name	TCP speed	Orientation	Linear ext.axis	Rotating ext.axis
v5	5 mm/s	1000°/s	5000 mm/s	1000°/s
v10	10 mm/s	1000°/s	5000 mm/s	1000°/s
v20	20 mm/s	1000°/s	5000 mm/s	1000°/s
v30	30 mm/s	1000°/s	5000 mm/s	1000°/s
v40	40 mm/s	1000°/s	5000 mm/s	1000°/s
v50	50 mm/s	1000°/s	5000 mm/s	1000°/s
v60	60 mm/s	1000°/s	5000 mm/s	1000°/s
v80	80 mm/s	1000°/s	5000 mm/s	1000°/s
v100	100 mm/s	1000°/s	5000 mm/s	1000°/s

Continues on next page

3 Data types

3.69 speeddata - Speed data

RobotWare Base

Continued

Name	TCP speed	Orientation	Linear ext.axis	Rotating ext.axis
v150	150 mm/s	1000°/s	5000 mm/s	1000°/s
v200	200 mm/s	1000°/s	5000 mm/s	1000°/s
v300	300 mm/s	1000°/s	5000 mm/s	1000°/s
v400	400 mm/s	1000°/s	5000 mm/s	1000°/s
v500	500 mm/s	1000°/s	5000 mm/s	1000°/s
v600	600 mm/s	1000°/s	5000 mm/s	1000°/s
v800	800 mm/s	1000°/s	5000 mm/s	1000°/s
v1000	1000 mm/s	1000°/s	5000 mm/s	1000°/s
v1500	1500 mm/s	1000°/s	5000 mm/s	1000°/s
v2000	2000 mm/s	1000°/s	5000 mm/s	1000°/s
v2500	2500 mm/s	1000°/s	5000 mm/s	1000°/s
v3000	3000 mm/s	1000°/s	5000 mm/s	1000°/s
v4000	4000 mm/s	1000°/s	5000 mm/s	1000°/s
v5000	5000 mm/s	1000°/s	5000 mm/s	1000°/s
v6000	6000 mm/s	1000°/s	5000 mm/s	1000°/s
v7000	7000 mm/s	1000°/s	5000 mm/s	1000°/s
vmax	i	ii	iii	iv

- i Max. TCP speed for the used robot type and normal practical TCP values, specified by the system parameter *TCP Linear Max Speed (m/s)*. The RAPID function *MaxRobSpeed* returns this value. If extremely large TCP values are used in the tool frame, you can create your own speeddata with bigger TCP speed than returned by *MaxRobSpeed* and use *VelSet* to allow larger speed.
- ii Max. reorientation speed for the used robot type, specified by the system parameter *TCP Reorient Max Speed (deg/s)*. The RAPID function *MaxRobReorientSpeed* returns this value.
- iii Max. linear speed for additional axes, specified by the system parameter *Ext. Axis Linear Max Speed (m/s)*. The RAPID function *MaxExtLinearSpeed* returns this value.
- iv Max. rotational speed for additional axes, specified by the system parameter *Ext. Axis Rotational Max Speed (deg/s)*. The RAPID function *MaxExtReorientSpeed* returns this value.

Predefined speeddata to be used for moving rotating external axes with instruction *MoveExtJ*.

Name	TCP speed	Orientation	Linear ext.axis	Rotating ext.axis
vrot1	0 mm/s	0°/s	0 mm/s	1°/s
vrot2	0 mm/s	0°/s	0 mm/s	2°/s
vrot5	0 mm/s	0°/s	0 mm/s	5°/s
vrot10	0 mm/s	0°/s	0 mm/s	10°/s
vrot20	0 mm/s	0°/s	0 mm/s	20°/s
vrot50	0 mm/s	0°/s	0 mm/s	50°/s
vrot100	0 mm/s	0°/s	0 mm/s	100°/s

Predefined speeddata to be used for moving linear external axes with instruction *MoveExtJ*.

Name	TCP speed	Orientation	Linear ext.axis	Rotating ext.axis
vlin10	0 mm/s	0°/s	10 mm/s	0°/s
vlin20	0 mm/s	0°/s	20 mm/s	0°/s

Continues on next page

Name	TCP speed	Orientation	Linear ext.axis	Rotating ext.axis
vlin50	0 mm/s	0°/s	50 mm/s	0°/s
vlin100	0 mm/s	0°/s	100 mm/s	0°/s
vlin200	0 mm/s	0°/s	200 mm/s	0°/s
vlin500	0 mm/s	0°/s	500 mm/s	0°/s
vlin1000	0 mm/s	0°/s	1000 mm/s	0°/s

Components

v_tcp

velocity tcp

Data type: num

The velocity of the tool center point (TCP) in mm/s.

If a stationary tool or coordinated external axes are used, the velocity is specified relative to the work object.

v_ori

velocity orientation

Data type: num

The reorientation velocity of the TCP expressed in degrees/s.

If a stationary tool or coordinated external axes are used, the velocity is specified relative to the work object.

v_leax

velocity linear external axes

Data type: num

The velocity of linear external axes in mm/s.

v_reax

velocity rotational external axes

Data type: num

The velocity of rotating external axes in degrees/s.

Structure

```

< dataobject of speeddata >
  < v_tcp of num >
  < v_ori of num >
  < v_leax of num >
  < v_reax of num >

```

Limitations

At very slow motion each movement should be short enough to give an interpolation time less than 240 seconds.

Continues on next page

3 Data types

3.69 speeddata - Speed data

RobotWare Base

Continued

Related information

For information about	See
Positioning instructions	<i>Technical reference manual - RAPID Overview, section RAPID Summary - Motion</i>
Motion/Speed in general	<i>Technical reference manual - RAPID Overview, section Motion and I/O principles - Positioning during program execution</i>
Defining maximum velocity	VelSet - Changes the programmed velocity on page 987
Max. TCP speed for this robot	MaxRobSpeed - Maximum robot speed on page 1346

3.70 stoppointdata - Stop point data

Usage

stoppointdata is used to specify how a position is to be terminated, i.e. how close to the programmed position the axes must be before moving towards the next position.

Description

A movement instruction can end either with a zone or a stop point. If the movement ends with a zone, the programmed position is never reached, instead the robot continues smoothly towards the next programmed position. If the movement instruction instead ends with a stop point, the robot must come to a defined stop at the programmed position before the RAPID program moves on to the next instruction. For more information on zones and stop points, see the data type [zonedata - Zone data on page 1783](#).

The data type stoppointdata tunes the criteria used for determining when a robot has stopped in a programmed position. It can also be used for determining how long the robot should stand still in a stop point before continuing with the next programmed movement. The last use of stoppointdata is to set up a position to be coordinated to a conveyor.

If a movement instruction ends with stop point instead of a zone, then RAPID execution will remain¹ on the movement instruction until the criteria of the stoppointdata are fulfilled. These criteria are hereafter referred to as the inpos (in position) conditions. The stoppointdata allows for a tradeoff between cycle time and accuracy/predictability at stopped positions. For example, tightening the inpos condition leads to better repeatability of a CRobT performed directly after a movement ending with a stop point. Loosening the inpos condition will make the RAPID execution faster and thus improve cycle time. When no stoppointdata is provided in the movement instruction, the robot specific default values are used. The default values for the inpos condition tend to favor cycle time. Note that the used stoppointdata will also affect the behavior of instructions like WaitTime\Inpos, WaitUntil\Inpos, and WaitRob\Inpos.

Three types of stop points can be defined by the stoppointdata.

- The *in position* type of stop point defines the inpos condition as a percentage of the default speed tolerance and position tolerance. The inpos condition is satisfied only if both the speed and the position are within respective tolerance at the same time. The in position type also uses a minimum and maximum time. The robot waits for at least the minimum time, and at most the maximum time, for the inpos condition to be satisfied.
- The *stop time* type of stop point always waits in the stop point for the given time.
- The *follow time* type of stop point is a special type of stop point used to coordinate the robot movement with a conveyor.

¹ An exception is when the switch \Conc is used on a movement instruction. In that case RAPID will execute the next instruction immediately.

Continues on next page

3 Data types

3.70 stoppointdata - Stop point data

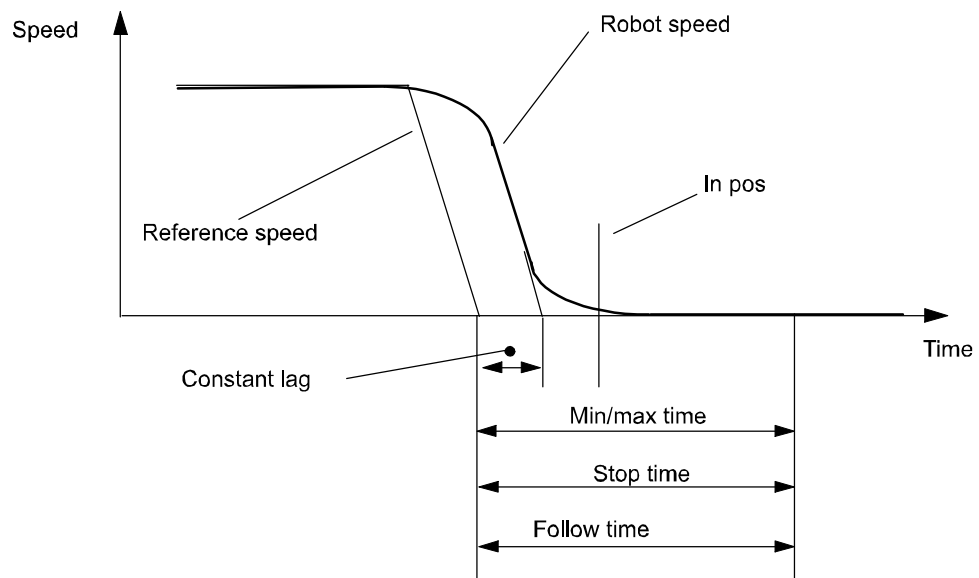
RobotWare Base

Continued

The stoppointdata also determines how the movement shall be synchronized with the RAPID execution. If the movement is synchronized, the RAPID execution waits for an inpos event when the robot is in position. If the movement is not synchronized, the RAPID execution gets a prefetch event almost a half second before the physical robot reaches the programmed position. When the program execution gets an inpos or a prefetch event, it continues with the next instruction. When the prefetch event arrives, the robot still has a long way to move. When the inpos event arrives the robot is close to the programmed position.

For the type **stop time** and **follow time**, the next instruction starts its execution at the same time as the stop time and follow time, respectively, start to count down. But for the type **in position**, the next instruction is started when the convergence criteria is fulfilled.

If use of move instructions with argument \Conc, no synchronization at all is done, so the actual move instruction execution will be ready at once.



xx0500002374

In the figure above, the termination of the stop points is described. The robot's speed does not decrease linearly. The robot servo is always ahead of the physical robot. It is shown as the constant lag in the figure above. The constant lag is about 0.1 seconds. The timing elements of stoppointdata use the reference speed as trigger. When the reference speed is zero the time measurement starts. Therefore the time in the timing elements always include the constant lag. Consequently there is no sense in using values less than the constant lag.

Basic examples

The following examples illustrate the data type stoppointdata:

inpos

```
VAR stoppointdata my_inpos := [ inpos, TRUE, [ 25, 40, 0.1, 5], 0,
                                0];
MoveL *, v1000, fine \Inpos:=my_inpos, grip4;
```

Continues on next page

The stop point data `my_inpos` is defined by means of the following characteristics:

- The type of stop point is in-position type, `inpos`.
- The stop point will be synchronized with the RAPID program execution, `TRUE`.
- The stop point distance criteria is 25% of the distance defined for the stop point `fine`, 25.
- The stop point speed criteria is 40% of the speed defined for the stop point `fine`, 40.
- The minimum time to wait before convergence is 0.1 s, 0.1.
- The maximum time to wait on convergence is 5 s, 5.

The robot moves towards the programmed position until one of the criteria, position or speed, are satisfied.

```
my_inpos.inpos.position := 40;
MoveL *, v1000, fine \Inpos:=my_inpos, grip4;
```

The stop point distance criteria is adjusted to 40%.

stoptime

```
VAR stoppointdata my_stoptime := [ stoptime, FALSE, [ 0, 0, 0, 0],
    1.45, 0];
MoveL *, v1000, fine \Inpos:=my_stoptime, grip4;
```

The stop point data `my_stoptime` is defined by means of the following characteristics:

- The type of stop point is stop-time type, `stoptime`.
- The stop point will not be synchronized with the RAPID program execution, `FALSE`.
- The wait time in position is 1.45 s, 1.45.

The robot moves towards the programmed position until the prefetch event arrives. The next RAPID instruction executes. If it is a move-instruction then the robot stops for 1.45 seconds before the next movement starts.

```
my_stoptime.stoptime := 6.66;
MoveL *, v1000, fine \Inpos:=my_stoptime, grip4;
```

The stop point stop time is adjusted to 6.66 seconds. If the next RAPID instruction is a move-instruction, the robot stops for 6.66 s.

followtime

```
VAR stoppointdata my_followtime := [ flwtime, TRUE, [ 0, 0, 0,
    0], 0, 0.5];
MoveL *, v1000, z10 \Inpos:=my_followtime, grip6\wobj:=conveyor1;
```

The stop point data `my_followtime` is defined by means of the following characteristics:

- The type of stop point is follow-time type, `flwtime`.
- The stop point will be synchronized with the RAPID program execution, `TRUE`.
- The stop point follow time is 0.5 s, 0.5.

The robot will follow the conveyor for 0.5 s before leaving it with the zone 10 mm, `z10`.

```
my_followtime.followtime := 0.4;
```

Continues on next page

3 Data types

3.70 stoppointdata - Stop point data

RobotWare Base

Continued

The stop point follow time is adjusted to 0.4 s.

Predefined data

A number of stop point data are already defined in the system.

In position stop points

Name	progsynch	position	speed	mintime	maxtime	stop-time	follow-time
inpos20	TRUE	20%	20%	0 s	2 s	-	-
inpos50	TRUE	50%	50%	0 s	2 s	-	-
inpos100	TRUE	100%	100%	0 s	2 s	-	-

(inpos100 has same convergence criteria as stop point fine)

Stop time stop points

Name	progsynch	position	speed	mintime	maxtime	stop-time	follow-time
stoptime0_5	FALSE	-	-	-	-	0.5 s	-
stoptime1_0	FALSE	-	-	-	-	1.0 s	-
stoptime1_5	FALSE	-	-	-	-	1.5 s	-

Follow time stop points

Name	progsynch	position	speed	mintime	maxtime	stop-time	follow-time
flwtime0_5	TRUE	-	-	-	-	-	0.5 s
flwtime1_0	TRUE	-	-	-	-	-	1.0 s
flwtime1_5	TRUE	-	-	-	-	-	1.5 s

Components

type

type of stop point

Data type: stoppoint

The following table defines the type of stoppoint.

1 (inpos)	The movement terminates as an in-position type of stop point. Enables the inpos element in stoppointdata. The zone data in the instruction is not used, use fine or z0.
2 (stoptime)	The movement terminates as a stop-time type of stop point. Enables the stoptime element in stoppointdata. The zone data in the instruction is not used, use fine or z0.
3 (followtime)	The movement terminates as a conveyor follow-time type of fine point. The zone data in the instruction is used when the robot leaves the conveyor. Enables the followtime element in stoppointdata.

Continues on next page

Data type stoppoint is an alias data type for num. It is used to choose the type of stop point and which data elements to use in the stoppointdata. Predefined constants are:

Value	Symbolic constant	Comment
1	inpos	In position type number
2	stoptime	Stop time type number
3	flwtime	Follow time type number

progsynch

program synchronization

Data type: bool

Synchronization with RAPID program execution.

- TRUE: The movement is synchronized with RAPID execution. The program does not start to execute the next instruction until the stop point has been reached.
- FALSE: The movement is not synchronized with RAPID execution. The program starts the execution of the next instruction before the stop point has been reached.

If use of move instructions with argument \Conc, no synchronization at all is done independent of the data in progsynch, so the actual move instruction will always be ready at once.

inpos.position

position condition for TCP

Data type: num

The position condition (the radius) for the TCP in percent of a normal fine stop point.

inpos.speed

speed condition for TCP

Data type: num

The speed condition for the TCP in percent of a normal fine stop point.

inpos.mintime

minimum wait time

Data type: num

The minimum wait time in seconds before in position. Used to make the robot wait at least the specified time in the point. Maximum value is 20.0 seconds.

inpos.maxtime

maximum wait time

Data type: num

The maximum wait time in seconds for convergence criteria to be satisfied. Used to assure that the robot does not get stuck in the point if the speed and position conditions are set too tight. Maximum value is 20.0 seconds.

Continues on next page

3 Data types

3.70 stoppointdata - Stop point data

RobotWare Base

Continued

stoptime

stop time

Data type: num

The time in seconds, that the TCP stands still in position before starting the next movement. Valid range 0-20 s, resolution 0.001 s.

followtime

follow time

Data type: num

The time in seconds that the TCP follows the conveyor. Valid range is 0-20 s, resolution 0.001 s.

Structure

```
< data object of stoppointdata >
  < type of stoppoint >
  < progsynch of bool >
  < inpos of inposdata >
    < position of num >
    < speed of num >
    < mintime of num >
    < maxtime of num >
  < stoptime of num >
  < followtime of num >
```

Related information

For information about	See
Positioning instructions	<i>Technical reference manual - RAPID Overview, section RAPID summary - Motion</i>
Movements/Paths in general	<i>Technical reference manual - RAPID Overview, section Motion and I/O principles - Positioning during program execution</i>
Stop or fly-by points	zonedata - Zone data on page 1783

3.71 string - Strings

Usage

string is used for character strings.

Description

A character string consists of a number of characters (a maximum of 80 bytes) enclosed by quotation marks (""), e.g. "This is a character string".

If the quotation marks are to be included in the string, they must be written twice, e.g. "This string contains a ""character".

If the back slashes are to be included in the string, it must be written twice, e.g. "This string contains a \\ character".

Basic examples

The following example illustrates the data type string:

Example 1

```
VAR string text;
...
text := "start welding pipe 1";
TPWrite text;
```

The text start welding pipe 1 is written on the FlexPendant.

Predefined data

A number of predefined string constants are available in the system and can be used together with string functions. See for example StrMemb.

Name	Character set
STR_DIGIT	<digit> ::= 0 1 2 3 4 5 6 7 8 9
STR_UPPER	<upper case letter> ::= A B C D E F G H I J K L M N O P Q R S T U V W X Y Z À Á Â Ã Ä Å Æ Ç È É Ê Ë Ì Í Î Ï Ð Ñ Ò Ó Ô Õ Ö Ø Ù Ú Û Ü Ý Þ ß
STR_LOWER	<lower case letter> ::= a b c d e f g h i j k l m n o p q r s t u v w x y z ß à á â ã ä å æ ç è é ê ë ì í î ï ð ñ ò ó ô õ ö ø ù ú û ü ý þ ÿ
STR_WHITE	<blank character> ::=

The following constants are already defined in the system:

```
CONST string diskhome := "HOME:";
```

Continues on next page

3 Data types

3.71 string - Strings

RobotWare Base

Continued

```
! For old programs from S4C system
CONST string ram1disk := "HOME:";

CONST string disktemp := "TEMP:";

CONST string flp1 := "flp1:";

CONST string stSpace := " ";

CONST string stEmpty := "";

CONST string stComma := ",";
```

Limitations

A string may have 0 to 80 bytes; inclusive of extra quotation marks or back slashes. Note that 1 character can consist of 1 to 4 bytes depending on what character it is. This is a functionality in the UTF-8 format.

A string may contain any of the characters specified by UTF-8 as well as control characters.

Related information

For information about	See
Operations using strings	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Expressions</i>
String values	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Basic elements</i>
Instruction using character set	StrMemb - Checks if a character belongs to a set on page 1480

3.72 supervtimeouts - Handshake supervision time outs

Usage

supervtimeouts is used to define timeout times for handshake supervision in CAP.

supervtimeouts is a component of capdata and defines the timeout times for the following handshake supervision phases in CAP:

- START_PRE
- END_PRE and START_MAIN
- END MAIN and START_POST1
- END_POST1 and START_POST2
- END_POST2

If the parameter is set to 0, there is no timeout.

Components

pre_cond

Data type: num

Timeout time (in seconds) for the START_PRE phase conditions to be fulfilled.

start_cond

Data type: num

Timeout time (in seconds) for the END_PRE and START_MAIN phase conditions to be fulfilled.

end_main_cond

Data type: num

Timeout time (in seconds) for the END_MAIN and START_POST1 phase conditions to be fulfilled.

end_post1_cond

Data type: num

Timeout time (in seconds) for the END_POST1 and START_POST2 phase conditions to be fulfilled.

end_post2_cond

Data type: num

Timeout time (in seconds) for the END_POST2 phase conditions to be fulfilled.

Syntax

```

< data object of supervtimeouts >
  < pre_cond of num >
  < start_cond of num >
  < end_main_cond of num >
  < end_post1_cond of num >
  < end_post2_cond of num >

```

Continues on next page

3 Data types

3.72 supervtimeouts - Handshake supervision time outs

Continuous Application Platform

Continued

Related information

	Described in:
capdata data type	capdata - CAP data on page 1605
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>

3.73 switch - Optional parameters

Usage

switch is used for optional parameters.

Description

The special type, switch may (only) be assigned to optional parameters and provides a means to use switch arguments, i.e. arguments that are only specified by names (not values). A value can not be transmitted to a switch parameter. The only way to use a switch parameter is to check for its presence using the predefined function Present.

Basic examples

The following example illustrates the data type switch:

Example 1

```
PROC my_routine(\switch on | switch off)
....
IF Present (off) THEN
....
ENDIF
ENDPROC
```

Depending on what arguments the caller of my_routine uses, the program flow can be controlled.

Characteristics

switch is a non-value data type and can not be used in value-orientated operations.

Related information

For information about	See
Parameters	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Routines.</i>
How to check if an optional parameter is present	<i>Present - Tests if an optional parameter is used on page 1399</i>

3 Data types

3.74 symnum - Symbolic number *RobotWare Base*

3.74 symnum - Symbolic number

Usage

symnum (*Symbolic Number*) is used to represent an integer with a symbolic constant.

Description

A symnum constant is intended to be used when checking the return value from the functions OpMode and RunMode.

Basic examples

The following example illustrates the data type symnum:

Example 1

```
IF RunMode() = RUN_CONT_CYCLE THEN
  ..
ELSE
  ..
ENDIF
```

Predefined data

The following symbolic constants of the data type symnum are predefined and can be used when checking return values from the functions OpMode and RunMode.

Value	Symbolic constant	Comment
0	RUN_UNDEF	Undefined running mode
1	RUN_CONT_CYCLE	Continuous or cycle running mode
2	RUN_INSTR_FWD	Instruction forward running mode
3	RUN_INSTR_BWD	Instruction backward running mode
4	RUN_SIM	Simulated running mode
5	RUN_STEP_MOVE	Move instructions in forward running mode and logical instructions in continuous running mode

Value	Symbolic constant	Comment
0	OP_UNDEF	Undefined operating mode
1	OP_AUTO	Automatic operating mode
2	OP_MAN_PROG	Manual operating mode max. 250 mm/s
3	OP_MAN_TEST	Manual operating mode full speed, 100%

Characteristics

Symnum is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Data types in general, alias data types	<i>Technical reference manual - RAPID Overview</i> , section <i>Basic characteristics - Data types</i>

3.75 syncident - Identity for synchronization point

Usage

`syncident` (*synchronization identity*) is used to specify the name of a synchronization point. The name of the synchronization point will be the name (identity) of the declared data of type `syncident`.

Description

`syncident` is used to identify a point in the program where the actual program task will wait for cooperate program tasks to reach the same synchronization point. The data name (identity) of the type `syncident` must be the same in all cooperative program tasks.

Data type `syncident` is used in the instructions `WaitSyncTask`, `SyncMoveOn`, and `SyncMoveOff`.

Basic examples

The following example illustrates the data type `syncident`:

Example 1

Program example in program task `T_ROB1`

```
PERS tasks task_list{3} := [ ["T_STN1"], ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync1;
```

```
WaitSyncTask sync1, task_list;
```

At execution of instruction `WaitSyncTask` in the program task `T_ROB1`, the execution in that program task will wait until the other program tasks `T_STN1` and `T_ROB2` have reached their corresponding `WaitSyncTask` with the same synchronization (meeting) point `sync1`.

Structure

`syncident` is a non-value data type.

Related information

For information about	See
Specify cooperated program tasks	tasks - RAPID program tasks on page 1749
Wait for synchronization point with other tasks	WaitSyncTask - Wait at synchronization point for other program tasks on page 1037
Start coordinated synchronized movements	SyncMoveOn - Start coordinated synchronized movements on page 811
End coordinated synchronized movements	SyncMoveOff - End coordinated synchronized movements on page 805

3 Data types

3.76 System data - Current RAPID system data settings

RobotWare Base

3.76 System data - Current RAPID system data settings

Usage

System data mirrors the current settings of RAPID system data such as current model motion settings, current error recovery number ERRNO, current interrupt number INTNO, etc.

These data can be accessed and read by the program. It can be used to read the current status, e.g. the current program displacement.

C_MOTSET

The variable C_MOTSET of data type motsetdata mirrors the current motion settings:

Description	Data type	Changed by	Also see
Current motion settings, i.e.:	motsetdata	Instructions	motsetdata - Motion settings data on page 1674
Velocity override and max velocity		VelSet	VelSet - Changes the programmed velocity on page 987
Acceleration override		AccSet	AccSet - Reduces the acceleration on page 23
Movements around singular points		SingArea	SingArea - Defines interpolation around singular points on page 696
Linear configuration control Joint configuration control		ConfL ConfJ	ConfL - Monitors the configuration during linear movement on page 152 ConfJ - Controls the configuration during joint movement on page 150
Path resolution		PathResol	PathResol - Override path resolution on page 540
Tuning motion supervision		MotionSup	MotionSup - Deactivates/Activates motion supervision on page 383
Reduction of TCP acceleration/deceleration along the movement path		PathAccLim	PathAccLim - Reduce TCP acceleration along the path on page 515
Modification of the tool orientation during circle interpolation		CirPathMode	CirPathMode - Tool reorientation during circle path on page 129
Reduction of payload acceleration in world coordinate system		WorldAccLim	WorldAccLim - Control acceleration in world coordinate system on page 1061

C_PROGDISP

The variable C_PROGDISP of data type progdisp mirrors the current program displacement and external axes offset:

Description	Data type	Changed by	Also see
Current program displacement for robot axes	progdisp	Instructions:	progdisp - Program displacement on page 1700

Continues on next page

Description	Data type	Changed by	Also see
		PDispSet	PDispSet - Activates program displacement using known frame on page 548
		PDispOn	PDispOn - Activates program displacement on page 543
		PDispOff	PDispOff - Deactivates program displacement on page 542
Current external axes offset		EOffsSet	EOffsSet - Activates an offset for additional axes using known values on page 188
		EOffsOn	EOffsOn - Activates an offset for additional axes on page 186
		EOffsOff	EOffsOff - Deactivates an offset for additional axes on page 185

ERRNO

The variable ERRNO of data type `errnum` mirrors the current error recovery number:

Description	Data type	Changed by	Also see
The latest error that occurred	<code>errnum</code>	The system	Technical reference manual - RAPID Overview, section RAPID summary - Error recovery intnum - Interrupt identity on page 1656

INTNO

The variable INTNO of data type `intnum` mirrors the current interrupt number:

Description	Data type	Changed by	Also see
The latest interrupt that occurred	<code>intnum</code>	The system	Technical reference manual - RAPID Overview, section RAPID summary - Interrupts intnum - Interrupt identity on page 1656

ROB_ID

The variable ROB_ID of data type `mecunit` contains a reference to the TCP-robot (if any) in the actual program task.

Description	Data type	Changed by	Also see
Reference to the robot (if any) in the actual program task. Always check before use with <code>TaskRunRob ()</code>	<code>mecunit</code>	The system	mecunit - Mechanical unit on page 1672

3 Data types

3.77 taskid - Task identification

Multitasking

3.77 taskid - Task identification

Usage

taskid is used to identify available program tasks in the system.

The names of the program tasks are defined in the system parameters and, consequently, must not be defined in the program.

Description

Data of the type taskid only contains a reference to the program task.

Predefined data

The program tasks defined in the system parameters can always be accessed from the program (installed data).

For all program tasks in the system, predefined variables of the data type taskid will be available. The variable identity will be "taskname"+"Id", e.g. for the T_ROB1 task the variable identity will be T_ROB1Id, T_ROB2 - T_ROB2Id etc.

Limitations

Data of the type taskid must not be defined in the program. The data type can, on the other hand, be used as a parameter when declaring a routine.

Characteristics

taskid is a non-value data type. This means that data of this type does not permit value-oriented operations.

Related information

For information about	See
Saving program modules	Save - Save a program module on page 632
Configuration of program tasks	<i>Technical reference manual - System parameters</i>
Characteristics of non-value data types	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Data types</i>

3.78 tasks - RAPID program tasks

Usage

tasks is used to specify several RAPID program tasks.

Description

To specify several RAPID program tasks, the name of each task can be given as a string. An array of data type tasks can then hold all the task names.

This task list can then be used in the instructions `WaitSyncTask` and `SyncMoveOn`.



Note

The instructions above demand that the data is defined as system global PERS variables available in all the cooperated tasks.

Basic examples

The following example illustrates the data type tasks:

Example 1

Program example in program task T_ROB1

```
PERS tasks task_list{3} := [ ["T_STN1"], ["T_ROB1"], ["T_ROB2"] ];
VAR syncident sync1;
```

```
WaitSyncTask sync1, task_list;
```

At execution of instruction `WaitSyncTask` in the program task T_ROB1, the execution in that program task will wait until all the other program tasks T_STN1 and T_ROB2 have reached their corresponding `WaitSyncTask` with the same synchronization (meeting) point sync1.

Components

The data type has the following components.

taskname

Data type: string

The name of a RAPID program task specified in a string.

Structure

```
<dataobject of tasks>
  <taskname of string>
```

Related information

For information about	See
Identity for synchronization point	syncident - Identity for synchronization point on page 1745
Wait for synchronization point with other tasks	WaitSyncTask - Wait at synchronization point for other program tasks on page 1037
Start coordinated synchronized movements	SyncMoveOn - Start coordinated synchronized movements on page 811

Continues on next page

3 Data types

3.78 tasks - RAPID program tasks

Multitasking

Continued

For information about	See
End coordinated synchronized movements	<i>SyncMoveOff - End coordinated synchronized movements on page 805</i>

3.79 testsignal - Test signal

Usage

The data type `testsignal` is used when a test of the robot motion system is performed.

Description

A number of predefined test signals are available in the robot system. The `testsignal` data type is available in order to simplify programming of instruction `TestSignDefine`.

Basic examples

The following examples illustrate the data type `testsignal`:

Example 1

```
TestSignDefine 2, speed, Orbit, 2, 0;
```

The predefined constant `speed` is used to read the actual speed of axis 2 on the manipulator orbit.

Example 2

```
TestSignDefine 4, 4001, ROB_1, 2, 0;
```

The test signal `speed` is used to read the actual speed of axis 2 on the robot.

Predefined data

The following test signals are available for additional axes and are predefined in the system. All data is in SI units and measured on the motor side of the axis.

Symbolic constant	Value	Unit
<code>testsignal_speed</code>	6	rad/s
<code>testsignal_torque_ref</code>	9	Nm
<code>testsignal_resolver_angle</code>	1	rad
<code>testsignal_speed_ref</code>	4	rad/s

The following test signals are available for both robot and additional axes and are predefined in the system. All data is measured on the arm side of the axis.

Test signal	Value	Unit
Position	4000	degrees or mm ⁱ
Speed	4001	degrees/second or mm/s ⁱ
Torque	4002	Nm
External torque ⁱⁱ	4003	Nm

ⁱ The unit depends on if the axis is rotational or linear.

ⁱⁱ Returns an estimated externally applied torque (by contact with the environment). On an additional axis External torque might not be valid.

Characteristics

`testsignal` is an alias data type for `num` and consequently inherits its characteristics.

Continues on next page

3 Data types

3.79 testsignal - Test signal

RobotWare Base

Continued

Related information

For information about	See
Define test signal	TestSignDefine - Define test signal on page 827
Read test signal	TestSignRead - Read test signal value on page 1506
Reset test signals	TestSignReset - Reset all test signal definitions on page 829

3.80 tooldata - Tool data

Usage

`tooldata` is used to describe the characteristics of a tool, for example, a welding gun or a gripper. These characteristics are position and orientation of the tool center point (TCP) and the physical characteristics of the tool load.

If the tool is fixed in space (a stationary tool), the tool data firstly defines position and orientation of this very tool in space, TCP. Then it describes the load of the gripper moved by the robot.

Description

Tool data affects robot movements in the following ways:

- The tool center point (TCP) refers to a point that will satisfy the specified path and velocity performance. If the tool is reorientated or if coordinated external axes are used, only this point will follow the desired path at the programmed velocity.
- If a stationary tool is used, the programmed speed and path will relate to the work object held by the robot.
- Programmed positions refer to the position of the current TCP and the orientation in relation to the tool coordinate system. This means that if, for example, a tool is replaced because it is damaged, the old program can still be used if the tool coordinate system is redefined.

Tool data is also used when jogging the robot to:

- Define the TCP which is not moving when the tool is reorientated.
- Define the tool coordinate system in order to facilitate moving in or rotating in the tool coordinate directions.

**WARNING**

It is important to always define the actual tool load and, when used, the payload of the robot (for example, a gripped part). Incorrect definitions of load data can result in overloading of the robot mechanical structure. There is also a risk that the speed in manual reduced speed mode can be exceeded.

When incorrect load data is specified, it can often lead to the following consequences:

- The robot may not use its maximum capacity.
- Impaired path accuracy including a risk of overshooting.
- Risk of overloading the mechanical structure.

The controller continuously monitors the load and writes an event log if the load is higher than expected. This event log is saved and logged in the controller memory.

Basic examples

The following examples illustrate the data type `tooldata`:

Continues on next page

3 Data types

3.80 tooldata - Tool data

RobotWare Base

Continued

Example 1

```
PERS tooldata gripper := [ TRUE, [[97.4, 0, 223.1], [0.924, 0, 0.383, 0]], [5, [23, 0, 75], [1, 0, 0, 0], 0, 0, 0]];
```

The tool is described using the following values:

- The robot is holding the tool.
- The TCP is located at a point 223.1 mm straight out from the mounting flange and 97.4 mm along the X-axis of the wrist coordinate system.
- The X' and Z' directions of the tool are rotated 45° in relation to Y direction in the wrist coordinate system.
- The tool mass is 5 kg.
- The center of gravity is located at a point 75 mm straight out from mounting flange and 23 mm along the X-axis of the wrist coordinate system.
- The load can be considered a point mass, that is, without any moment of inertia.

Example 2

```
gripper.tframe.trans.z := 225.2;
```

The TCP of the tool, gripper, is adjusted to 225.2 in the z-direction.

Predefined data

The tool `tool0` defines the wrist coordinate system, with the origin being the center of the mounting flange. `tool0` can always be accessed from the program, but can never be changed (it is stored in system module `BASE`).

```
PERS tooldata tool0 := [ TRUE, [ [0, 0, 0], [1, 0, 0, 0] ], [0.001, [0, 0, 0.001], [1, 0, 0, 0], 0, 0, 0] ];
```

Components

`robhold`

robot hold

Data type: `bool`

Defines whether or not the robot is holding the tool:

- `TRUE`: The robot is holding the tool.
- `FALSE`: The robot is not holding the tool, that is, a stationary tool.

`tframe`

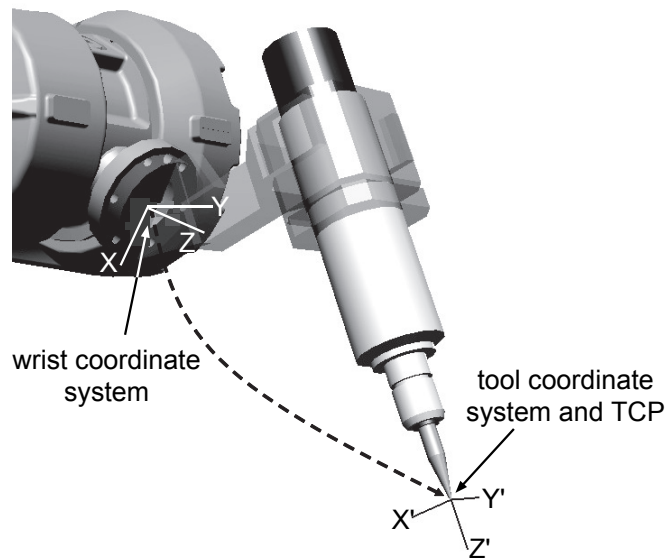
tool frame

Data type: `pose`

The tool coordinate system, that is:

- The position of the TCP (x, y and z) in mm, expressed in the wrist coordinate system (`tool0`) (see figure below).
- The orientation of the tool coordinate system, expressed in the wrist coordinate system (see figure below).

Continues on next page



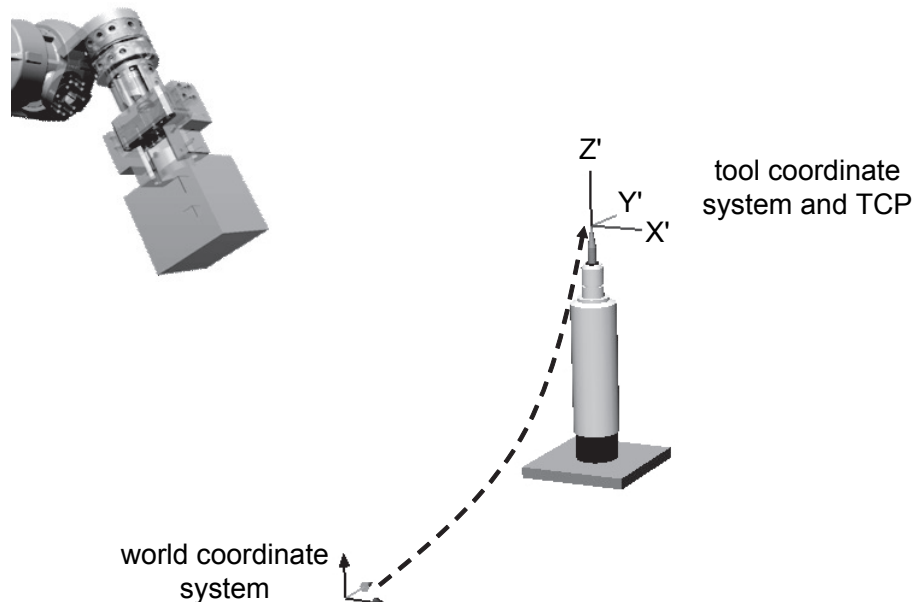
xx1100000517

Figure 3.3: Robot held tool



Note

If a stationary tool is used, the tool frame is defined in relation to the world coordinate system.



xx1100000518

Figure 3.4: Stationary tool

Continues on next page

3 Data types

3.80 tooldata - Tool data

RobotWare Base

Continued

tload

tool load

Data type: loaddata



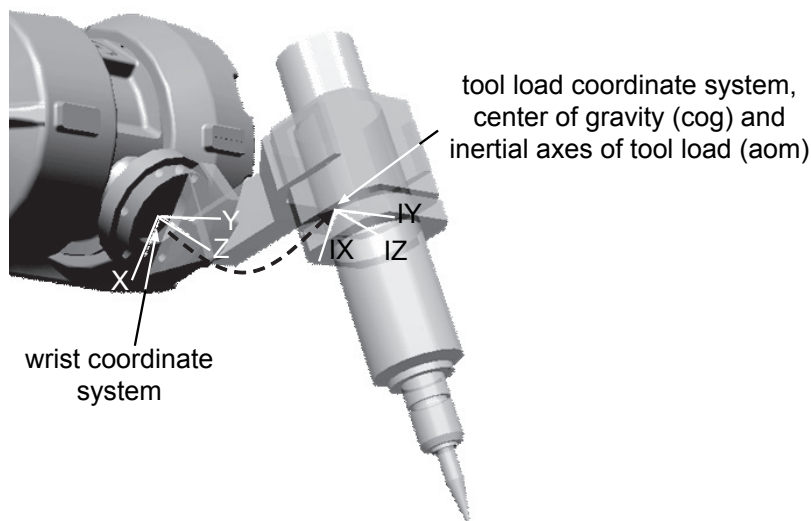
Note

This data is used both for robot held tool and for stationary tool. For a robot held tool the data describes the tool load. For a stationary tool the data describes the load of the robot held gripper.

Robot held tool:

The load of the tool, that is:

- The mass (weight) of the tool in kg.
- The center of gravity of the tool load (x, y and z) in mm, expressed in the wrist coordinate system
- The orientation of the principal inertial axes of moment of the tool expressed in the wrist coordinate system
- The moments of inertia around inertial axes of moment in kgm^2 . If all inertial components are defined as being 0 kgm^2 , the tool is handled as a point mass.



xx1100000519

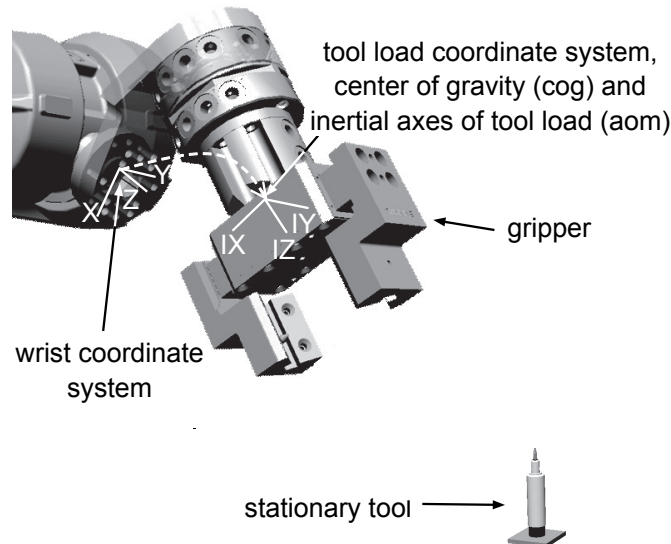
Stationary tool:

The load of the gripper holding the work object:

- The mass (weight) of the moved gripper in kg
- The center of gravity of moved gripper (x, y and z) in mm, expressed in the wrist coordinate system
- The orientation of the principal inertial axes of moment of the moved gripper expressed in the wrist coordinate system

Continues on next page

- The moments of inertia around inertial axes of moment in kgm^2 . If all inertial components are defined as being 0 kgm^2 , the gripper is handled as a point mass.



xx1100000520



Note

Only the load of the tool/gripper is to be specified in tooldata. The payload handled by a gripper is connected and disconnected by the instruction GripLoad and defined with a loaddata.

Instead of using the instruction GripLoad it is possible to define and use different tooldata for *gripper with gripped workpiece* and *gripper without workpiece*.

Summary

Position and orientation of TCP in tooldata are defined in the wrist coordinate system for a robot held tool.

Position and orientation of TCP in tooldata are defined in the world coordinate system for a stationary tool.

The loaddata part in tooldata is in all cases related to the wrist coordinate system, regardless of the fact whether a robot held tool (to describe the tool) or a stationary tool (to describe the gripper) is used.

Structure

```
< dataobject of tooldata >
  < robhold of bool >
  < tframe of pose >
    < trans of pos >
      < x of num >
      < y of num >
      < z of num >
```

Continues on next page

3 Data types

3.80 tooldata - Tool data

RobotWare Base

Continued

```
< rot of orient >  
  < q1 of num >  
  < q2 of num >  
  < q3 of num >  
  < q4 of num >  
< tload of loaddata >  
  < mass of num >  
  < cog of pos >  
  < x of num >  
  < y of num >  
  < z of num >  
  < aom of orient >  
    < q1 of num >  
    < q2 of num >  
    < q3 of num >  
    < q4 of num >  
  < ix of num >  
  < iy of num >  
  < iz of num >
```

Limitations

The tool data should be defined as a persistent variable (PERS) and should not be defined within a routine. The current values are then saved when the program is saved and are retrieved on loading.

Arguments of the type tool data in any motion instruction should only be an entire persistent (not array element or record component).

Related information

For information about	See
Positioning instructions	<i>Technical reference manual - RAPID Overview, section RAPID summary - Motion</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview, section Motion and I/O Principles - Coordinate systems</i>
Define payload for robots	GripLoad - Defines the payload for a robot on page 239
Definition of load data	loaddata - Load data on page 1664
Definition of work object data	wobjdata - Work object data on page 1775

3.81 tpnum - FlexPendant window number

Usage

tpnum is used to represent the FlexPendant window number with a symbolic constant.

Description

A tpnum constant is intended to be used in instruction TPShow.

Basic examples

The following example illustrates the data type tpnum:

Example 1

```
TPShow TP_LATEST;
```

The last used FlexPendant Window before the current FlexPendant window will be active after execution of this instruction.

Predefined data

The following symbolic constant of the data type tpnum is predefined and can be used in instruction TPShow:

Value	Symbolic constant	Comment
2	TP_LATEST	Latest used FlexPendant window

Characteristics

tpnum is an alias data type for num and consequently inherits its characteristics.

Related information

Information about	See
Data types in general, alias data types	<i>Technical reference manual - RAPID Overview</i> , section <i>Basic Characteristics - Data Types</i>
Communicating using the FlexPendant	<i>Technical reference manual - RAPID Overview</i> , section <i>RAPID Summary - Communication</i>
Switch window on the FlexPendant	TPShow - Switch window on the FlexPendant on page 846

3 Data types

3.82 trapdata - Interrupt data for current trap routine

RobotWare Base

3.82 trapdata - Interrupt data for current trap routine

Usage

trapdata (*trap data*) is used to contain the interrupt data that caused the current trap routine to be executed.

To be used in trap routines generated by instruction IError, before use of the instruction ReadErrData.

Description

Data of the type trapdata represents internal information related to the interrupt that caused the current trap routine to be executed. Its content depends on the type of interrupt.

Basic examples

The following example illustrates the data type trapdata:

Example 1

```
VAR errdomain err_domain;  
VAR num err_number;  
VAR errtype err_type;  
VAR trapdata err_data;  
...  
TRAP trap_err  
  GetTrapData err_data;  
  ReadErrData err_data, err_domain, err_number, err_type;  
ENDTRAP
```

When an error is trapped to the trap routine trap_err, the error domain, the error number, and the error type are saved into appropriate non-value variables of type trapdata.

Characteristics

trapdata is a non-value data type.

Related information

For information about	See
Summary of interrupts	<i>Technical reference manual - RAPID Overview</i>
More information on interrupt management	<i>Technical reference manual - RAPID Overview</i>
Non value data types	<i>Technical reference manual - RAPID Overview</i>
Orders an interrupt on errors	IError - Orders an interrupt on errors on page 253
Get interrupt data for current trap	GetTrapData - Get interrupt data for current trap routine on page 235
Gets information about an error	ReadErrData - Gets information about an error on page 573

3.83 triggdata - Positioning events, trigg

Usage

triggdata is used to store data about a positioning event during a robot movement.

A positioning event can take the form of setting an output signal or running an interrupt routine at a specific position along the movement path of the robot.

Description

To define the conditions for the respective measures at a positioning event, variables of the type triggdata are used. The data contents of the variable are formed in the program using one of the instructions TriggIO, TriggEquip, TriggCheckIO, TriggInt, TriggSpeed or TriggRampAO and are used by one of the instructions TriggL, TriggC or TriggJ.

Basic examples

The following example illustrates the data type triggdata :

Example 1

```
VAR triggdata gunoff;
TriggIO gunoff, 0,5 \D0p:=gun, 0;
TriggL p1, v500, gunoff, fine, gun1;
```

The digital output signal gun is set to the value 0 when the TCP is at a position 0,5 mm before the point p1.

Characteristics

triggdata is a non-value data type.

Related information

For information about	See
Definition of triggs	TriggIO - Define a fixed position or time I/O event near a stop point on page 888 TriggEquip - Define a fixed position and time I/O event on the path on page 877 TriggCheckIO - Defines I/O check at a fixed position on page 867 TriggInt - Defines a position related interrupt on page 883
Use of triggs	TriggL - Linear robot movements with events on page 902 TriggC - Circular robot movement with events on page 858 TriggJ - Axis-wise robot movements with events on page 894
Characteristics of non-value data types	Technical reference manual - RAPID Overview, section Basic characteristics - Data types

3 Data types

3.84 triggios - Positioning events, trigg *RobotWare Base*

3.84 triggios - Positioning events, trigg

Usage

`triggios` is used to store data about a positioning event during a robot movement. When the positioning event is distributed at a specific position on the path, an output signal is set to a specified value.

Description

`triggios` is used to define conditions and actions for setting a digital output signal, a group of digital output signals or an analog output signal at a fixed position along the robot's movement path.

Examples

The following example illustrates the data type `triggios`:

Example 1

```
VAR triggios gunon{1};

gunon{1}.used:=TRUE;
gunon{1}.distance:=3;
gunon{1}.start:=TRUE;
gunon{1}.signalname="gun";
gunon{1}.equiplag:=0;
gunon{1}.setvalue:=1;

MoveJ p1, v500, z50, gun1;
TriggLI0s p2, v500, \TriggData1:=gunon, z50, gun1;
MoveL p3, v500, z50, gun1;
```

The signal `gun` is set when the TCP is 3 mm after point `p1`.

Components

`used`

Data type: `bool`

Defines whether or not the array element should be used or not.

`distance`

Data type: `num`

Defines the position on the path where the I/O event shall occur. Specified as the distance in mm (positive value) from the end point of the movement path if component `start` is set to `FALSE`.

`start`

Data type: `bool`

Set to `TRUE` when the distance starts at the movement start point instead of the end point.

`equiplag`

Equipment Lag

Continues on next page

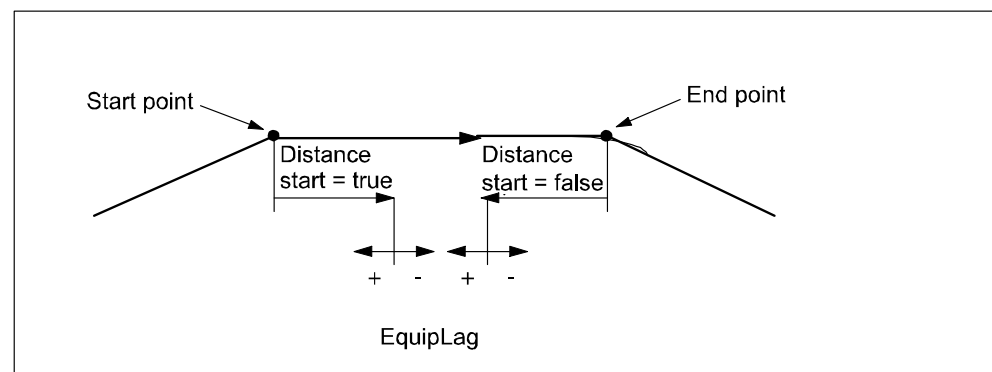
Data type: num

Specify the lag for the external equipment in s.

For compensation of external equipment lag, use a positive argument value. Positive value means that the I/O signal is set by the robot system at a specified time before the TCP physically reaches the specified distance in relation to the movement start or end point.

Negative value means that the I/O signal is set by the robot system at a specified time after that the TCP has physically passed the specified distance in relation to the movement start or end point.

The figure shows use of component equiplag.



xx0800000173

signalname

Data type: string

The name of the signal that shall be changed. It have to be a digital output signal, group of digital output signals or an analog output signal.

setvalue

Data type: num

Desired value of output signal (within the allowed range for the current signal).

Structure

```
<dataobject of triggios>
  <used of bool>
  <distance of num>
  <start of bool>
  <equiplag of num>
  <signalname of string>
  <setvalue of num>
```

Related information

For information about	See
Positioning events, trigg	triggiosdnum - Positioning events, trigg on page 1764
Linear robot movements with I/O events	TriggLIOs - Linear robot movements with I/O events on page 919

3 Data types

3.85 triggiosdnum - Positioning events, trigg *RobotWare Base*

3.85 triggiosdnum - Positioning events, trigg

Usage

triggiosdnum is used to store data about a positioning event during a robot movement. When the positioning event is distributed at a specific position on the path, an output signal is set to a specified value.

Description

triggiosdnum is used to define conditions and actions for setting a digital output signal, a group of digital output signals or an analog output signal at a fixed position along the robot's movement path.

Examples

The following example illustrates the data type triggiosdnum:

Example 1

```
VAR triggiosdnum gunon{1};

gunon{1}.used:=TRUE;
gunon{1}.distance:=3;
gunon{1}.start:=TRUE;
gunon{1}.signalname="go_gun";
gunon{1}.equiplag:=0;
gunon{1}.setvalue:=123456789;

MoveJ p1, v500, z50, gun1;
TriggLI0s p2, v500, \TriggData3:=gunon, z50, gun1;
MoveL p3, v500, z50, gun1;
```

The signal go_gun is set when the TCP is 3 mm after point p1.

Components

used

Data type: bool

Defines whether or not the array element should be used or not.

distance

Data type: num

Defines the position on the path where the I/O event shall occur. Specified as the distance in mm (positive value) from the end point of the movement path if component start is set to FALSE.

start

Data type: bool

Set to TRUE when the distance starts at the movement start point instead of the end point.

equiplag

Equipment Lag

Continues on next page

Data type: num

Specifies the lag for the external equipment in s.

For compensation of external equipment lag, use a positive argument value. Positive value means that the I/O signal is set by the robot system at a specified time before the TCP physically reaches the specified distance in relation to the movement start or end point.

Negative value means that the I/O signal is set by the robot system at a specified time after the TCP has physically passed the specified distance in relation to the movement start or end point.

signalname

Data type: string

The name of the signal that shall be changed. It has to be a digital output signal, group of digital output signals or an analog output signal.

setvalue

Data type: dnum

Desired value of output signal (within the allowed range for the current signal).

Structure

```
<dataobject of triggiosdnum>
  <used of bool>
  <distance of num>
  <start of bool>
  <equiplag of num>
  <signalname of string>
  <setvalue of dnum>
```

Related information

For information about	See
Positioning events, trigg	triggios - Positioning events, trigg on page 1762
Linear robot movements with I/O events	TriggLIOs - Linear robot movements with I/O events on page 919

3 Data types

3.86 triggmode - Trigg action mode *RobotWare Base*

3.86 triggmode - Trigg action mode

Usage

triggmode is used to specify different action modes when defining triggers.

Description

A triggmode constant is intended to be used to define the mode for instructions used for definition of triggers.

Basic examples

The following examples illustrate the data type triggmode:

Example 1

```
CONNECT intno1 WITH trap1;
TriggInt trigg1, Distance:=17, intno1 \Inhib:=inhibit
\Mode:=TRIGG_MODE1;
TriggL p1, v500, trigg1, z50, gun1;
```

The interrupt routine trap1 is run when the TCP is at a position 17 mm before the point p1 if persistent variable inhibit flag is TRUE (mode TRIGG_MODE1 invert the value read from inhibit flag).

Example 2

```
TriggEquip trigg1, 17, 0 \GOp:=go1, SetValue:=5 \Inhib:=inhibit
\Mode:=TRIGG_MODE2;
TriggL p1, v500, trigg1, z50, gun1;
```

If the persistent flag inhibit is FALSE when the TCP is at a position 17 mm before the point p1, the I/O signal go1 is set to the value specified in SetValue. If persistent variable inhibit is TRUE, no action at all is performed (keep value of I/O signal go1).

Example 3

```
TriggEquip trigg1, 17, 0 \GOp:=go1, SetValue:=0 \Inhib:=inhibit
\InhibSetValue:=setDnum \Mode:=TRIGG_MODE3;
TriggL p1, v500, trigg1, z50, gun1;
```

If the persistent flag inhibit is TRUE when the TCP is at a position 17 mm before the point p1, the I/O signal go1 is set to the value read from the dnum persistent variable setDnum. If inhibit is FALSE, no action at all is performed (keep value of I/O signal go1).

Example 4

```
TriggEquip trigg1, 17, 0 \GOp:=go1, SetValue:=5 \Inhib:=inhibit
\Mode:=TRIGG_MODE3;
TriggL p1, v500, trigg1, z50, gun1;
```

If the persistent flag inhibit is TRUE when the TCP is at a position 17 mm before the point p1, the I/O signal go1 is set to the value specified in SetValue (5 in this example). If inhibit is FALSE, no action at all is performed (keep value of I/O signal go1).

Continues on next page

Predefined data

The following symbolic constants of the data type triggmode are predefined and can be used to specify different action modes when defining triggers.

Value	Symbolic constant	Comment
1	TRIGG_MODE1	Can be used by instructions TriggCheckIO, TriggEquip, TriggIO, TriggInt, TriggSpeed, and TriggRampAO. Invert the value read from persistent variable used in optional argument Inhib.
2	TRIGG_MODE2	Can be used by instructions TriggEquip, TriggIO, TriggSpeed, and TriggRampAO if using optional argument Inhib. If the actual value of the specified flag used in Inhib is TRUE at the position-time for setting the I/O signal, then the specified I/O signal will not be updated (no action).
3	TRIGG_MODE3	Mode can only be used together with optional argument Inhib in instructions TriggEquip and TriggIO. If the actual value of the specified flag used in Inhib is FALSE, the I/O signal is not updated (no action). If used only with Inhib and the specified flag used in Inhib is TRUE at the position, the I/O signal is set to the value specified in argument SetValue or SetDvalue. If used with both Inhib and InhibSetValue: The arguments SetValue and SetDvalue are not considered at all. If the actual value of the specified flag used in Inhib is TRUE, then the I/O signal is set to the value that the persistent variable used in optional argument InhibSetValue has at the position.

Characteristics

triggmode is an alias data type for num and consequently inherits its characteristics.

Continues on next page

3 Data types

3.86 triggmode - Trigg action mode

RobotWare Base

Continued

Related information

For information about	See
Use of triggers	TriggL - Linear robot movements with events on page 902 TriggC - Circular robot movement with events on page 858 TriggJ - Axis-wise robot movements with events on page 894
Definition of triggers	TriggEquip - Define a fixed position and time I/O event on the path on page 877 TriggInt - Defines a position related interrupt on page 883 TriggIO - Define a fixed position or time I/O event near a stop point on page 888 TriggRampAO - Define a fixed position ramp AO event on the path on page 927 TriggSpeed - Defines TCP speed proportional analog output with fixed position-time scale event on page 934
Define I/O check at a fixed position	TriggCheckIO - Defines I/O check at a fixed position on page 867
Storage of trigg data	triggdata - Positioning events, trigg on page 1761
Data types in general, alias data types	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Data types</i>

3.87 tsp_status - Task selection panel status

Usage

tsp_status is used to mirror the status of the **Task Selection Panel** on the FlexPendant.

Description

With the functions **TaskIsActive** and **GetTSPStatus**, it is possible to read out current status of **Task Selection Panel** on the FlexPendant.

Basic examples

The following example illustrates the data type **tsp_status**:

Example 1

```

VAR tsp_status tspstatus;
...
tspstatus:=GetTSPStatus("MYTASK");
IF tspstatus >= TSP_NORMAL_UNCHECKED AND tspstatus <=
    TSP_SEMISTATIC_UNCHECKED THEN
    TPWrite "Task MYTASK is unchecked in the Task Selection Panel";
ELSEIF tspstatus >= TSP_NORMAL_CHECKED THEN
    TPWrite "Task MYTASK is checked in the Task Selection Panel";
ELSE
    TPWrite "Task MYTASK is unchecked in TSP due to execution in
        service routine";
ENDIF

```

This program example investigates if program task MYTASK is checked or unchecked in the **Task Selection Panel** on the FlexPendant.

Predefined data

Following constants of type **tsp_status** are predefined:

RAPID constant	Value	Description
TSP_STATUS_NOT_NORMAL_TASK	0	TaskIsActive. The task is a semistatic or static task, not a normal task.
TSP_STATUS_DEACT	1	TaskIsActive. The normal task is deactivated in the Task Selection Panel.
TSP_STATUS_DEACT_SERV_ROUT	2	TaskIsActive. The normal task is deactivated in the Task Selection Panel because some other task is executing a service routine.
TSP_STATUS_ACT	3	TaskIsActive. The normal task is active in the Task Selection Panel.
TSP_UNCHECKED_RUN_SERV_ROUT	10	GetTSPStatus. The normal task is unchecked in the Task Selection Panel because some other task is executing a service routine.
TSP_NORMAL_UNCHECKED	11	GetTSPStatus. The normal task is unchecked in the Task Selection Panel.

Continues on next page

3 Data types

3.87 tsp_status - Task selection panel status

RobotWare Base

Continued

RAPID constant	Value	Description
TSP_STATIC_UNCHECKED	12	GetTSPStatus. The static task is unchecked in the Task Selection Panel.
TSP_SEMISTATIC_UNCHECKED	13	GetTSPStatus. The semistatic task is unchecked in the Task Selection Panel.
TSP_NORMAL_CHECKED	14	GetTSPStatus. The normal task is checked in the Task Selection Panel.
TSP_STATIC_CHECKED	15	GetTSPStatus. The static task is checked in the Task Selection Panel.
TSP_SEMISTATIC_CHECKED	16	GetTSPStatus. The semistatic task is checked in the Task Selection Panel.

Characteristics

tsp_status is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Get current task selection panel status	GetTSPStatus - Get current task selection panel status on page 1293
Check if a normal task is active	TaskIsActive - Check if a normal task is active on page 1497

3.88 tunetype - Servo tune type

Usage

tunetype is used to represent an integer with a symbolic constant for different types of servo tuning.

Description

A tunetype constant is intended to be used as an argument to the instruction TuneServo.

Basic examples

The following example illustrates the data type tunetype:

Example 1

```
TuneServo MHA160R1, 1, 110 \Type:= TUNE_KP;
```

Predefined data

The following symbolic constants of the data type tunetype are predefined and can be used as arguments for the instruction TuneServo.

Value	Symbolic constant	Comment
0	TUNE_DF	Reduces overshoots
1	TUNE_KP	Affects position control gain
2	TUNE_KV	Affects speed control gain
3	TUNE_TI	Affects speed control integration time
4	TUNE_FRIC_LEV	Affects friction compensation level
5	TUNE_FRIC_RAMP	Affects friction compensation ramp
6	TUNE_DG	Only for ABB internal use
7	TUNE_DH	Reduces vibrations with heavy loads
8	TUNE_DI	Only for ABB internal use
9	TUNE_DK	Only for ABB internal use
10	TUNE_DL	Only for ABB internal use

Characteristics

tunetype is an alias data type for num and consequently inherits its characteristics.

Related information

For information about	See
Data types in general, alias data types	<i>Technical reference manual - RAPID Overview, section Basic characteristics - Data types</i>
Use of data type tunetype	TuneServo - Tuning servos on page 954

3 Data types

3.89 uidisplaynum - Instance ID for UIDisplay

RobotWare Base

3.89 uidisplaynum - Instance ID for UIDisplay

Usage

uidisplaynum is the data type used for parameter InstanceId in instruction UIDisplay. It is used to identify a view on the FlexPendant.

Description

When a persistent variable of type uidisplaynum is used with the instruction UIDisplay, it is given a specific value identifying the view launched on the FlexPendant. This persistent is then used in all dealings with that view, such as launching the view again, modifying the view, etc.

Examples

The following example illustrates the data type uidisplaynum:

Example 1

```
CONST string ID:="MyWebApp";  
CONST string Args1:="MainView=DashBoard&SubView=ProductionData";  
PERS uidisplaynum myinstance:=0; VAR uidisplaystatus mystatus;  
...  
! Launch one view of MyWebApp  
UIDisplay ID, \Args:=Args1\InstanceID:=myinstance \Status:=mystatus;
```

The code above will launch the *MyWebApp* and navigate to *DashBoard* view and open a sub-view called *ProductionData* and the token used to identify the view is saved in the parameter *myinstance*.

Characteristics

uidisplaynum is an alias data type for num and thus inherits its properties.

Related information

For information about	See
UIDisplay	UIDisplay - user messages on page 961

3.90 weavestartdata - weave start data

Usage

weavestartdata is used to control stationary weaving during start and restart of a process in CAP.

weavestartdata is a component of capdata and defines the properties of stationary weaving at start or restart of a CAP process:

- if there shall be stationary weaving at start (active)
- width of stationary weaving (width)
- direction relative path direction (dir)
- frequency of stationary weaving (cycle_time)

Stationary weaving uses always geometric weaving with zig-zag pattern, see [capweavedata - Weavedata for CAP on page 1609](#).

Components

active

Data type: bool

Value	Description
TRUE	Perform stationary weaving at start of a CAP process
FALSE	Do NOT perform stationary weaving at start of a CAP process

width

Data type: num

Defines the amplitude of stationary weaving (mm).

dir

Data type: num

Defines the direction of stationary weaving relative to the path direction (degrees). Zero degrees means weaving perpendicular to both the path and the z-coordinate of the tool.

cycle_time

Data type: num

Defines the total time (in seconds) for a complete cycle of stationary weaving, that is, it defines the weaving frequency. The stationary weaving will last until the process has started, that is, the supervision criteria of the START_MAIN phase are fulfilled.

Syntax

```

< data object of weavestartdata >
  < active of bool >
  < width of num >
  < dir of num >
  < cycle_time of num >

```

Continues on next page

3 Data types

3.90 weavestartdata - weave start data

Continuous Application Platform

Continued

Related information

	Described in:
capdata data type	capdata - CAP data on page 1605
<i>Continuous Application Platform</i>	<i>Application manual - Continuous Application Platform</i>

3.91 wobjdata - Work object data

Usage

wobjdata is used to describe the work object that the robot welds, processes, moves within, etc.

Description

If work objects are defined in a positioning instruction, the position will be based on the coordinates of the work object. The advantages of this are as follows:

- If position data is entered manually, such as in off-line programming, the values can often be taken from a drawing.
- Programs can be reused quickly following changes in the robot installation. If, for example, the fixture is moved, only the user coordinate system has to be redefined.
- Variations in how the work object is attached can be compensated for. For this, however, some sort of sensor will be required to position the work object.

If a stationary tool or coordinated external axes are used, the work object must be defined, since the path and velocity would then be related to the work object instead of the TCP.

Work object data can also be used for jogging:

- The robot can be jogged in the directions of the work object.
- The current position displayed is based on the coordinate system of the work object.

Basic examples

The following example illustrates the data type wobjdata:

Example 1

```
PERS wobjdata wobj2 :=[ FALSE, TRUE, "", [ [300, 600, 200], [1, 0, 0, 0] ], [ [0, 200, 30], [1, 0, 0, 0] ] ];
```

The work object in the figure above is described using the following values:

- The robot is not holding the work object.
- The fixed user coordinate system is used.
- The user coordinate system is not rotated and the coordinates of its origin are x= 300, y = 600 and z = 200 mm in the world coordinate system.
- The object coordinate system is not rotated and the coordinates of its origin are x= 0, y= 200 and z= 30 mm in the user coordinate system.

```
wobj2.oframe.trans.z := 38.3;
```

- The position of the work object wobj2 is adjusted to 38.3 mm in the z-direction.

Predefined data

The work object data wobj0 is defined in such a way that the object coordinate system coincides with the world coordinate system. The robot does not hold the work object.

Continues on next page

3 Data types

3.91 wobjdata - Work object data

RobotWare Base

Continued

Wobj0 can always be accessed from the program, but can never be changed (it is stored in system module BASE).

```
PERS wobjdata wobj0 := [ FALSE, TRUE, "", [ [0, 0, 0], [1, 0, 0], [0, 0, 0] ], [ [0, 0, 0], [1, 0, 0], [0, 0, 0] ] ];
```

Components

robhold

robot hold

Data type: bool

Defines whether or not the robot in the actual program task is holding the work object:

- TRUE: The robot is holding the work object, i.e. using a stationary tool.
- FALSE: The robot is not holding the work object, i.e. the robot is holding the tool.

ufprog

user frame programmed

Data type: bool

Defines whether or not a fixed user coordinate system is used:

- TRUE: Fixed user coordinate system.
- FALSE: Movable user coordinate system, i.e. coordinated external axes are used. Also to be used in a MultiMove system in semicoordinated or synchronized coordinated mode.

ufmec

user frame mechanical unit

Data type: string

The mechanical unit with which the robot movements are coordinated. Only specified in the case of movable user coordinate systems (ufprog is FALSE).

Specify the mechanical unit name defined in system parameters, e.g. orbit_a.

uframe

user frame

Data type: pose

The user coordinate system, i.e. the position of the current work surface or fixture (see figure below):

- The position of the origin of the coordinate system (x, y and z) in mm.
- The rotation of the coordinate system, expressed as a quaternion (q1, q2, q3, q4).

If the robot is holding the tool, the user coordinate system is defined in the world coordinate system (in the wrist coordinate system if a stationary tool is used).

For movable user frame (ufprog is FALSE), the user frame is continuously defined by the system.

Continues on next page

oframe

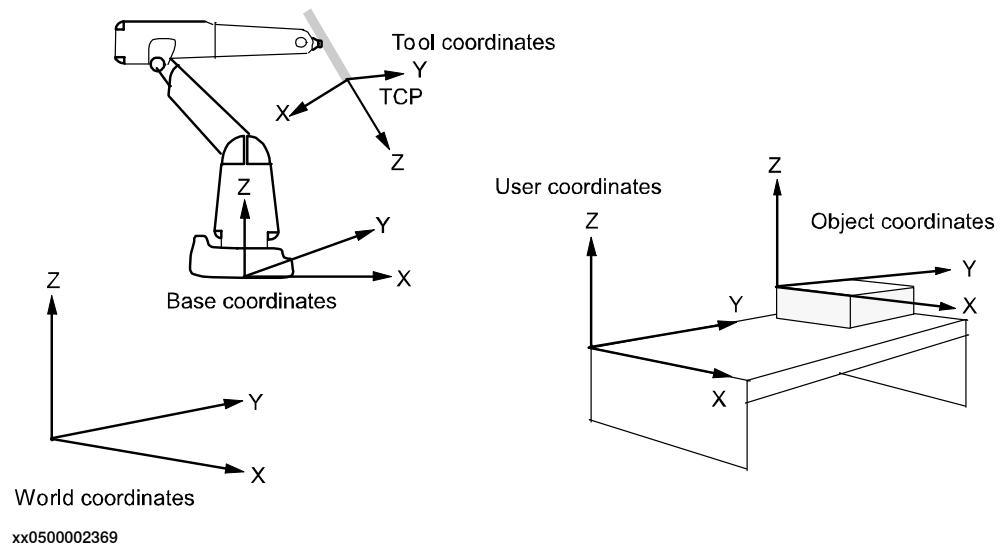
object frame

Data type: pose

The object coordinate system, i.e. the position of the current work object (see figure below):

- The position of the origin of the coordinate system (x, y and z) in mm.
- The rotation of the coordinate system, expressed as a quaternion (q1, q2, q3, q4).

The object coordinate system is defined in the user coordinate system.



Structure

```
< dataobject of wobjdata >
  < robhold of bool >
  < ufprog of bool >
  < ufmec of string >
  < uframe of pose >
    < trans of pos >
      < x of num >
      < y of num >
      < z of num >
    < rot of orient >
      < q1 of num >
      < q2 of num >
      < q3 of num >
      < q4 of num >
  < oframe of pose >
    < trans of pos >
      < x of num >
      < y of num >
      < z of num >
    < rot of orient >
      < q1 of num >
```

Continues on next page

3 Data types

3.91 wobjdata - Work object data

RobotWare Base

Continued

< q2 of num >
< q3 of num >
< q4 of num >

Limitations

The work object data should be defined as a persistent variable (PERS) and should not be defined within a routine. The current values are then saved when the program is saved and are retrieved on loading.

Arguments of the type work object data in any motion instruction should only be an entire persistent (not array element or record component).

Related information

For information about	See
Positioning instructions	<i>Technical reference manual - RAPID Overview, section RAPID summary - Motion</i>
Coordinate systems	<i>Technical reference manual - RAPID Overview, section Motion and I/O Principles - Coordinate systems</i>
Coordinated external axes	<i>Technical reference manual - RAPID Overview, section Motion and I/O Principles - Coordinate systems</i>
Calibration of coordinated axes	<i>Application manual - Additional axes</i> <i>Application manual - MultiMove</i>

3.92 wzstationary - Stationary world zone data

Usage

wzstationary (*world zone stationary*) is used to identify a stationary world zone and can only be used in an event routine connected to the event POWER ON.

A world zone is supervised during robot movements both during program execution and jogging. If the robot's TCP reaches the world zone or if the robot/external axes reaches the world zone in joints, the movement is stopped or a digital output signal is set or reset.

Description

A wzstationary world zone is defined and activated by a WZLimSup or a WZD0Set instruction.

WZLimSup or WZD0Set gives the variable or the persistent of data type wzstationary a numeric value. The value identifies the world zone.

A stationary world zone is **always active** in motor on state and is only erased by a **Restart**. It is not possible to deactivate, activate or erase a stationary world zone via RAPID instructions.

Stationary world zones should be active from power on and should be defined in a POWER ON event routine or a semistatic task

Basic examples

The following example illustrates the data type wzstationary:

Example 1

```
VAR wzstationary conveyor;
...
PROC ...
  VAR shapedata volume;
  ...
  WZBoxDef \Inside, volume, p_corner1, p_corner2;
  WZLimSup \Stat, conveyor, volume;
ENDPROC
```

A conveyor is defined as a straight box (the volume below the belt). If the robot reaches this volume, the movement is stopped.

More examples

For a complete example see instruction WZLimSup.

Limitations

A wzstationary data can be defined as a variable (**VAR**) or as a persistent (**PERS**). It can be global in task or local within module, but not local within a routine. Arguments of the type wzstationary should only be entire data (not array element or record component).

An init value for data of the type wzstationary is not used by the control system. When there is a need to use a persistent variable in a multi-tasking system, set

Continues on next page

3 Data types

3.92 wzstationary - Stationary world zone data

World Zones

Continued

the init value to 0 in both tasks, e.g. PERS wzstationary share_workarea := [0];

Characteristics

wzstationary is an alias data type of wztemporary and inherits its characteristics.

Related information

For information about	See
World Zones	<i>Technical reference manual - RAPID Overview, section Motion and I/O programming, World Zones</i>
World zone shape	shapedata - World zone shape data on page 1721
Temporary world zone	wztemporary - Temporary world zone data on page 1781
Activate world zone limit supervision	WZLimSup - Activate world zone limit supervision on page 1109
Activate world zone digital output set	WZDOSet - Activate world zone to set digital output on page 1093

3.93 wztemporary - Temporary world zone data

Usage

wztemporary (*world zone temporary*) is used to identify a temporary world zone and can be used anywhere in the RAPID program for any motion task.

A world zone is supervised during robot movements both during program execution and jogging. If the robot's TCP reaches the world zone or if the robot/external axes reaches the world zone in joints, the movement is stopped or a digital output signal is set or reset.

Description

A wztemporary world zone is defined and activated by a WZLimSup or a WZD0Set instruction.

WZLimSup or WZD0Set gives the variable or the persistent of data type wztemporary a numeric value. The value identifies the world zone.

Once defined and activated, a temporary world zone can be deactivated by WZDisable, activated again by WZEnable, and erased by WZFree.

All temporary world zones in the motion task are automatically erased and all data objects of type wztemporary in the motion task are set to 0:

- when a new program is loaded in the motion task
- when starting program execution from the beginning in the motion task

Basic examples

The following example illustrates the data type wztemporary:

Example 1

```

VAR wztemporary roll;
...
PROC
  VAR shapedata volume;
  CONST pos t_center := [1000, 1000, 1000];
  ...
  WZCylDef \Inside, volume, t_center, 400, 1000;
  WZLimSup \Temp, roll, volume;
ENDPROC

```

A wztemporary variable, roll, is defined as a cylinder. If the robot reaches this volume, the movement is stopped.

More examples

For a complete example see instruction WZD0Set.

Limitations

A wztemporary data can be defined as a variable (VAR) or as a persistent (PERS). It can be global in a task or local within a module, but not local within a routine.

Arguments of the type wztemporary must only be entire data, not an array element or record component.

Continues on next page

3 Data types

3.93 wztemporary - Temporary world zone data

RobotWare Base

Continued

A temporary world zone must only be defined (WZLimSup or WZDOSet) and free (WZFree) in the motion task. Definitions of temporary world zones in any background is not allowed because it would affect the program execution in the connected motion task. The instructions WZDisable and WZEnable can be used in the background task. When there is a need to use a persistent variable in a multi-tasking system, set the init value to 0 in both tasks, e.g. PERS wztemporary share_workarea := [0];

Structure

< dataobject of wztemporary >
< wz of num >

Related information

For information about	See
World Zones	<i>Technical reference manual - RAPID Overview, section Motion and I/O programming, World Zones</i>
World zone shape	shapedata - World zone shape data on page 1721
Stationary world zone	wzstationary - Stationary world zone data on page 1779
Activate world zone limit supervision	WZLimSup - Activate world zone limit supervision on page 1109
Activate world zone digital output set	WZDOSet - Activate world zone to set digital output on page 1093
Deactivate world zone	WZDisable - Deactivate temporary world zone supervision on page 1091
Activate world zone	WZEnable - Activate temporary world zone supervision on page 1098
Erase world zone	WZFree - Erase temporary world zone supervision on page 1100

3.94 zonedata - Zone data

Usage

zonedata is used to specify how a position is to be terminated, i.e. how close to the programmed position the axes must be before moving towards the next position.

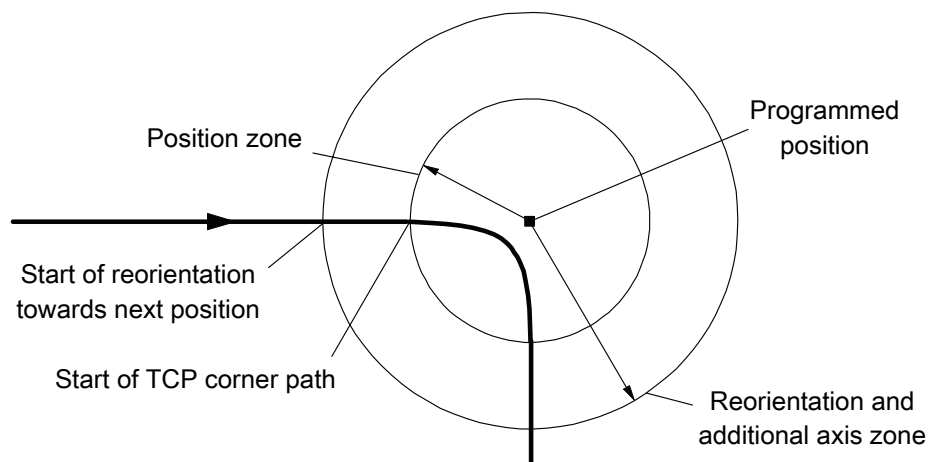
Description

A position can be terminated either in the form of a stop point or a fly-by point.

A stop point means that the robot and additional axes must reach the specified position (stand still) before program execution continues with the next instruction. It is also possible to define stop points other than the predefined *fine*. The stop criteria, that tells if the robot is considered to have reached the point, can be manipulated using the *stoppointdata*.

A fly-by point means that the programmed position is never attained. Instead, the direction of motion is changed before the position is reached. Two different zones (ranges) can be defined for each position:

- The position zone for the TCP path.
- The reorientation and additional axis zone.



xx1800000945

The zone for the TCP path

A corner path is generated as soon as the edge of the corner zone is reached (see figure above).

Continues on next page

3 Data types

3.94 zonedata - Zone data

RobotWare Base

Continued

Calculation of reorientation and additional axis zone

The datatype zonedata contains one component that determines the position zone, pzone_tcp. But the reorientation and additional axis zone can be affected by all of the following zonedata components.

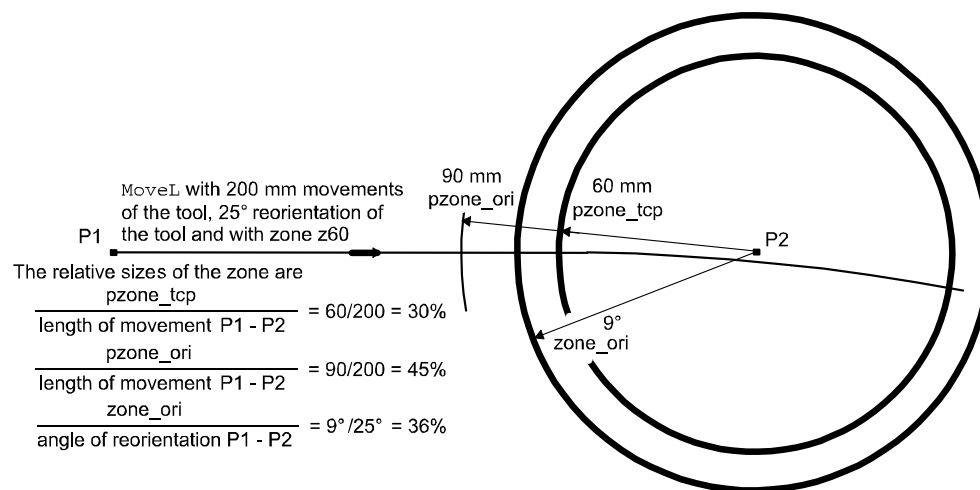
- pzone_ori - zone radius, in mm TCP movement, for reorientation of the tool
- pzone_eax - zone radius, in mm TCP movement, for movement of the additional axis
- zone_ori - angle zone, in degrees of tool reorientation
- zone_leax - zone size, in mm of linear additional axis movement
- zone_reax - angle zone, in degrees of rotational additional axis reorientation

The size of the reorientation and additional axis zone is generally limited by the smallest zone generated from the applicable components above. The zone will be defined as the smallest relative size of the zone based upon the zone components and the programmed motion.

If the calculations result in a reorientation and additional axis zone that is smaller than the position zone, the reorientation and additional axis zone will be set to the same size as the position zone. The exception is if there is no (or almost no) TCP position movement. If the reorientation is large and the position movement is small, the position zone can be reduced to the size of the reorientation and additional axis zone.

Reorientation and additional axis zone limited by zone_ori

The following figure shows an example of the reorientation and additional axis zone being reduced to 36% of the motion due to zone_ori.



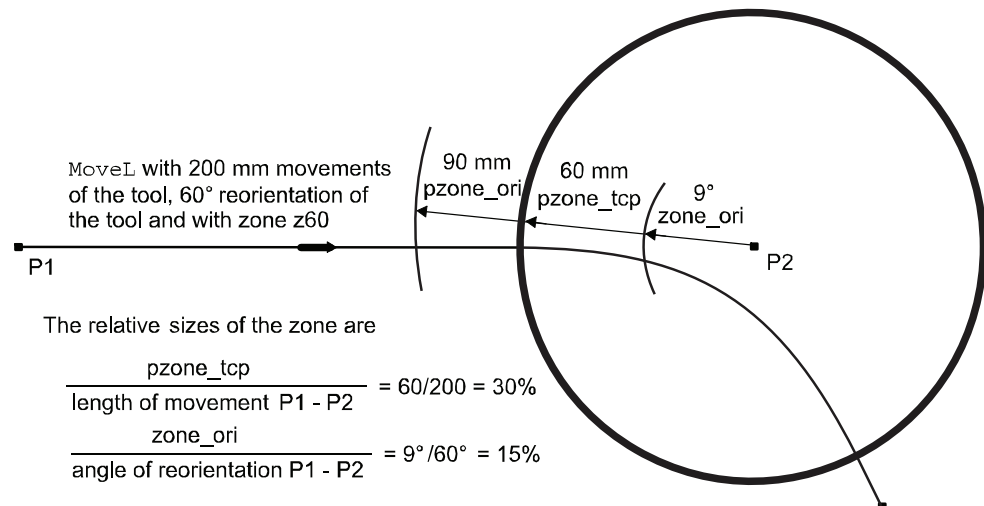
xx0500002362

Reorientation and additional axis zone increased to position zone

The size of the reorientation and additional axis zone must never be smaller than the position zone. So if, for example, zone_ori result in a smaller size than pzone_tcp, the reorientation and additional axis zone is increased to the size of the position zone.

Continues on next page

The following figure shows an example where zone_ori would result in a reorientation and additional axis zone of 15% of the motion, but is increased to 30% of the motion to match the position zone.



xx0500002363

Formulas for calculating the reorientation and additional axis zone

Normally not all zonedata components are applicable. For example, for a rotational additional axis reorientation without robot movement, only zone_reax is applicable.

For all zonedata components that are applicable, the smallest of the following relations determine the size of the reorientation and additional axis zone (as long as it is larger or equal to the position zone).

$$\frac{\text{pzone\_ori}}{\text{length of movement P1 - P2}}$$

$$\frac{\text{zone\_ori}}{\text{angle of tool reorientation P1 - P2}}$$

$$\frac{\text{pzone\_eax}}{\text{length of movement P1 - P2}}$$

$$\frac{\text{pzone\_leax}}{\text{length of max linear add. axis movement P1 - P2}}$$

$$\frac{\text{pzone\_reax}}{\text{angle of max reorientation of rotating add. axis P1 - P2}}$$

xx1800000781

Reduced corner zones

If programmed positions are close to each other and the corner zones are big, the corner zones can be reduced from the programmed size. See section *Interpolation of corner paths* in *Technical reference manual - RAPID Overview*.

Basic examples

The following example illustrates the data type zonedata:

Continues on next page

3 Data types

3.94 zonedata - Zone data

RobotWare Base

Continued

Example 1

```
VAR zonedata path := [ FALSE, 25, 40, 40, 10, 35, 5 ];
```

The zone data path is defined by means of the following characteristics:

- The zone size for the TCP path is 25 mm.
- The zone size for the tool reorientation is 40 mm (TCP movement).
- The zone size for external axes is 40 mm (TCP movement).

If the TCP is standing still, or there is a large reorientation, or there is a large external axis movement with respect to the zone, the following apply instead:

- The zone size for the tool reorientation is 10 degrees.
- The zone size for linear external axes is 35 mm.
- The zone size for rotating external axes is 5 degrees.

Predefined data

A number of zone data are already defined in the system.

Stop points

Use zonedata named fine.

Fly-by points

Path zone				Zone		
Name	TCP path	Orientation	Ext. axis	Orientation	Linear axis	Rotating axis
z0	0.3 mm	0.3 mm	0.3 mm	0.15°	0.3 mm	0.15°
z1	1 mm	1 mm	1 mm	0.5°	1 mm	0.5°
z5	5 mm	8 mm	8 mm	4°	8 mm	4°
z10	10 mm	15 mm	15 mm	7.5°	15 mm	7.5°
z15	15 mm	23 mm	23 mm	11°	23 mm	11°
z20	20 mm	30 mm	30 mm	15°	30 mm	15°
z30	30 mm	45 mm	45 mm	22°	45 mm	22°
z40	40 mm	60 mm	60 mm	30°	60 mm	30°
z50	50 mm	75 mm	75 mm	35°	75 mm	35°
z60	60 mm	90 mm	90 mm	40°	90 mm	40°
z80	80 mm	120 mm	120 mm	50°	120 mm	50°
z100	100 mm	150 mm	150 mm	60°	150 mm	60°
z150	150 mm	225 mm	225 mm	80°	225 mm	80°
z200	200 mm	300 mm	300 mm	90°	300 mm	90°

Components

finep

fine point

Data type: bool

Continues on next page

Defines whether the movement is to terminate as a stop point (fine point) or as a fly-by point.

- TRUE: The movement terminates as a stop point, and the program execution will not continue until robot reach the stop point. The remaining components in the zone data are not used.
- FALSE: The movement terminates as a fly-by point, and the program execution continues when the prefetch conditions have been met (see system parameter *Prefetch Time*).

pzone_tcp

path zone TCP

Data type: num

The size (the radius) of the TCP zone in mm.

pzone_ori

path zone orientation

Data type: num

The zone size (the radius) for the tool reorientation. The size is defined as the distance of the TCP from the programmed point in mm.

The size must be larger than the corresponding value for pzone_tcp. If a lower value is specified, the size is automatically increased to make it the same as pzone_tcp.

pzone_eax

path zone external axes

Data type: num

The zone size (the radius) for external axes. The size is defined as the distance of the TCP from the programmed point in mm.

The size must be larger than the corresponding value for pzone_tcp. If a lower value is specified, the size is automatically increased to make it the same as pzone_tcp.

zone_ori

zone orientation

Data type: num

The zone size for the tool reorientation in degrees. If the robot is holding the work object, this means an angle of rotation for the work object.

zone_leax

zone linear external axes

Data type: num

The zone size for linear external axes in mm.

zone_reax

zone rotational external axes

Data type: num

Continues on next page

3 Data types

3.94 zonedata - Zone data

RobotWare Base

Continued

The zone size for rotating external axes in degrees.

Structure

```
<data object of zonedata>
  <finep of bool>
  <pzone_tcp of num>
  <pzone_ori of num>
  <pzone_eax of num>
  <zone_ori of num>
  <zone_leax of num>
  <zone_reax of num>
```

Related information

For information about	See
Positioning instructions	<i>Technical reference manual - RAPID Overview</i>
Movements/Paths in general	<i>Technical reference manual - RAPID Overview</i>
Configuration of external axes	<i>Application manual - Additional axes</i>
Other Stop points	stoppointdata - Stop point data on page 1733

4 Programming type examples

4.1 ERROR handler with movements

Usage

These type examples describe how to use move instructions in an ERROR handler after an asynchronously raised process or movement error has occurred.

This function can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Description

The ERROR handler can start a new temporary movement and finally restart the original interrupted and stopped movement. For example, it can be used to go to a service position or to clean the gun after an asynchronously raised process or movement error has occurred.

To reach this functionality, the instructions StorePath - RestoPath must be used in the ERROR handler. To restart the movement and continue the program execution, several RAPID instructions are available.

Type examples

Type examples of the functionality are illustrated below.

Principle

```
...
ERROR
  IF ERRNO = ERR_PATH_STOP THEN
    StorePath;
    ! Move away and back to the interrupted position
    ...
    RestoPath;
    StartMoveRetry;
  ENDIF
ENDPROC
```

At execution of StartMoveRetry the robot resumes its movement, any active process is restarted and the program retries its execution. StartMoveRetry does the same as StartMove plus RETRY in one indivisible operation.

Automatic restart of execution

```
CONST robtarget service_pos := [...];
VAR robtarget stop_pos;
...
ERROR
  IF ERRNO = AW_WELD_ERR THEN
    ! Current movement on motion base path level
    ! is already stopped.
    ! New motion path level for new movements in the ERROR handler
    StorePath;
    ! Store current position from motion base path level
```

Continues on next page

4 Programming type examples

4.1 ERROR handler with movements

Path Recovery

Continued

```
stop_pos := CRobT(\Tool:=tool1, \WObj:=wobj1);
! Do the work to fix the problem
MoveJ service_pos, v50, fine, tool1, \WObj:=wobj1;
...
! Move back to the position on the motion base path level
MoveJ stop_pos, v50, fine, tool1, \WObj:=wobj1;
! Go back to motion base path level
RestoPath;
! Restart the stopped movements on motion base path level,
! restart the process and retry program execution
StartMoveRetry;
ENDIF
ENDPROC
```

This is a type example of how to use automatic asynchronously error recovery after some type of process error during robot movements.

Manual restart of execution

```
...
ERROR
IF ERRNO = PROC_ERR_XXX THEN
! Current movement on motion base path level
! is already stopped and in stop move state.
! This error must be handle manually.
! Reset the stop move state on motion base path level.
StopMoveReset;
ENDIF
ENDPROC
```

This is a type example of how to use manual handling of asynchronously error recovery after some type of process error during robot movements.

After the above ERROR handler has executed to the end, the program execution stops and the program pointer is at the beginning of the instruction with the process error (also at beginning of any used NOSTEPIN routine). The next program start restarts the program and movement from the position in which the original process error occurred.

Program execution

Execution behavior:

- At start execution of the ERROR handler, the program leaves its base execution level
- At execution of StorePath, the motion system leaves its base execution level
- At execution of RestoPath, the motion system returns to its base execution level
- At execution of StartMoveRetry, the program returns to its base execution level

Continues on next page

Limitations

The following RAPID instructions must be used in the ERROR handler with move instructions to get it working for automatically error recovery after an asynchronously raised process or path error:

Instruction	Description
StorePath	Enter new motion path level
RestoPath	Return to motion base path level
StartMoveRetry	Restart the interrupted movements on the motion base path level. Also restart the process and retry the program execution. Same functionality as StartMove + RETRY.

The following RAPID instruction must be used in the ERROR handler to get it working for manually error recovery after an asynchronously raised process or path error:

Instruction	Description
StopMoveReset	Enter new motion path level

Related information

For information about	See
To enter a new motion path level	StorePath - Stores the path when an interrupt occurs on page 798
To return to motion base path level	RestoPath - Restores the path after an interrupt on page 600
To restart the interrupted movement, process and retry program execution.	StartMoveRetry - Restarts robot movement and execution on page 766

4 Programming type examples

4.2 Service routines with or without movements

Path recovery

4.2 Service routines with or without movements

Usage

These type examples describe how to use movement instructions in a service routine. The same principle about StopMove, StartMove, and StopMoveReset are also valid for service routines without movements (only logical instructions). Both service routines or other routines (procedures) without parameters can be started manually and perform movements according to these type examples. This functionality can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks in independent or semi-coordinated mode.

Description

The service routine can start a new temporary movement and, at later program start, restart the original movement. For example, it can be used to go to a service position or manually start cleaning the gun.

To reach this functionality the instructions StorePath - RestoPath and StopMoveReset must be used in the service routine.

Type examples

Type examples of the functionality are illustrated below.

Principle

```
PROC xxxx()  
  StopMove;  
  StorePath;  
  ! Move away and back to the interrupted position  
  ...  
  RestoPath;  
  StopMoveReset;  
ENDPROC
```

StopMove is required in order to make sure that the originally stopped movement is not restarted upon a manually "stop program-restart program" sequence during execution of the service routine.

Stop on path

```
VAR robtarget service_pos := [...];  
...  
PROC proc_stop_on_path()  
  VAR robtarget stop_pos;  
  ! Current stopped movements on motion base path level  
  ! must not be restarted in the service routine.  
  StopMove;  
  ! New motion path level for new movements in the service routine.  
  StorePath;  
  ! Store current position from motion base path level  
  stop_pos := CRobT(\Tool:=tool1 \WObj:=wobj1);  
  ! Do the work  
  MoveJ service_pos, v50, fine, tool1 \WObj:=wobj1;
```

Continues on next page

```
...
! Move back to interrupted position on the motion base path level
MoveJ stop_pos, v50, fine, tool1, \WObj:=wobj1;
! Go back to motion base path level
RestoPath;
! Reset the stop move state for the interrupted movement
! on motion base path level
StopMoveReset;
ENDPROC
```

In this type example the movements in the service routine start and end at the position on the path where the program was stopped.

Also note that the tool and work object used are known at the time of programming.

Stop in next stop point

```
TASK PERS tooldata used_tool := [...];
TASK PERS wobjdata used_wobj := [...];
...
PROC proc_stop_in_stop_point()
  VAR robtarget stop_pos;
  ! Current move instruction on motion base path level continue to
  ! its ToPoint and will be finished in a stop point.
  StartMove;
  ! New motion path level for new movements in the service routine
  StorePath;
  ! Get current tool and work object data
  GetSysData used_tool;
  GetSysData used_wobj;
  ! Store current position from motion base path level
  stop_pos := CRobT(\Tool:=used_tool \WObj:=used_wobj);
  ! Do the work
  MoveJ Offs(stop_pos,0,0,20),v50,fine,used_tool\WObj:=used_wobj;
  ...
  ! Move back to interrupted position on the motion base path level
  MoveJ stop_pos, v50, fine, used_tool,\WObj:=used_wobj;
  ! Go back to motion base path level
  RestoPath;
  ! Reset the stop move state for any new movement
  ! on motion base path level
  StopMoveReset;
ENDPROC
```

In this type example the movements in the service routine continue to and end at the ToPoint in the interrupted move instructions before the instruction StorePath is ready.

Also note that the tool and work object used are unknown at the time of programming.

Continues on next page

4 Programming type examples

4.2 Service routines with or without movements

Path recovery

Continued

Program execution

Execution behavior:

- At start execution of the service routine, the program leaves its base execution level
- At execution of StorePath, the motion system leaves its base execution level
- At execution of RestoPath, the motion system returns to its base execution level
- At execution of ENDPROC, the program returns to its base execution level

Limitations

The following RAPID instructions must be used in the service routine with move instructions to get it working:

Instruction	Description
StorePath	Enter new motion path level
RestoPath	Return to motion base path level
StopMoveReset	Reset the stop move state for the interrupted movement on the motion base path level

Related information

For information about	See
No restart of the already stopped movement on the motion base path level	StopMove - Stops robot movement on page 792
Restart of the already stopped movement on the motion base path level	StopMove - Stops robot movement on page 792
To enter a new motion path level	StorePath - Stores the path when an interrupt occurs on page 798
To return to the motion base path level	RestoPath - Restores the path after an interrupt on page 600
Reset the stop move state for the interrupted movement on the motion base path level	StopMoveReset - Reset the system stop move state on page 796

4.3 System I/O interrupts with or without movements

Usage

These type examples describe how to use movement instructions in a system I/O interrupt routine. The same principle about `StopMove`, `StartMove`, and `StopMoveReset` are also valid for system I/O interrupts without movements (only logical instructions).

This functionality can only be used in the main task `T_ROB1` or, if in a `MultiMove` system, in Motion tasks in independent or semi-coordinated mode.

Description

The system I/O interrupt routine can start a new temporary movement and, at later program start, restart the original movement. For example, it can be used to go to a service position or to clean the gun when an interrupt occurs.

To reach this functionality the instructions `StorePath` - `RestoPath` and `StopMoveReset` must be used in the system I/O interrupt routine.

Type examples

Type examples of the functionality are illustrated below.

Principle

```
PROC xxxx()  
  StopMove;  
  StorePath;  
  ! Move away and back to the interrupted position  
  ...  
  RestoPath;  
  StopMoveReset;  
ENDPROC
```

`StopMove` is required in order to make sure that the originally stopped movement is not restarted at start of the I/O interrupt routine.

Without `StopMove` or with `StartMove` instead the movement in the I/O interrupt routine will continue at once and end at the `ToPoint` in the interrupted move instruction.

Stop on path

```
VAR robtarget service_pos := [...];  
...  
PROC proc_stop_on_path()  
  VAR robtarget stop_pos;  
  ! Current stopped movements on motion base path level is not  
    restarted in the system I/O routine.  
  StopMove;  
  ! New motion path level for new movements in the system I/O  
    routine.  
  StorePath;  
  ! Store current position from motion base path level  
  stop_pos := CRobT(\Tool:=tool1 \Wobj:=wobj1);  
  ! Do the work
```

Continues on next page

4 Programming type examples

4.3 System I/O interrupts with or without movements

Path recovery

Continued

```
MoveJ service_pos, v50, fine, tool1 \WObj:=wobj1;
...
! Move back to interrupted position on the motion base path level
MoveJ stop_pos, v50, fine, tool1, \WObj:=wobj1;
! Go back to motion base path level
RestoPath;
! Reset the stop move state for the interrupted movement on motion
  base path level
StopMoveReset;
ENDPROC
```

In this type example the interrupted movements are stopped at once and are restarted at program start after the system I/O interrupt routine is finished.

Also note that the tool and work object used are known at the time of programming.

Stop in next stop point

```
TASK PERS tooldata used_tool := [...];
TASK PERS wobjdata used_wobj := [...];
...
PROC proc_stop_in_stop_point()
  VAR robtarget stop_pos;
  ! Current move instruction on motion base path level continue to
    its ToPoint and will be finished in a stop point.
  StartMove;
  ! New motion path level for new movements in the system
  ! I/O routine
  StorePath;
  ! Get current tool and work object data
  GetSysData used_tool;
  GetSysData used_wobj;
  ! Store current position from motion base path level
  stop_pos := CRobT(\Tool:=used_tool \WObj:=used_wobj);
  ! Do the work
  MoveJ Offs(stop_pos,0,0,20),v50,fine,used_tool\WObj:=used_wobj;
  ...
  ! Move back to interrupted position on the motion base path level
  MoveJ stop_pos, v50, fine, used_tool,\WObj:=used_wobj;
  ! Go back to motion base path level
  RestoPath;
  ! Reset the stop move state for new movement
  ! on motion base path level
  StopMoveReset;
ENDPROC
```

In this type example the movements in the system I/O routine continue at once, and end at the ToPoint in the interrupted move instructions.

Also note that the tool and work object used are unknown at the time of programming.

Continues on next page

Program execution

Execution behavior:

- At start execution of the system I/O routine, the program leaves its base execution level
- At execution of StorePath, the motion system leaves its base execution level
- At execution of RestoPath, the motion system returns to its base execution level
- At execution of ENDPROC, the program returns to its base execution level

Limitations

The following RAPID instructions must be used in the system I/O routine with move instructions to get it working:

Instruction	Description
StorePath	Enter new motion path level
RestoPath	Return to motion base path level
StopMoveReset	Reset the stop move state for the interrupted movement on the motion base path level

Related information

For information about	See
No restart of the already stopped movement on the motion base path level	StopMove - Stops robot movement on page 792
Restart of the already stopped movement on the motion base path level	StartMove - Restarts robot movement on page 763
To enter a new motion path level	StorePath - Stores the path when an interrupt occurs on page 798
To return to the motion base path level	RestoPath - Restores the path after an interrupt on page 600
Reset the stop move state for the interrupted movement on the motion base path level	StopMoveReset - Reset the system stop move state on page 796

4 Programming type examples

4.4 Trap routines with movements

Path Recovery

4.4 Trap routines with movements

Usage

These type examples describe how to use move instructions in a trap routine after an interrupt has occurred.

This functionality can only be used in the main task T_ROB1 or, if in a MultiMove system, in Motion tasks.

Description

The trap routine can start a new temporary movement and finally restart the original movement. For example, it can be used to go to a service position or to clean the gun when an interrupt occurs.

To reach this functionality the instructions StorePath - RestoPath and StartMove must be used in the trap routine.

Type examples

Type examples of the functionality are illustrated below.

Principle

```
TRAP xxxx
  StopMove;
  StorePath;
  ! Move away and back to the interrupted position
  ...
  RestoPath;
  StartMove;
ENDTRAP
```

If StopMove is used, the movement stops at once on the ongoing path; otherwise, the movement continues to the ToPoint in the actual move instruction.

Stop in next stop point

```
VAR robtarget service_pos := [...];
...
TRAP trap_in_stop_point
  VAR robtarget stop_pos;
  ! Current move instruction on motion base path level continue
  ! to its ToPoint and will be finished in a stop point.
  ! New motion path level for new movements in the TRAP
  StorePath;
  ! Store current position from motion base path level
  stop_pos := CRobT(\Tool:=tool1 \WObj:=wobj1);
  ! Do the work
  MoveJ service_pos, v50, fine, tool1 \WObj:=wobj1;
  ...
  ! Move back to interrupted position on the motion base path level
  MoveJ stop_pos, v50, fine, tool1, \WObj:=wobj1;
  ! Go back to motion base path level
  RestoPath;
  ! Restart the interrupted movements on motion base path level
```

Continues on next page

```
    StartMove;  
ENDTRAP
```

In this type example the movements in the trap routine start and end at the ToPoint in the interrupted move instructions. Also note that the tool and work object are known at the time of programming.

Stop on path at once

```
TASK PERS tooldata used_tool := [...];  
TASK PERS wobjdata used_wobj := [...];  
...  
TRAP trap_stop_at_once  
  VAR robtarget stop_pos;  
  ! Current move instruction on motion base path level stops  
  ! at once  
  StopMove;  
  ! New motion path level for new movements in the TRAP  
  StorePath;  
  ! Get current tool and work object data  
  GetSysData used_tool;  
  GetSysData used_wobj;  
  ! Store current position from motion base path level  
  stop_pos := CRobT(\Tool:=used_tool \WObj:=used_wobj);  
  ! Do the work  
  MoveJ Offs(stop_pos,0,0,20),v50,fine,used_tool\WObj:=used_wobj;  
  ...  
  ! Move back to interrupted position on the motion base path level  
  MoveJ stop_pos, v50, fine, used_tool,\WObj:=used_wobj;  
  ! Go back to motion base path level  
  RestoPath;  
  ! Restart the interrupted movements on motion base path level  
  StartMove;  
ENDTRAP
```

In this type example the movements in the trap routine start and end at the position on the path where the interrupted move instruction was stopped. Also note that the tool and work object used are unknown at the time of programming.

Program execution

Execution behavior:

- At start execution of the trap routine, the program leaves its base execution level
- At execution of StorePath, the motion system leaves its base execution level
- At execution of RestoPath, the motion system returns to its base execution level
- At execution of ENDTRAP, the program returns to its base execution level

Continues on next page

4 Programming type examples

4.4 Trap routines with movements

Path Recovery

Continued

Limitations

The following RAPID instructions must be used in the trap routine with move instructions.

Instruction	Description
StorePath	Enter new motion path level
RestoPath	Return to motion base path level
StartMove	Restart the interrupted movements on the motion base path level

Related information

For information about	See
To stop the current movement at once	StopMove - Stops robot movement on page 792
To enter a new motion path level	StorePath - Stores the path when an interrupt occurs on page 798
To return to the motion base path level	RestoPath - Restores the path after an interrupt on page 600
To restart the interrupted movement	StartMove - Restarts robot movement on page 763

Index

A

Abs, 1115
 AbsDnum, 1117
 AccSet, 23
 ACos, 1119
 ACosDnum, 1120
 ActEventBuffer, 26
 ActUnit, 28
 Add, 30
 AInput, 1121
 aiotrigg, 1589
 ALIAS, 1591
 AliasCamera, 32
 AliasIO, 34
 AliasIOReset, 37
 AND, 1123
 AOutput, 1125
 ArgName, 1127
 ASin, 1130
 ASinDnum, 1131
 Assignment
 =, 39
 ATan, 1132
 ATan2, 1134
 ATan2Dnum, 1135
 ATanDnum, 1133

B

BitAnd, 1136
 BitAndDnum, 1138
 BitCheck, 1140
 BitCheckDnum, 1142
 BitClear, 41
 BitLSh, 1144
 BitLShDnum, 1146
 BitNeg, 1148
 BitNegDnum, 1150
 BitOr, 1152
 BitOrDnum, 1154
 BitRSh, 1156
 BitRShDnum, 1158
 BitSet, 44
 BitXOr, 1160
 BitXOrDnum, 1162
 BookErrNo, 47
 bool, 1592
 Break, 49
 btnres, 1593
 buttondata, 1595
 byte, 1597
 BytesReset, 51
 BytesToVal, 1166
 ByteToStr, 1164

C

CalcJointT, 1169
 CalcRobT, 1173
 CalcRotAxFrameZ, 1175
 CalcRotAxisFrame, 1180
 CallByVar, 52
 cameradev, 1598
 camerastatus, 1599
 cameratarget, 1601
 CamFlush, 54

CamGetExposure, 1184
 CamGetLoadedJob, 1186
 CamGetMode, 1188
 CamGetName, 1189
 CamGetParameter, 55
 CamGetResult, 57
 CamLoadJob, 59
 CamNumberOfResults, 1190
 CamReqImage, 61
 CamSetExposure, 63
 CamSetParameter, 65
 CamSetProgramMode, 67
 CamSetRunMode, 68
 CamStartLoadJob, 69
 CamStartSetParameter, 71
 CamWaitLoadJob, 74
 CamWaitSetParameter, 76
 CancelLoad, 78
 capaptrreferencedata, 1603
 CapAPTrSetupAI, 80
 CapAPTrSetupAO, 83
 CapAPTrSetupPERS, 86
 CapC, 89
 capdata, 1605
 CapEquiDist, 100
 CapInitSupervision, 102
 CapL, 103
 CapNoProcess, 113
 CapRefresh, 115
 CapRemoveSupervision, 117
 CapSetDOAtStop, 119
 CapSetupSupervision, 121
 capspeeddata, 1608
 capweavedata, 1609
 CapWeaveSync, 124
 CASE, 825
 CDate, 1192
 cfgdomain, 1615
 CheckProgRef, 127
 CirPathMode, 129
 CJointT, 1193
 Clear, 135
 ClearPath, 136
 ClearRawBytes, 140
 ClkRead, 1195
 ClkReset, 142
 ClkStart, 143
 ClkStop, 145
 clock, 1616
 Close, 146
 CloseDir, 147
 comment, 148
 CompactIF, 149
 Concat, 1197
 confdata, 1617
 ConfJ, 150
 ConfL, 152
 CONNECT, 155
 ContactL, 157
 Continue, 162
 CopyFile, 163
 CopyRawBytes, 165
 CornerPathWarning, 167
 CorrClear, 169
 CorrCon, 170
 corrdescr, 1625

CorrDiscon, 175
CorrRead, 1199
CorrWrite, 176
Cos, 1200
CosDnum, 1201
CPos, 1202
CRobT, 1204
CrossProd, 1207
CSpeedOverride, 1210
CTime, 1212
CTool, 1213
CWObj, 1215

D

datapos, 1627
DeactEventBuffer, 178
DeactUnit, 180
DebugBreak, 50
Decr, 182
DecToHex, 1217
DefAccFrame, 1218
DefDFrame, 1221
DefFrame, 1224
Dim, 1227
DInput, 1229
dionum, 1628
dir, 1629
Distance, 1231
DIV, 1233
dnum, 1630
DnumToNum, 1234
DnumToStr, 1236
DotProd, 1238
DOutput, 1240
DropWObj, 184

E

ELSE, 256
ELSEIF, 256
ENDIF, 256
EOF_NUM, 1411, 1416
EOffsOff, 185
EOffsOn, 186
EOffsSet, 188
EraseModule, 190
errdomain, 1632
ErrLog, 192
errnum, 1634
ERROR handler, 1789
ErrRaise, 196
errstr, 1642
errtype, 1643
ErrWrite, 200
EulerZYX, 1242
event_type, 1644
EventType, 1244
exec_level, 1645
ExecHandler, 1246
ExecLevel, 1247
EXIT, 203
ExitCycle, 204
Exp, 1248
extjoint, 1646

F

FileSize, 1249
FileTimeDnum, 1252

FitCircle, 206
FitLine, 210, 212, 214
FitPlane, 212
FitSphere, 214
flypointdata, 1648
FOR, 216
FricIdEvaluate, 220
FricIdInit, 219
FricIdSetFricLevels, 223
FSSize, 1255

G

GetAxisDistance, 1258
GetAxisMoveTime, 1260
GetDataVal, 225
GetGroupSignalInfo, 228
GetJointData, 230
GetMaxNumberOfCyclicBool, 1262
GetMecUnitName, 1263
GetModalPayloadMode, 1264
GetMotorTorque, 1265
GetNextCyclicBool, 1268
GetNextMechUnit, 1270
GetNextOption, 1273
GetNextProduct, 1275
GetNextSym, 1277
GetNumberOfCyclicBool, 1279
GetServiceInfo, 1280
GetSignalOrigin, 1282
GetSysData, 232
GetSysInfo, 1284
GetTaskName, 1287
GetTime, 1289
GetTorqueMargin, 1291
GetTrapData, 235
GetTSPStatus, 1293
GetUASUserName, 1295
GInput, 1297
GInputDnum, 1299
GOTO, 237
GOutput, 1302
GOutputDnum, 1304
GripLoad, 239

H

handler_type, 1651
HexToDec, 1307
HollowWristReset, 241

I

I/O interrupt routines, 1795
ICap, 243
ICapPathPos, 248
icondata, 1652
IDelete, 250
identno, 1654
IDisable, 251
IEnable, 252
IError, 253
IF, 256
Incr, 258
IndAMove, 260
IndCMove, 264
IndDMove, 268
IndInpos, 1308
IndReset, 271
IndRMove, 276

IndSpeed, 1310
intnum, 1656
InvertDO, 280
IOActivate, 282
IODeactivate, 285
iodev, 1658
iodevice_state, 1659
IODeviceMute, 288
IODeviceState, 1312
ionetwork_state, 1660
IONetworkState, 1315
IPers, 289
IRMQMessage, 291
IsBrakeCheckActive, 1318
IsCollFree, 1319
IsCyclicBool, 1321
IsFile, 1324
ISignalAI, 295
ISignalAO, 305
ISignalDI, 309
ISignalDO, 312
ISignalGI, 315
ISignalGO, 318
IsLeadThrough, 1328
ISleep, 321
IsMechUnitActive, 1330
IsPers, 1331
IsStopMoveAct, 1333
IsStopStateEvent, 1335
IsSyncMoveOn, 1337
IsSysId, 1339
IsVar, 1340
ITimer, 323
IVarValue, 326
IWatch, 329

J

jointtarget, 1661

L

label, 331
listitem, 1663
Load, 332
loaddata, 1664
LoadId, 337
loadidnum, 1670
loadsession, 1671

M

MakeDir, 343
ManLoadIdProc, 344
MatrixAdd, 348
MatrixInverse, 351
MatrixMult, 354
MatrixReset, 360
MatrixSolve, 362
MatrixSolveQR, 365
MatrixSub, 367
MatrixSVD, 370
MatrixTranspose, 373
Max, 1342
MaxExtLinearSpeed, 1343
MaxExtReorientSpeed, 1344
MaxRobReorientSpeed, 1345
MaxRobSpeed, 1346
MechUnitLoad, 376
mecunit, 1672

Min, 1347
MirPos, 1348
MOD, 1350
ModExist, 1351
ModTimeDnum, 1352
MotionPlannerNo, 1354
MotionProcessModeSet, 381
MotionSup, 383
motsetdata, 1674
MoveAbsJ, 386
MoveC, 398
MoveCAO, 407
MoveCDO, 412
MoveCGO, 417
MoveCSync, 422
MoveExtJ, 427
MoveJ, 431
MoveJAO, 437
MoveJDO, 442
MoveJGO, 447
MoveJSync, 452
MoveL, 457
MoveLAO, 464
MoveLDO, 469
MoveLGO, 474
MoveLSync, 479
MovePnP, 484
MToolRotCalib, 494
MToolTCPCalib, 497

N

NonMotionMode, 1356
NOrient, 1359
NOT, 1358
num, 1680
NumToDnum, 1361
NumToStr, 1362

O

Offs, 1364
Open, 500
OpenDir, 504
OpMode, 1366
opnum, 1682
OR, 1367
orient, 1683
OrientZYX, 1368
ORobT, 1370

P

PackDNHeader, 506
PackRawBytes, 509
paridnum, 1688
ParIdPosVaild, 1372
ParIdRobValid, 1375
paridvalidnum, 1690
PathAccLim, 515
PathLengthGet, 1378
PathLengthReset, 519
PathLengthStart, 521
PathLengthStop, 523
PathLevel, 1380
pathrecid, 1692
PathRecMoveBwd, 525
PathRecMoveFwd, 531
PathRecStart, 534
PathRecStop, 537

PathRecValidBwd, 1382
PathRecValidFwd, 1385
PathResol, 540
PDispOff, 542
PDispOn, 543
PDispSet, 548
PFRestart, 1389
pnpdata, 1694
pos, 1696
pose, 1698
PoseInv, 1390
PoseMult, 1392
PoseVect, 1394
Pow, 1396
PowDnum, 1397
PPMovedInManMode, 1398
Present, 1399
ProcCall, 550
ProcerrRecovery, 552
processtimes, 1699
progdisp, 1700
ProgMemFree, 1401
PulseDO, 558

R

RAISE, 561
RaiseToUser, 564
Rand, 1402
rawbytes, 1702
RawBytesLen, 1404
ReadAnyBin, 567
ReadBin, 1406
ReadCfgData, 569
ReadDir, 1408
ReadErrData, 573
ReadMotor, 1414
ReadNum, 1411, 1416
ReadRawBytes, 576
ReadStr, 1419
ReadStrBin, 1424
ReadVar, 1426
ReadVarArr, 579
RelTool, 1428
RemainingRetries, 1430
RemoveAllCyclicBool, 581
RemoveCyclicBool, 583
RemoveDir, 585
RemoveFile, 587
RenameFile, 588
Reset, 590
ResetAxisDistance, 592
ResetAxisMoveTime, 594
ResetData, 596
ResetPPMoved, 597
ResetRetryCount, 598
ResetTorqueMargin, 599
restartblkdata, 1704
restartdata, 1706
RestoPath, 600
RETRY, 602
RETURN, 603
Rewind, 605
RMQEmptyQueue, 606
RMQFindSlot, 608
RMQGetMessage, 610
RMQGetMsgData, 613
RMQGetMsgHeader, 616

RMQGetSlotName, 1431
rmqheader, 1710
rmqmessage, 1712
RMQReadWait, 619
RMQSendMessage, 622
RMQSendWait, 626
rmqslot, 1713
robjoint, 1714
RobName, 1433
RobOS, 1435
robtarg, 1715
Round, 1436
RoundDnum, 1438
RunMode, 1440

S

SafetyControllerGetChecksum, 1442
SafetyControllerGetGroupChecksum, 1443
SafetyControllerGetNextGroupName, 1444
SafetyControllerGetOpModePinCode, 1446
SafetyControllerGetSWVersion, 1447
SafetyControllerGetUserChecksum, 1448
SafetyControllerSyncRequest, 631
Save, 632
SaveCfgData, 635
SearchC, 637
SearchExtJ, 647
SearchL, 655
SenDevice, 666
sensorvardata, 1719
service routines, 1792
Set, 668
SetAllDataVal, 670
SetAO, 672
SetDataSearch, 674
SetDataVal, 679
SetDO, 682
SetGO, 684
SetLeadThrough, 687
SetSysData, 690
SetupCyclicBool, 692
shapedata, 1721
signalorigin, 1723
signalxx, 1725
SimCollision, 695
Sin, 1449
SinDnum, 1450
SingArea, 696
SkipWarn, 699
SocketAccept, 700
SocketBind, 704
SocketClose, 707
SocketConnect, 709
SocketCreate, 712
socketdev, 1727
SocketGetStatus, 1451
SocketListen, 715
SocketPeek, 1454
SocketReceive, 717
SocketReceiveFrom, 723
SocketSend, 728
SocketSendTo, 733
socketstatus, 1728
SoftAct, 738
SoftDeact, 740
SoftElbow, 741
speeddata, 1729

SpeedLimAxis, 743
 SpeedLimCheckPoint, 747
 SpeedRefresh, 752
 SpyStart, 755
 SpyStop, 758
 Sqrt, 1457
 SqrtDnum, 1458
 StartLoad, 759
 StartMove, 763
 StartMoveRetry, 766
 STCalcForce, 1459
 STCalcTorque, 1461
 STCalib, 769
 STClose, 773
 StepBwdPath, 776
 STIndGun, 778
 STIndGunReset, 780
 STIsCalib, 1463
 STIsClosed, 1465
 STIsIndGun, 1467
 STIsOpen, 1468
 SToolRotCalib, 781
 SToolTCPCalib, 784
 Stop, 787
 STOpen, 790
 StopMove, 792
 StopMoveReset, 796
 stoppointdata, 1733
 StorePath, 798
 StrFind, 1470
 StrFormat, 1472
 string, 1739
 StrLen, 1475
 StrMap, 1476
 StrMatch, 1478
 StrMemb, 1480
 StrOrder, 1482
 StrPart, 1484
 StrSize, 1486
 StrToByte, 1487
 StrToVal, 1489
 STTune, 800
 STTuneReset, 804
 supervtimeouts, 1741
 switch, 1743
 symnum, 1744
 syncident, 1745
 SyncMoveOff, 805
 SyncMoveOn, 811
 SyncMoveResume, 817
 SyncMoveSuspend, 819
 SyncMoveUndo, 821
 system data, 1746
 SystemStopAction, 823

T

Tan, 1491
 TanDnum, 1492
 taskid, 1748
 TaskIsActive, 1497
 TaskIsExecuting, 1499
 TaskRunMec, 1493
 TaskRunRob, 1494
 tasks, 1749
 TasksInSync, 1495
 TEST, 825
 TestAndSet, 1501

TestDI, 1504
 testsignal, 1751
 TestSignDefine, 827
 TestSignRead, 1506
 TestSignReset, 829
 TextGet, 1508
 TextTabFreeToUse, 1512
 TextTabGet, 1514
 TextTabInstall, 830
 tooldata, 1753
 TPErase, 832
 tpnum, 1759
 TPReadDnum, 833
 TPReadFK, 837
 TPReadNum, 842
 TPSHow, 846
 TPWrite, 847
 trapdata, 1760
 trap routines, 1798
 TRAP routines, 1798
 TriggAbsJ, 850
 TriggC, 858
 TriggCheckIO, 867
 triggdata, 1761
 TriggDataCopy, 873
 TriggDataReset, 875
 TriggDataValid, 1516
 TriggEquip, 877
 TriggInt, 883
 TriggIO, 888
 triggios, 1762
 triggiosdnum, 1764
 TriggJ, 894
 TriggJIOs, 911
 TriggL, 902
 TriggLIOs, 919
 triggmode, 1766
 TriggRampAO, 927
 TriggSpeed, 934
 TriggStopProc, 944
 Trunc, 1518
 TruncDnum, 1520
 TryInt, 950
 TRYNEXT, 952
 tsp_status, 1769
 TuneReset, 953
 TuneServo, 954
 tunetype, 1771
 Type, 1522

U

UIAlphaEntry, 1524
 UIClientExist, 1531
 UIDisplay, 961
 uidisplaynum, 1772
 UIDnumEntry, 1532
 UIDnumTune, 1540
 UICollection, 1547
 UIMessageBox, 1556
 UIMsgBox, 964
 UIMsgWrite, 973
 UIMsgWriteAbort, 977
 UINumEntry, 1565
 UINumTune, 1573
 UnLoad, 978
 UnpackRawBytes, 981

V

ValidIO, 1580
ValToBytes, 1582
ValToStr, 1584
VectMagn, 1586
VelSet, 987

W

WaitAI, 989
WaitAO, 996
WaitDI, 1003
WaitDO, 1009
WaitGI, 1015
WaitGO, 1023
WaitLoad, 1031
WaitRob, 1035
WaitSyncTask, 1037
WaitTestAndSet, 1041
WaitTime, 1044
WaitUntil, 1046
WaitWObj, 1055
WarmStart, 1058
weavestartdata, 1773
WHILE, 1059
wobjdata, 1775
WorldAccLim, 1061

WristOpt, 1063

Write, 1067
WriteAnyBin, 1070
WriteBin, 1072
WriteCfgData, 1074
WriteRawBytes, 1078
WriteStrBin, 1080
WriteVar, 1082
WriteVarArr, 1084
WZBoxDef, 1086
WZCylDef, 1088
WZDisable, 1091
WZDOSet, 1093
WZEnable, 1098
WZFree, 1100
WZHomeJointDef, 1102
WZLimJointDef, 1105
WZLimSup, 1109
WZSphDef, 1112
wzstationary, 1779
wztemporary, 1781

X

XOR, 1588

Z

zonedata, 1783



ABB Robotics Sweden AB
S-721 71 VÄSTERÅS, Sweden
Telephone +46 10-732 50 00

ABB Robotics Norway AS
Nordlysvegen 7, N-4340 BRYNE, Norway
Box 265, N-4349 BRYNE, Norway
Telephone: +47 22 87 2000

ABB Robotics (Shanghai) Limited
No. 39, 99 Miaoqiao Road,
Pudong New Area,
Shanghai, China
Telephone: +86 21 6105 6666

ABB Inc.
Robotics & Discrete Automation
1250 Brown Road
Auburn Hills, MI 48326
USA
Telephone: +1 248 391 9000

abb.com/robotics