

# SIEMENS

## SIMOTION

## PLCopen Blocks

### Function Manual

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## Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

|                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------|
|  <b>DANGER</b>                        |
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| indicates that death or severe personal injury <b>may</b> result if proper precautions are not taken.                  |
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## Prescribed Usage

Note the following:

|                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b>                                                                                                                                                                                                                                                                                           |
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# Forward

## SIMOTION Documentation

An overview of the SIMOTION documentation can be found in a separate list of references.

This documentation is included as electronic documentation with the supplied SIMOTION SCOUT.

The SIMOTION documentation consists of 9 documentation packages containing approximately 60 SIMOTION documents and documents on other products (e.g. SINAMICS).

The following documentation packages are available for SIMOTION V4.1:

- SIMOTION Engineering System
- SIMOTION System and Function Descriptions
- SIMOTION Diagnostics
- SIMOTION Programming
- SIMOTION Programming - References
- SIMOTION C2xx
- SIMOTION P350
- SIMOTION D4xx
- SIMOTION Supplementary Documentation

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#### Siemens Internet address

The latest information about SIMOTION products, product support, and FAQs can be found on the Internet at:

- General information:
  - <http://www.siemens.de/simotion> (German)
  - <http://www.siemens.com/simotion> (international)
- Product support:
  - <http://support.automation.siemens.com/WW/view/en/10805436>

#### Additional support

We also offer introductory courses to help you familiarize yourself with SIMOTION.

Please contact your regional training center or our main training center at D-90027 Nuremberg, phone +49 (911) 895 3202.

Information about training courses on offer can be found at:

[www.sitrain.com](http://www.sitrain.com)

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# Introduction

## 1.1 Introduction

The PLCopen blocks are designed for use in cyclic programs/tasks and enable motion control programming in a PLC environment. If preferred, they can be used in the LAD/FBD programming language.

PLCopen blocks are available as standard functions (directly from the command library).

The motion control functions meet the PLCopen specifications in terms of interfaces, functions and sequence, and are certified according to "PLCopen Compliance Procedure for Motion Control Library V1.1".



## Description

### 2.1 Description of PLCopen blocks

In SIMOTION, the following list of blocks, which are certified according to "PLCopen Compliance Procedure for Motion Control Library V1.1", can be used in cyclic programs/tasks.

If preferred, they can be used in the LAD/FBD programming language. PLCopen blocks are available as standard functions (directly from the command library).

Table 2-1 SingleAxis functions for the axis

| Function                                                                                                       | Description                                                                    |
|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| _MC_Power()                                                                                                    | Enabling the axis                                                              |
| _MC_Stop()                                                                                                     | Stopping the axis                                                              |
| _MC_Reset()                                                                                                    | Resetting the axis                                                             |
| _MC_Home()                                                                                                     | Homing an axis                                                                 |
| _MC_MoveAbsolute()                                                                                             | Absolutely positioning axis                                                    |
| _MC_MoveRelative()                                                                                             | Relatively positioning axis                                                    |
| _MC_MoveVelocity()                                                                                             | Traversing axis at defined velocity                                            |
| _MC_MoveAdditive()                                                                                             | Relative traversing of axis by a defined path additively to the remaining path |
| _MC_MoveSuperimposed()                                                                                         | Relative superimposing of a new motion on an existing motion                   |
| _MC_PositionProfile()                                                                                          | Traversing axis by a predefined and specified position/time profile            |
| _MC_VelocityProfile()                                                                                          | Traversing axis by a predefined and specified velocity/time profile            |
| _MC_ReadActualPosition()                                                                                       | Reading the actual position of axis                                            |
| _MC_ReadStatus()                                                                                               | Reading the status of an axis                                                  |
| _MC_ReadAxisError()                                                                                            | Reading the error of an axis                                                   |
| _MC_ReadParameter()                                                                                            | Reading the axis parameter data type LREAL                                     |
| _MC_ReadBoolParameter()                                                                                        | Reading the axis parameter data type BOOL                                      |
| _MC_WriteParameter()                                                                                           | Writing the axis parameter data type LREAL                                     |
| _MC_WriteBoolParameter()                                                                                       | Writing the axis parameter data type BOOL                                      |
| <b>Apart from the standard PLCopen functions, the following additional standard axis function is included:</b> |                                                                                |
| _MC_Jog()                                                                                                      | Continuous or incremental jogging                                              |

Table 2-2 MultiAxis functions for the axis

| Function      | Description                         |
|---------------|-------------------------------------|
| _MC_CamIn()   | Insert cam with synchronization     |
| _MC_CamOut()  | Remove cam with desynchronization   |
| _MC_GearIn()  | Synchronize synchronous operation   |
| _MC_GearOut() | Desynchronize synchronous operation |
| _MC_Phasing() | Phase shift                         |

Table 2-3 Functions for external encoder

| Function                 | Description |
|--------------------------|-------------|
| _MC_Power()              |             |
| _MC_Reset()              |             |
| _MC_Home()               |             |
| _MC_ReadActualPosition() |             |
| _MC_ReadStatus()         |             |
| _MC_ReadAxisError()      |             |
| _MC_ReadParameter()      |             |
| _MC_ReadBoolParameter()  |             |
| _MC_WriteParameter()     |             |
| _MC_WriteBoolParameter() |             |

## Blocks

### 3.1 SingleAxis

#### 3.1.1 \_MC\_Home

##### 3.1.1.1 Overview

- Schematic diagram
- Purpose
- Applicable for
- Requirements
- Input parameters
- Output parameters
- ErrorIDs
- Examples

##### 3.1.1.2 Schematic diagram

##### Schematic diagram

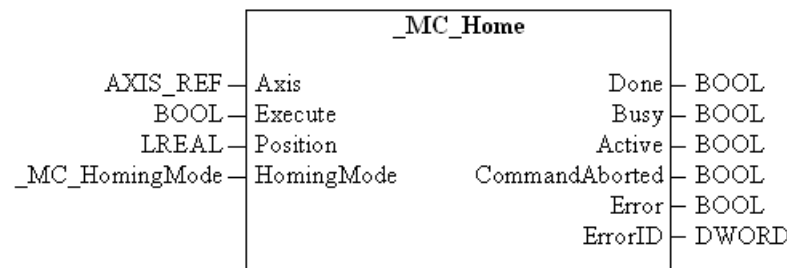


Figure 3-1 \_MC\_Home Schematic diagram

### 3.1.1.3 Purpose

#### Purpose

The function block **\_MC\_Home** establishes a positional relationship between the control and the mechanical system via a measuring system.

### 3.1.1.4 Applicable for

#### Applications

Positioning axes  
Following axes  
External Encoders

#### Restrains

The parameter **HomingMode** of the function block **\_MC\_Home** only defines the homing mode. The homing procedure itself is performed in accordance with the configuration of the encoder on the axis.

| Homing mode                       | Virtual axis | Real axis with incremental encoder | Real axis with absolute encoder | External Encoders |
|-----------------------------------|--------------|------------------------------------|---------------------------------|-------------------|
| ACTIVE_HOMING                     |              | X <sup>(1)</sup>                   |                                 |                   |
| PASSIVE_HOMING                    |              | X                                  |                                 | X                 |
| DIRECT_HOMING                     | X            | X                                  | X                               | X                 |
| DIRECT_HOMING_RELATIVE            | X            | X                                  | X                               | X                 |
| ENABLE_OFFSET_OF_ABSOLUTE_ENCODER |              |                                    | X <sup>(2)</sup>                | X <sup>(2)</sup>  |

<sup>(1)</sup> If the homing mode **MODE\_NO\_REFERENCE** is set in the configuration of the encoder **TypeOfAxis.NumberOfEncoders.Encoder\_<n>.IncHomingEncoder.HomingMode**, then the homing mode **ACTIVE\_HOMING** is not possible on the function block.

<sup>(2)</sup> In the homing mode **ENABLE\_OFFSET\_OF\_ABSOLUTE\_ENCODER** the value transferred with the input parameter **Position** is not effective.  
For this mode you must enter the required offset in the encoder configuration before calling the function block **\_MC\_Home**. Enter the offset value in the configuration data under **TypeOfAxis.NumberOfEncoders.Encoder\_<n>.absHomingEncoder.absShift** and select **absolute** or **relative**.  
If **absolute** is selected, the axis is set to the specified offset value. If **relative** is selected, the specified offset value is added to the current axis position and the axis is set to this "total" value.



### 3.1.1.5 Requirements

#### Requirements

Enabling axes or external encoders

### 3.1.1.6 Input parameters

#### Input parameters

| Parameter  | Data type      | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                 |
|------------|----------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis       | AXIS_REF       | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Position axis</li> <li>• Following axis</li> <li>• External encoder</li> </ul>                                                                                                                                                                               |
| Execute    | BOOL           | FALSE         | Function block enable<br>The homing procedure starts with a rising edge at this input.                                                                                                                                                                                                                                                                                                      |
| Position   | LREAL          | 0.0           | Specification of the position at the reference point or the position setting value or the position offset value                                                                                                                                                                                                                                                                             |
| HomingMode | _MC_HomingMode | ACTIVE_HOMING | Specification of the homing mode:<br>ACTIVE_HOMING:<br>Active homing<br>PASSIVE_HOMING:<br>On-the-fly homing<br>DIRECT_HOMING:<br>Direct homing<br>DIRECT_HOMING_RELATIVE:<br>Direct homing (the actual position of the axis is added to the value specified in the parameter <b>Position</b> as position difference).<br>ENABLE_OFFSET_OF_ABSOLUTE_ENCODER:<br>Absolute encoder adjustment |

### 3.1.1.7 Output parameter

#### Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                             |
|----------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done           | BOOL      | FALSE         | Display of the completion of the function block<br>With TRUE, the programmed target position has been reached.                                                                                                                          |
| Busy           | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                        |
| Active         | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the axis.                                                  |
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error in the command processing or by an overriding command. The error description can be read at the <b>ErrorID</b> output. |
| Error          | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output.        |
| ErrorID        | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                        |

### 3.1.1.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

### 3.1.1.9 Examples

#### Example: Active homing

Sequence for active homing:

- Phase 1:  
Approach of the home position switch (BERO).  
The axis traverses with the homing approach velocity  $V_{app}$  (approach velocity).
- Phase 2:  
Synchronization with the zero mark.  
The axis traverses with the homing reduced velocity  $V_{red}$  (reduced velocity).
- Phase 3:  
Travel to the home position coordinate.  
The axis traverses with the homing entry velocity  $V_{ent}$  (entry velocity).

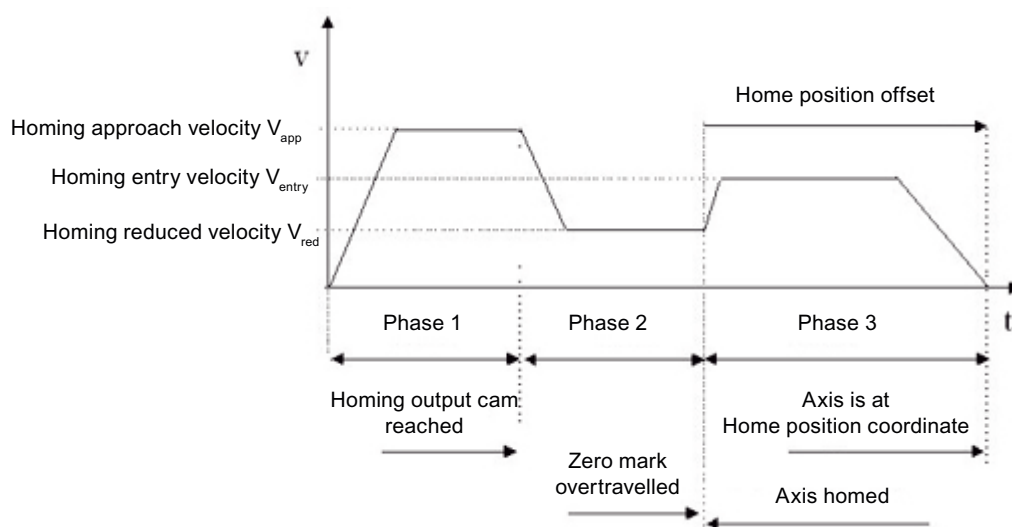


Figure 3-2 \_MC\_Home Example: Active homing

**Example: Direct homing**

The new absolute position is set in the next interpolator cycle after the call of the function block with the set Execute input. When calling the function block from a task which is not synchronous with the interpolator, the setting procedure is only recommended for axes at standstill.

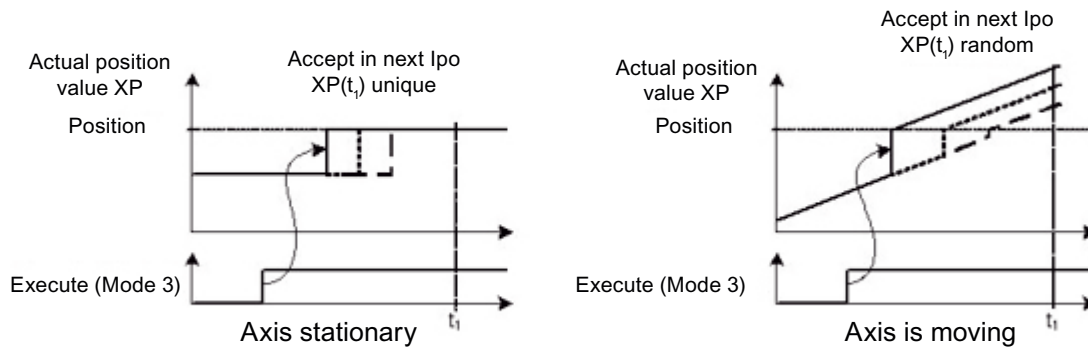


Figure 3-3 \_MC\_Home Example: Direct homing

### Example: Passive homing

The axis is traversed at the velocity 50. Then the passive homing with zero mark is triggered.  
At the next zero pulse, the actual position of the axis is set to 90.

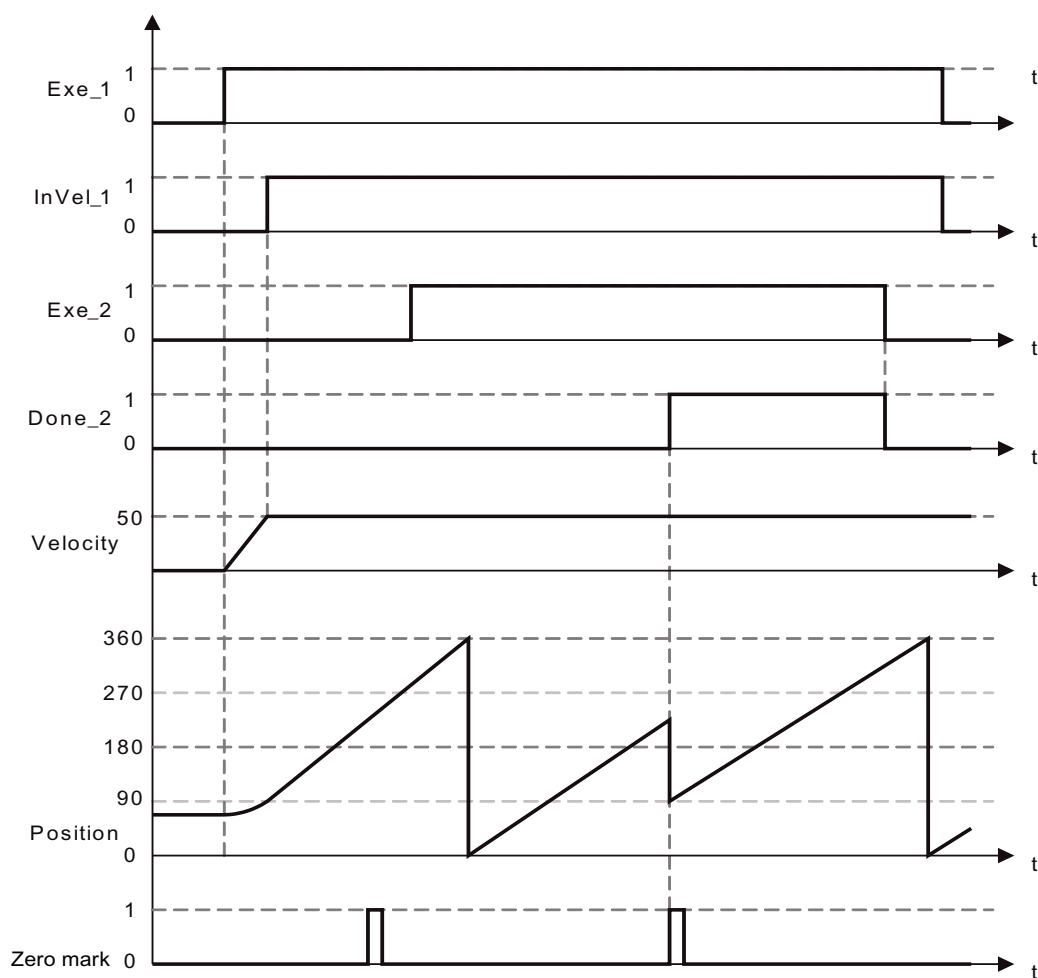
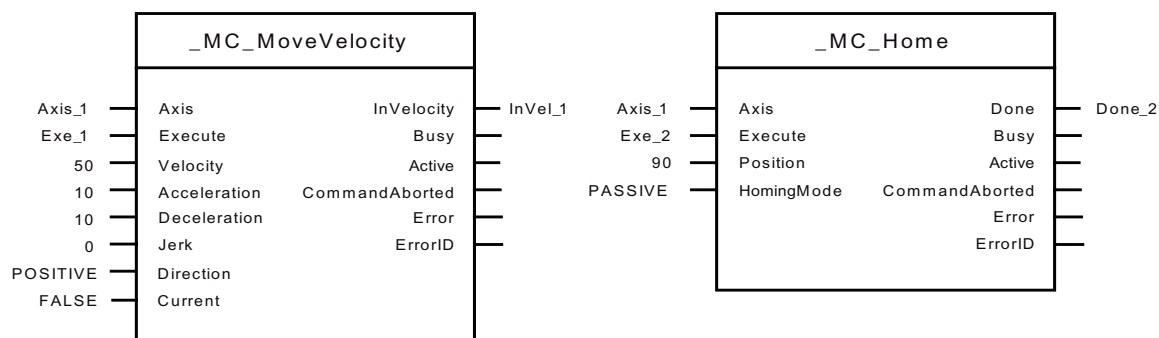


Figure 3-4 \_MC\_Home Example: Passive homing

## 3.1.2 \_MC\_MoveAbsolute

### 3.1.2.1 Overview

Schematic diagram

Purpose

Applicable for

Requirements

Input parameters

Output parameters

ErrorIDs

Example

### 3.1.2.2 Schematic diagram

Schematic diagram

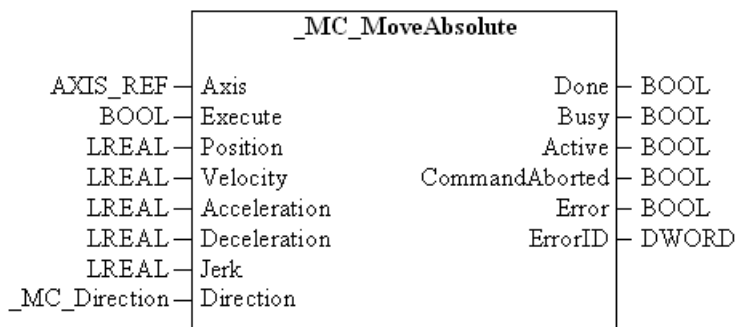


Figure 3-5 \_MC\_MoveAbsolute Schematic diagram

### 3.1.2.3 Purpose

#### Purpose

The function block **\_MC\_MoveAbsolute** starts a positioning motion of an axis to an absolute position.

The dynamic response parameters **Velocity**, **Acceleration**, **Deceleration** and **Jerk** define the dynamic response of the motion procedure.

The axis stops after completion of the positioning motion.

An active motion command is overridden by the function block.

### 3.1.2.4 Applicable for

#### Applications

Positioning axes  
Following axes

### 3.1.2.5 Requirements

#### Requirements

Axis enabled  
Axis homed if the axis configuration data item **TypeOfAxis.Homing.referenceingNecessary** was set to **YES** (homing required).  
No **\_MC\_Stop** active

### 3.1.2.6 Input parameters

#### Input parameters

| Parameter    | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                                  |
|--------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis         | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>Position axis</li> <li>Following axis</li> </ul>                                                                                                                                                                |
| Execute      | BOOL      | FALSE         | Function block enable<br>The positioning operation starts with a rising edge at this input.                                                                                                                                                                                                                                                  |
| Position     | LREAL     | 0.0           | Specification of the absolute target position of the motion                                                                                                                                                                                                                                                                                  |
| Velocity     | LREAL     | -1.0          | Specification of the maximum velocity<br>The velocity is reached depending on the set values for traversing distance, acceleration and jerk.<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.velocity</code> of the axis is used. |
| Acceleration | LREAL     | -1.0          | Specification of the maximum acceleration (increasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.positiveaccel</code> of the axis is used.                                                              |

## 3.1 SingleAxis

| Parameter    | Data type     | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|---------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Deceleration | LREAL         | -1.0          | Specification of the maximum deceleration (decreasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.negativeaccel</code> of the axis is used.                                                                                                                                                              |
| Jerk         | LREAL         | -1.0          | Specification of the maximum jerk<br>Value > 0: The specified value is used<br>Value = 0: Use trapezoidal travel profile<br>Value = -1.0: The preset values in the system variables <code>userdefaultdynamics.positiveaccelstartjerk</code> , <code>userdefaultdynamics.positiveaccelendjerk</code> , <code>userdefaultdynamics.negativeaccelstartjerk</code> and <code>userdefaultdynamics.negativeaccelendjerk</code> of the axis are used |
| Direction    | _MC_Direction | USER_DEFAULT  | Specification of the direction of motion:<br>USER_DEFAULT: Default value from axis configuration<br>POSITIVE: Direction of rotation/motion positive<br>SHORTEST_WAY: In the direction of the shortest way (for modulo axes only)<br>NEGATIVE: Direction of rotation/motion negative<br>EFFECTIVE: Last programmed direction of rotation/motion                                                                                               |

## 3.1.2.7 Output parameter

## Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                             |
|----------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done           | BOOL      | FALSE         | Display of the completion of the function block<br>With TRUE, the programmed target position has been reached.                                                                                                                          |
| Busy           | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                        |
| Active         | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the axis.                                                  |
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error in the command processing or by an overriding command. The error description can be read at the <b>ErrorID</b> output. |



| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                      |
|-----------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Error     | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output. |
| ErrorID   | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                 |

### 3.1.2.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

### 3.1.2.9 Example

#### Case A:

Two `_MC_MoveAbsolute` blocks are started in succession.

#### Case B:

The second `_MC_MoveAbsolute` cancels the first `_MC_MoveAbsolute` block. The target position results relatively from the position at the start of the second block.

3.1 SingleAxis

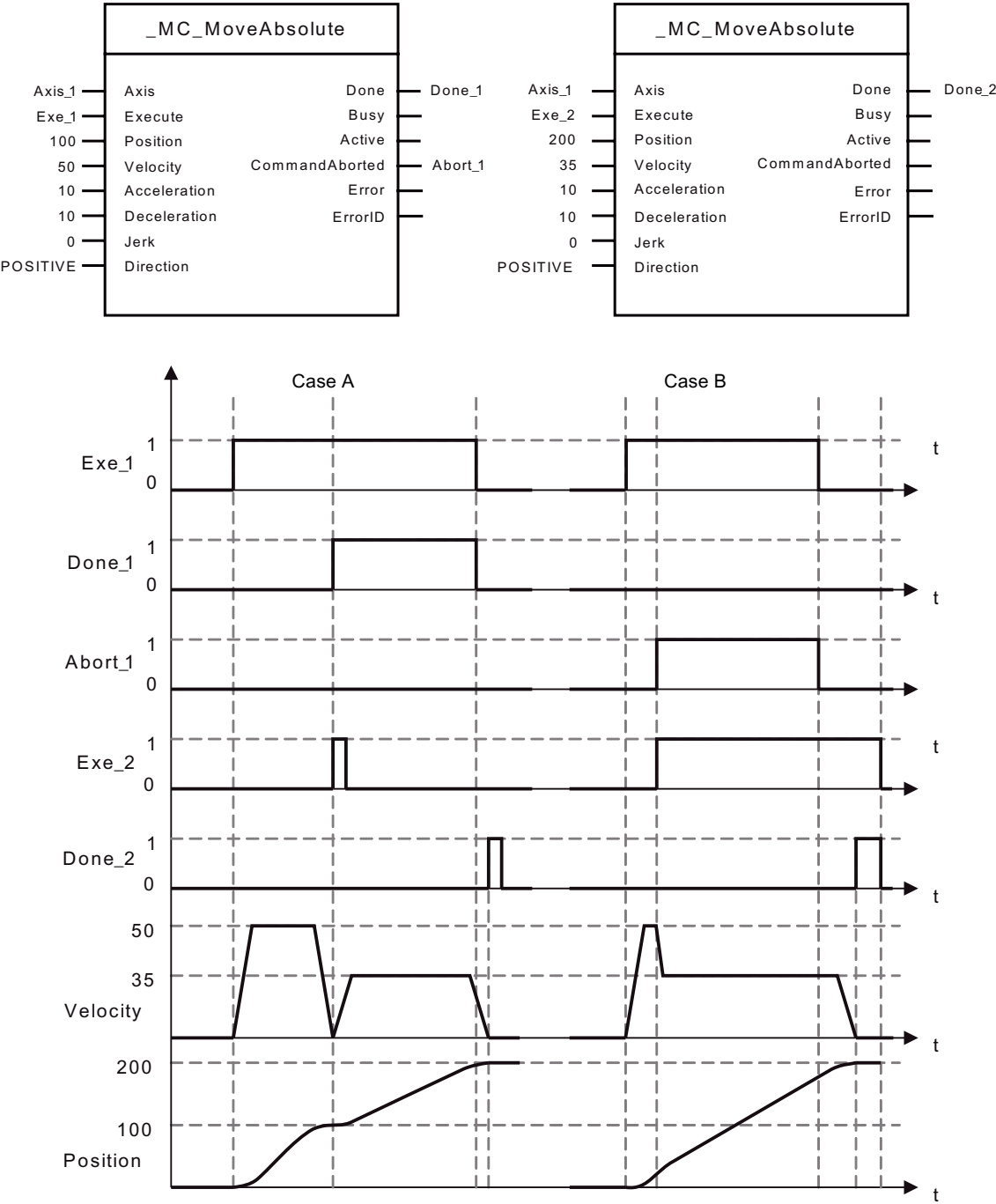


Figure 3-6 \_MC\_MoveAbsolute Example

### 3.1.3 \_MC\_MoveAdditive

#### 3.1.3.1 Overview

Schematic diagram  
Purpose  
Applicable for  
Requirements  
Input parameters  
Output parameters  
ErrorIDs  
Example

#### 3.1.3.2 Schematic diagram

##### Schematic diagram

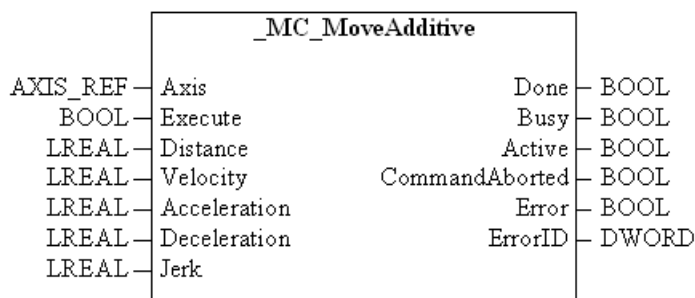


Figure 3-7 \_MC\_MoveAdditive Schematic diagram

#### 3.1.3.3 Purpose

##### Purpose

The function block **\_MC\_MoveAdditive** positions an axis relative to the target position of the active positioning command. The function block enables a correction of the target position of the previous positioning command by a distance specified at the Distance input.

The dynamic response parameters **Velocity**, **Acceleration**, **Deceleration** and **Jerk** define the dynamic response of the motion procedure.

The axis stops after completion of the positioning motion.

An active motion command is overridden by the function block.

### 3.1.3.4 Applicable for

#### Applications

Positioning axes

Following axes

### 3.1.3.5 Requirements

#### Requirements

Axis enabled

No **\_MC\_Stop** active

---

**Note**The function block **\_MC\_MoveAdditive** behaves like a **\_MC\_MoveRelative** function block, if

- The axis is stationary at the start of the job or
  - An active motion command without defined target position is overridden by the function block. The target position then depends on the position of the axis at the time of the override and the additional distance to be traversed.
- 

### 3.1.3.6 Input parameters

#### Input parameters

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                     |
|-----------|-----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis      | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Position axis</li> <li>• Following axis</li> </ul>                                                                                                                                               |
| Execute   | BOOL      | FALSE         | Function block enable<br>The positioning operation starts with a rising edge at this input.                                                                                                                                                                                                                                     |
| Distance  | LREAL     | 0.0           | Specification of the additional distance difference to be traversed                                                                                                                                                                                                                                                             |
| Velocity  | LREAL     | -1.0          | Specification of the maximum velocity<br>The velocity is reached depending on the set values for traversing distance, acceleration and jerk.<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable userdefaultdynamics.velocity of the axis is used. |

| Parameter    | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Acceleration | LREAL     | -1.0          | Specification of the maximum acceleration (increasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.positiveaccel</code> of the axis is used.                                                                                                                                                              |
| Deceleration | LREAL     | -1.0          | Specification of the maximum deceleration (decreasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.negativeaccel</code> of the axis is used.                                                                                                                                                              |
| Jerk         | LREAL     | -1.0          | Specification of the maximum jerk<br>Value > 0: The specified value is used<br>Value = 0: Use trapezoidal travel profile<br>Value = -1.0: The preset values in the system variables <code>userdefaultdynamics.positiveaccelstartjerk</code> , <code>userdefaultdynamics.positiveaccelendjerk</code> , <code>userdefaultdynamics.negativeaccelstartjerk</code> and <code>userdefaultdynamics.negativeaccelendjerk</code> of the axis are used |

### 3.1.3.7 Output parameter

#### Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                             |
|----------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done           | BOOL      | FALSE         | Display of the completion of the function block<br>With TRUE, the axis is at the resulting position setpoint.                                                                                                                           |
| Busy           | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                        |
| Active         | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the axis.                                                  |
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error in the command processing or by an overriding command. The error description can be read at the <b>ErrorID</b> output. |

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                      |
|-----------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Error     | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output. |
| ErrorID   | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                 |

### 3.1.3.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

### 3.1.3.9 Example

#### Case A:

Two `_MC_MoveAdditive` blocks are started in succession.

#### Case B:

The second `_MC_MoveAdditive` cancels the first `_MC_MoveAdditive` block. The target position results from the target position of the first block.

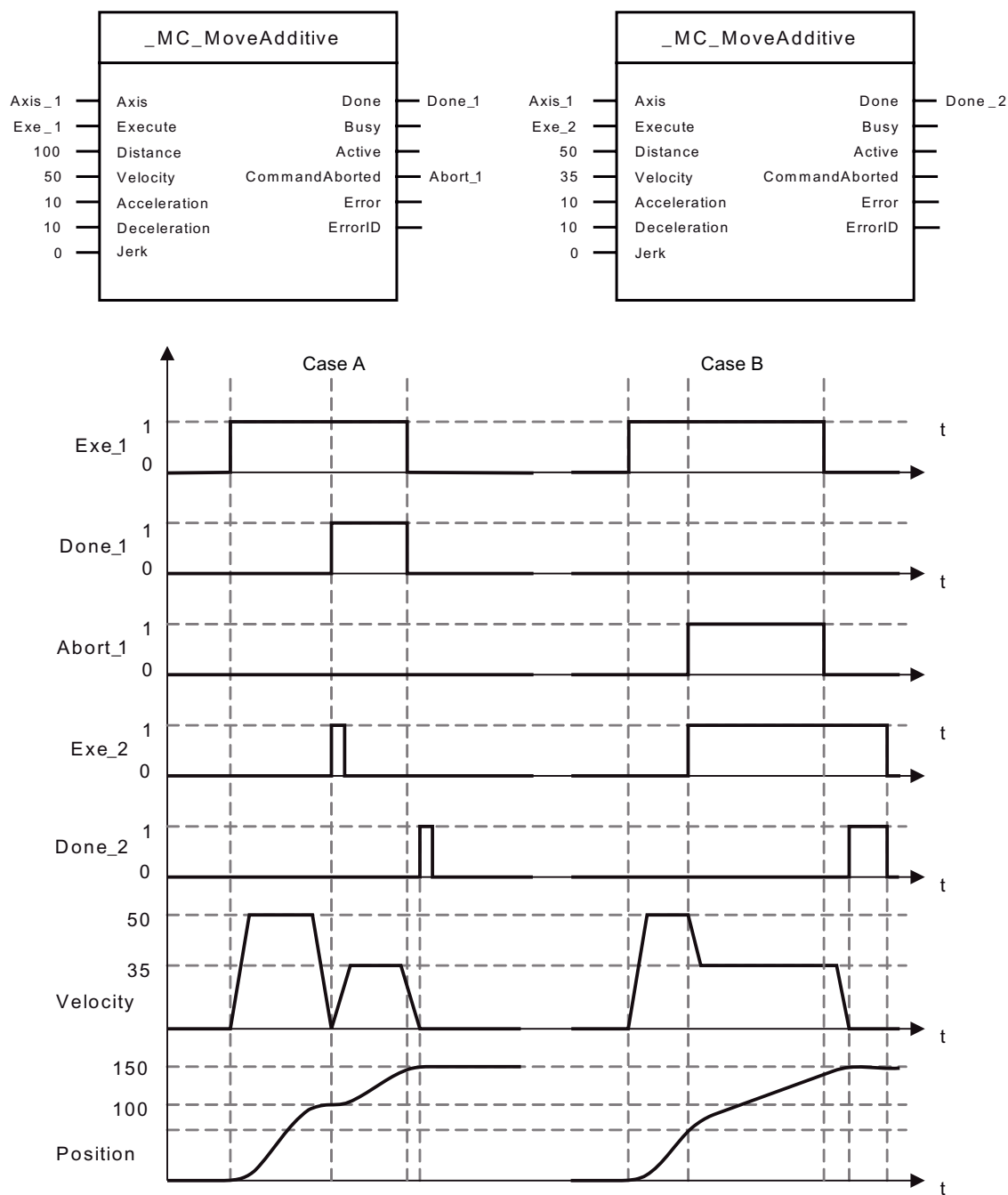


Figure 3-8 `_MC_MoveAdditive` Example

### 3.1.4 \_MC\_MoveRelative

#### 3.1.4.1 Overview

Schematic diagram

Purpose

Applicable for

Requirements

Input parameters

Output parameters

ErrorIDs

Example

#### 3.1.4.2 Schematic diagram

##### Schematic diagram

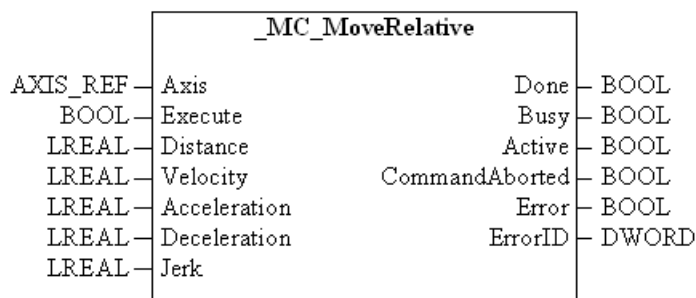


Figure 3-9 \_MC\_MoveRelative Schematic diagram

#### 3.1.4.3 Purpose

##### Purpose

The function block **\_MC\_MoveRelative** positions an axis relative to the actual position of the axis. If the axis is already in motion when the job is started, the position that is present in the system at the start of the job processing is used as the start position. It must be taken into account that there is a response time between the processing of the function block and the execution of the motion, which depends on the user task in which the function block was programmed and on the set interpolation cycle clock.

The dynamic response parameters **Velocity**, **Acceleration**, **Deceleration** and **Jerk** define the dynamic response of the motion procedure.

The axis stops after completion of the positioning motion.

An active motion command is overridden by the function block.



#### 3.1.4.4 Applicable for

##### Application

Positioning axes  
Following axes

#### 3.1.4.5 Requirements

##### Requirements

Axis enabled  
No **\_MC\_Stop** active

#### 3.1.4.6 Input parameters

##### Input parameters

| Parameter    | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                                  |
|--------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis         | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>Position axis</li> <li>Following axis</li> </ul>                                                                                                                                                                |
| Execute      | BOOL      | FALSE         | Function block enable<br>The positioning operation starts with a rising edge at this input.                                                                                                                                                                                                                                                  |
| Distance     | LREAL     | 0.0           | Specification of the distance difference to be traversed                                                                                                                                                                                                                                                                                     |
| Velocity     | LREAL     | -1.0          | Specification of the maximum velocity<br>The velocity is reached depending on the set values for traversing distance, acceleration and jerk.<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.velocity</code> of the axis is used. |
| Acceleration | LREAL     | -1.0          | Specification of the maximum acceleration (increasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.positiveaccel</code> of the axis is used.                                                              |

| Parameter    | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Deceleration | LREAL     | -1.0          | Specification of the maximum deceleration (decreasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.negativeaccel</code> of the axis is used.                                                                                                                                                              |
| Jerk         | LREAL     | -1.0          | Specification of the maximum jerk<br>Value > 0: The specified value is used<br>Value = 0: Use trapezoidal travel profile<br>Value = -1.0: The preset values in the system variables <code>userdefaultdynamics.positiveaccelstartjerk</code> , <code>userdefaultdynamics.positiveaccelendjerk</code> , <code>userdefaultdynamics.negativeaccelstartjerk</code> and <code>userdefaultdynamics.negativeaccelendjerk</code> of the axis are used |

### 3.1.4.7 Output parameter

#### Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                             |
|----------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done           | BOOL      | FALSE         | Display of the completion of the function block<br>With TRUE, the programmed target position has been reached.                                                                                                                          |
| Busy           | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                        |
| Active         | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the axis.                                                  |
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error in the command processing or by an overriding command. The error description can be read at the <b>ErrorID</b> output. |
| Error          | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output.        |
| ErrorID        | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                        |

#### 3.1.4.8 ErrorIDs

##### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

##### See also

Troubleshooting - PLCopen Blocks (Page 113)

#### 3.1.4.9 Example

##### Case A:

Two `_MC_MoveRelative` blocks are started in succession.

##### Case B:

The second `_MC_MoveRelative` cancels the first `_MC_MoveRelative` block. The target position results relatively from the position at the start of the second block.

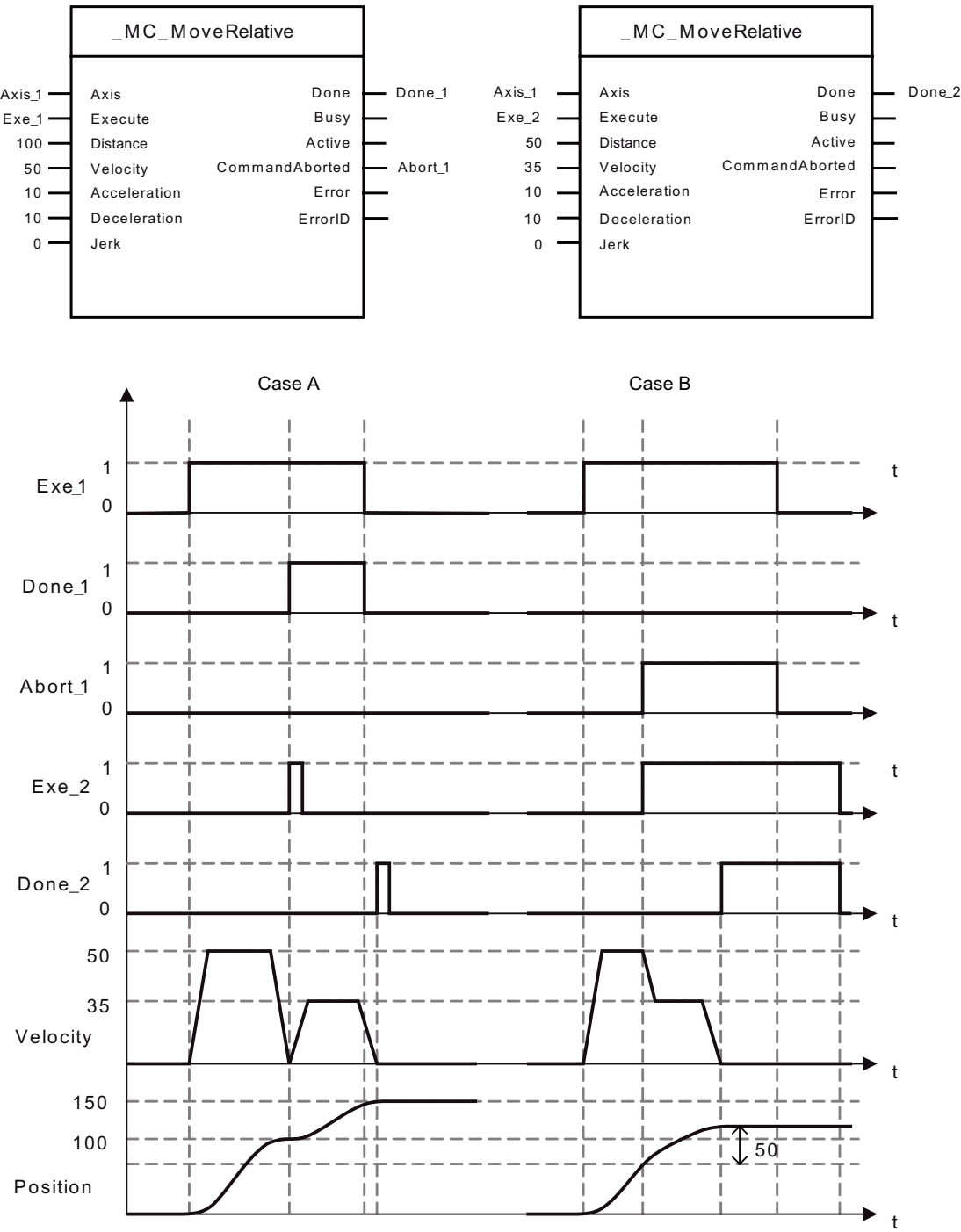


Figure 3-10 `_MC_MoveRelative` Example

## 3.1.5 \_MC\_MoveSuperimposed

### 3.1.5.1 Overview

Schematic diagram  
Purpose  
Applicable for  
Requirements  
Input parameters  
Output parameters  
ErrorIDs  
Example

### 3.1.5.2 Schematic diagram

#### Schematic diagram

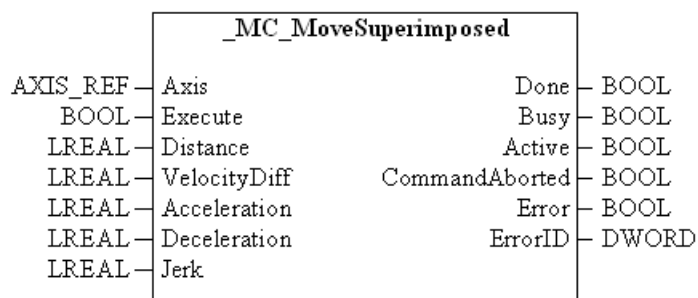


Figure 3-11 \_MC\_MoveSuperimposed Schematic diagram

### 3.1.5.3 Purpose

#### Purpose

The function block **\_MC\_MoveSuperImposed** starts a positioning motion relative to the active positioning motion of an axis. This enables a superimposed positioning of an axis, e.g., for the print-mark correction.

The dynamic response parameters **VelocityDiff**, **Acceleration**, **Deceleration** and **Jerk** define the dynamic response of the motion procedure.

An active motion command (main motion) is not overridden by the function block.

An active superimposed positioning motion is overridden by a restart of the function block **\_MC\_MoveSuperImposed**. The remaining distance-to-go of the overridden superimposed positioning motion is lost.

### 3.1.5.4 Applicable for

#### Applications

Positioning axes

Following axes

### 3.1.5.5 Requirements

#### Requirements

Axis enabled

No **\_MC\_Stop** active

The axis velocity is increased for the superimposed positioning operation. Therefore, the basic motion of the axis should not be performed with the maximum permissible velocity.

### 3.1.5.6 Input parameters

#### Input parameters

| Parameter    | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                                  |
|--------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis         | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Position axis</li> <li>• Following axis</li> </ul>                                                                                                                                                            |
| Execute      | BOOL      | FALSE         | Function block enable<br>The positioning operation starts with a rising edge at this input.                                                                                                                                                                                                                                                  |
| Distance     | LREAL     | 0.0           | Specification of the distance difference to be traversed                                                                                                                                                                                                                                                                                     |
| Velocity     | LREAL     | -1.0          | Specification of the maximum velocity<br>The velocity is reached depending on the set values for traversing distance, acceleration and jerk.<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.velocity</code> of the axis is used. |
| Acceleration | LREAL     | -1.0          | Specification of the maximum acceleration (increasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.positiveaccel</code> of the axis is used.                                                              |

| Parameter    | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Deceleration | LREAL     | -1.0          | Specification of the maximum deceleration (decreasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.negativeaccel</code> of the axis is used.                                                                                                                                                              |
| Jerk         | LREAL     | -1.0          | Specification of the maximum jerk<br>Value > 0: The specified value is used<br>Value = 0: Use trapezoidal travel profile<br>Value = -1.0: The preset values in the system variables <code>userdefaultdynamics.positiveaccelstartjerk</code> , <code>userdefaultdynamics.positiveaccelendjerk</code> , <code>userdefaultdynamics.negativeaccelstartjerk</code> and <code>userdefaultdynamics.negativeaccelendjerk</code> of the axis are used |

### 3.1.5.7 Output parameter

#### Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                             |
|----------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done           | BOOL      | FALSE         | Display of the completion of the function block<br>With TRUE, the programmed target position has been reached.                                                                                                                          |
| Busy           | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                        |
| Active         | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the axis.                                                  |
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error in the command processing or by an overriding command. The error description can be read at the <b>ErrorID</b> output. |
| Error          | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output.        |
| ErrorID        | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                        |

### 3.1.5.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

### 3.1.5.9 Example

#### Case A:

An `_MC_MoveSuperImposed` is started during a relative positioning.

#### Case B:

`MC_MoveSuperImposed` is started again before `_MC_MoveSuperImposed` is completed.

#### Case C:

Start `_MC_MoveSuperImposed` with a stationary axis.



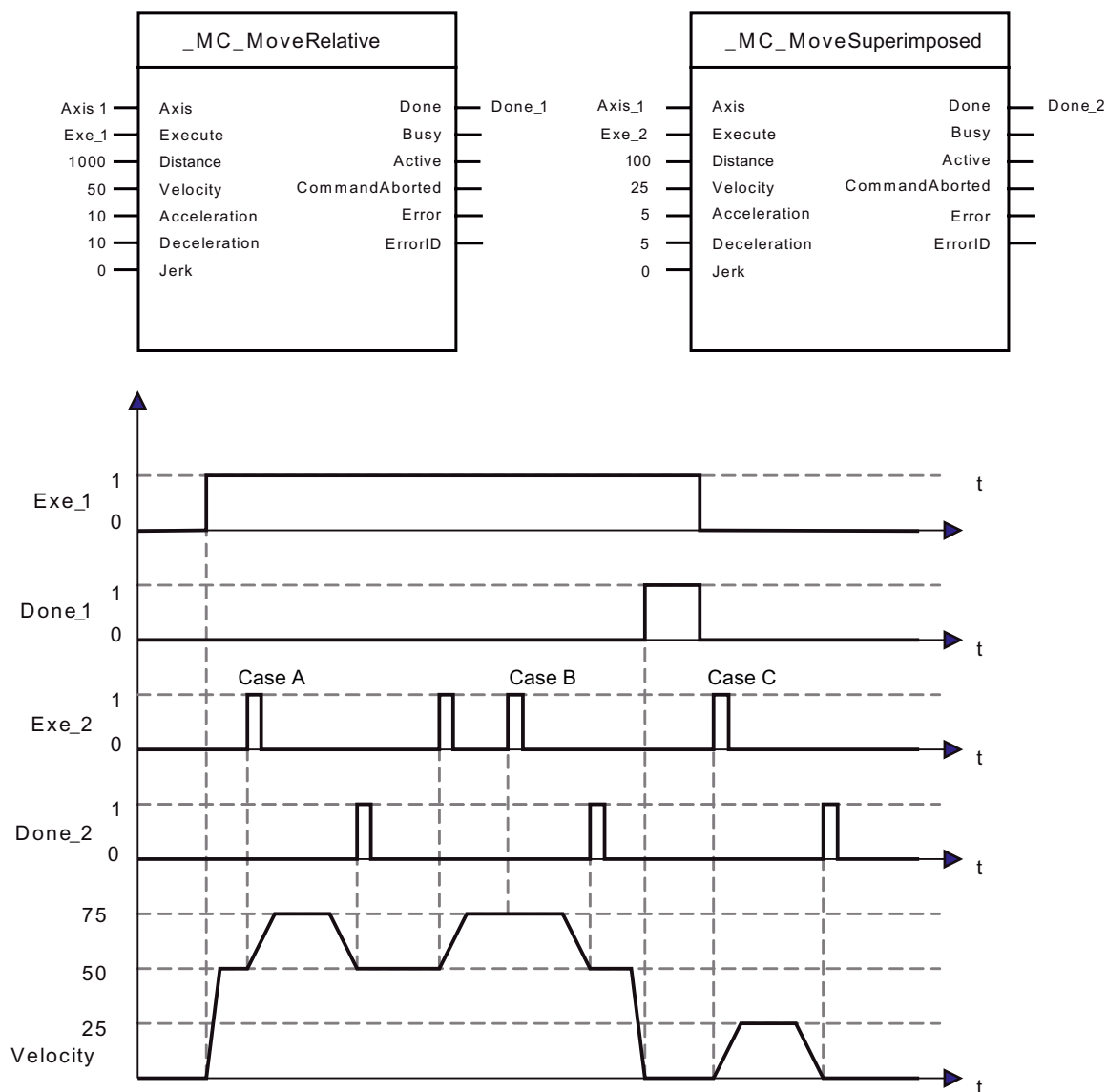


Figure 3-12 \_MC\_MoveSuperimposed Example

### 3.1.6 \_MC\_MoveVelocity

#### 3.1.6.1 Overview

Schematic diagram

Purpose

Applicable for

Requirements

Input parameters

Output parameters

ErrorIDs

Example

#### 3.1.6.2 Schematic diagram

##### Schematic diagram

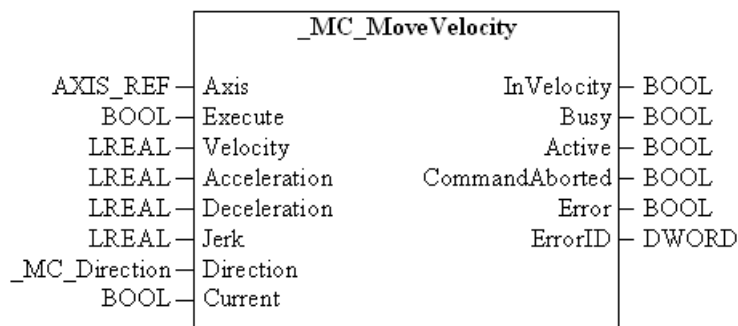


Figure 3-13 \_MC\_MoveAdditive Schematic diagram

#### 3.1.6.3 Purpose

##### Purpose

The technology function **\_MC\_MoveVelocity** accelerates or decelerates an axis to a set velocity.

The dynamic response parameters **Acceleration**, **Deceleration** and **Jerk** define the dynamic response of the motion procedure.

If a velocity override is in effect, then the end velocity is calculated under consideration of the override. You must take this behavior into account in the user program.

### 3.1.6.4 Applicable for

#### Applications

Drive axes  
Positioning axes  
Following axes

### 3.1.6.5 Requirements

#### Requirements

Axis enabled  
No **\_MC\_Stop** active

### 3.1.6.6 Input parameters

#### Input parameters

| Parameter    | Data type | Initial value | Description                                                                                                                                                                                                                                                                     |
|--------------|-----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis         | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Drive axis</li> <li>• Position axis</li> <li>• Following axis</li> </ul>                                                                         |
| Execute      | BOOL      | FALSE         | Function block enable<br>The axis accelerates or decelerates to the programmed set velocity with a rising edge at this input.                                                                                                                                                   |
| Velocity     | LREAL     | -1.0          | Specification of the set velocity<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.velocity</code> of the axis is used.                                               |
| Acceleration | LREAL     | -1.0          | Specification of the maximum acceleration (increasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.positiveaccel</code> of the axis is used. |

| Parameter    | Data type     | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|---------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Deceleration | LREAL         | -1.0          | Specification of the maximum deceleration (decreasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.negativeaccel</code> of the axis is used.                                                                                                                                                              |
| Jerk         | LREAL         | -1.0          | Specification of the maximum jerk<br>Value > 0: The specified value is used<br>Value = 0: Use trapezoidal travel profile<br>Value = -1.0: The preset values in the system variables <code>userdefaultdynamics.positiveaccelstartjerk</code> , <code>userdefaultdynamics.positiveaccelendjerk</code> , <code>userdefaultdynamics.negativeaccelstartjerk</code> and <code>userdefaultdynamics.negativeaccelendjerk</code> of the axis are used |
| Direction    | _MC_Direction | USER_DEFAULT  | Specification of the direction of motion:<br>USER_DEFAULT: Default value from axis configuration<br>POSITIVE: Direction of rotation/motion positive<br>NEGATIVE: Direction of rotation/motion negative<br>EFFECTIVE: Last programmed direction of rotation/motion                                                                                                                                                                            |
| Current      | BOOL          | FALSE         | Type of velocity specification<br>With TRUE, the actual velocity of the axis is taken over as programmed set velocity.<br>With FALSE, the set velocity programmed on the <b>Velocity</b> input is used.                                                                                                                                                                                                                                      |

### 3.1.6.7 Output parameter

#### Output parameter

| Parameter  | Data type | Initial value | Description                                                                                                                                                                                                                                               |
|------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| InVelocity | BOOL      | FALSE         | Indicates termination of the function block.<br>With TRUE, the axis has reached the programmed setpoint velocity. Until the abort of the function block, the output remains unchanged irrespective of the subsequent characteristic of the axis velocity. |
| Busy       | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                                          |
| Active     | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the axis.                                                                    |

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                             |
|----------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error in the command processing or by an overriding command. The error description can be read at the <b>ErrorID</b> output. |
| Error          | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output.        |
| ErrorID        | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                        |

### 3.1.6.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

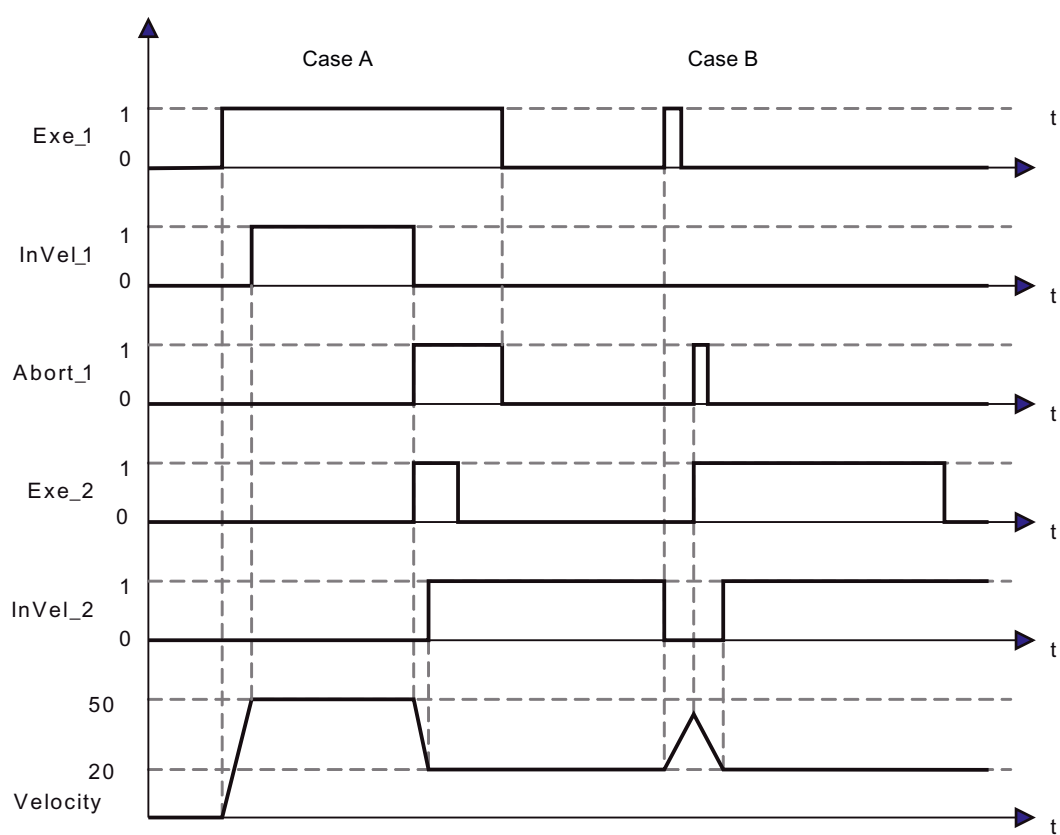
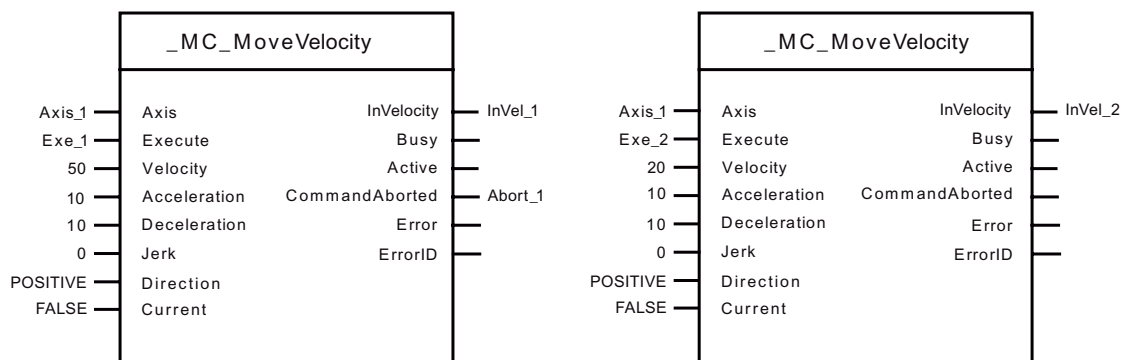
### 3.1.6.9 Example

#### Case A:

An `_MC_MoveVelocity` block is overridden by another `_MC_MoveVelocity` block after the end velocity has been reached (**InVelocity = TRUE**).

#### Case B:

An `_MC_MoveVelocity` block is overridden by another `_MC_MoveVelocity` block before the end velocity has been reached (**InVelocity = FALSE**).

Figure 3-14 `_MC_MoveVelocity` Example

## 3.1.7 \_MC\_PositionProfile

### 3.1.7.1 Overview

Schematic diagram  
Purpose  
Applicable for  
Requirements  
Input parameters  
Output parameters  
ErrorIDs

### 3.1.7.2 Schematic diagram

Schematic diagram

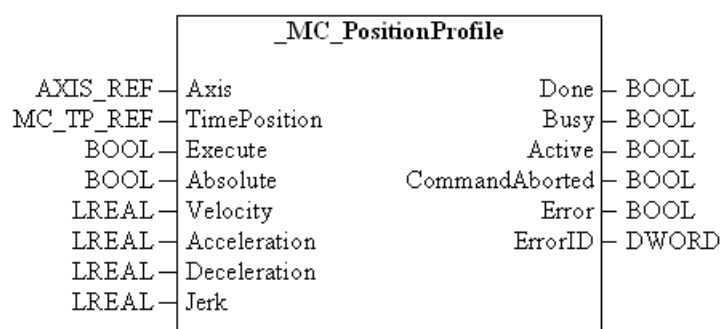


Figure 3-15 \_MC\_PositionProfile Schematic diagram

### 3.1.7.3 Purpose

Purpose

The function block **\_MC\_PositionProfile** traverses an axis along a position profile which is specified as an s(t) function.

### 3.1.7.4 Applicable for

Applications

Positioning axes  
Following axes

### 3.1.7.5 Requirements

#### Requirements

Axis enabled

Axis homed if the axis configuration data item **TypeOfAxis.Homing.referenceingNecessary** was set to **YES** (homing required).

No **\_MC\_Stop** active

### 3.1.7.6 Input parameters

#### Input parameters

| Parameter    | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                                  |
|--------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis         | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>Position axis</li> <li>Following axis</li> </ul>                                                                                                                                                                |
| TimePosition | MC_TP_REF | 0             | Specification of the reference to the cam that describes the position profile.                                                                                                                                                                                                                                                               |
| Execute      | BOOL      | FALSE         | Function block enable<br>The positioning motion starts with a rising edge at this input.                                                                                                                                                                                                                                                     |
| Absolute     | BOOL      | TRUE          | Specification of the traversing method<br>With TRUE, the cam positions are approached according to the absolute values.<br>With FALSE, the position profile of the cam is set at the actual position of the axis.                                                                                                                            |
| Velocity     | LREAL     | -1.0          | Specification of the maximum velocity<br>The velocity is reached depending on the set values for traversing distance, acceleration and jerk.<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.velocity</code> of the axis is used. |
| Acceleration | LREAL     | -1.0          | Specification of the maximum acceleration (increasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.positiveaccel</code> of the axis is used.                                                              |



| Parameter    | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Deceleration | LREAL     | -1.0          | Specification of the maximum deceleration (decreasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.negativeaccel</code> of the axis is used.                                                                                                                                                              |
| Jerk         | LREAL     | -1.0          | Specification of the maximum jerk<br>Value > 0: The specified value is used<br>Value = 0: Use trapezoidal travel profile<br>Value = -1.0: The preset values in the system variables <code>userdefaultdynamics.positiveaccelstartjerk</code> , <code>userdefaultdynamics.positiveaccelendjerk</code> , <code>userdefaultdynamics.negativeaccelstartjerk</code> and <code>userdefaultdynamics.negativeaccelendjerk</code> of the axis are used |

### 3.1.7.7 Output parameter

#### Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                             |
|----------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done           | BOOL      | FALSE         | Display of the completion of the function block<br>With TRUE, the axis has completed the specified position profile.                                                                                                                    |
| Busy           | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                        |
| Active         | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the axis.                                                  |
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error in the command processing or by an overriding command. The error description can be read at the <b>ErrorID</b> output. |
| Error          | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output.        |
| ErrorID        | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                        |

### 3.1.7.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

## 3.1.8 \_MC\_Power

### 3.1.8.1 Overview

Schematic diagram

Purpose

Applicable for

Requirements

Input parameters

Output parameters

ErrorIDs

Example

### 3.1.8.2 Schematic diagram

#### Schematic diagram

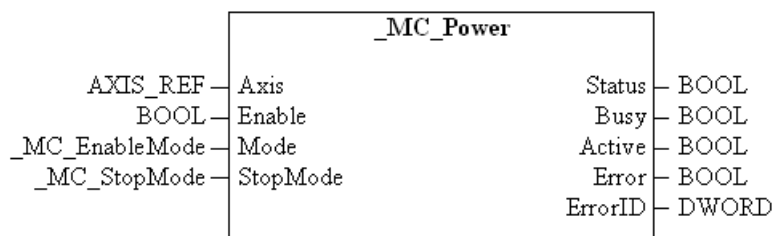


Figure 3-16 \_MC\_Power Schematic diagram

### 3.1.8.3 Purpose

#### Purpose

The **\_MC\_Power** function block enables or disables an Axis technology object or an External Encoder technology object.

If an active braking is possible before an axis is disabled, it is stopped with the set stop mode. The parameter **StopMode** specifies a stop mode for the axis. The stop mode is taken over with a falling edge at the **Enable** input.

### 3.1.8.4 Applicable for

#### Applications

Drive axes  
Positioning axes  
Following axes  
External Encoders

### 3.1.8.5 Requirements

#### Requirements

No alarms preventing the enable may be present on the TO.

### 3.1.8.6 Input parameters

#### Input parameters

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                                    |
|-----------|-----------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis      | AXIS_REF  | 0             | <p>Specification of the axis reference</p> <p>The following technology objects can be homed:</p> <ul style="list-style-type: none"> <li>• Drive axis</li> <li>• Position axis</li> <li>• Following axis</li> <li>• External encoder</li> </ul> |

| Parameter | Data type      | Initial value           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------|----------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enable    | BOOL           | FALSE                   | <p>Function block enable</p> <p>The axis is enabled with a rising edge at this input. If this is not possible, the attempt to set the enables is repeated as long as <b>Enable</b> is set.</p> <p>The axis is stopped with a falling edge at this input. The axis is disabled after reaching standstill.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Mode      | _MC_EnableMode | ALL                     | <p>Specification of the axis enables to be set</p> <p>Not effective for external encoders.</p> <p>ALL: Set all enables and deactivate follow-up mode</p> <p>DRIVE: Only set drive enable</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| StopMode  | _MC_StopMode   | WITH_COMMAND_VALUE_ZERO | <p>Specification of the stop mode</p> <p>Not effective for external encoders.</p> <p>WITH_COMMAND_VALUE_ZERO:<br/>The axis is stopped with emergency stop in the STOP_WITH_COMMAND_VALUE_ZERO mode. It is stopped via the emergency stop ramp in the controller. The ramp is set during axis configuration.</p> <p>WITH_MAXIMAL_DECELERATION:<br/>The axis is stopped with emergency stop in the STOP_WITH_MAXIMAL_DECELERATION mode. It is stopped according to interpolation with the maximum dynamic values of the axis.</p> <p>IN_DEFINED_TIME:<br/>The axis is stopped with emergency stop in the STOP_IN_DEFINED_TIME mode. The default setting for the stop time defined in the system variable userDefaultDynamics.stopTime is used. The specified time is adhered to irrespective of the starting velocity.</p> <p>DISABLE_DRIVE_IMMEDIATELY:<br/>The POWER enable is removed directly from the axis. The drive coasts to a standstill.</p> |

### 3.1.8.7 Output parameter

#### Output parameter

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                                             |
|-----------|-----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Status    | BOOL      | FALSE         | Display of the enable status of the axis<br>With TRUE, the enables of the axis are set according to the <b>Mode</b> parameter.<br>With TRUE, the enables of the external encoder are set.<br>With FALSE, an individual enable or all enables are reset. |
| Busy      | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                                        |
| Active    | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, a command is being processed by the command processing, i.e. the function block has active control of the axis.                                                                     |
| Error     | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred with the function block. The error description can be read at the <b>ErrorID</b> output.                                                                                  |
| ErrorID   | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the output <b>Error</b> .                                                                                                                                  |

### 3.1.8.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

## 3.1.8.9 Example

## Example

The axis is traversed with velocity 50 after the enable. After an error has occurred resulting in the removal of the axis enable, the error is corrected with **\_MC\_Reset**. The axis is enabled again. The axis is then traversed again with velocity 50 and the enable is removed. The axis brakes with the ramp set in the **StopMode** parameter.

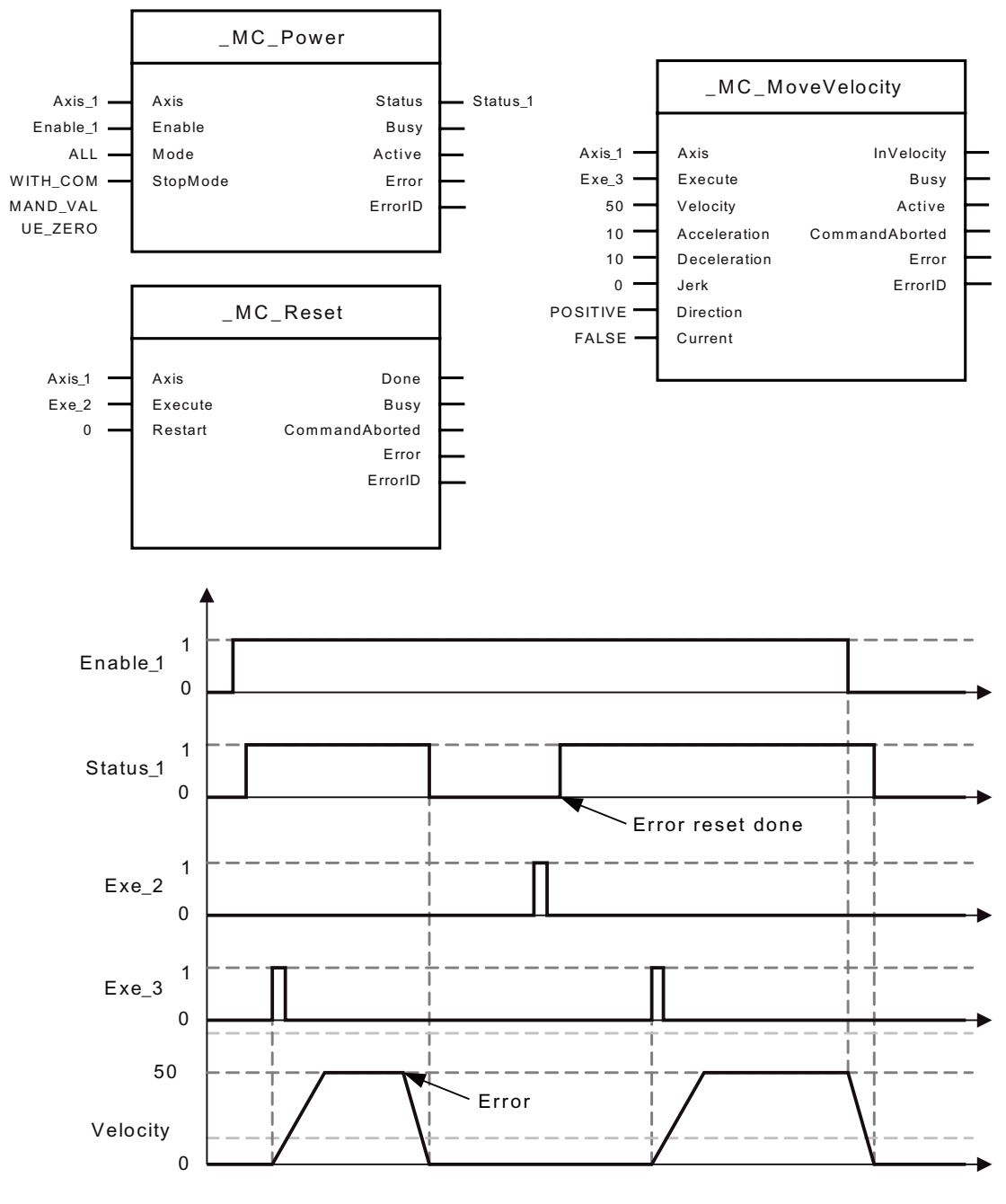


Figure 3-17 \_MC\_Power Example

## 3.1.9 \_MC\_ReadActualPosition

### 3.1.9.1 Overview

Schematic diagram  
Purpose  
Applicable for  
Input parameters  
Output parameters  
ErrorIDs

### 3.1.9.2 Schematic diagram

#### Schematic diagram

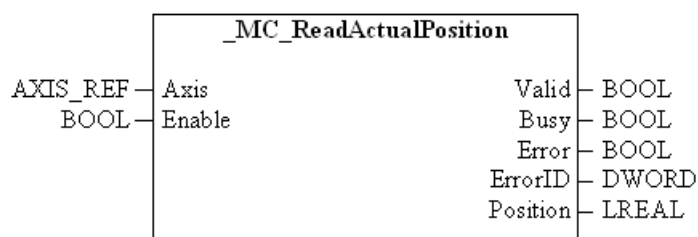


Figure 3-18 \_MC\_ReadActualPosition Schematic diagram

### 3.1.9.3 Purpose

#### Purpose

The function block **\_MC\_ReadActualPosition** reads the actual position of an axis or an external encoder.

### 3.1.9.4 Applicable for

#### Applications

Positioning axes  
Following axes  
External Encoders

### 3.1.9.5 Input parameters

#### Input parameters

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                   |
|-----------|-----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis      | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Position axis</li> <li>• Following axis</li> <li>• External encoder</li> </ul> |
| Enable    | BOOL      | FALSE         | Function block enable<br>The value at output <b>Position</b> is updated as long as <b>Enable</b> equals <b>TRUE</b> .                                                                                         |

### 3.1.9.6 Output parameter

#### Output parameter

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                                 |
|-----------|-----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Valid     | BOOL      | FALSE         | Display of the validity of the value which can be read at output <b>Position</b> .                                                                                                                                                          |
| Busy      | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                            |
| Error     | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, either an error has occurred during the initialization of the function block or the error status could not be read. The error description can be read at the <b>ErrorID</b> output. |
| ErrorID   | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the output <b>Error</b> .                                                                                                                      |
| Position  | LREAL     | 0.0           | Displays the actual position of the axis or external encoder                                                                                                                                                                                |

### 3.1.9.7 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)



## 3.1.10 \_MC\_ReadAxisError

### 3.1.10.1 Overview

Schematic diagram  
Purpose  
Applicable for  
Input parameters  
Output parameters  
ErrorIDs

### 3.1.10.2 Schematic diagram

#### Schematic diagram

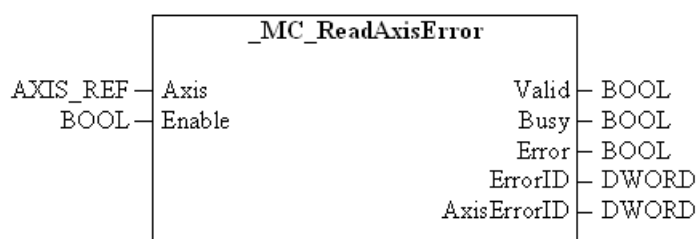


Figure 3-19 \_MC\_ReadAxisError Schematic diagram

### 3.1.10.3 Purpose

#### Purpose

The function block **\_MC\_ReadAxisError** reads the error status of an axis or an external encoder. The error status is a 32-bit representation of all alarms present on the technology object.

### 3.1.10.4 Applicable for

#### Applications

Drive axes  
Positioning axes  
Following axes  
External Encoders

### 3.1.10.5 Input parameters

#### Input parameters

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                      |
|-----------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis      | AXIS_REF  | 0             | Specification of the axis reference The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Drive axis</li> <li>• Position axis</li> <li>• Following axis</li> <li>• External encoder</li> </ul> |
| Enable    | BOOL      | FALSE         | Function block enable<br>The value at output <b>AxisErrorID</b> is updated as long as <b>Enable</b> equals <b>TRUE</b> .                                                                                                         |

### 3.1.10.6 Output parameter

#### Output parameter

| Parameter   | Data type | Initial value | Description                                                                                                                                                                                                                                 |
|-------------|-----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Valid       | BOOL      | FALSE         | Display of the validity of the value which can be read at output <b>AxisErrorID</b> .                                                                                                                                                       |
| Busy        | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                            |
| Error       | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, either an error has occurred during the initialization of the function block or the error status could not be read. The error description can be read at the <b>ErrorID</b> output. |
| ErrorID     | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the output <b>Error</b> .                                                                                                                      |
| AxisErrorID | DWORD     | 0             | Displays the error status of the axis or external encoder                                                                                                                                                                                   |

### 3.1.10.7 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

Generally, the following is valid:

- The **ErrorID** on the **\_MC\_...** function blocks refer to special block-related errors and to errors on the axis
- The **AxisErrorID** on the **\_MC\_ReadAxisError** function block refers to errors on the axis

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

### 3.1.11 \_MC\_ReadBoolParameter

#### 3.1.11.1 Overview

Schematic diagram

Purpose

Applicable for

Input parameters

Output parameters

ErrorIDs

#### 3.1.11.2 Schematic diagram

#### Schematic diagram

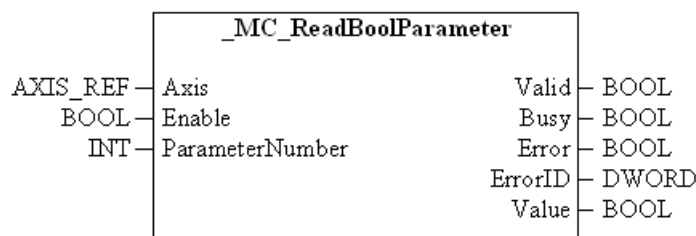


Figure 3-20 \_MC\_ReadBoolParameter Schematic diagram

### 3.1.11.3 Purpose

#### Purpose

The function block **\_MC\_ReadBoolParameter** reads values of various parameters of an axis or external encoder. Each parameter is specified by a number. The return value of the parameter is converted to the data type of the function block (BOOL), i.e. values that are not of the data type BOOL are converted to FALSE when they are exactly 0 and to TRUE in all other cases.

### 3.1.11.4 Applicable for

#### Applications

Drive axes  
Positioning axes  
Following axes  
External Encoders

### 3.1.11.5 Input parameters

#### Input parameters

| Parameter       | Data type | Initial value | Description                                                                                                                                                                                                                    |
|-----------------|-----------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis            | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"><li>• Drive axis</li><li>• Position axis</li><li>• Following axis</li><li>• External encoder</li></ul> |
| Enable          | BOOL      | FALSE         | Function block enable<br>The value at output <b>Value</b> is updated as long as <b>Enable</b> equals <b>TRUE</b> .                                                                                                             |
| ParameterNumber | INT       | 0             | Specification of the number of the parameter to be read (see table below).                                                                                                                                                     |

## Parameter description for input ParameterNumber

Table 3-1 Input ParameterNumber for axes

| Parameter | Data type | Description                                                                                                                                                                                                                     |
|-----------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1         | LREAL     | <b>positioningstate.commandposition</b> : Axis position setpoint                                                                                                                                                                |
| 2         | LREAL     | <b>swlimit.plusposition</b> : Position of the positive software limit switch<br>(10 <sup>12</sup> is output with inactive limit switch.)                                                                                        |
| 3         | LREAL     | <b>swlimit.minusposition</b> : Position of the negative software limit switch<br>(-10 <sup>12</sup> is output with inactive limit switch.)                                                                                      |
| 4         | BOOL      | <b>swlimit.state</b> : Activation state of the two software limit switches<br>(The limit switches are always activated or deactivated together.)                                                                                |
| 6         | BOOL      | <b>typeofaxis.numberofdatssets.dataset_x.dynamicfollowing.enable</b> : Activation state of the following error monitoring                                                                                                       |
| 7         | LREAL     | <b>typeofaxis.numberofdatssets.dataset_x.dynamicfollowing.minpositiontolerance</b> : Minimum permissible following error                                                                                                        |
| 8         | LREAL     | <b>typeofaxis.maxvelocity.maximum</b> : Maximum permissible velocity                                                                                                                                                            |
| 10        | LREAL     | <b>motionstatedata.actualvelocity</b> : Actual axis velocity<br>(A value is only displayed if an encoder was configured on the axis. For drive axes, the encoder must be configured for the setpoint acceptance if applicable.) |
| 11        | LREAL     | <b>motionstatedata.commandvelocity</b> : Axis velocity setpoint                                                                                                                                                                 |
| 12        | LREAL     | <b>typeofaxis.maxacceleration.maximum</b> : Maximum permissible acceleration                                                                                                                                                    |
| 16        | LREAL     | <b>typeofaxis.maxjerk.maximum</b> : Maximum permissible jerk                                                                                                                                                                    |

Table 3-2 Input ParameterNumber for external encoders

| Parameter | Data type | Description                                                    |
|-----------|-----------|----------------------------------------------------------------|
| 10        | LREAL     | <b>motionState.melocity</b> : External encoder actual velocity |

### 3.1.11.6 Output parameter

#### Output parameter

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                                 |
|-----------|-----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Valid     | BOOL      | FALSE         | Display of the validity of the value which can be read at output <b>Value</b> .                                                                                                                                                             |
| Busy      | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                            |
| Error     | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, either an error has occurred during the initialization of the function block or the error status could not be read. The error description can be read at the <b>ErrorID</b> output. |
| ErrorID   | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the output <b>Error</b> .                                                                                                                      |
| Value     | BOOL      | FALSE         | Display of the parameter value                                                                                                                                                                                                              |

### 3.1.11.7 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

## 3.1.12 \_MC\_ReadParameter

### 3.1.12.1 Overview

Schematic diagram

Purpose

Applicable for

Input parameters

Output parameters

ErrorIDs

### 3.1.12.2 Schematic diagram

#### Schematic diagram

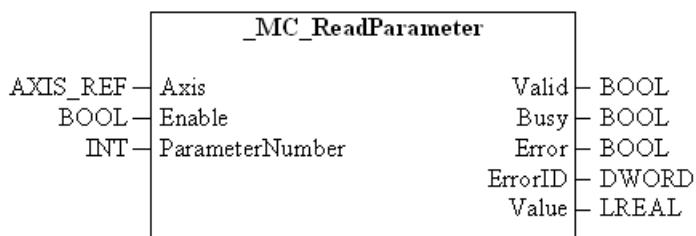


Figure 3-21 \_MC\_ReadParameter Schematic diagram

BOOL values are output as 0.0 for FALSE and as 1.0 for TRUE.

### 3.1.12.3 Purpose

#### Purpose

The function block **\_MC\_ReadParameter** reads values of various parameters of an axis or external encoder. Each parameter is specified by a number.

### 3.1.12.4 Applicable for

#### Applications

- Drive axes
- Positioning axes
- Following axes
- External Encoders

## 3.1.12.5 Input parameters

## Input parameters

| Parameter       | Data type | Initial value | Description                                                                                                                                                                                                                         |
|-----------------|-----------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis            | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Drive axis</li> <li>• Position axis</li> <li>• Following axis</li> <li>• External encoder</li> </ul> |
| Enable          | BOOL      | FALSE         | Function block enable<br>The value at output <b>Value</b> is updated as long as <b>Enable</b> equals <b>TRUE</b> .                                                                                                                  |
| ParameterNumber | INT       | 0             | Specification of the number of the parameter to be read (see table below).                                                                                                                                                          |

## Parameter description for input ParameterNumber

Table 3-3 Input ParameterNumber for axes

| Parameter | Data type | Access     | Description                                                                                                                                                                                                                     |
|-----------|-----------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1         | LREAL     | Read       | <b>positioningstate.commandposition</b> : Axis position setpoint                                                                                                                                                                |
| 2         | LREAL     | Read/Write | <b>swlimit.plusposition</b> : Position of the positive software limit switch<br>(10 <sup>12</sup> is output with inactive limit switch.)                                                                                        |
| 3         | LREAL     | Read/Write | <b>swlimit.minusposition</b> : Position of the negative software limit switch<br>(-10 <sup>12</sup> is output with inactive limit switch.)                                                                                      |
| 4         | BOOL      | Read/Write | <b>swlimit.state</b> : Activation state of the two software limit switches<br>(The limit switches are always activated or deactivated together.)                                                                                |
| 6         | BOOL      | Read/Write | <b>typeofaxis.numberofdatssets.dataset_x.dynamicfollowing.enable</b> : Activation state of the following error monitoring                                                                                                       |
| 7         | LREAL     | Read/Write | <b>typeofaxis.numberofdatssets.dataset_x.dynamicfollowing.minpositiontolerance</b> : Minimum permissible following error                                                                                                        |
| 8         | LREAL     | Read/Write | <b>typeofaxis.maxvelocity.maximum</b> : Maximum permissible velocity                                                                                                                                                            |
| 10        | LREAL     | Read       | <b>motionstatedata.actualvelocity</b> : Actual axis velocity<br>(A value is only displayed if an encoder was configured on the axis. For drive axes, the encoder must be configured for the setpoint acceptance if applicable.) |
| 11        | LREAL     | Read       | <b>motionstatedata.commandvelocity</b> : Axis velocity setpoint                                                                                                                                                                 |
| 12        | LREAL     | Read/Write | <b>typeofaxis.maxacceleration.maximum</b> : Maximum permissible acceleration                                                                                                                                                    |
| 16        | LREAL     | Read/Write | <b>typeofaxis.maxjerk.maximum</b> : Maximum permissible jerk                                                                                                                                                                    |



Table 3-4 Input ParameterNumber for external encoders

| Parameter | Data type | Access | Description                                                                    |
|-----------|-----------|--------|--------------------------------------------------------------------------------|
| 10        | LREAL     | Read   | <b>motionState.velocity</b> : Actual velocity measured by the external encoder |

### 3.1.12.6 Output parameter

#### Output parameter

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                                 |
|-----------|-----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Valid     | BOOL      | FALSE         | Display of the validity of the value which can be read at output <b>Value</b> .                                                                                                                                                             |
| Busy      | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                            |
| Error     | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, either an error has occurred during the initialization of the function block or the error status could not be read. The error description can be read at the <b>ErrorID</b> output. |
| ErrorID   | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the output <b>Error</b> .                                                                                                                      |
| Value     | LREAL     | 0.0           | Display of the parameter value                                                                                                                                                                                                              |

### 3.1.12.7 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

### 3.1.13 \_MC\_ReadStatus

#### 3.1.13.1 Overview

Schematic diagram

Purpose

Applicable for

Input parameters

Output parameters

ErrorIDs

#### 3.1.13.2 Schematic diagram

Schematic diagram

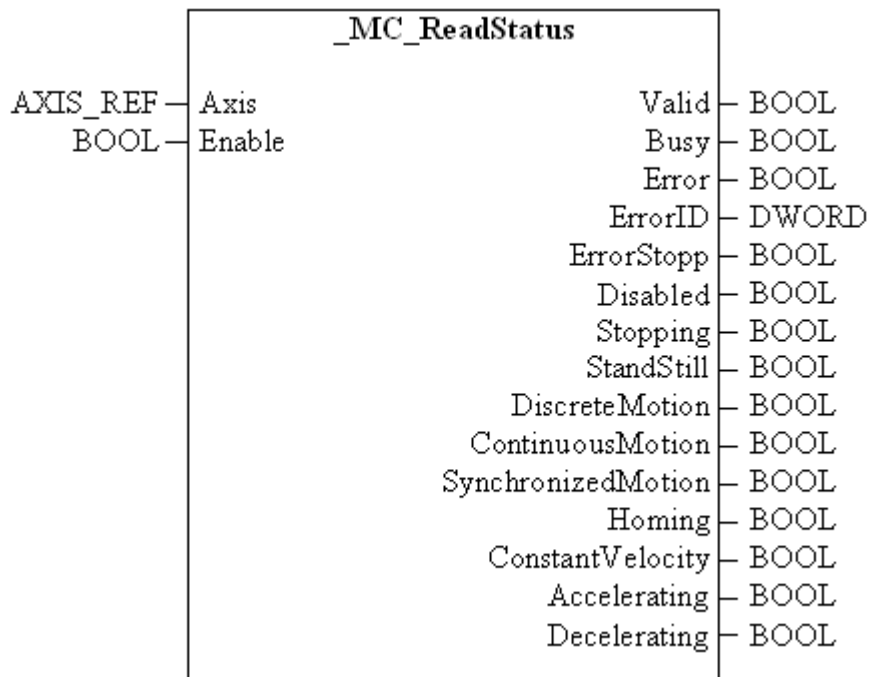


Figure 3-22 \_MC\_ReadStatus Schematic diagram

#### 3.1.13.3 Purpose

Purpose

The function block **\_MC\_ReadStatus** reads various states of an axis or an external encoder.

### 3.1.13.4 Applicable for

#### Applications

Drive axes  
Positioning axes  
Following axes  
External Encoders

### 3.1.13.5 Input parameters

#### Input parameters

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                         |
|-----------|-----------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis      | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Drive axis</li> <li>• Position axis</li> <li>• Following axis</li> <li>• External encoder</li> </ul> |
| Enable    | BOOL      | FALSE         | Function block enable<br>The values at the status outputs are updated as long as <b>Enable</b> equals <b>TRUE</b> .                                                                                                                 |

### 3.1.13.6 Output parameter

#### Output parameter

Table 3-5 Generally applicable output parameter

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                          |
|-----------|-----------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Valid     | BOOL      | FALSE         | Display of the validity of the values that can be read at the status outputs                                                                                                                                                         |
| Busy      | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                     |
| Error     | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, either an error has occurred during the initialization of the function block or the states could not be read. The error description can be read at the <b>ErrorID</b> output |
| ErrorID   | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the output <b>Error</b> .                                                                                                               |

Table 3-6 Output parameters for axes

| Parameter          | Data type | Initial value | Description                                                                |
|--------------------|-----------|---------------|----------------------------------------------------------------------------|
| ErrorStop          | BOOL      | FALSE         | Display of an active axis stop triggered by an error                       |
| Disabled           | BOOL      | FALSE         | Display of no enable of the axis                                           |
| Stopping           | BOOL      | FALSE         | Display of an active regular axis stop                                     |
| StandStill         | BOOL      | FALSE         | Display of the standstill signal of the axis                               |
| DiscreteMotion     | BOOL      | FALSE         | Display of an active single axis motion with discrete target position      |
| ContinuousMotion   | BOOL      | FALSE         | Display of an active single axis motion without a discrete target position |
| SynchronizedMotion | BOOL      | FALSE         | Display of an active synchronous operation on the axis                     |
| Homing             | BOOL      | FALSE         | Display of an active homing procedure on the axis                          |
| ConstantVelocity   | BOOL      | FALSE         | Display of traversing the axis with a constant velocity                    |
| Accelerating       | BOOL      | FALSE         | Display of traversing the axis with an accelerating velocity               |
| Decelerating       | BOOL      | FALSE         | Display of traversing the axis with a decelerating velocity                |

Table 3-7 Output parameter for external encoders

| Parameter        | Data type | Initial value | Description                                                                             |
|------------------|-----------|---------------|-----------------------------------------------------------------------------------------|
| ErrorStop        | BOOL      | FALSE         | Display of an error on the external encoder                                             |
| Disabled         | BOOL      | FALSE         | Display of no enable of the external encoder                                            |
| StandStill       | BOOL      | FALSE         | Display of the standstill signal of the external encoder                                |
| Homing           | BOOL      | FALSE         | Display of an active homing procedure on the external encoder                           |
| ConstantVelocity | BOOL      | FALSE         | Display of a constant velocity that is measured/determined by the external encoder      |
| Accelerating     | BOOL      | FALSE         | Display of an accelerating velocity that is measured/determined by the external encoder |
| Decelerating     | BOOL      | FALSE         | Display of a decelerating velocity that is measured/determined by the external encoder  |

### 3.1.13.7 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

## 3.1.14 \_MC\_Reset

### 3.1.14.1 Overview

Schematic diagram

Purpose

Applicable for

Requirements

Input parameters

Output parameters

ErrorIDs

### 3.1.14.2 Schematic diagram

#### Schematic diagram

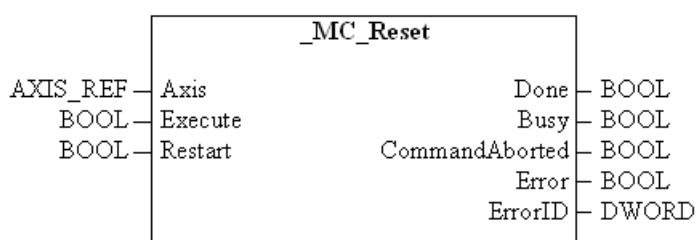


Figure 3-23 \_MC\_Reset Schematic diagram

### 3.1.14.3 Purpose

#### Purpose

The function block **\_MC\_Reset** resets all errors on an axis or external encoder that can be acknowledged by means of the software. Fatal errors can be acknowledged via Power off/on or reloading of the project to the module.

If the **Restart** input is set, the transferred technology object is re-initialized via **\_MC\_Reset**. Axes that are operated with incremental encoders return to the **Not homed** mode.

### 3.1.14.4 Applicable for

#### Applications

Drive axes  
Positioning axes  
Following axes  
External Encoders

### 3.1.14.5 Requirements

#### Requirements

The restart of an axis depends on the condition set with configuration data item **restartAxisCondition**.

#### NOTICE

- Set the input **Restart** to **FALSE**, only when the errors present on the transferred technology object are to be acknowledged.
- No variables of the technology object are updated during the restart operation!

### 3.1.14.6 Input parameters

#### Input parameters

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                         |
|-----------|-----------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis      | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Drive axis</li> <li>• Position axis</li> <li>• Following axis</li> <li>• External encoder</li> </ul> |
| Execute   | BOOL      | FALSE         | Function block enable<br>With a rising edge at this input, the function block acknowledges the errors present on the transferred technology object or optionally triggers a restart.                                                |
| Restart   | BOOL      | FALSE         | Specification of the reset type<br>With TRUE, the transferred technology object is restarted and modified configuration data are accepted.<br>With FALSE, the alarms pending on the transferred technology object are acknowledged. |

### 3.1.14.7 Output parameter

#### Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                      |
|----------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done           | BOOL      | FALSE         | Display of the completion of the function block<br>The alarms have been acknowledged or a restart performed.                                                                                                                     |
| Busy           | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                 |
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error during the command processing. The error description can be read at the <b>ErrorID</b> output.                  |
| Error          | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output. |
| ErrorID        | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                 |

### 3.1.14.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

### 3.1.15 \_MC\_Stop

#### 3.1.15.1 Overview

Schematic diagram

Purpose

Applicable for

Requirements

Input parameters

Output parameters

ErrorIDs

Example

#### 3.1.15.2 Schematic diagram

##### Schematic diagram

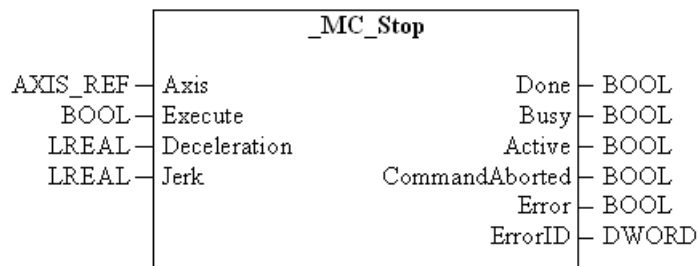


Figure 3-24 \_MC\_Stop Schematic diagram

#### 3.1.15.3 Purpose

##### Purpose

The function block **\_MC\_Stop** terminates all active motion commands on an axis and decelerates it down to standstill. The function block can be overridden or aborted by another motion command, i.e. it is not possible to start a motion command.

The function block is terminated (**Done** equals **TRUE**) when the axis is stationary and the input **Execute** is reset to **FALSE**. It is then possible again to start a motion command on the axis.

The input parameters **Deceleration** and **Jerk** define the dynamic response of the stop procedure.



### 3.1.15.4 Applicable for

#### Applications

Drive axes  
Positioning axes  
Following axes

### 3.1.15.5 Requirements

#### Requirements

Axis enabled and not in follow-up mode

### 3.1.15.6 Input parameters

#### Input parameters

| Parameter    | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis         | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Drive axis</li> <li>• Position axis</li> <li>• Following axis</li> </ul>                                                                                                                                                                                                                                      |
| Execute      | BOOL      | FALSE         | Function block enable<br>The axis stops with a rising edge at this input.                                                                                                                                                                                                                                                                                                                                                                    |
| Deceleration | LREAL     | -1.0          | Specification of the maximum deceleration (decreasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.negativeaccel</code> of the axis is used.                                                                                                                                                              |
| Jerk         | LREAL     | -1.0          | Specification of the maximum jerk<br>Value > 0: The specified value is used<br>Value = 0: Use trapezoidal travel profile<br>Value = -1.0: The preset values in the system variables <code>userdefaultdynamics.positiveaccelstartjerk</code> , <code>userdefaultdynamics.positiveaccelendjerk</code> , <code>userdefaultdynamics.negativeaccelstartjerk</code> and <code>userdefaultdynamics.negativeaccelendjerk</code> of the axis are used |

**WARNING**

If an illegal numerical value is specified at the input parameter **Deceleration** or **Jerk**, **\_MC\_Stop** is not executed.

If the function block **\_MC\_Stop** is started with a jerk specification not equal to zero during the acceleration phase of an axis, its velocity can increase to the configured maximum velocity of the drive in an extreme situation. The axis is only decelerated after the reduction of the acceleration by the jerk!

## 3.1.15.7 Output parameter

## Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                                                        |
|----------------|-----------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done           | BOOL      | FALSE         | Display of the completion of the function block<br>The axis is at standstill and the disable for the motion commands has been removed ( <b>Execute</b> equals <b>FALSE</b> ). This output is only set for one cycle.                                               |
| Busy           | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                                                   |
| Active         | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the axis.                                                                             |
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error in the command processing or by a stop response with the same or higher priority. The error description can be read at the <b>ErrorID</b> output. |
| Error          | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, <b>an error</b> has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output.                            |
| ErrorID        | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                                                   |

### 3.1.15.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

## 3.1.15.9 Example

## Example

The axis is started with velocity 50 and then decelerated to velocity 0 with **\_MC\_Stop**. A further call of **\_MC\_MoveVelocity** results in an error as the **Execute** input is set on the **\_MC\_Stop**. After the **Execute** input on the **\_MC\_Stop** is reset, the **\_MC\_MoveVelocity** can be executed again.

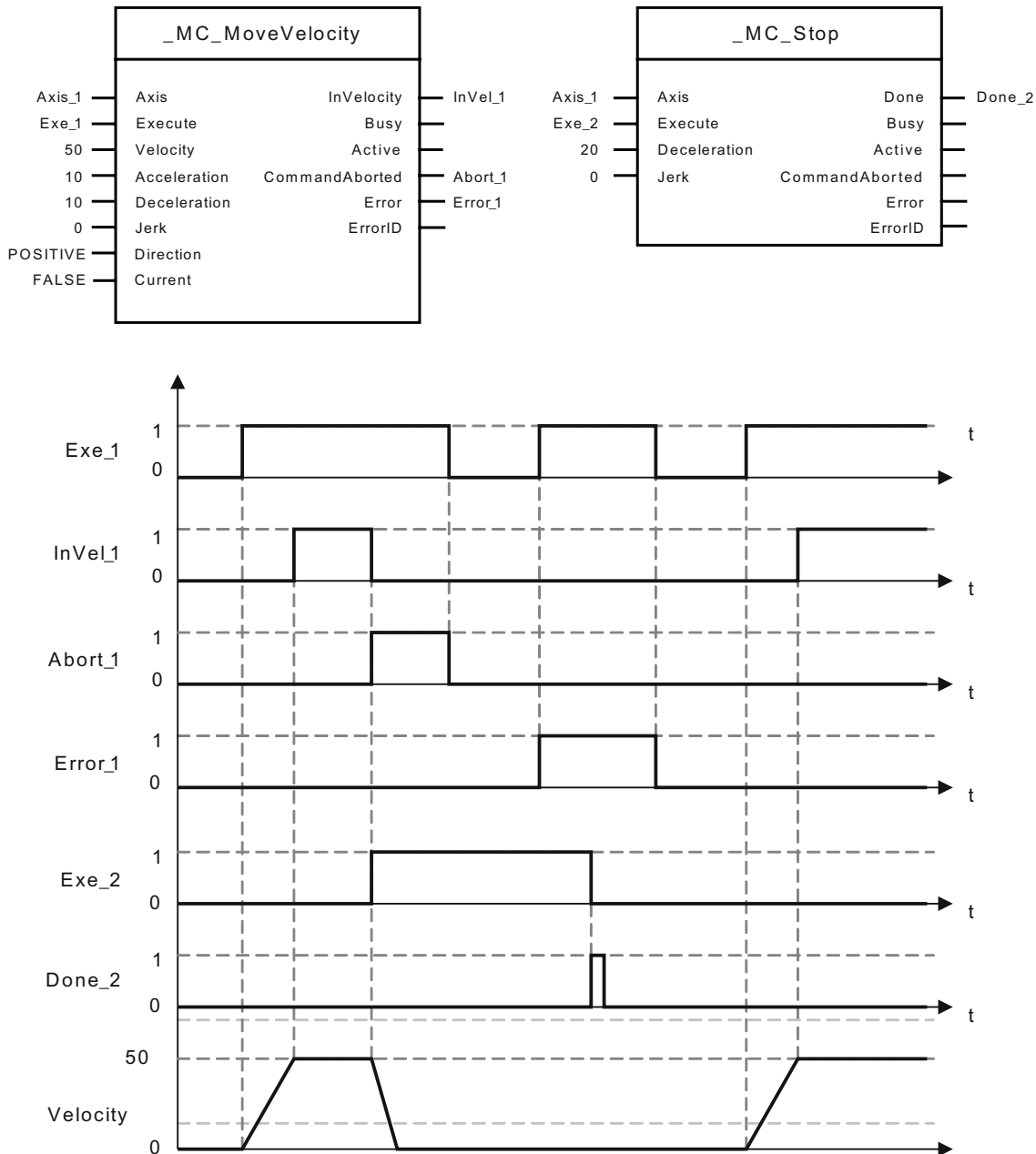


Figure 3-25 \_MC\_Stop Example

## 3.1.16 \_MC\_VelocityProfile

### 3.1.16.1 Overview

Schematic diagram  
Purpose  
Applicable for  
Requirements  
Input parameters  
Output parameters  
ErrorIDs

### 3.1.16.2 Schematic diagram

#### Schematic diagram

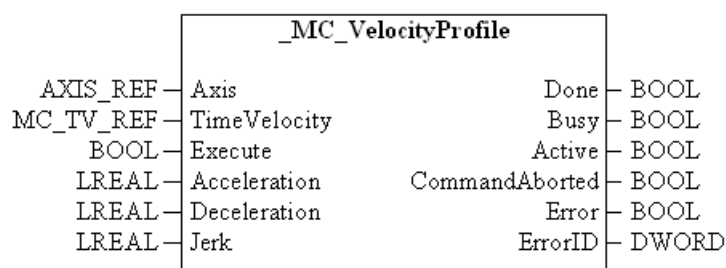


Figure 3-26 \_MC\_VelocityProfile Schematic diagram

### 3.1.16.3 Purpose

#### Purpose

The function block **\_MC\_VelocityProfile** traverses an axis along a velocity profile, which is specified as a  $v(t)$  function.

### 3.1.16.4 Applicable for

#### Applications

Drive axes  
Positioning axes  
Following axes

### 3.1.16.5 Requirements

#### Requirements

Axis enabled

No **\_MC\_Stop** active

### 3.1.16.6 Input parameters

#### Input parameters

| Parameter    | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis         | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Drive axis</li> <li>• Position axis</li> <li>• Following axis</li> </ul>                                                                                                                                                                                                                                      |
| TimeVelocity | MC_TV_REF | 0             | Specification of the reference to the cam that describes the velocity profile.                                                                                                                                                                                                                                                                                                                                                               |
| Execute      | BOOL      | FALSE         | Function block enable<br>The motion starts with a rising edge at this input.                                                                                                                                                                                                                                                                                                                                                                 |
| Acceleration | LREAL     | -1.0          | Specification of the maximum acceleration (increasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.positiveaccel</code> of the axis is used.                                                                                                                                                              |
| Deceleration | LREAL     | -1.0          | Specification of the maximum deceleration (decreasing energy in the motor)<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefaultdynamics.negativeaccel</code> of the axis is used.                                                                                                                                                              |
| Jerk         | LREAL     | -1.0          | Specification of the maximum jerk<br>Value > 0: The specified value is used<br>Value = 0: Use trapezoidal travel profile<br>Value = -1.0: The preset values in the system variables <code>userdefaultdynamics.positiveaccelstartjerk</code> , <code>userdefaultdynamics.positiveaccelendjerk</code> , <code>userdefaultdynamics.negativeaccelstartjerk</code> and <code>userdefaultdynamics.negativeaccelendjerk</code> of the axis are used |

### 3.1.16.7 Output parameter

#### Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                             |
|----------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done           | BOOL      | FALSE         | Display of the completion of the function block<br>With TRUE, the axis has traversed the specified velocity profile.                                                                                                                    |
| Busy           | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                        |
| Active         | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the axis.                                                  |
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error in the command processing or by an overriding command. The error description can be read at the <b>ErrorID</b> output. |
| Error          | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output.        |
| ErrorID        | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                        |

### 3.1.16.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

### 3.1.17 \_MC\_WriteBoolParameter

#### 3.1.17.1 Overview

Schematic diagram

Purpose

Applicable for

Input parameters

Output parameters

ErrorIDs

#### 3.1.17.2 Schematic diagram

Schematic diagram

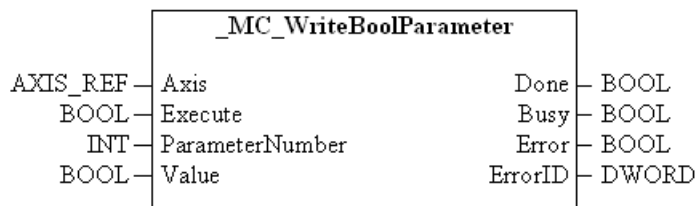


Figure 3-27 \_MC\_WriteBoolParameter Schematic diagram

#### 3.1.17.3 Purpose

Purpose

The function block **\_MC\_WriteBoolParameter** writes values of various parameters of an axis. Each axis parameter is specified by a number.

#### 3.1.17.4 Applicable for

Applications

Drive axes

Positioning axes

Following axes

External Encoders



### 3.1.17.5 Input parameters

#### Input parameters

| Parameter       | Data type | Initial value | Description                                                                                                                                                                                                                         |
|-----------------|-----------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis            | AXIS_REF  | 0             | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Drive axis</li> <li>• Position axis</li> <li>• Following axis</li> <li>• External encoder</li> </ul> |
| Execute         | BOOL      | FALSE         | Function block enable<br>The parameter at input <b>Value</b> is written with a rising edge at this input.                                                                                                                           |
| ParameterNumber | INT       | 0             | Specification of the number of the parameter to be written (see table below)                                                                                                                                                        |
| Value           | BOOL      | FALSE         | Specification of the parameter value to be written                                                                                                                                                                                  |

#### Parameter description for input ParameterNumber

| Parameter number | Data type | Description                                                                                                                                                              |
|------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4                | BOOL      | <b>swlimit.state</b> : Activation state of the positive and negative software limit switches (the limit switches are always activated or deactivated together)           |
| 6                | BOOL      | <b>typeofaxis.numberofdatssets.dataset_x.dynamicfollowing.enable</b> : Activation state of the following error monitoring (the change only takes effect after a restart) |

### 3.1.17.6 Output parameter

#### Output parameter

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                                 |
|-----------|-----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done      | BOOL      | FALSE         | Display of the completion of the function block<br>With TRUE, the parameter could be written successfully.                                                                                                                                  |
| Busy      | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                            |
| Error     | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, either an error has occurred during the initialization of the function block or the parameter could not be written. The error description can be read at the <b>ErrorID</b> output. |
| ErrorID   | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the output <b>Error</b> .                                                                                                                      |

### 3.1.17.7 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

### 3.1.18 \_MC\_WriteParameter

#### 3.1.18.1 Overview

Schematic diagram

Purpose

Applicable for

Input parameters

Output parameters

ErrorIDs

#### 3.1.18.2 Schematic diagram

#### Schematic diagram

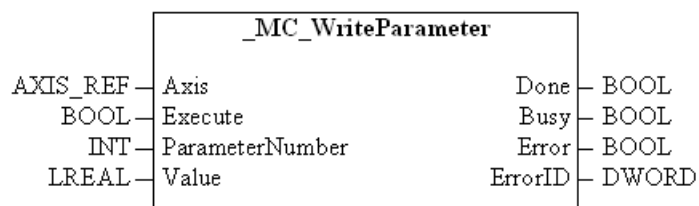


Figure 3-28 \_MC\_WriteParameter Schematic diagram

### 3.1.18.3 Purpose

#### Purpose

The function block **\_MC\_WriteParameter** writes values of various parameters of an axis. Each axis parameter is specified by a number.

### 3.1.18.4 Applicable for

#### Applications

Drive axes  
Positioning axes  
Following axes  
External Encoders

### 3.1.18.5 Input parameters

#### Input parameters

| Parameter       | Data type | Start value | Description                                                                                                                                                                                                                         |
|-----------------|-----------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis            | AXIS_REF  | 0           | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Drive axis</li> <li>• Position axis</li> <li>• Following axis</li> <li>• External encoder</li> </ul> |
| Execute         | BOOL      | FALSE       | Function block enable<br>The parameter at input <b>Value</b> is written with a rising edge at this input.                                                                                                                           |
| ParameterNumber | INT       | 0           | Specification of the number of the parameter to be written (see table below)                                                                                                                                                        |
| Value           | LREAL     | 0.0         | Specification of the parameter value to be written                                                                                                                                                                                  |

#### Parameter description for input ParameterNumber

| Parameter number | Data type | Description                                                                                                                                                              |
|------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2                | LREAL     | <b>swlimit.plusposition</b> : Position of the positive software limit switch                                                                                             |
| 3                | LREAL     | <b>swlimit.minusposition</b> : Position of the negative software limit switch                                                                                            |
| 4                | BOOL      | <b>swlimit.state</b> : Activation state of the positive and negative software limit switches (the limit switches are always activated or deactivated together)           |
| 6                | BOOL      | <b>typeofaxis.numberofdatssets.dataset_x.dynamicfollowing.enable</b> : Activation state of the following error monitoring (the change only takes effect after a restart) |

| Parameter number | Data type | Description                                                                                                                                                                                                                  |
|------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7                | LREAL     | <b>typeofaxis.numberofdatssets.dataset_x.dynamicfollowing.minpositiontolerance;</b><br><b>typeofaxis.numberofdatssets.dataset_x.dynamicfollowing.maxpositiontolerance:</b><br>Minimum or maximum permissible following error |
| 8                | LREAL     | <b>typeofaxis.maxvelocity.maximum:</b> Maximum permissible velocity (the change only takes effect after a restart)                                                                                                           |
| 12               | LREAL     | <b>typeofaxis.maxacceleration.maximum:</b> Maximum permissible acceleration                                                                                                                                                  |
| 16               | LREAL     | <b>typeofaxis.maxjerk.maximum:</b> Maximum permissible jerk                                                                                                                                                                  |

### 3.1.18.6 Output parameter

#### Output parameter

| Parameter | Data type | Initial value | Description                                                                                                                                                                                                                                 |
|-----------|-----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done      | BOOL      | FALSE         | Display of the completion of the function block<br>With TRUE, the parameter could be written successfully.                                                                                                                                  |
| Busy      | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                            |
| Error     | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, either an error has occurred during the initialization of the function block or the parameter could not be written. The error description can be read at the <b>ErrorID</b> output. |
| ErrorID   | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the output <b>Error</b> .                                                                                                                      |

### 3.1.18.7 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

## 3.2 MultiAxis

### 3.2.1 \_MC\_CamIn

#### 3.2.1.1 Overview

Schematic diagram

Purpose

Applicable for

Requirements

Input parameters

Output parameters

ErrorIDs

#### 3.2.1.2 Schematic diagram

#### Schematic diagram

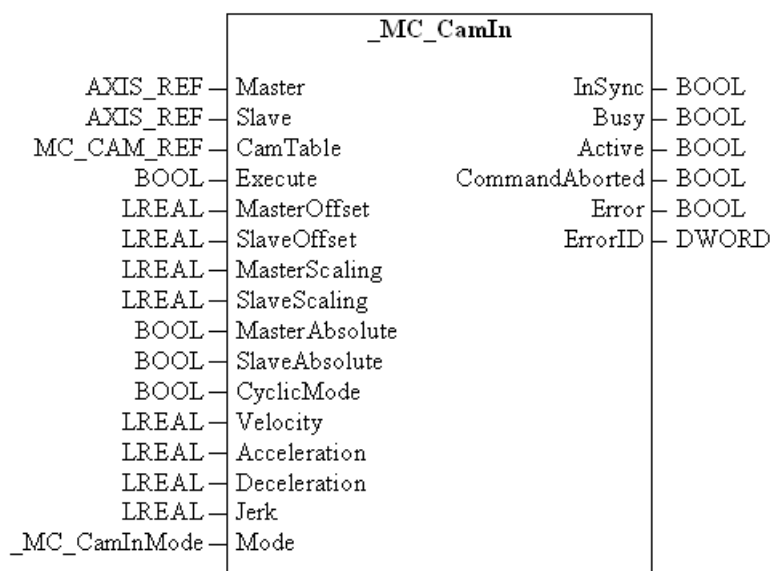


Figure 3-29 \_MC\_CamIn Schematic diagram

### 3.2.1.3 Purpose

#### Purpose

The function block **\_MC\_CamIn** starts a camming between a master and a slave axis.

The dynamic response parameters **Velocity**, **Acceleration**, **Deceleration** and **Jerk** define the dynamic response of the slave axis during synchronization.

The cam profile can be scaled and/or the position offset.

The specified cam can optionally be run through once or periodically.

The synchronous operation can be absolute or relative.

### 3.2.1.4 Applicable for

#### Applications

Master:

- Positioning axes
- Following axes
- External Encoders
- ...

Slave:

- Following axes

### 3.2.1.5 Requirements

#### Requirements

The synchronous object of the slave axis must be interconnected with the desired cam and the desired master.

Master and slave axes are enabled.

No **\_MC\_Stop** active on the slave axis

### 3.2.1.6 Input parameters

#### Input parameters

| Parameter      | Data type  | Initial value | Description                                                                                                                                                                                                                                                                                                                                                         |
|----------------|------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Master         | AXIS_REF   | 0             | Specification of the reference to the master<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Position axis</li> <li>• Following axis</li> <li>• External encoder</li> </ul>                                                                                                                                              |
| Slave          | AXIS_REF   | 0             | Specification of the reference to the slave axis<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>• Following axis</li> </ul>                                                                                                                                                                                               |
| CamTable       | MC_CAM_REF | 0             | Specifies the cam                                                                                                                                                                                                                                                                                                                                                   |
| Execute        | BOOL       | FALSE         | Function block enable<br>The slave axis is synchronized with the interconnected master with a rising edge on this input.                                                                                                                                                                                                                                            |
| MasterOffset   | LREAL      | 0.0           | Specification of the offset of the master values in the master coordinates.                                                                                                                                                                                                                                                                                         |
| SlaveOffset    | LREAL      | 0.0           | Specification of the offset of the slave values in the slave coordinates.                                                                                                                                                                                                                                                                                           |
| MasterScaling  | LREAL      | 1.0           | Specification of the scaling for the master values in the master coordinates.                                                                                                                                                                                                                                                                                       |
| SlaveScaling   | LREAL      | 1.0           | Specification of the scaling for the slave values in the slave coordinates.                                                                                                                                                                                                                                                                                         |
| MasterAbsolute | BOOL       | TRUE          | Specification of the evaluation method of the master values<br>With TRUE, the master values are applied as absolute values in the domain of the cam.<br>With FALSE, the master values are evaluated relative to the start value of the cam.                                                                                                                         |
| SlaveAbsolute  | BOOL       | TRUE          | Specification of the evaluation method of the slave values<br>With TRUE, the slave values are applied as absolute values in the range of the cam.<br>With FALSE, the slave values are applied relative to the start value of the cam. During synchronization, the slave axis also travels the path difference between the start of the cam and the cam start value. |
| CyclicMode     | BOOL       | TRUE          | Specification of the cam mode<br>With TRUE, the cam repeats after reaching its end point.<br>With FALSE, the function block is terminated after one cycle of the cam.                                                                                                                                                                                               |

| Parameter    | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Velocity     | LREAL     | -1.0          | <p>Specification of the maximum synchronization velocity</p> <p>The parameter is only taken into account with <b>Mode</b> equals <b>IMMEDIATELY_BY_TIME_PROFILE</b>.</p> <p>Value &gt; 0: The specified value is used</p> <p>Value = 0: Not permissible</p> <p>Value = -1.0: The preset value in the system variable <code>userdefault.syncdynamics.velocity</code> of the interconnected synchronous object is used</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Acceleration | LREAL     | -1.0          | <p>Specification of the maximum synchronization acceleration</p> <p>The parameter is only taken into account with <b>Mode</b> equals <b>IMMEDIATELY_BY_TIME_PROFILE</b>.</p> <p>Value &gt; 0: The specified value is used</p> <p>Value = 0: Not permissible</p> <p>Value = -1.0: The preset value in the system variable <code>userdefault.syncdynamics.positiveaccel</code> of the interconnected synchronous object is used</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Deceleration | LREAL     | -1.0          | <p>Specification of the maximum synchronization deceleration</p> <p>The parameter is only taken into account with <b>Mode</b> equals <b>IMMEDIATELY_BY_TIME_PROFILE</b>.</p> <p>Value &gt; 0: The specified value is used</p> <p>Value = 0: Not permissible</p> <p>Value = -1.0: The preset value in the system variable <code>userdefault.syncdynamics.negativeaccel</code> of the interconnected synchronous object is used</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Jerk         | LREAL     | -1.0          | <p>Specification of the maximum synchronization jerk</p> <p>The parameter is only taken into account with <b>Mode</b> equals <b>IMMEDIATELY_BY_TIME_PROFILE</b>.</p> <p>To activate the jerk limitation, the configuration data <b>SyncingMotion.smoothAbsoluteSynchronization</b> on the interconnected synchronous object must be set to <b>YES</b>. Otherwise the parameter specification for <b>Jerk</b> is ignored and a trapezoidal velocity profile is always used.</p> <p>Value &gt; 0: The specified value is used</p> <p>Value = 0: Use trapezoidal velocity profile</p> <p>Value = -1.0: The preset values in the system variables <code>userdefault.syncdynamics.positiveaccelstartjerk</code>, <code>userdefault.syncdynamics.positiveaccelendjerk</code>, <code>userdefault.syncdynamics.negativeaccelstartjerk</code> and <code>userdefault.syncdynamics.negativeaccelendjerk</code> of the interconnected synchronous object are used</p> |



| Parameter | Data type     | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------|---------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mode      | _MC_CamInMode | USER_DEFAULT  | <p>Specification of the synchronization mode / engage mode</p> <p><b>USER_DEFAULT:</b><br/>The preset values in the system variables of the synchronization parameters userdefault.cammingsettings and the dynamic response values userdefault.syncdynamics are used.</p> <p><b>IMMEDIATELY_BY_TIME_PROFILE:</b><br/>Synchronization is performed immediately according to time taking into account the dynamic response values set on the function block. The synchronous operation is operated with the parameters userDefault.syncprofile.syncprofilereference equals RELATE_SYNC_PROFILE_TO_TIME, userDefault.cammingsettings.synchronizingmode equals IMMEDIATELY and userDefault.cammingsettings.synchronizingdirection equals SYSTEM_DEFINED.</p> |

### 3.2.1.7 Output parameter

#### Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                                        |
|----------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| InSync         | BOOL      | FALSE         | <p>Display of the synchronism of the master and slave axis</p> <p>With TRUE, the slave axis is in synchronous operation with the master.</p>                                                                                                       |
| Busy           | BOOL      | FALSE         | <p>Display of the activity of the function block</p> <p>With TRUE, the function block has been started.</p>                                                                                                                                        |
| Active         | BOOL      | FALSE         | <p>Display of the command activity in the function block</p> <p>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the slave axis.</p>                                            |
| CommandAborted | BOOL      | FALSE         | <p>Display of the abort of the function block</p> <p>With TRUE, the function block has been aborted because of an error in the command processing or by an overriding command. The error description can be read at the <b>ErrorID</b> output.</p> |
| Error          | BOOL      | FALSE         | <p>Display of an error in the function block</p> <p>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output.</p>        |
| ErrorID        | DWORD     | 0             | <p>Display of a function block error code</p> <p>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b>.</p>                                                                                         |

### 3.2.1.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

## 3.2.2 \_MC\_CamOut

### 3.2.2.1 Overview

Schematic diagram

Purpose

Applicable for

Requirements

Input parameters

Output parameters

ErrorIDs

### 3.2.2.2 Schematic diagram

#### Schematic diagram

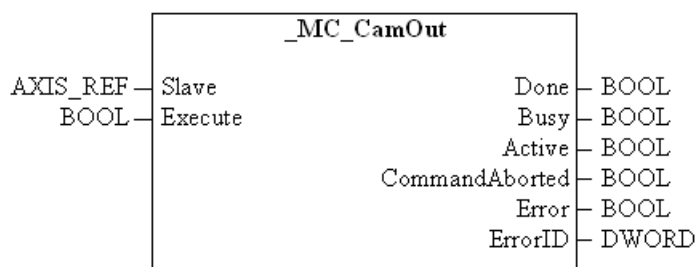


Figure 3-30 \_MC\_CamOut Schematic diagram

### 3.2.2.3 Purpose

#### Purpose

The function block **\_MC\_CamOut** terminates a camming and stops the slave axis. The desynchronization conditions can be set in the system variables **userdefault.cammingSettings** of the interconnected synchronous object.

#### Recommendation

Use the function block when the shutdown procedure is to depend on the position of the master and/or the slave axis. You can also remove the slave axis from the synchronous operation with the technology functions **\_MC\_Stop**, **\_MC\_MoveRelative**, **\_MC\_MoveAdditive**, **\_MC\_MoveAbsolute** or **\_MC\_MoveVelocity**.

### 3.2.2.4 Applicable for

#### Applications

Following axes

### 3.2.2.5 Requirements

#### Requirements

A camming must be active on the slave axis. If no synchronous operation is active, the function block is aborted.

No **\_MC\_Stop** active on the slave axis

### 3.2.2.6 Input parameters

#### Input parameters

| Parameter | Data type | Start value | Description                                                                                                                                                         |
|-----------|-----------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Slave     | AXIS_REF  | 0           | Specification of the reference to the slave axis<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>Following axis</li> </ul> |
| Execute   | BOOL      | FALSE       | Function block enable<br>The synchronous operation of the slave axis with the interconnected master is terminated with a rising edge on this input.                 |

### 3.2.2.7 Output parameter

#### Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                             |
|----------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done           | BOOL      | FALSE         | Display of the completion of the function block<br>With TRUE, the slave axis has been desynchronized from the interconnected master.                                                                                                    |
| Busy           | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                        |
| Active         | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the slave axis.                                            |
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error in the command processing or by an overriding command. The error description can be read at the <b>ErrorID</b> output. |
| Error          | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output.        |
| ErrorID        | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                        |

### 3.2.2.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

### 3.2.3 \_MC\_GearIn

#### 3.2.3.1 Overview

Schematic diagram  
Purpose  
Applicable for  
Requirements  
Input parameters  
Output parameters  
ErrorIDs  
Examples

#### 3.2.3.2 Schematic diagram

Schematic diagram

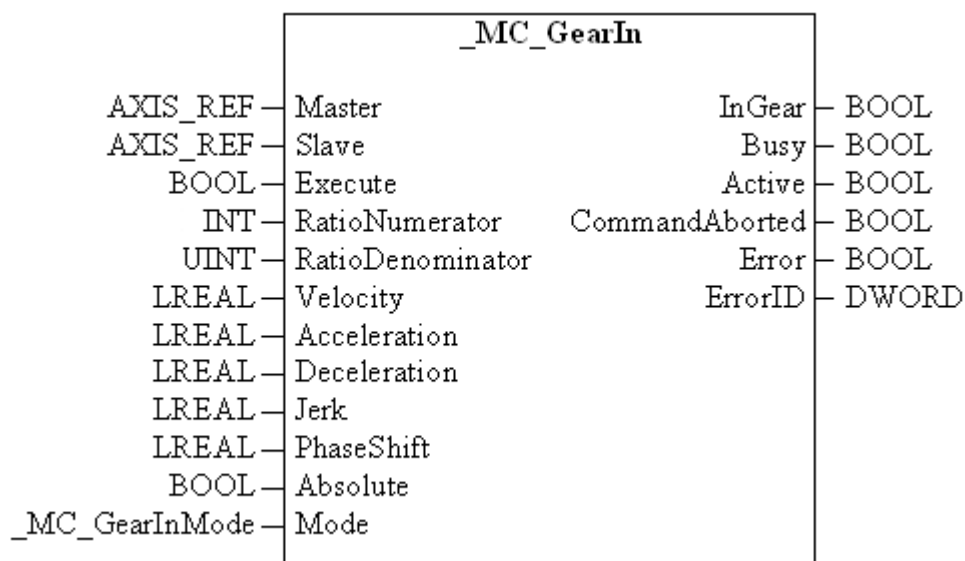


Figure 3-31 \_MC\_GearIn Schematic diagram

### 3.2.3.3 Purpose

#### Purpose

The function block **\_MC\_GearIn** starts a gearing between a master and a slave axis.

The dynamic response parameters **Velocity**, **Acceleration**, **Deceleration** and **Jerk** define the dynamic response of the slave axis during synchronization.

The gear ratio is specified as a fraction.

The synchronous operation can be absolute or relative.

### 3.2.3.4 Applicable for

#### Applications

Master:

- Positioning axes
- Following axes
- External Encoders
- ...

Slave:

- Following axes

### 3.2.3.5 Requirements

#### Requirements

The synchronous object of the slave axis must be interconnected with the desired master.

Master and slave axes are enabled.

No **\_MC\_Stop** active on the slave axis

### 3.2.3.6 Input parameters

#### Input parameters

| Parameter        | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------|-----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Master           | AXIS_REF  | 0             | Specification of the reference to the master<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>Position axis</li> <li>Following axis</li> <li>External encoder</li> </ul>                                                                                                                                                                            |
| Slave            | AXIS_REF  | 0             | Specification of the reference to the slave axis<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>Following axis</li> </ul>                                                                                                                                                                                                                         |
| Execute          | BOOL      | FALSE         | Function block enable<br>The slave axis is synchronized with the interconnected master with a rising edge on this input.                                                                                                                                                                                                                                                                    |
| RatioNumerator   | INT       | 1             | Specification of the numerator of the gear ratio                                                                                                                                                                                                                                                                                                                                            |
| RatioDenominator | UINT      | 1             | Specification of the denominator of the gear ratio                                                                                                                                                                                                                                                                                                                                          |
| Velocity         | LREAL     | -1.0          | Specification of the maximum synchronization velocity<br>The parameter is only taken into account with <b>Mode</b> equals <b>IMMEDIATELY_BY_TIME_PROFILE</b> .<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable userdefault.syncdynamics.velocity of the interconnected synchronous object is used          |
| Acceleration     | LREAL     | -1.0          | Specification of the maximum synchronization acceleration<br>The parameter is only taken into account with <b>Mode</b> equals <b>IMMEDIATELY_BY_TIME_PROFILE</b> .<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable userdefault.syncdynamics.positiveaccel of the interconnected synchronous object is used |
| Deceleration     | LREAL     | -1.0          | Specification of the maximum synchronization deceleration<br>The parameter is only taken into account with <b>Mode</b> equals <b>IMMEDIATELY_BY_TIME_PROFILE</b> .<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable userdefault.syncdynamics.negativeaccel of the interconnected synchronous object is used |

| Parameter  | Data type     | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------|---------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Jerk       | LREAL         | -1.0          | <p>Specification of the maximum synchronization jerk</p> <p>The parameter is only taken into account with <b>Mode</b> equals <b>IMMEDIATELY_BY_TIME_PROFILE</b>.</p> <p>To activate the jerk limitation, the configuration data <b>SyncingMotion.smoothAbsoluteSynchronization</b> on the interconnected synchronous object must be set to <b>YES</b>. Otherwise the parameter specification for <b>Jerk</b> is ignored and a trapezoidal velocity profile is always used.</p> <p>Value &gt; 0: The specified value is used</p> <p>Value = 0: Use trapezoidal velocity profile</p> <p>Value = -1.0: The preset values in the system variables <code>userdefault.syncdynamics.positiveaccelstartjerk</code>, <code>userdefault.syncdynamics.positiveaccelendjerk</code>, <code>userdefault.syncdynamics.negativeaccelstartjerk</code> and <code>userdefault.syncdynamics.negativeaccelendjerk</code> of the interconnected synchronous object are used</p> |
| PhaseShift | LREAL         | 0.0           | <p>Specification of the phase shift for absolute synchronous operation</p> <p>The phase shift is absolute when synchronous operation is reached if <b>Absolute</b> = <b>TRUE</b>.</p> <p>The specified phase shift is added to the phase offset determined by the relative relationship if <b>Absolute</b> = <b>FALSE</b>.</p> <p>Value &gt; 0: The specified value is used</p> <p>Value = 0: No phase shift</p> <p>Value &lt; 0: Not permissible</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Absolute   | BOOL          | TRUE          | <p>Specification of the gearing type</p> <p>With <b>TRUE</b>, gearing is absolute relative to the axis zero for the relevant axes. A phase shift can be set via the parameter <b>PhaseShift</b>.</p> <p>With <b>FALSE</b>, gearing is relative to the start position or synchronization position.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Mode       | _MC_CamInMode | USER_DEFAULT  | <p>Specification of the synchronization mode / engage mode</p> <p><b>USER_DEFAULT</b>:</p> <p>The preset values in the system variables of the synchronization parameters <code>userdefault.cammingsettings</code> and the dynamic response values <code>userdefault.syncdynamics</code> are used.</p> <p><b>IMMEDIATELY_BY_TIME_PROFILE</b>:</p> <p>Synchronization is performed immediately according to time taking into account the dynamic response values set on the function block. The synchronous operation is operated with the parameters <code>userDefault.syncprofile.syncprofilereference</code> equals <b>RELATE_SYNC_PROFILE_TO_TIME</b>, <code>userDefault.cammingsettings.synchronizingmode</code> equals <b>IMMEDIATELY</b> and <code>userDefault.cammingsettings.synchronizingdirection</code> equals <b>SYSTEM_DEFINED</b>.</p>                                                                                                      |



### 3.2.3.7 Output parameter

#### Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                             |
|----------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| InGear         | BOOL      | FALSE         | Display of the synchronism of the master and slave axis<br>With TRUE, the slave axis is in synchronous operation with the master.                                                                                                       |
| Busy           | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                        |
| Active         | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the axis.                                                  |
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error in the command processing or by an overriding command. The error description can be read at the <b>ErrorID</b> output. |
| Error          | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output.        |
| ErrorID        | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                        |

### 3.2.3.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

### 3.2.3.9 Examples

#### Example: Relative / absolute synchronism

In the first step, the slave axis (Axis\_2) is synchronized with the master (Axis\_1) when relative synchronous operation is active (**Absolute** = FALSE). A random offset develops between both axes. In the next step the axes are once again synchronized with **Absolute** = TRUE. This eliminates any offset between the axes.

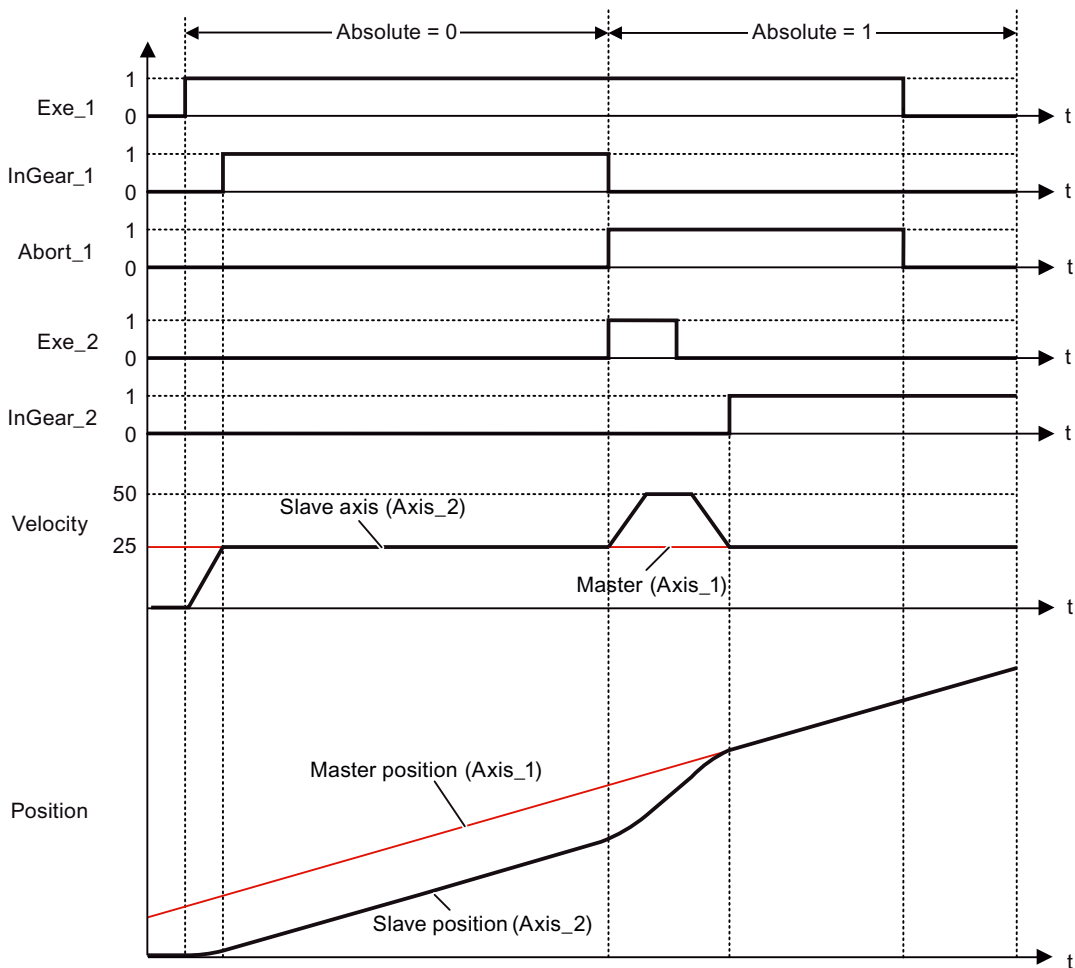
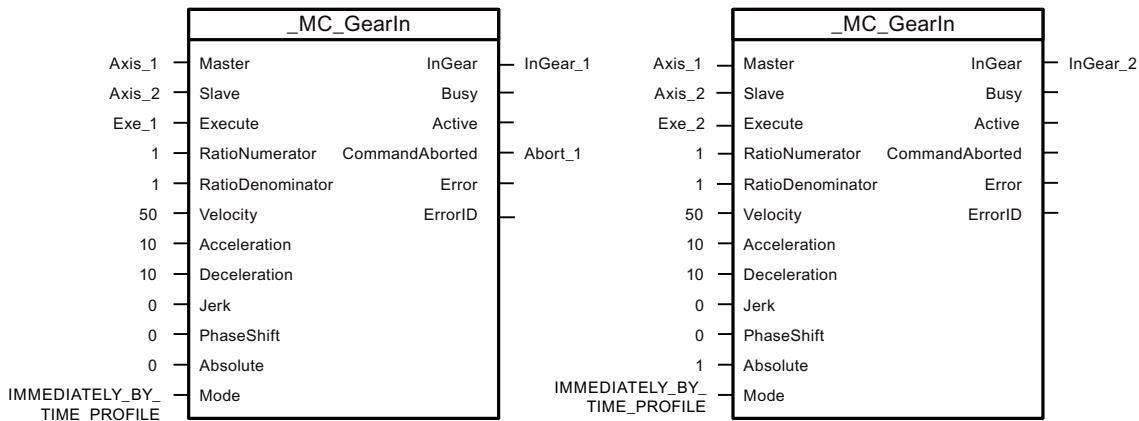


Figure 3-32 `_MC_GearIn` example: Synchronous operation

### Example: Phase offset

The example below shows the differences based on the signal profile between absolute synchronism with and without phase shift.

#### Absolute synchronism without phase shift

Start positions of the signal profile:

- Master position (Axis\_1) = 0
- Slave position (Axis\_2) = 0

A positive edge at **Exe\_1** starts absolute synchronism without phase shift. After a short delay, **InGear\_1** signals that absolute synchronism has been achieved. Absolute synchronism is established between the master position (Axis\_1) and the slave position (Axis\_2), i.e., their positions are identical.

#### Absolute synchronism with phase shift

The start positions for the signal profile shown are the same as those for the signal profile without phase shift.

A positive edge at **Exe\_2** starts absolute synchronism with a phase shift (**PhaseShift** = 20). After a short delay, **InGear\_2** reports that absolute synchronism is reached. The specified phase shift between the master position and the slave position is applied.

The position of the slave axis corresponds to the difference between the master position and the phase shift, for example master position (300) minus phase shift (20) gives the slave position 280.

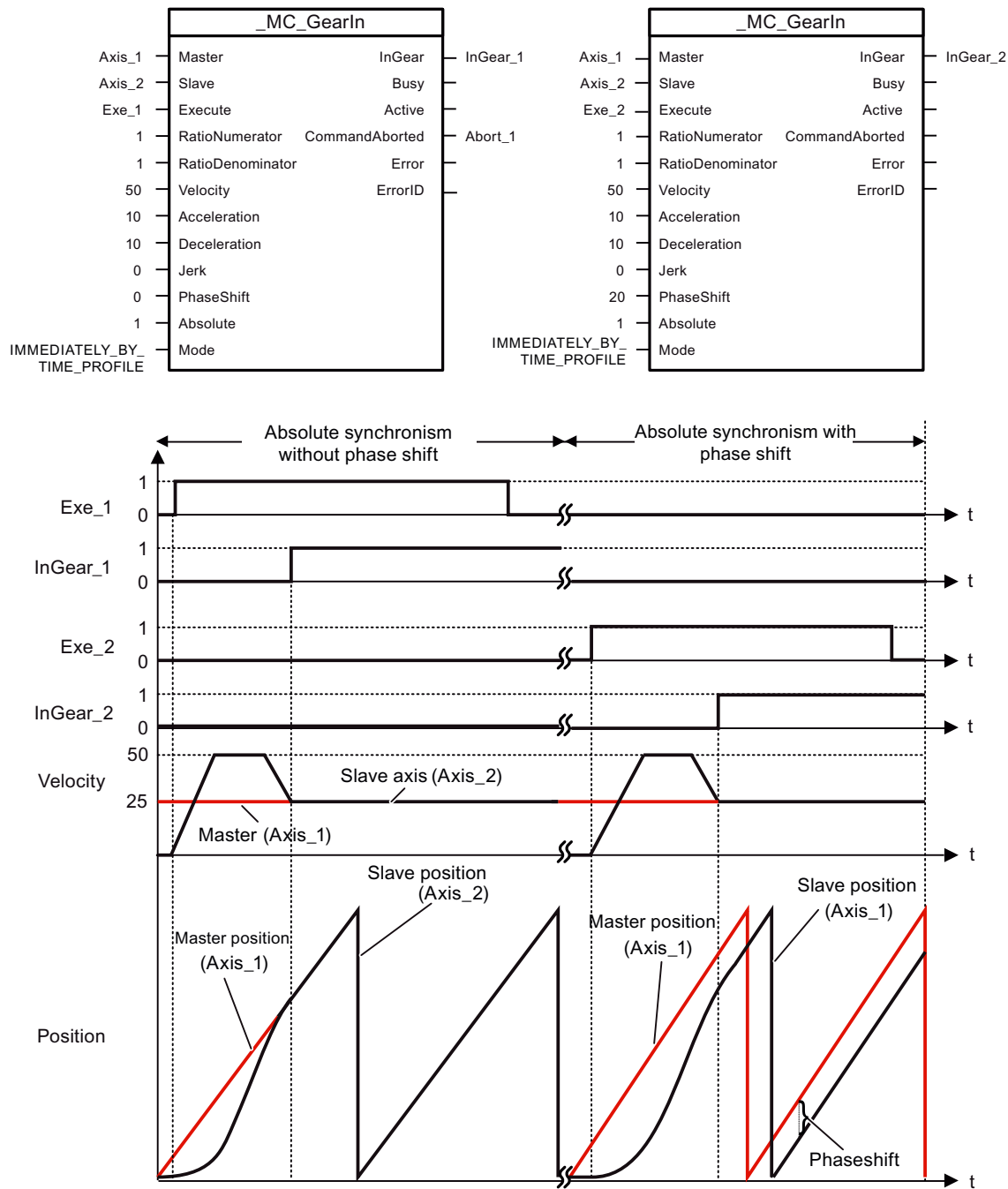


Figure 3-33 \_MC\_GearIn example: Phase offset

## 3.2.4 \_MC\_GearOut

### 3.2.4.1 Overview

Schematic diagram  
Purpose  
Applicable for  
Requirements  
Input parameters  
Output parameters  
ErrorIDs

### 3.2.4.2 Schematic diagram

#### Schematic diagram

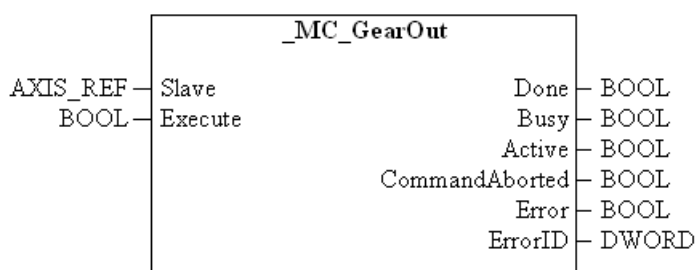


Figure 3-34 \_MC\_GearOut Schematic diagram

### 3.2.4.3 Purpose

#### Purpose

The function block **\_MC\_GearOut** terminates a gearing and stops the slave axis. The desynchronization conditions can be set in the system variables **userdefault.gearingSettings** of the interconnected synchronous object.

#### Recommendation

Use the function block when the shutdown procedure is to depend on the position of the master and/or the slave axis. You can also remove the slave axis from the synchronous operation with the technology functions **\_MC\_Stop**, **\_MC\_MoveRelative**, **\_MC\_MoveAdditive**, **\_MC\_MoveAbsolute** or **\_MC\_MoveVelocity**.

#### 3.2.4.4 Applicable for

##### Applications

Following axes

#### 3.2.4.5 Requirements

##### Requirements

A gearing must be active on the slave axis. If no synchronous operation is active, the function block is aborted.

No **\_MC\_Stop** active on the slave axis.

#### 3.2.4.6 Input parameters

##### Input parameters

| Parameter | Data type | Start value | Description                                                                                                                                                         |
|-----------|-----------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Slave     | AXIS_REF  | 0           | Specification of the reference to the slave axis<br>The following technology objects can be homed: <ul style="list-style-type: none"><li>• Following axis</li></ul> |
| Execute   | BOOL      | FALSE       | Function block enable<br>The synchronous operation of the slave axis with the interconnected master is terminated with a rising edge on this input.                 |

#### 3.2.4.7 Output parameter

##### Output parameter

| Parameter | Data type | Initial value | Description                                                                                                                                                                            |
|-----------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done      | BOOL      | FALSE         | Display of the completion of the function block<br>With TRUE, the slave axis has been desynchronized from the interconnected master.                                                   |
| Busy      | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                       |
| Active    | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the axis. |

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                             |
|----------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error in the command processing or by an overriding command. The error description can be read at the <b>ErrorID</b> output. |
| Error          | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output.        |
| ErrorID        | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                        |

### 3.2.4.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

### 3.2.5 \_MC\_Phasing

#### 3.2.5.1 Overview

Schematic diagram

Purpose

Applicable for

Requirements

Input parameters

Output parameters

ErrorIDs

### 3.2.5.2 Schematic diagram

#### Schematic diagram

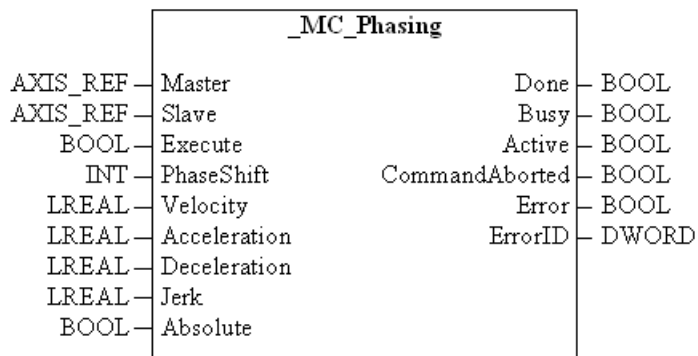


Figure 3-35 \_MC\_Phasing Schematic diagram

### 3.2.5.3 Purpose

#### Purpose

The function block **\_MC\_Phasing** shifts the position of the slave axis with respect to the master.

The shift can be absolute or relative to the existing offsets.

The dynamic response parameters **Velocity**, **Acceleration**, **Deceleration** and **Jerk** define the dynamic response of the motion procedure.

### 3.2.5.4 Applicable for

#### Applications

Following axes

### 3.2.5.5 Requirements

#### Requirements

No **\_MC\_Stop** active on the slave axis

A camming or gearing must be active on the slave axis.



### 3.2.5.6 Input parameters

#### Input parameters

| Parameter    | Data type | Initial value | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Master       | AXIS_REF  | 0             | Specification of the reference to the master<br>This parameter presently has no function. The slave axis is always offset with respect to the current master of the active synchronous operation.                                                                                                                                                                                                                                                                                |
| Slave        | AXIS_REF  | 0             | Specification of the reference to the slave axis<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>Following axis</li> </ul>                                                                                                                                                                                                                                                                                                              |
| Execute      | BOOL      | FALSE         | Function block enable<br>With a rising edge on this input, the position of the slave axis is offset with respect to the position of the master.                                                                                                                                                                                                                                                                                                                                  |
| PhaseShift   | INT       | 1             | Specification of the phase shift                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Velocity     | LREAL     | -1.0          | Specification of the maximum velocity<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefault.syncdynamics.velocity</code> of the synchronous object is used                                                                                                                                                                                                                          |
| Acceleration | LREAL     | -1.0          | Specification of the maximum acceleration<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefault.syncdynamics.positiveaccel</code> of the synchronous object is used                                                                                                                                                                                                                 |
| Deceleration | LREAL     | -1.0          | Specification of the maximum deceleration<br>Value > 0: The specified value is used<br>Value = 0: Not permissible<br>Value = -1.0: The preset value in the system variable <code>userdefault.syncdynamics.negativeaccel</code> of the synchronous object is used                                                                                                                                                                                                                 |
| Jerk         | LREAL     | -1.0          | Specification of the maximum jerk<br>Value > 0: The specified value is used<br>Value = 0: Use trapezoidal velocity profile<br>Value = -1.0: The preset values in the system variables <code>userdefault.syncdynamics.positiveaccelstartjerk</code> , <code>userdefault.syncdynamics.positiveaccelendjerk</code> , <code>userdefault.syncdynamics.negativeaccelstartjerk</code> and <code>userdefault.syncdynamics.negativeaccelendjerk</code> of the synchronous object are used |
| Absolute     | BOOL      | TRUE          | Indicates the type of phase shift<br>With TRUE, the phase shift is taken over as an absolute value.<br>With FALSE, the phase shift is added to an existing offset.                                                                                                                                                                                                                                                                                                               |

### 3.2.5.7 Output parameter

#### Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                                                                             |
|----------------|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done           | BOOL      | FALSE         | Indicates termination of the function block.<br>With TRUE, the master and slave axis have been displaced with respect to one another by the absolute value of the phase shift.                                                          |
| Busy           | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started.                                                                                                                                        |
| Active         | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the axis.                                                  |
| CommandAborted | BOOL      | FALSE         | Display of the abort of the function block<br>With TRUE, the function block has been aborted because of an error in the command processing or by an overriding command. The error description can be read at the <b>ErrorID</b> output. |
| Error          | BOOL      | FALSE         | Display of an error in the function block<br>With TRUE, an error has occurred during the initialization of the function block. The function block is terminated. The error description can be read at the <b>ErrorID</b> output.        |
| ErrorID        | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> .                                                                                        |

### 3.2.5.8 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

#### See also

Troubleshooting - PLCopen Blocks (Page 113)

### 3.3 Advanced functions

#### 3.3.1 \_MC\_Jog

##### 3.3.1.1 Overview

Schematic diagram

Purpose

Applicable for

Requirements

Input parameters

Output parameters

Function

ErrorIDs

##### 3.3.1.2 Schematic diagram

Schematic diagram

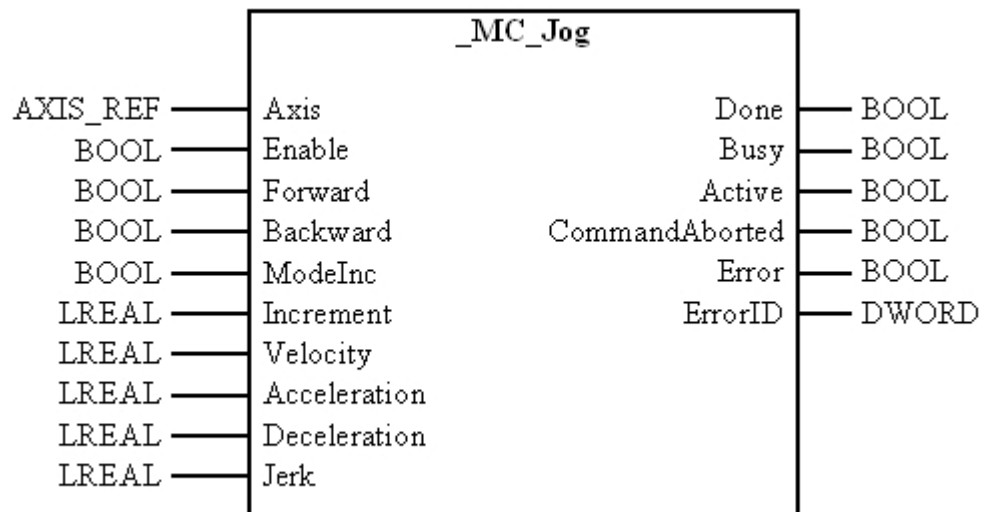


Figure 3-36 \_MC\_Jog Schematic diagram

### 3.3.1.3 Purpose

#### Purpose

The function block **\_MC\_Jog** implements a continuous or incremental jogging of an axis.

### 3.3.1.4 Applicable for

#### Applications

Positioning axes

Following axes

### 3.3.1.5 Requirements

#### Requirements

Axis enabled

No **\_MC\_Stop** active

### 3.3.1.6 Input parameters

#### Input parameters

| Parameter | Data type | Start value | Description                                                                                                                                                                                          |
|-----------|-----------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Axis      | AXIS_REF  | 0           | Specification of the axis reference<br>The following technology objects can be homed: <ul style="list-style-type: none"> <li>Position axis</li> <li>Following axis</li> </ul>                        |
| Enable    | BOOL      | FALSE       | Function block enable                                                                                                                                                                                |
| Forward   | BOOL      | FALSE       | Start of the traversing motion in positive direction with positive edge<br>Stop of the traversing motion with negative edge<br>TRUE = motion in positive direction as long as <b>Forward</b> is set  |
| Backward  | BOOL      | FALSE       | Start of the traversing motion in negative direction with positive edge<br>Stop of the traversing motion with negative edge<br>TRUE = motion in negative direction as long as <b>Backward</b> is set |
| Modelnc   | BOOL      | FALSE       | FALSE = continuous jogging<br>TRUE = incremental jogging<br>Each status change on the <b>Modelnc</b> results in an axis stop and deletion of the distance-to-go                                      |
| Increment | LREAL     | 0.0         | Value for incremental jogging                                                                                                                                                                        |

| Parameter    | Data type | Start value | Description                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|-----------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Velocity     | LREAL     | -1.0        | Maximum velocity that is reached depending on the set traversing distance, acceleration and jerk (is not always reached)<br>Value > 0: Use the specified value<br>Value = 0: Not permissible<br>Value < 0: The preset value in the system variable <code>userdefaultdynamics.velocity</code> of the axis is used.                                                                                            |
| Acceleration | LREAL     | -1.0        | Acceleration (increasing energy in the motor):<br>Value > 0: Use the specified value<br>Value = 0: Not permissible<br>Value < 0: The preset value in the system variable <code>userdefaultdynamics.positiveaccel</code> of the axis is used.                                                                                                                                                                 |
| Deceleration | LREAL     | -1.0        | Deceleration (decreasing energy in the motor):<br>Value > 0: Use the specified value<br>Value = 0: Not permissible<br>Value < 0: The preset value in the system variable <code>userdefaultdynamics.negativeaccel</code> of the axis is used.                                                                                                                                                                 |
| Jerk         | LREAL     | -1.0        | Jerk:<br>Value > 0: Use the specified value<br>Value = 0: Use trapezoidal travel profile<br>Value = -1.0: The preset values in the system variables <code>userdefaultdynamics.positiveaccelstartjerk</code> , <code>userdefaultdynamics.positiveaccelendjerk</code> , <code>userdefaultdynamics.negativeaccelstartjerk</code> and <code>userdefaultdynamics.negativeaccelendjerk</code> of the axis are used |

### 3.3.1.7 Output parameter

#### Output parameter

| Parameter      | Data type | Initial value | Description                                                                                                                                                                            |
|----------------|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Done           | BOOL      | FALSE         | Incremental or continuous jogging finished, the axis has been stopped                                                                                                                  |
| Busy           | BOOL      | FALSE         | Display of the activity of the function block<br>With TRUE, the function block has been started, distance-to-go pending                                                                |
| Active         | BOOL      | FALSE         | Display of the command activity in the function block<br>With TRUE, the command is being processed by the command processing, i.e., the function block has active control of the axis. |
| CommandAborted | BOOL      | FALSE         | Command has been aborted by another command or by an error during the command processing.                                                                                              |
| Error          | BOOL      | FALSE         | Indicates an error<br><b>An error</b> has occurred during the command execution. The cause can be found in the <b>ErrorID</b> .                                                        |

| Parameter | Data type | Initial value | Description                                                                                                                                      |
|-----------|-----------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| ErrorID   | DWORD     | 0             | Display of a function block error code<br>The error code is always output in connection with the outputs <b>CommandAborted</b> or <b>Error</b> . |

### 3.3.1.8 Function

#### Function

The function block traverses the axis with the parameterized dynamic response values either continuously or incrementally in a positive or negative direction.

A positive edge at the input parameters **Forward** or **Backward** starts the traversing motion; it is stopped with the negative edge.

When incremental jogging is selected, the axis is stopped by the function block after traversing the parameterized distance. If the axle is stopped before reaching the parameterized distance, a restart of the motion completes the residual distance.

When incremental jogging is selected, the direction can only be changed when there is no remaining distance to be traversed.

- **Enable**

- **Enable = TRUE:** Functionality of the block is processed and traversing motions are possible; with the transition FALSE/TRUE at Enable, all output parameters are reset and the distance-to-go is deleted.

Note: Busy is only set with an action.

- **Enable = FALSE:** Stop of the traversing motion - traversing motions no longer possible; with the transition from Enable = TRUE to Enable = FALSE, the **\_MC\_Stop** is always called internally, irrespective of whether the axis is in motion or not.

- **Busy/Active**

- Incremental jogging:

Busy = TRUE / Active = TRUE: Axis moves, distance-to-go != 0

Busy = TRUE / Active = FALSE: Intermediate stop - the axis is stationary, distance-to-go != 0

- Continuous jogging:

After a positive edge at the input parameter **Forward** or **Backward**, **Busy = TRUE** is output in the same cycle. **Active** is only output in the interpolator after activation of the motion command. This may occur several cycles later.

- **Continuous jogging**

- The jogging is started with a positive edge at **Forward** or **Backward**. The axis traverses with continuous jogging as long as the level on one of the two parameters is TRUE. The motion is stopped with the falling edge.
- If the two inputs **Forward** and **Backward** are set to TRUE at the same time, no axis motion is started (**Active** = FALSE, **Busy** = FALSE, **Done** = FALSE), the distance-to-go is deleted and no error message is generated.

- If the input parameter for the opposite direction is also set during the traversing motion, the traversing motion is stopped, the distance-to-go is deleted and also no error message is generated.
- A positive edge at **Forward** and a negative edge at **Backward** in the same cycle results in a change of direction. The same applies for the reverse situation.
- **Incremental jogging**
  - With incremental jogging, the traversing motion is stopped when the distance parameterized in the input parameter **Increment** is reached. If a falling edge is detected at the input parameter **Forward** (or **Backward**) before this, the traversing motion is also stopped.
  - Behavior with distance-to-go present:

If a distance-to-go is present, i.e., the traversing motion was stopped before reaching the distance parameterized at the input parameter **Increment** by a falling edge at **Forward** or **Backward**, this state is signaled with **Busy** = TRUE, **Done** = FALSE, **Active** = FALSE.

With another positive edge in the same direction of motion, the present distance-to-go is traversed.

Incremental jogging in the opposite direction with a stopped axis and distance-to-go present is not possible. To do this, the distance-to-go present must be deleted with selection of continuous jogging or **Enable** = 0/1 and incremental jogging selected again.
  - Behavior when distance-to-go is zero:

The transition **Busy** = TRUE to FALSE, **Active** = TRUE to FALSE and **Done** = FALSE to TRUE signals the complete traversing of the selected increment. The distance-to-go is 0.
- **Switchover from incremental / continuous jogging**

A change of **ModelInc** during traversing with an active traversing motion results in an axis stop without error message. If the input parameter **ModelInc** is changed to continuous jogging (**ModelInc**=FALSE), the distance-to-go is deleted.
- **Override**

If the **Override** = 0 with active, started traversing motion, then there is no traversing motion and **Active** is TRUE.
- **Parameter acceptance**

The parameter acceptance of the distances/**Increment** and the dynamic response parameters (**Velocity**, **Acceleration**, ...) is performed with a rising edge of **Forward/Backward**, i.e., a change of **Increment**, **Velocity**, **Acceleration**, **Deceleration** or **Jerk** has no effect during traversing.
- **Axis not in position control**

If jogging is issued and the axis is not in position control, the corresponding error message of the used PLCopen FB is output.

### 3.3.1.9 ErrorIDs

#### ErrorIDs

The error code contains the number and, when available, the associated reason for the error that has occurred in the function block. The error number occupies the lower 16 bits of the error code. The error reason, when available, is also coded as a number and occupies the upper 16 bits of the error code.

---

#### Note

##### ErrorIDs from other blocks possible

During execution of the function block **\_MC\_Jog**, the function blocks **\_MC\_MoveVelocity**, **\_MC\_MoveRelative** and **\_MC\_Stop** are called internally.

If the **\_MC\_Jog** is aborted, errorIDs can therefore also be reported from these three function blocks.

---



## Troubleshooting PLCopen blocks

### 4.1 Troubleshooting - PLCopen Blocks

#### Troubleshooting - PLCopen Blocks

The error codes of the function blocks (errorID) have been taken over from the return values of the ST commands in SIMOTION and from the command abort reason. The return value of the ST commands is written to the LOW word of the errorID. The command abort reason is in the HIGH word of the errorID.

### 4.2 Error codes of the errorID (LOW word)

#### Error codes of the errorID (LOW word)

| Error code |     | Description                                                                                     |
|------------|-----|-------------------------------------------------------------------------------------------------|
| Hex        | dec |                                                                                                 |
| 0          | 0   | No error                                                                                        |
| 1          | 1   | Illegal command parameter                                                                       |
| 2          | 2   | Illegal range specification in command parameters                                               |
| 3          | 3   | Command aborted                                                                                 |
| 4          | 4   | Unknown command                                                                                 |
| 5          | 5   | Command cannot be executed due to current object state                                          |
| 6          | 6   | Command aborted due to termination of user task                                                 |
| 7          | 7   | Command rejected due to suspension of command interpretation of the addressed technology object |
| 8          | 8   | Command aborted due to full command buffer                                                      |
| 9          | 9   | Insufficient memory                                                                             |
| A          | 10  | A connection to a technology object required for this operation does not exist                  |
| B          | 11  | No object configuration                                                                         |
| C          | 12  | The error to be reset cannot be reset due to its configuration                                  |
| D          | 13  | Axis is not homed                                                                               |
| E          | 14  | Measuring job on virtual axis not possible                                                      |
| F          | 15  | Ambiguous <b>commandId</b>                                                                      |

4.2 Error codes of the errorID (LOW word)

| Error code |       | Description                                                                                   |
|------------|-------|-----------------------------------------------------------------------------------------------|
| 10         | 16    | Command not implemented                                                                       |
| 11         | 17    | Read access denied                                                                            |
| 12         | 18    | Write access denied                                                                           |
| 13         | 19    | Command argument not supported                                                                |
| 14         | 20    | The cam has already been interpolated and cannot be manipulated                               |
| 15         | 21    | The interpolation condition was violated                                                      |
| 16         | 22    | The programmed jerk is 0                                                                      |
| 17         | 23    | The alarm to be deleted is not pending                                                        |
| 18         | 24    | Command not possible on a virtual axis                                                        |
| 19         | 25    | A synchronized start of this command is not possible                                          |
| 1a         | 26    | Superimposed command has been aborted as it is not permitted by the active command            |
| 1b         | 27    | Time-out during communication with the drive                                                  |
| 1c         | 28    | Actual values are not valid                                                                   |
| 1d         | 29    | The command cannot be executed when velocity control is active                                |
| 1e         | 30    | The command cannot be executed when position control is active                                |
| 1f         | 31    | The command cannot be executed in torque-reduced operation or during travel to fixed end stop |
| 20         | 32    | The command can only be executed when force or pressure control is active                     |
| 21         | 33    | The command cannot be executed when force/pressure control is active                          |
| 22         | 34    | The command can only be executed when pressure limiting is active                             |
| 23         | 35    | Master values are not valid                                                                   |
| 24         | 36    | Slave values are not valid                                                                    |
| 25         | 37    | No slave value can be defined for a master value                                              |
| 26         | 38    | No master value can be defined for a slave value                                              |
| 27         | 39    | The command cannot be executed when synchronous operation is inactive                         |
| 28         | 40    | The command cannot be executed with non-synchronous operation                                 |
| 29         | 41    | The command cannot be executed when gearing or camming is active                              |
| 2a         | 42    | The command cannot be executed when camming is inactive                                       |
| 2b         | 43    | This command can only be used for an interpolated cam                                         |
| 2c         | 44    | The command can only not be executed when pressure limiting is active                         |
| 2d         | 45    | Insufficient interpolation points are available to interpolate the cam                        |
| 2e         | 46    | The specified path point cannot be reached due to restrictions of the kinematics              |
| 2f         | 47    | Path axis values are not valid                                                                |
| 30         | 48    | Reserved memory is full                                                                       |
| 2710       | 10000 | (Greater than or equal to) internal error                                                     |

See also

Troubleshooting - PLCopen Blocks (Page 113)

## 4.3 Command abort reason of the errorID (HIGH word)

### Command abort reason of the errorID (HIGH word)

| Command abort reason |     | Description                                                      |
|----------------------|-----|------------------------------------------------------------------|
| Hex                  | dec |                                                                  |
| 0                    | 0   | No abort reason                                                  |
| 1                    | 1   | Reset of the command buffer                                      |
| 2                    | 2   | Abort by another command                                         |
| 3                    | 3   | Abort by a stop                                                  |
| 4                    | 4   | Abort by a higher-order stop                                     |
| 5                    | 5   | Abort by a pending error response                                |
| 6                    | 6   | Abort due to ambiguous <b>commandId</b>                          |
| 7                    | 7   | Acknowledgement delay                                            |
| 8                    | 8   | No actual value for axis (e.g., encoder or data bus not ready)   |
| 9                    | 9   | Abort due to abort of a dependent command                        |
| a                    | 10  | Abort due to active synchronous operation                        |
| b                    | 11  | Abort due to active superimposed motion                          |
| c                    | 12  | Abort due to active speed-controlled controller mode             |
| d                    | 13  | Abort due to active position-controlled controller mode          |
| e                    | 14  | Abort due to active travel to fixed end stop                     |
| f                    | 15  | Axis is not in pressure-limiting operation                       |
| 10                   | 16  | Abort due to active pressure-controlled operation                |
| 11                   | 17  | Abort due to inactive pressure-controlled operation              |
| 12                   | 18  | Superimposed command is not permitted                            |
| 13                   | 19  | Abort due to error during cam access                             |
| 14                   | 20  | Slave is not ready for operation                                 |
| 15                   | 21  | Error in the slave synchronization                               |
| 16                   | 22  | Abort by command on the slave                                    |
| 17                   | 23  | Abort by stop on the slave                                       |
| 18                   | 24  | Abort by a pending error response on the slave                   |
| 19                   | 25  | No actual values for slave (e.g., encoder or data bus not ready) |
| 1a                   | 26  | Abort by reset on the slave                                      |
| 1b                   | 27  | Master values are not valid                                      |
| 1c                   | 28  | Active command in recursive TO interconnection                   |
| 1d                   | 29  | Abort due to error during synchronization                        |
| 1e                   | 30  | Axis is in pressure-limiting operation                           |
| 1f                   | 31  | Maximum number of active commands exceeded                       |
| 20                   | 32  | Abort due to active correction command                           |
| 21                   | 33  | Action only permissible in standstill                            |
| 22                   | 34  | Path axis is not ready for operation                             |

| Command abort reason |    | Description                                                          |
|----------------------|----|----------------------------------------------------------------------|
| 23                   | 35 | Error during synchronization with a path axis                        |
| 24                   | 36 | Abort due to command on a path axis                                  |
| 25                   | 37 | Abort due to stop on a path axis                                     |
| 26                   | 38 | Abort due to a pending error response on a path axis                 |
| 27                   | 39 | No actual values for path axis (e.g., encoder or data bus not ready) |
| 28                   | 40 | Abort due to reset on a path axis                                    |
| 29                   | 41 | Command parameters became invalid during processing                  |
| 2a                   | 42 | A required connection to a technology object does not exist          |
| 2b                   | 43 | Abort through user program                                           |

See also

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## 4.4 Query of general errors with the ReadAxisError function block

### Query of general errors with the ReadAxisError function block

General errors on the **axis**, on the **external encoder**, on the **synchronous object** and on the **cam** can be queried with the **ReadAxisError** function block. The function block converts the alarms pending on the technology object into a 32-bit representation. The alarm bit coding is defined in the alarm group association in the appropriate description files and documented in the reference lists generated from these. The alarm group association is hidden during the alarm configuration in SIMOTION SCOUT.

### Meaning of the bit numbers for the axis

| Bit number | Description                  |
|------------|------------------------------|
| 0          | System fault                 |
| 1          | Config fault                 |
| 2          | User fault                   |
| 3          | Peripheral fault             |
| 4          | Function fault               |
| 5          | Function aborted             |
| 6          | Reset/restart fault          |
| 7          | Distributed motion fault     |
| 8          | Following error              |
| 9          | Standstill positioning error |
| 10         | Dynamic limit                |
| 11         | Clamping error               |

| Bit number | Description                   |
|------------|-------------------------------|
| 12         | Software limit                |
| 13         | Limit switch                  |
| 14         | Sensor fault                  |
| 15         | Reference not found           |
| 16         | Output limit                  |
| 17         | Force dynamic limit           |
| 18         | Additional sensor fault       |
| 19         | Synchronous motion fault      |
| 20         | Following object              |
| 21         | Path synchronous motion fault |
| 22         | Path motion fault             |
| 23         | Path object                   |

#### Meaning of the bit numbers for the external encoder

| Bit number | Description                  |
|------------|------------------------------|
| 0          | System fault                 |
| 1          | Config fault                 |
| 2          | User fault                   |
| 3          | Peripheral fault             |
| 4          | Function fault               |
| 5          | Function aborted             |
| 6          | Reset/restart fault          |
| 7          | Distributed motion fault     |
| 9          | Standstill positioning error |
| 14         | Sensor fault                 |
| 15         | Reference not found          |
| 19         | Synchronous motion fault     |

#### Meaning of the bit numbers for the following object

| Bit number | Description              |
|------------|--------------------------|
| 0          | System fault             |
| 1          | Config fault             |
| 2          | User fault               |
| 3          | Peripheral fault         |
| 4          | Function fault           |
| 5          | Function aborted         |
| 6          | Reset/restart fault      |
| 7          | Distributed motion fault |
| 8          | Direct sync              |

| Bit number | Description     |
|------------|-----------------|
| 9          | Stability       |
| 10         | Dynamic limit   |
| 11         | Value ambiguous |

### Meaning of the bit numbers for the cam

| Bit number | Description         |
|------------|---------------------|
| 0          | System fault        |
| 1          | Config fault        |
| 2          | User fault          |
| 3          | Peripheral fault    |
| 4          | Function fault      |
| 5          | Function aborted    |
| 6          | Reset/restart fault |
| 8          | Value not valid     |
| 9          | Interpolation fault |

Alarms and therefore error states, which switch the controller to the STOP mode (e.g., 20001 **Internal error**), can be evaluated by the **ReadAxisError** block in the shutdown task. In addition to the 32-bit error representation, the TO alarms are also output.

### See also

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