

TIA Portal Motion Control Library for Synapticon Drives

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1 PLC Data Types (UDTs)

These data structures define the custom data types used throughout the library to organize axis data, I/O mappings, and status information.

1.1 CiA 402 State Constants

The library uses integer constants to define the states of the CiA 402 drive state machine. These are set within the MC_ReadStatus block.

Value	Name	Description
0	UnknownState	Default or uninitialized state
1	NotReadyToSwitchOn	Drive initialization is not complete
2	SwitchOnDisabled	Drive is initialized but power is disabled
3	ReadyToSwitchOn	Drive is ready to have voltage applied
4	SwitchedOn	Main power is applied, but the drive is not yet operational
5	OperationEnabled	The drive is fully operational and will execute motion commands
6	QuickStopActive	A Quick Stop command is active
7	FaultReactionActive	The drive is in the process of reacting to a fault
8	Fault	A fault has occurred

1.2 I/O Data Structures

These structures define the logical layout of the Process Image for communication with the drive.

1.2.1 ST_Statusword_Bits & ST_Controlword_Bits

These structures provide access to the individual bits of the 16-bit Statusword and Controlword for easier manipulation and reading within the PLC logic.

Table 1: ST_Statusword_Bits

Bit	Name	Description
0	rtso	Ready to Switch On
1	so	Switched On
2	oe	Operation Enabled.
3	f	Fault - the primary drive fault indicator
4	ve	Voltage Enabled
5	qs	Quick Stop (0 = Active, 1 = Not Active)
6	sod	Switch On Disabled
7	w	Warning
8	ms1	Manufacturer Specific
9	rm	Remote (Controlword is being processed)
10	tr	Target Reached
11	ila	Internal Limit Active
12	oms1	Operation Mode Specific (e.g., Homing Attained, Set-point Acknowledge)
13	oms2	Operation Mode Specific (e.g., Homing Error, Following Error)
14	ms2	Manufacturer Specific
15	ms3	Manufacturer Specific

Table 2: ST_Controlword_Bits

Bit	Name	Description
0	so	Switch On
1	ev	Enable Voltage
2	qs	Quick Stop (0 = Execute Quick Stop, 1 = Normal)
3	eo	Enable Operation
4	oms1	Operation Mode Specific (e.g., Start Homing, New Setpoint in PP)
5	oms2	Operation Mode Specific (e.g., Change Setpoint Immediately in PP)
6	oms3	Operation Mode Specific (e.g., Relative move in PP)
7	fr	Fault Reset (rising edge)
8	h	Halt (0 = Execute Motion, 1 = Halt Motion)
9	oms4	Operation Mode Specific
10	re	Reserved (must be 0)
11	ms1	Manufacturer Specific
12	ms2	Manufacturer Specific
13	ms3	Manufacturer Specific
14	ms4	Manufacturer Specific
15	ms5	Manufacturer Specific

1.2.2 ST_Axis_IO_Logical

This UDT represents the logical, structured view of the axis I/O data inside the PLC, after any necessary byte swapping or conversion has been performed by MC_Hardware_Interface.

Parameter	Type	Description
Statusword_Bits	ST_Statusword_Bits	The 16-bit status word from the drive, accessible by bit.
Statusword_Word	Word	The 16-bit status word as a single word.
ModeOfOperationDisplay	SInt	The currently active mode of operation reported by the drive.
ActualPosition	DInt	The raw position value from the drive's encoder.
ActualVelocity	DInt	The raw velocity value from the drive.
ActualTorque	Int	The raw torque value from the drive.
Controlword_Bits	ST_Controlword_Bits	The 16-bit control word to be sent to the drive, accessible by bit.
Controlword_Word	Word	The 16-bit control word as a single word.
ModeOfOperation	SInt	The commanded mode of operation.
TargetTorque	Int	The target torque value.
TargetPosition	DInt	The target position value.
TargetVelocity	DInt	The target velocity value.

1.3 ST_AxisRef

This is the main data structure for an axis, bundling all necessary information together. An instance of this structure is passed as a VAR_IN_OUT to almost all function blocks, allowing them to read status and write commands.

Parameter	Type	Description
IO	ST_Axis_IO_Logical	Structure holding all logical I/O data for the axis.
fScaleFactorPosition	LReal	Scaling factor to convert raw encoder counts to user units (e.g., degrees). Calculated as 'UserUnits / EncoderCount'.
fScaleFactorVelocity	LReal	Scaling factor to convert raw drive velocity units (RPM) to user units (e.g., degrees/second).
fScaleFactorTorque	LReal	Scaling factor to convert raw drive torque units (permille) to user units.
bPowerEnabled	Bool	Status flag, set by MC_Power, indicating the drive is in 'OperationEnabled'.
bError	Bool	General error flag, set by MC_ReadStatus, indicating a drive fault.
eCurrentState	Int	The current decoded drive state, set by MC_ReadStatus.
sErrorDescription	String	A string containing a description of the current error, if any.

2 Function Blocks (FBs)

2.1 General & Status Blocks

2.1.1 MC_Hardware_Interface

This is a central block that should be called once at the beginning of the program cycle. It maps the raw hardware I/O tags (from %I and %Q memory) to the logical `ST_Axis_IO_Logical` structure. It is responsible for all necessary data conversions (e.g., `DWord` to `DInt`) and for synchronizing the bit-level and word-level representations of the `Controlword` and `Statusword`.

2.1.2 MC_ReadStatus

Continuously reads and decodes the drive's status word and other I/O inputs. It provides scaled, human-readable values for position and velocity, and determines the current drive state. When a drive fault is detected, it automatically triggers an SDO read of the error description string from Index 17393. It is essential at the beginning of the program cycle since it encapsulates the data to the `ST_AxisRef` that is required as an input to all blocks that perform cyclic operations.

Parameter	Type	Direction	Description
Enable	Bool	VAR_INPUT	If TRUE, the block is active and reads status.
ID	HW_ANY	VAR_INPUT	The hardware ID of the drive, required for SDO communication.
Axis	ST_AxisRef	VAR_IN_OUT	The axis data structure to read from and update.
ActualPosition	LReal	VAR_OUTPUT	The scaled current position of the axis in user-defined units.
ActualVelocity	LReal	VAR_OUTPUT	The scaled current velocity of the axis in user-defined units.
ActualTorque	Int	VAR_OUTPUT	The raw current torque value from the drive.
Error	Bool	VAR_OUTPUT	TRUE if the drive is in a 'Fault' state.
ModeOfOperationDisplay	SInt	VAR_OUTPUT	The mode of operation currently reported by the drive.
AxisState	Int	VAR_OUTPUT	The current decoded CiA 402 state of the drive.
ErrorDescription	String[8]	VAR_OUTPUT	If a fault occurs, contains the 8-byte error message read from SDO Index 17393.

2.1.3 MC_Power

Manages the CiA 402 state machine to correctly power up, enable, and power down the drive. It follows the required state transitions from 'Switch On Disabled' to 'Operation Enabled' and back. If a drive fault occurs, this block detects it, enters a fault state, and attempts to read the drive's specific error code from SDO Index 1008. It does not automatically reset faults.

Parameter	Type	Direction	Description
Enable	Bool	VAR_INPUT	Master enable. If FALSE, it attempts to power down the drive.
EnableOperation	Bool	VAR_INPUT	Defines the target state: 'TRUE' for 'OperationEnabled', 'FALSE' for 'SwitchedOn'.
DisableBlock	Bool	VAR_INPUT	If TRUE, the FB's logic is completely bypassed.
ID	HW_ANY	VAR_INPUT	The hardware ID of the drive, required for SDO communication.
Axis	ST_AxisRef	VAR_IN_OUT	The axis data structure to control.
Busy	BOOL	VAR_OUTPUT	TRUE while the state machine is transitioning between states.
Active	BOOL	VAR_OUTPUT	TRUE if the drive is in the 'OperationEnabled' state.
Error	BOOL	VAR_OUTPUT	TRUE if a drive fault is detected or an internal timeout occurs.
ErrorID	UDInt	VAR_OUTPUT	Contains the drive error code from SDO Index 1008 or an FB-internal error code.
CurrentStep	String	VAR_OUTPUT	For debugging, shows the internal state of the state machine.

2.1.4 MC_StatusWord

A utility block that breaks down the 16-bit status word from the central Axis structure into individual Boolean outputs. This is primarily for visualization on an HMI.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	If TRUE, the block is active.
Axis	ST_AxisRef	VAR_IN_OUT	The axis data structure to read from.
rtso	BOOL	VAR_OUTPUT	Status of Bit 0: Ready to Switch On.
so	BOOL	VAR_OUTPUT	Status of Bit 1: Switched On.
oe	BOOL	VAR_OUTPUT	Status of Bit 2: Operation Enabled.
f	BOOL	VAR_OUTPUT	Status of Bit 3: Fault.
ve	BOOL	VAR_OUTPUT	Status of Bit 4: Voltage Enabled.
qs	BOOL	VAR_OUTPUT	Status of Bit 5: Quick Stop.
sod	BOOL	VAR_OUTPUT	Status of Bit 6: Switch On Disabled.
w	BOOL	VAR_OUTPUT	Status of Bit 7: Warning.
ms1	BOOL	VAR_OUTPUT	Status of Bit 8: Manufacturer Specific.
rm	BOOL	VAR_OUTPUT	Status of Bit 9: Remote.
tr	BOOL	VAR_OUTPUT	Status of Bit 10: Target Reached.
ila	BOOL	VAR_OUTPUT	Status of Bit 11: Internal Limit Active.
oms1	BOOL	VAR_OUTPUT	Status of Bit 12: Operation Mode Specific.
oms2	BOOL	VAR_OUTPUT	Status of Bit 13: Operation Mode Specific.
ms2	BOOL	VAR_OUTPUT	Status of Bit 14: Manufacturer Specific.
ms3	BOOL	VAR_OUTPUT	Status of Bit 15: Manufacturer Specific.

2.1.5 MC_ControlWord

A utility block that can either write a complete 16-bit word to the control word (for manual testing) or decompose the control word from the Axis structure into individual bits for HMI visualization.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	If TRUE, the block is active.
Write	BOOL	VAR_INPUT	Rising edge writes the content of 'Value_i' to the control word.
Value_i	Word	VAR_INPUT	The 16-bit value to write to the control word.
Axis	ST_AxisRef	VAR_IN_OUT	The axis data structure to write to.
so	BOOL	VAR_OUTPUT	Status of Bit 0: Switch On.
ev	BOOL	VAR_OUTPUT	Status of Bit 1: Enable Voltage.
qs	BOOL	VAR_OUTPUT	Status of Bit 2: Quick Stop.
eo	BOOL	VAR_OUTPUT	Status of Bit 3: Enable Operation.
oms1	BOOL	VAR_OUTPUT	Status of Bit 4: Operation Mode Specific.
oms2	BOOL	VAR_OUTPUT	Status of Bit 5: Operation Mode Specific.
oms3	BOOL	VAR_OUTPUT	Status of Bit 6: Operation Mode Specific.
fr	BOOL	VAR_OUTPUT	Status of Bit 7: Fault Reset.
h	BOOL	VAR_OUTPUT	Status of Bit 8: Halt.
oms4	BOOL	VAR_OUTPUT	Status of Bit 9: Operation Mode Specific.
re	BOOL	VAR_OUTPUT	Status of Bit 10: Reserved.
ms1	BOOL	VAR_OUTPUT	Status of Bit 11: Manufacturer Specific.
ms2	BOOL	VAR_OUTPUT	Status of Bit 12: Manufacturer Specific.
ms3	BOOL	VAR_OUTPUT	Status of Bit 13: Manufacturer Specific.
ms4	BOOL	VAR_OUTPUT	Status of Bit 14: Manufacturer Specific.
ms5	BOOL	VAR_OUTPUT	Status of Bit 15: Manufacturer Specific.
Controlword_Word	Word	VAR_OUTPUT	The current value of the control word as a whole.

2.1.6 MC_Reset

Provides a simple mechanism for sending a fault reset command to the drive.

Parameter	Type	Direction	Description
Execute	BOOL	VAR_INPUT	A rising edge triggers the fault reset command (sets Controlword Bit 7).
Axis	ST_AxisRef	VAR_IN_OUT	The axis to reset.
Done	BOOL	VAR_OUTPUT	TRUE when the drive is no longer in a fault state after the command.
Busy	BOOL	VAR_OUTPUT	TRUE while the reset command is active.
Error	BOOL	VAR_OUTPUT	TRUE if the reset command fails (e.g., drive was not in fault).

2.1.7 MC_Halt

Commands or releases the Halt bit (Bit 8) in the drive's control word.

Parameter	Type	Direction	Description
Execute	BOOL	VAR_INPUT	If TRUE, Halt is commanded (CW Bit 8 = 1). If FALSE, Halt is released.
Axis	ST_AxisRef	VAR_IN_OUT	The axis to control.
Active	BOOL	VAR_OUTPUT	TRUE if Halt is being actively commanded.
Error	BOOL	VAR_OUTPUT	TRUE if trying to Halt from an invalid state (e.g., not Operation Enabled).

2.2 Parameter Read/Write Blocks

2.2.1 MC_Parameter_Read

A general-purpose function block for performing acyclic parameter read operations using the RDREC system instruction.

Parameter	Type	Direction	Description
Execute	BOOL	VAR_INPUT	Rising edge starts the read operation.
ID	HW_ANY	VAR_INPUT	Hardware ID of the device to read from.
Index	UInt	VAR_INPUT	The parameter Index to read.
Length	UInt	VAR_INPUT	The expected length of the data in bytes.
Done	BOOL	VAR_OUTPUT	TRUE when the read completes successfully.
Busy	BOOL	VAR_OUTPUT	TRUE while the read is in progress.
Error	BOOL	VAR_OUTPUT	TRUE if an error occurred during the operation.
Value	Array[0..50] of Byte	VAR_OUTPUT	Buffer where the read data is stored.

2.2.2 MC_Parameter_Write

A general-purpose function block for performing acyclic parameter write operations using the WRREC system instruction.

Parameter	Type	Direction	Description
Execute	BOOL	VAR_INPUT	Rising edge starts the write operation.
ID	HW_ANY	VAR_INPUT	Hardware ID of the device to write to.
Index	UInt	VAR_INPUT	The parameter Index to write to.
Length	UInt	VAR_INPUT	The length of the data to write in bytes.
Value	Array[0..50] of Byte	VAR_INPUT	Buffer containing the data to be written.
Done	BOOL	VAR_OUTPUT	TRUE when the write completes successfully.
Busy	BOOL	VAR_OUTPUT	TRUE while the write is in progress.
Error	BOOL	VAR_OUTPUT	TRUE if an error occurred during the operation.
Status	DWord	VAR_OUTPUT	The raw status code from the WRREC instruction.

2.3 Configuration Blocks

2.3.1 MC_Configure_PP

Configures parameters for Profile Position (PP) mode by sequentially writing multiple SDO records.

Parameter	Type	Direction	Description
Execute	BOOL	VAR_INPUT	Rising edge starts the configuration sequence.
ID	HW_ANY	VAR_INPUT	Hardware ID of the drive.
Acceleration	UDInt	VAR_INPUT	Profile Acceleration value for Index 2096.
Deceleration	UDInt	VAR_INPUT	Profile Deceleration value for Index 2112.
Velocity	UDInt	VAR_INPUT	Profile Velocity value for Index 2064.
Window	UDInt	VAR_INPUT	Position Window value for Index 1648.
Done	BOOL	VAR_OUTPUT	TRUE when all SDO writes are complete.
Busy	BOOL	VAR_OUTPUT	TRUE while the configuration sequence is in progress.
Error	BOOL	VAR_OUTPUT	TRUE if any SDO write fails.

2.3.2 MC_Configure_PV

Configures parameters for Profile Velocity (PV) mode.

Parameter	Type	Direction	Description
Execute	BOOL	VAR_INPUT	Rising edge starts the configuration sequence.
ID	HW_ANY	VAR_INPUT	Hardware ID of the drive.
Acceleration	UDInt	VAR_INPUT	Profile Acceleration value for Index 2096.
Deceleration	UDInt	VAR_INPUT	Profile Deceleration value for Index 2112.
Window	UDInt	VAR_INPUT	Velocity Window value for Index 1744.
Done	BOOL	VAR_OUTPUT	TRUE when all SDO writes are complete.
Busy	BOOL	VAR_OUTPUT	TRUE while the configuration sequence is in progress.
Error	BOOL	VAR_OUTPUT	TRUE if any SDO write fails.

2.3.3 MC_Configure_PT

Configures parameters for Profile Torque (PT) mode.

Parameter	Type	Direction	Description
Execute	BOOL	VAR_INPUT	Rising edge starts the configuration sequence.
ID	HW_ANY	VAR_INPUT	Hardware ID of the drive.
TorqueSlope	UDInt	VAR_INPUT	Torque Slope value for Index 2096.
QuickStopDeceleration	UDInt	VAR_INPUT	Quick Stop Deceleration value for Index 2128.
Done	BOOL	VAR_OUTPUT	TRUE when all SDO writes are complete.
Busy	BOOL	VAR_OUTPUT	TRUE while the configuration sequence is in progress.
Error	BOOL	VAR_OUTPUT	TRUE if any SDO write fails.

2.3.4 MC_SaveConfig

Saves the current drive parameters to non-volatile memory by writing the signature 0x65766173 ('save') to Index 28929.

Parameter	Type	Direction	Description
Execute	BOOL	VAR_INPUT	Rising edge starts the save operation.
ID	HW_ANY	VAR_INPUT	Hardware ID of the drive to save parameters on.
Done	BOOL	VAR_OUTPUT	One-cycle pulse when the save command completes successfully.
Busy	BOOL	VAR_OUTPUT	TRUE while the save operation is in progress.
Error	BOOL	VAR_OUTPUT	TRUE if the save operation fails.

2.4 Utility Blocks

2.4.1 MC_Inc2UsrDefUnit

A simple utility block to convert a raw encoder value (DInt) into a floating-point user-defined unit (LReal) using a provided scaling ratio.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	If TRUE, the block performs the conversion.
fScalingRatio	LReal	VAR_INPUT	The conversion factor ('UserUnits / EncoderCount').
Axis	ST_AxisRef	VAR_IN_OUT	The axis structure to read 'Actual-Position' from.
Active	BOOL	VAR_OUTPUT	TRUE if the block is enabled and active.
EncoderValue_In	DInt	VAR_OUTPUT	Echo of the raw encoder value read from the axis.
UserDefinedUnit_Out	LReal	VAR_OUTPUT	The converted position in user-defined units.

2.5 Motion Blocks

2.5.1 MC_Homing

Manages the homing procedure. On 'Execute', it sets the desired homing method via SDO (Index 2432), commands ****Homing Mode (Mode 6)****, and starts the procedure using Controlword bit 4. It monitors for completion or errors.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	Enables management of Homing Mode.
Execute	BOOL	VAR_INPUT	Rising edge starts the homing procedure.
HomingMethod	SInt	VAR_INPUT	The homing method number to use (for SDO Index 2432).
ID	HW_ANY	VAR_INPUT	The Hardware ID of the drive.
Axis	ST_AxisRef	VAR_IN_OUT	The axis to home.
HomingModeActive	BOOL	VAR_OUTPUT	TRUE if the drive confirms it is in Homing Mode.
Busy	BOOL	VAR_OUTPUT	TRUE while setting mode, writing SDO, or the homing procedure is active.
Done	BOOL	VAR_OUTPUT	One-cycle pulse when homing is successfully completed.
Error	BOOL	VAR_OUTPUT	TRUE if a drive fault, homing error, or SDO error occurs.
ErrorID	UDInt	VAR_OUTPUT	Specific error code.

2.5.2 MC_MovePP

Executes an absolute or relative move in ****Profile Position (PP) mode (Mode 1)****. It uses the drive's internal profile generator. If not included in the drive configuration file, parameters must be pre-configured using MC_Configure_PP.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	Enables management of Profile Position mode.
Execute	BOOL	VAR_INPUT	Rising edge starts/re-triggers the move.
Position	LReal	VAR_INPUT	The target position or relative distance in user-defined units.
IsRelative	BOOL	VAR_INPUT	If TRUE, 'Position' is a relative distance; otherwise, it's absolute.
ChangeSetpointImmediately	BOOL	VAR_INPUT	If TRUE, sets CW bit 5 to interrupt the current move.
Axis	ST_AxisRef	VAR_IN_OUT	The axis to move.
PPModeActive	BOOL	VAR_OUTPUT	TRUE if the drive is in PP mode.
Busy	BOOL	VAR_OUTPUT	TRUE while a move is in progress.
Done	BOOL	VAR_OUTPUT	One-cycle pulse when the target is reached.
Error	BOOL	VAR_OUTPUT	TRUE if a drive fault occurs.

2.5.3 MC_MovePV

Commands a velocity in **Profile Velocity (PV) mode (Mode 3)** using the drive's internal ramps. If not included in the drive configuration file, parameters must be pre-configured using MC_Configure_PV.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	Enables management of Profile Velocity mode.
Execute	BOOL	VAR_INPUT	If TRUE, ramps to 'TargetVel'. If FALSE, ramps to zero.
TargetVel	LReal	VAR_INPUT	The target velocity in user-defined units.
Axis	ST_AxisRef	VAR_IN_OUT	The axis to move.
PVModeActive	BOOL	VAR_OUTPUT	TRUE if drive is in PV mode.
InVelocity	BOOL	VAR_OUTPUT	Pulse when target velocity is reached (equivalent to 'Done').
Busy	BOOL	VAR_OUTPUT	TRUE while ramping to the target velocity.
Error	BOOL	VAR_OUTPUT	TRUE if a drive fault occurs.

2.5.4 MC_MovePT

Commands a torque in **Profile Torque (PT) mode (Mode 4)** using the drive's internal torque slope. If not included in the drive configuration file, parameters must be pre-configured using MC_Configure_PT.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	Enables management of Profile Torque mode.
Execute	BOOL	VAR_INPUT	If TRUE, applies 'TargetTorque'. If FALSE, applies zero torque.
TargetTorque	LReal	VAR_INPUT	The target torque in user-defined units (e.g., permill).
Axis	ST_AxisRef	VAR_IN_OUT	The axis to command.
PTModeActive	BOOL	VAR_OUTPUT	TRUE if drive is in PT mode.
InTorque	BOOL	VAR_OUTPUT	Pulse when target torque is reached (equivalent to 'Done').
Busy	BOOL	VAR_OUTPUT	TRUE while ramping to the target torque.
Error	BOOL	VAR_OUTPUT	TRUE if a drive fault occurs.

2.5.5 MC_MoveAbsoluteCSP

Commands a direct absolute target position to the drive in **Cyclic Synchronous Position (CSP) mode (Mode 8)**. This block does not perform any ramp or profile generation.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	Enables management of CSP mode and commanding the position.
TargetPos	LReal	VAR_INPUT	The absolute target position in user-defined units.
Axis	ST_AxisRef	VAR_IN_OUT	The axis to move.
CSPModeActive	BOOL	VAR_OUTPUT	TRUE if the drive is in CSP mode.
Error	BOOL	VAR_OUTPUT	TRUE if a drive fault or prerequisite error occurs.
ErrorID	UDInt	VAR_OUTPUT	The specific error code.

2.5.6 MC_MoveRelativeCSP

Commands a direct relative position offset to the drive in ****Cyclic Synchronous Position (CSP) mode (Mode 8)****. The target position is calculated once on the rising edge of 'Enable'.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	Rising edge triggers the move calculation and enables commanding.
Distance	LReal	VAR_IN_OUT	The relative distance to move in user-defined units.
Axis	ST_AxisRef	VAR_IN_OUT	The axis to move.
CSPModeActive	BOOL	VAR_OUTPUT	TRUE if the drive is in CSP mode.
Error	BOOL	VAR_OUTPUT	TRUE if a drive fault or prerequisite error occurs.
ErrorID	UDInt	VAR_OUTPUT	The specific error code.

2.5.7 MC_MoveVelocityCSV

Commands a direct target velocity to the drive in ****Cyclic Synchronous Velocity (CSV) mode (Mode 9)****. This block does not perform any ramp generation.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	Enables management of CSV mode and commanding the velocity.
TargetVel	LReal	VAR_INPUT	The target velocity in user-defined units.
Axis	ST_AxisRef	VAR_IN_OUT	The axis to move.
CSVModeActive	BOOL	VAR_OUTPUT	TRUE if the drive is in CSV mode.
Error	BOOL	VAR_OUTPUT	TRUE if a drive fault or prerequisite error occurs.
ErrorID	UDInt	VAR_OUTPUT	The specific error code.

2.5.8 MC_MoveTorqueCST

Commands a direct target torque to the drive in ****Cyclic Synchronous Torque (CST) mode (Mode 10)****. This block does not perform any ramp generation.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	Enables management of CST mode and commanding the torque.
TargetTor	LReal	VAR_INPUT	The target torque in user-defined units.
Axis	ST_AxisRef	VAR_IN_OUT	The axis to move.
CSTModeActive	BOOL	VAR_OUTPUT	TRUE if the drive is in CST mode.
Error	BOOL	VAR_OUTPUT	TRUE if a drive fault or prerequisite error occurs.
ErrorID	UDInt	VAR_OUTPUT	The specific error code.

2.5.9 MC_MoveAbsoluteCSP_Trap

Generates a trapezoidal position profile within the PLC and sends continuous target position updates to the drive in ****Cyclic Synchronous Position (CSP) mode (Mode 8)****.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	Enables management of CSP mode.
Execute	BOOL	VAR_INPUT	Rising edge starts/re-triggers the move.
TargetPosition_User	LReal	VAR_INPUT	(Absolute) Target position in user units.
ProfileVelocity_User	LReal	VAR_INPUT	Profile velocity in user_units/sec.
ProfileAccel_User	LReal	VAR_INPUT	Profile acceleration in user_units/sec ² .
ProfileDecel_User	LReal	VAR_INPUT	Profile deceleration in user_units/sec ² .
PositionWindow_User	LReal	VAR_INPUT	Tolerance window for reaching the target in user units.
CycleTime	LReal	VAR_INPUT	PLC task cycle time in seconds.
Axis	ST_AxisRef	VAR_IN_OUT	The axis to move.
CSPModeActive	BOOL	VAR_OUTPUT	TRUE if drive is in CSP mode.
Busy	BOOL	VAR_OUTPUT	TRUE while profile is executing.
Done	BOOL	VAR_OUTPUT	One-cycle pulse when target is reached.
Error	BOOL	VAR_OUTPUT	TRUE if a drive fault occurs.
CurrentProfilePosition_User	LReal	VAR_OUTPUT	Live calculated position of the profile.
CurrentProfileVelocity_User	LReal	VAR_OUTPUT	Live calculated velocity of the profile.

2.5.10 MC_MoveRelativeCSP_Trap

This block behaves identically to MC_MoveAbsoluteCSP_Trap, except its primary position input is a relative distance.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	Enables management of CSP mode.
Execute	BOOL	VAR_INPUT	Rising edge starts/re-triggers the move.
Distance_User	LReal	VAR_INPUT	(Relative) Relative distance to move in user units.
ProfileVelocity_User	LReal	VAR_INPUT	Profile velocity in user_units/sec.
ProfileAccel_User	LReal	VAR_INPUT	Profile acceleration in user_units/sec ² .
ProfileDecel_User	LReal	VAR_INPUT	Profile deceleration in user_units/sec ² .
PositionWindow_User	LReal	VAR_INPUT	Tolerance window for reaching the target in user units.
CycleTime	LReal	VAR_INPUT	PLC task cycle time in seconds.
Axis	ST_AxisRef	VAR_IN_OUT	The axis to move.
CSPModeActive	BOOL	VAR_OUTPUT	TRUE if drive is in CSP mode.
Busy	BOOL	VAR_OUTPUT	TRUE while profile is executing.
Done	BOOL	VAR_OUTPUT	One-cycle pulse when target is reached.
Error	BOOL	VAR_OUTPUT	TRUE if a drive fault occurs.
CurrentProfilePosition_User	LReal	VAR_OUTPUT	Live calculated position of the profile.
CurrentProfileVelocity_User	LReal	VAR_OUTPUT	Live calculated velocity of the profile.

2.5.11 MC_MoveVelocityCSV_Trap

Generates a velocity ramp (acceleration/deceleration) within the PLC and sends continuous target velocity updates to the drive in **Cyclic Synchronous Velocity (CSV) mode (Mode 9)**.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	Enables management of CSV mode.
Execute	BOOL	VAR_INPUT	If TRUE, ramps to TargetVelocity_User. If FALSE, ramps to zero.
TargetVelocity_User	LReal	VAR_INPUT	Target velocity in user_units/sec.
ProfileAccel_User	LReal	VAR_INPUT	Ramp up rate in user_units/sec ² .
ProfileDecel_User	LReal	VAR_INPUT	Ramp down rate in user_units/sec ² .
VelocityWindow_User	LReal	VAR_INPUT	Tolerance window for reaching target velocity.
CycleTime	LReal	VAR_INPUT	PLC task cycle time in seconds.
Axis	ST_AxisRef	VAR_IN_OUT	The axis to move.
CSVModeActive	BOOL	VAR_OUTPUT	TRUE if drive is in CSV mode.
InVelocity	BOOL	VAR_OUTPUT	Pulse when target velocity is reached (equivalent to 'Done').
Busy	BOOL	VAR_OUTPUT	TRUE while profile is executing.
Error	BOOL	VAR_OUTPUT	TRUE if a drive fault occurs.

2.5.12 MC_MoveTorqueCST_Trap

Generates a torque ramp within the PLC and sends continuous target torque updates to the drive in ****Cyclic Synchronous Torque (CST) mode (Mode 10)****.

Parameter	Type	Direction	Description
Enable	BOOL	VAR_INPUT	Enables management of CST mode.
Execute	BOOL	VAR_INPUT	If TRUE, ramps to TargetTorque_User. If FALSE, ramps to zero.
TargetTorque_User	LReal	VAR_INPUT	Target torque in user units (e.g., per-mill).
ProfileAccel_User	LReal	VAR_INPUT	Torque ramp up rate in user_units/sec ² .
ProfileDecel_User	LReal	VAR_INPUT	Torque ramp down rate in user_units/sec ² .
TorqueWindow_User	LReal	VAR_INPUT	Tolerance window for reaching target torque.
CycleTime	LReal	VAR_INPUT	PLC task cycle time in seconds.
Axis	ST_AxisRef	VAR_IN_OUT	The axis to command.
CSTModeActive	BOOL	VAR_OUTPUT	TRUE if drive is in CST mode.
InTorque	BOOL	VAR_OUTPUT	Pulse when target torque is reached (equivalent to 'Done').
Busy	BOOL	VAR_OUTPUT	TRUE while profile is executing.
Error	BOOL	VAR_OUTPUT	TRUE if a drive fault occurs.