Kollmorgen Automation Suite

KAS Reference Manual - Motion Library

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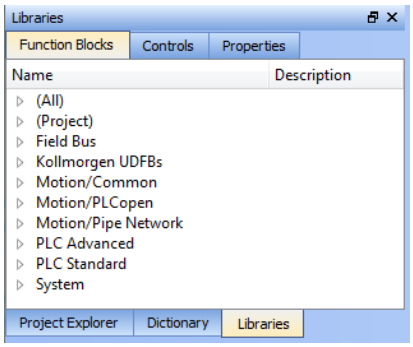
1 Motion Library

This chapter covers the Motion Library (for **Pipe Network** and **PLCopen**) in the function blocks tab of the Library toolbox.



KAS function library contains ML function blocks that are used to integrate motion in a PLC program. ML function blocks can be used in 4 of the IEC 61131-3 languages: ST, FBD, FFLD and IL.

Regarding SFCSFC programs, ML function blocks (like any other function blocks from the library) are used as part of a stepstep or transitiontransition which are defined with ST, FBD, FFLD or IL languages.

1.1 Motion Library / Pipe Network

The KAS IDE function library contains ML function blocks that are used to integrate motion from a Pipe Network in a PLC program. ML Function blocks are of the following types:

Function	Description
Motion	Prepare the physical motion part: init, reset, start, stop
Pipe Network	Manage the Pipe Network: create/activate
Block	Manage the blocks: create/activate
Pipe Block	Manage each specific Pipe Block: read/write parameters…

Table 1-1: List of Pipe Network FB

IMPORTANT Pipe Network code is generated automatically by the compiler, you should not try to modify it.

Hover the mouse above a Pipe Block in the figure below to display its description at the bottom....

1.1.1 Motion Library

Name	Description	Return type
MLMotionInit	Initializes the motion library. Must be called before any other Motion Library function. Returns TRUE if the function succeeded. BasePeriod is the duration of one motion cycle in microseconds.	BOOL
MLMotionStart	Starts the motion engine, motion bus driver, and initializes EtherCAT network to operational mode. Applicable to PLCopen and PipesNetwork motion engines. Returns TRUE if the function succeeded.	BOOL
MLMotionStatus	Returns the status of the motion engine 0: Not initialized 1: Running 2: Stopped 3: Error	None
MLMotionStop	Stops the motion bus driver, motion engine, and EtherCAT network operation, resulting in the EtherCAT network transitioning to the Init state. Returns TRUE if the function succeeded.	BOOL
MLMotionSysTime	Prints the system time to the log	BOOL
MLMotionCycleTime		

1.1.2 Motion Library - Pipe Network

Name	Description	Return type
MLPipeAct	Activates a pipe	BOOL
MLPipeAddBlock	Adds a Pipe Block to a pipe	BOOL
MLPipeCreate	Creates a new pipe object	None
MLPipeDeact	Deactivates a pipe	BOOL

1.1.2.1 MLPipeAct

1.1.2.2.1 Description

Activates a pipe. A Pipe contains an Input Pipe Block (Master, PMP, or Sampler), a Converter Output Pipe Block, and any Transformation Pipe Block that can be in between. The figure below shows two Pipes, both with the same Master Input Pipe Block. The first ends with the first converter, and has a Gear Pipe Block to transform the input values from the Master. The second pipe ends with the second converter, and has a CAM Pipe Block to modify the input values from the Master.

Once a Pipe is activated then history on the values in the Pipe's Blocks are saved and updated each program cycle. A Converter object connected to a destination Axis object cannot send updated position values unless its Pipe is activated.

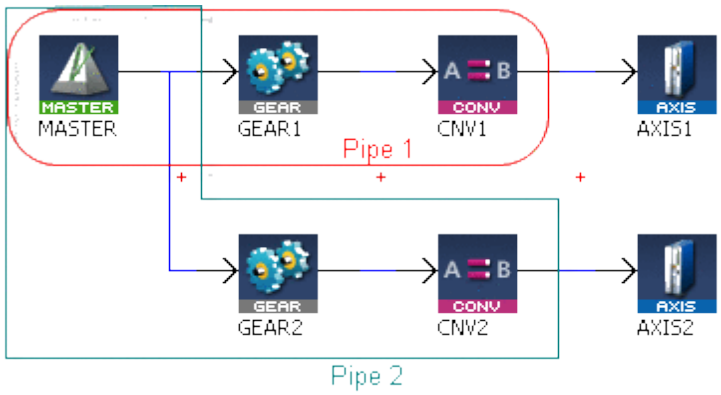


Figure 1-1: MLPipeAct

> **NOTE** All Pipes in the Pipe Network can be activated at once with the command PipeNetwork(MLPN_ACTIVATE). This calls automatically generated code with MLPipeAct commands for each Pipe object. Therefore, in a multi-pipe program only one command can be used to activate Pipes instead of writing code for each Pipe separately.

1.1.2.3.2 Arguments

1.1.2.4.3.1 Input

PipeID

Description	ID number of a created Pipe object
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.2.5.4.2 Output

Default (.Q)	**Description**	Returns TRUE if the Pipe is activated
	Data type	BOOL
	Unit	n/a

1.1.2.6.5.3 Return Type

BOOL

1.1.2.7.6 Related Functions

MLPipeDeact

MLCNVConnect

PipeNetwork(MLPN_ACTIVATE)

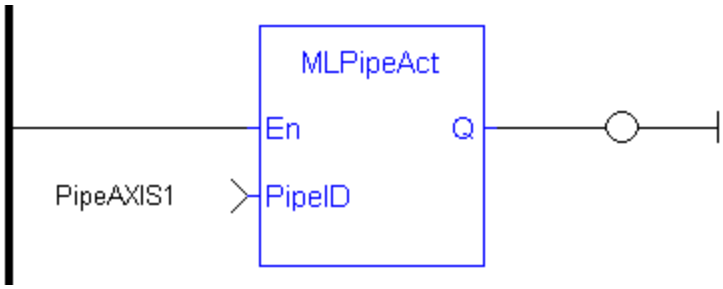
MLPipeAddBlock

1.1.2.8.7 Example

1.1.2.9.8.1 Structured Text

```
//Activate a Pipe
MLPipeAct( PipeAXIS1 );
```

1.1.2.10.9.2 Ladder Diagram



1.1.2.11.10.3 Function Block Diagram

1.1.2.12 MLPipeAddBlock

1.1.2.13.1 Description

Add a Pipe Block to a pipe. A Pipe contains an Input Pipe Block (Master, PMP, or Sampler), a Converter Output Pipe Block, and any Transformation Pipe Block that can be in between.

The figure below shows two Pipes, both with the same Master Input Pipe Block. If a user were to create the Pipe 1 below without using the Graphical Engine, they would use the following commands once a Pipe and the Pipe Blocks have been created.

MLPipeAddBlock(PipeAXIS1, MASTER);

MLPipeAddBlock(PipeAXIS1, MyGear);

MLPipeAddBlock(PipeAXIS1, CNV1);

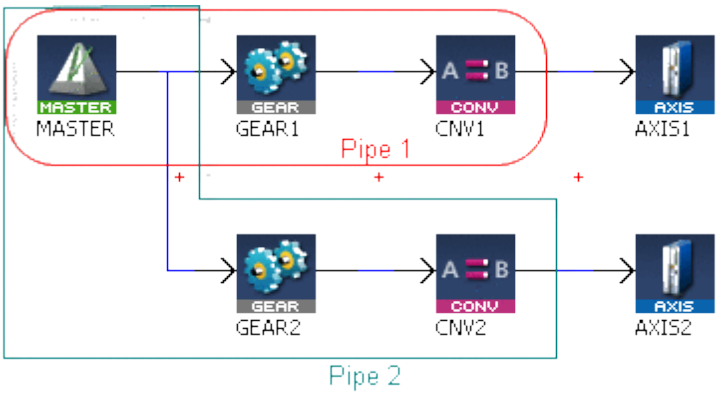


Figure 1-2: MLPipeAddBlock

NOTE All Blocks in the Pipe Network are added to a Pipe automatically. Code with MLPipeAddBlock commands are automatically generated and called in a program with PipeNetwork(MLPN_CREATE_OBJECTS). Therefore, when using the Pipe Network graphical engine to create Pipe Blocks the user does not have to manually add MLPipeAddBlock commands to the Project.

1.1.2.14.2 Arguments

1.1.2.15.3.1 Input

PipeID	**Description**	ID number of a created Pipe
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
BlockID	**Description**	ID number of a created Pipe object to add to the selected Pipe
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—

1.1.2.16.4.2 Output

Default (.Q)	**Description**	Returns TRUE if the Pipe Block is added to the Pipe

Data type	BOOL
Unit	n/a

1.1.2.17.5.3 Return Type

BOOL

1.1.2.18.6 Related Functions

PipeNetwork(MLPN_CREATE_OBJECTS)

MLPipeAct

MLPipeCreate

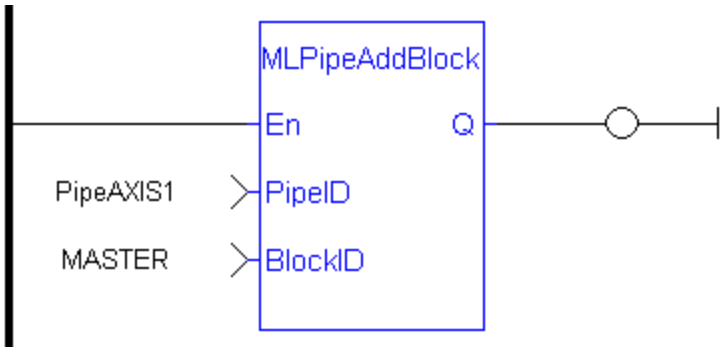
MLPipeDeact

1.1.2.19.7 Example

1.1.2.20.8.1 Structured Text

```
//Add a block to a pipe
MLPipeAddBlock( PipeAXIS1, MyGear );
```

1.1.2.21.9.2 Ladder Diagram



1.1.2.22.10.3 Function Block Diagram

1.1.2.23 MLPipeCreate

1.1.2.24.1 Description

Create a new pipe object. A Pipe contains an Input Pipe Block (Master, PMP, or Sampler), a Converter Output Pipe Block, and any Transformation Pipe Block that can be in between. The figure below shows two Pipes, both with the same Master Input Pipe Block.

NOTE Pipes are normally created in the Pipe Network using the graphical

NOTE engine. Then you do not have to add MLPipeCreate function blocks to their programs. Pipes are created graphically, and the code with MLPipeCreate commands are automatically generated and called in a program with PipeNetwork(MLPN_CREATE_OBJECTS).

1.1.2.25.2 Arguments

1.1.2.26.3.1 Input

Name	**Description**	Desired name for the newly created Pipe
	Data type	String
	Range	—
	Unit	n/a
	Default	—

1.1.2.27.4.2 Output

ID	**Description**	Assigned ID number of the created Pipe
	Data type	DINT
	Unit	n/a
	Default	—

1.1.2.28.5 Related Functions

PipeNetwork(MLPN_CREATE_OBJECTS)

MLPipeAddBlock

MLPipeAct

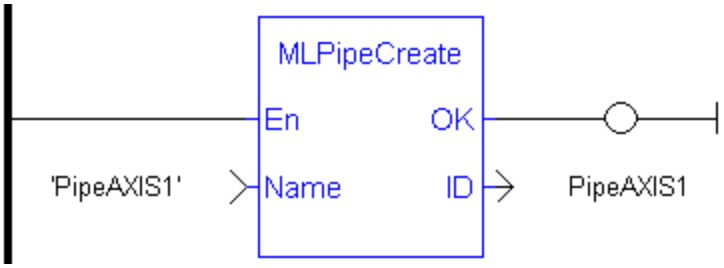
MLPipeDeact

1.1.2.29.6 Example

1.1.2.30.7.1 Structured Text

```
//Create a new pipe
PipeAXIS1 := MLPipeCreate( 'PipeAXIS1' );
```

1.1.2.31.8.2 Ladder Diagram



1.1.2.32.9.3 Function Block Diagram

1.1.2.33 MLPipeDeact

1.1.2.34.1 Description

Deactivates a pipe. A Pipe contains an Input Pipe Block (Master, PMP, or Sampler), a Converter Output Pipe Block, and any Transformation Pipe Block that can be in between. The figure below shows two Pipes, both with the same Master Input Pipe Block. The first ends with the first converter, and has a Gear Pipe Block to transform the input values from the Master. The second pipe ends with the second converter, and has a CAM Pipe Block to modify the input values from the Master.

Once a Pipe is activated then history on the values in the Pipe's Blocks are lost and no longer updated. A Converter object connected to a destination Axis object cannot send updated position values once its Pipe is deactivated.

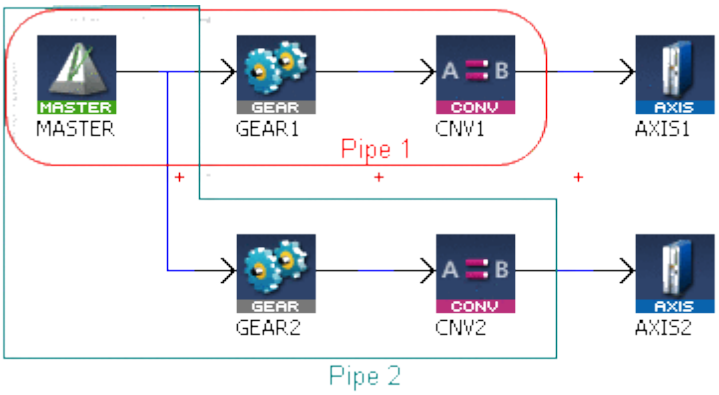


Figure 1-3: MLPipeDeact

> **NOTE** All Pipes in the Pipe Network can be deactivated at once with the command PipeNetwork(MLPN_DEACTIVATE). This calls automatically generated code with MLPipeDeact commands for each Pipe object. Therefore, in a multi-pipe program only one command can be used to deactivate Pipes instead of writing code for each Pipe separately.

1.1.2.35.2 Arguments

1.1.2.36.3.1 Input

PipeID

Description	ID number of a created Pipe object
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.2.37.4.2 Output

Default (.Q)	**Description**	Returns TRUE if the Pipe is deactivated
	Data type	BOOL
	Unit	n/a

1.1.2.38.5.3 Return Type

BOOL

1.1.2.39.6 Related Functions

MLPipeAct

MLCNVDisconnect

PipeNetwork(MLPN_DEACTIVATE)

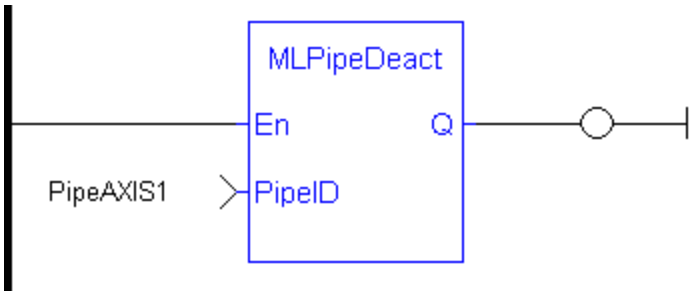
MLPipeAddBlock

1.1.2.40.7 Example

1.1.2.41.8.1 Structured Text

```
//Deactivate a Pipe
MLPipeDeact( PipeAXIS1 );
```

1.1.2.42.9.2 Ladder Diagram



1.1.2.43.10.3 Function Block Diagram

1.1.3 Motion Library - Block

Name	Description	Return type
"MLBlkCreate" (see page 46)	Creates a new Pipe Block object	None
"MLBlkIsReady" (see page 50)	Checks if a Pipe Block currently has a function running	BOOL

Name	Description	Return type
"MLBlkReadModPos" (see page 48)	Gets the value of the period of a block in user units	None
"MLBlkReadOutVal" (see page 47)	Gets the output value of a selected Pipe Block	None
"MLBlkWriteModPos" (see page 51)	Sets the value of the period of a block in user units	BOOL

1.1.3.1 MLBlkCreate

1.1.3.2.1 Description

Creates a new Pipe Block object. Before a Pipe Block is Initialized the block needs to be created and assigned an ID number. MLBlkCreate function block is automatically called if a Block is added to the Pipe Network.

NOTE Pipe Blocks are normally created in the Pipe Network using the graphical engine. Then you do not have to add MLBlkCreate function blocks to their programs. Blocks are created graphically, and the code with MLBlkCreate commands are automatically generated and called in a program with Pipe Network(MLPN_CREATE_OBJECTS).

TIP This function must be called or executed before MLMotionStart is called.

1.1.3.3.2 Arguments

1.1.3.4.3.1 Input

Name	**Description**	Desired name for the newly created Pipe Block
	Data type	String
	Range	—
	Unit	n/a
	Default	—
Type	**Description**	Type of Pipe Block to create (ex. MASTER, GEAR, PHASER, etc.)
	Data type	String
	Range	—
	Unit	n/a
	Default	—

1.1.3.5.4.2 Output

ID	**Description**	Assigned ID number of the created Block
	Data type	DINT
	Unit	n/a
	Default	—

1.1.3.6.5 Related Functions

PipeNetwork(MLPN_CREATE_OBJECTS)

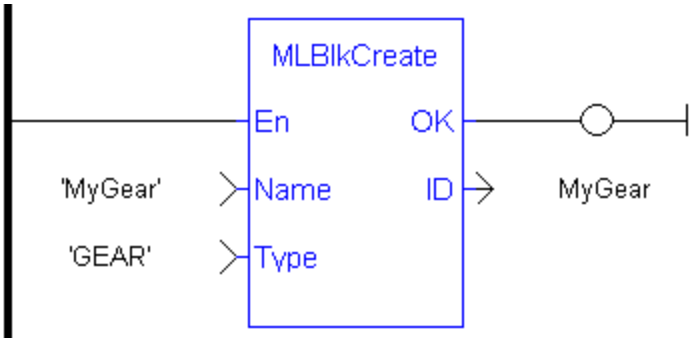
MLAxisInit

1.1.3.7.6 Example

1.1.3.8.7.1 Structured Text

```
//Create a new Pipe Block
MyGear := MLBlkCreate( 'MyGear', 'GEAR' );
```

1.1.3.9.8.2 Ladder Diagram



1.1.3.10.9.3 Function Block Diagram

1.1.3.11 MLBlkReadOutVal

1.1.3.12.1 Description

Get the output value a selected Pipe Block.

1.1.3.13.2 Arguments

1.1.3.14.3.1 Input

ID

Description	ID number of a created Pipe Block
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.3.15.4.2 Output

Value	**Description**	Current output value of the selected Pipe Block
	Data type	LREAL
	Unit	n/a
	Default	—

1.1.3.16.5 Related Functions

MLBlkReadModPos

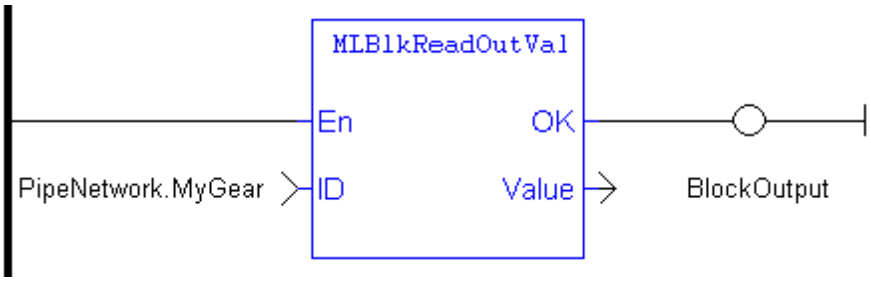
MLBlkCreate

1.1.3.17.6 Example

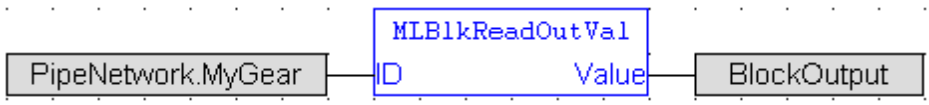
1.1.3.18.7.1 Structured Text

```
//Save the output of a Gear Pipe Block
BlockOutput := MLBlkReadOutVal( PipeNetwork.MyGear );
```

1.1.3.19.8.2 Ladder Diagram



1.1.3.20.9.3 Function Block Diagram



1.1.3.21 MLBlkReadModPos

1.1.3.22.1 Description

Get the value of the period of a block in user units. The output value of a block is reset each time it reaches its period value.

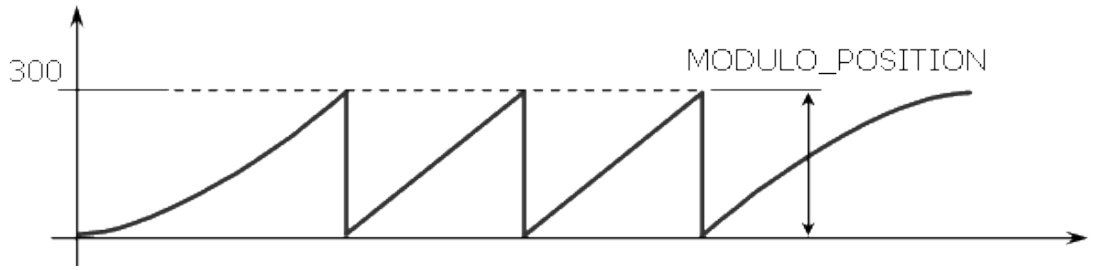


Figure 1-4: MLBlkReadModPos

1.1.3.23.2 Arguments

1.1.3.24.3.1 Input

ID	**Description**	ID number of a created Pipe Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—

1.1.3.25.4.2 Output

ModuloPosition	**Description**	Current Period Value for selected Pipe Block
	Data type	LREAL
	Unit	User unit
	Default	—

1.1.3.26.5 Related Functions

MLBlkWriteModPos

MLBlkCreate

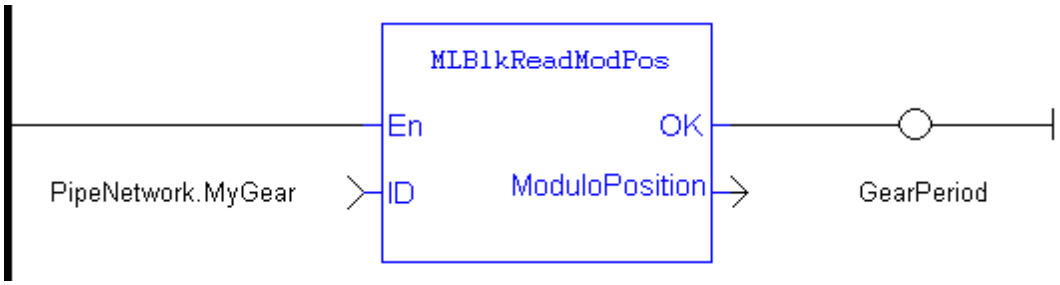
MLBlkReadOutVal

1.1.3.27.6 Example

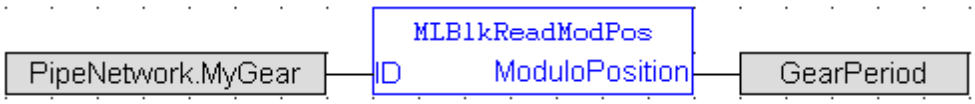
1.1.3.28.7.1 Structured Text

```
//Return and save the Period of a Pipe Block
GearPeriod := MLBlkReadModPos( PipeNetwork.MyGear );
```

1.1.3.29.8.2 Ladder Diagram



1.1.3.30.9.3 Function Block Diagram



1.1.3.31 MLBlkIsReady

1.1.3.32.1 Description

Check if a block is ready. Returns FALSE if the selected Pipe Block has a function running. Returns TRUE if no function of a specified Pipe Block is running.

NOTE Same return value as the .Q output of a specific function itself

1.1.3.33.2 Arguments

1.1.3.34.3.1 Input

ID

Description	ID number of a created Pipe Block
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.3.35.4.2 Output

Default (.Q)

Description	Returns TRUE if no function of a specified Pipe Block is running.
Data type	BOOL
Unit	n/a

1.1.3.36.5.3 Return Type

BOOL

1.1.3.37.6 Related Functions

MLBlkReadOutVal

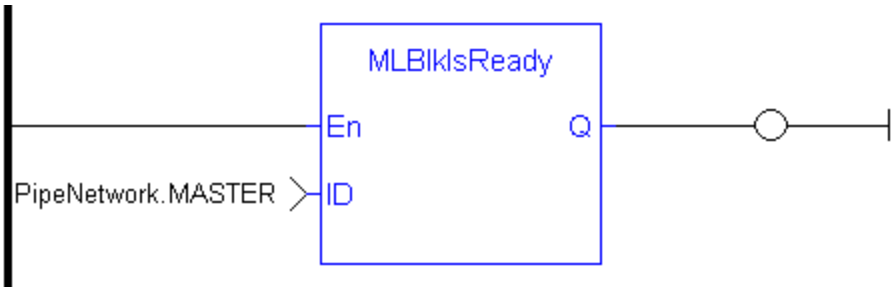
MLBlkReadModPos

1.1.3.38.7 Example

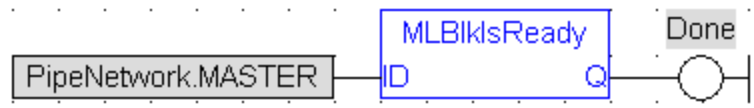
1.1.3.39.8.1 Structured Text

```
//Check if a Pipe Block has a function running
IsReady := MLBlkIsReady( PipeNetwork.MASTER );
```

1.1.3.40.9.2 Ladder Diagram



1.1.3.41.10.3 Function Block Diagram



1.1.3.42 MLBlkWriteModPos

1.1.3.43.1 Description

Set the value of the period of a block in user units. The output value of a block is reset each time it reaches its period value.

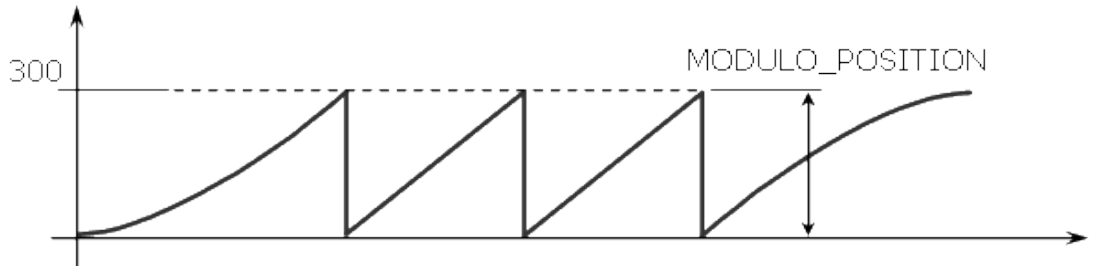


Figure 1-5: MLBlkReadModPos

1.1.3.44.2 Arguments

1.1.3.45.3.1 Input

ID	**Description**	ID number of a created Pipe Block
	Data type	DINT
	Range	[-2147483648, 2147483648]

	Unit	n/a
	Default	—
ModuloPosition	**Description**	Desired new Period Value for selected Pipe Block
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—

1.1.3.46.4.2 Output

Default (.Q)	**Description**	Returns TRUE if the function block executes
	Data type	BOOL
	Unit	n/a

1.1.3.47.5.3 Return Type

BOOL

1.1.3.48.6 Related Functions

MLBlkReadModPos

MLBlkCreate

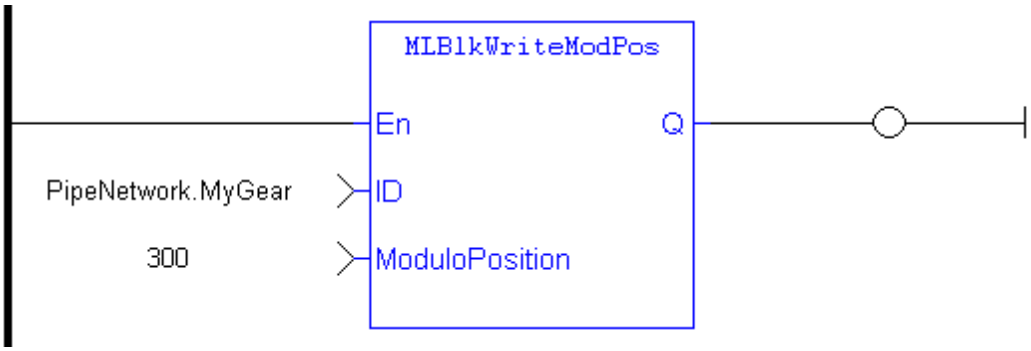
MLBlkReadOutVal

1.1.3.49.7 Example

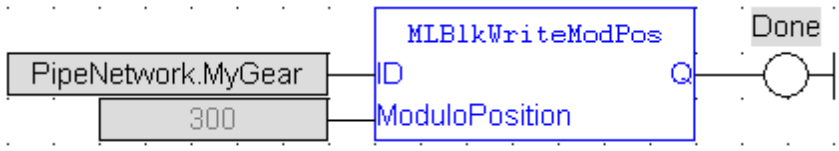
1.1.3.50.8.1 Structured Text

```
//Set the Period of a Pipe Block to 300
MLBlkWriteModPos( PipeNetwork.MyGear, 300 );
```

1.1.3.51.9.2 Ladder Diagram



1.1.3.52.10.3 Function Block Diagram



1.1.4 Motion Library - Adder

Name	Description	Return type
MLAddInit	Initializes an Adder Pipe Block with user-defined settings	BOOL
MLAddReadOff1	Returns the offset value of the first entry of an Adder block	None
MLAddReadOff2	Returns the offset value of the second entry of an Adder block	None
MLAddReadRatio1	Returns the ratio value of the first entry of an Adder block	None
MLAddReadRatio2	Returns the ratio value of the second entry of an Adder block	None
MLAddWriteInput	Sets the source of an input of an adder Pipe Block	BOOL
MLAddWriteOff1	Sets the offset value of the first entry of the Adder block	BOOL
MLAddWriteOff2	Sets the offset value of the second entry of the Adder block	BOOL
MLAddWriteRat1	Sets the ratio value of the first entry of the Adder block	BOOL
MLAddWriteRat2	Sets the ratio value of the second entry of the Adder block	BOOL

1.1.4.1 MLAddInit

1.1.4.2.1 Description

Initializes an Adder Pipe Block for use in a PLC Program. Function block is automatically called if an Adder Block is added to the Pipe Network, with user-defined settings entered in the Pipe Blocks Properties screen.

The Pipe Block is assigned ratios and offsets for both inputs. After an Adder block is initialized, the inputs still need to be selected using the MLAddWriteInput function block or graphically using the Pipe Network.

Adder Block Output = Ratio1*Input1 + Offset1 + Ratio2*Input2 + Offset2

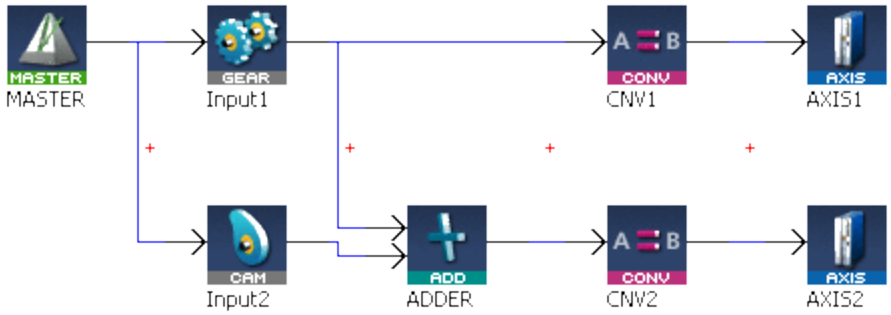


Figure 1-6: MLAddInit

> **NOTE** Adder objects are normally created in the Pipe Network using the graphical engine. Then you do not have to add MLAddInit function blocks to their programs. Parameters are entered directly in pop-up windows, and the code is then automatically added to the current project.

1.1.4.3.2 Arguments

1.1.4.4.3.1 Input

BlockID	**Description**	ID number of a created Pipe Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
Ratio1	**Description**	Sets the Ratio value of the first entry of an Adder object
	Data type	LREAL
	Range	—
	Unit	n/a
	Default	—
Offset1	**Description**	Sets the Offset value of the first entry of an Adder object
	Data type	LREAL
	Range	—
	Unit	n/a
	Default	—
Ratio2	**Description**	Sets the Ratio value of the second entry of an Adder object
	Data type	LREAL
	Range	—
	Unit	n/a
	Default	—

Offset2	**Description**	Sets the Offset value of the second entry of an Adder object
	Data type	LREAL
	Range	—
	Unit	n/a
	Default	—

1.1.4.5.4.2 Output

Default (.Q)	**Description**	Returns TRUE if the Adder Pipe Block is initialized
	Data type	BOOL
	Unit	n/a

1.1.4.6.5.3 Return Type

BOOL

1.1.4.7.6 Related Functions

MLBlkCreate

MLAddWriteInput

MLAddReadOff1

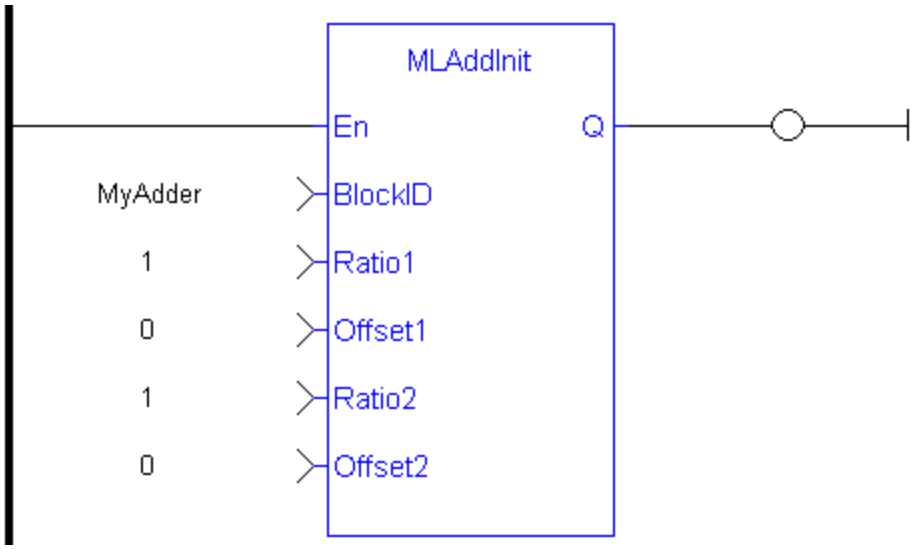
MLAddReadRatio1

1.1.4.8.7 Example

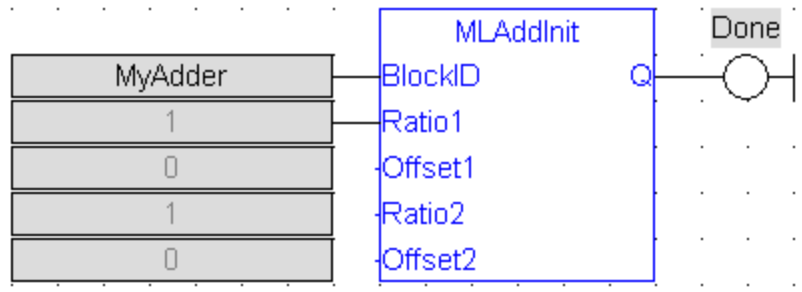
1.1.4.9.8.1 Structured Text

```
//Create and Initiate a Trigger object
MyAdder := MLBlkCreate( 'MyAdder', 'ADDER' );
MLAddInit( MyAdder, 1.0, 0.0, 1.0, 0.0 );
```

1.1.4.10.9.2 Ladder Diagram



1.1.4.11.10.3 Function Block Diagram



1.1.4.12 MLAddReadOff1

1.1.4.13.1 Description

Returns the offset value of the first entry of an Adder block. Can change the offset value with MLAddWriteOff1 function block. Offset1 shifts the value of the first input to the block before its added to the second input.

Adder Block Output = Ratio1*Input1 + Offset1 + Ratio2*Input2 + Offset2

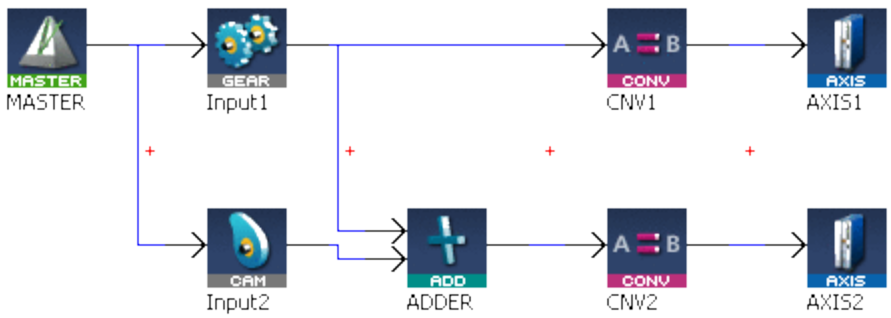


Figure 1-7: MLAddReadOff1

1.1.4.14.2 Arguments

1.1.4.15.3.1 Input

BlockID

Description	ID number of an initiated Adder object
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.4.16.4.2 Output

Offset

Description	Returns the offset value of the first entry of an Adder object
Data type	LREAL
Unit	n/a

1.1.4.17.5 Related Functions

MLAddWriteOff1

MLAddReadOff2

MLAddReadRatio1

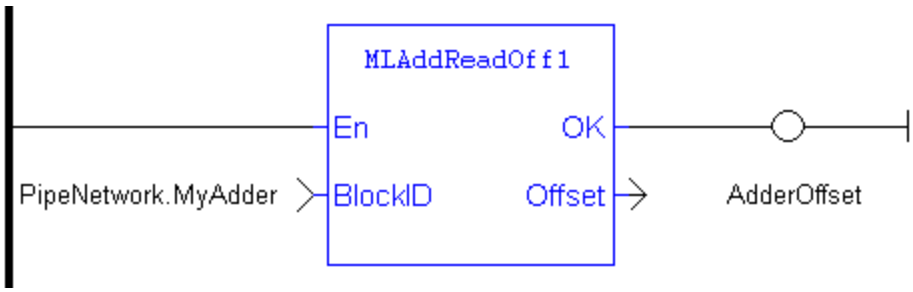
MLAddWriteRat1

1.1.4.18.6 Example

1.1.4.19.7.1 Structured Text

```
//Save the offset value of first entry to the Adder block
AdderOffset := MLAddReadOff1( PipeNetwork.MyAdder );
```

1.1.4.20.8.2 Ladder Diagram



1.1.4.21.9.3 Function Block Diagram

1.1.4.22 MLAddReadOff2

1.1.4.23.1 Description

Returns the offset value of the second entry of an Adder block. Can change the offset value with MLAddWriteOff2 function block. Offset2 shifts the value of the second input to the block before its added to the first input.

Adder Block Output = Ratio1*Input1 + Offset1 + Ratio2*Input2 + Offset2

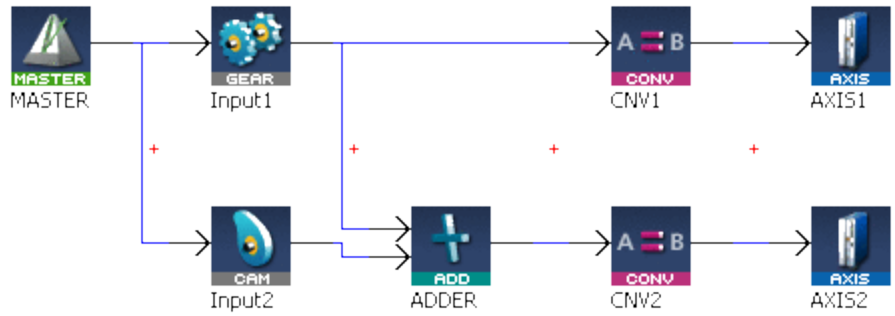


Figure 1-8: MLAddReadOff2

1.1.4.24.2 Arguments

1.1.4.25.3.1 Input

BlockID

Description	ID number of an initiated Adder object
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.4.26.4.2 Output

Offset

Description	Returns the offset value of the second entry of an Adder object
Data type	LREAL
Unit	n/a

1.1.4.27.5 Related Functions

MLAddWriteOff2

MLAddReadOff1

MLAddReadRatio2

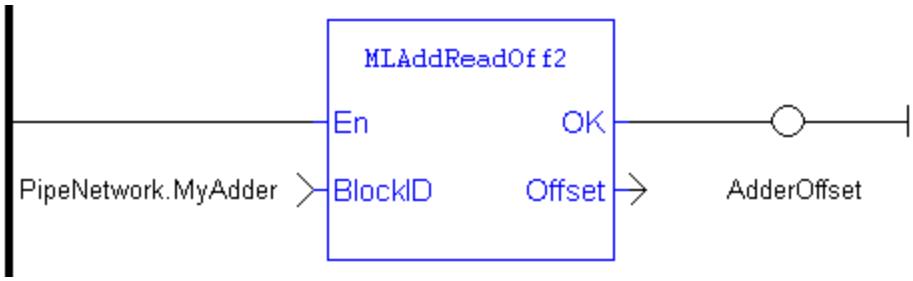
MLAddWriteRat2

1.1.4.28.6 Example

1.1.4.29.7.1 Structured Text

```
//Save the offset value of second entry to the Adder block
AdderOffset := MLAddReadOff2( PipeNetwork.MyAdder );
```

1.1.4.30.8.2 Ladder Diagram



1.1.4.31.9.3 Function Block Diagram

1.1.4.32 MLAddReadRatio1

1.1.4.33.1 Description

Returns the ratio value of the first entry of an Adder block. Can change the ratio value with MLAddWriteRat1 function block. Ratio1 amplifies the value of the first input to the block before its added to the second input.

Adder Block Output = Ratio1*Input1 + Offset1 + Ratio2*Input2 + Offset2

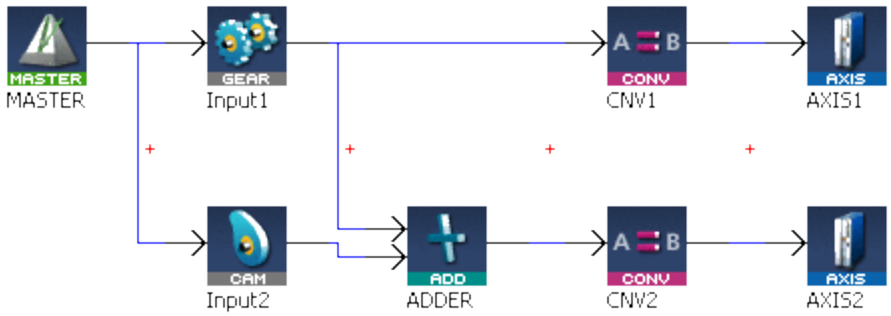


Figure 1-9: MLAddReadRatio1

1.1.4.34.2 Arguments

1.1.4.35.3.1 Input

BlockID **Description** ID number of an initiated Adder object

Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.4.36.4.2 Output

Ratio

Description	Returns the Ratio value of the first entry of an Adder object
Data type	LREAL
Unit	n/a

1.1.4.37.5 Related Functions

MLAddWriteRat1

MLAddReadRatio2

MLAddReadOff1

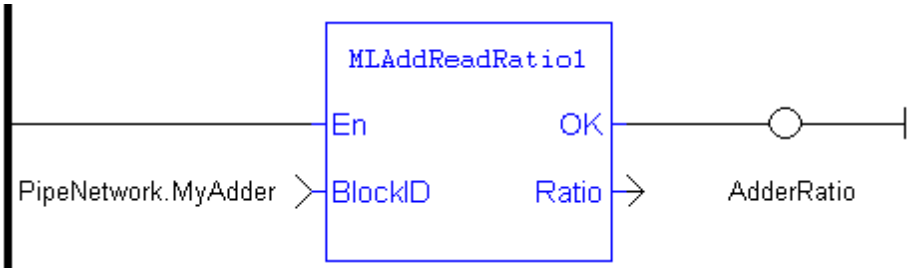
MLAddReadOff2

1.1.4.38.6 Example

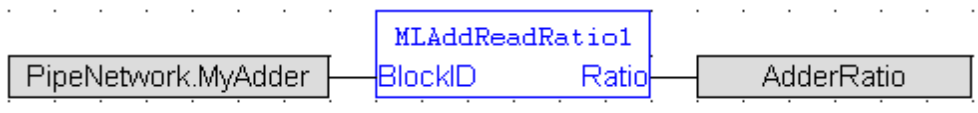
1.1.4.39.7.1 Structured Text

```
//Save the ratio value of first entry to the Adder block
AdderRatio := MLAddReadRatio1( PipeNetwork.MyAdder );
```

1.1.4.40.8.2 Ladder Diagram



1.1.4.41.9.3 Function Block Diagram



1.1.4.42 MLAddReadRatio2

1.1.4.43.1 Description

Returns the ratio value of the second entry of an Adder block. Can change the ratio value with MLAddWriteRat2 function block. Ratio2 amplifies the value of the second input to the block

before its added to the first input.

Adder Block Output = Ratio1*Input1 + Offset1 + Ratio2*Input2 + Offset2

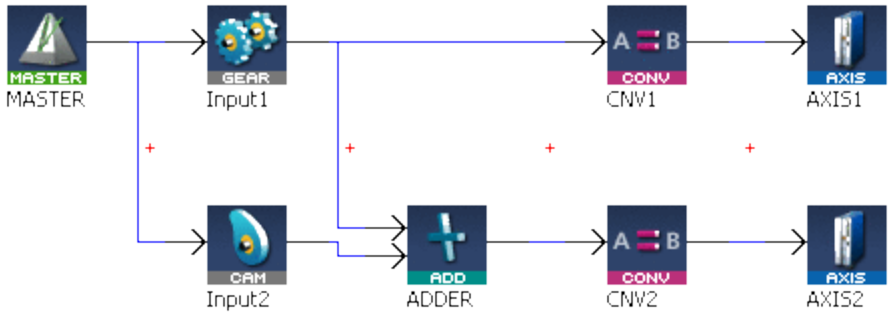


Figure 1-10: MLAddReadRatio2

1.1.4.44.2 Arguments

1.1.4.45.3.1 Input

BlockID

Description	ID number of an initiated Adder object
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.4.46.4.2 Output

Ratio

Description	Returns the Ratio value of the second entry of an Adder object
Data type	LREAL
Unit	n/a

1.1.4.47.5 Related Functions

MLAddWriteRat2

MLAddReadRatio1

MLAddReadOff1

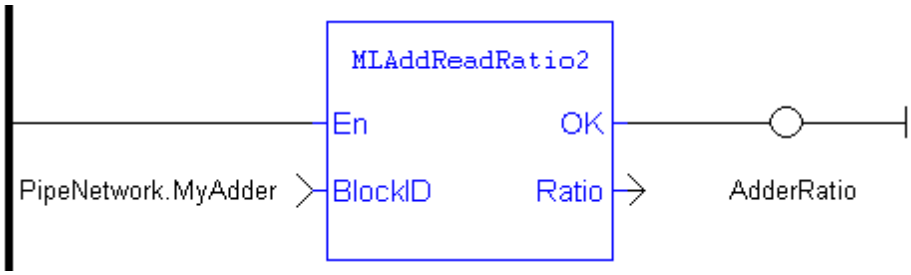
MLAddReadOff2

1.1.4.48.6 Example

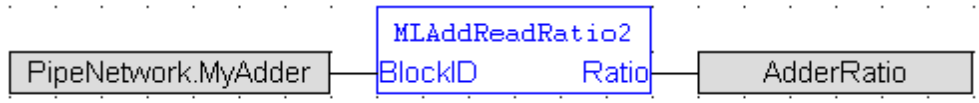
1.1.4.49.7.1 Structured Text

```
//Save the ratio value of second entry to the Adder block
AdderRatio := MLAddReadRatio2( PipeNetwork.MyAdder );
```

1.1.4.50.8.2 Ladder Diagram



1.1.4.51.9.3 Function Block Diagram



1.1.4.52 MLAddWriteInput

1.1.4.53.1 Description

Sets the source of an input of an adder Pipe Block. Function block is automatically called if an Adder Block is connected to other blocks in the Pipe Network.

Adder Block Output = Ratio1*Input1 + Offset1 + Ratio2*Input2 + Offset2

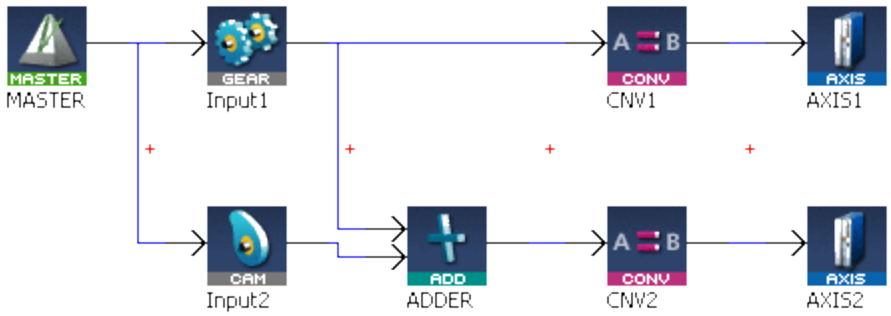


Figure 1-11: MLAddWriteInput

> **NOTE** Adder objects are normally created in the Pipe Network using the graphical engine. Then you do not have to add MLAddWriteInput function blocks to their programs. Blocks are connected with lines in the Pipe Network, and the code is then automatically added to the current project.

1.1.4.54.2 Arguments

1.1.4.55.3.1 Input

BlockID

Description	ID number of an initiated Adder object
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a

	Default	—
InputID	**Description**	Select first or second input to the Adder object
	Data type	DINT
	Range	[1, 2]
	Unit	n/a
	Default	—
InputBlockID	**Description**	ID number of an initiated Pipe Block which is an input to the Adder object
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—

1.1.4.56.4.2 Output

Default (.Q)	**Description**	Returns TRUE if the input to the Adder object is set
	Data type	BOOL
	Unit	n/a

1.1.4.57.5.3 Return Type

BOOL

1.1.4.58.6 Related Functions

MLBlkCreate

MLAddInit

MLAddReadOff1

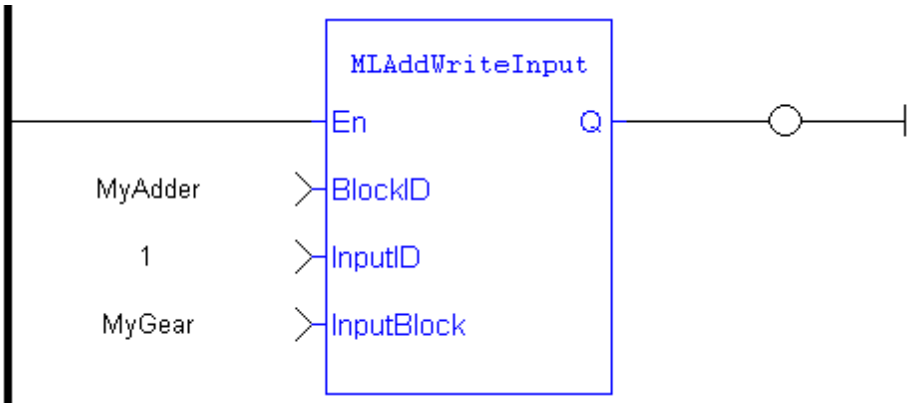
MLAddReadRatio1

1.1.4.59.7 Example

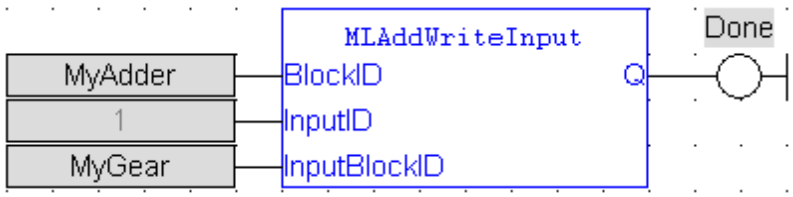
1.1.4.60.8.1 Structured Text

```
//Set the inputs to an Adder object
MLAddWriteInput( MyAdder, 1, GEAR );
DoneGEAR :=TRUE;
MLAddWriteInput( MyAdder, 2, CAM );
DoneCAM :=TRUE;
```

1.1.4.61.9.2 Ladder Diagram



1.1.4.62.10.3 Function Block Diagram



1.1.4.63 MLAddWriteOff1

1.1.4.64.1 Description

Set the offset value of the first entry of the Adder block. Offset1 shifts the value of the first input to the block before its added to the second input.

Adder Block Output = Ratio1*Input1 + Offset1 + Ratio2*Input2 + Offset2

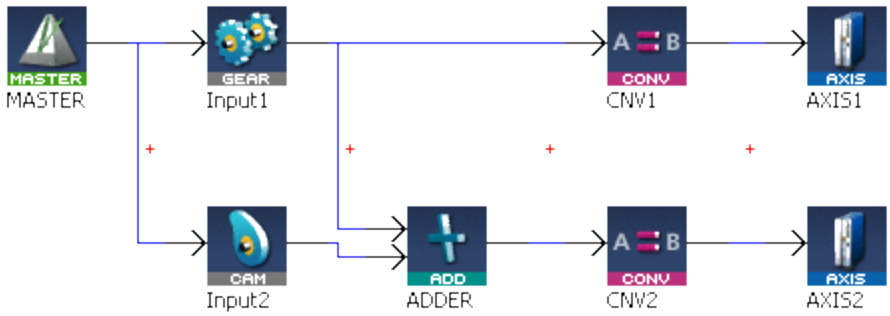


Figure 1-12: MLAddWriteOff1

IMPORTANT Changes made to the Offset of an Adder block are executed immediately and can cause an axis position to jump.

1.1.4.65.2 Arguments

1.1.4.66.3.1 Input

BlockID

Description ID number of an initiated Adder object

Data type DINT

	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
Offset	**Description**	Desired new value for the Adder Object's Offset1
	Data type	LREAL
	Range	—
	Unit	n/a
	Default	—

1.1.4.67.4.2 Output

Default (.Q)	**Description**	Returns TRUE if the Offset value for input one is set
	Data type	BOOL
	Unit	n/a

1.1.4.68.5.3 Return Type

BOOL

1.1.4.69.6 Related Functions

MLAddReadOff1

MLAddWriteOff2

MLAddReadRatio1

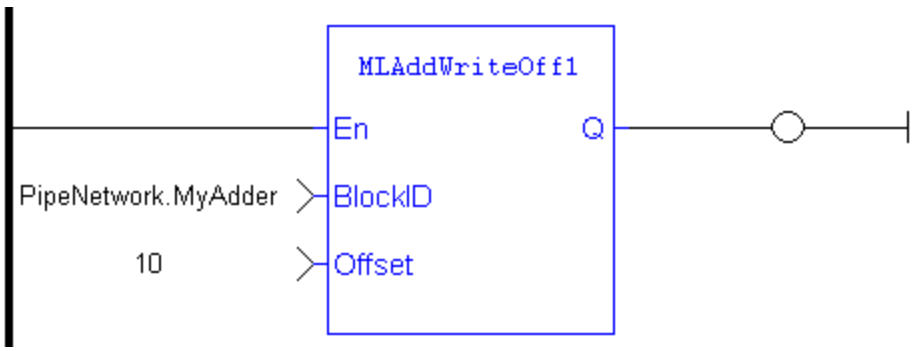
MLAddWriteRat1

1.1.4.70.7 Example

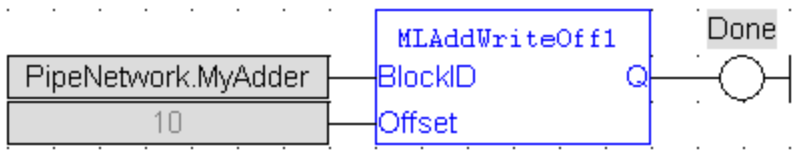
1.1.4.71.8.1 Structured Text

```
//Change the offset value of first entry to the Adder block to
10

MLAddWriteOff1( PipeNetwork.MyAdder, 10 );
```

1.1.4.72.9.2 Ladder Diagram



1.1.4.73.10.3 Function Block Diagram



1.1.4.74 MLAddWriteOff2

1.1.4.75.1 Description

Set the offset value of the second entry of the Adder block. Offset2 shifts the value of the second input to the block before its added to the first input.

Adder Block Output = Ratio1*Input1 + Offset1 + Ratio2*Input2 + Offset2

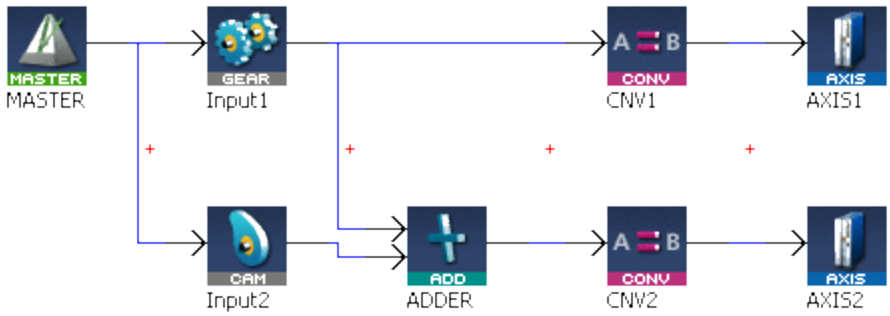


Figure 1-13: MLAddWriteOff2

IMPORTANT Changes made to the Offset of an Adder block are executed immediately and can cause an axis position to jump.

1.1.4.76.2 Arguments

1.1.4.77.3.1 Input

BlockID	**Description**	ID number of an initiated Adder object
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
Offset	**Description**	Desired new value for the Adder Object's Offset2
	Data type	LREAL
	Range	—
	Unit	n/a
	Default	—

1.1.4.78.4.2 Output

Default (.Q)	**Description**	Returns TRUE if the Offset value for input two is set
	Data type	BOOL
	Unit	n/a

1.1.4.79.5.3 Return Type

BOOL

1.1.4.80.6 Related Functions

MLAddReadOff2

MLAddWriteOff1

MLAddReadRatio2

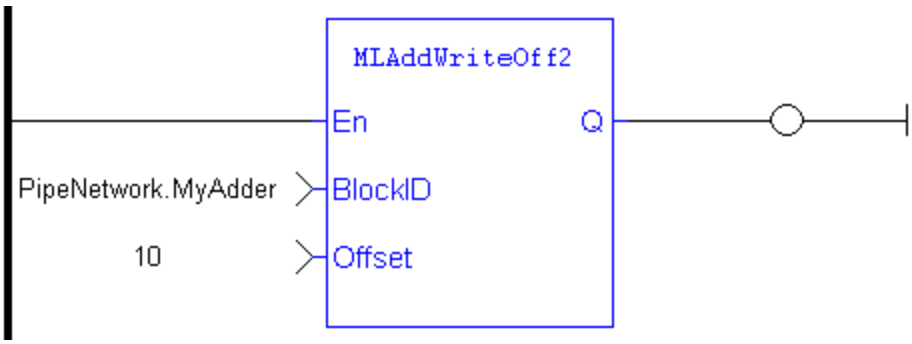
MLAddWriteRat2

1.1.4.81.7 Example

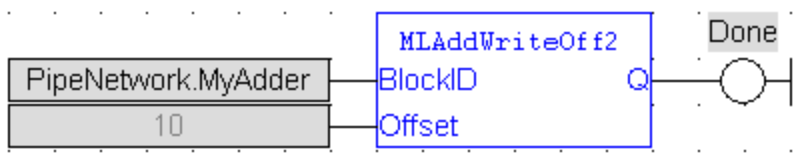
1.1.4.82.8.1 Structured Text

```
//Change the offset value of second entry to the Adder block
to 10

MLAddWriteOff2( PipeNetwork.MyAdder, 10 );
```

1.1.4.83.9.2 Ladder Diagram



1.1.4.84.10.3 Function Block Diagram



1.1.4.85 MLAddWriteRat1

1.1.4.86.1 Description

Set the ratio value of the first entry of the Adder block. Ratio1 amplifies the value of the first input to the block before its added to the second input.

Adder Block Output = Ratio1*Input1 + Offset1 + Ratio2*Input2 + Offset2

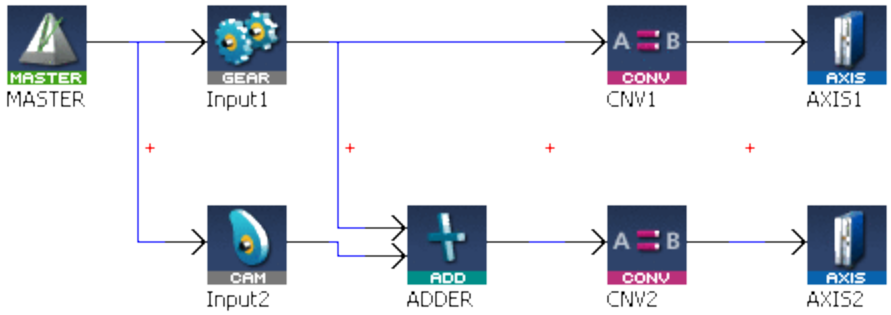


Figure 1-14: MLAddWriteRat1

IMPORTANT Changes made to the Ratio of an Adder block are executed immediately and can cause an axis position to jump.

1.1.4.87.2 Arguments

1.1.4.88.3.1 Input

BlockID	**Description**	ID number of an initiated Adder object
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
Ratio	**Description**	Desired new value for the Adder Object's Ratio1
	Data type	LREAL
	Range	—
	Unit	n/a
	Default	—

1.1.4.89.4.2 Output

Default (.Q)	**Description**	Returns TRUE if the Ratio value for input one is set
	Data type	BOOL
	Unit	n/a

1.1.4.90.5.3 Return Type

BOOL

1.1.4.91.6 Related Functions

MLAddReadRatio1

MLAddWriteRat2

MLAddReadOff1

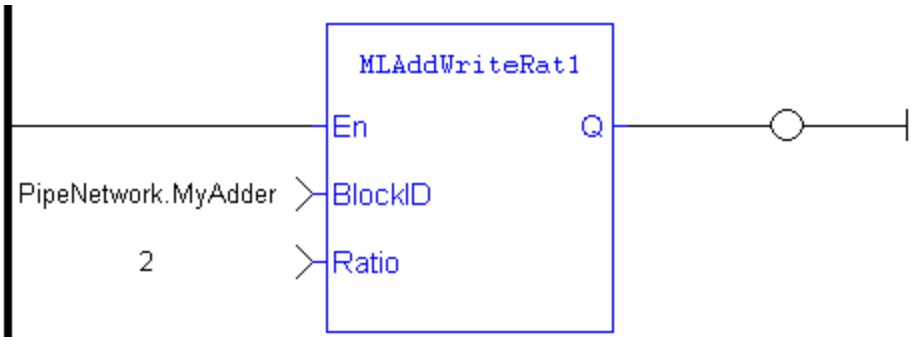
MLAddWriteOff1

1.1.4.92.7 Example

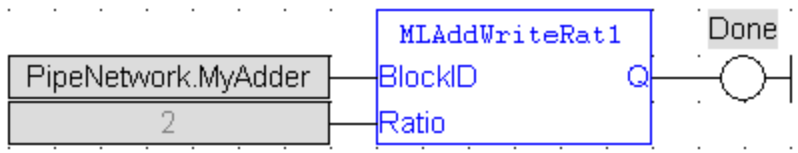
1.1.4.93.8.1 Structured Text

```
//Change the ratio value of first entry to the Adder block to
2

MLAddWriteRat1( PipeNetwork.MyAdder, 2 );
```

1.1.4.94.9.2 Ladder Diagram



1.1.4.95.10.3 Function Block Diagram



1.1.4.96 MLAddWriteRat2

1.1.4.97.1 Description

Set the ratio value of the second entry of the Adder block. Ratio2 amplifies the value of the second input to the block before its added to the first input.

Adder Block Output = Ratio1*Input1 + Offset1 + Ratio2*Input2 + Offset2

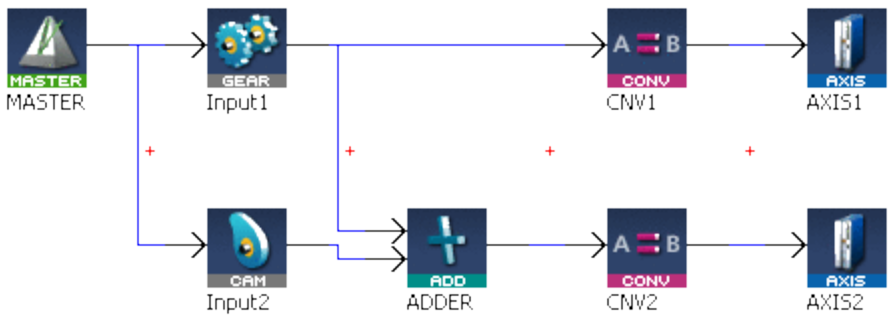


Figure 1-15: MLAddWriteRat2\

IMPORTANT Changes made to the Ratio of an Adder block are executed immediately

IMPORTANT and can cause an axis position to jump.

1.1.4.98.2 Arguments

1.1.4.99.3.1 Input

BlockID	**Description**	ID number of an initiated Adder object
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
Ratio	**Description**	Desired new value for the Adder Object's Ratio2
	Data type	LREAL
	Range	—
	Unit	n/a
	Default	—

1.1.4.100.4.2 Output

Default (.Q)	**Description**	Returns TRUE if the Ratio value for input two is set
	Data type	BOOL
	Unit	n/a

1.1.4.101.5.3 Return Type

BOOL

1.1.4.102.6 Related Functions

MLAddReadRatio2

MLAddWriteRat1

MLAddReadOff2

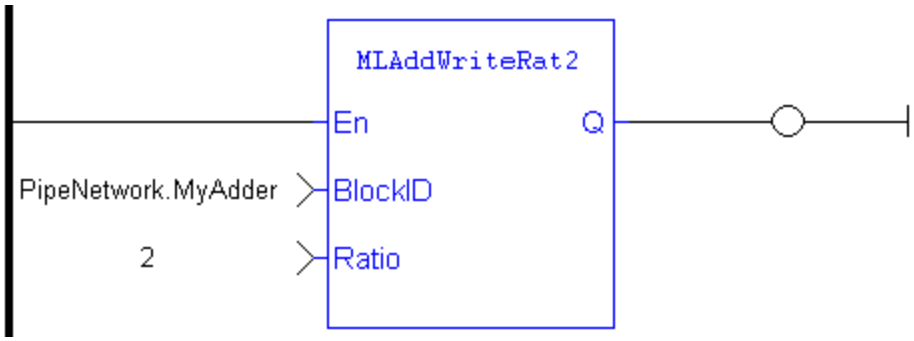
MLAddWriteOff2

1.1.4.103.7 Example

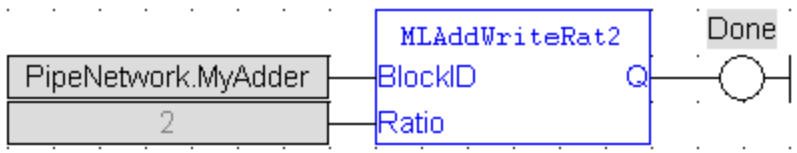
1.1.4.104.8.1 Structured Text

```
//Change the ratio value of second entry to the Adder block to
2

MLAddWriteRat2 ( PipeNetwork.MyAdder, 2 );
```

1.1.4.105.9.2 Ladder Diagram



1.1.4.106.10.3 Function Block Diagram



1.1.5 Motion Library - Axis

TIP For usage example about Axis Functions, click here...

Function sorted by types:

Power Stage	Motion Control	Inquiry Functions	Position setting
MLAxisPower	MLAxisAbs	MLAxisGenPos	
MLAxisPowerDOff	MLAxisAdd	MLAxisPipePos	MLAxisReAlign
	MLAxisMoveVel	MLAxisCmdPos	
	MLAxisRel	MLAxisReadActPos	
	MLAxisStop	MLAxisFBackPos	
		MLAxisStatus	
		MLAxisReadGenStatus	
		MLAxisGenIsRdy	
		MLAxisTimeStamp	

Functions sorted in alphabetical order:

Name	Description	Return type
MLAxisAbs	Performs a move to an absolute position	BOOL
MLAxisAdd	Performs an additive move relative for a specified distance from the endpoint of the previous move	BOOL
MLAxisAddress	Returns the motion bus address of the axis	DINT
MLAxisAddTq	Sets additive torque	BOOL

Name	Description	Return type
MLAxisCfgFastIn	Initializes the Fast Input capability for the axis	BOOL
MLAxisCmdPos	Returns the reference position of the axis	None
MLAxisCreate	Creates a new axis object	None
MLAxisFBackPos	Returns the feedback position of the axis	None
MLAxisGenEN	Enables or disables the internal TMP generator of the axis	BOOL
MLAxisGenIsEN	Checks if the internal TMP generator of the axis is enabled	BOOL
MLAxisGenIsRdy	Checks if an axis is ready	BOOL
MLAxisGenPos	Returns the generator position of the axis	None
MLAxisGenReadAcc	Gets the acceleration of the internal generator of an axis	None
MLAxisGenReadDec	Gets the deceleration of the internal generator of an axis	None
MLAxisGenReadSpd	Gets the speed of the internal generator of an axis	None
MLAxisGenWriteAcc	Sets the acceleration of the internal generator of an axis	BOOL
MLAxisGenWriteDec	Sets the deceleration of the internal generator of an axis	BOOL
MLAxisGenWriteSpd	Sets the speed of the internal generator of an axis	BOOL
MLAxisInit	Initializes an axis object	BOOL
MLAxisIsCnctd	Checks if a pipe is currently connected to the axis	BOOL
MLAxisIsTrigged	Checks if the axis got a trigger event	BOOL
MLAxisMoveVel	Jogs at the specified speed	BOOL
MLAxisPipePos	Returns the pipe position of the axis	None
MLAxisPower	Powers up the axis. Enables Axis Servo Drive.	BOOL
MLAxisPowerDOff	Returns the adjustment of position done by the last power on to avoid bumps	None
MLAxisRatedTq	Sets rated motor torque	BOOL
MLAxisRead2ndFB	Read secondary feedback	None
MLAxisReadActPos	Returns the actual position of the axis	None
MLAxisReadFBUnit	Gets the feedback units per revolution value of the axis	None
MLAxisReadFEUU	Read following error in user units	None

Name	Description	Return type
MLAxisReadGenStatus	Returns the status of the internal generator of the axis	DINT
MLAxisReadModPos	Get the value period of the axis	None
MLAxisReadTq	Read actual torque	None
MLAxisReadUUnits	Get the user units per revolution value of the axis	None
MLAxisReadVel	Read actual velocity	None
MLAxisReAlgnRdy	Checks if an axis is ready. Returns TRUE if the internal realignment axis is ready.	BOOL
MLAxisReAlign	Realigns the actual position with the reference position by moving the axis by the specified delta position	BOOL
MLAxisRel	Performs a relative move for a specified distance from the current position	BOOL
MLAxisResetErrors	Clears errors of the specified axis	BOOL
MLAxisRstFastIn	Resets the Fast Input	BOOL
MLAxisStatus	Returns the status of the axis	DINT
MLAxisStop	Stop with the specified deceleration	None
MLAxisTimeStamp	Returns the timestamp of the triggered axis	DINT
MLAxisWriteModPos	Sets the value period of the axis	BOOL
MLAxisWritePipPos	Forces the pipe position internal value. This function is working only when no pipe is connected.	BOOL
MLAxisWritePos	Sets the logical zero position of an axis	BOOL
MLAxisWriteUUnits	Sets the user units per revolution value of the axis	BOOL

1.1.6 Motion Library - Cam Profile

Name	Description	Return type
MLCamInit	Initializes a cam Pipe Block with user-defined settings	BOOL
MLCamSwitch	Switches profiles of the selected cam object	BOOL
MLPrfReadIOffset	Returns the Input Offset value of a selected cam profile	None
MLPrfReadIScale	Returns the Input Ratio value of a selected cam profile	None
MLPrfReadOOffset	Returns the Output Offset value of a selected cam profile	None

Name	Description	Return type
MLPrfReadOScale	Returns the Output Ratio value of a selected cam profile	None
MLPrfWriteIOffset	Sets the Input Offset value of a selected cam profile	BOOL
MLPrfWriteIScale	Sets the Input Ratio value of a selected cam profile	BOOL
MLPrfWriteOOffset	Sets the Output Offset value of a selected cam profile	BOOL
MLPrfWriteOScale	Sets the Output Ratio value of a selected cam profile	BOOL
MLProfileBuild	Builds a cam profile from application data	See Output
MLProfileCreate	Creates a new cam profile object	None
MLProfileInit	Initializes a previously created cam profile object	BOOL
MLProfileRelease	Removes a Profile so the Profile ID may be used by a different or new Profile.	See Output

1.1.7 Motion Library - Comparator

TIP For usage example about Comparator Functions, see page 83

Name	Description	Return type
MLCompCheck	Checks if the reference of a comparator Pipe Block has been crossed. Returns TRUE if the reference has been crossed	BOOL
MLCompInit	Initializes a comparator Pipe Block with user-defined settings	BOOL
MLCompReadRef	Returns the reference position of a comparator block	None
MLCompReset	Clears the Transition Flag of a comparator Pipe Block	BOOL
MLCompWriteRef	Sets the reference position of a comparator block	BOOL

1.1.7.1 MLCompCheck

1.1.7.2.1 Description

Check if the reference of a comparator Pipe Block has been crossed. Returns the Transition Flag of a comparator object, which turns TRUE if the input position to the comparator is greater or equal to the reference. The Comparator Transition Flag stays TRUE until it is reset.

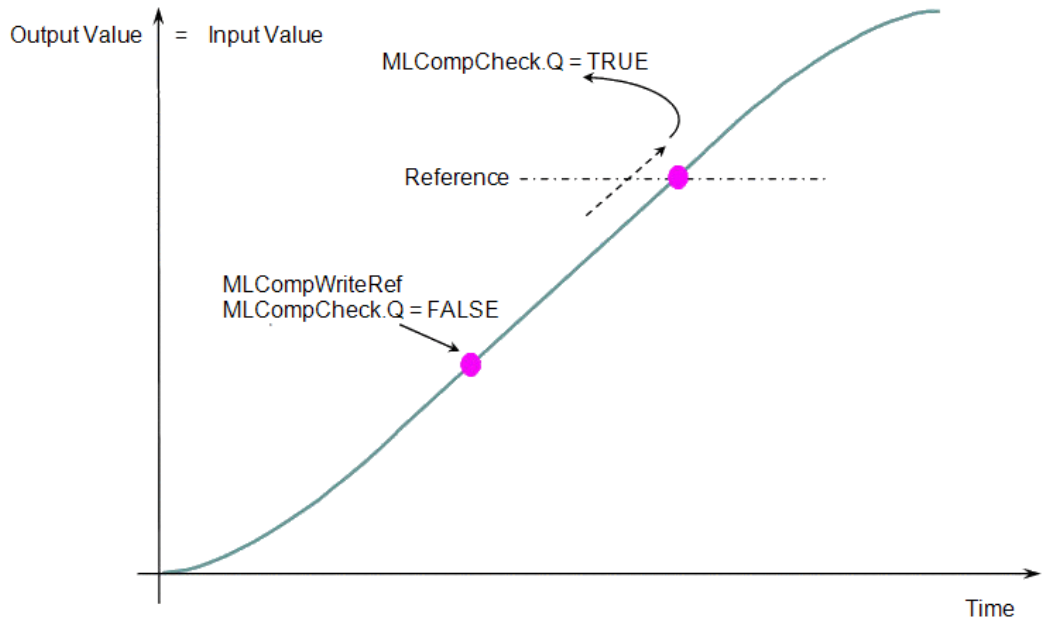


Figure 1-16: MLCompCheck

1.1.7.3.2 Arguments

1.1.7.4.3.1 Input

BlockID

Description	ID number of an initiated Comparator object
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.7.5.4.2 Output

Default (.Q)

Description	Returns TRUE if reference position of the Comparator object has been crossed
Data type	BOOL
Unit	n/a

1.1.7.6.5.3 Return Type

BOOL

1.1.7.7.6 Related Functions

MLCompReset

MLCompWriteRef

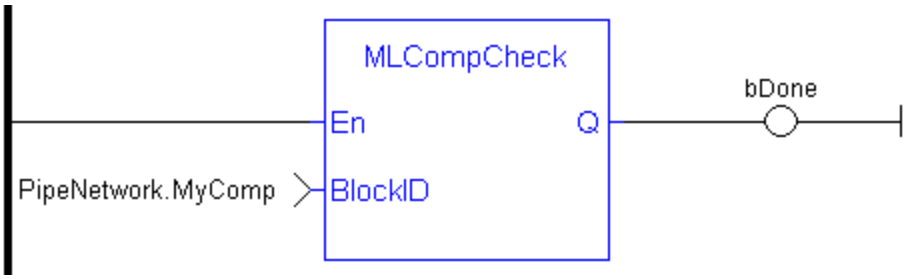
MLCompReadRef

1.1.7.8.7 Example

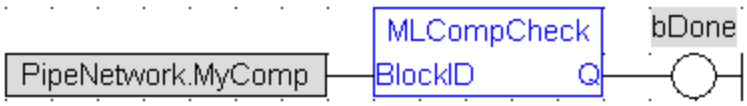
1.1.7.9.8.1 Structured Text

```
//Check if Comparator Reference has been reached
bCrossed := MLCompCheck( PipeNetwork.MyComp );
```

1.1.7.10.9.2 Ladder Diagram



1.1.7.11.10.3 Function Block Diagram



1.1.7.12 MLCompInit

1.1.7.13.1 Description

Initializes a comparator Pipe Block for use in a PLC Program. Function block is automatically called if a Comparator Block is added to the Pipe Network, with user-defined settings entered in the Pipe Blocks Properties screen.

The Transition Flag of a comparator object turns TRUE if the input position to the comparator is greater or equal to the reference. The Comparator Transition Flag stays TRUE until it is reset.

If the input ThroughZero is set to TRUE, system must cross zero and then the reference position before the Transition Flag is set. If ThroughZero is FALSE, Transition Flag is set immediately if the input pipe position is greater or equal to the Reference value.

NOTE Comparator objects are normally created in the Pipe Network using the graphical engine. Then you do not have to add MLCompInit function blocks to their programs. Parameters are entered directly in pop-up windows, and the code is then automatically added to the current project.

1.1.7.14.2 Arguments

1.1.7.15.3.1 Input

BlockID	Description	ID number of a created Comparator Pipe Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
ModuloPosition	Description	Value of the period of a cyclic system
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—
ThroughZero	Description	When TRUE, system must cross zero and then the reference position before the Transition Flag is set. If FALSE, Transition Flag is set immediately if the input pipe position is greater then or equal to the Reference value.
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Reference	Description	Set the reference position in the new Comparator object
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—

1.1.7.16.4.2 Output

Default (.Q)	Description	Returns TRUE when function starts to execute
	Data type	BOOL
	Unit	n/a

1.1.7.17.5.3 Return Type

BOOL

1.1.7.18.6 Related Functions

MLBlkCreate

MLCompCheck

MLCompReset

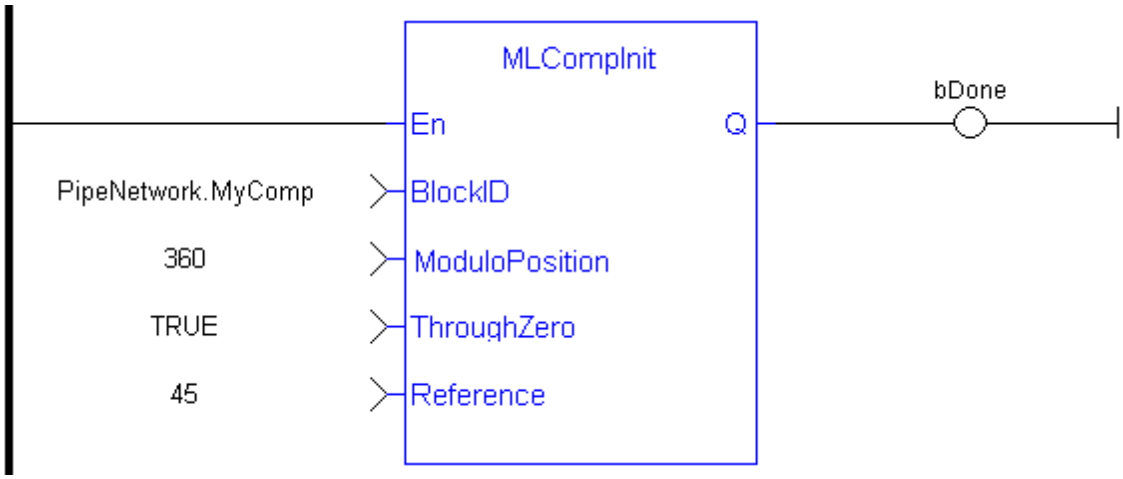
MLCompWriteRef

1.1.7.19.7 Example

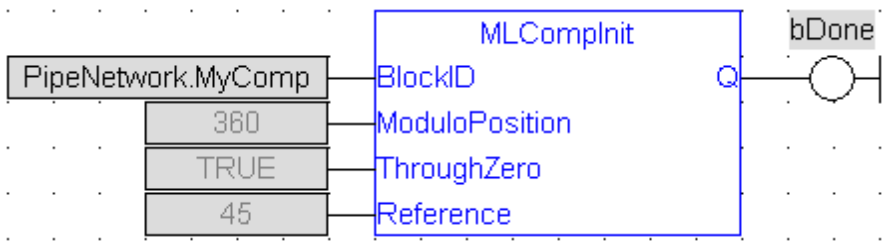
1.1.7.20.8.1 Structured Text

```
//Create and Initiate a Trigger object
MyComp := MLBlkCreate( 'MyComp', 'COMPARATOR' );
MLCompInit( MyComp, 360.0, TRUE, 45.0 );
```

1.1.7.21.9.2 Ladder Diagram



1.1.7.22.10.3 Function Block Diagram



1.1.7.23 MLCompReadRef

1.1.7.24.1 Description

Returns the reference position of a comparator block. The Transition Flag of a comparator object turns TRUE if the input position to the comparator is greater or equal to the reference. The Comparator Transition Flag stays TRUE until it is reset.

1.1.7.25.2 Arguments

1.1.7.26.3.1 Input

BlockID

Description	ID number of an initiated Comparator object
Data type	DINT

Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.7.27.4.2 Output

Reference

Description	Returns the current reference position of the Comparator object
Data type	LREAL
Unit	User unit

1.1.7.28.5 Related Functions

MLCompWriteRef

MLCompReset

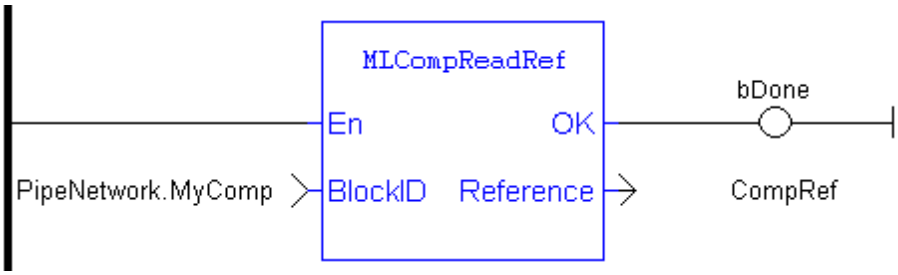
MLCompCheck

1.1.7.29.6 Example

1.1.7.30.7.1 Structured Text

```
//Return the Comparator Reference value
CompRef := MLCompReadRef( PipeNetwork.MyComp );
```

1.1.7.31.8.2 Ladder Diagram



1.1.7.32.9.3 Function Block Diagram

1.1.7.33 MLCompReset

1.1.7.34.1 Description

Clear the Transition Flag of a comparator Pipe Block. The Transition Flag of a comparator object turns TRUE if the input position to the comparator is greater or equal to the reference. The Comparator Transition Flag stays TRUE until it is reset.

1.1.7.35.2 Arguments

1.1.7.36.3.1 Input

BlockID

Description	ID number of an initiated Comparator object
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.7.37.4.2 Output

Default (.Q)

Description	Returns TRUE when function starts to execute
Data type	BOOL
Unit	n/a

1.1.7.38.5.3 Return Type

BOOL

1.1.7.39.6 Related Functions

MLCompCheck

MLCompReadRef

MLCompWriteRef

1.1.7.40.7 Example

1.1.7.41.8.1 Structured Text

```
//Clear the Transition Flag of a Comparator object
MLCompReset( PipeNetwork.MyComp );
```

1.1.7.42.9.2 Ladder Diagram

1.1.7.43.10.3 Function Block Diagram

1.1.7.44 MLCompWriteRef

1.1.7.45.1 Description

Set the reference position of a comparator block. The Transition Flag of a comparator object turns TRUE if the input position to the comparator is greater or equal to the reference. The Comparator Transition Flag stays TRUE until it is reset.

If the input ThroughZero is set to TRUE, system must cross zero and then the reference position before the Transition Flag is set. If ThroughZero is FALSE, Transition Flag is set immediately if the input pipe position is greater then or equal to the Reference value.

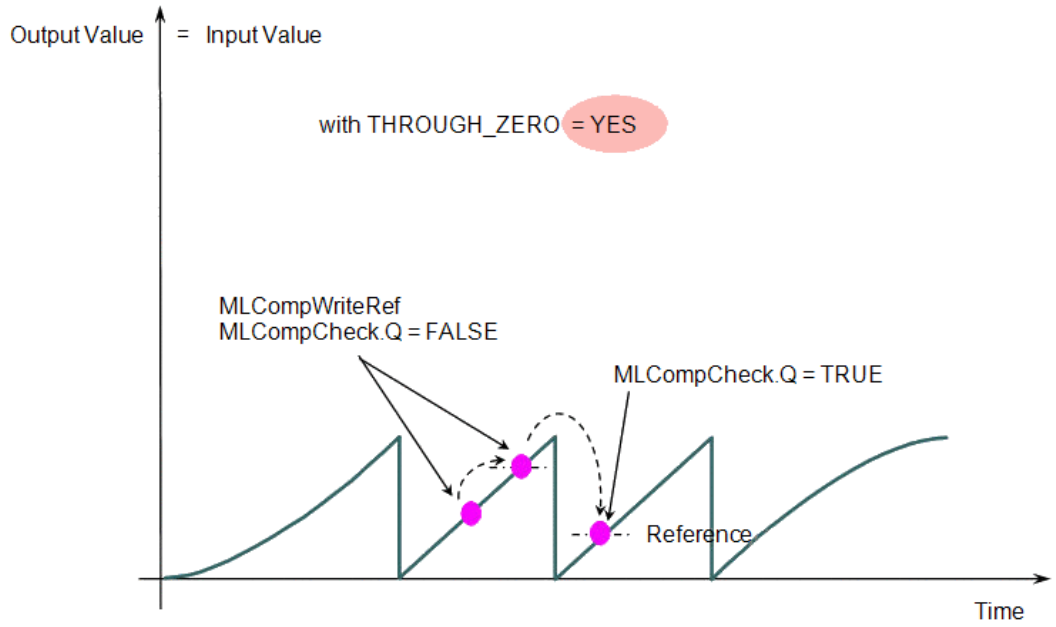


Figure 1-17: MLCompWriteRef

1.1.7.46.2 Arguments

1.1.7.47.3.1 Input

BlockID	Description	ID number of an initiated Comparator object
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
ThroughZero	Description	When TRUE, system must cross zero and then the reference position before the Transition Flag is set. If FALSE, Transition Flag is set immediately if the input pipe position is greater then or equal to the Reference value.
	Data type	BOOL
	Range	0, 1

	Unit	n/a
	Default	—
Reference	Description	New reference position to set in the selected Comparator object
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—

1.1.7.48.4.2 Output

Default (.Q)	Description	Returns TRUE when function starts to execute
	Data type	BOOL
	Unit	n/a

1.1.7.49.5.3 Return Type

BOOL

1.1.7.50.6 Related Functions

MLCompCheck

MLCompReadRef

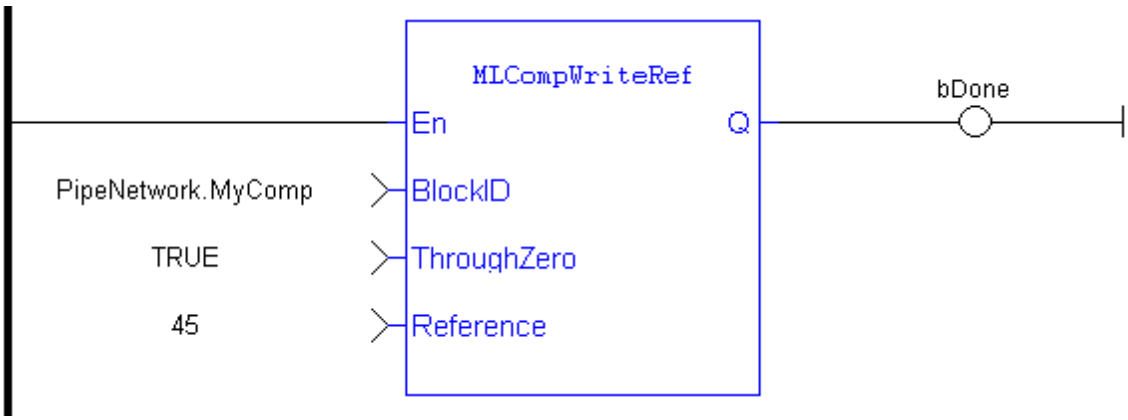
MLCompReset

1.1.7.51.7 Example

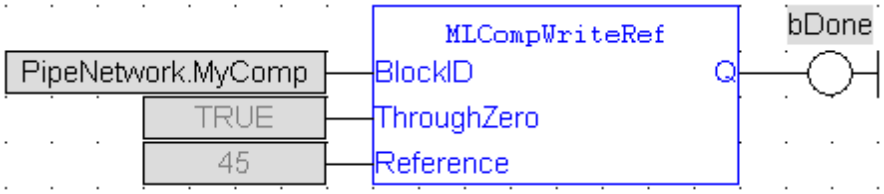
1.1.7.52.8.1 Structured Text

```
//Set the Comparator Reference value
MLCompWriteRef( PipeNetwork.MyComp , TRUE , 45 );
```

1.1.7.53.9.2 Ladder Diagram

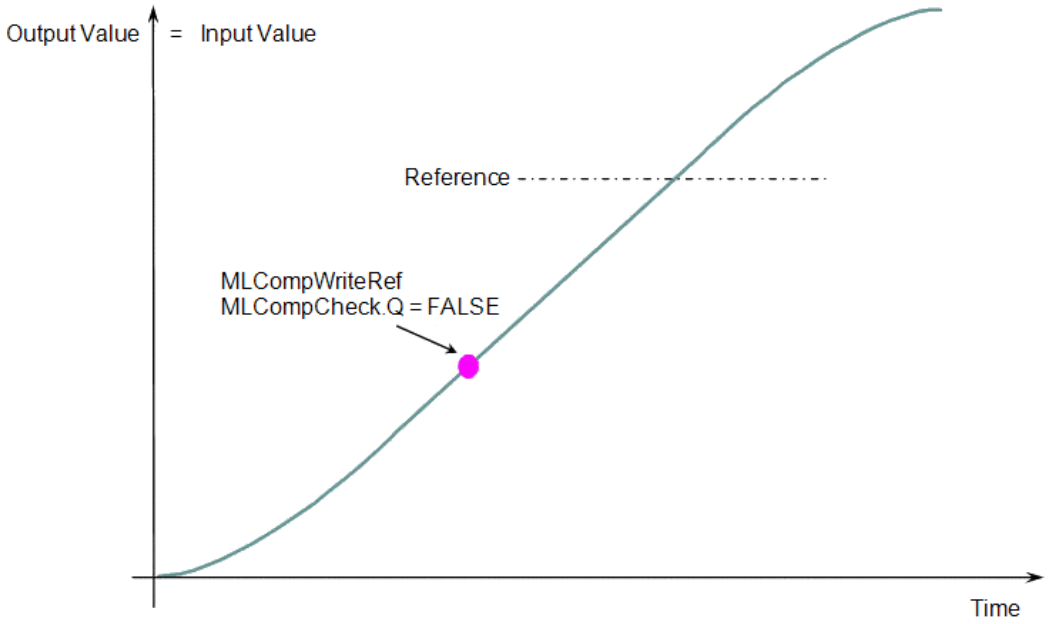


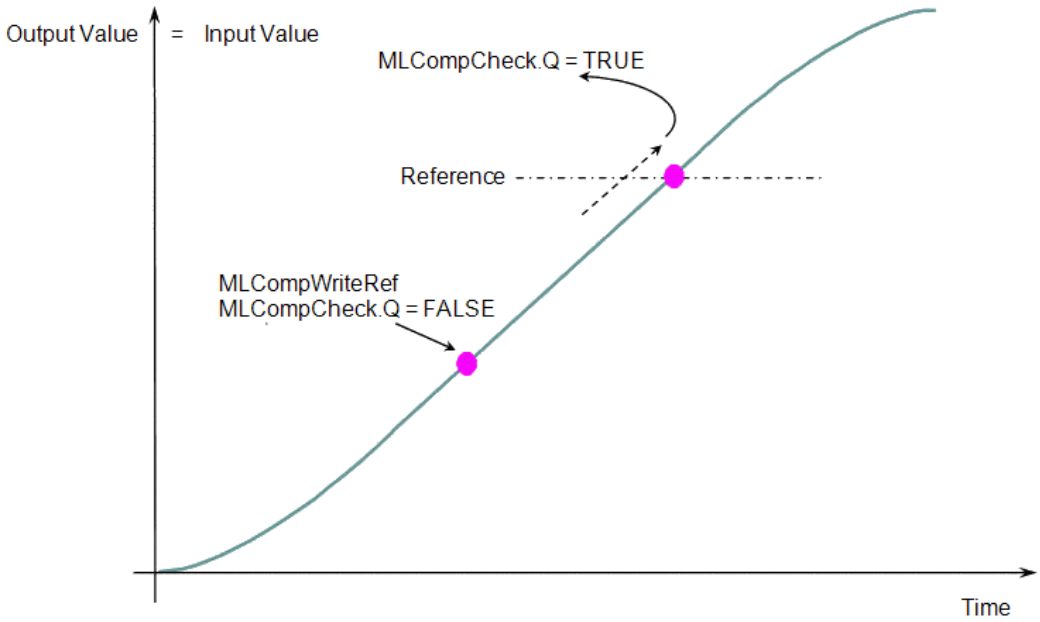
1.1.7.54.10.3 Function Block Diagram



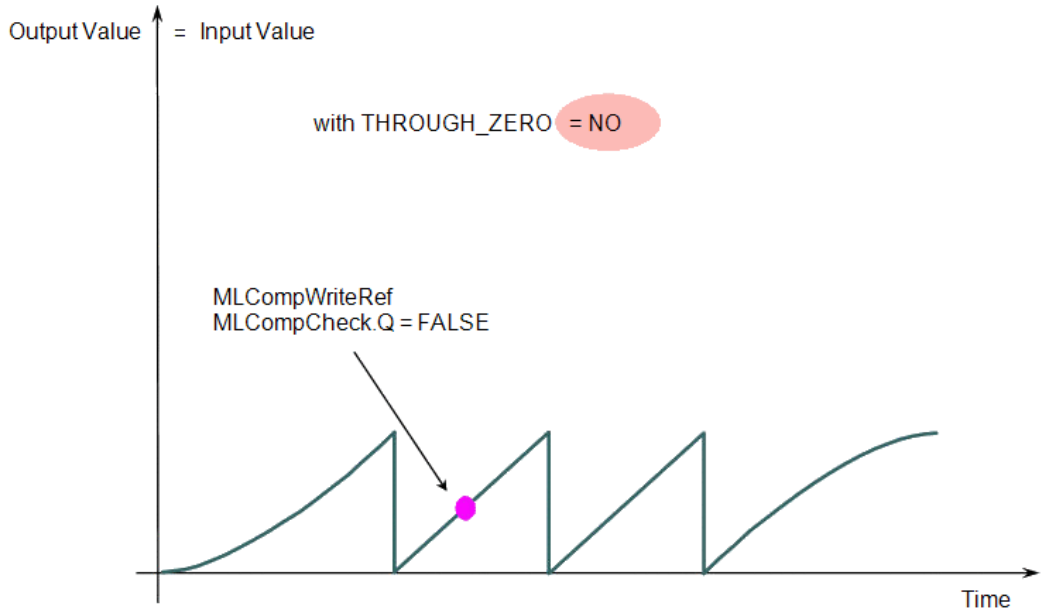
1.1.7.55 Usage example of Comparator Functions

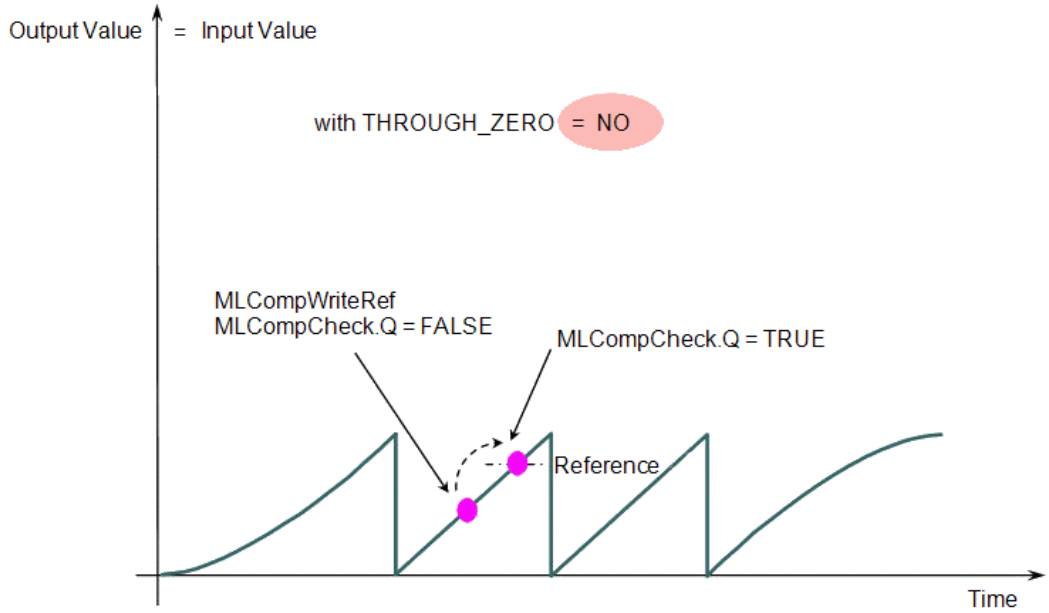
When you call the **MLCompWriteRef** function, the output for MLCompCheck becomes True as soon as the input value reaches the reference.





The same function can also be called for a cyclic input value.





When the THROUGH_ZERO parameter is set to YES, the output for MLCompCheck becomes True as soon as the input value reaches the reference, but not before it has passed through zero.

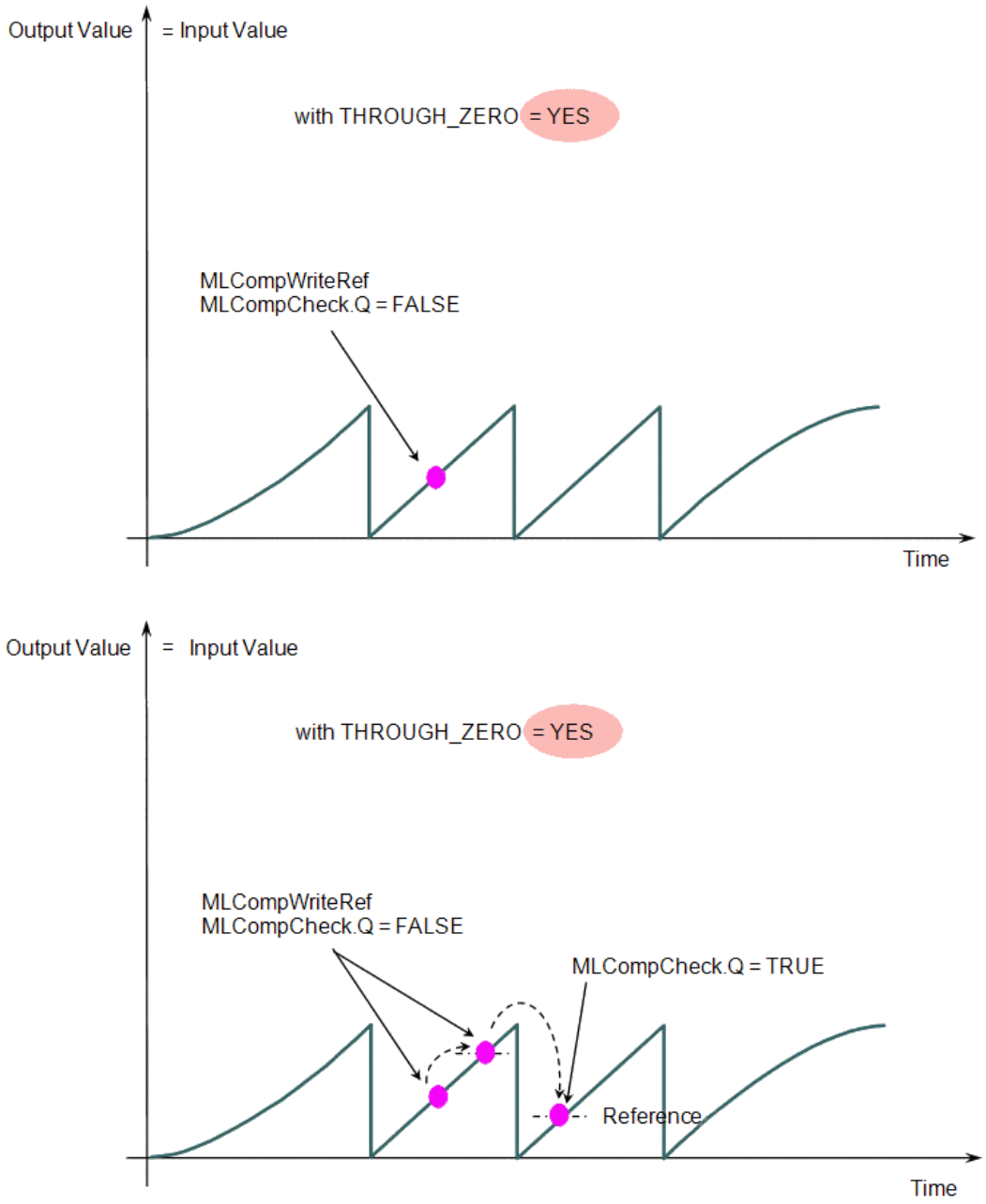


Figure 1-18: Comparator Functions Usage

1.1.8 Motion Library - Convertor

Name	Description	Return type
MLCNVConnect	Connects a converter Pipe Block to the specified axis	BOOL
MLCNVConnectEx	Connects an extra converter Pipe Block to the specified axis. This function connects the output of a pipe to an axis data other than the control position.	BOOL
MLCNVDisconnect	Disconnects a converter Pipe Block from its associated axis	BOOL
MLCNVInit	Initializes a converter Pipe Block in Position or Speed mode	BOOL

1.1.8.1 MLCNVConnect

1.1.8.2.1 Description

Connect a converter Pipe Block to the specified axis. When using the Pipe Network for coordinated motion, Pipe Blocks have to be Activated, Connected, and then Powered On before move commands work.

The Converter block changes the incoming flow of values to continuous position output with no periodicity. If a converter block is not connected to an Axis, it does not send position output values to its assigned Axis. Every pipe branch must end in a converter, whether or not it is connected to a destination Axis object, as seen in Figure 1 below.

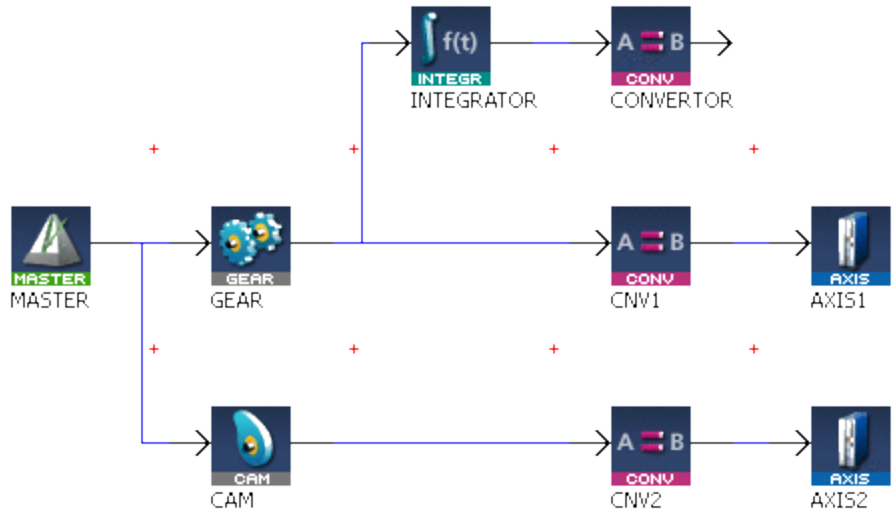


Figure 1-19: MLCNVConnect

NOTE All converters in the Pipe Network can be connected at once with the command PipeNetwork(MLPN_Connect). This calls automatically generated code with MLCNVConnect commands for each Converter block. Therefore, in a multi-axis program only one command can be used to connect Pipe Blocks instead of writing code for each Axis separately.

TIP The converter block has the ability to control the analog output on the AKD. See for information on the parameters.

1.1.8.3.2 Arguments

1.1.8.4.3.1 Input

BlockID	Description	ID number of an initiated Converter object
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
AxisID	Description	ID number of an initiated Axis object
	Data type	DINT
	Range	[-2147483648, 2147483648]

	Unit	n/a
	Default	—

1.1.8.5.4.2 Output

Default (.Q)	Description	Returns TRUE if the converter is connected to the Axis object
	Data type	BOOL
	Unit	n/a

1.1.8.6.5.3 Return Type

BOOL

1.1.8.7.6 Related Functions

MLCNVConnectEx

MLCNVDisconnect

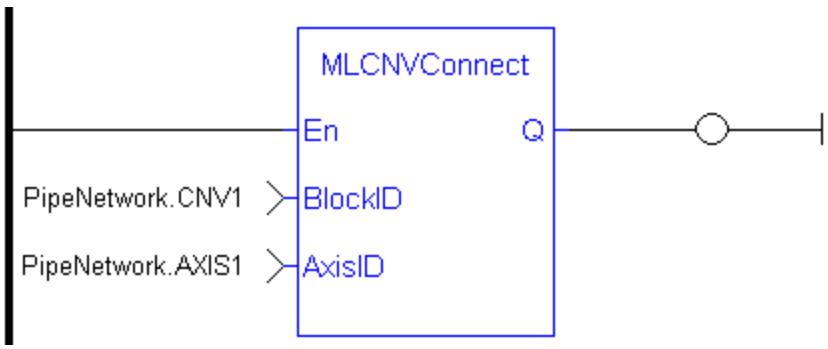
MLCNVInit

1.1.8.8.7 Example

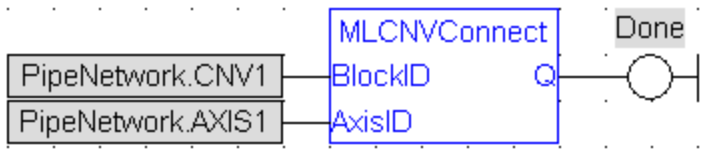
1.1.8.9.8.1 Structured Text

```
//Connect a converter Pipe Block to Axis1
MLCNVConnect( CNV1, AXIS1 );
```

1.1.8.10.9.2 Ladder Diagram



1.1.8.11.10.3 Function Block Diagram



1.1.8.12 MLCNVConnectEx

1.1.8.13.1 Description

Connect a converter Pipe Block to the specified axis. This function connects the output of a pipe to an axis data other than the control position. With this function, several converter Pipe Blocks can connect to the same axis and acts on different data.

Normally a Converter block sends position values to an Axis. However, some cases exist that require additional information such as torque feed-forward (IDN 3056) that needs to be provided by a second converter.

NOTE This FB does not work when you choose to simulate the device. In such a case, the FB continuously generates error messages displayed in the Controller log window.

NOTE Need to add 16#8000 to desired IDN number for ValueID input. 8000 in hexadecimal signals a vendor-specific IDN value.

1.1.8.14.2 Arguments

1.1.8.15.3.1 Input

BlockID	Description	ID number of an initiated Converter object
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
AxisID	Description	ID number of an initiated Axis object
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—

ValueID

Description (for EtherCAT motion bus)

EtherCAT:

Specify the following constant:

- EC_ADDITIVE_TORQUE_VALUE
  (for torque feed-forward)
- EC_ANALOG_OUTPUT
  (for control of Analog Output: AKD parameter: "AOUT.VALUEU")

NOTE

If the Analog Output is mapped to a PLC variable, the connection to the analog output by EC_ANALOG_ OUTPUT will not work as the output value will be overwritten by the PLC mapped variable data. In order to function properly the AOUT.MODE must be set to “User Mode (mode = 0) ".

TIP

The PDO values will be overwritten by Mapped PLC variables including a possible link to the mapping of variables or the section on MLParamWrite() warning indicating that the function block write of Analog output will be overwritten by the MLCnvConnectEx function.

Precedence rules:

1. A PLC variable mapped to Analog Output takes precedence.
2. If MLCNVConnect assigns a Pipe output to Analog Output it will take precedence over a DriveParamWrite function call.
3. DriveParamWrite will modify the Analog Output but get overwritten by the higher precedent options if they are present.

Data type DINT

Range [-2147483648, 2147483648]

Unit n/a

Default —

ValueInfo

Description	**EtherCAT:** This value is ignored and must be set to **zero**
Data type	DINT
Range	[-2147483648, 2147483648]

Unit	n/a
Default	—

1.1.8.16.4.2 Output

Default (.Q)

Description	Returns TRUE if the converter is connected to the Axis object
Data type	BOOL
Unit	n/a

1.1.8.17.5.3 Return Type

BOOL

1.1.8.18.6 Related Functions

MLCNVConnect

MLCNVDisconnect

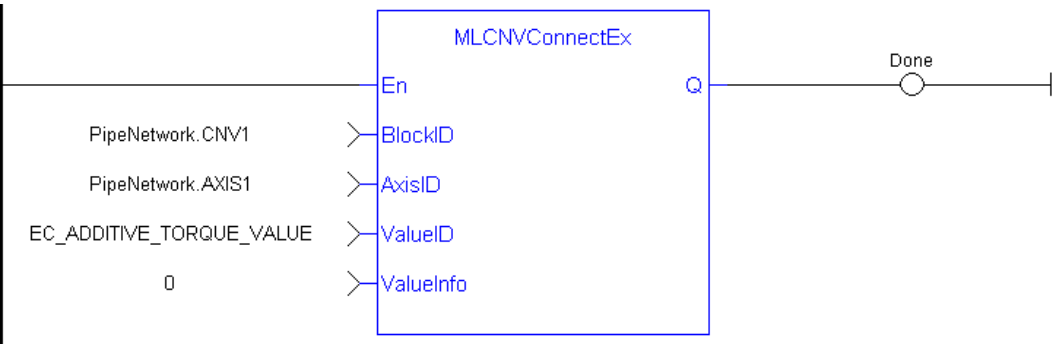
MLCNVInit

1.1.8.19.7 Example

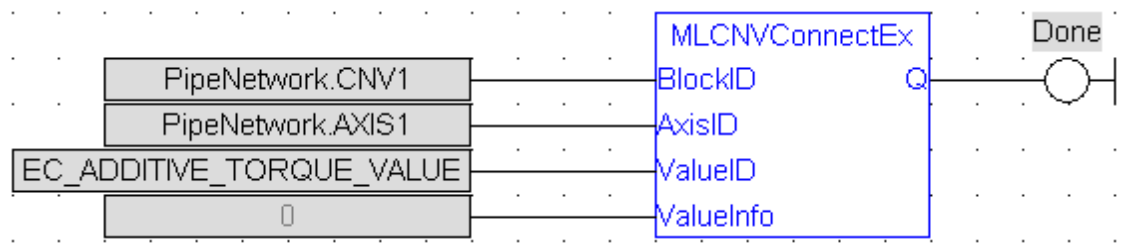
1.1.8.20.8.1 Structured Text

```
//Connect a converter Pipe Block to Axis1 to send feed-forward

MLCNVConnectEx( PipeNetwork.CNV1, PipeNetwork.AXIS1, EC_
ADDITIVE_TORQUE_VALUE, 0 );
```

1.1.8.21.9.2 Ladder Diagram



1.1.8.22.10.3 Function Block Diagram



1.1.8.23 MLCNVDisconnect

1.1.8.24.1 Description

Disconnect a converter Pipe Block from its associated axis.

If a converter block is not connected to an Axis, it does not send position output values to its assigned Axis. Can disconnect one or multiple Axis from the Pipe Network and still send single-axis motion commands. Axis can be disconnected while the Pipe Positions are reset to different values or if coordinated motion is only not needed with every axis in the project in a certain state.

1.1.8.25.2 Arguments

1.1.8.26.3.1 Input

BlockID	Description	ID number of an initiated Converter object
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—

1.1.8.27.4.2 Output

Default (.Q)	Description	Returns TRUE if the converter is disconnected from the Axis object
	Data type	BOOL
	Unit	n/a

1.1.8.28.5.3 Return Type

BOOL

1.1.8.29.6 Related Functions

MLCNVConnect

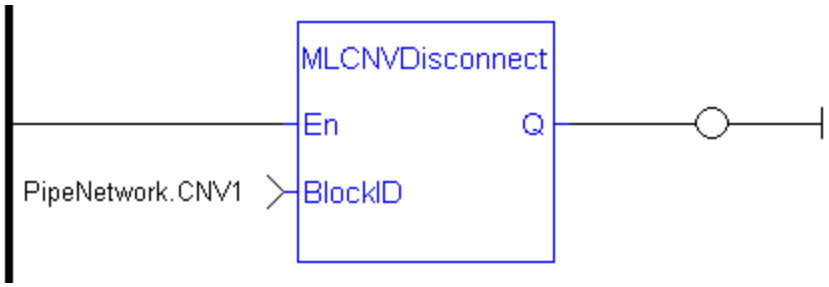
MLCNVInit

1.1.8.30.7 Example

1.1.8.31.8.1 Structured Text

```
//Disconnect a converter Pipe Block from its axis
MLCNVDisconnect( CNV1);
```

1.1.8.32.9.2 Ladder Diagram



1.1.8.33.10.3 Function Block Diagram

1.1.8.34 MLCNVInit

1.1.8.35.1 Description

Initializes a converter Pipe Block. Function block is automatically called if a Convertor Block is added to the Pipe Network, with the input mode (position or speed) entered in the Pipe Blocks Properties screen. The Converter block changes the incoming flow of speed or position values to continuous position output with no periodicity.

NOTE Converter objects are normally created in the Pipe Network using the graphical engine. Then you do not have to add MLCNVInit function blocks to their programs. Parameters are entered directly in pop-up windows, and the code is then automatically added to the current project.

1.1.8.36.2 Arguments

1.1.8.37.3.1 Input

BlockID	Description	ID number of a created Pipe Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
Mode	Description	1 for Position mode, 2 for Speed mode. Determines the type of input to the Converter Object.
	Data type	DINT
	Range	[1, 2]
	Unit	n/a
	Default	—

1.1.8.38.4.2 Output

Default (.Q)	Description	Returns TRUE if the Convertor Pipe Block is initialized

Data type	BOOL
Unit	n/a

1.1.8.39.5.3 Return Type

BOOL

1.1.8.40.6 Related Functions

MLBlkCreate

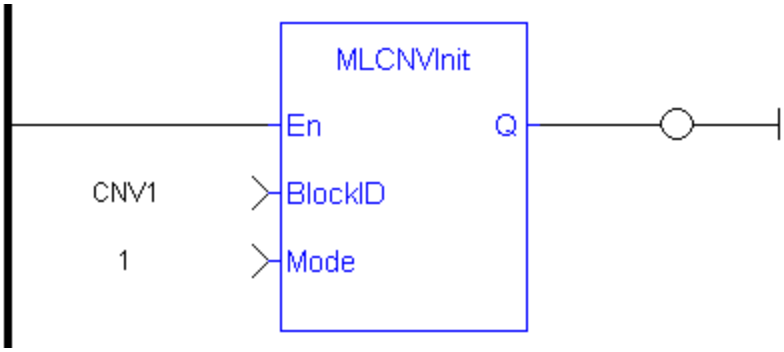
MLCNVConnect

1.1.8.41.7 Example

1.1.8.42.8.1 Structured Text

```
//Create and Initiate a Convertor object
CNV1 := MLBlkCreate( 'CNV1', 'CONVERTOR' );
MLCNVInit( CNV1, 1 );
```

1.1.8.43.9.2 Ladder Diagram



1.1.8.44.10.3 Function Block Diagram

1.1.9 Motion Library - Delay

Name	Description	Return type
MLDelayInit	Initializes a delay object	BOOL

1.1.9.1 MLDelayInit

1.1.9.2.1 Description

Initializes a delay object. Returns TRUE if the function succeeded. This FB is automatically created in the compiled code of a Pipe Network. It is included in the MLPN_CREATE_OBJECT

(created in ST) which is typically executed in a project as part of the startup sequence of the Pipe Network.

1.1.9.3.2 Arguments

1.1.9.4.3.1 Input

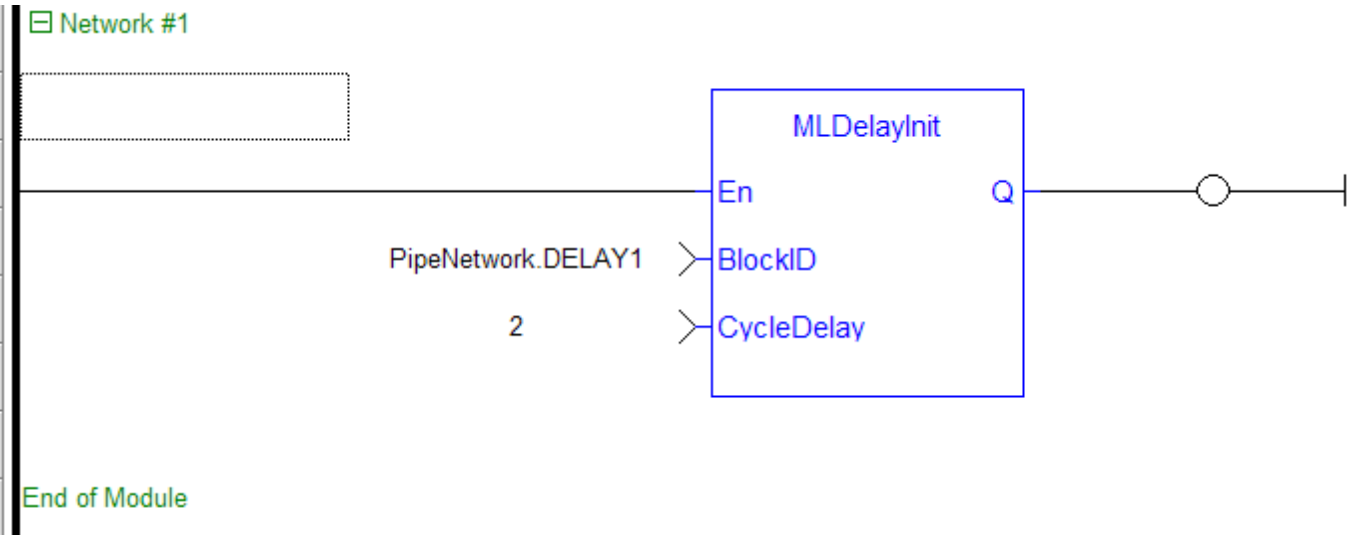
BlockID	Description	ID number of a created Pipe Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
CycleDelay	Description	Number of delay cycles
	Data type	DINT
	Range	[0 , 9]
	Unit	Cycle
	Default	0

1.1.9.5.4.2 Example

1.1.9.6.5.3 Structured Text

```
MLDelayInit(PipeNetwork.DELAY1, 2 );
```

1.1.9.7.6.4 Ladder Diagram



1.1.9.8.7.5 Function Block Diagram

1.1.10 Motion Library - Derivator

Name	Description	Return type
MLDerInit	Initializes a derivator object	BOOL
MLDerReadInModPos	Returns the input MODULO_POSITION of the Derivator block	None
MLDerWriteInModPos	Sets the input MODULO_POSITION of the Derivator block	BOOL

1.1.10.1 MLDerInit

1.1.10.2.1 Description

Initializes an derivator object. Function block is automatically called if a Derivator Block is added to the Pipe Network, with user-defined settings entered in the Pipe Blocks Properties screen. Input ModuloPosition is defined to manage the periodicity (modulo) of the input values.

NOTE Derivator objects are normally created in the Pipe Network using the graphical engine. Then you do not have to add MLDerInit function blocks to their programs. Parameters are entered directly in pop-up windows, and the code is then automatically added to the current project.

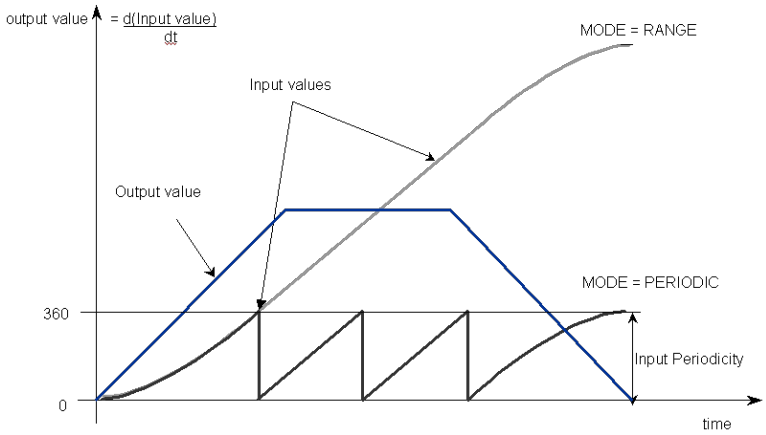


Figure 1-20: MLDerInit

1.1.10.3.2 Arguments

1.1.10.4.3.1 Input

BlockID

Description	ID number of a created Pipe Block
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

ModuloPosition

Description	Input ModuloPosition of Derivator object
Data type	LREAL
Range	—

	Unit	User unit
	Default	360.0

1.1.10.5.4.2 Output

Default (.Q)	Description	Returns TRUE if the Derivator object is initialized
	Data type	BOOL
	Unit	n/a

1.1.10.6.5.3 Return Type

BOOL

1.1.10.7.6 Related Functions

MLBlkCreate

MLDerReadInModPos

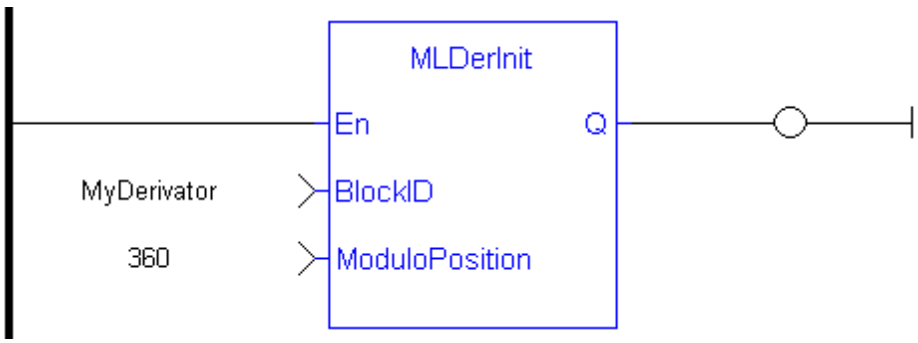
MLDerWriteInModPos

1.1.10.8.7 Example

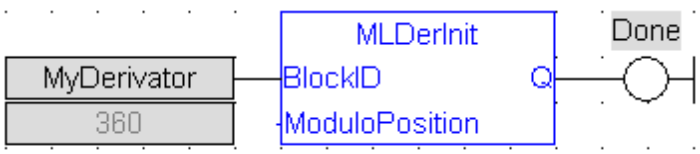
1.1.10.9.8.1 Structured Text

```
//Create and Initiate a Derivator object
MyDerivator := MLBlkCreate( 'MyDerivator', 'DERIVATOR' );
MLDerInit( MyDerivator, 360.0 );
```

1.1.10.10.9.2 Ladder Diagram



1.1.10.11.10.3 Function Block Diagram



1.1.10.12 MLDerReadInModPos

1.1.10.13.1 Description

Returns the Input ModuloPosition of the derivator block. Input ModuloPosition is defined to manage the periodicity (modulo) of the input values.

For example, if the input value increases each millisecond by one degree then the output value is 1000 degrees per second. Now lets imagine that the input value skips suddenly from 359 to 0

- If Input ModuloPosition = 360, the output continues to indicate 1000 degrees per second, indicating that rollover into the next period has been properly handled

- If Input ModuloPosition = 1000, the output then indicates 359,000 degrees per second, indicating that the input has incorrectly interpreted roll-over as a 359 degree move in one millisecond

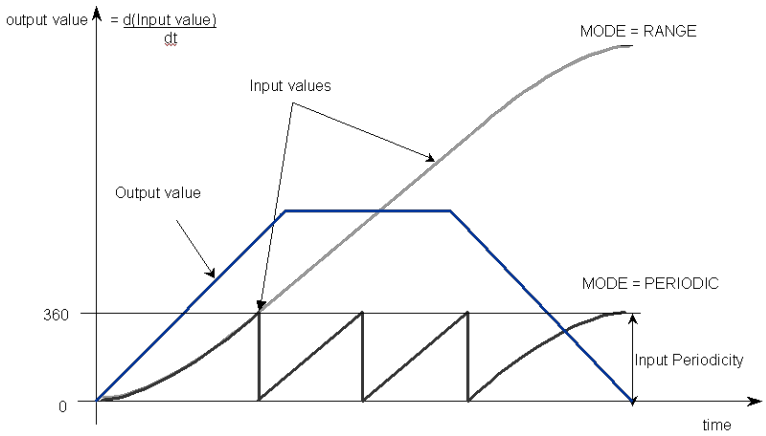


Figure 1-21: MLDerReadInModPos

> **NOTE** The first calculation of a Derivator Pipe Block just after the pipe installation indicates zero regardless of the initial input value.

1.1.10.14.2 Arguments

1.1.10.15.3.1 Input

ID

Description	ID number of an initiated Derivator object
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.10.16.4.2 Output

ModuloPosition

Description	Current Input ModuloPosition of the selected Derivator object
Data type	LREAL
Unit	User unit
Default	—

1.1.10.17.5 Related Functions

MLDerWriteInModPos

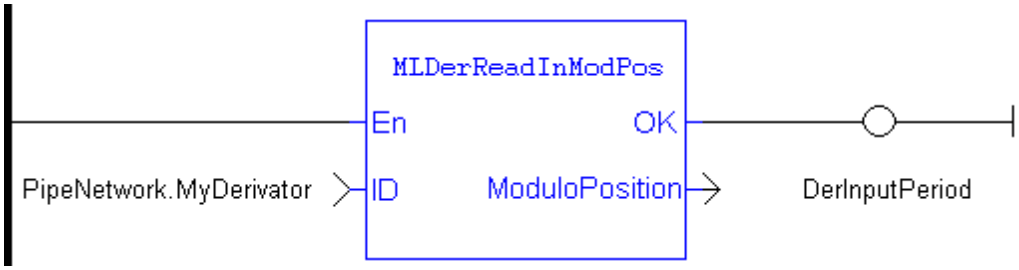
MLDerInit

1.1.10.18.6 Example

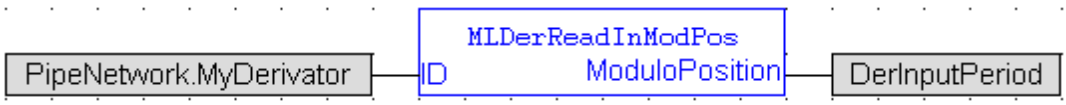
1.1.10.19.7.1 Structured Text

```
//save the current input MODULO_POSITION of a Derivator object
DerInputPeriod := MLDerReadInModPos ( PipeNetwork.MyDerivator );
```

1.1.10.20.8.2 Ladder Diagram



1.1.10.21.9.3 Function Block Diagram



1.1.10.22 MLDerWriteInModPos

1.1.10.23.1 Description

Sets the Input ModuloPosition of the Derivator block. Input ModuloPosition is defined to manage the periodicity (modulo) of the input values.

For example, if the input value increases each millisecond by one degree then the output value is 1000 degrees per second. Now lets imagine that the input value skips suddenly from 359 to 0

-If Input ModuloPosition = 360, the output continues to indicate 1000 degrees per second, indicating that rollover into the next period has been properly handled

-If Input ModuloPosition = 1000, the output then indicates 359,000 degrees per second, indicating that the input has incorrectly interpreted roll-over as a 359 degree move in one millisecond

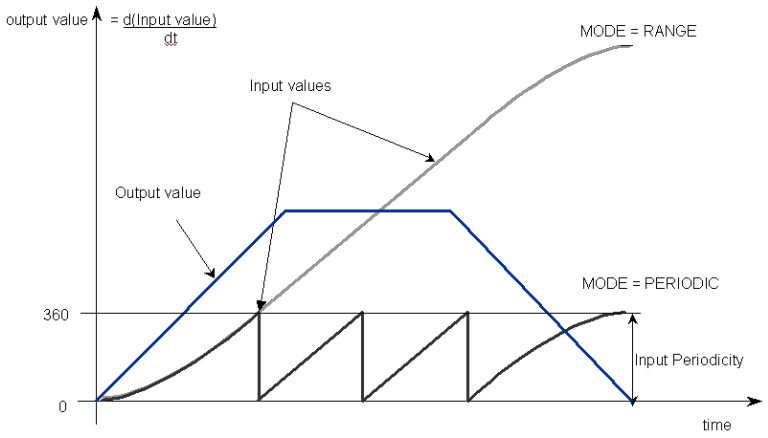


Figure 1-22: MLDerWriteInModPos

NOTE The first calculation of a Derivator Pipe Block just after the pipe installation indicates zero regardless of the initial input value.

1.1.10.24.2 Arguments

1.1.10.25.3.1 Input

ID	Description	ID number of an initiated Derivator object
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
ModuloPosition	Description	Desired new value of Input ModuloPosition of the selected Derivator object
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—

1.1.10.26.4.2 Output

Default (.Q)	Description	Returns TRUE if the Input ModuloPosition value is changed
	Data type	BOOL
	Unit	n/a

1.1.10.27.5.3 Return Type

BOOL

1.1.10.28.6 Related Functions

MLDerReadInModPos

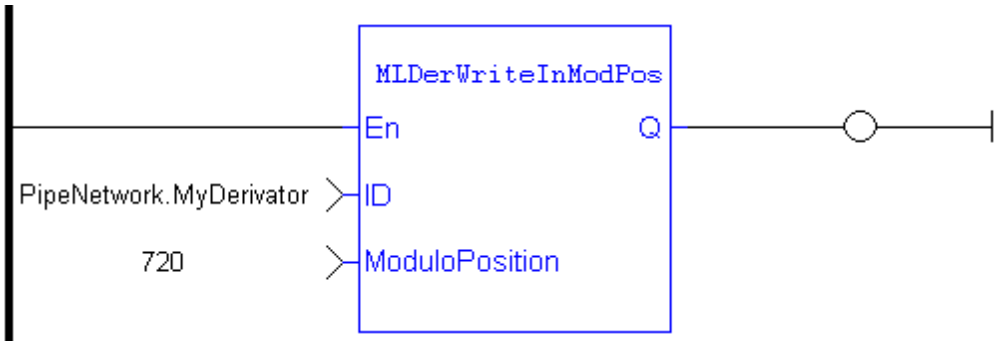
MLDerInit

1.1.10.29.7 Example

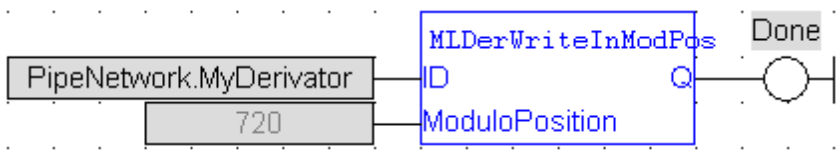
1.1.10.30.8.1 Structured Text

```
//change the input MODULO_POSITION of a Derivator object to 720
MLDerWriteInModPos ( PipeNetwork.MyDerivator, 720 );
```

1.1.10.31.9.2 Ladder Diagram



1.1.10.32.10.3 Function Block Diagram

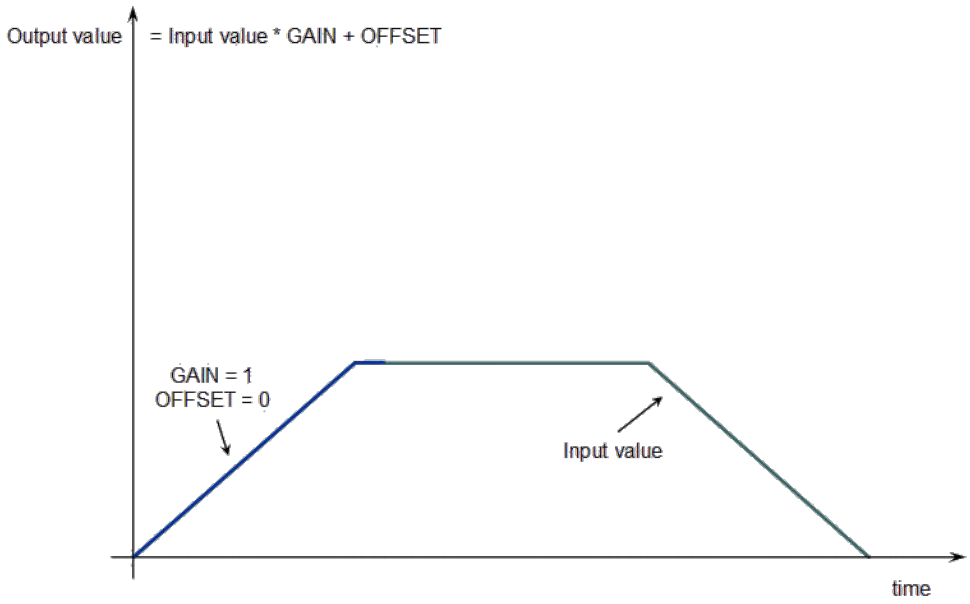


1.1.11 Motion Library - Gear

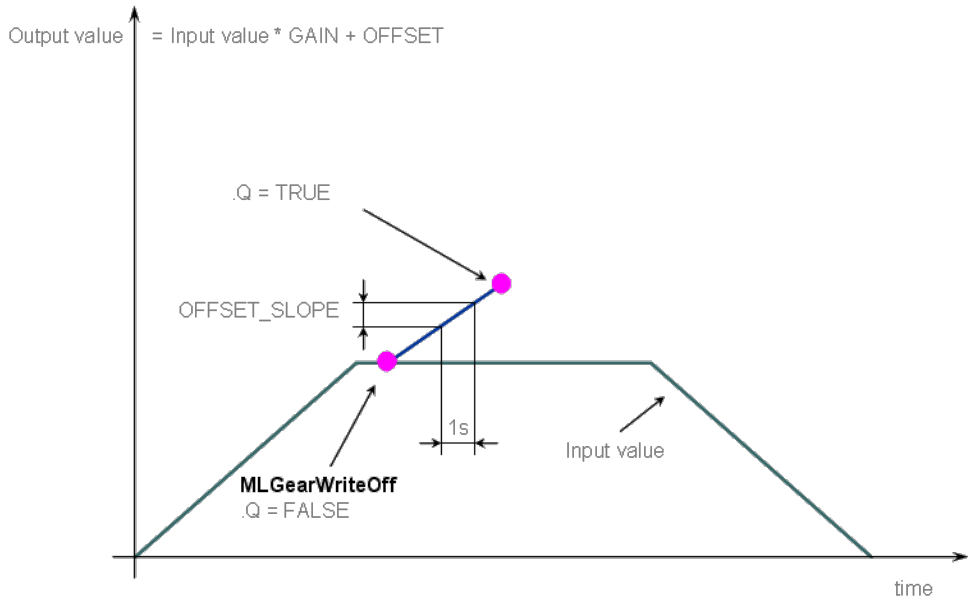
Name	Description	Return type
MLGearInit	Initializes a Gear Pipe Block with user-defined settings	BOOL
MLGearReadOffset	Returns the offset value of selected Gear Block	None
MLGearReadOffSlp	Returns the Offset Slope value of selected Gear Block	None
MLGearReadRatio	Returns the ratio value of a gear block	None
MLGearReadRatSlp	Returns the ratio slope value of a gear block	None
MLGearWriteOff	Sets the Offset value of a selected Gear Pipe Block	BOOL
MLGearWriteOSlp	Sets the Offset Slope value of a selected Gear Pipe Block	BOOL
MLGearWriteRatio	Sets the Ratio value of a selected Gear Pipe Block	BOOL
MLGearWriteRatSlp	Sets the Ratio Slope value of a selected Gear Pipe Block	BOOL

1.1.11.1 Usage example of Gear Functions

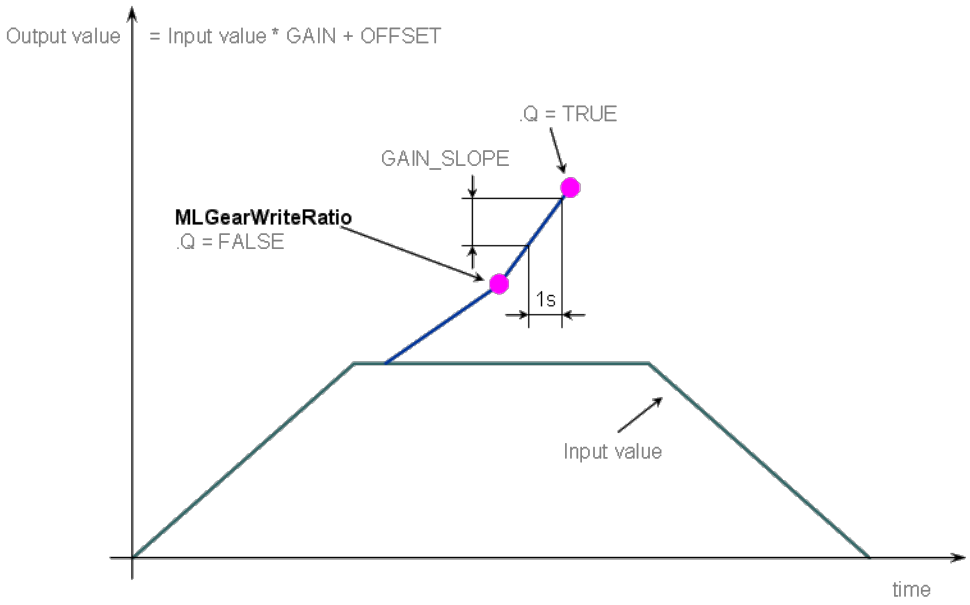
The output value starts with offset = 0 and gain = 1 (blue line)



You can call the **MLGearWriteOff** function to modify the Offset (where Offset_Slope is set with the **MLGearWriteOSlp** function).



After setting the Offset (Q=TRUE in the previous figure), you can call the **MLGearWriteRatio** function to modify the gear Ratio (where Gain_Slope is set with the **MLGearWriteRatSlp** function).



The output value is finally adapted with the gear offset and ratio (blue line).

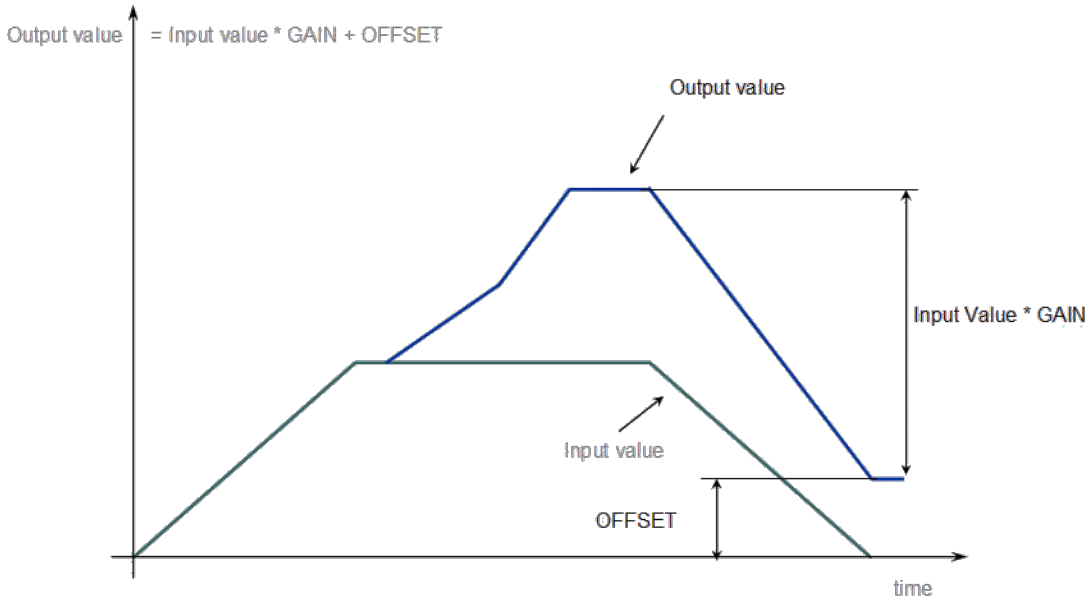


Figure 1-23: Gear Functions Usage

1.1.12 Motion Library - Integrator

Name	Description	Return type
MLIntInit	Initializes an integrator object	BOOL
MLIntWriteOutVal	Sets the output value of an integrator object	BOOL

1.1.12.1 MLIntInit

1.1.12.2.1 Description

Initializes an integrator object. Function block is automatically called if an Integrator Block is added to the Pipe Network, with user-defined settings entered in the Pipe Blocks Properties screen.

Integrator object can operate in Modulo or not modulo mode. While in Modulo mode, the output values are adapted according to the entered ModuloPosition value.

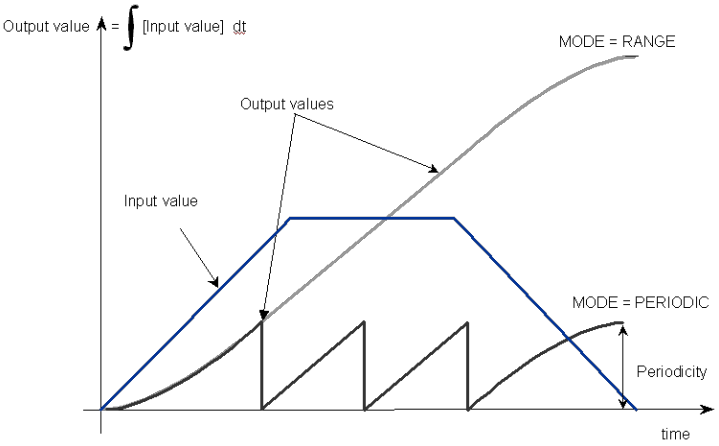


Figure 1-24: MLIntInit

> **NOTE** Integrator objects are normally created in the Pipe Network using the graphical engine. Then you do not have to add MLIntInit function blocks to their programs. Parameters are entered directly in pop-up windows, and the code is then automatically added to the current project.

1.1.12.3.2 Arguments

1.1.12.4.3.1 Input

BlockID	Description	ID number of a created Pipe Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
ModuloPosition	Description	Output ModuloPosition of Integrator object
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	360.0
Modulo	Description	TRUE when mode is modulo. Modulo mode adapts the output values according to the ModuloPosition (modulo)
	Data type	BOOL

Range	0, 1
Unit	n/a
Default	TRUE

1.1.12.5.4.2 Output

Default (.Q)	Description	Returns TRUE if the Integrator object is initialized
	Data type	BOOL
	Unit	n/a

1.1.12.6.5.3 Return Type

BOOL

1.1.12.7.6 Related Functions

MLBlkCreate

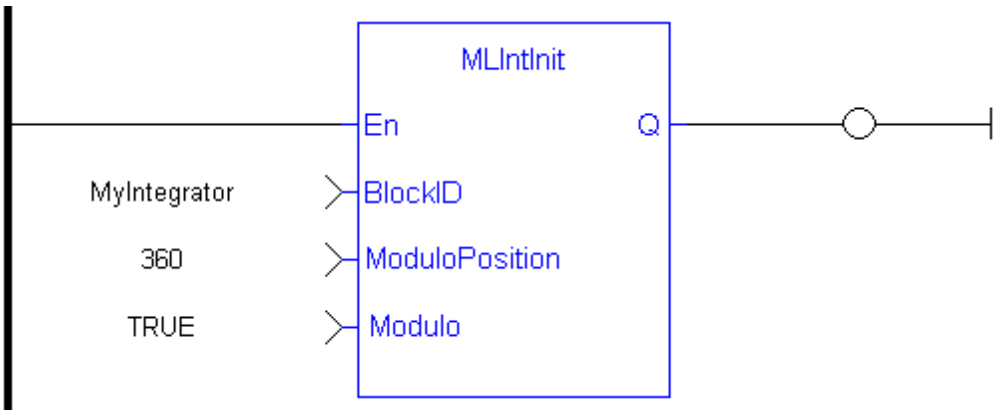
MLIntWriteOutVal

1.1.12.8.7 Example

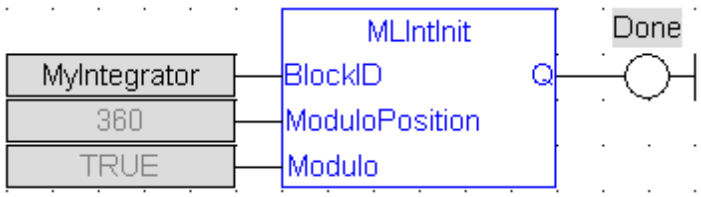
1.1.12.9.8.1 Structured Text

```
//Create and Initiate an Integrator object
MyIntegrator := MLBlkCreate( 'MyIntegrator', 'INTEGRATOR' );
MLIntInit(MyIntegrator, 360.0, true );
```

1.1.12.10.9.2 Ladder Diagram



1.1.12.11.10.3 Function Block Diagram



1.1.12.12 MLIntWriteOutVal

1.1.12.13.1 Description

Sets the output value of an integrator object. This function can force the output to an entered value not dependent on the input value from the Pipe Network.

> **NOTE** Output value can jump to another value instantly after the function is executed if the Pipe Network is running.

1.1.12.14.2 Arguments

1.1.12.15.3.1 Input

BlockID	Description	ID number of an initiated Integrator object
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
Value	Description	Desired new output value of the selected Integrator object
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—

1.1.12.16.4.2 Output

Default (.Q)	Description	Returns TRUE if the output value if the Integrator object is changed
	Data type	BOOL
	Unit	n/a

1.1.12.17.5.3 Return Type

BOOL

1.1.12.18.6 Related Functions

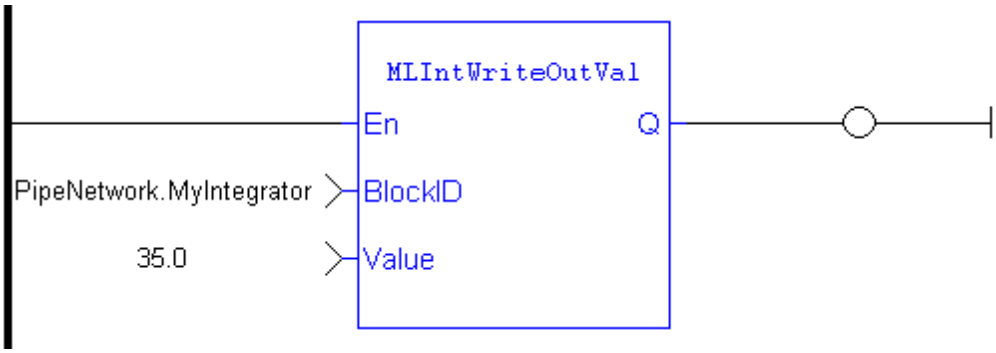
MLIntInit

1.1.12.19.7 Example

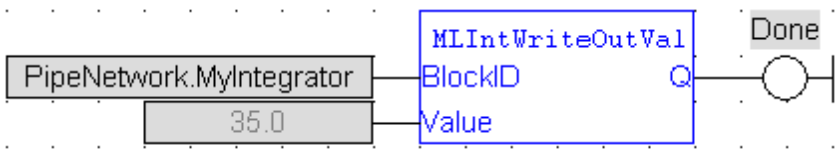
1.1.12.20.8.1 Structured Text

```
//change the output value of an integrator object to 35
MLIntWriteOutVal ( PipeNetwork.MyIntegrator, 35.0 );
```

1.1.12.21.9.2 Ladder Diagram



1.1.12.22.10.3 Function Block Diagram



1.1.13 Motion Library - Master

TIP For usage example about Master Functions, see page 131

Function sorted by types:

Motion Control	Inquiry Functions	Position setting
MLMstInit	MLMstReadAccel	MLMstAbs
MLMstRun	MLMstReadDecel	MLMstAdd
MLMstWriteAccel	MLMstReadInitPos	MLMstForcePos
MLMstWriteDecel	MLMstReadSpeed	MLMstRel
MLMstWriteSpeed	MLMstStatus	

Functions sorted in alphabetical order:

Name	Description	Return type
MLMstAbs	Does an absolute move	BOOL
MLMstAdd	Does an additive move relative for a specified distance from the endpoint of the previous move	BOOL
MLMstForcePos	Forces the specified position. Possible only when the block is **not** moving.	BOOL
MLMstInit	Initializes a master object (TMP generator)	BOOL
MLMstReadAccel	Gets the present acceleration value of a master block	None
MLMstReadDecel	Gets the present deceleration value of a master block	None
MLMstReadInitPos	Gets the initial position of a master block	None
MLMstReadSpeed	Gets the speed of a master block	None

Name	Description	Return type
MLMstRel	Does an Relative move for a specified distance from the current position	BOOL
MLMstRun	Jogs at the specified speed. Returns TRUE if the function succeeded	BOOL
MLMstStatus	Returns the status of the generator	DINT
MLMstWriteAccel	Sets the acceleration of a master block	BOOL
MLMstWriteDecel	Sets the deceleration of a master block	BOOL
MLMstWriteInitPos	Sets the initial position of a master block	BOOL
MLMstWriteSpeed	Sets the speed of a master block	BOOL

1.1.13.1 MLMstAbs

1.1.13.2.1 Description

Performs a move to an absolute position. Returns TRUE if the function succeeded.

1.1.13.3.2 Arguments

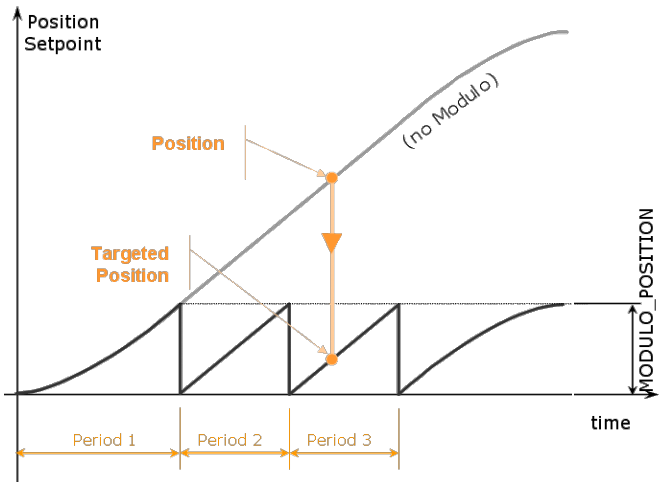
1.1.13.4.3.1 Input

BlockID

Description	ID name of the Master Block
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

Position

Description	Sets the value of the absolute destination position. When the Modulo is turned on, the Master Block moves to the targeted position during the corresponding period, calculated as follows: • If the Position input is between 0 and the Modulo Position, then the Master Block moves within the **current** period (no position rollover). • If the Position input is greater than the Modulo Position, then the Master Block moves during one of the **next** period (positive position rollover).



The Master Block works similarly for negative positions: if the Position input is less than zero, then the Master Block moves during one of the **previous** period (negative position rollover).

Data type	LREAL
Range	—
Unit	User unit
Default	—

1.1.13.5.4.2 Output

Default (.Q)

Description	Returns true when function successfully executes
Data type	BOOL
Unit	n/a

1.1.13.6.5 Related Functions

MLMstWriteSpeed

MLMstWriteDecel

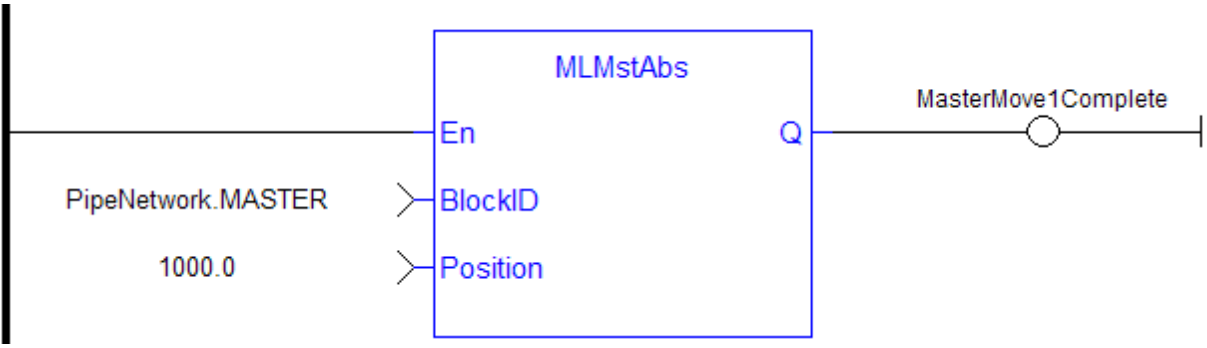
MLMstWriteSpeed

1.1.13.7.6 Example

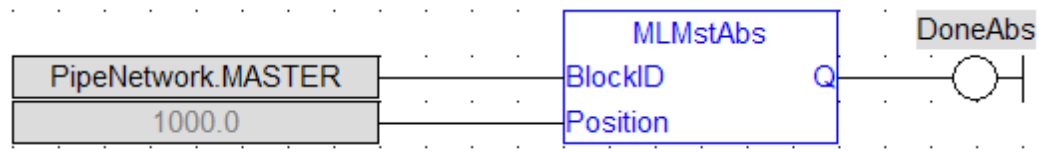
1.1.13.8.7.1 Structured Text

```
MLMstAbs( PipeNetwork.MASTER, 1000.0 );
```

1.1.13.9.8.2 Ladder Diagram



1.1.13.10.9.3 Function Block Diagram



1.1.13.11 MLMstAdd

1.1.13.12.1 Description

Performs a move for a specified distance relative to the endpoint of the previous move. Returns TRUE if the function succeeded.

1.1.13.13.2 Arguments

1.1.13.14.3.1 Input

EN	Description	Enables FB to be executed
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Block ID	Description	ID name of the Master Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—

DeltaPos	Description	Relative distance to move
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—

1.1.13.15.4.2 Output

Default (.Q)	Description	Returns true when function successfully executes
	Data type	BOOL
	Unit	n/a

1.1.13.16.5 Related Functions

MLMstWriteSpeed

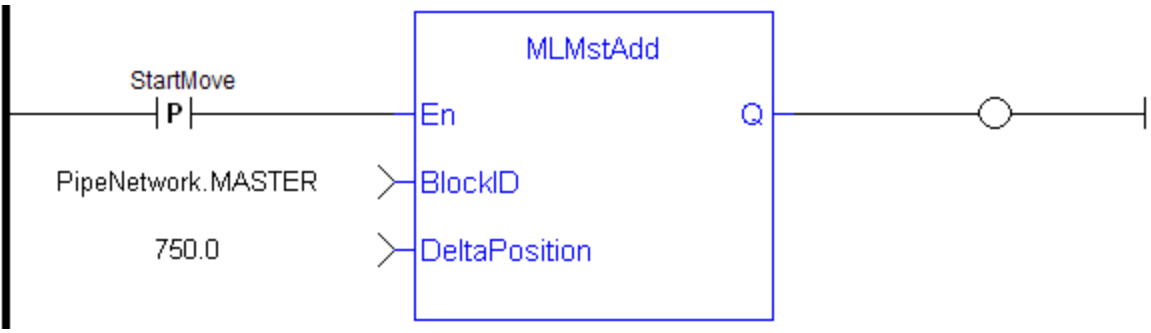
MLMstWriteDecel

1.1.13.17.6 Example

1.1.13.18.7.1 Structured Text

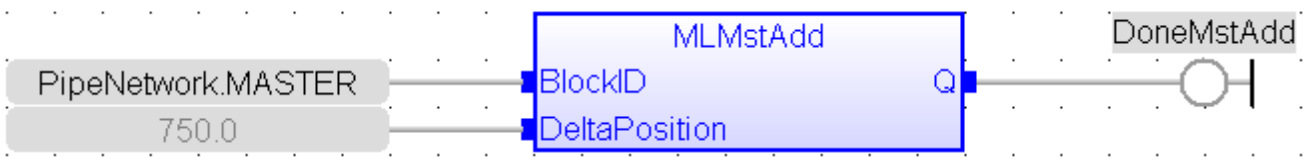
```
MLMstAdd( PipeNetwork.MASTER, 750.0 );
```

1.1.13.19.8.2 Ladder Diagram



NOTE You must use a pulse contact to start the FB

1.1.13.20.9.3 Function Block Diagram



1.1.13.21 MLMstForcePos

1.1.13.22.1 Description

Forces the position of a Master Block to a specified position. This block can only be executed when motion is not occurring. It can be used to force the master starting position to the desired values from which to start motion.

1.1.13.23.2 Arguments

1.1.13.24.3.1 Input

EN	Description	Enables FB to be executed
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Block ID	Description	ID name of the Master Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
Position	Description	Defines the Master starting position when the motion starts
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—

1.1.13.25.4.2 Output

Default (.Q)	Description	Returns true when function successfully executes
	Data type	BOOL
	Unit	n/a

1.1.13.26.5 Related Functions

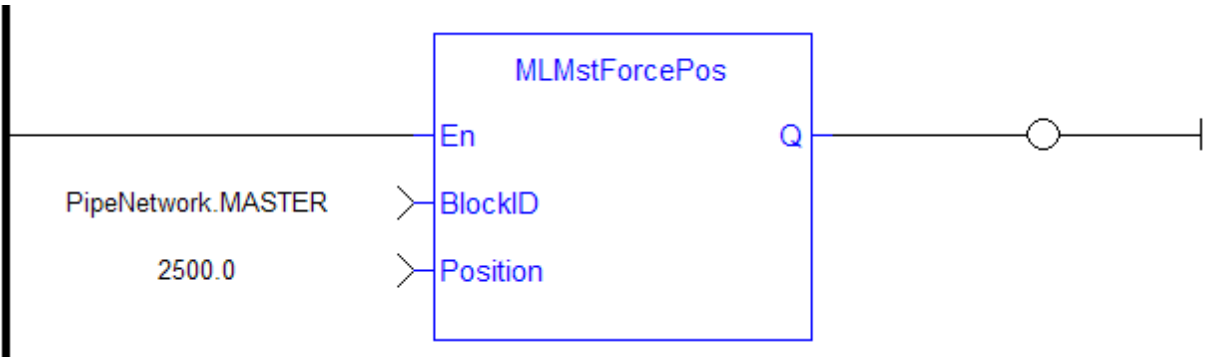
MLMstReadInitPos

1.1.13.27.6 Example

1.1.13.28.7.1 Structured Text

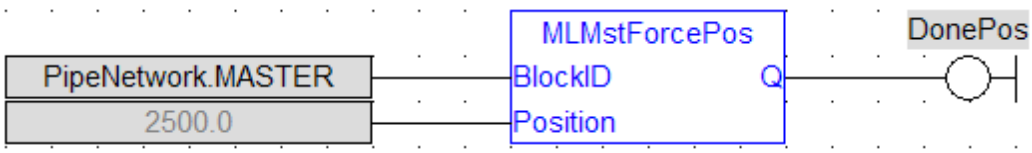
```
MLMstForcePos( PipeNetwork.MASTER, 2500.0 );
```

1.1.13.29.8.2 Ladder Diagram



NOTE You must use a pulse contact to start the FB

1.1.13.30.9.3 Function Block Diagram



1.1.13.31 MLMstInit

1.1.13.32.1 Description

Initializes a Master TMP (trapezoidal motion profile) generator block. This function is automatically created when the MLMaster Block is included in the Pipe Network Editor. Based on the parameters defined in the Master pipe block (see figure below), the Inputs for this function are initialized by default.

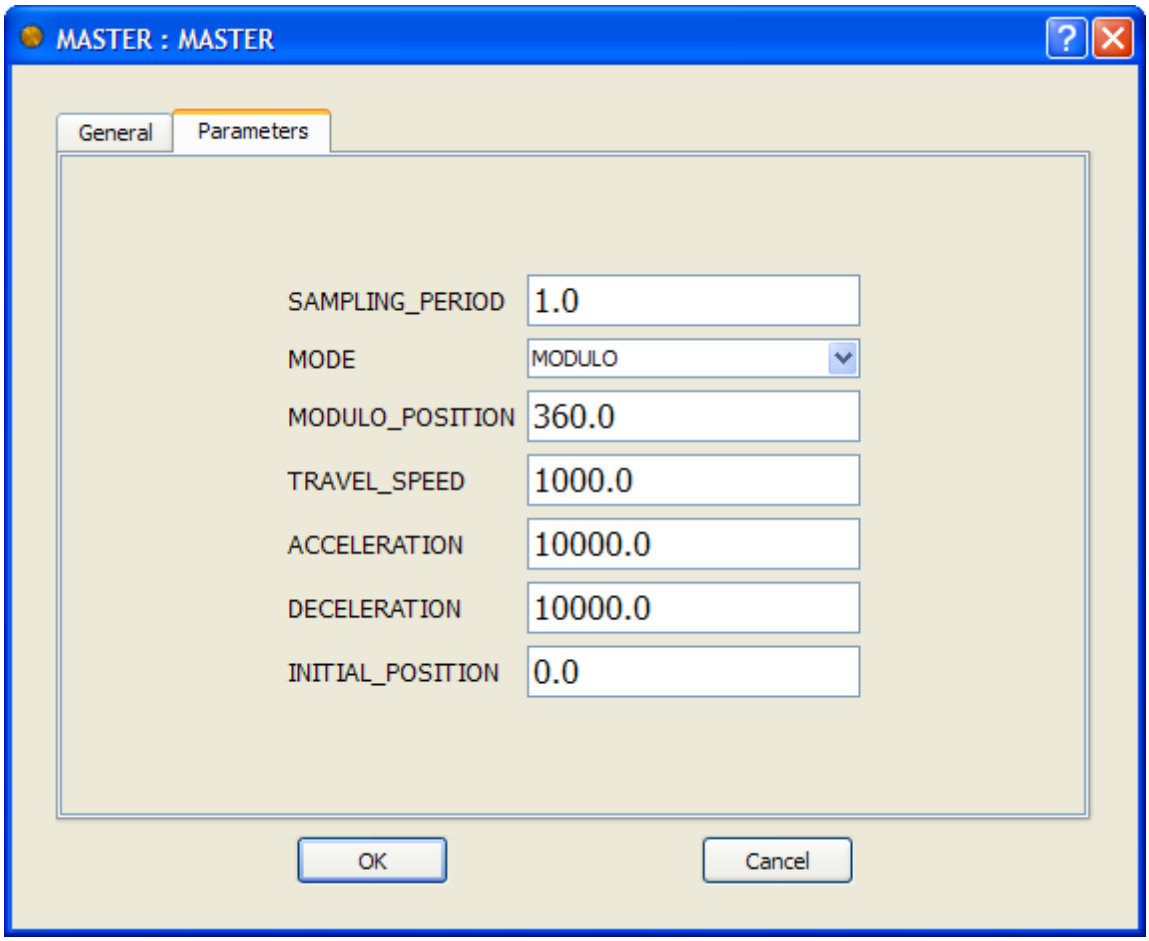


Figure 1-25: TMP Initialization

1.1.13.33.2 Arguments

1.1.13.34.3.1 Input

Block ID

Description	ID name of the Master Block
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

ModuloPosition

Description	Modulo Position for cyclic motion systems expressed in user logical units (Position Rollover Value)
Data type	LREAL
Range	—
Unit	User unit
Default	—

Period

Description	Sampling period of the generator expressed according to the update cycle (e.g. 2.0 means the sampling is done once every 2 cycles)
Data type	LREAL

	Range	—
	Unit	User unit
	Default	—
Speed	Description	Travel speed value expressed in user logical units per second. The travel speed value is used to set the constant speed part of the trapezoidal motion profile
	Data type	LREAL
	Range	—
	Unit	User unit/sec
	Default	—
Acceleration	Description	Acceleration value expressed in user logical units per second squared. The acceleration value is always used to generate the first part of the trapezoidal motion profile
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Deceleration	Description	Deceleration value expressed in user logical units per second squared. The deceleration value is always used to generate the last part of the trapezoidal motion profile
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Initial Position	Description	Initial position value expressed in user logical units. Used only at the pipe activation to initialize the position starting point
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—
Modulo	Description	The available modes are Modulo (True) or No modulo (False)
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—

1.1.13.35.4.2 Output

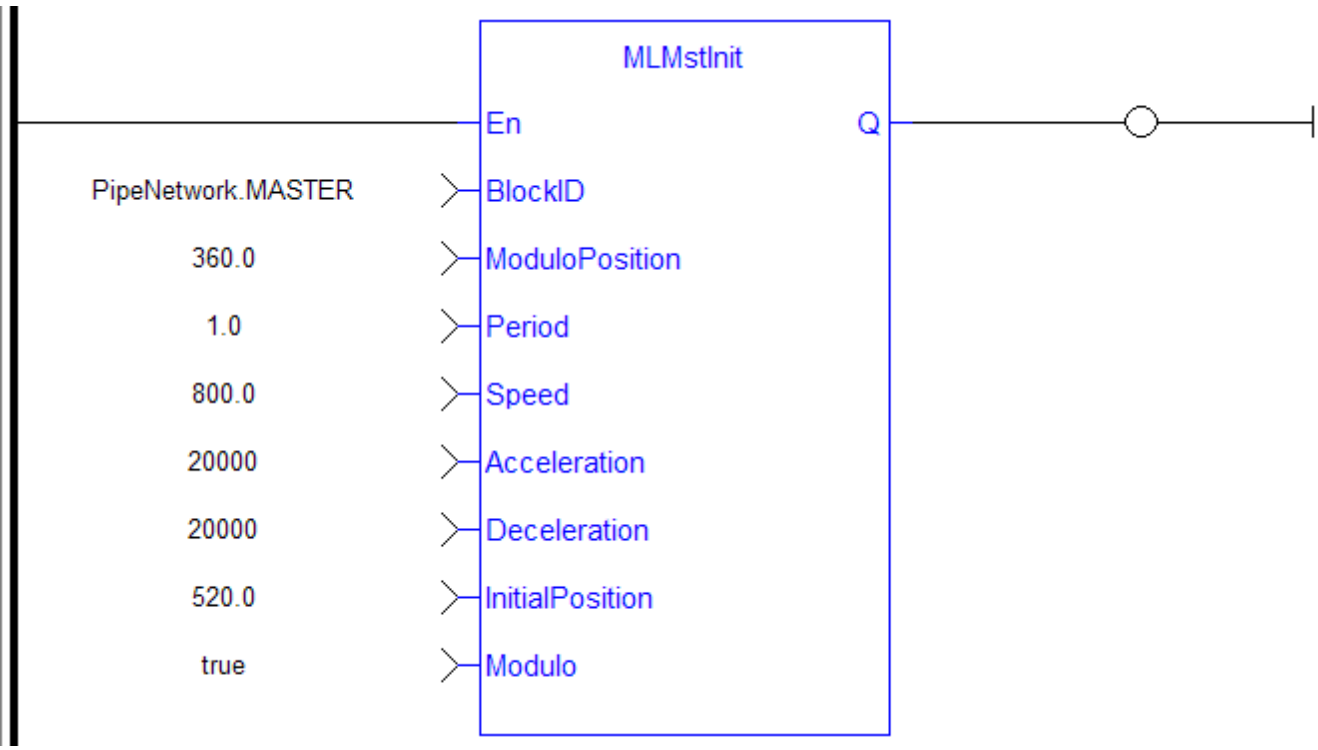
Default (.Q)	Description	Returns true when function successfully executes
	Data type	BOOL
	Unit	n/a

1.1.13.36.5 Example

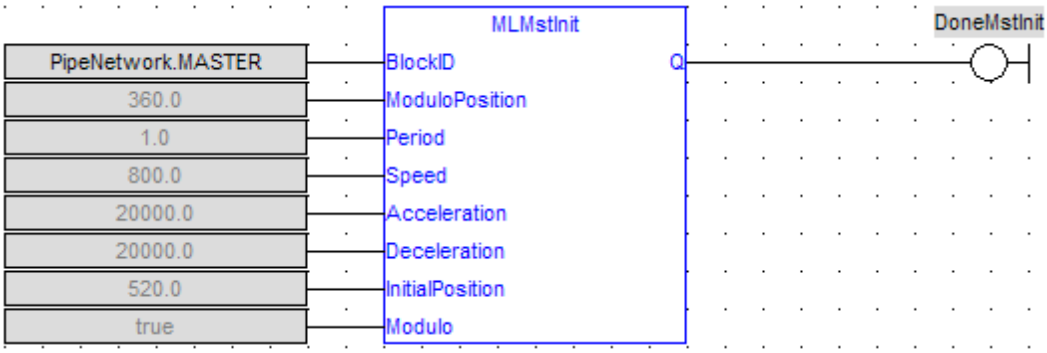
1.1.13.37.6.1 Structured Text

```
MLMstInit( PipeNetwork.MASTER, 360.0, 1.0, 1000.0, 10000.0,
10000.0, 0.0, true );
```

1.1.13.38.7.2 Ladder Diagram



1.1.13.39.8.3 Function Block Diagram



1.1.13.40 MLMstReadAccel

1.1.13.41.1 Description

Get the presently used value for acceleration of a master block.

1.1.13.42.2 Arguments

1.1.13.43.3.1 Input

EN	Description	Enables FB to be executed
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Block ID	Description	ID name of the Master Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—

1.1.13.44.4.2 Output

OK	Description	Returns true when function successfully executes
	Data type	BOOL
	Unit	n/a
Acceleration	Description	Returns Acceleration value
	Data type	LREAL
	Unit	User unit/sec^2

1.1.13.45.5 Related Functions

MLMstReadSpeed

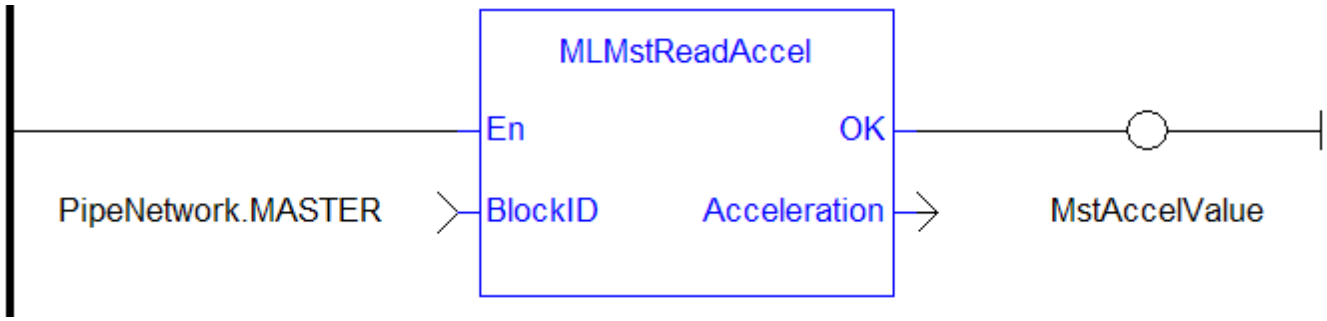
MLMstReadDecel

1.1.13.46.6 Example

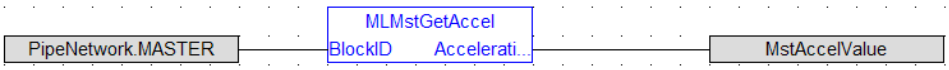
1.1.13.47.7.1 Structured Text

```
MLMstReadAccel( PipeNetwork.MASTER );
```

1.1.13.48.8.2 Ladder Diagram



1.1.13.49.9.3 Function Block Diagram



1.1.13.50 MLMstReadDecel

1.1.13.51.1 Description

Get the presently used value for deceleration of a master block.

1.1.13.52.2 Arguments

1.1.13.53.3.1 Input

EN	Description	Enables FB to be executed
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Block ID	Description	ID name of the Master Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—

1.1.13.54.4.2 Output

OK	Description	Returns true when function successfully executes
	Data type	BOOL
	Unit	n/a

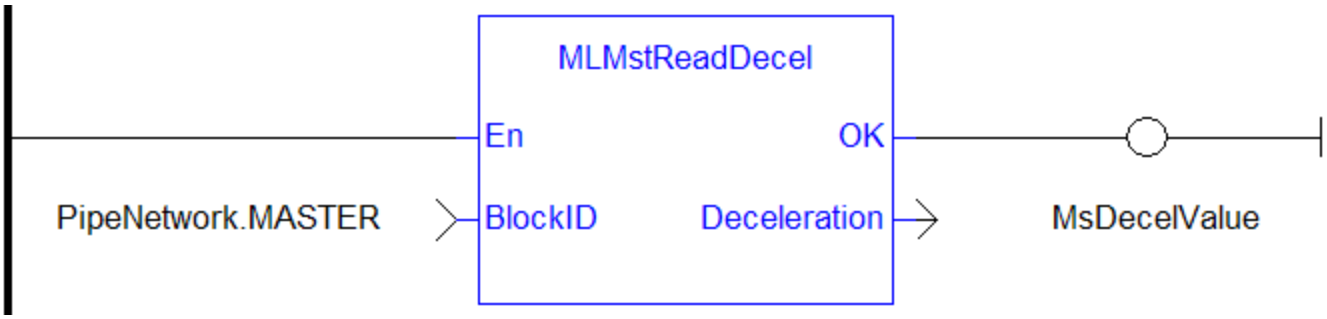
Deceleration	Description	Returns Deceleration value
	Data type	LREAL
	Unit	User unit/sec^2

1.1.13.55.5 Example

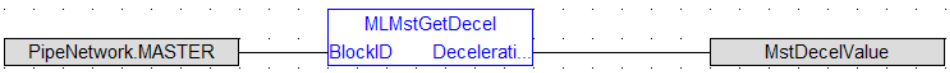
1.1.13.56.6.1 Structured Text

```
MLMstReadDecel( PipeNetwork.MASTER );
```

1.1.13.57.7.2 Ladder Diagram



1.1.13.58.8.3 Function Block Diagram



1.1.13.59 MLMstReadInitPos

1.1.13.60.1 Description

Get the presently used value for initial position of a master block.

1.1.13.61.2 Arguments

1.1.13.62.3.1 Input

EN	Description	Enables FB to be executed
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Block ID	Description	PipeNetwork Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—

1.1.13.63.4.2 Output

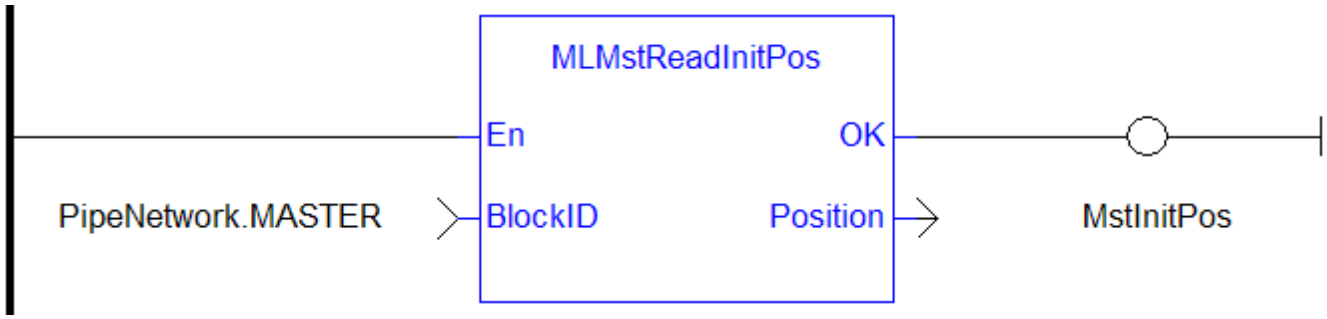
OK	Description	Returns true when function successfully executes
	Data type	BOOL
	Unit	n/a
Position	Description	Returns Intial Postion
	Data type	LREAL
	Unit	User unit

1.1.13.64.5 Example

1.1.13.65.6.1 Structured Text

```
MstInitPos := MLMstReadInitPos( PipeNetwork.MASTER );
```

1.1.13.66.7.2 Ladder Diagram



1.1.13.67.8.3 Function Block Diagram

1.1.13.68 MLMstReadSpeed

1.1.13.69.1 Description

Get the presently used value for speed of a master block.

1.1.13.70.2 Arguments

1.1.13.71.3.1 Input

EN	Description	Enables FB to be executed
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Block ID	Description	ID name of the Master Block
	Data type	DINT

Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.13.72.4.2 Output

OK

Description	Returns true when function successfully executes
Data type	BOOL
Unit	n/a

Speed

Description	Returns current Speed
Data type	LREAL
Unit	User unit/sec

1.1.13.73.5 Related Functions

MLMstReadAccel

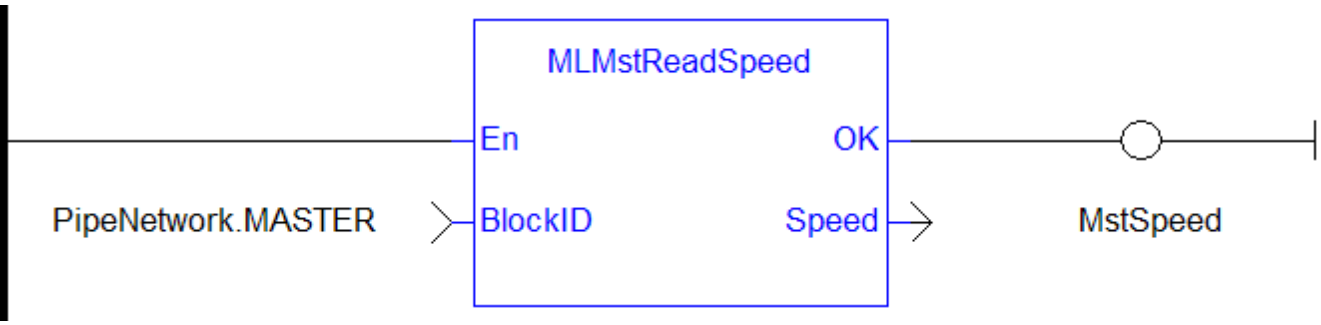
MLMstReadDecel

1.1.13.74.6 Example

1.1.13.75.7.1 Structured Text

```
MstSpeed := MLMstReadSpeed( PipeNetwork.MASTER );
```

1.1.13.76.8.2 Ladder Diagram



1.1.13.77.9.3 Function Block Diagram

1.1.13.78 MLMstRel

1.1.13.79.1 Description

Performs a move for a specified distance relative to the current position. Returns TRUE if the function succeeded.

1.1.13.80.2 Arguments

1.1.13.81.3.1 Input

EN	Description	Enables FB to be executed
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Block ID	Description	ID name of the Master Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
DeltaPos	Description	Relative distance to move
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—

1.1.13.82.4.2 Output

Default (.Q)	Description	Returns true when function successfully executes
	Data type	BOOL
	Unit	n/a

1.1.13.83.5 Related Functions

MLMstWriteSpeed

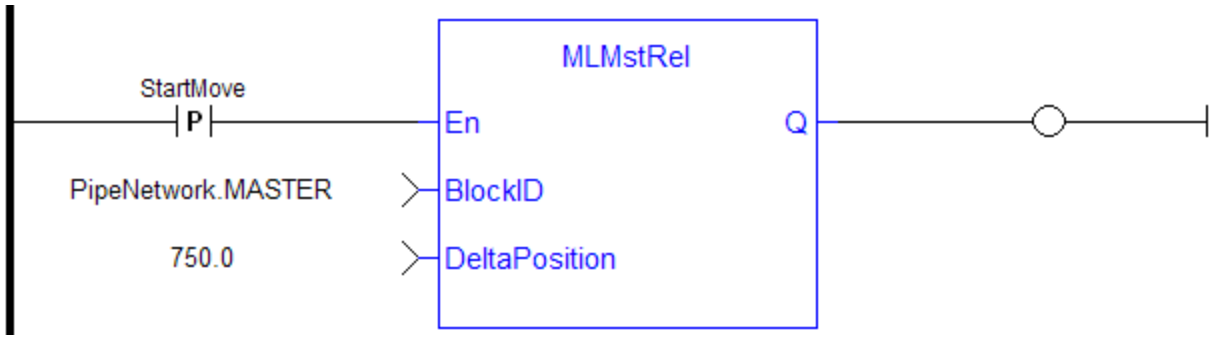
MLMstWriteDecel

1.1.13.84.6 Example

1.1.13.85.7.1 Structured Text

```
MLMstRel( PipeNetwork.MASTER, 750.0 );
```

1.1.13.86.8.2 Ladder Diagram



NOTE You must use a pulse contact to start the FB

1.1.13.87.9.3 Function Block Diagram

1.1.13.88 MLMstRun

1.1.13.89.1 Description

Jog at the specified speed. Returns TRUE if the function succeeded.

1.1.13.90.2 Arguments

1.1.13.91.3.1 Input

EN	Description	Enables FB to be executed
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Block ID	Description	ID name of the Master Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
Speed	Description	Speed to jog motor
	Data type	LREAL
	Range	—
	Unit	User unit/sec
	Default	—

1.1.13.92.4.2 Output

Default (.Q)	Description	Returns true when function successfully executes
	Data type	BOOL
	Unit	n/a

1.1.13.93.5 Related Functions

MLMstWriteSpeed

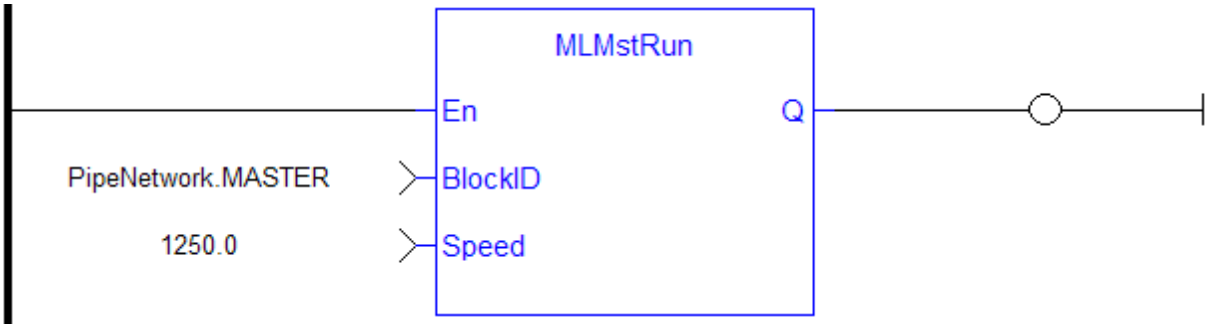
MLMstWriteDecel

1.1.13.94.6 Example

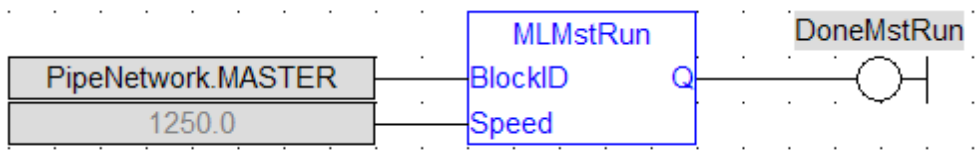
1.1.13.95.7.1 Structured Text

```
MLMstRun( PipeNetwork.MASTER, 1250.0 );
```

1.1.13.96.8.2 Ladder Diagram



1.1.13.97.9.3 Function Block Diagram



1.1.13.98 MLMstStatus

1.1.13.99.1 Description

The value returned is the state being executed by the TMP generator as it processes the various motion commands. Some states are transitory, others are stable until the next event takes place. The following terms are relevant to the returned values.

Term	Definition
Running	Speed is non-zero
Stopped	Speed is zero
Positioning	A target position has been programmed with a relative, additive or absolute command.

Status	Definition
0	(New speed programmed) is entered when a jog move (MLMstRun) is commanded and the current speed is not at the commanded speed.
1	(Stable state Running or Stopped) is entered when a jog move (MLMstRun) is commanded and the current speed is at the commanded speed. (Stable state Running or Stopped) is entered when a position move is programmed and motion is completed.
2	(Speed change) is entered when the current speed is greater than the commanded speed.
3	(Speed reversal while positioning) is entered when a position move is programmed and the distance to go requires a speed reversal.
4	(Acceleration while positioning) current speed is below the travel speed
5	(Constant Speed while positioning) is entered when a positioning move is commanded and the current speed is at the commanded speed.
6	(Deceleration while positioning) is entered when a positioning move is commanded and the current speed is changing to achieve the target position at zero speed.
7	(Micro step) is entered when a small change in position is required and the current speed is zero.

1.1.13.100.2 Arguments

1.1.13.101.3.1 Input

EN

Description	Enables FB to be executed
Data type	BOOL
Range	0, 1
Unit	n/a
Default	—

Block ID

Description	ID name of the Master Block
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.13.102.4.2 Output

OK

Description	Returns true when function successfully executes
Data type	BOOL
Unit	n/a

Default (.Q)

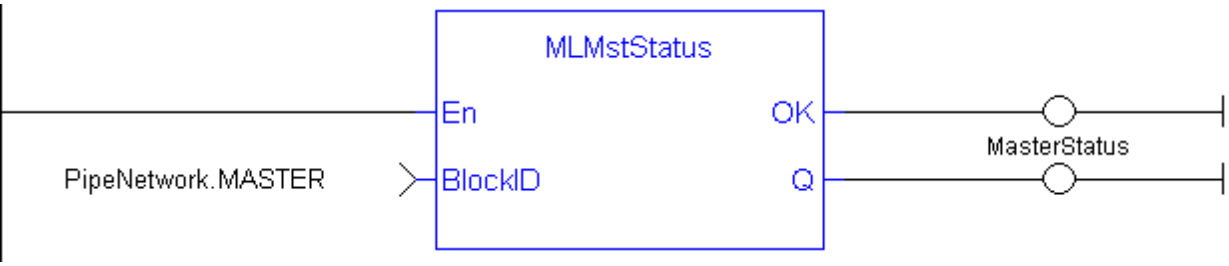
Description	Returns the status of the generator
Data type	DINT
Unit	n/a

1.1.13.103.5 Example

1.1.13.104.6.1 Structured Text

```
MasterStatus := MLMstStatus( PipeNetwork.MASTER );
```

1.1.13.105.7.2 Ladder Diagram



1.1.13.106.8.3 Function Block Diagram

1.1.13.107 MLMstWriteAccel

1.1.13.108.1 Description

Set the acceleration of a master block. Returns TRUE if the function succeeded.

1.1.13.109.2 Arguments

1.1.13.110.3.1 Input

EN	Description	Enables FB to be executed
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Block ID	Description	ID name of the Master Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
Acceleration	Description	Acceleration value expressed in user logical units per second squared
	Data type	LREAL
	Range	—

Unit	User unit/sec^2
Default	—

1.1.13.111.4.2 Output

Default (.Q)	Description	Returns true when function successfully executes
	Data type	BOOL
	Unit	n/a

1.1.13.112.5 Related Functions

MLMstAbs

MLMstRel

MLMstWriteSpeed

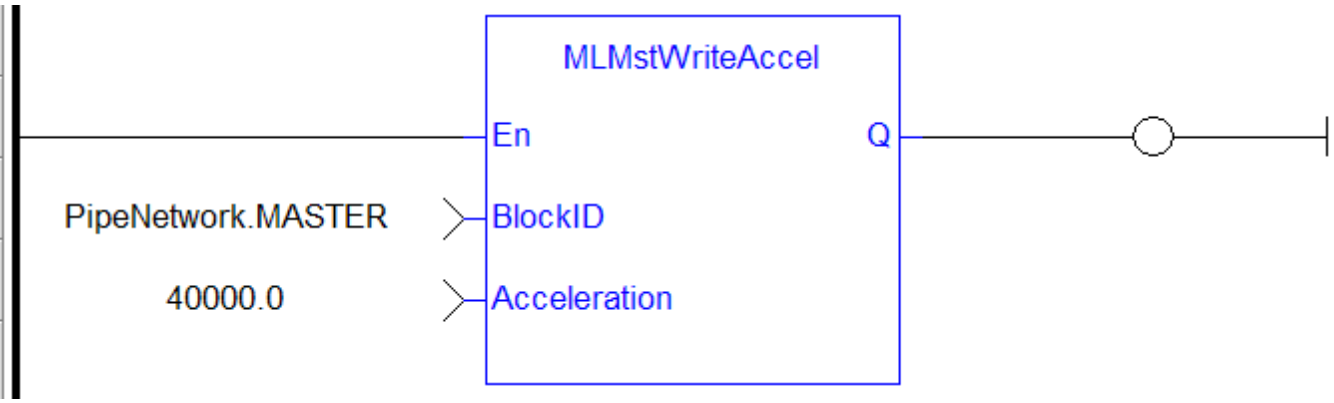
MLMstWriteDecel

1.1.13.113.6 Example

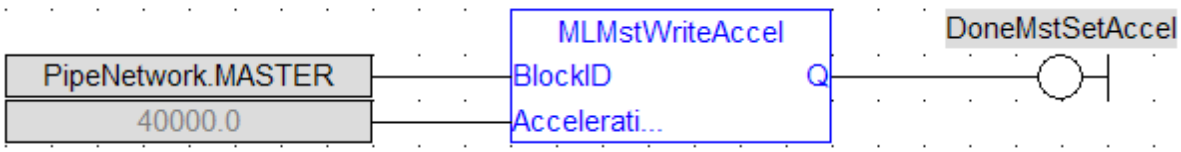
1.1.13.114.7.1 Structured Text

```
MLMstWriteAccel( PipeNetwork.MASTER, 40000.0 );
```

1.1.13.115.8.2 Ladder Diagram



1.1.13.116.9.3 Function Block Diagram



1.1.13.117 MLMstWriteDecel

1.1.13.118.1 Description

Set the deceleration of a master block. Returns TRUE if the function succeeded.

1.1.13.119.2 Arguments

1.1.13.120.3.1 Input

EN	Description	Enables FB to be executed
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Block ID	Description	ID name of the Master Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
Deceleration	Description	Deceleration value
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—

1.1.13.121.4.2 Output

Default (.Q)	Description	Returns true when function successfully executes
	Data type	BOOL
	Unit	n/a

1.1.13.122.5 Related Functions

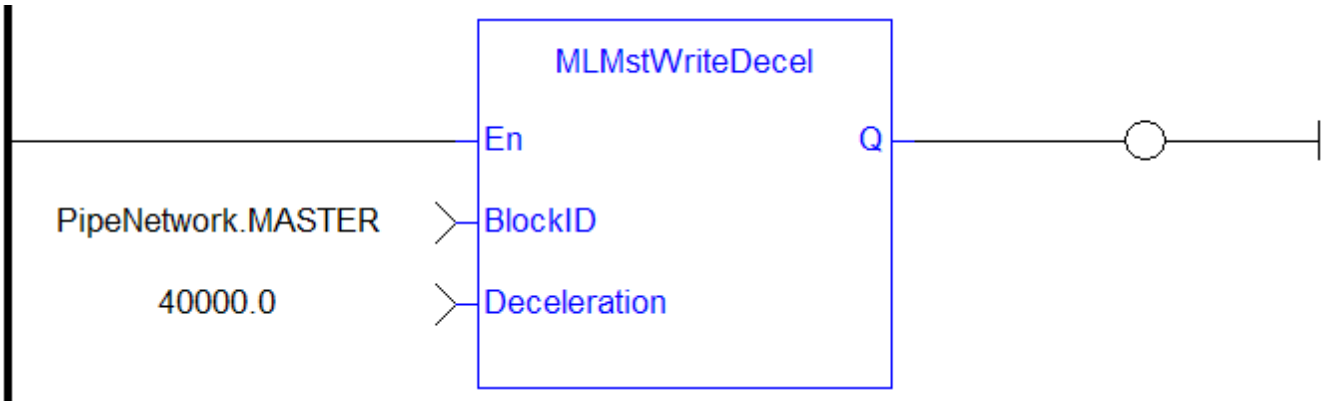
MLMstWriteSpeed

1.1.13.123.6 Example

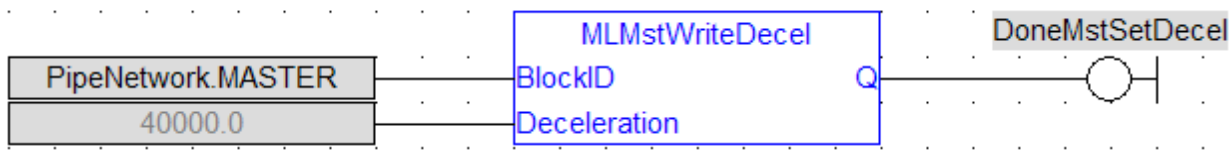
1.1.13.124.7.1 Structured Text

```
MLMstWriteDecel( PipeNetwork.MASTER, 40000.0 );
```

1.1.13.125.8.2 Ladder Diagram



1.1.13.126.9.3 Function Block Diagram



1.1.13.127 MLMstWriteInitPos

1.1.13.128.1 Description

Set the initial position of a master block. Returns TRUE if the function succeeded.

1.1.13.129.2 Arguments

1.1.13.130.3.1 Input

EN

Description	Enables FB to be executed
Data type	BOOL
Range	0, 1
Unit	n/a
Default	—

Block ID

Description	ID name of the Master Block
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

Position

Description	Initial position
Data type	LREAL
Range	—
Unit	User unit
Default	—

1.1.13.131.4.2 Output

Default (.Q)	Description	Returns true when function successfully executes
	Data type	BOOL
	Unit	n/a

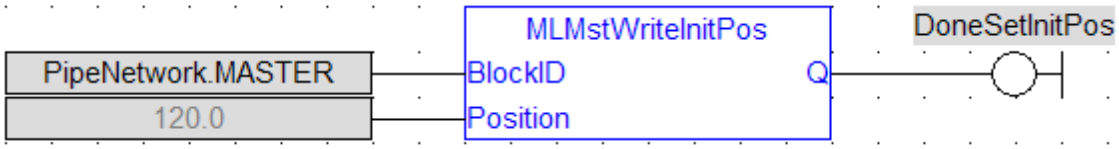
1.1.13.132.5 Example

1.1.13.133.6.1 Structured Text

```
MLMstWriteInitPos( PipeNetwork.MASTER, 120.0 );
```

1.1.13.134.7.2 Ladder Diagram

1.1.13.135.8.3 Function Block Diagram



1.1.13.136 MLMstWriteSpeed

1.1.13.137.1 Description

Set the speed of a master block. Returns TRUE if the function succeeded.

1.1.13.138.2 Arguments

1.1.13.139.3.1 Input

EN	Description	Enables FB to be executed
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—

Block ID	Description	ID name of the Master Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—

Speed	Description	Speed of the motion
	Data type	LREAL
	Range	—
	Unit	User unit/sec
	Default	—

1.1.13.140.4.2 Output

Default (.Q)	Description	Returns true when function successfully executes
	Data type	BOOL
	Unit	n/a

1.1.13.141.5 Related Functions

MLMstWriteSpeed

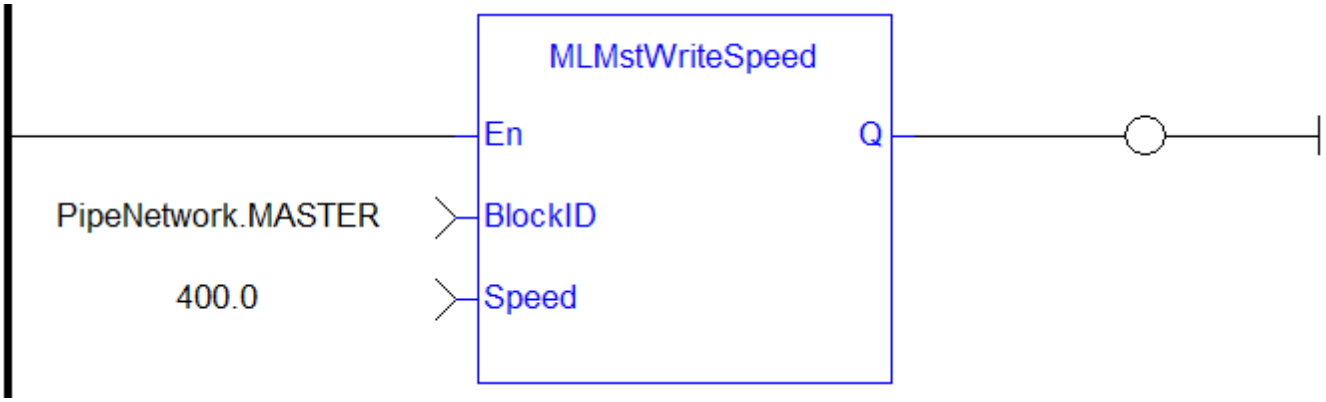
MLMstWriteDecel

1.1.13.142.6 Example

1.1.13.143.7.1 Structured Text

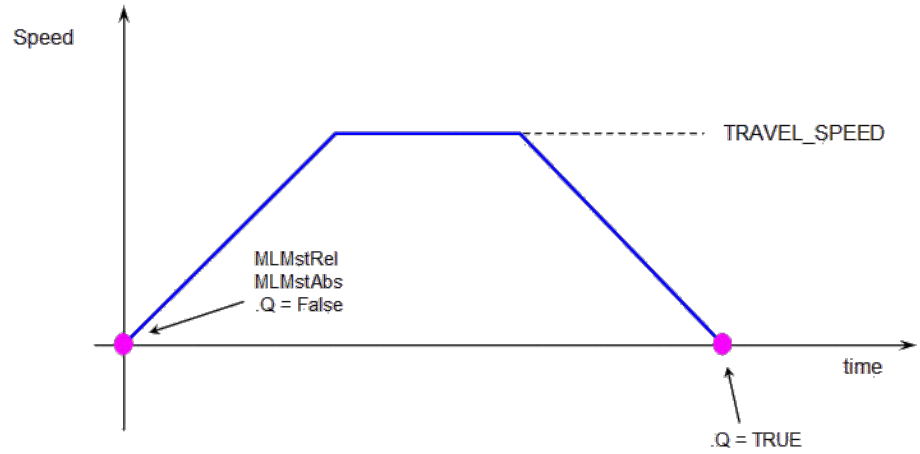
```
MLMstWriteSpeed( PipeNetwork.MASTER, 400.0 );
```

1.1.13.144.8.2 Ladder Diagram



1.1.13.145.9.3 Function Block Diagram

1.1.13.146 Usage example of Master Functions



MLMstRun(0.0) reduce the speed down to 0.

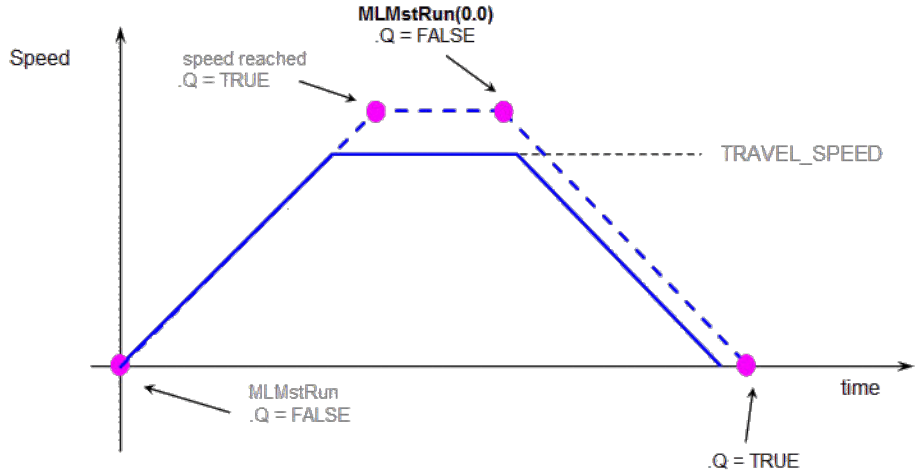


Figure 1-26: Master Functions Usage

1.1.14 Motion Library - Phaser

TIP For usage example about Phaser Functions, see page 132

Names	Description	Return type
MLPhaInit	Initializes a phaser Pipe Block	BOOL
MLPhaReadPhase	Gets the phase value of a phaser block	None

Names	Description	Return type
MLPhaReadSlope	Gets the phase slope value of a phaser block	None
MLPhaWritePhase	Sets the phase value of a phaser block	BOOL
MLPhaWriteSlope	Sets the phase slope value of a phaser block	BOOL
MLPhaReadActPhase		

TIP There is a delay when using an external encoder. The delay is five cycles (2 cycles to read the encoder from the AKD via EtherCAT, 1 cycle for computing, 2 cycles for sending the new position set point to the AKD). This lag error is speed proportional (5 cycles * speed). A Phaser block can be used to compensate for this lag.

When executing, the phaser block is in one of three states: **Standby**, **Changing phase**, or **Applying phase**.

Standby	Entered when the Block is initialized. Exits to the State "Changing Phase" when the Phase value is changed via the MLPhaWritePhase command
Changing Phase	Entered when a new value is programmed, and exits to "Applying phase" state when the programmed phase offset is reached. The current Phase offset value is slewed to the new phase offset by the amount of the slew value.
Applying Phase	Entered when the programmed Phase value is reached. Exits to the Changing phase state whenever a new value is programmed via the MLPhaWritePhase function changes the Phase Offset target.

1.1.14.1 Usage example of Phaser Functions

You can call MLPhaWritePhase function to modify the Phase value..

You can call MLPhaWriteSlope to modify the rate of change of phase, or slope, applied when the Phase value is changed.

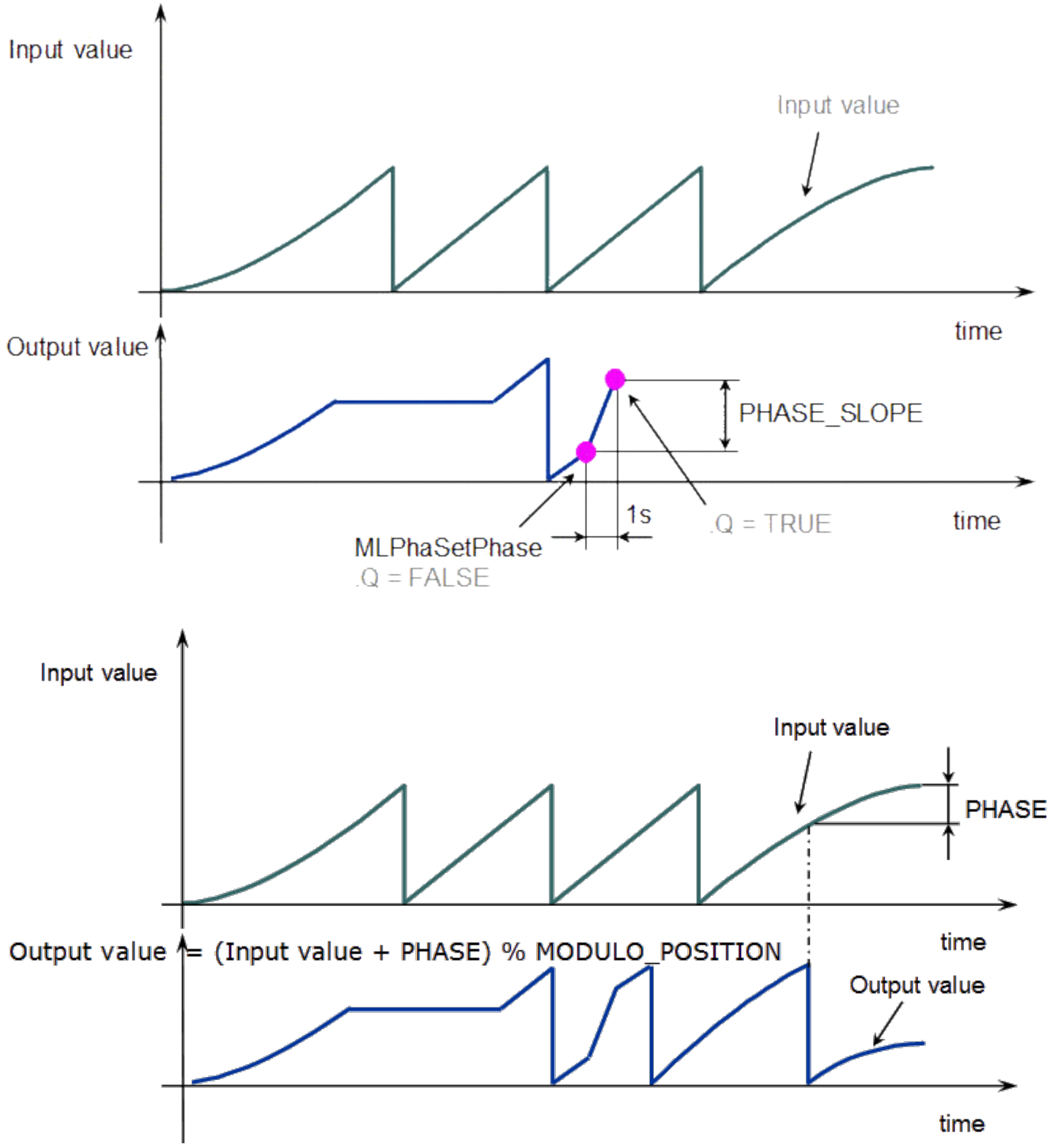


Figure 1-27: Phaser Functions Usage

NOTE **% MODULO_POSITION** is in the equation to take into account the modulo (periodicity) of the value.

1.1.15 Motion Library - PMP

Name	Description	Return type
MLPmpAbs	Moves to an Absolute Position	BOOL

Name	Description	Return type
MLPmpForcePos	Forces the specified position. Possible only when the block is **not** moving.	BOOL
MLPmpInit	Initializes a PMP object (Parabolic Motion Profile generator) with user-defined settings	BOOL
MLPmpReadAccel	Gets the Acceleration parameter of a PMP block	None
MLPmpReadFstSpd	Gets the FirstTravelSpeed parameter of a PMP block	None
MLPmpReadInitPos	Gets the InitialPosition parameter of a PMP block	None
MLPmpReadJerk	Gets the Jerk parameter of a PMP block	None
MLPmpReadLstSpd	Gets the LastTravelSpeed parameter of a PMP block	None
MLPmpRel	Does two subsequent relative moves	BOOL
MLPmpRun	Jog the generator at the specified speed	BOOL
MLPmpStatus	Returns the status of the PMP block generator	None
MLPmpWriteAccel	Sets the acceleration parameter of a PMP block	BOOL
MLPmpWriteFstSpd	Sets the FirstTravelSpeed parameter of a PMP block	BOOL
MLPmpWriteJerk	Sets the jerk parameter of a PMP block	BOOL
MLPmpWriteLstSpd	Sets the LastTravelSpeed parameter of a PMP block	BOOL

1.1.16 Motion Library - Sampler

Name	Description	Return type
MLSmpConnect	Connects a sampler to a pipe network axis or pipe block	BOOL
MLSmpConnectEx	Connects a sampler to the specified external data source	BOOL
MLSmpInit	Initializes a sampler object	BOOL

TIP There is a delay when using an external encoder. The delay is five cycles (2 cycles to read the encoder from the AKD via EtherCAT, 1 cycle for computing, 2 cycles for sending the new position set point to the AKD). This lag error is speed proportional (5 cycles * speed). A Phaser block can be used to compensate for this lag.

1.1.16.1 MLSmpConnect

1.1.16.2.1 Description

Connect a sampler to an axis or pipe block as a value source. Returns TRUE if the function succeeded.

1.1.16.3.2 Arguments

1.1.16.4.3.1 Input

BlockID

Description	ID Name of the SMP function block in the Pipe Network
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

AxisID

Description	ID Name of the Axis or Pipe Block the sampler is connected to
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.16.5.4.2 Output

Default (.Q)

Description	Returns True if the Sampler is connected
Data type	BOOL
Unit	n/a

1.1.16.6.5.3 Return Type

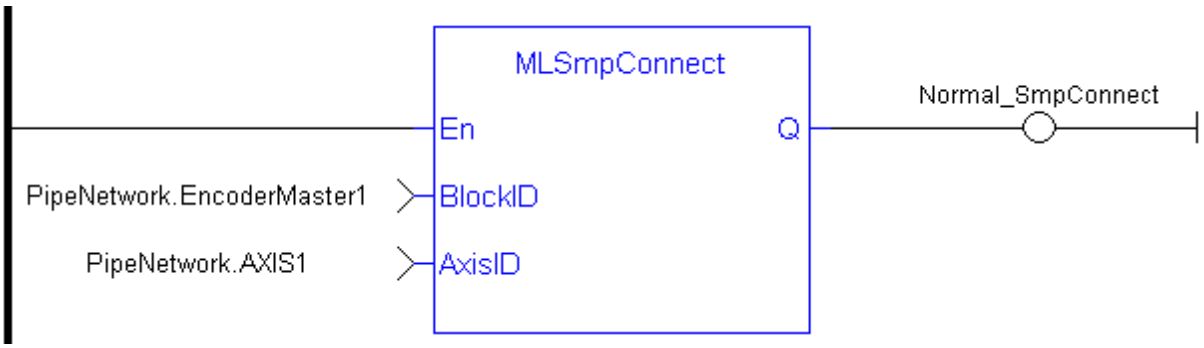
BOOL

1.1.16.7.6 Example

1.1.16.8.7.1 Structured Text

```
MLSmpConnect( PipeNetwork.EncoderMaster1, AxisID(*DINT*) ) ;
```

1.1.16.9.8.2 Ladder Diagram



1.1.16.10.9.3 Function Block Diagram

1.1.16.11 MLSmpConnectEx

1.1.16.12.1 Description

Connect a sampler to the specified data source. Returns TRUE if the function succeeded.

1.1.16.13.2 Arguments

1.1.16.14.3.1 Input

BlockID	**Description**	ID Name of the SMP function block in the Pipe Network
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
DriverName	**Description**	Driver name of the external source or Axis Name. Examples: 'EtherCATDriver' 'AXIS1' 'PLCOpenAxis1'
	Data type	STRING
	Range	—
	Unit	n/a
	Default	—

SourceConfig

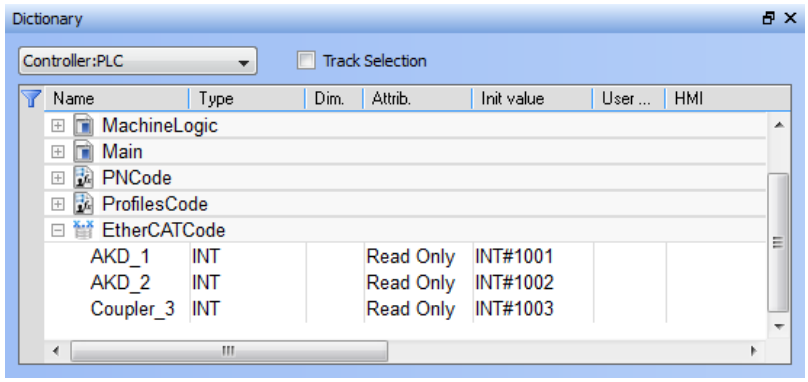
Description Configuration of the source (for EtherCAT motion bus) or the specific variable inside an axis object.

EtherCAT:

The string must have the form '<EtherCAT address>:<source type>'

For example: '1001:Position actual value 2'

- This maps the secondary feedback from an axis in the created pipe network
- The <EtherCAT address> can be found by looking in *EtherCATcode* item in the project Dictionary. For example:



Example for **AXIS1 'PipePosition'**
(One of the following:
'PipePosition'
'ReferencePosition'
'GeneratorPosition'
'ActualPosition'
'FeedbackPosition'
'2ndFeedbackPosition'
'ActualVelocity'
'ActualTorque'
'FollowingError'
'CurrentPosition')

PLCOpen Axis:

Example: **PLCOpenAxis1 'ActualPosition'**
(One of the following:
'ActualPosition'
'CommandPosition'
'NormalCmdPos'
'SuperimposedCmdPos'
'PhaseCmdPos')

Data Type STRING

Range —

Unit n/a

Default —

1.1.16.15.4.2 Output

Default (.Q) **Description** Function block is operational

Data type	BOOL
Unit	n/a

1.1.16.16.5.3 Return Type

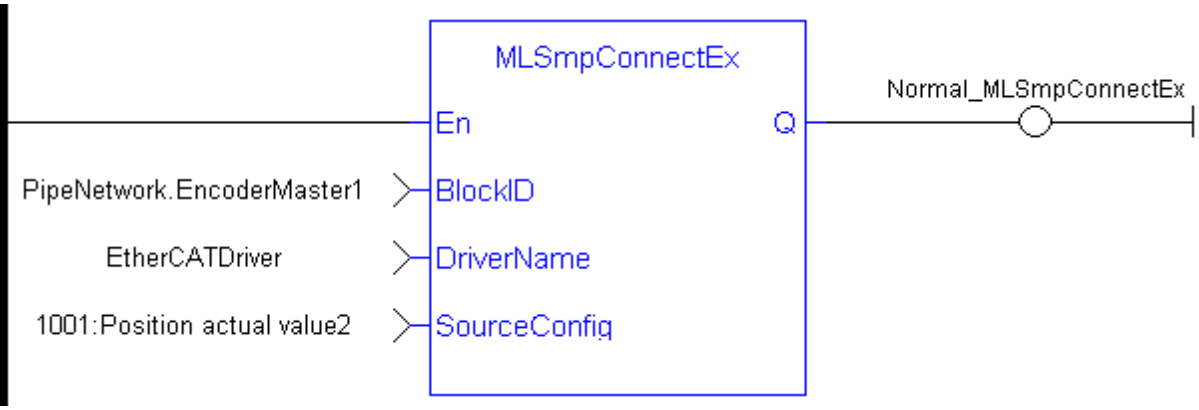
BOOL

1.1.16.17.6 Example

1.1.16.18.7.1 Structured Text

```
MLSmpConnectEx(PipeNetwork.Feedback2, 'EtherCATDriver',
'1001:Position actual value 2');
```

1.1.16.19.8.2 Ladder Diagram



1.1.16.20.9.3 Function Block Diagram

1.1.16.21 MLSmpInit

1.1.16.22.1 Description

The purpose of the sampler block is to periodically sample and place into a pipe some output of a source object. The sampled output can typically be the POSITION or SPEED of a source object measured by a resolver, an encoder or some other types of sensor.

The sampler implements the logical connection between an encoder on a physical master axis (the source object) and one or more pipes and performs the function of periodically sampling the source and placing the sampled values into the pipe.

This function block is automatically called by the Function PipeNetwork(MLPN_CREATE_ OBJECTS) if a Smp Block is added to the Pipe Network, with user-defined settings entered in the Pipe Blocks Properties screen.

The Smp Pipe Block is assigned a Name, SAMPLING_PERIOD, MODE, INPUT_VALUE_ PERIOD and OUTPUT_VALUE_PERIOD.

1.1.16.23.2 Arguments

1.1.16.24.3.1 Input

BlockID	**Description**	ID Name of the PMP function block in the Pipe Network
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
SamplingPeriod	**Description**	period that the device is sampled
	Data type	LREAL
	Range	0.25 to ?
	Unit	millisecond
	Default	1.0
Mode	**Description**	Sampled output can be either position or velocity
	Data type	DINT
	Range	[1 , 2] Position or Speed
	Unit	n/a
	Default	position
InputModuloPosition	**Description**	Period of the input signal. This should be set equal to 2^{32} (4294967296).
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	360.0
OutputModuloPosition	**Description**	Period of the output signal
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	360.0

1.1.16.25.4.2 Output

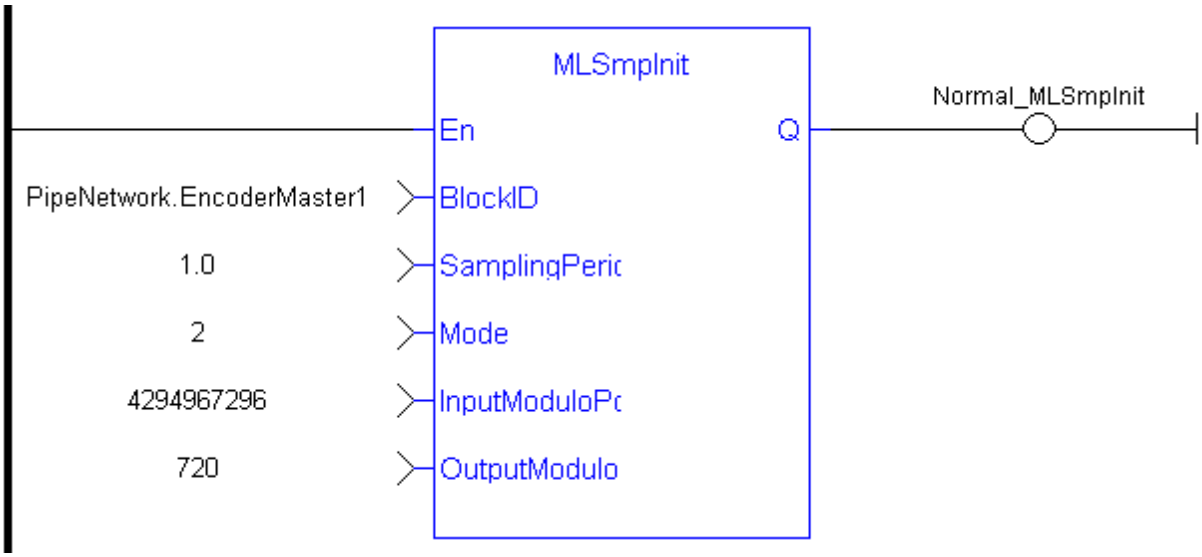
Default (.Q)	**Description**	Smp Block successfully initiated
	Data type	BOOL
	Unit	n/a

1.1.16.26.5 Example

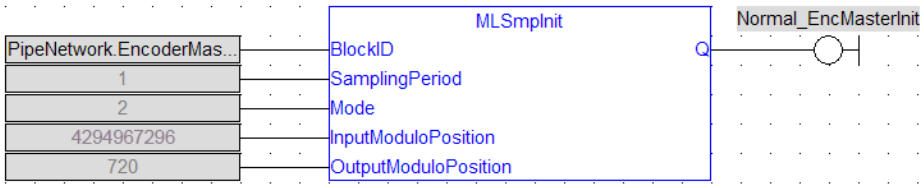
1.1.16.27.6.1 Structured Text

```
MLSmpInit( PipeNetwork.EncoderMaster1, SamplingPeriod(*LREAL*),
Mode(*DINT*),
InputModuloPosition(*LREAL*), OutputModuloPosition(*LREAL*) ) );
```

1.1.16.28.7.2 Ladder Diagram



1.1.16.29.8.3 Function Block Diagram



1.1.17 Motion Library - Synchronizer

TIP For usage example about Synchronizer Functions, see page 148

Name	Description	Return type
MLSyncInit	Initializes a synchronizer Pipe Block	BOOL
MLSyncReadDeltaS	Gets the output phasing value of a synchronizer block	None
MLSyncStart	Starts a synchronization of a synchronizer Pipe Block	BOOL
MLSyncStop	De-synchronizes a synchronizer Pipe Block	BOOL
MLSyncWriteDeltaS	Sets the output phasing value of a synchronizer block	BOOL

1.1.17.1 MLSyncInit

1.1.17.2.1 Description

Initializes a synchronizer Pipe Block. Returns TRUE if the function succeeded.

This FB is automatically created in the compiled code of a Pipe Network.

This function block is part of the MLPN_CREATE_OBJECT to initialize the Pipe Network. It is called at the beginning of an application program with the function call:

```
PipeNetwork(MLPN_CREATE_OBJECTS);
```

1.1.17.3.2 Arguments

1.1.17.4.3.1 Input

BLockID	Description	Name of the Pipe Network Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
ModuloPosition	Description	The modulo distance
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—
CurveType	Description	The curve type to the motion when starting and stopping synchronization. Option are Parabolic or Polynomial
	Data type	DINT
	Range	[1 , 2] (1 = Parabolic, 2 = Polynomial)
	Unit	n/a
	Default	—
DeltaS	Description	The Distance to get in or out of synchronization. This parameter is used in the MLSyncStart and MLSyncStop FunctionBlocks
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—

1.1.17.5.4.2 Output

Default (.Q)	Description	Function Block Execute Successfully
	Data type	BOOL
	Unit	n/a

1.1.17.6.5 Related Functions

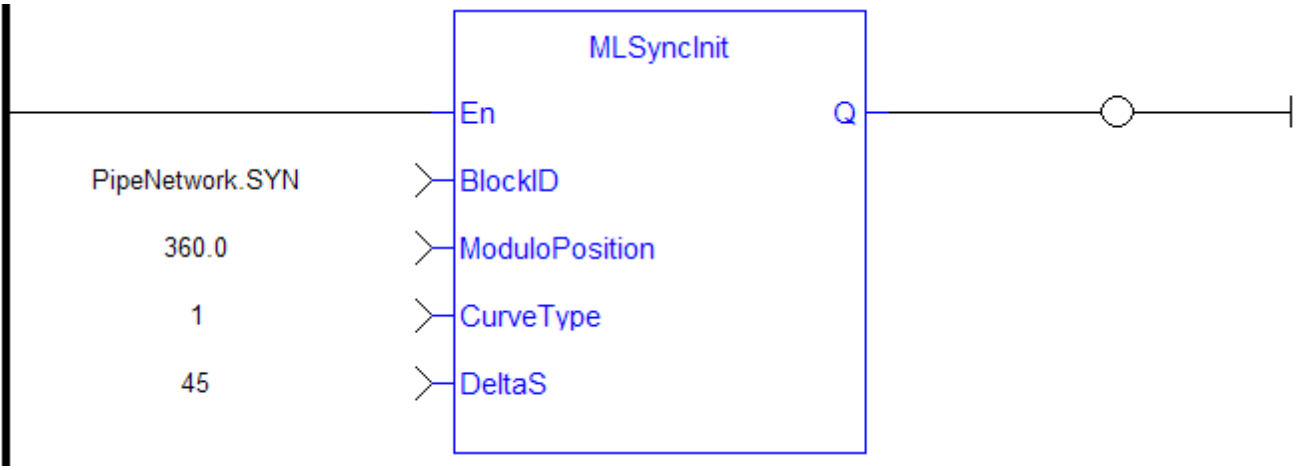
MLSyncWriteDeltaS

1.1.17.7.6 Example

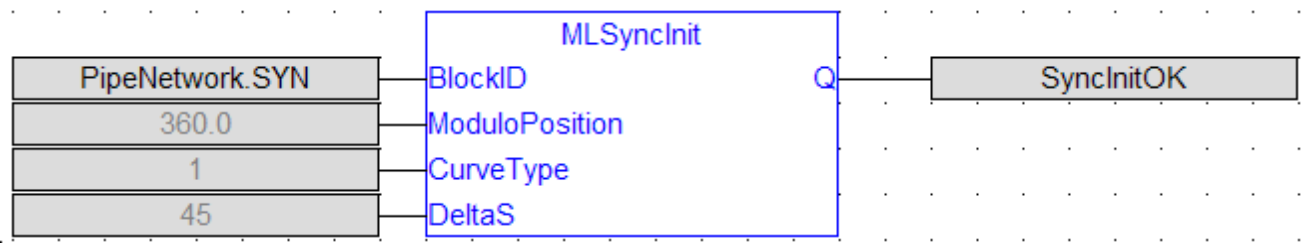
1.1.17.8.7.1 Structured Text

```
MLSyncInit( PipeNetwork.SYN, 360, 1, 30 );
```

1.1.17.9.8.2 Ladder Diagram



1.1.17.10.9.3 Function Block Diagram



1.1.17.11 MLSyncReadDeltaS

1.1.17.12.1 Description

Gets the output phasing value of a synchronizer block. Output phasing is the distance or the slope the output takes to synchronize with the input when MLSyncStart Block is executed (see "Figure 1-28: Get Output Phasing after MLSyncStart " on page 143). It also affects the distance or the slope the output takes to desynchronize with the input and come to a stop when MLSyncStop Block is executed (see "Figure 1-29: Get Output Phasing after MLSyncStop " on page 143).

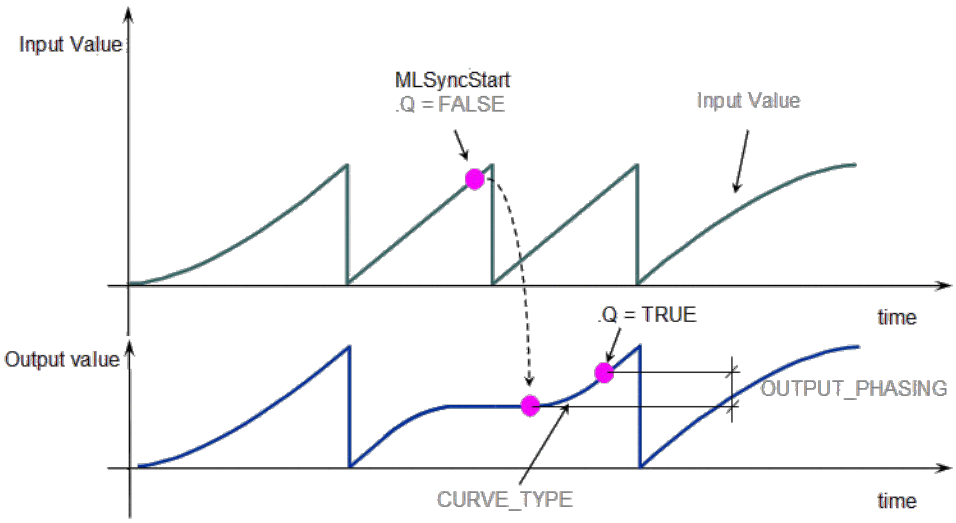


Figure 1-28: Get Output Phasing after MLSyncStart

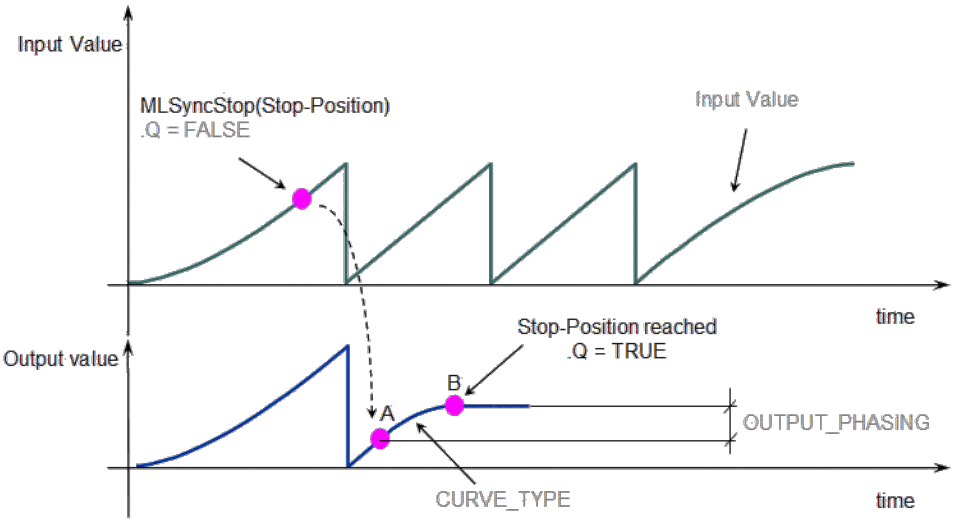


Figure 1-29: Get Output Phasing after MLSyncStop

1.1.17.13.2 Arguments

1.1.17.14.3.1 Input

BlockID

Description	Name of the Pipe Network Block
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.17.15.4.2 Output

DeltaS

Description	Present Delta Slope value
Data type	LREAL
Unit	User unit

1.1.17.16.5 Related Functions

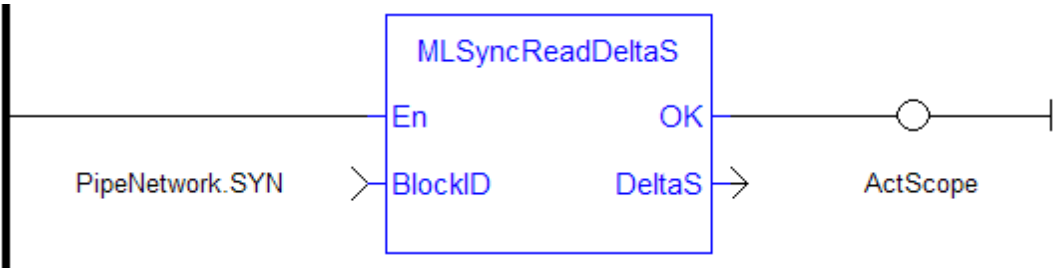
MLSyncWriteDeltaS

1.1.17.17.6 Example

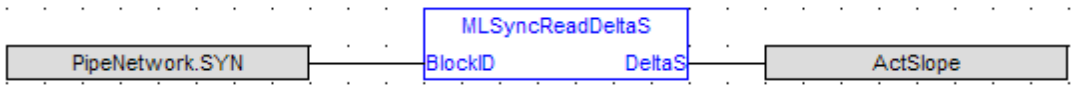
1.1.17.18.7.1 Structured Text

```
ActScope := MLSyncReadDeltaS( PipeNetwork.SYN );
```

1.1.17.19.8.2 Ladder Diagram



1.1.17.20.9.3 Function Block Diagram



1.1.17.21 MLSyncStart

1.1.17.22.1 Description

Start a synchronization of a synchronizer Pipe Block. Returns TRUE if the function succeeded.

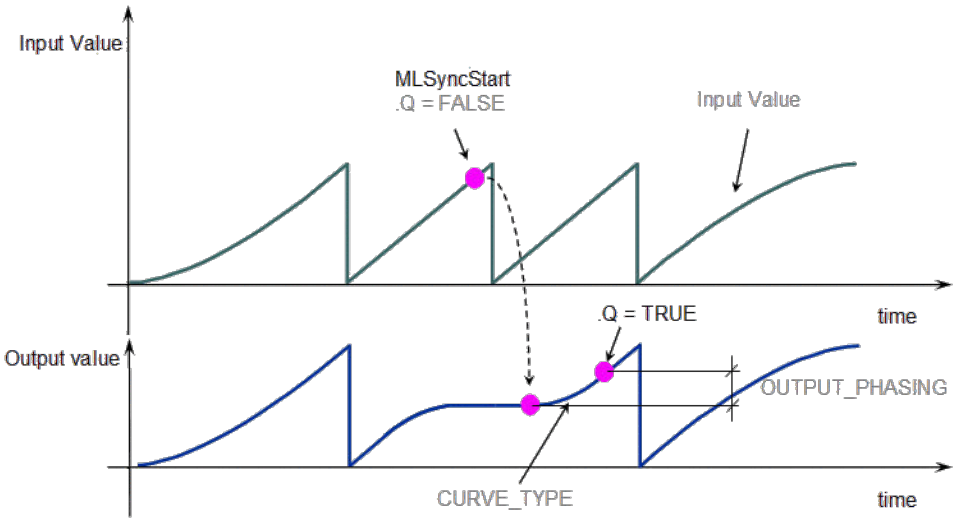


Figure 1-30: MLSyncStart

1.1.17.23.2 Arguments

1.1.17.24.3.1 Input

BLockID	Description	Name of the Pipe Network Block

Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.17.25.4.2 Output

Default (.Q)

Description	Function Block Execute Successfully
Data type	BOOL
Unit	n/a

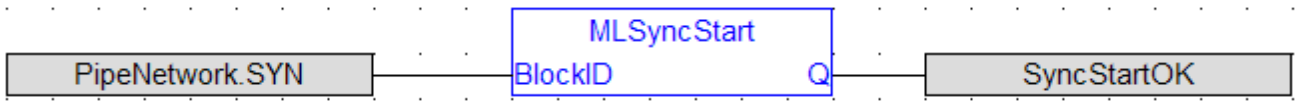
1.1.17.26.5 Example

1.1.17.27.6.1 Structured Text

```
MLSyncStart( PipeNetwork.SYN );
```

1.1.17.28.7.2 Ladder Diagram

1.1.17.29.8.3 Function Block Diagram



1.1.17.30 MLSyncStop

1.1.17.31.1 Description

De-synchronizes a synchronizer Pipe Block. Returns TRUE if the function succeeded.

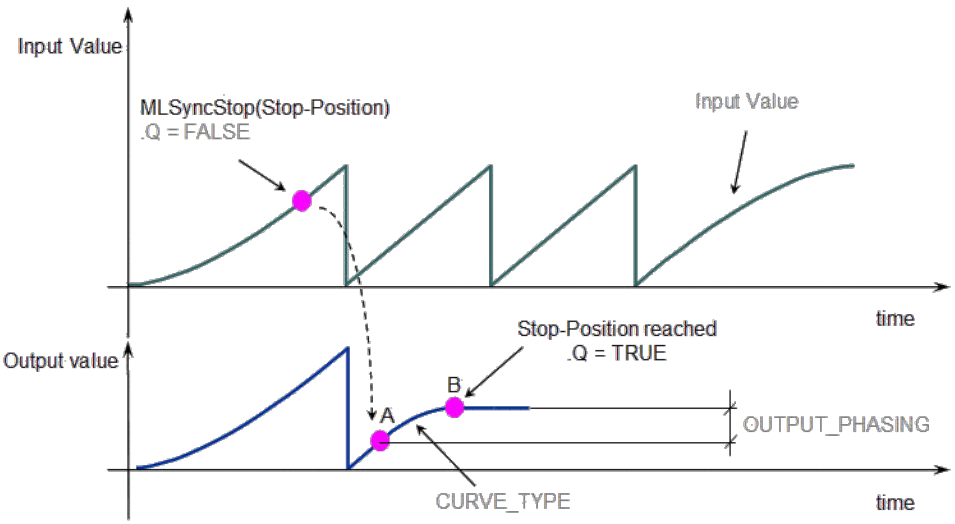


Figure 1-31: MLSyncStop

1.1.17.32.2 Arguments

1.1.17.33.3.1 Input

Position

Description	Motion Stop Position
Data type	LREAL
Range	—
Unit	User unit
Default	—

1.1.17.34.4.2 Output

Default (.Q)

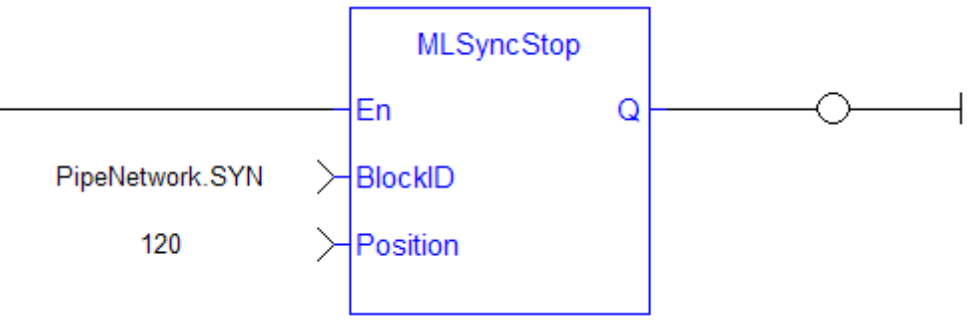
Description	Function Block Execute Successfully
Data type	BOOL
Unit	n/a

1.1.17.35.5 Example

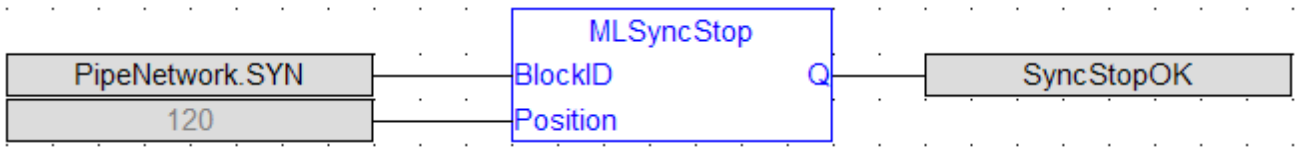
1.1.17.36.6.1 Structured Text

```
MLSyncStop( PipeNetwork.SYN , 120 );
```

1.1.17.37.7.2 Ladder Diagram



1.1.17.38.8.3 Function Block Diagram



1.1.17.39 MLSyncWriteDeltaS

1.1.17.40.1 Description

Set the output phasing value of a synchronizer block. Returns TRUE if the function succeeded. Output phasing is the distance or the slope the output takes to synchronize with the input when MLSyncStart Block is executed. It also affects the distance or the slope the output takes to desynchronize with the input and come to a stop when MLSyncStop Block is executed.

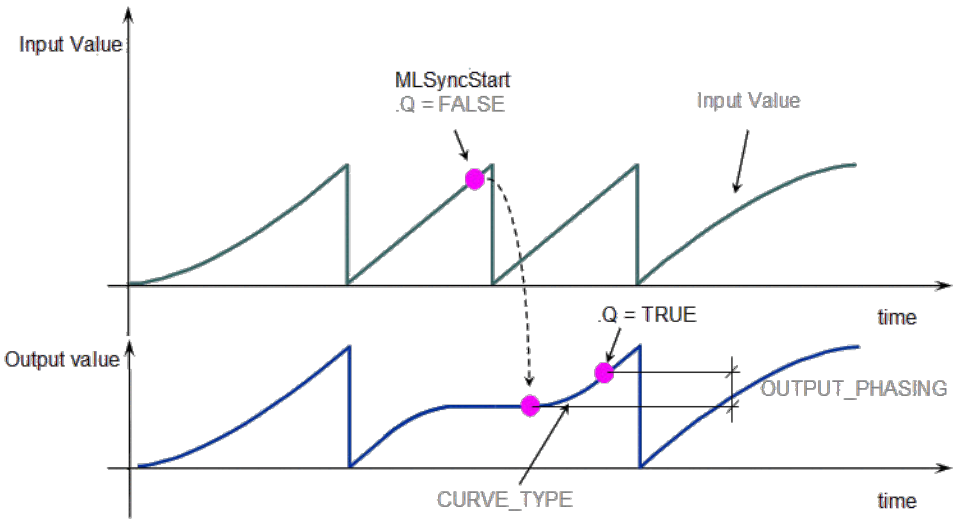


Figure 1-32: Set output phasing after MLSyncStart

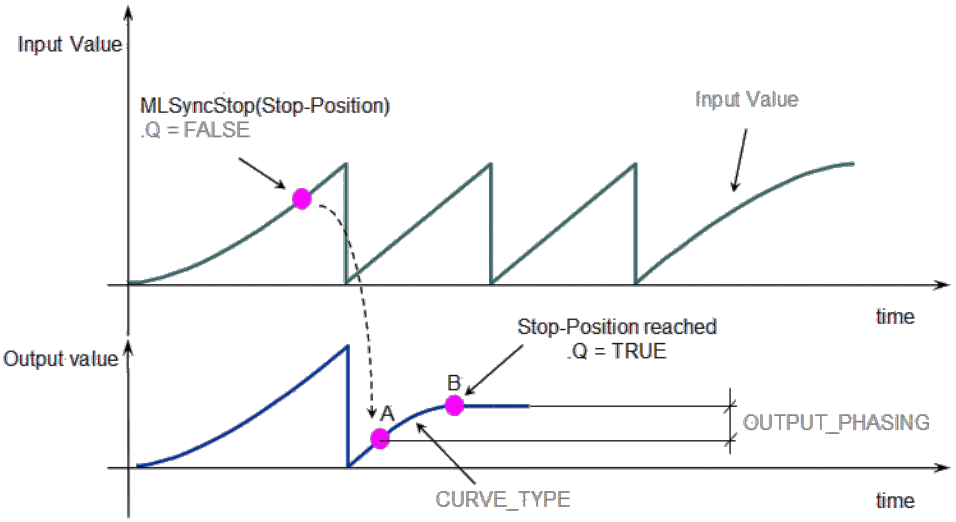


Figure 1-33: Set output phasing after MLSyncStop

1.1.17.41.2 Arguments

1.1.17.42.3.1 Input

BLockID	Description	Name of the Pipe Network Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
DeltaS	Description	Slope to be used during Start and stop of Synchronization
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—

1.1.17.43.4.2 Output

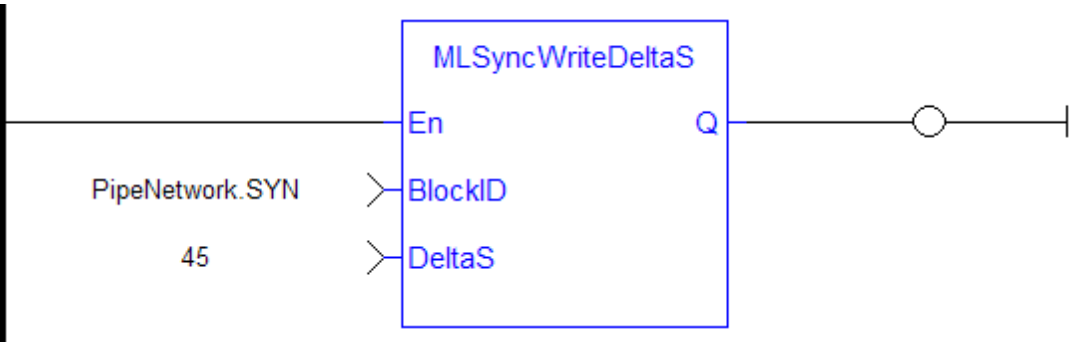
Default (.Q)	Description	Function Block Execute Successfully
	Data type	BOOL
	Unit	n/a

1.1.17.44.5 Example

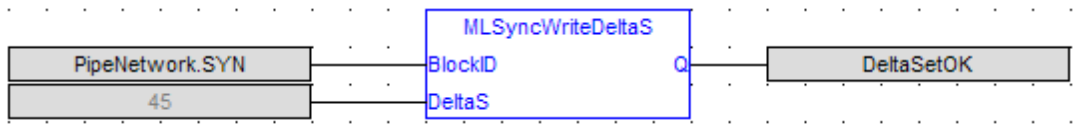
1.1.17.45.6.1 Structured Text

```
MLSyncWriteDeltaS( PipeNetwork.SYN, 45 );
```

1.1.17.46.7.2 Ladder Diagram



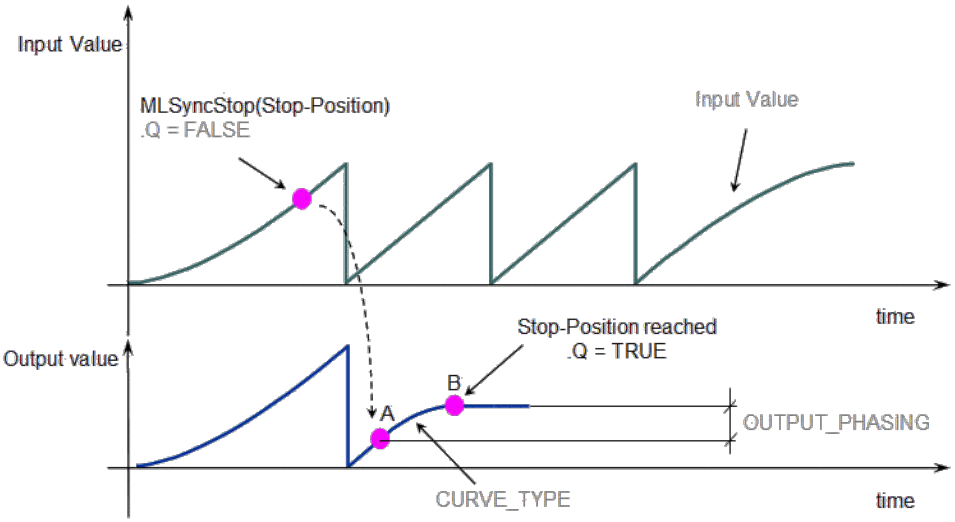
1.1.17.47.8.3 Function Block Diagram



1.1.17.48 Usage example of Synchronizer Functions

When you call the **MLSyncStop** function, the output value is adapted according to the specified Stop-Position (point B).

The OUTPUT_PHASING parameter is used to define point A, where the flow follows a curve in order to smooth the output value.



When you call the **MLSyncStart** function, the output value is adapted to catch up with the input value.

The OUTPUT_PHASING parameter is also used to define a curve in order to smooth the output value.

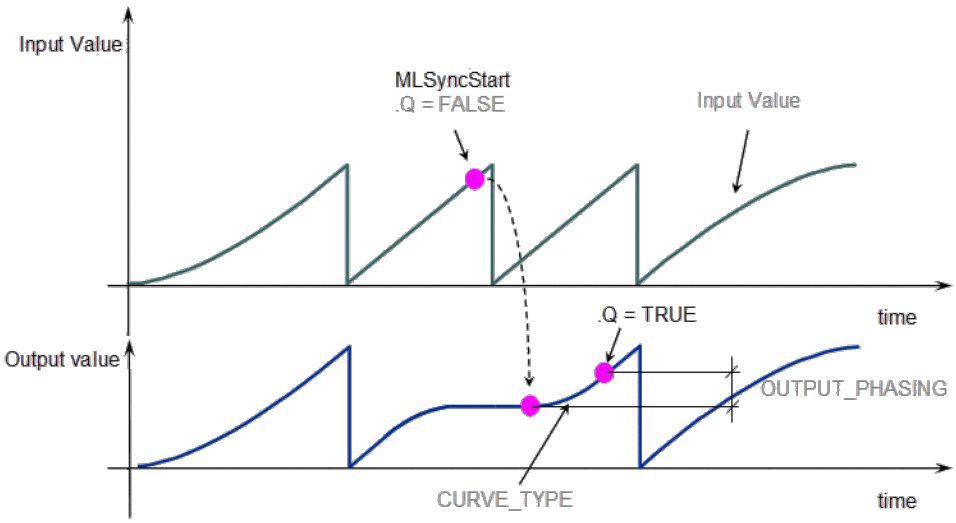


Figure 1-34: Synchronizer Functions Usage

1.1.18 Motion Library - Trigger

TIP For usage example about Trigger Functions, see page 161

Name	Description	Return type
MLTrigClearFlag	Clears the flag of an initiated Trigger block	BOOL
MLTrigInit	Initializes a Trigger object	BOOL
MLTrigIsTrigged	Checks if the selected block has been triggered	BOOL
MLTrigReadDelay	Returns the time that the trigger block uses to compensate the delay of the sensor that captures the triggering signal	None
MLTrigReadPos	Returns the position of the block at the moment when it was triggered	None
MLTrigReadTime	Returns the time of the moment where the block was triggered in milliseconds	None
"MLTrigSetEdge" (see page 159)	Sets the edge configuration for a Trigger object	BOOL
MLTrigWriteDelay	Sets the time that the trigger block uses to compensate for the delay introduced by the sensor that captures the triggering signal	BOOL

1.1.18.1 MLTrigClearFlag

1.1.18.2.1 Description

Clears the flag of an initiated Trigger block so the block can capture the position and time of the next event. Once triggered, a block has to be reset with this command before it can be triggered again. All events that are sent to a block while in a triggered state are ignored and the position and time information is lost.

IMPORTANT The Fast Input assigned to a Trigger block has to be reset as well before information on a new event can be captured. MLAxisRstFastIn is generally used at the same time as MLTrigClearFlag

1.1.18.3.2 Arguments

1.1.18.4.3.1 Input

BlockID

Description	ID number of an initiated Trigger object
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.18.5.4.2 Output

Default (.Q)

Description	Returns TRUE if function block is executed
Data type	BOOL
Unit	n/a

1.1.18.6.5.3 Return Type

BOOL

1.1.18.7.6 Related Functions

MLAxisRstFastIn

MLTrigIsTrigged

MLTrigReadPos

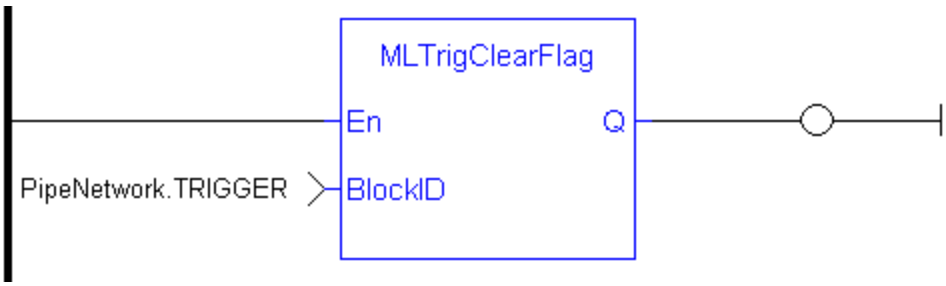
MLTrigReadTime

1.1.18.8.7 Example

1.1.18.9.8.1 Structured Text

```
//Clear Trigger Flag
MLTrigClearFlag( PipeNetwork.TRIGGER );
```

1.1.18.10.9.2 Ladder Diagram



1.1.18.11.10.3 Function Block Diagram

1.1.18.12 MLTrigInit

1.1.18.13.1 Description

Initializes a Trigger object for use in a PLC Program. Function block is automatically called if a Trigger Block is added to the Pipe Network, with user-defined settings entered in the Pipe Blocks Properties screen.

The Trigger object monitors a selected Fast Input and captures the time of a rising or falling edge event. With the time and pipe position information the Trigger object extrapolates the axis position when the Fast Input event occurred.

Parameters to enter include the name of the Pipe Block, the Axis where the Fast Input is located, the number of the desired Fast Input, and whether to trigger on the rising or falling edge of the input.

NOTE Trigger objects are normally created in the Pipe Network using the

NOTE graphical engine. Then you do not have to add MLTrigInit function blocks to their programs. Parameters are entered directly in pop-up windows, and the code is then automatically added to the current project.

1.1.18.14.2 Arguments

1.1.18.15.3.1 Input

BlockID	Description	ID number of a created Pipe Block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
Input_Axis	Description	Name of the axis where the Fast Input is located
	Data type	STRING
	Range	—
	Unit	n/a
	Default	—
InputID	Description	ID number of the Fast Input 0 = Capture Engine 0 1 = Capture Engine 1 Range is [0,1] For information on configuring the capture engines, refer to AKD Capture Engine Configuration.
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
EdgeID	Description	Trigger at rising or falling edge of Fast Input. Enter 1 for rising edge, 2 for falling edge, and 0 disables the Fast Input
	Data type	DINT
	Range	[0 , 2]
	Unit	n/a
	Default	1 (Rising edge)

1.1.18.16.4.2 Output

Default (.Q)	Description	Returns TRUE if function block is executed
	Data type	BOOL
	Unit	n/a

1.1.18.17.5.3 Return Type

BOOL

1.1.18.18.6 Related Functions

MLTrigIsTrigged

MLTrigReadPos

MLTrigClearFlag

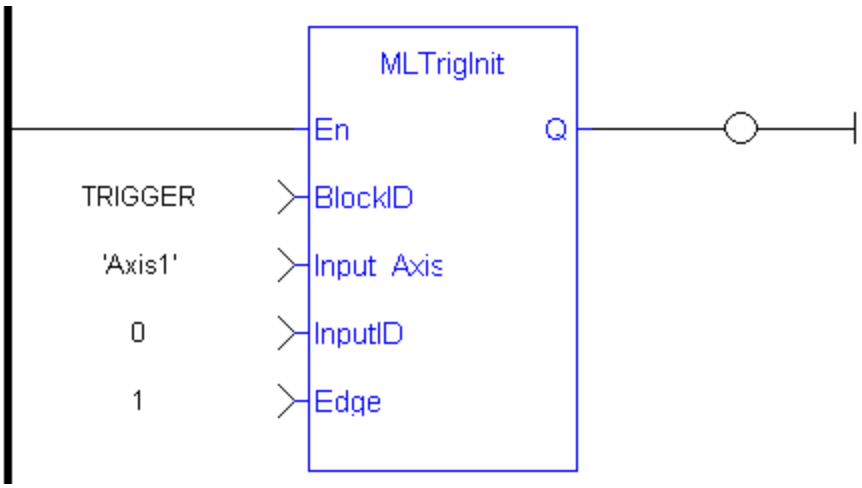
MLAxisRstFastIn

1.1.18.19.7 Example

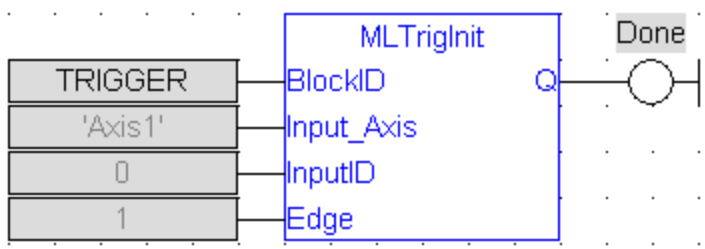
1.1.18.20.8.1 Structured Text

```
//Create and Initiate a Trigger object
TRIGGER := MLBlkCreate( 'TRIGGER', 'TRIGGER' );
MLTrigInit( TRIGGER, 'Axis1', 0, 1 );
```

1.1.18.21.9.2 Ladder Diagram



1.1.18.22.10.3 Function Block Diagram



1.1.18.23 MLTrigIsTrigged

1.1.18.24.1 Description

Checks if the selected block has been triggered. When a block has been triggered, it contains the time and position when a Fast Input event occurred. The application has to reset the block before the block can be triggered again. All trigger events that are sent to the block during its triggered state are lost.

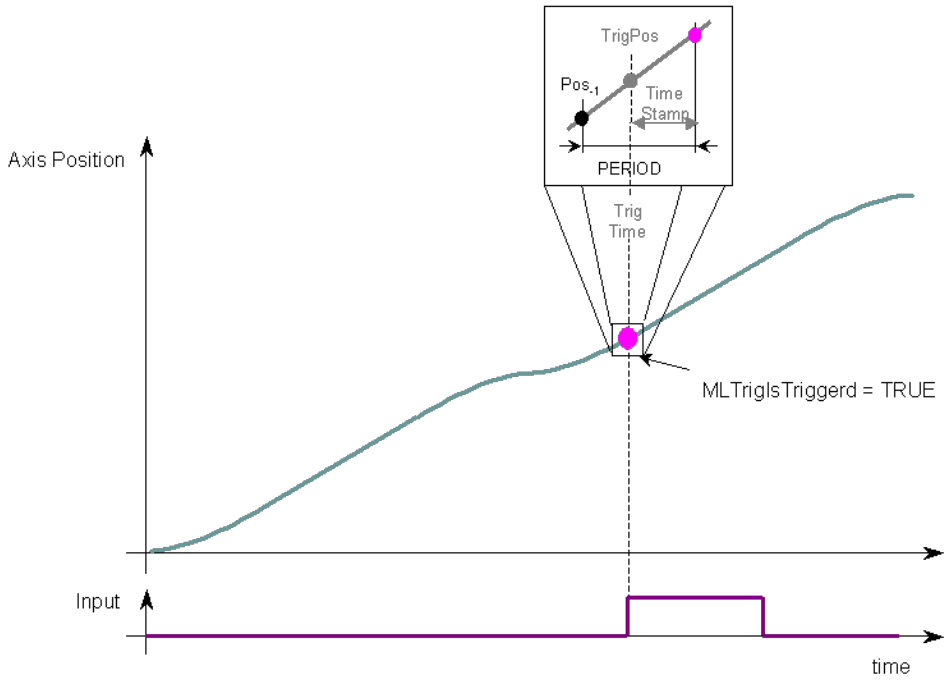


Figure 1-35: MLTrigIsTrigged

> **NOTE** Once triggered, a block has to be reset before it can be triggered again. All events that are sent to a block while in a triggered state are ignored and the position and time information is lost.

1.1.18.25.2 Arguments

1.1.18.26.3.1 Input

BlockID

Description	ID number of an initiated Trigger object
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.18.27.4.2 Output

Default (.Q)

Description	Returns TRUE if the selected Trigger Object has Triggered
Data type	BOOL
Unit	n/a

1.1.18.28.5.3 Return Type

BOOL

1.1.18.29.6 Related Functions

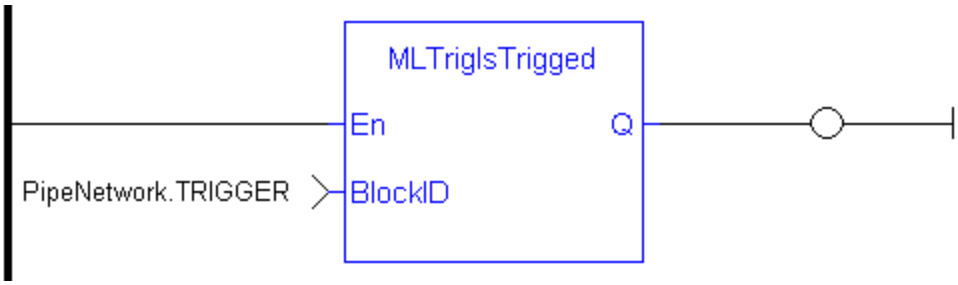
MLTrigReadPos

MLTrigReadTime

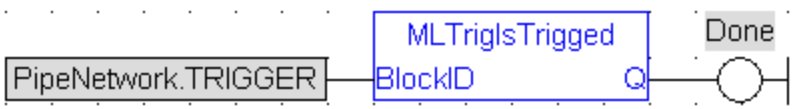
1.1.18.30.7 Example

```
//Check if a Trigger Block has been triggered, then save position

IF MLTrigIsTrigged( PipeNetwork.TRIGGER ) THEN

Trig_Position := MLTrigReadPos( PipeNetwork.TRIGGER );

END_IF
```

1.1.18.31.8.1 Ladder Diagram



1.1.18.32.9.2 Function Block Diagram



1.1.18.33 MLTrigReadDelay

1.1.18.34.1 Description

Electronic sensors are not able to respond immediately to a signal. Sensors usually require a certain amount of time to process a change of state in their input signal. This function returns the delay that has been programmed in a trigger block by the MLTrigWriteDelay function to compensate for this reaction time required by the sensor.

1.1.18.35.2.1 Input

BlockID	Description	Identifier of the trigger block whose delay is requested
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
En	Description	Enables execution

	Data type	BOOL
	Unit	n/a
	Default	-

1.1.18.36.3.2 Output

Delay	Description	Value of the delay compensation currently applied by the trigger block
	Data type	LREAL
	Unit	microseconds
OK	Description	Returns true when the function successfully executes
	Data type	BOOL
	Unit	n/a

1.1.18.37.4 Related Functions

MLTrigWriteDelay

1.1.18.38 MLTrigReadPos

1.1.18.39.1 Description

Returns the position of the block at the moment when it was triggered by the Trigger Block's selected Fast Input. This value is only valid when TrigIsTrigged() returns TRUE. The Trigger block extrapolates the output value based on the timestamp of the Fast Input event to provide an accurate position even if the event occurs in the middle of a program cycle.

Once triggered, a block has to be reset before it can be triggered again. All events that are sent to a block while in a triggered state are ignored and the position and time information is lost.

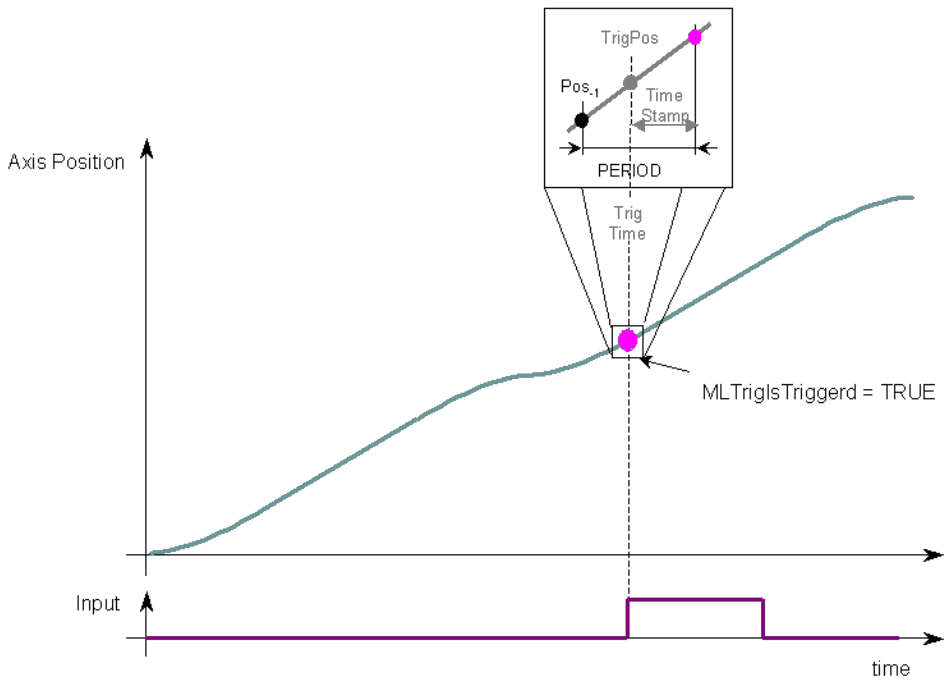


Figure 1-36: MLTrigReadPos

1.1.18.40.2 Arguments

1.1.18.41.3.1 Input

BlockID

Description	ID number of an initiated Trigger object
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.18.42.4.2 Output

Position

Description	Returns the position of the selected block's Axis at the moment when it was triggered
Data type	LREAL
Unit	User unit

1.1.18.43.5 Related Functions

MLTrigIsTrigged

MLTrigReadTime

MLTrigClearFlag

MLAxisRstFastIn

1.1.18.44.6 Previous Function Name

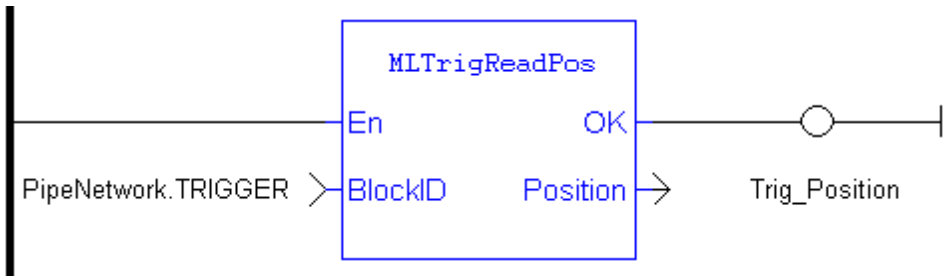
MLTrigGetPos

1.1.18.45.7 Example

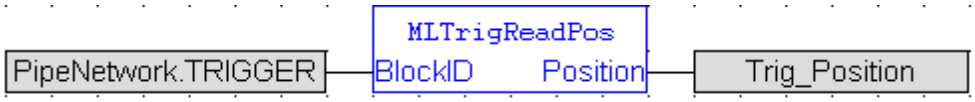
1.1.18.46.8.1 Structured Text

```
//Save position of Axis when Fast Input event occurs
Trig_Position := MLTrigReadPos( PipeNetwork.TRIGGER );
```

1.1.18.47.9.2 Ladder Diagram



1.1.18.48.10.3 Function Block Diagram



1.1.18.49 MLTrigReadTime

1.1.18.50.1 Description

Returns the time of the moment where the block was triggered in milliseconds. This value is only valid when TrigIsTrigged() returns TRUE. The output is computed from the timestamp of a Fast Input time event

Once triggered, a block has to be reset before it can be triggered again. All events that are sent to a block while in a triggered state are ignored and the position and time information is lost.

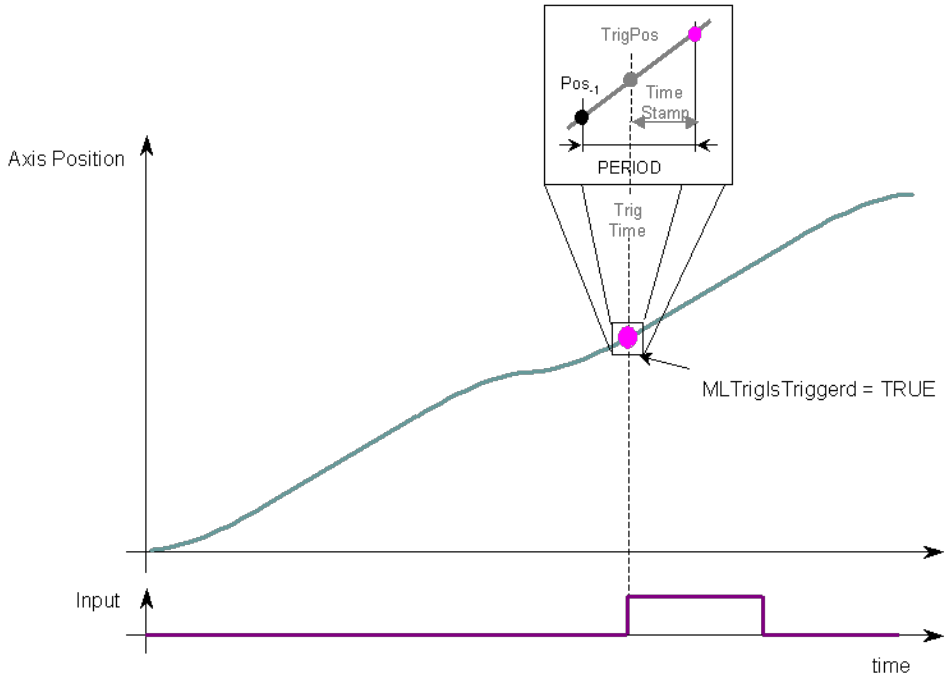


Figure 1-37: MLTrigReadTime

1.1.18.51.2 Arguments

1.1.18.52.3.1 Input

BlockID

Description	ID number of an initiated Trigger object
Data type	DINT
Range	[-2147483648, 2147483648]
Unit	n/a
Default	—

1.1.18.53.4.2 Output

Time

Description	Returns the time that the Trigger Block's selected Fast Input was triggered
Data type	LREAL
Unit	milliseconds

1.1.18.54.5 Related Functions

MLTrigIsTrigged

MLTrigReadPos

MLTrigClearFlag

MLAxisRstFastIn

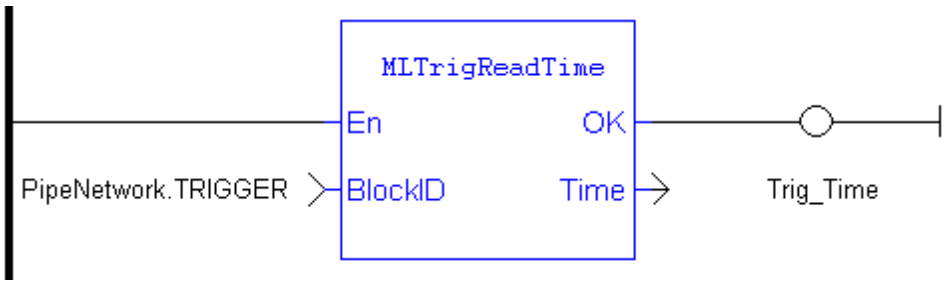
1.1.18.55.6 Previous Function Name

MLTrigGetTime

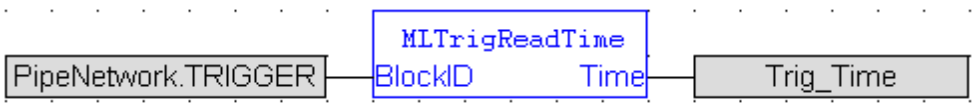
1.1.18.56.7 Example

```
//Save time when Fast Input event occurs

Trig_Time := MLTrigReadTime( PipeNetwork.TRIGGER );
```

1.1.18.57.8.1 Ladder Diagram



1.1.18.58.9.2 Function Block Diagram



1.1.18.59 MLTrigSetEdge

1.1.18.60.1 Description

Sets the edge configuration (rising, falling, etc.) for a trigger block. This block should be called prior to calling MLAxisCfgFastIn. Also the value at the Edge input must match the value at MLAxisCfgFastIn's Mode input.

1.1.18.61.2 Arguments

1.1.18.62.3.1 Input

BlockID	Description	Identifier of the trigger block
	Data type	DINT
	Range	[-2147483648, 2147483647]
	Unit	n/a
	Default	—
Edge	Description	The edge on which to trigger 0 = disable the fast input 1 = rising edge 2 = falling edge
	Data type	DINT
	Range	[0,2]
	Unit	n/a
	Default	1 (rising edge)

1.1.18.63.4.2 Output

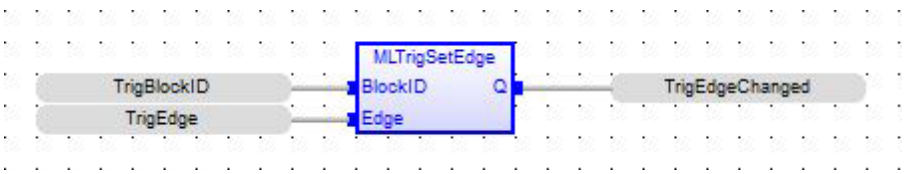
Q	Description	True if block executed successfully False if execution is not successful
	Data type	BOOL
	Unit	n/a

1.1.18.64.5.3 Return Type

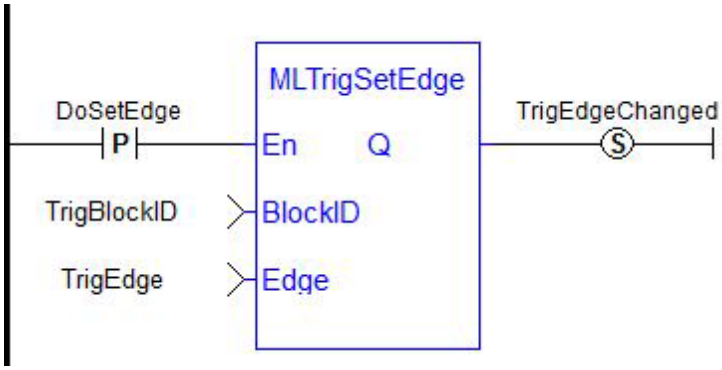
BOOL

1.1.18.65.6 Examples

1.1.18.66.7.1 Function Block Diagram



1.1.18.67.8.2 Ladder Diagram



1.1.18.68.9.3 Structured Text

```
TrigEdgeChanged := MLTrigSetEdge(TrigBlockID,TrigEdge);
```

1.1.18.69 MLTrigWriteDelay

1.1.18.70.1 Description

Electronic sensors are not able to respond immediately to a signal. Sensors usually require a certain amount of time to process a change of state in their input signal. This function allows the trigger block to calculate the exact moment at which a signal was triggered by letting you specify the delay introduced by the sensor.

1.1.18.71.2.1 Input

BlockID	Description	Identifier of the trigger block
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—
Delay	Description	Reaction time of the sensor that the trigger block has to compensate
	Data type	LREAL
	Range	—
	Unit	microseconds
	Default	—

1.1.18.72.3.2 Output

Default (.Q)	Description	Returns TRUE if the delay is successfully set
	Data type	BOOL
	Unit	n/a

1.1.18.73.4.3 Return Type

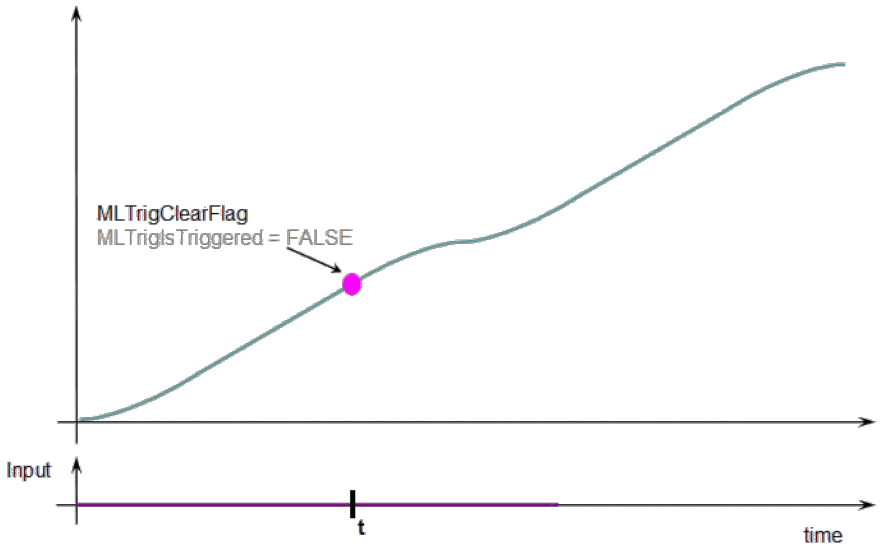
BOOL

1.1.18.74.5 Related Functions

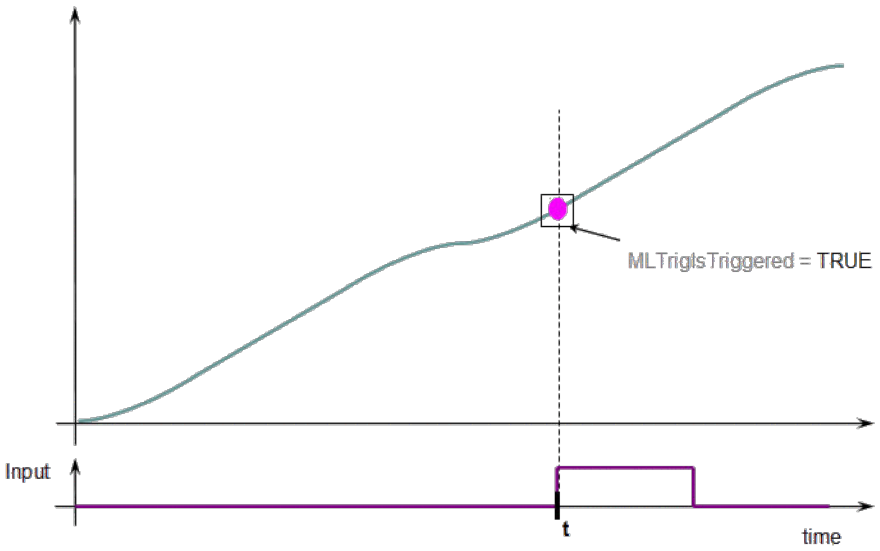
MLTrigReadDelay

1.1.18.75 Usage example of Trigger Functions

When you call the **MLTrigClearFlag** function, the flag for trigger is reset to False.



When a Fast Input is set, the **MLTrigIsTriggered** function returns True.



Then you can call the **MLTrigReadPos** and **MLTrigReadTime** functions to get more details.

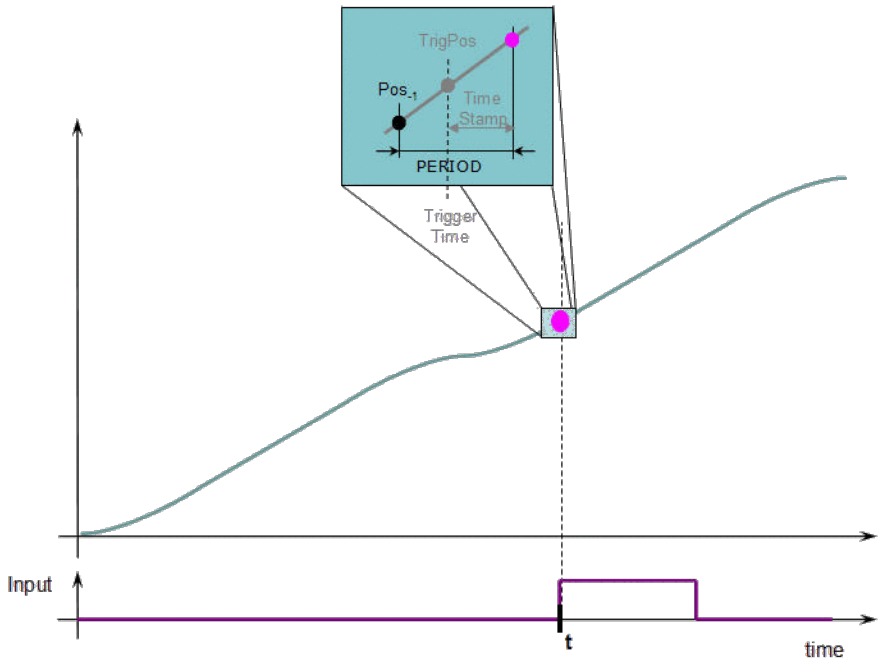


Figure 1-38: Trigger Functions Usage

IMPORTANT The trigger delay has to be calculated by **you** and set with the MLTrigWriteDelay function block.
This delay belongs to the sensor and it is additional to the MLTrigReadTime / MLTrigReadPos.

1.2 Motion Library / PLCopen

Functions sorted in alphabetical order:

Name	Description
MC_AbortTrigger	Abort MC_TouchProbe
MC_AddSuperAxis	Add an axis to the axis's list of assigned, superimposed axes.
MC_CamIn	Performs a slave axis move based on the Cam Table
MC_CamOut	Disengages the slave axis from a MC_CamIn move
MC_CamResumePos	Returns the slave axis position for resuming an MC_CamIn move
MC_CamStartPos	Returns the slave axis position for starting an MC_CamIn move
MC_CamTblSelect	Defined to read and initialize the specified profile
MC_ClearFaults	Clear Drive Faults
MC_CreateAxis	Creates a PLCopen Axis
MC_EStop	Performs a Emergency stop
MC_ErrorDescription	Converts the PLCopen error IDs into message strings.
MC_GearIn	Performs a slave axis move based on the ratio
MC_GearInPos	Performs a slave axis move based on the ratio

Name	Description
MC_GearOut	Disengages the slave axis from a MC_GearIn or MC_ GearInPos move
MC_Halt	Decelerates an axis to zero velocity
MC_InitAxis	Initializes a PLCopen Servo Axis' data
MC_MachRegist	Runs Mark-to-Machine registration
MC_MarkRegist	Runs Mark-to-Mark registration
MC_MoveAbsolute	Performs a single-axis move to a specified endpoint position
MC_MoveAdditive	Performs a single-axis move for a specified distance from the endpoint of the previous move
"MC_MoveRelative" (see page 215)	Performs a single-axis move for a specified distance
MC_MoveSuperimp	Performs a single-axis move which is superimposed upon the active move
MC_MoveVelocity	Performs a single-axis non-ending move at a specified velocity
MC_Phasing	Performs a master position phase shift for the slave axis
MC_Power	Requests to enable the drive and close the loop, or disable the drive and open the loop
MC_ReadActPos	Reads the actual position of the axis
MC_ReadActVel	Reads the actual velocity of the axis
MC_ReadAxisErr	Returns the error status of the specified axis
MC_ReadBoolPar	Returns the value of the specified Boolean axis parameter
MC_ReadParam	Returns the value of the specified axis parameter
MC_ReadStatus	Returns the state of the specified axis
MC_Reference	Defines the position at the reference location for PLCopen Axis
MC_RemSuperAxis	Remove an axis from the axis's list of assigned, superimposed axes.
MC_ResetError	Resets the errors of the specified axis
MC_SetOverride	Writes velocity and acceleration override factors
MC_SetPosition	Deprecated by MC_SetPos
MC_SetPos	Sets a new axis position
MC_Stop	Aborts the active move, removes the next move from the queue, performs a controlled stop, and switches the axis to Stopping state
MC_StopRegist	Turns off registration for the specified axis
MC_SyncSlaves	Specifies synchronized slaves
MC_TouchProbe	Arm a Fast Input and capture an axis position
MC_WriteBoolPar	Writes the specified axis Boolean parameter
MC_WriteParam	Writes the specified axis parameter

1.2.1 Control

1.2.1.1 MC_ClearFaults (Function)

1.2.1.2.1 Description

MC_ClearFaults sends a request to the drive to clear any drive faults that exists.

> **NOTE** The condition causing the drive fault has to be corrected before calling this function. If the fault condition still exists when this function is called, this function sends a request to the drive but the drive faults remain.

This function does **not** reset axis errors. MC_ResetError is required to reset axis errors.

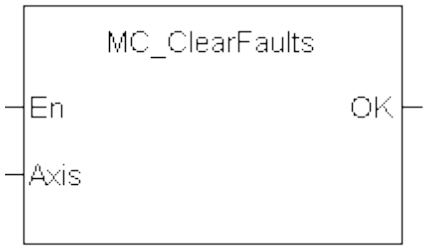


Figure 1-39: MC_ClearFaults

1.2.1.3.2 Arguments

1.2.1.4.3.1 Input

En	Description	Function enable – execute function. This Input must be on shot.
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	Description	AXIS_REF.AXIS_NUM is the master axis number
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—

1.2.1.5.4.2 Output

OK	Description	Boolean output to indicate successful request. This output does not indicate that the fault are cleared, but simply indicates the request was made.
	Data type	BOOL

1.2.1.6.5 Usage

Upon the positive transition of the EN input, this function requests a Fault Reset of the Drive for the Axis defined in the axis input of this function.

1.2.1.7.6 Related Functions

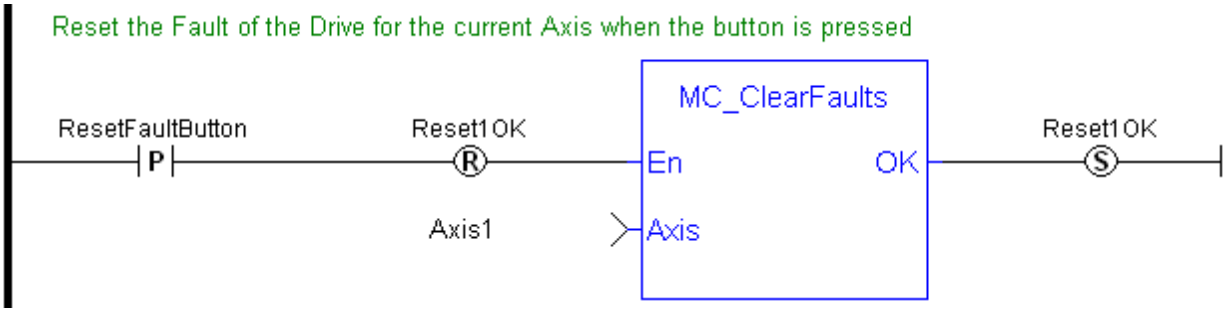
MC_ResetError

1.2.1.8.7 Example

1.2.1.9.8.1 Structured Text

```
(* MC_ClearFaults ST example *)
MC_ClearFaults( Axis1); //clear drive faults for Axis 1
```

1.2.1.10.9.2 Ladder Diagram



1.2.1.11 MC_CreateAxis

1.2.1.12.1 Description

This function creates a PLCopen Axis. A call to this function is automatically generated when the application is compiled, based on the data entered in the PLCopen Axis Data dialog.

IMPORTANT MC_CreateAxis must be called between MLMotionInit and MLMotionStart.

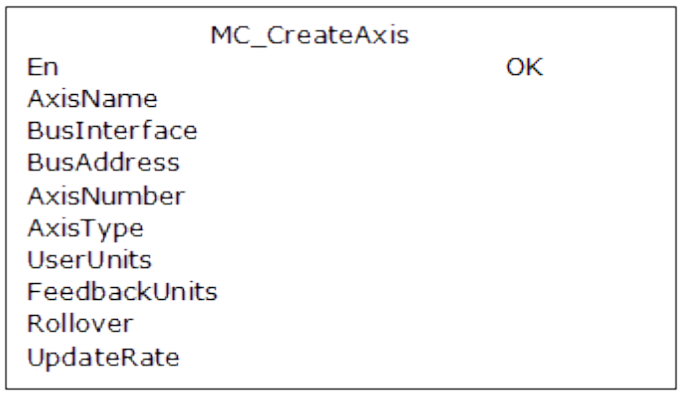


Figure 1-40: MC_CreateAxis

1.2.1.13.2 Arguments

1.2.1.14.3.1 Input

En **Description** Requests to create a PLCopen axis

	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
AxisName	**Description**	Axis name
	Data type	STRING
	Range	—
	Unit	n/a
	Default	—
BusInterface	**Description**	Bus interface identifier: “EtherCATDriver” = EtherCAT interface “MSBusDriver” = KAS Simulator interface
	Data type	STRING
	Range	—
	Unit	n/a
	Default	—
BusAddress	**Description**	Address of the drive on the bus
	Data type	DINT
	Range	bus dependent
	Unit	n/a
	Default	—
AxisNumber	**Description**	Axis number
	Data type	UINT
	Range	[1,256]
	Unit	n/a
	Default	—
AxisType	**Description**	Axis type: 0 (MC_AXIS_TYPE_SERVO) denotes servo 1 (MC_AXIS_TYPE_DIGITIZING) denotes digitizing 2 (MC_AXIS_TYPE_VIRTUAL_SERVO) denotes virtual servo
	Data type	USINT
	Range	[0,1]
	Unit	n/a
	Default	—

UserUnits	**Description**	User unit portion of the user unit/feedback unit ratio
	Data type	UDINT
	Range	[1,4294967296]
	Unit	User unit
	Default	—
FeedbackUnits	**Description**	Feedback unit portion of the user unit/feedback unit ratio
	Data type	UDINT
	Range	[1,4294967296]
	Unit	feedback units. **Note:** *The FeedbackUnits input must be a power of 2.* If input FeedbackUnits is not a power of two, the axis will not be created, and the OK output will be FALSE.
	Default	—
Rollover	**Description**	Rollover position (0 = no rollover)
	Data type	UDINT
	Range	[0, 4294967296]
	Unit	User unit
	Default	—
UpdateRate	**Description**	Servo update rate (0, 1, and 2 are reserved for future enhancements) 3 = 125 µsec 4 = 250 µsec 5 = 500 µsec 6 = 1 msec 7 = 2 msec 8 = 4 msec 9 = 8 msec
	Data type	UINT
	Range	[3,9]
	Unit	n/a
	Default	—

1.2.1.15.4.2 Output

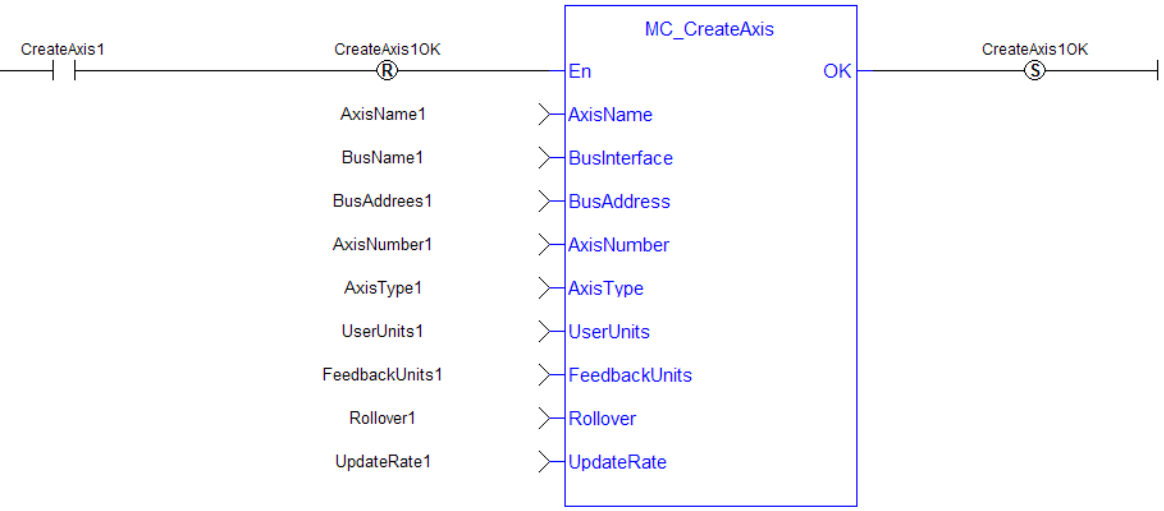
OK	**Description**	Indicates the axis has been created
	Data type	BOOL

1.2.1.16.5 Example

1.2.1.17.6.1 Structured Text

```
(* MC_CreateAxis ST example *)
MC_CreateAxis( 'PLCopenAxis1', 'EtherCATDriver', 1001, 1, MC_AXIS_
TYPE_SERVO, 360, 1048576, 0, 3 );
```

1.2.1.18.7.2 Ladder Diagram



1.2.1.19 MC_EStop

1.2.1.20.1 Description

This function causes an emergency stop (E-stop). An E-stop stops motion interpolation, clear all moves from the queue (active and next), change the axis state to ErrorStop, and request the drive to open the position loop and disable the drive. The E-stop remains in effect until the application calls MC_ResetError to reset the E-stop.

Figure 1-41: MC_EStop

1.2.1.21.2 Arguments

1.2.1.22.3.1 Input

En	Description	A positive transition of this input causes an E-stop on the specified axis
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	Description	Axis identifier
	Data type	AXIS_REF

Range	1-256 The AXIS_NUM element of the AXIS_REF structure must be in the range [1-256]
Unit	n/a
Default	—

1.2.1.23.4.2 Output

OK

Description	Indicates the E-stop was executed. If an invalid Axis input was specified, this output is not energized and no E-stop is performed.
Data type	BOOL

1.2.1.24.5 Usage

Call MC_EStop to generate an emergency stop for an axis.

Call MC_ResetError to reset the emergency stop.

1.2.1.25.6 Related Functions

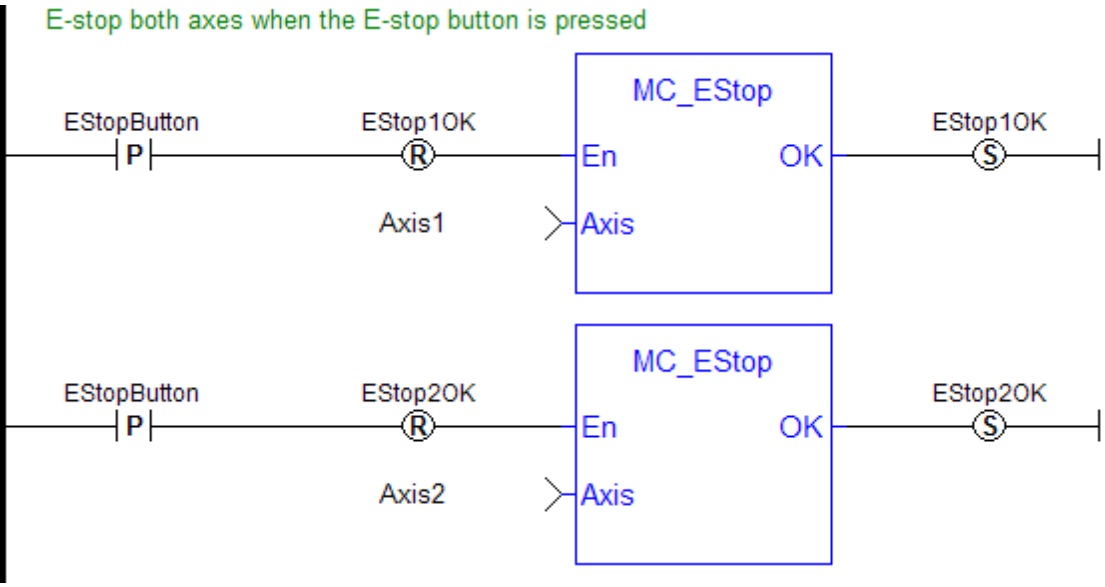
MC_ResetError

1.2.1.26.7 Example

1.2.1.27.8.1 Structured Text

```
(* MC_Estop ST example *)
MC_EStop( Axis1 ); //E-Stop Axis 1
```

1.2.1.28.9.2 Ladder Diagram



1.2.1.29 MC_InitAxis (Function)

1.2.1.30.1 Description

MC_InitAxis initializes a PLCopen Servo Axis' data. A call to this function is automatically generated when the application is compiled, based on the data entered in the PLCopen Axis Data dialog.

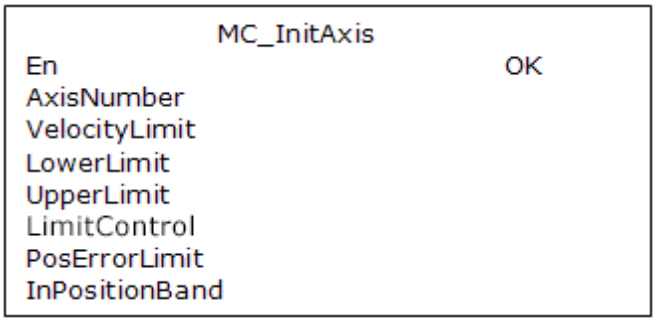


Figure 1-42: MC_InitAxis

1.2.1.31.2 Arguments

1.2.1.32.3.1 Input

En	Description	Request to initialize a PLCopen servo axis
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
AxisNumber	Description	Servo axis number
	Data type	UINT
	Range	[1,256]
	Unit	none
	Default	—
VelocityLimit	Description	Velocity limit
	Data type	LREAL
	Range	—
	Unit	User unit/sec
	Default	—
LowerLimit	Description	Lower position limit
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—
UpperLimit	Description	Upper position limit
	Data type	LREAL
	Range	—

	Unit	User unit
	Default	—
LimitControl	Description	Establishes how position limits are applied 0 = apply position limits 1 = ignore position limits 2 = ignore limits until referenced
	Data type	UINT
	Range	[0,2]
	Unit	n/a
	Default	—
PosErrorLimit	Description	Position error limit – when the Position Error (command position – actual position) exceeds this value, an E-stop is generated
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—
InPositionBand	Description	In-position bandwidth – when the axis actual position is within this distance from its programmed endpoint, the axis is considered “in position”
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—

1.2.1.33.4.2 Output

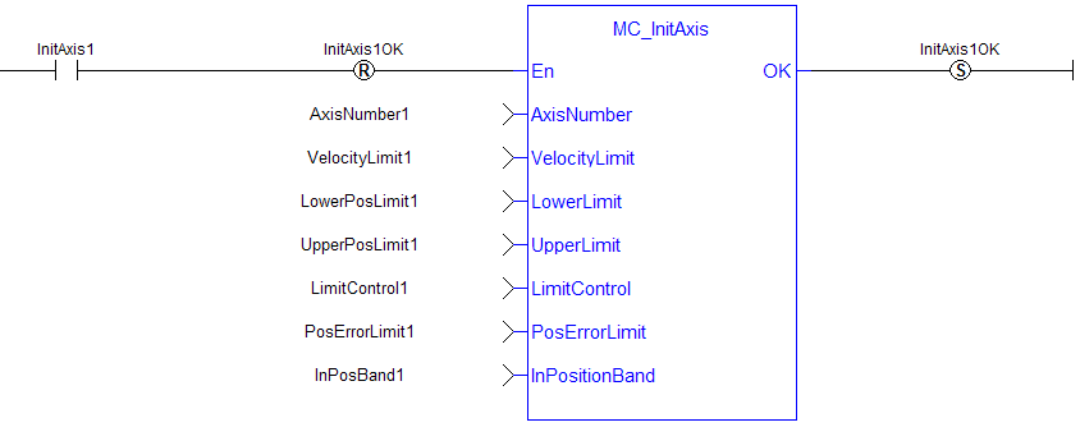
OK	Description	Indicates the initialization is complete
	Data type	BOOL

1.2.1.34.5 Example

1.2.1.35.6.1 Structured Text

```
(* MC_InitAxis ST example *)
MC_InitAxis( 1, 0, 0, 0, 2, 0, 0 );
```

1.2.1.36.7.2 Ladder Diagram



1.2.1.37 MC_Power

1.2.1.38.1 Description

This function block requests to enable the drive and close the position loop, or disable the drive and open the position loop. The Status output indicates the state of the position loop. If the position loop is open, the axis command position is set to the actual position of the axis and tracks the actual position.

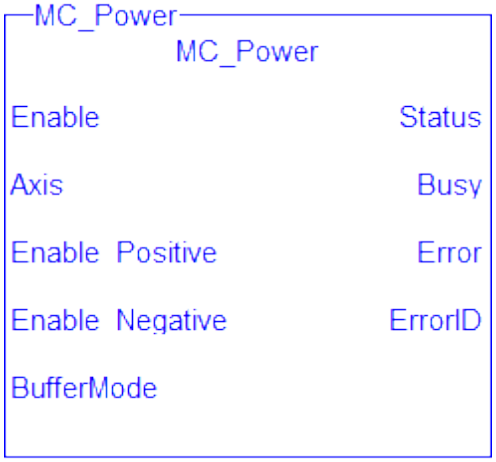


Figure 1-43: MC_Power

NOTE

You must be careful if you have more than one instance of MC_Power FB for the same drive, scanned in the same cycle. The problem arises when one instance requests the drive to enable and the other requests the same drive to disable.
To avoid this trap, it is recommended to have only one instance of MC_Power for all of your active programs.

1.2.1.39.2 Arguments

1.2.1.40.3.1 Input

Enable	Description	When this transitions go to high, the control closes the servo loop **and sends a command to the drive to enable**. When this transitions go to low, the control opens the servo loop **and sends a command to the drive to disable**.
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	Description	Name of a declared instance of the AXIS_REF library function.
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
Enable Positive	Description	*for future enhancement*
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Enable Negative	Description	*for future enhancement*
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
BufferMode	Description	Unused
	Data type	SINT
	Range	[0]
	Unit	n/a
	Default	—

1.2.1.41.4.2 Output

Status	Description	Indicates the enabled/disabled state of the drive
	Data type	BOOL
Busy	Description	for future enhancement – always false
	Data type	BOOL

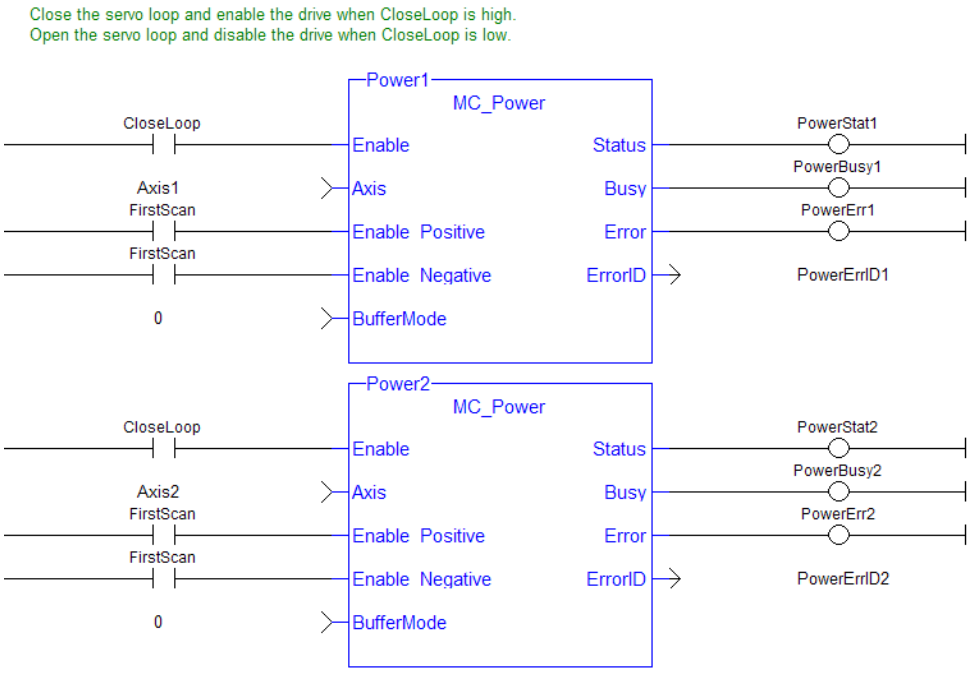
Error	Description	Indicates an invalid input was specified
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT

1.2.1.42.5 Example

1.2.1.43.6.1 Structured Text

```
(* MC_Power ST example *)
Inst_MC_Power( CloseLoopReq, Axis1, TRUE, TRUE, 0 );
//Inst_MC_Power is an instance of MC_Power function block
DriveIsOn := Inst_MC_Power.Status; //store the Status output
into a user defined variable
```

1.2.1.44.7.2 Ladder Diagram



1.2.1.45 MC_ResetError

1.2.1.46.1 Description

The function MC_ResetError resets the errors of a specified axis.

This function performs in sequence the following tasks:

- It sends a request to the drive to clear any drive faults that exists
- Then it resets the axis errors

NOTE The condition causing the axis error has to be corrected before calling this function. The axis error still remains until the error condition exists when this function is called.

See also transition 15 in the status machine of the CANopen protocol.

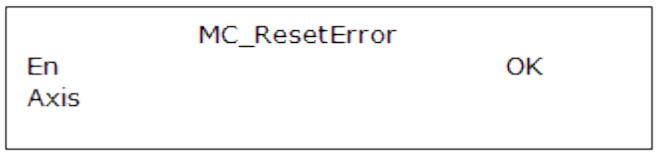


Figure 1-44: MC_ResetError

1.2.1.47.2 Arguments

1.2.1.48.3.1 Input

En	Description	Requests to reset the axis errors
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	Description	Name of a declared instance of the AXIS_REF library function)
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—

1.2.1.49.4.2 Output

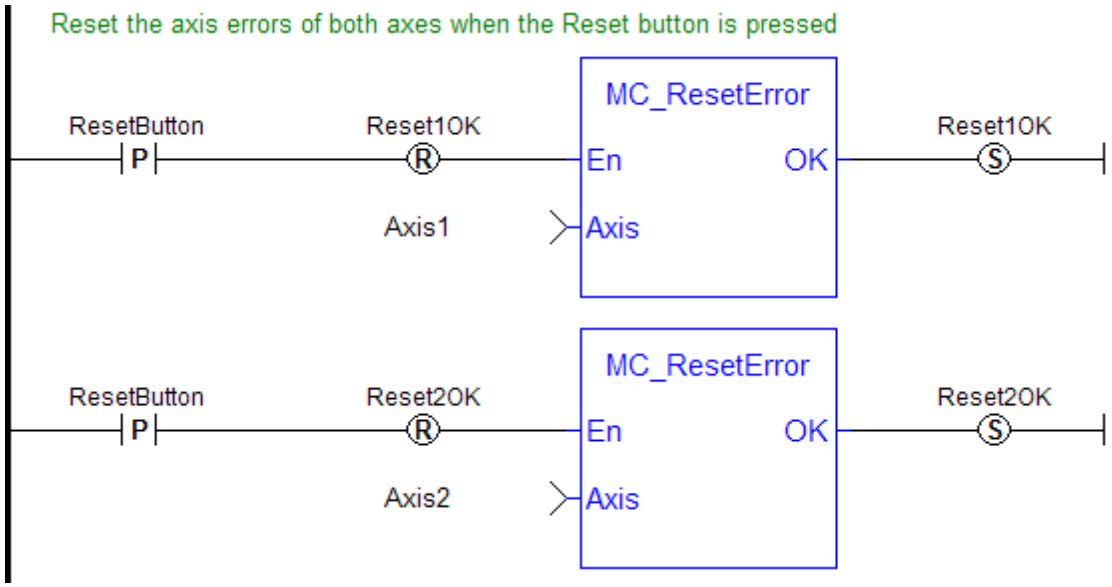
OK	Description	Indicates the function has completed successfully
	Data type	BOOL

1.2.1.50.5 Example

1.2.1.51.6.1 Structured Text

```
//reset the axis and drive errors for Axis 1
MC_ResetError( Axis1 );
```

1.2.1.52.7.2 Ladder Diagram



1.2.1.53 MC_Stop

1.2.1.54.1 Description

This function block aborts the active move, removes the next move from the queue, performs a controlled stop at the specified deceleration rate, and switches the axis to Stopping state.

MC_Stop cannot be aborted. This means that, while in Stopping state, no function block can command any motion on the axis. The axis remains in Stopping state until it reaches zero velocity and the Execute input is low. The application program can hold the axis in Stopping state even after it reaches zero velocity by leaving the Execute input high.

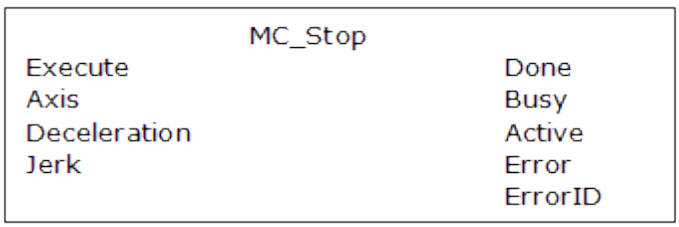


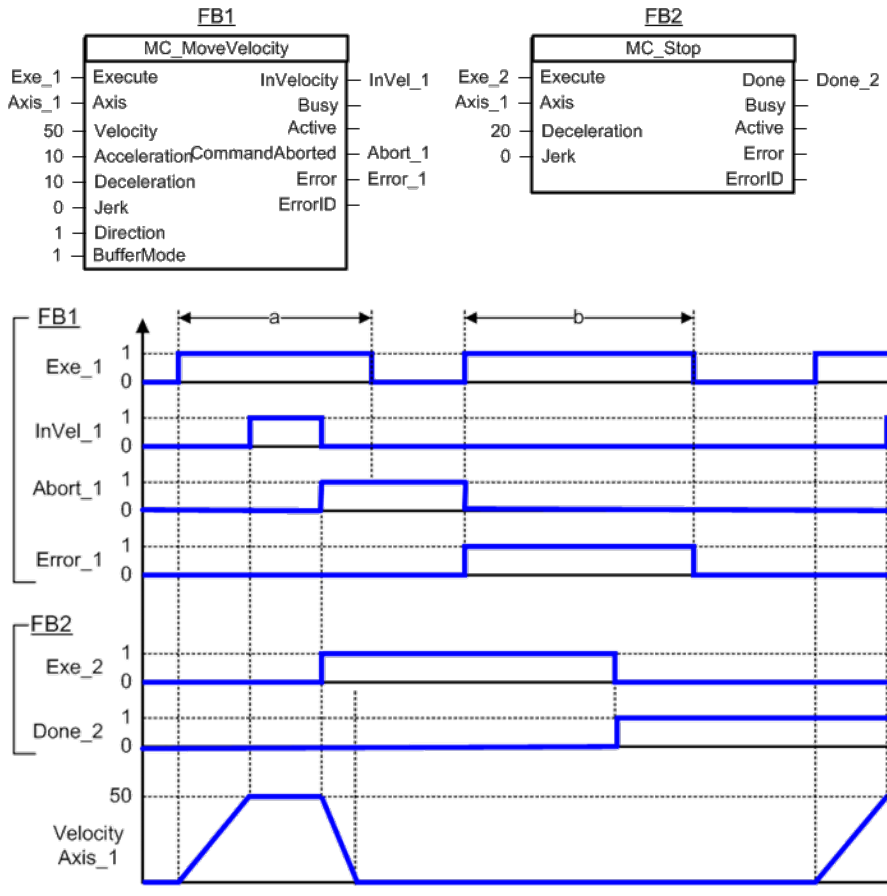
Figure 1-45: MC_Stop

1.2.1.55.2 Time Diagram

The example below shows the behavior of the combination of a MC_Stop FB with a MC_ MoveVelocity FB.

- A rotating axis is ramped down with FB2 MC_Stop
- The axis rejects motion commands as long as MC_Stop parameter “Execute” = TRUE

FB1 MC_MoveVelocity reports an error indicating the busy MC_Stop command.



1.2.1.56.3 Arguments

1.2.1.57.4.1 Input

Execute

Description	Requests to stop the axis. It can be held high to prevent any other moves from being queued
Data type	BOOL
Range	0, 1
Unit	n/a
Default	—

Axis

Description	Name of a declared instance of the AXIS_REF library function.
Data type	AXIS_REF
Range	[1,256]
Unit	n/a
Default	—

Deceleration

Description	Trapezoidal: Deceleration rate S-curve: Maximum deceleration
Data type	LREAL
Range	—
Unit	User unit/sec^2

	Default	—
Jerk	**Description**	Trapezoidal: 0 S-curve: Constant jerk
	Data type	LREAL
	Range	—
	Unit	User unit/sec^3
	Default	—

1.2.1.58.5.2 Output

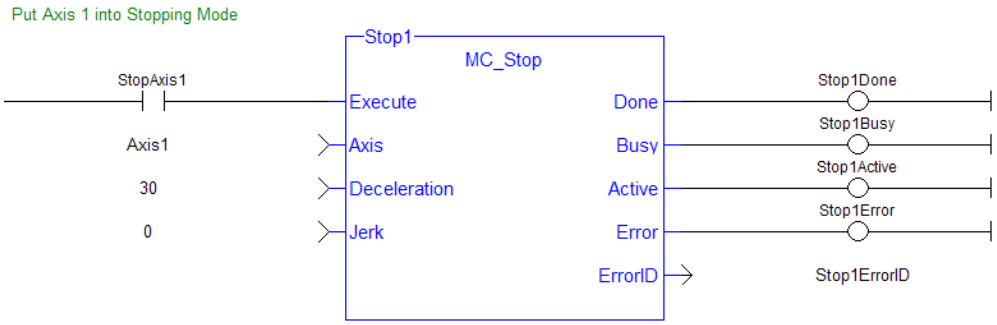
Done	**Description**	Indicates the axis has reached zero velocity AND the Execute input is low
	Data type	BOOL
Busy	**Description**	High from the time the Execute input goes high until the axis reaches zero velocity AND the Execute input is low
	Data type	BOOL
Active	**Description**	High from the time the MC_Stop move becomes the active move, until the axis reaches zero velocity AND the Execute input is low
	Data type	BOOL
Error	**Description**	Indicates an invalid input was specified
	Data type	BOOL
ErrorID	**Description**	Indicates the error if Error output is set to TRUE
	Data type	INT

1.2.1.59.6 Example

1.2.1.60.7.1 Structured Text

```
(* MC_Stop ST example *)

Inst_MC_Stop( StopRequest , Axis1, 100.0, 100.0 ); //Inst_MC_
Stop is an instance of MC_Stop function block

StopComplete := Inst_MC_Stop.Done;      //store the Done output
into a user defined variable

StopActive := Inst_MC_Stop.Active;      //store the Active out-
put into a user defined variable

StopError := Inst_MC_Stop.Error;        //store the Error output
into a user defined variable
```

1.2.1.61.8.2 Ladder Diagram



1.2.2 I/O

1.2.2.1 MC_AbortTrigger (Function Block)

1.2.2.2.1 Description

When the Execute input transitions from low to high, this function block aborts an MC_ TouchProbe function block.

1.2.2.3.2 Arguments

1.2.2.4.3.1 Input

Execute	Description	Enables execution
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	Description	Specifies the axis that was specified in the MC_TouchProbe function block which is to be aborted
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—

TriggerInput	Description	Specifies the Fast Input that was specified in the MC_TouchProbe function block which is to be aborted. The elements of TriggerInput are as follows: INT TriggerInput.InputID 0 = Capture Engine 0 1 = Capture Engine 1 Range is [0,1] For information on configuring the capture engines, refer to AKD Capture Engine Configuration. INT TriggerInput.Direction 1 = rising edge 2 = falling edge Range is [1,2] INT TriggerInput.TrigID is the axis number of the input. 0 indicates that the trigger axis is to be the same as Axis.AXIS_NUM. Range is [0,256]
	Data type	TRIGGER_REF
	Range	See Description above
	Unit	n/a
	Default	—

1.2.2.5.4.2 Output

Done	Description	Function block has completed
	Data type	BOOL
Busy	Description	Indicates the function block is currently executing
	Data type	BOOL
Error	Description	Indicates the function block did not complete due to an error. The ErrorID output indicates the type of error when this output is high
	Data type	BOOL

ErrorID	Description	When the Error output is high, this output indicates the type of error. When the Error output is low, this output is undefined
	Data type	INT

1.2.2.6.5 Usage

This function block is used to abort an MC_TouchProbe function block.

1.2.2.7.6 Related Functions

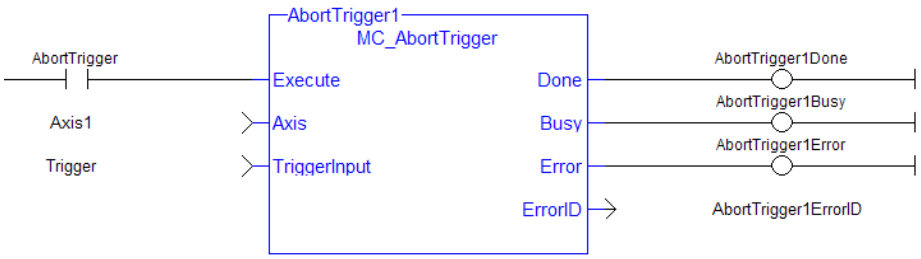
MC_TouchProbe

1.2.2.8.7 Example

1.2.2.9.8.1 Structured Text

```
(* MC_AbortTrigger ST example *)
Inst_MC_AbortTrigger( AbortReq, Axis1, TriggerInputRef );
//Inst_MC_AbortTrigger is an instance of MC_AbortTrigger
```

1.2.2.10.9.2 Ladder Diagram



1.2.2.11 MC_TouchProbe (Function Block)

1.2.2.12.1 Description

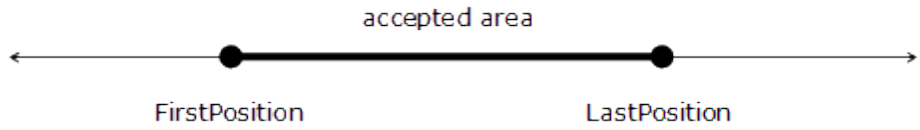
This function block arms a Fast Input and returns the latched position when the Fast Input event occurs. This function block causes no motion.

When the Execute input transitions from low to high, the control requests the drive to arm its Fast Input to latch the axis position when a Fast Input occurs. The Axis input specifies which axis's position to latch and the TriggerInput input specifies which Fast Input to use and whether to trigger on the rising or falling edge of the Fast Input. When the Fast Input event occurs, the drive latches the axis's position. This function block then returns the latched position at the RecordedPosition output and set the Done output high. This process can be canceled with the AbortTrigger function block.

If the WindowOnly input is high, the FirstPosition input and the LastPosition input define a window in which a Fast Input is accepted. Any Fast Input events that occur outside the window is ignored.

If First Position <= LastPosition, the window in which a Fast Input is accepted is:

FastInputPosition >= FirstPosition AND FastInputPosition <= LastPosition.



If First Position > LastPosition, the window in which a Fast Input is accepted is:

FastInputPosition >= FirstPosition OR FastInputPosition <= LastPosition.

The following figure shows the ladder diagram view of the MC_TouchProbe function block:

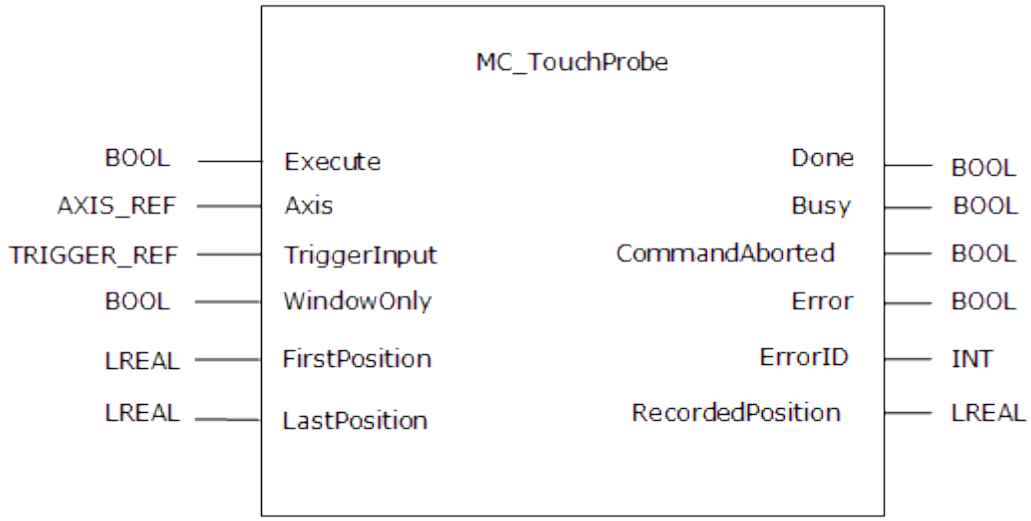


Figure 1-46: MC_TouchProbe

1.2.2.13.2 Arguments

1.2.2.14.3.1 Input

Execute

Description	Enables execution
Data type	BOOL
Range	0, 1
Unit	n/a
Default	—

Axis	Description	Selects the axis for which the position is latched
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
TriggerInput	Description	Selects the axis which contains the specified input to be armed. The elements of TriggerInput are as follows: INT TriggerInput.InputID 0 = Capture Engine 0 1 = Capture Engine 1 Range is [0,1] For information on configuring the capture engines, refer to AKD Capture Engine Configuration. INT TriggerInput.Direction 1 = rising edge 2 = falling edge Range is [1,2] INT TriggerInput.TrigID is the axis number of the input. 0 indicates that the trigger axis is to be the same as Axis.AXIS_NUM. Range is [0,256]
	Data type	TRIGGER_REF
	Range	See Description above
	Unit	n/a
	Default	—
WindowOnly	Description	Enables a position latching window. When this input is set, a window is defined by the FirstPosition and LastPosition inputs. Any Fast Input event that occurs outside the window is ignored. The first Fast Input event that occurs within the window latches the axis position
	Data type	BOOL
	Range	—
	Unit	n/a
	Default	—

FirstPosition	Description	See the function block Description above for an explanation of how this input and the LastPosition input define the window. This input is only applicable when the WindowOnly input is high. If the WindowOnly input is low, this input is ignored
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—
LastPosition	Description	See the function block Description above for an explanation of how this input and the FirstPosition input define the window. This input is only applicable when the WindowOnly input is high. If the WindowOnly input is low, this input is ignored
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—

1.2.2.15.4.2 Output

Done	Description	Function block has completed and the RecordedPosition output is valid
	Data type	BOOL
Busy	Description	Indicates that the specified input is arming or is armed, and waiting for the trigger and recording of the position to occur
	Data type	BOOL
CommandAborted	Description	A TriggerAbort function block has executed and canceled this function
	Data type	BOOL
Error	Description	The function block has not completed successfully due to an error. The ErrorID output indicates the type of error
	Data type	BOOL
ErrorID	Description	When the Error output is high, this output indicates the type of error. When the Error output is low, this output is undefined
	Data type	INT

RecordedPosition	Description	When the Done output goes high, this output returns the latched position. When the Done output is low, this output is undefined
	Data type	LREAL
	Unit	User unit

1.2.2.16.5 Usage

This function block can be used to:

- Perform registration
- Determine the position of a product
- Measure product length

1.2.2.17.6 Related Functions

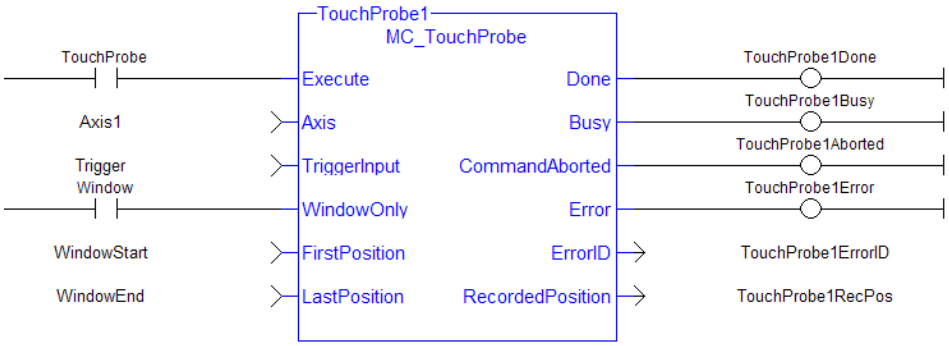
MC_AbortTrigger

1.2.2.18.7 Example

1.2.2.19.8.1 Structured Text

```
(* MC_TouchProbe ST example *)

TriggerInputRef.InputID := 1; //configure InputID

TriggerInputRef.Direction := 1; //configure Direction

TriggerInputRef.TrigID := 0; //configure TrigID

Inst_MC_TouchProbe( ArmProbe, Axis1, TriggerInputRef, FALSE,0.0,
0.0 );

//Inst_MC_TouchProbe is an instance of MC_TouchProbe function
block

ProbeIsDone := Inst_MC_TouchProbe.Done; //store Done output into
a user defined variable

ProbeValue := Inst_MC_TouchProbe.RecordedPosition; //store
RecordedPosition output into a user defined variable
```

1.2.2.20.9.2 Ladder Diagram



1.2.3 Info

1.2.3.1 MC_ReadActPos

1.2.3.2.1 Description

The MC_ReadActPos function block reads the actual position of the axis.

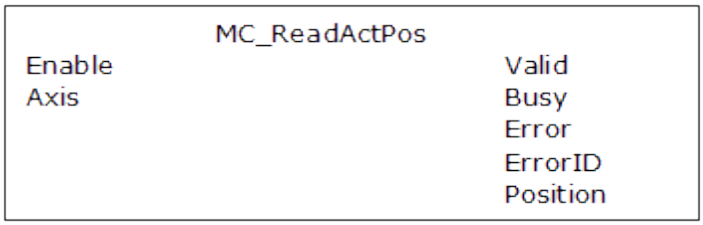


Figure 1-47: MC_ReadActPos

1.2.3.3.2 Arguments

1.2.3.4.3.1 Input

Enable	**Description**	Request to read the axis's actual position Keeps continuously to read the actual position every PLC cycle, as long as the Enable remains high
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	**Description**	Name of a declared instance of the AXIS_REF library function.)
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—

1.2.3.5.4.2 Output

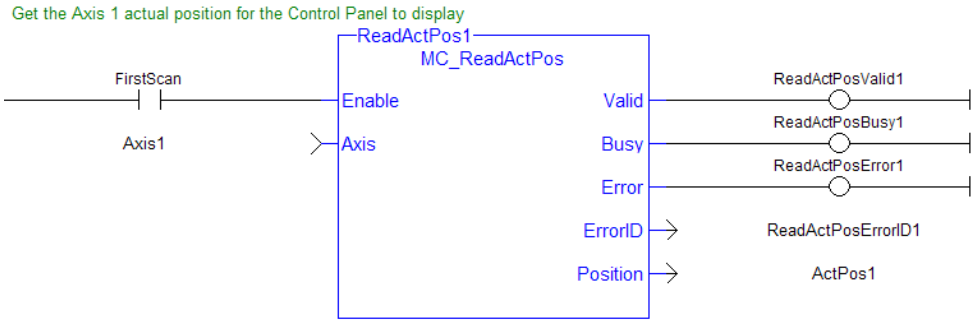
Valid	**Description**	Indicates the value at the Position output is available
	Data type	BOOL
Busy	**Description**	Indicates this function block is executing
	Data type	BOOL
Error	**Description**	Indicates an invalid input
	Data type	BOOL
ErrorID	**Description**	Indicates the error if Error output is set to TRUE.
	Data type	INT
Position	**Description**	Actual position of the axis.
	Unit	User unit
	Data type	LREAL

1.2.3.6.5 Example

1.2.3.7.6.1 Structured Text

```
(* MC_ReadActPos ST example *)
Inst_MC_ReadActPos( TRUE, Axis1 );
//Inst_MC_ReadActPos is an instance of MC_ReadActPos function
block

ActualPos := Inst_MC_ReadActPos.Position;
//store Position output into a user defined variable
```

1.2.3.8.7.2 Ladder Diagram



1.2.3.9 MC_ReadActVel

1.2.3.10.1 Description

The MC_ReadActVel function block reads the actual velocity of the axis.

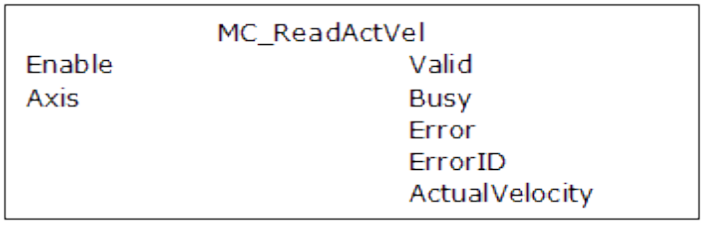


Figure 1-48: MC_ReadActVel

1.2.3.11.2 Arguments

1.2.3.12.3.1 Input

Enable	**Description**	Requests to read the axis's actual velocity
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	**Description**	Name of a declared instance of the AXIS_REF library function.
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—

1.2.3.13.4.2 Output

Valid	**Description**	Indicates the value at the ActualVelocity output is available
	Data type	BOOL
Busy	**Description**	Indicates this function block is executing
	Data type	BOOL
Error	**Description**	Indicates an invalid input
	Data type	BOOL
ErrorID	**Description**	Indicates the error if Error output is set to TRUE.
	Data type	INT
ActualVelocity	**Description**	Actual velocity of the axis.

NOTE Oscillations may be seen due to this being an instant velocity, not an average velocity.

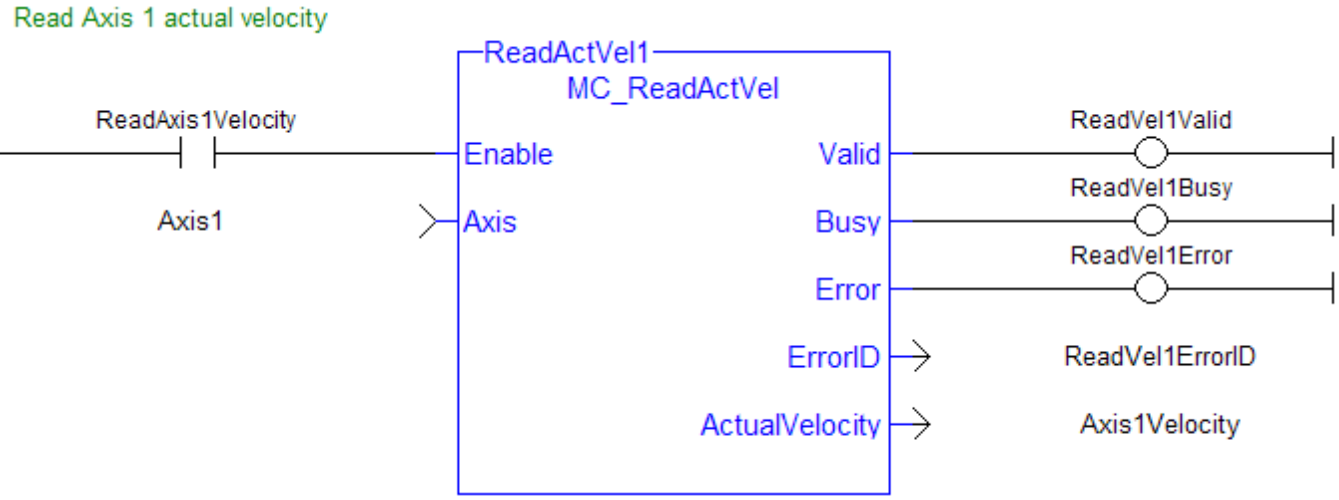
	Unit	User unit/sec
	Data type	LREAL

1.2.3.14.5 Example

1.2.3.15.6.1 Structured Text

```
* MC_ReadActVel ST example *);
Inst_MC_ReadActVel( TRUE, Axis1 ); //Inst_MC_ReadActVel is an
instance of MC_ReadActVel function block

ActualVel := Inst_MC_ReadActVel.ActualVelocity; // store Actu-
alVelocity output into a user defined variable
```

1.2.3.16.7.2 Ladder Diagram



1.2.3.17 MC_ReadAxisErr

1.2.3.18.1 Description

The Function Block MC_ReadAxisErr returns the error status of the specified axis.

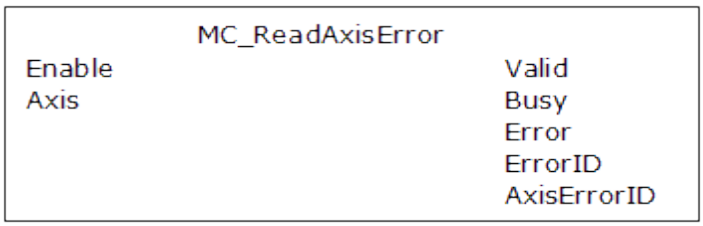


Figure 1-49: MC_ReadAxisErr

1.2.3.19.2 Arguments

1.2.3.20.3.1 Input

Enable

Description	requests to read the error status of the axis
Data type	BOOL
Range	0, 1
Unit	n/a
Default	—

Axis	Description	Name of a declared instance of the AXIS_REF library function.
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—

1.2.3.21.4.2 Output

Valid	Description	Indicates the AxisErrorID output is valid
	Data type	BOOL
Busy	Description	Indicates this function block is executing
	Data type	BOOL
Error	Description	Indicates an invalid input
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT
AxisErrorID	Description	Indicates the error status of the axis. Each bit indicates a specific error. Both emergency-stop (E-stop) and controlled-stop (C-stop) errors are indicated. The table below defines the bits of this output.
	Data type	INT

Hexadecimal	Decimal	Description
0000H	0	No Error
0001H	1	User-set E-stop via MC_EStop, E-stop
0002H	2	Loss of Feedback, E-stop
0004H	4	Drive Fault, E-stop
0008H	8	Drive Communication Failure, E-stop
0400H	1024	Synchronization Error, C-stop

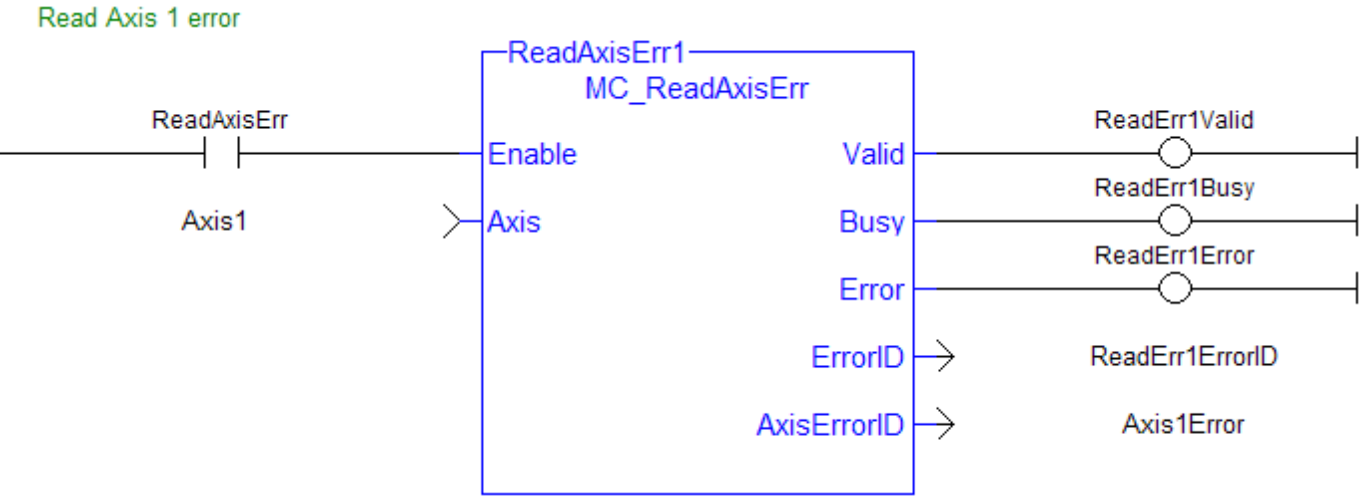
NOTE Multiple errors can be active at the same time. For example, if a User-set E-stop and an Excess Position Error E-stop are both active, the value would be 00000011H (17 decimal).

1.2.3.22.5 Example

1.2.3.23.6.1 Structured Text

```
(* MC_ReadAxisErr ST example *)

Inst_MC_ReadAxisErr( TRUE, Axis1 );

//Inst_MC_ReadAxisErr is an instance of MC_ReadAxisErr function
block

AxisErrorBits := Inst_MC_ReadAxisErr.AxisErrorID; //AxisErrorID
contains the error bits
```

1.2.3.24.7.2 Ladder Diagram



1.2.3.25 MC_ReadBoolPar (Function Block)

1.2.3.26.1 Description

MC_ReadBoolPar returns the value of the specified Boolean axis parameter.

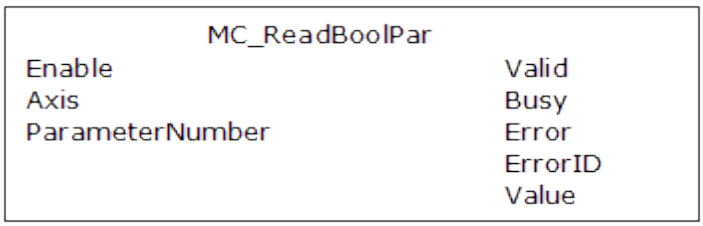


Figure 1-50: MC_ReadBoolPar

1.2.3.27.2 Arguments

1.2.3.28.3.1 Input

Enable	Description	Requests to read the Boolean axis parameter

	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	Description	Name of a declared instance of the AXIS_REF library function.)
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
ParameterNumber	Description	Parameter number, see table in § "**Motion Library (PLCopen)**"
	Data type	INT
	Range	—
	Unit	n/a
	Default	—

1.2.3.29.4.2 Output

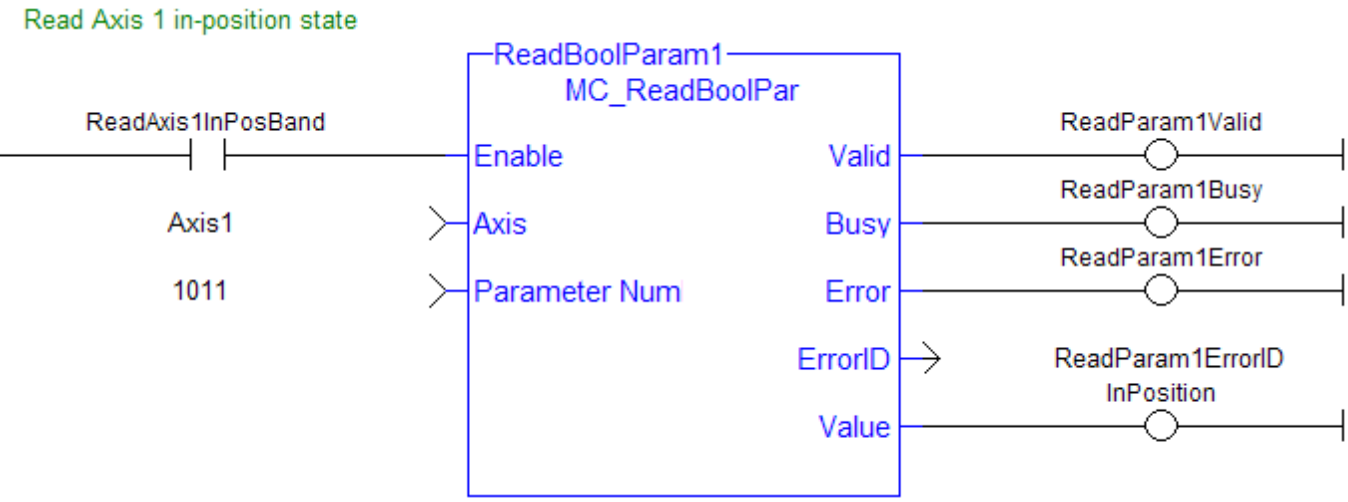
Valid	Description	Indicates the Value output is valid
	Data type	BOOL
Busy	Description	Indicates this function block is executing
	Data type	BOOL
Error	Description	Indicates an invalid input
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT
Value	Description	State of the Boolean parameter
	Data type	BOOL

1.2.3.30.5 Example

1.2.3.31.6.1 Structured Text

```
(* MC_ReadBoolPar ST example *)

Inst_MC_ReadBoolPar( EnableRead, Axis1, 3 );

//Inst_MC_ReadBoolPar is an instance of MC_ReadBoolPar function
block

BoolParm := Inst_MC_ReadBoolPar.Value; //store the Value output
into a user defined variable
```

1.2.3.32.7.2 Ladder Diagram



1.2.3.33 MC_ReadParam (Function Block)

1.2.3.34.1 Description

MC_ReadParam returns the value of the specified axis parameter.

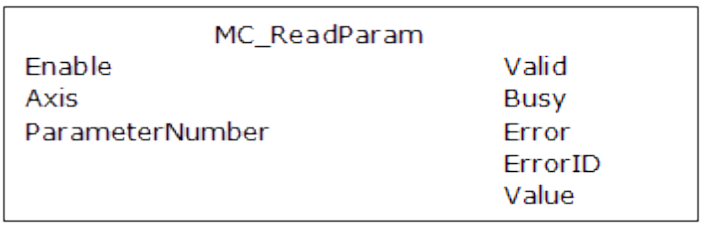


Figure 1-51: MC_ReadParam

1.2.3.35.2 Arguments

1.2.3.36.3.1 Input

Enable	Description	Requests to read the axis parameter
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	Description	Name of a declared instance of the AXIS_REF library function.)
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
ParameterNumber	Description	Parameter number, see table in § "**Axis Parameters**"
	Data type	INT
	Range	—

	Unit	n/a
	Default	—

1.2.3.37.4.2 Output

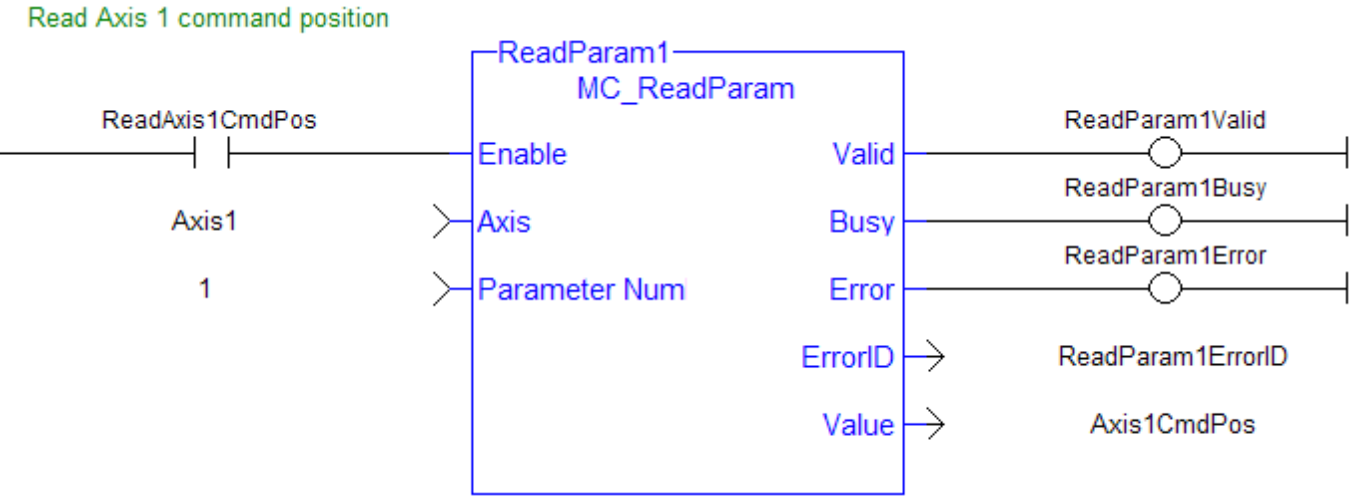
Valid	Description	Indicates the Value output is valid
	Data type	BOOL
Busy	Description	Indicates this function block is executing
	Data type	BOOL
Error	Description	Indicates an invalid input
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT
Value	Description	Value of the parameter
	Data type	LREAL

1.2.3.38.5 Example

1.2.3.39.6.1 Structured Text

```
(* MC_ReadParam ST example *)
ParameterNumber := 3; //configure the parameter to read
Inst_MC_ReadParam( EnableRead, Axis1, ParameterNumber );
//Inst_MC_ReadParam is an instance of MC_ReadParam function
block
ParmVal := Inst_MC_ReadParam.Value; //store the Value output
into a user defined variable
```

1.2.3.40.7.2 Ladder Diagram



1.2.3.41 MC_ReadStatus

1.2.3.42.1 Description

The function block MC_ReadStatus returns the state of the specified axis.

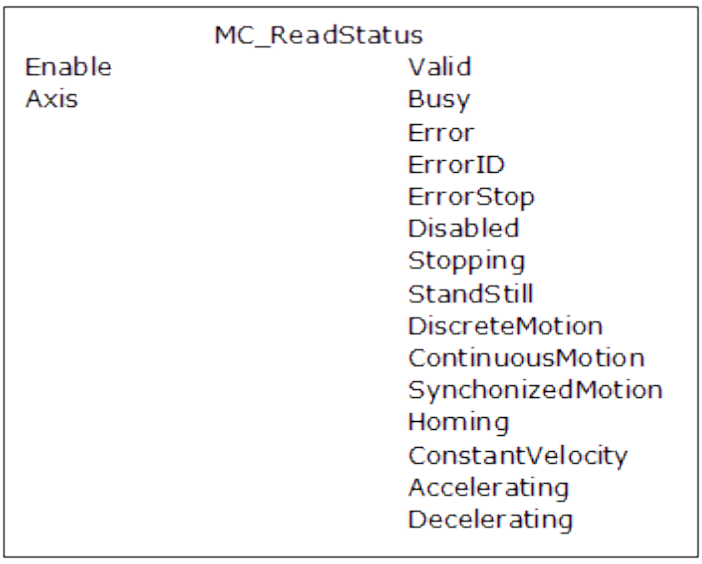


Figure 1-52: MC_ReadStatus

1.2.3.43.2 Arguments

1.2.3.44.3.1 Input

Enable

Description	Requests to read and return the axis status
Data type	BOOL
Range	0, 1
Unit	n/a
Default	—

Axis	Description	Name of a declared instance of the AXIS_REF library function. click here...
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—

1.2.3.45.4.2 Output

Valid	Description	Indicates the outputs are valid
	Data type	BOOL
Busy	Description	Indicates this function block is executing
	Data type	BOOL
Error	Description	Indicates an invalid input
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT
ErrorStop	Description	Indicates Error Stop state – E-stop or C-stop
	Data type	BOOL
Disabled	Description	Indicates Disabled state – open loop and drive is disabled
	Data type	BOOL
Stopping	Description	Indicates Stopping state – MC_Stop command
	Data type	BOOL
StandStill	Description	Indicates Stand Still state – no move, closed loop, drive enabled
	Data type	BOOL
DiscreteMotion	Description	Indicates Discrete Motion state – programmed endpoint move is active
	Data type	BOOL
ContinuousMotion	Description	Indicates Continuous Motion state – unending, single-axis move is active
	Data type	BOOL
SynchronizedMotion	Description	Indicates Synchronized Motion state – slave move is active
	Data type	BOOL
Homing	Description	Indicates Homing state – a homing cycle is currently executing
	Data type	BOOL

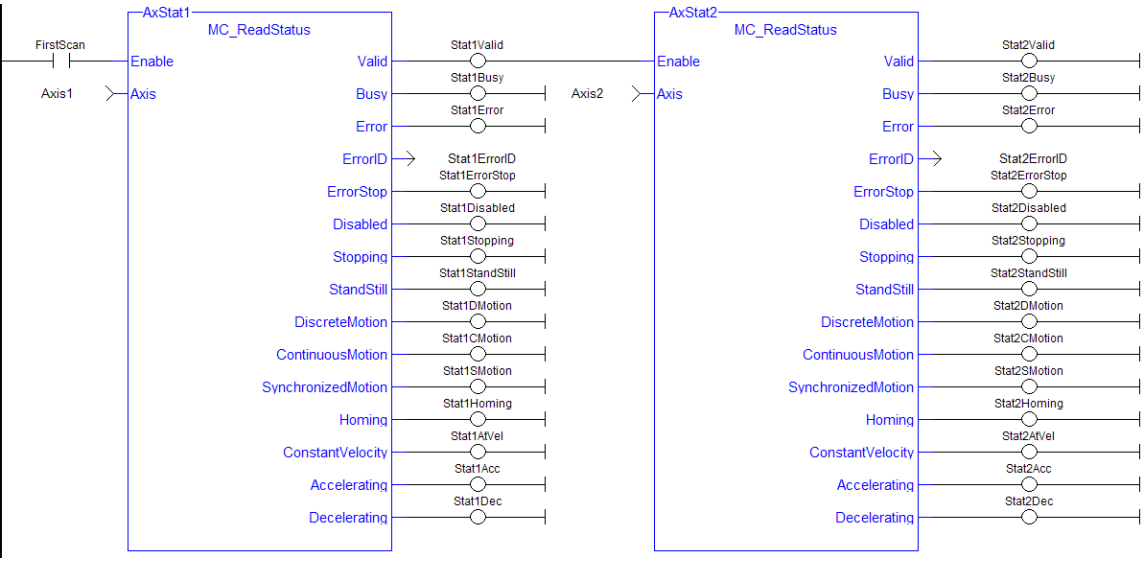
ConstantVelocity	Description	Indicates the axis is moving at a constant velocity
	Data type	BOOL
Accelerating	Description	Indicates the axis is accelerating
	Data type	BOOL
Decelerating	Description	Indicates the axis is decelerating
	Data type	BOOL

1.2.3.46.5 Example

1.2.3.47.6.1 Structured Text

```
(* MC_ReadStatus ST example *)

Inst_MC_ReadStatus( EnableRead, Axis1 );

//Inst_MC_ReadStatus is an instance of MC_ReadStatus function
block

AxisStopping := Inst_MC_ReadStatus.Stopping; // store Stopping
output to a user defined variable

AxisAccelerating := Inst_MC_ReadStatus.Accelerating; // store
Accelerating output to a user defined variable
```

1.2.3.48.7.2 Ladder Diagram



1.2.3.49 MC_WriteBoolPar (Function Block)

1.2.3.50.1 Description

MC_WriteBoolPar writes the specified axis Boolean parameter.

1.2.3.51.2 Arguments

1.2.3.52.3.1 Input

Execute	Description	Requests to write a Boolean axis parameter
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	Description	Name of a declared instance of the AXIS_REF library function.
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
ParameterNumber	Description	Parameter number, see table in § "**Motion Library (PLCopen)**"
	Data type	INT
	Range	—
	Unit	n/a
	Default	—
Value	Description	State to write
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—

1.2.3.53.4.2 Output

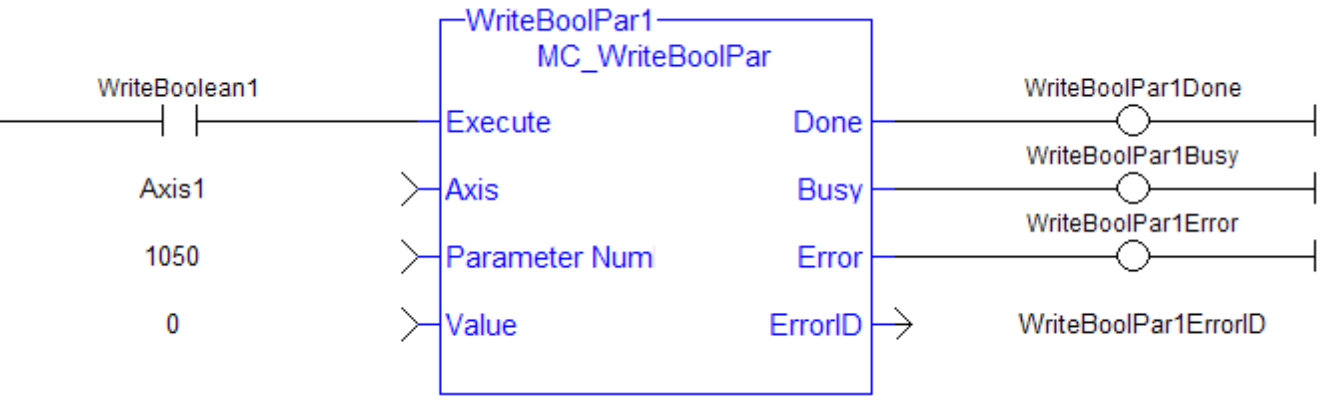
Done	Description	Indicates the Boolean parameter has been written
	Data type	BOOL
Busy	Description	Indicates this function block is executing
	Data type	BOOL
Error	Description	Indicates an invalid input
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT

1.2.3.54.5 Example

1.2.3.55.6.1 Structured Text

```
(* MC_WriteBoolPar ST example *)

WriteBool := TRUE; //value to write to the boolean parameter #1

Inst_MC_WriteBoolPar( WriteReq, Axis1, 1, WriteBool ); //Inst_
MC_WriteBoolPar is an instance of MC_WriteBoolPar
```

1.2.3.56.7.2 Ladder Diagram



NOTE Currently, MC_WriteBoolPar does not support any parameters (1050 is an arbitrary number chosen for example)

1.2.3.57 MC_WriteParam (Function Block)

1.2.3.58.1 Description

MC_WriteParam writes the specified axis parameter.

1.2.3.59.2 Arguments

1.2.3.60.3.1 Input

Execute	Description	Requests to write the axis parameter
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	Description	Name of a declared instance of the AXIS_REF library function.
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—

ParameterNumber	Description	Parameter number, see table in § "**Motion Library (PLCopen)**"
	Data type	INT
	Range	—
	Unit	n/a
	Default	—
Value	Description	Value to write
	Data type	LREAL
	Range	—
	Unit	n/a
	Default	—

1.2.3.61.4.2 Output

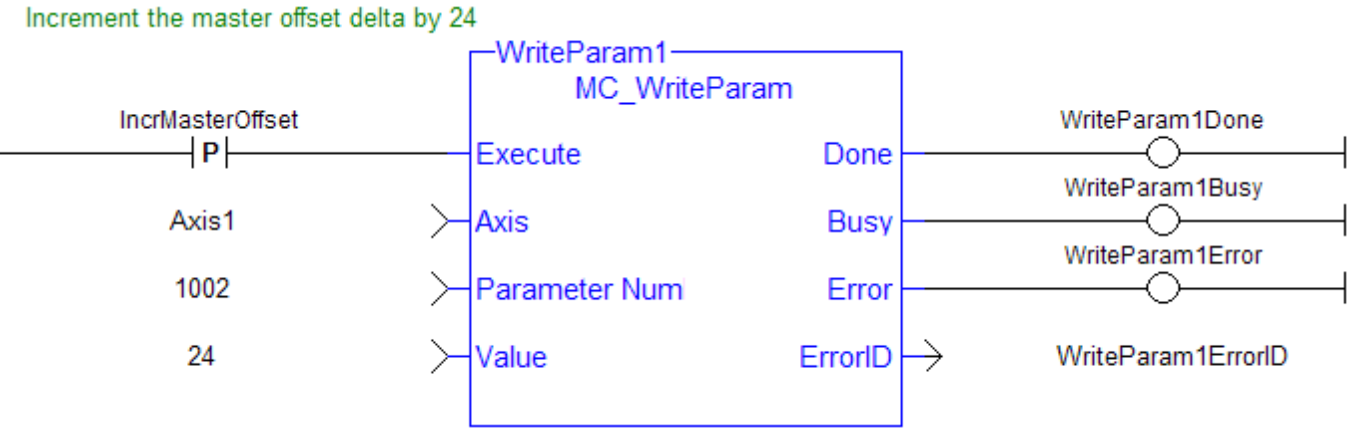
Done	Description	Indicates the parameter has been written
	Data type	BOOL
Busy	Description	Indicates this function block is executing
	Data type	BOOL
Error	Description	Indicates an invalid input
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT

1.2.3.62.5 Example

1.2.3.63.6.1 Structured Text

```
(* MC_WriteParam ST example *)
WriteValue := 1234.2; //value to write to parameter 1002
Inst_MC_WriteParam( WriteReq, Axis1, 1002, WriteValue); //Inst_
MC_WriteParam is an instance of MC_WriteParam
```

1.2.3.64.7.2 Ladder Diagram



1.2.4 PLCopenMotion

1.2.4.1 MC_Halt (Function Block)

1.2.4.2.1 Description

This function block decelerates an axis to zero velocity. It is a queued single-axis move. The move is complete when the axis reaches zero velocity. It is typically used with Abort at the BufferMode input to terminate a move. To execute a stop that cannot be aborted, see MC_Stop.

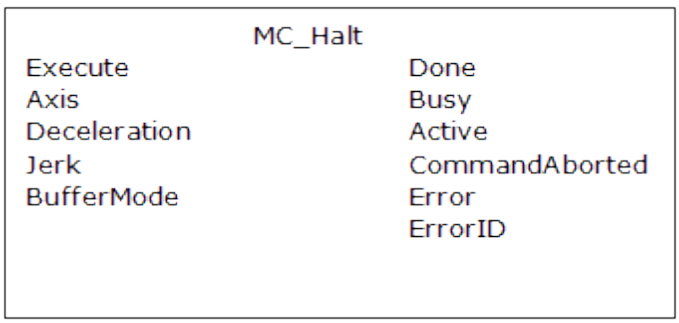


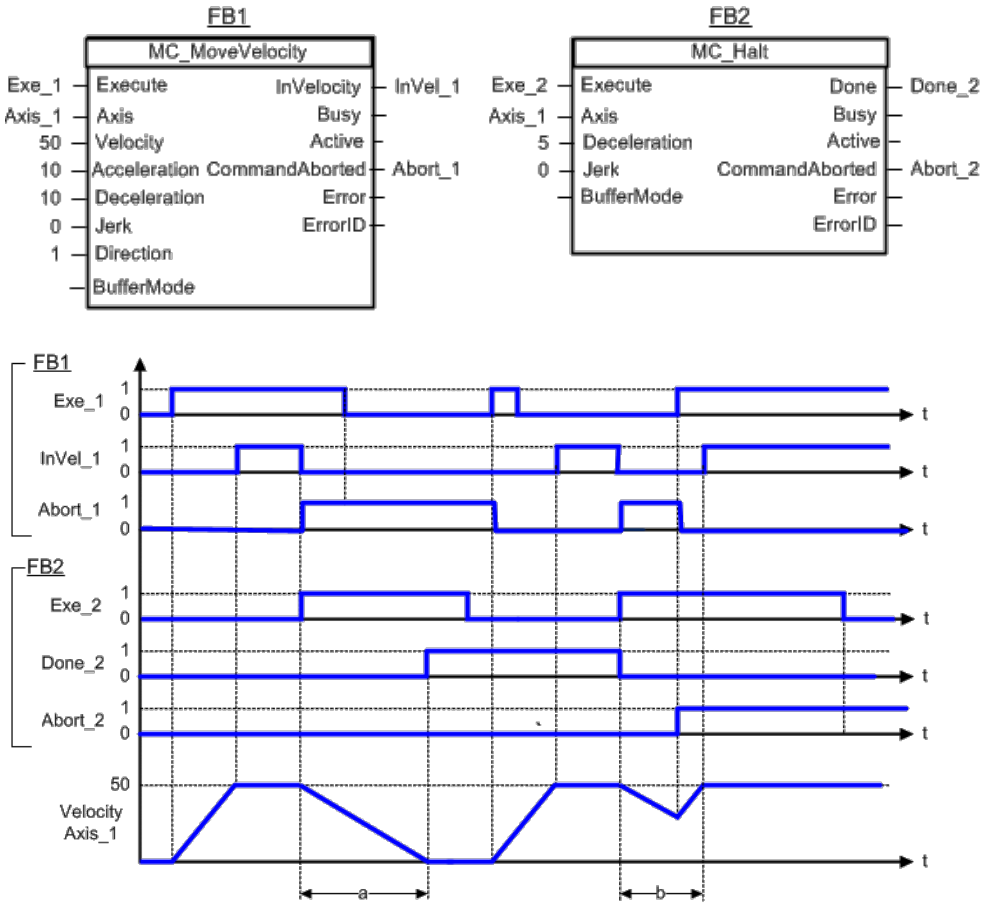
Figure 1-53: MC_Halt

1.2.4.3.2 Time Diagram

The example below shows the behavior in combination with a MC_MoveVelocity.

- A rotating axis is ramped down with FB2 MC_Halt
- Another motion command overrides the MC_Halt command

MC_Halt allows this, in contrast to MC_Stop. The axis can accelerate again without reaching standstill.



1.2.4.4.3 Arguments

1.2.4.5.4.1 Input

Execute

Description	Requests to queue the move
Data type	BOOL
Range	0, 1
Unit	n/a
Default	—

Axis

Description	Name of a declared instance of the AXIS_REF library function
Data type	AXIS_REF
Range	[1,256]
Unit	n/a
Default	—

Deceleration

Description	Trapezoidal: Deceleration rate S-curve: Maximum deceleration
Data type	LREAL
Range	—
Unit	User unit/sec^2
Default	—

Jerk

Description	Trapezoidal: 0 S-curve: Constant jerk

	Data type	LREAL
	Range	—
	Unit	User unit/sec^3
	Default	—
BufferMode	Description	0 = abort 1 = buffer 2 = blend to active 3 = blend to next 4 = blend to low velocity 5 = blend to high velocity
	Data type	SINT
	Range	[0,5]
	Unit	n/a
	Default	—

1.2.4.6.5.2 Output

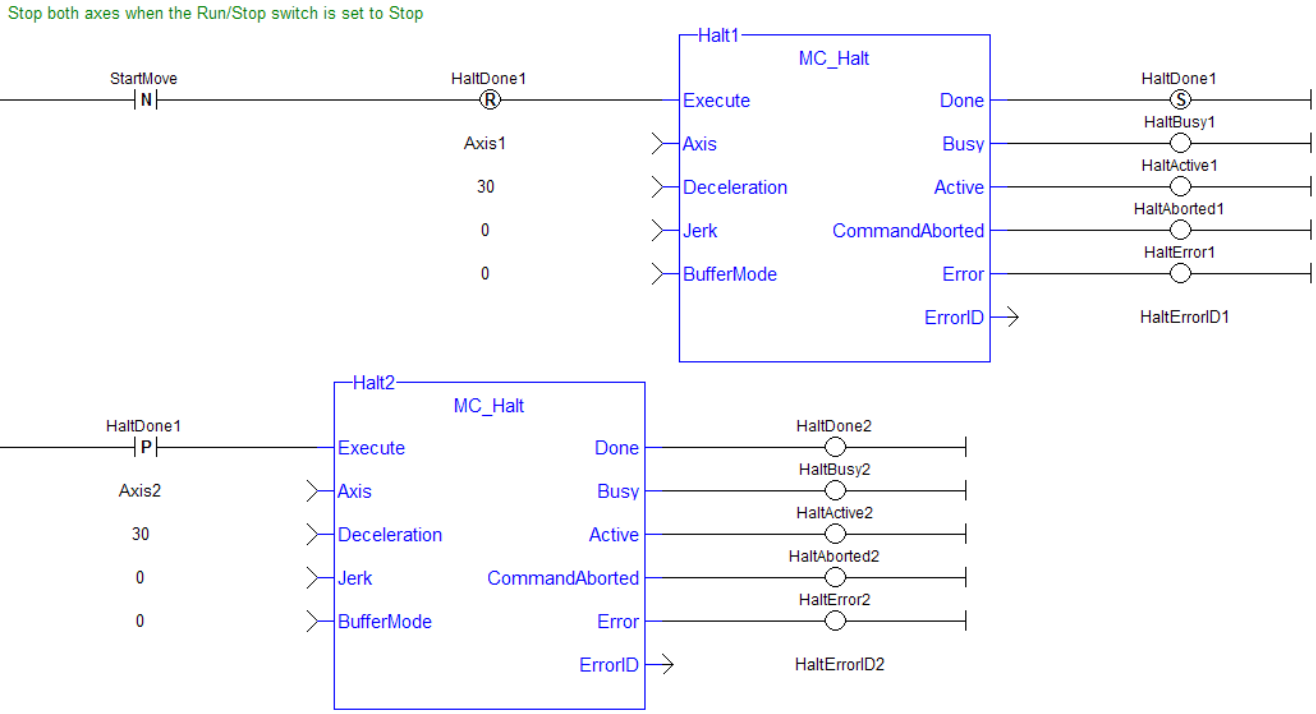
Done	Description	Indicates the move completed successfully. The Command Position has reached the endpoint.
	Data type	BOOL
Busy	Description	High from the moment the Execute input is one-shot to the time the move is ended
	Data type	BOOL
Active	Description	Indicates this move is the active move
	Data type	BOOL
CommandAborted	Description	Indicates this move was aborted
	Data type	BOOL
Error	Description	Indicates an invalid input was specified or the move was terminated due to an error
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT

1.2.4.7.6 Example

1.2.4.8.7.1 Structured Text

```
(* MC_Halt ST example *)

Inst_MC_Halt( HaltReq, Axis1,100.0, 100.0, 0 );

//Inst_MC_Halt is an instance of MC_halt function block

HaltComplete := Inst_MC_Halt.Done; //store Done output into
user defined variable
```

1.2.4.9.8.2 Ladder Diagram



1.2.4.10 MC_MoveAbsolute

1.2.4.11.1 Description

This function block performs a single-axis move to a specified endpoint position based on Axis, Position, Velocity, Acceleration, Deceleration, Jerk, and Direction parameters.

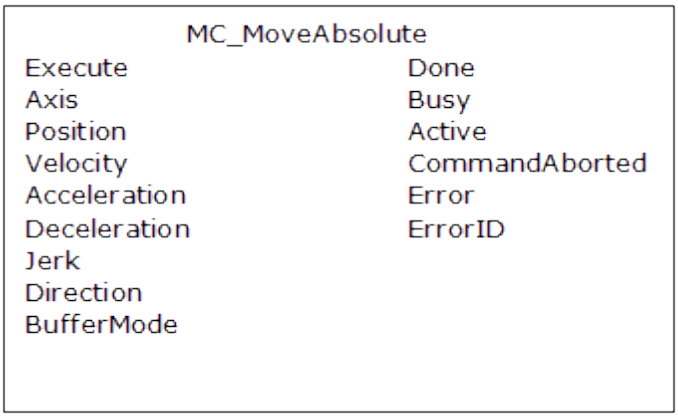
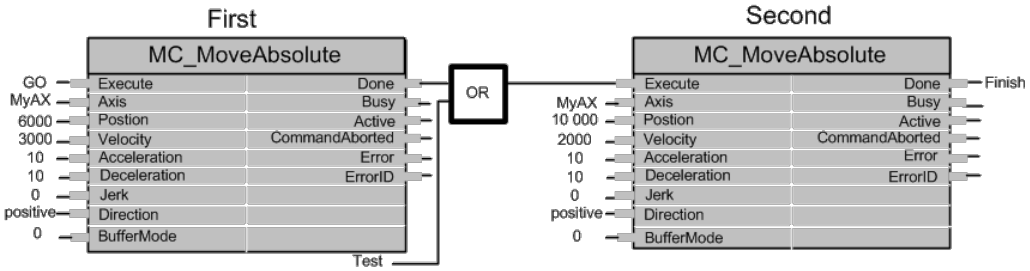


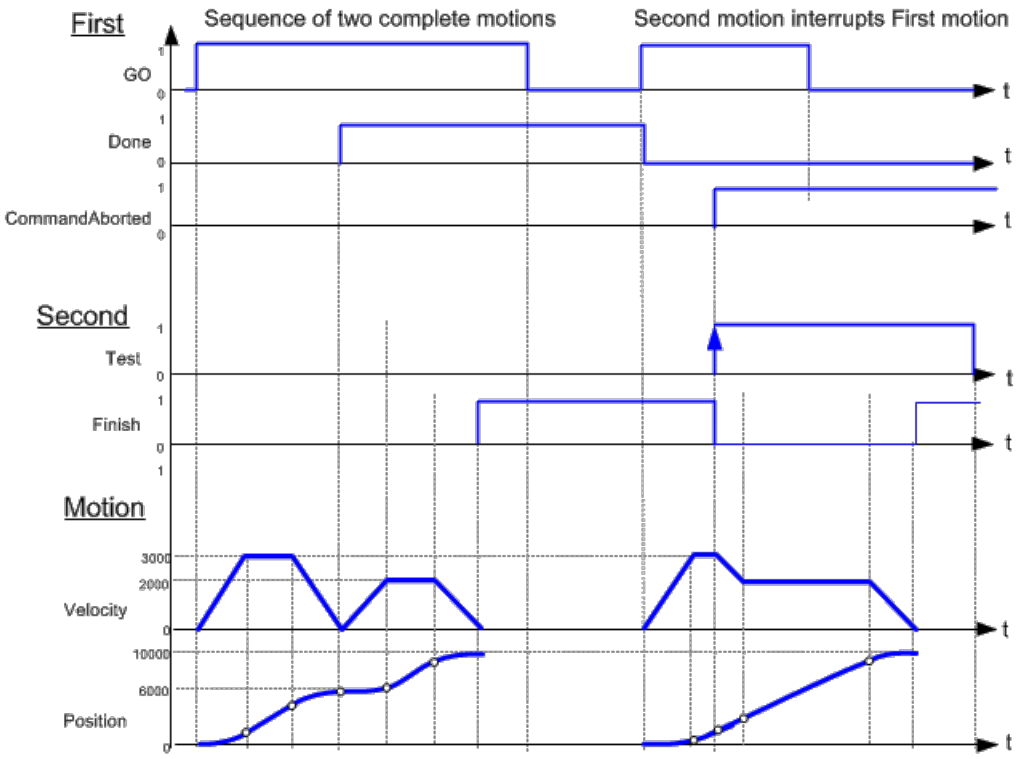
Figure 1-54: MC_MoveAbsolute

1.2.4.12.2 Time Diagram

The following figure shows two examples of the combination of two absolute move Function Blocks:

- The left part of timing diagram illustrates the case if the Second Function Block is called **after** the First one. If First reaches the commanded position of 6000 (and the velocity is 0) then the output Done causes the Second FB to move to the position 10000
- The right part of the timing diagram illustrates the case if the Second move Function Block starts the execution **while** the First FB is still executing. In this case the First motion is interrupted and aborted by the Test signal during the constant velocity of the First FB. The Second FB moves directly to the position 10000 although the position of 6000 is not yet reached





1.2.4.13.3 Arguments

1.2.4.14.4.1 Input

Execute	Description	Requests to queue the move
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	Description	Name of a declared instance of the AXIS_REF library function
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
Position	Description	Endpoint position. If Rollover Position is nonzero, this value must be in the range 0 <= Position < Rollover Position When not in Rollover mode, the input accepts a 64-bit floating point value. When converted to feedback units, the range is $[-2^{51},2^{51}-1]$ feedback units.
	Data type	LREAL
	Range	[see Description]
	Unit	User unit

	Default	—
Velocity	Description	Velocity setpoint
	Data type	LREAL
	Range	—
	Unit	User unit/sec
	Default	—
Acceleration	Description	Trapezoidal: Acceleration rate S-curve: Maximum acceleration See also "Selection of Acceleration and Jerk Parameters for Function Blocks" **NOTE** If Acceleration is not valid, ErrorID is set to 21
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Deceleration	Description	Trapezoidal: Deceleration rate S-curve: Unused
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Jerk	Description	Trapezoidal: 0 S-curve: Constant jerk See also "Selection of Acceleration and Jerk Parameters for Function Blocks" **NOTE** If Jerk is not valid, ErrorID is set to 21
	Data type	LREAL
	Range	—
	Unit	User unit/sec^3
	Default	—

Direction

Description

When Rollover Position is zero, a value of 0 must be specified.
When Rollover Position is nonzero, a value of 1, 2, 3, or 4 must be specified.

Value	Description
0	no direction specification
1	positive direction. The axis travels in the positive direction to the endpoint
2	shortest distance. The axis travels in the direction that provides the shortest distance to the endpoint
3	negative direction. The axis travels in the negative direction to the endpoint
4	last direction. The axis travels to the endpoint in the same direction as its previous move

NOTE

If the Position input is the same as the axis's current position, then:

- when Direction = **2** (shortest distance), the axis does not move and the Done output goes high indicating that the move has been completed.
- when

		NOTE Direction = **1, 3, or 4,** the axis travels in the specified direction, through one rollover cycle, and arrives back at the same position.
	Data type	SINT
	Range	[0,4]
	Unit	n/a
	Default	—
BufferMode	Description	0 = abort 1 = buffer 2 = blend to active 3 = blend to next 4 = blend to low velocity 5 = blend to high velocity
	Data type	SINT
	Range	[0,5]
	Unit	n/a
	Default	—

1.2.4.15.5.2 Output

Done	Description	Indicates the move completed successfully. The Command Position has reached the endpoint.
	Data type	BOOL
Busy	Description	High from the moment the Execute input is one-shot to the time the move is ended
	Data type	BOOL
Active	Description	Indicates this move is the active move
	Data type	BOOL
CommandAborted	Description	Indicates the move was aborted
	Data type	BOOL

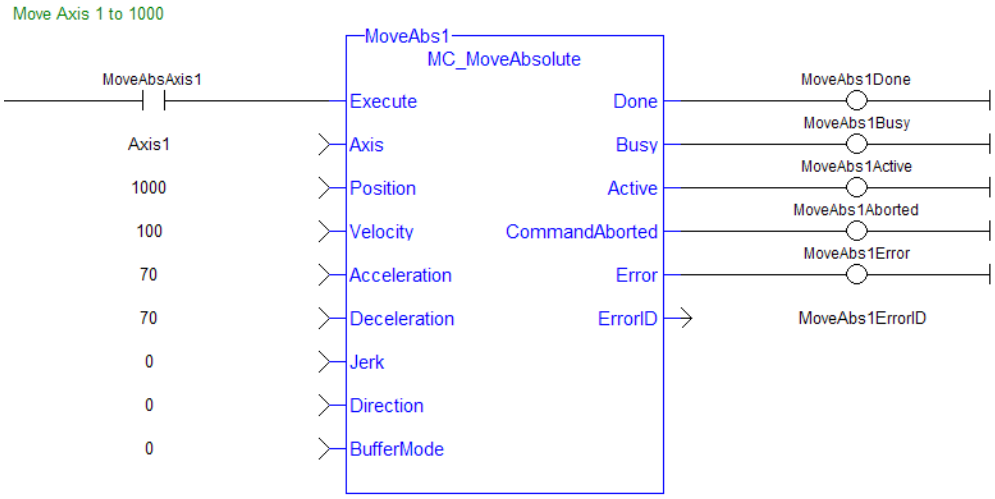
Error	Description	Indicates an invalid input was specified or the move was terminated due to an error
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT

1.2.4.16.6 Example

1.2.4.17.7.1 Structured Text

```
(* MC_MoveAbsolute ST example *)

Inst_MC_MoveAbsolute( MovAbsReq, Axis1, 1234.567, 100.0, 100.0,
100.0, 0, 0, 0 ); //instance of MC_MoveAbsolute

MovAbsDone := Inst_MC_MoveAbsolute.Done; //store done output
into user defined variable

MovAbsBusy := Inst_MC_MoveAbsolute.Busy;

MovAbsActive := Inst_MC_MoveAbsolute.Active;

MovAbsAborted := Inst_MC_MoveAbsolute.CommandAborted;

MovAbsError := Inst_MC_MoveAbsolute.Error;

MovAbsErrID := Inst_MC_MoveAbsolute.ErrorID;
```

1.2.4.18.8.2 Ladder Diagram



1.2.4.19 MC_MoveAdditive (Function Block)

1.2.4.20.1 Description

This function block performs a single-axis move for a specified distance from the endpoint of the previous move. It is typically used with Abort specified at the BufferMode input. If BufferMode is

not Abort, this move is identical to an MC_MoveRelative.

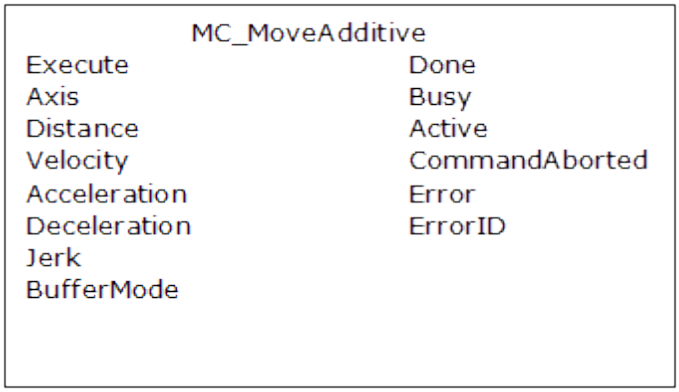
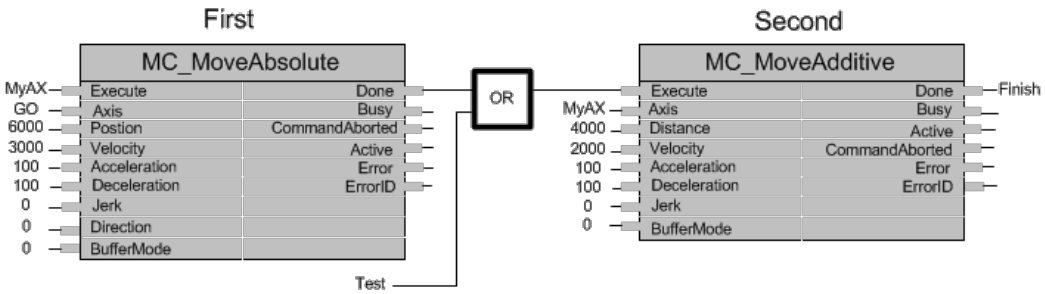


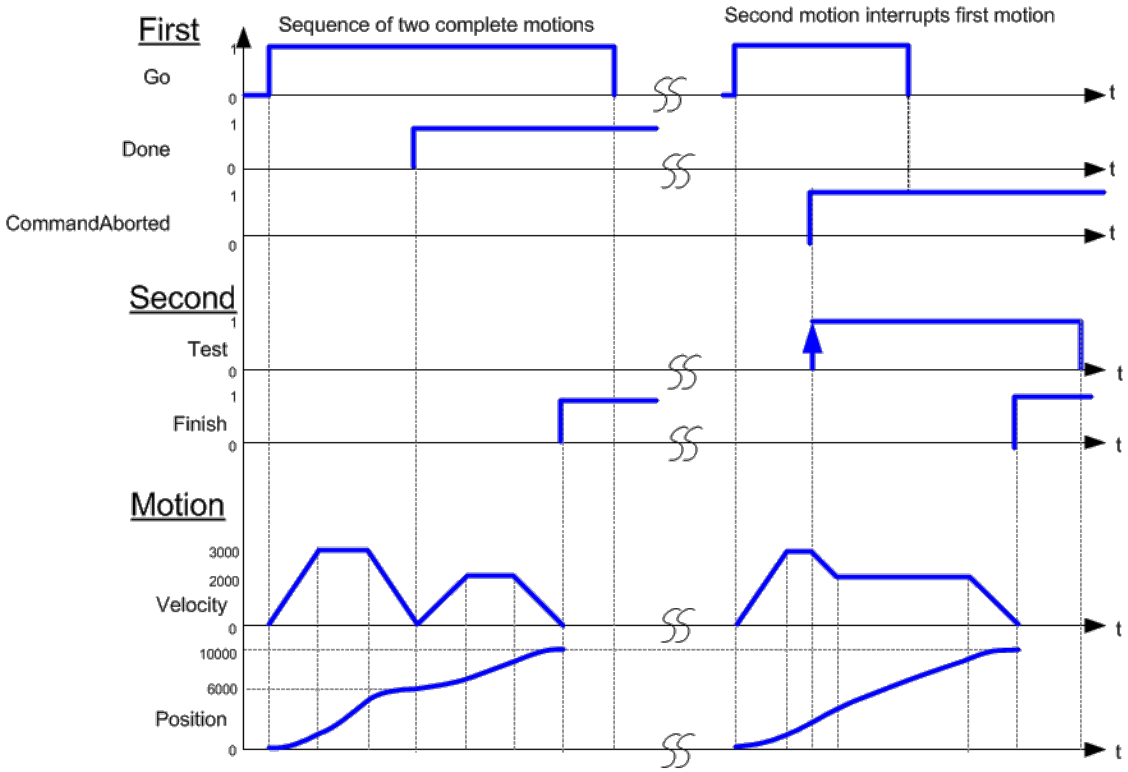
Figure 1-55: MC_MoveAdditive

1.2.4.21.2 Time Diagram

The following figure shows two examples of the combination of two Function Blocks while the axis is in Discrete Motion state:

- The left part of timing diagram illustrates the case if the Second Function Block is called **after** the First one. If First reaches the commanded distance 6000 (and the velocity is 0) then the output **Done** causes the Second FB to move to the distance 10000
- The right part of the timing diagram illustrates the case if the Second move Function Blocks starts the execution **while** the First FB is still executing. In this case the First motion is interrupted and aborted by the Test signal during the constant velocity of the First FB. The Second FB **adds on the previous commanded position** of 6000 the distance 4000 and moves the axis to the resulting position of 10000





1.2.4.22.3 Arguments

1.2.4.23.4.1 Input

Execute

Description	Requests to queue the move
Data type	BOOL
Range	0, 1
Unit	n/a
Default	—

Axis

Description	Name of a declared instance of the AXIS_REF library function.)
Data type	AXIS_REF
Range	[1,256]
Unit	n/a
Default	—

Distance

Description	Distance to add to the endpoint of the previous move
Data type	REAL
Range	—
Unit	User unit
Default	—

Velocity

Description	Velocity setpoint
Data type	LREAL
Range	—
Unit	User unit/sec
Default	—

Acceleration	Description	Trapezoidal: Acceleration rate S-curve: Maximum acceleration
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Deceleration	Description	Trapezoidal: Deceleration rate S-curve: Unused
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Jerk	Description	Trapezoidal: 0 S-curve: Constant jerk
	Data type	LREAL
	Range	—
	Unit	User unit/sec^3
	Default	—
BufferMode	Description	0 = abort 1 = buffer 2 = blend to active 3 = blend to next 4 = blend to low velocity 5 = blend to high velocity
	Data type	SINT
	Range	[0,5]
	Unit	n/a
	Default	—

1.2.4.24.5.2 Output

Done	Description	Indicates the move completed successfully. The Command Position has reached the endpoint.
	Data type	BOOL
Busy	Description	High from the moment the Execute input is one-shot to the time the move is ended
	Data type	BOOL
Active	Description	Indicates this move is the active move
	Data type	BOOL
CommandAborted	Description	Indicates the move was aborted
	Data type	BOOL

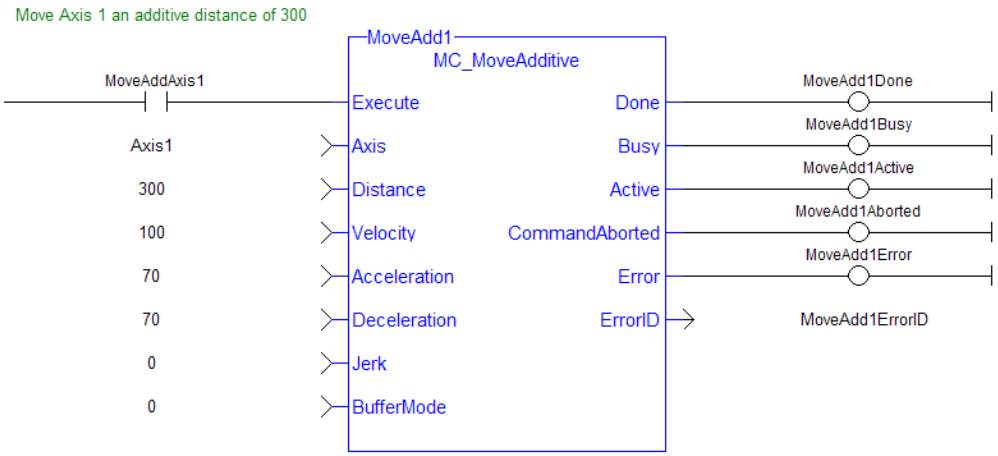
Error	Description	Indicates an invalid input was specified or the move was terminated due to an error
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT

1.2.4.25.6 Example

1.2.4.26.7.1 Structured Text

```
(* MC_MoveAdditive ST example *) //Inst_MC_MoveAdditive is an
instance of MC_MoveAdditive function block

Inst_MC_MoveAdditive( MovAddReq, Axis1, 123.456, 100.0, 100.0,
100.0, 0, 0 );

MovAddDone := Inst_MC_MoveAdditive.Done; //store Done output
into user defined variable
```

1.2.4.27.8.2 Ladder Diagram



1.2.4.28 MC_MoveRelative

1.2.4.29.1 Description

This function block executes a single-axis move for a specified distance to perform incremental motion.

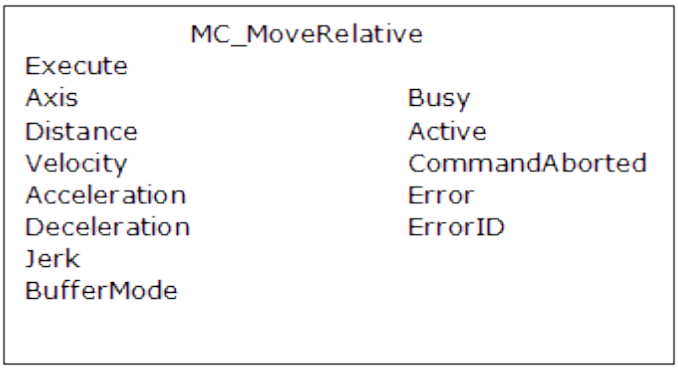
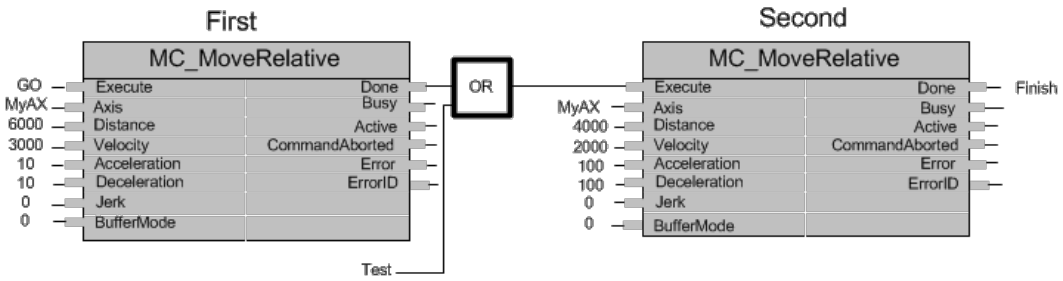


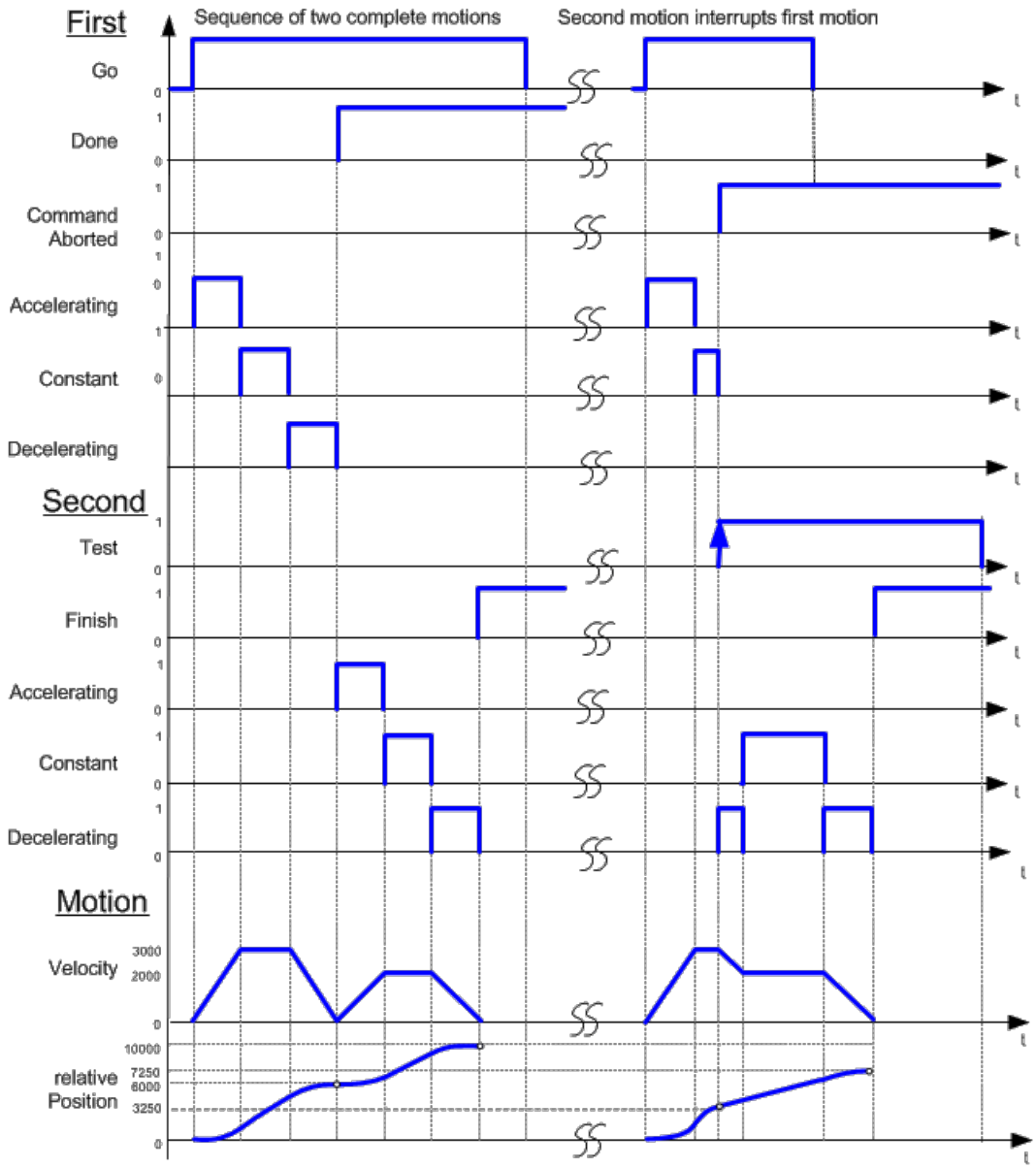
Figure 1-56: MC_MoveRelative

1.2.4.30.2 Time Diagram

The following figure shows the example of the combination of two relative move Function Blocks:

- The left part of timing diagram illustrates the case if the Second Function Block is called **after** the First one. If First reaches the commanded distance 6000 (and the velocity is 0) then the output **Done** causes the Second FB to move to the distance 10000
- The right part of the timing diagram illustrates the case if the Second move Function Blocks starts the execution **while** the First FB is still executing. In this case the First motion is interrupted and aborted by the Test signal during the constant velocity of the First FB. The Second FB **adds on the actual position** of 3250 the distance 4000 and moves the axis to the resulting position of 7250





1.2.4.31.3 Arguments

1.2.4.32.4.1 Input

Execute

Description	Requests to queue the move
Data type	BOOL
Range	0, 1
Unit	n/a
Default	—

Axis

Description	Name of a declared instance of the AXIS_REF library function.
Data type	AXIS_REF
Range	[1,256]
Unit	n/a
Default	—

Distance	Description	Distance
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—
Velocity	Description	Velocity setpoint
	Data type	LREAL
	Range	—
	Unit	User unit/sec
	Default	—
Acceleration	Description	Trapezoidal: Acceleration rate S-curve: Maximum acceleration
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Deceleration	Description	Trapezoidal: Deceleration rate S-curve: Unused
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Jerk	Description	Trapezoidal: 0 S-curve: Constant jerk
	Data type	LREAL
	Range	—
	Unit	User unit/sec^3
	Default	—
BufferMode	Description	0 = abort 1 = buffer 2 = blend to active 3 = blend to next 4 = blend to low velocity 5 = blend to high velocity
	Data type	SINT
	Range	[0,5]
	Unit	n/a
	Default	—

1.2.4.33.5.2 Output

Done	Description	Indicates the move completed successfully. The Command Position has reached the endpoint.
	Data type	BOOL
Busy	Description	High from the moment the Execute input is one-shot to the time the move is ended
	Data type	BOOL
Active	Description	Indicates this move is the active move
	Data type	BOOL
CommandAborted	Description	Indicates the move was aborted
	Data type	BOOL
Error	Description	Indicates an invalid input was specified or the move was terminated due to an error
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT

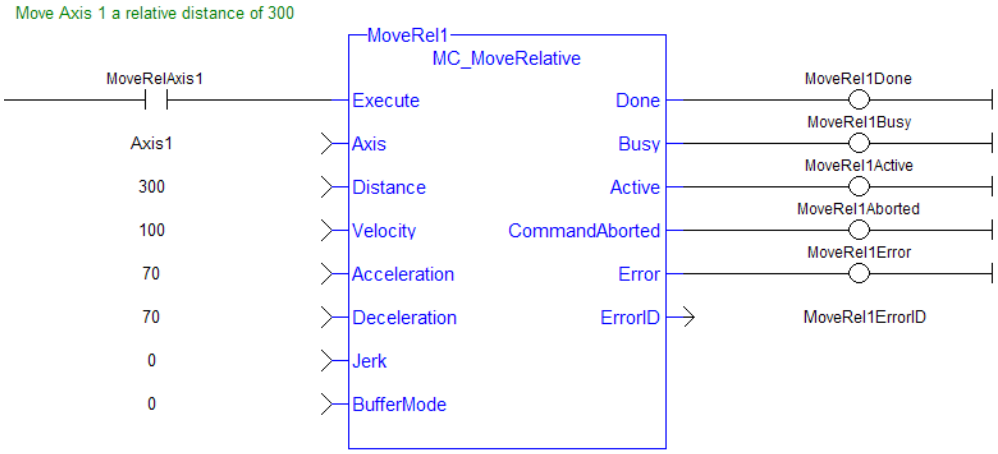
1.2.4.34.6 Example

1.2.4.35.7.1 Structured Text

```
(* MC_MoveRelative ST example *)

Inst_MC_MoveRelative( MovRelReq, Axis1, 10.0, 200.0,150.0,
150.0, 0,0 );

MovRelDone := Inst_MC_MoveRelative.Done; //store Done output
into user defined variable
```

See also how this function is used in the Hole punch project here

1.2.4.36.8.2 Ladder Diagram



1.2.4.37 MC_MoveSuperimp (Function Block)

1.2.4.38.1 Description

This function block performs a relative single-axis move which is superimposed upon the active move. Superimposed moves have their own Profile Generator and queue. Superimposed moves can be aborted by and blended with other superimposed moves. The distance of the superimposed move is an addition to the existing motion.

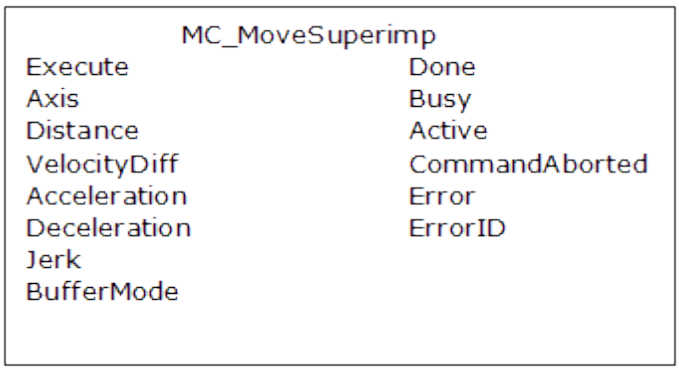
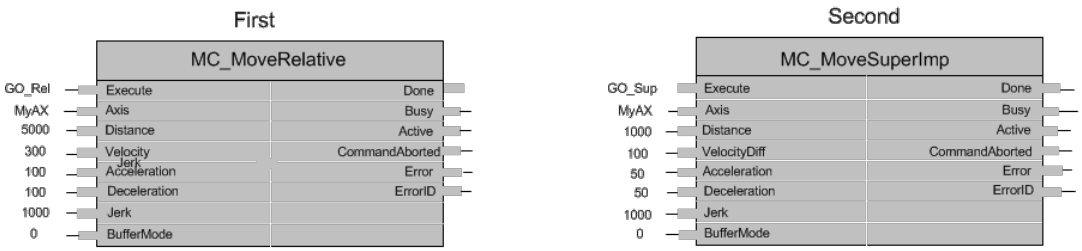
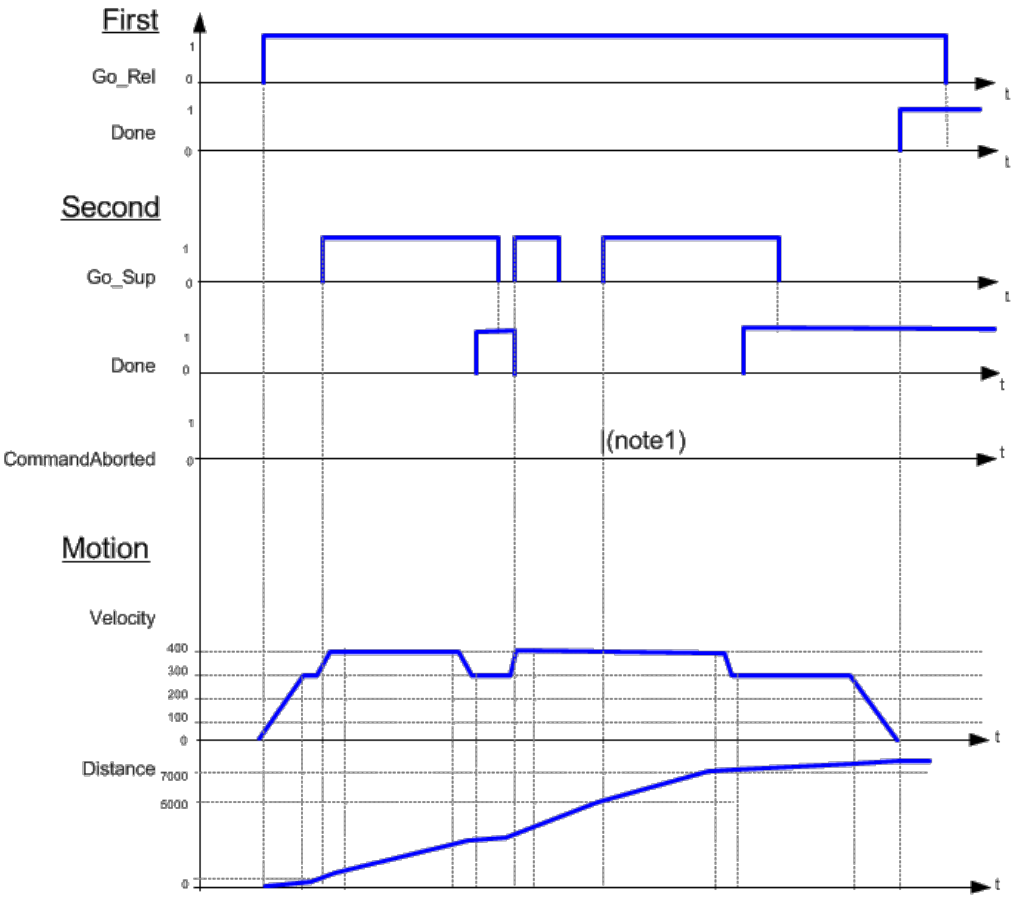


Figure 1-57: MC_MoveSuperimp

1.2.4.39.2 Time Diagram





NOTE

1. The CommandAborted is not visible here, because the new command works on the same instance
2. The end position is between 7000 and 8000, depending on the timing of the aborting of the second command set for the MC_MoveSuperimposed

1.2.4.40.3 Arguments

1.2.4.41.4.1 Input

Execute	Description	Requests to queue the superimposed move
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	Description	Name of a declared instance of the AXIS_REF library function.
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
Distance	Description	Distance

	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—
Velocity	Description	Velocity rate
	Data type	LREAL
	Range	—
	Unit	User unit/sec
	Default	—
Acceleration	Description	Trapezoidal: Acceleration rate S-curve: Maximum acceleration
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Deceleration	Description	Trapezoidal: Deceleration rate S-curve: Unused
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Jerk	Description	Trapezoidal: 0 S-curve: Constant jerk
	Data type	LREAL
	Range	—
	Unit	User unit/sec^3
	Default	—
BufferMode	Description	0 = abort 1 = buffer 2 = blend to active 3 = blend to next 4 = blend to low velocity 5 = blend to high velocity
	Data type	SINT
	Range	[0,5]
	Unit	n/a
	Default	—

1.2.4.42.5.2 Output

Done	Description	Indicates the move completed successfully. The Command Position has reached the endpoint.
	Data type	BOOL

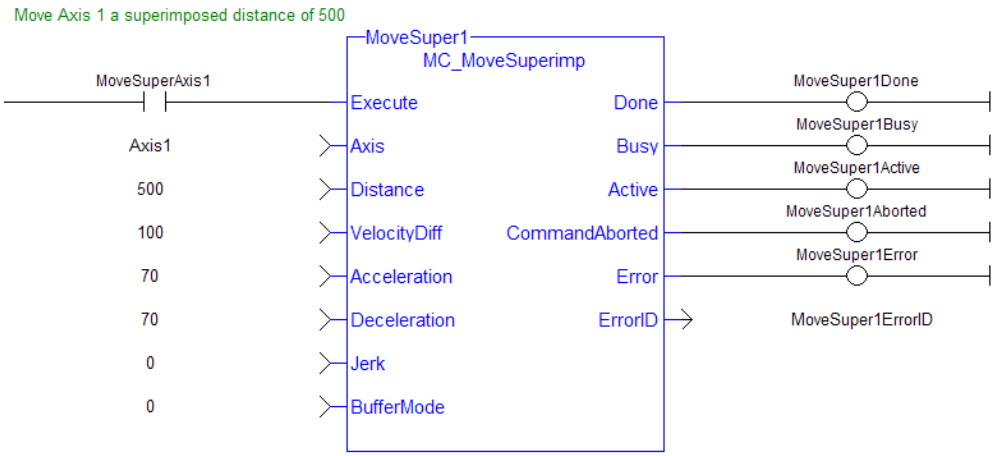
Busy	Description	High from the moment the Execute input is one-shot to the time the move is ended
	Data type	BOOL
Active	Description	Indicates this move is the active superimposed move
	Data type	BOOL
CommandAborted	Description	Indicates the move was aborted
	Data type	BOOL
Error	Description	Indicates an invalid input was specified or the move was terminated due to an error
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT

1.2.4.43.6 Example

1.2.4.44.7.1 Structured Text

```
(* MC_MoveSuperimp ST example *)

Inst_MC_MoveSuperimp( MovSupReq, Axis1, 123.555, 10.0, 100.0,
100.0, 0, 0 );

MovSupDone := Inst_MC_MoveSuperimp.Done; //store Done output
into user defined variable
```

1.2.4.45.8.2 Ladder Diagram



1.2.4.46 MC_MoveVelocity (Function Block)

1.2.4.47.1 Description

This function block performs a single-axis non-ending move at a specified velocity. This type of move can be terminated with the MC_Halt function block or by aborting it with another move.

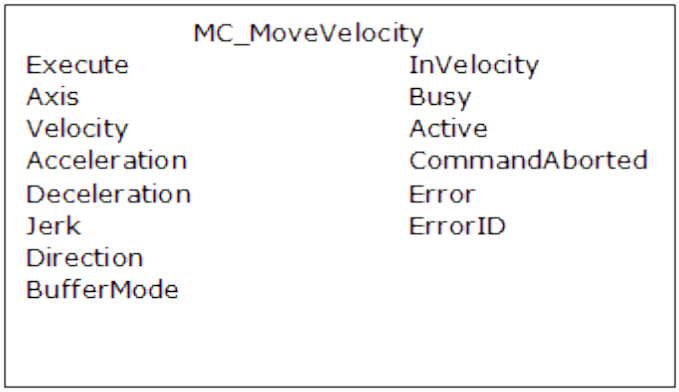


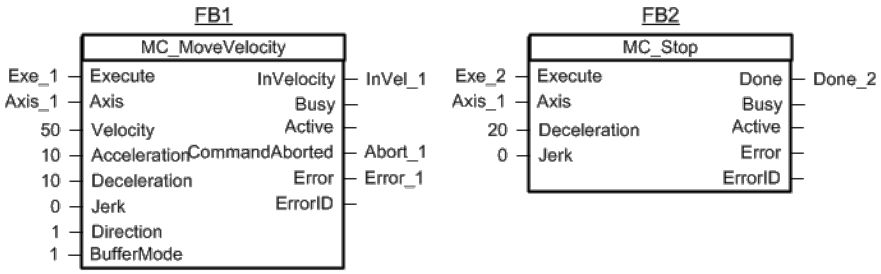
Figure 1-58: MC_MoveVelocity

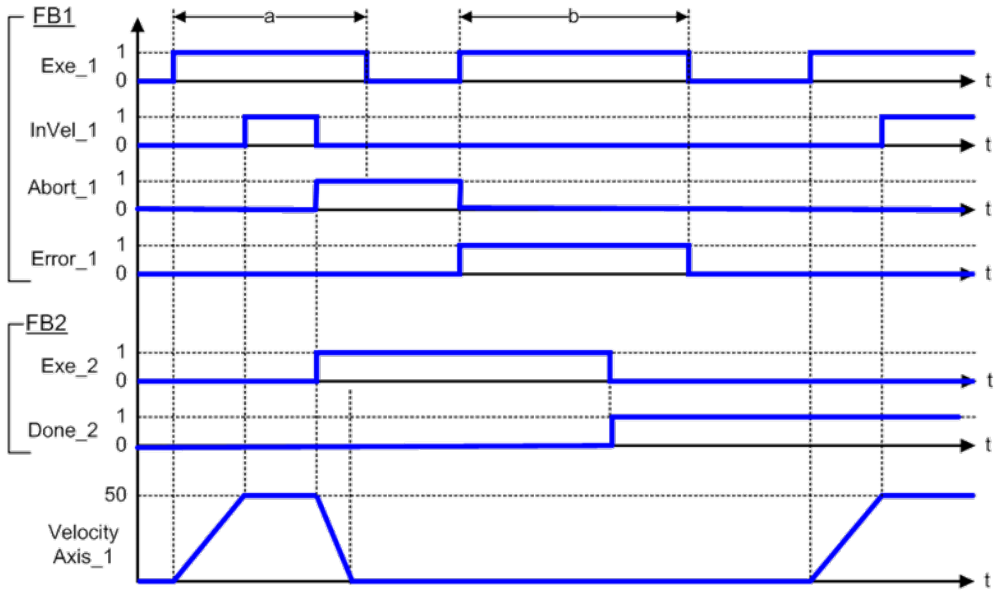
1.2.4.48.2 Time Diagram

The example below shows the behavior of the combination of a MC_Stop FB with a MC_ MoveVelocity FB.

- A rotating axis is ramped down with FB2 MC_Stop
- The axis rejects motion commands as long as MC_Stop parameter “Execute” = TRUE

FB1 MC_MoveVelocity reports an error indicating the busy MC_Stop command.





1.2.4.49.3 Arguments

1.2.4.50.4.1 Input

Execute	Description	Requests to queue the move
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	Description	Name of a declared instance of the AXIS_REF library function
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
Velocity	Description	Velocity rate
	Data type	LREAL
	Range	—
	Unit	User unit/sec
	Default	—
Acceleration	Description	Trapezoidal: Acceleration rate S-curve: Maximum acceleration
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Deceleration	Description	Trapezoidal: Deceleration rate S-curve: Unused
	Data type	LREAL
	Range	—

	Unit	User unit/sec^2
	Default	—
Jerk	Description	Trapezoidal: 0 S-curve: Constant jerk
	Data type	LREAL
	Range	—
	Unit	User unit/sec^3
	Default	—
Direction	Description	0 = positive direction 1 = negative direction
	Data type	SINT
	Range	[0,1]
	Unit	n/a
	Default	—
BufferMode	Description	0 = abort 1 = buffer 2 = blend to active 3 = blend to next 4 = blend to low velocity 5 = blend to high velocity
	Data type	SINT
	Range	[0,5]
	Unit	n/a
	Default	—

1.2.4.51.5.2 Output

InVelocity	Description	Indicates the command velocity has reached the programmed velocity
	Data type	BOOL
Busy	Description	High from the moment the Execute input is one-shot to the time the move is ended
	Data type	BOOL
Active	Description	Indicates this move is the active move
	Data type	BOOL
CommandAborted	Description	Indicates the move was aborted
	Data type	BOOL
Error	Description	Indicates an invalid input was specified or the move was terminated due to an error
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE

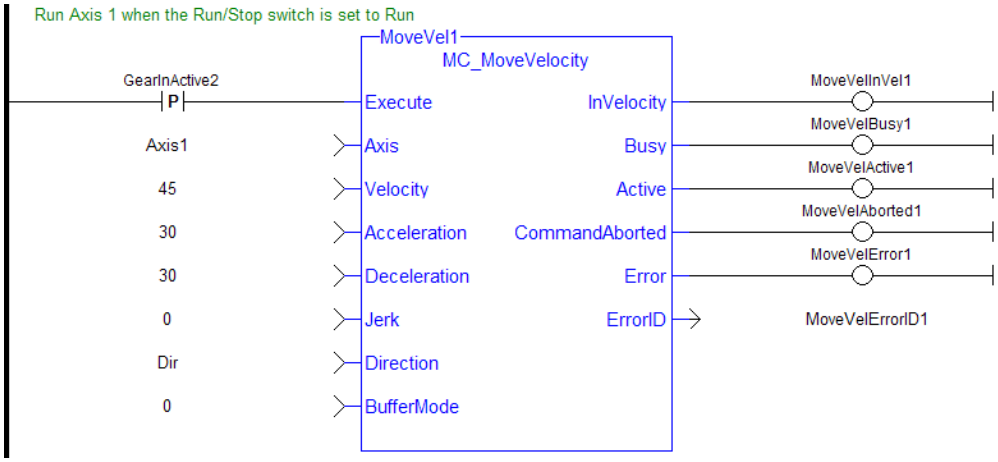
Data type INT

1.2.4.52.6 Example

1.2.4.53.7.1 Structured Text

```
(* MC_MoveVelocity ST example *)

Inst_MC_MoveVelocity( MovVelReq , Axis1, 200.0, 100.0,100.0, 0,
0, 0 );
```

1.2.4.54.8.2 Ladder Diagram



1.2.4.55 MC_SetOverride (Function Block)

1.2.4.56.1 Description

This function block writes the velocity override factor. A change in the velocity override factor takes effect immediately on the active move.

The velocity override factor is applied to the programmed velocity to determine the command velocity:

command velocity = programmed velocity * VelFactor

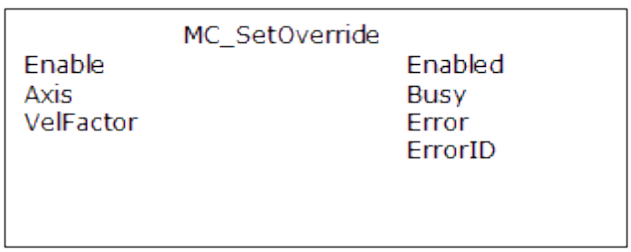


Figure 1-59: MC_SetOverride

1.2.4.57.2 Arguments

1.2.4.58.3.1 Input

Enable	Description	Request to write the override factors
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Axis	Description	Name of a declared instance of the AXIS_REF library function.
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
VelFactor	Description	Velocity override factor
	Data type	REAL
	Range	[0.0, 2.0]
	Unit	n/a
	Default	—

1.2.4.59.4.2 Output

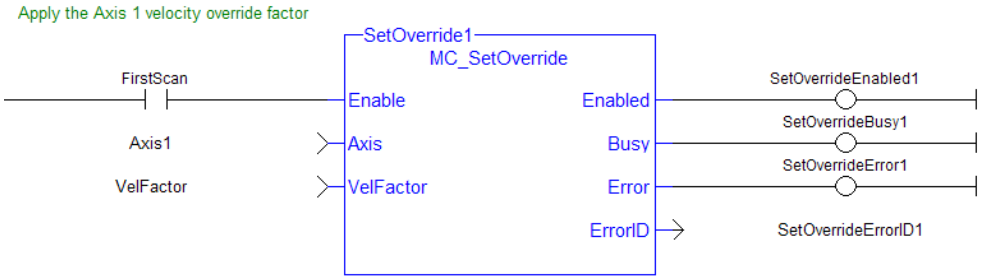
Enabled	Description	Indicates the override values have been written
	Data type	BOOL
Busy	Description	Indicates the function block is executing
	Data type	BOOL
Error	Description	Indicates an invalid input is specified
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT

1.2.4.60.5 Example

1.2.4.61.6.1 Structured Text

```
(* MC_SetOverride ST example *)
VelFactor := 1.25 ; //set the velocity factor to 1.25 (125%)
Inst_MC_SetOverride( TRUE , Axis1, VelFactor );
// Inst_MC_Setoverride is an instance of MC_SetOverride
```

1.2.4.62.7.2 Ladder Diagram



1.2.5 Profile

1.2.5.1 MC_CamIn

1.2.5.2.1 Description

This function block performs a slave axis move which follows the master axis based on the Cam Table specified by CamTableID.

This function block is used to either initiate a new MC_CamIn move or to resume a previously programmed MC_CamIn move. Refer to MC_CamStartPos and MC_CamResumePos for information on positioning the slave axis prior to calling MC_CamIn.

Add an image!

Figure 1-60: MC_CamIn

1.2.5.3.2 Arguments

1.2.5.4.3.1 Input

Execute	**Description**	Requests to queue the CamIn move
	Data type	BOOL
	Range	0, 1
	Unit	n/a
Master	**Description**	Name of a declared instance of the AXIS_REF library function
	Data type	AXIS_REF
	Range	1 - 256
	Unit	n/a
Slave	**Description**	AXIS_REF.AXIS_NUM is the slave axis number
	Data type	AXIS_REF
	Range	1-256
	Unit	n/a
MasterOffset	**Description**	Profile shift along the master axis. This input is not used if the StartMode input is set to 1 for Resume Mode.
	Data type	LREAL

	Range	—
	Unit	User unit
SlaveOffset	**Description**	Profile shift along the slave axis. This input is not used if the StartMode input is set to 1 for Resume Mode.
	Data type	LREAL
	Range	—
	Unit	User unit
MasterScaling	**Description**	Master axis profile range. This input is not used if the StartMode input is set to 1 for Resume Mode.
	Data type	LREAL
	Range	—
	Unit	User unit
SlaveScaling	**Description**	Slave axis profile range. This input is not used if the StartMode input is set to 1 for Resume Mode.
	Data type	LREAL
	Range	—
	Unit	User unit
Startmode	**Description**	Starting mode of the cam profile. 0 = Start Mode. Start a cam profile move. 1 = Resume Mode. Resume the most recent MC_CamIn move. This input indicates whether the axis should start a MC_CamIn move as an initial cam start (StartMode = 0) or if the axis should resume the most recently programmed MC_CamIn move (StartMode = 1). It should be noted that in the case of Resume Mode (StartMode = 1) that the inputs MasterOffset, SlaveOffset, MasterScaling, and SlaveScaling are not used. The function block will use the values that were in effect during the most recently programmed MC_CamIn move for the slave axis.
	Data type	INT
	Range	[0,1]
	Unit	n/a

CamTableID	**Description**	ID number of the profile to be used with MC_CamIn
	Data type	INT
	Range	—
	Unit	n/a
BufferMode	**Description**	Buffer mode for CamIn block.
	Data type	SINT
	Range	0-5
	Unit	n/a

1.2.5.5.4.2 Output

InSync	**Description**	Indicates the slave axis is in sync with the profile
	Data type	BOOL
	Range	0, 1
	Unit	n/a
Busy	**Description**	Indicates this function block is executing
	Data type	BOOL
	Range	0, 1
	Unit	n/a
Active	**Description**	Indicates this move is the Active move
	Data type	BOOL
	Range	0, 1
	Unit	n/a
CommandAborted	**Description**	Indicates the move was aborted
	Data type	BOOL
	Range	0, 1
	Unit	n/a
Error	**Description**	Indicates an invalid input, or the move was terminated due to an error
	Data type	BOOL
	Range	0, 1
	Unit	n/a
ErrorID	**Description**	Indicates the error if the Error output is high.
	Data type	INT
	Range	—
	Unit	n/a

EndOfProfile	**Description**	Indicates the end of profile has been reached. If the profile is periodic this output is set to ON for one ladder scan. If the profile is not periodic, the output remains ON while outside the range of the profile.
	Data type	BOOL
	Range	0, 1
	Unit	n/a

1.2.5.6.5 Usage

The slave axis immediately locks on to the Cam Table profile.

The **Master Offset** is used to shift the profile along the master axis.

The **Master Scaling** defines the range of the profile along the master axis.

The **Slave Offset** is used to shift the profile along the Slave axis.

The **Slave Scaling** defines the range of the profile along the slave axis.

If the profile is periodic, when the end of profile reached, the profile continues at the start of the profile. The EndOfProfile output is ON for 1 ladder scan.

If the profile is not periodic, when the end of profile is reached, the slave axis stops and remains at the end of the profile until the master axis returns to within the profile range as defined by MasterScaling. The EndOfProfile output remains ON anytime the master axis is outside of the profile range.

Adjustments computation is done as follows:

When cam is first started, offsets are adjusted if necessary

- If slave is not absolute, then slave offset = slave offset + starting position
- If master is not absolute, then master offset = master offset + starting position.

At run-time

- Master position for profile = master position - master offset
- Use master position for profile table to obtain slave profile position
- Slave commanded position = slave profile position + slave offset

1.2.5.7.6 Related Functions

MC_CamResumePos

MC_CamStartPos

MC_CamTblSelect

MC_CamOut

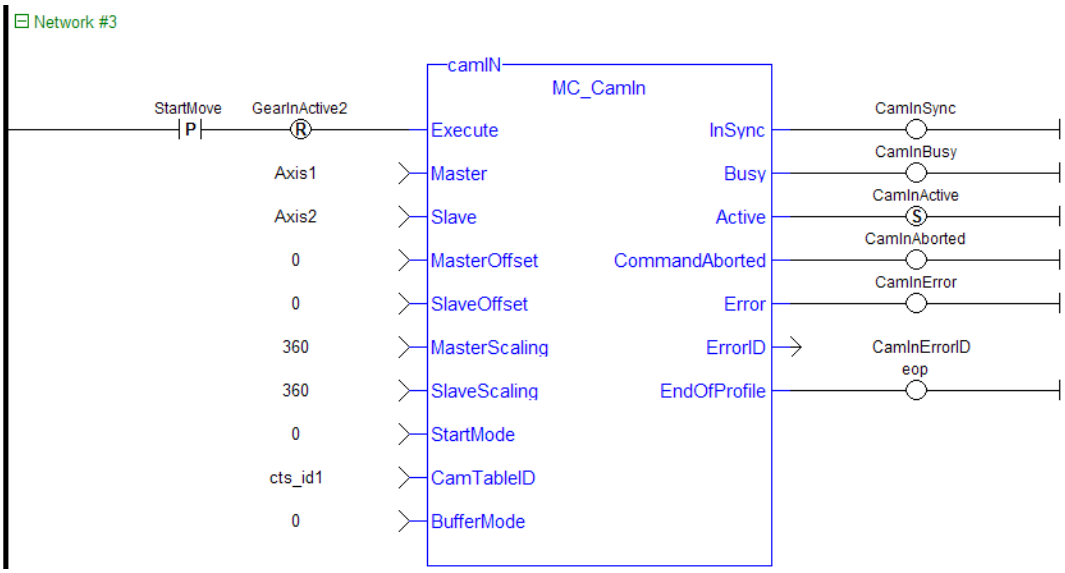
1.2.5.8.7 Examples

1.2.5.9.8.1 Structured Text

```
(* MC_CamIn ST example *)  //Inst_MC_CamIn is an instance of MC_CamIn
Inst_MC_CamIn( CamStartBool, Axis1, Axis2, 0.0, 0.0, 360.0, 360.0, 0,
```

```
    CamTableID, 0 );
```

1.2.5.10.9.2 Ladder Diagram



The three following examples utilizes the screen shot below showing the cam profile “MyProfile”

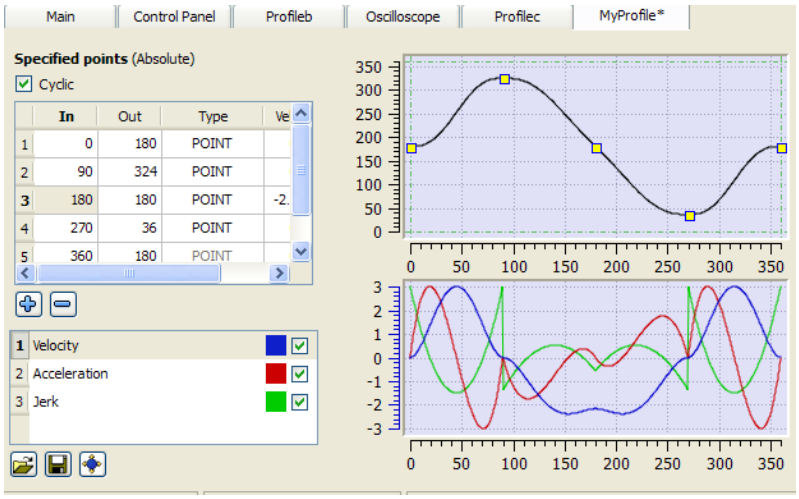


Figure 1-61: MC_CamIn examples

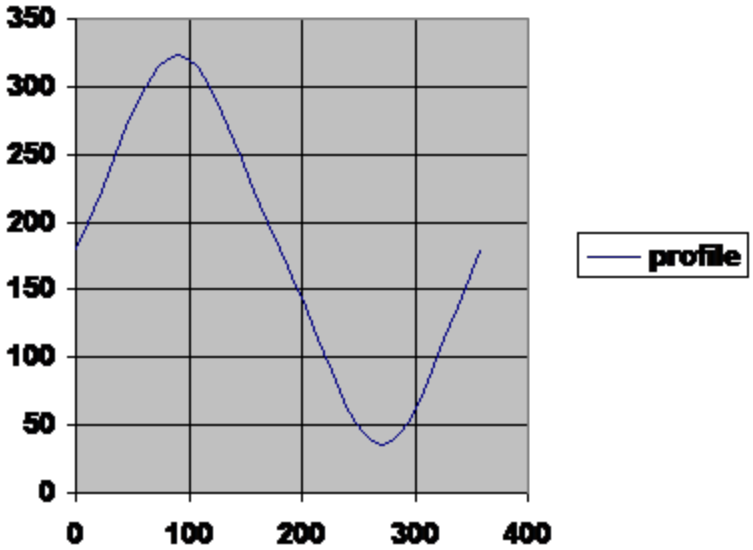
1.2.5.11.10.3 Example 1

Profile	MyProfile
Cycle	NO
MasterAbsolute	YES
SlaveAbsolute	YES
MasterOffset	0.0
SlaveOffset	0.0
MasterScaling	360.0
SlaveScaling	360.0

Initial Master position	0.0
Initial Slave position	180.0

After `MC_CamTblSelect` and `MC_CamIn` are programmed with the above parameters, the slave axis is locked on to the profile. Since both have zero offsets, the profile is not shifted in either axis. The initial condition of the master axis at position 0, yields a slave command position of 180.0. As the master axis moves positive, the slave position follows the profile. When the master position is at 90.0, the slave is commanded to 324.0 (see curve below where in = 90, out = 324). The slave follows the profile as the master axis moves until the master axis reaches a position of 360.0. At this time the slave is commanded to 180.0.

If the master were to continue to move past 360.0 the slave commanded position would remain at 180.0 since the Cyclic input is false. If the master moves negative and its position returns to less than 360.0, then the slave follows the profile again.



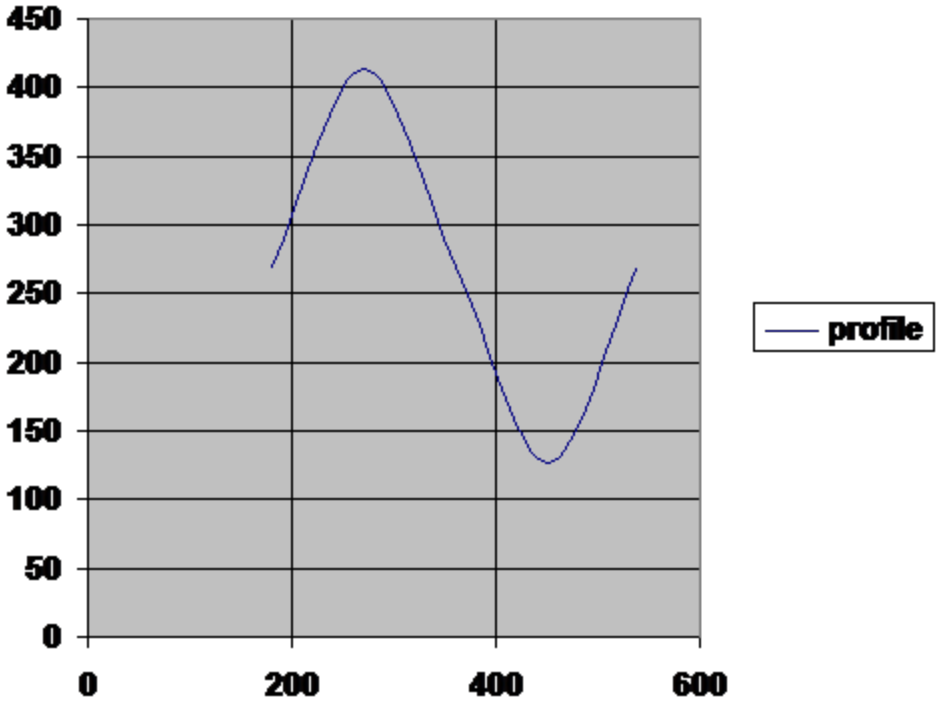
1.2.5.12.11.4 Example 2

Profile	MyProfile
Cycle	YES
MasterAbsolute	NO
SlaveAbsolute	NO
MasterOffset	0.0
SlaveOffset	0.0
MasterScaling	360.0
SlaveScaling	360.0
Initial Master position	180
Initial Slave position	90.0

After `MC_CamTblSelect` and `MC_CamIn` are programmed with the above parameters, the slave axis is locked on to the profile. Since the both axes have zero offsets, the profile is not shifted in

either axis. Neither the *MasterAbsolute* nor *SlaveAbsolute* input is on, so the profile is relative to the axes initial positions. Specifically, the initial condition of the master axis at position 180 would represent a master profile position of 0 (180-180). This yields a slave command position of 270 (180 + 90). As the master axis moves positive, the slave position follows the profile. When the master position is at 270, the slave is commanded to 414.0 (324 + 90). The slave follows the profile as the master axis moves until the master axis reaches a position of 540. At this time the slave is commanded to 270.0 (180 + 90).

If the master continues to move past 540.0, the slave commanded position follows the profile from the beginning since the Cyclic input is TRUE. When the master reaches a position of 630, the slave is commanded to a position of 414.0 (324 + 90).



1.2.5.13.12.5 Example 3

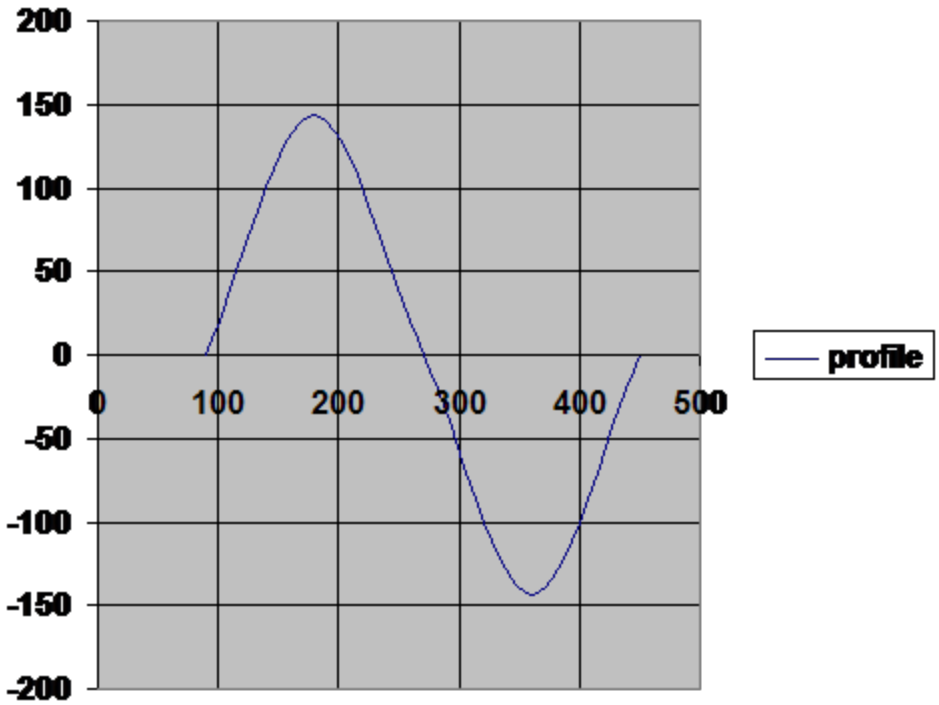
Profile	MyProfile
Cycle	NO
MasterAbsolute	YES
SlaveAbsolute	YES
MasterOffset	90
SlaveOffset	-180
MasterScaling	360.0
SlaveScaling	360.0
Initial Master position	180
Initial Slave position	144

After `MC_CamTblSelect` and `MC_CamIn` are programmed with the above parameters, the slave axis is locked on to the profile. Since the both axes have offsets, the profile is shifted along both

axes. Specifically the master axis is shifted 90, and the slave axis is shifted -180. Initially the master axis position of 180 yields a master position for the profile calculation of 90 (master position 180 - Master offset 90), which yields a slave command position of 144 (slave profile command 324 + slave offset (-180)). As the master axis moves positive, the slave position follows the profile. When the master axis position is at 270, the master position for profile calculation is 180 (270 - 90). This yields a slave command position of 0 (180 + (-180)).

The slave follows the profile as the master axis moves until the master axis reaches a position of 450. The master axis position of 450 yields a master position for profile calculation of 360 (450 - 90). The slave command position is 0 (180 + (-180)).

When the master reaches a position of 450, the slave commanded position remains at 0 since the Cyclic input is false.



1.2.5.14 MC_CamOut

1.2.5.15.1 Description

This function block:

- aborts the active MC_CamIn move
- disengages the axis from its master
- and commands the axis to continue at its current velocity

Like a MC_MoveVelocity move, the control continues to command the axis to move at this velocity until this MC_CamOut move is aborted. If this function block is called and the active move is not a MC_CamIn move, this function block returns an error and the active move is not aborted.

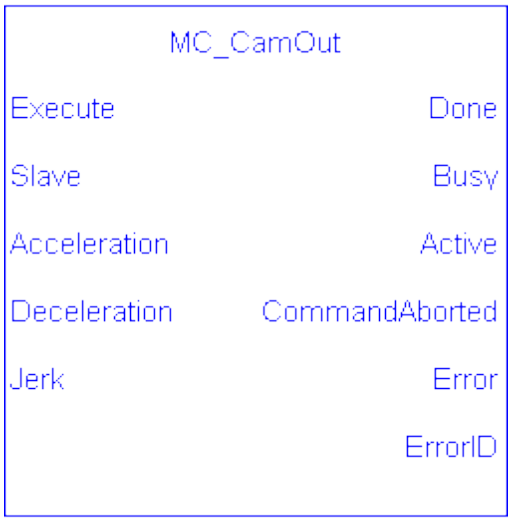


Figure 1-62: MC_CamOut

1.2.5.16.2 Arguments

1.2.5.17.3.1 Input

Execute	**Description**	Requests to queue the CamOut move
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Slave	**Description**	Name of a declared instance of the AXIS_REF library function
	Data type	AXIS_REF
	Range	1 – 256
	Unit	n/a
	Default	—
Acceleration	**Description**	Trapezoidal: Acceleration rate S-curve: Maximum acceleration
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Deceleration	**Description**	Trapezoidal: Deceleration rate S-curve: Unused
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—

Jerk	**Description**	Trapezoidal: 0 S-curve: Constant jerk
	Data type	LREAL
	Range	—
	Unit	User unit/sec^3
	Default	—

1.2.5.18.4.2 Output

Done	**Description**	Indicates the axis is disengaged from its master
	Data type	BOOL
	Range	0, 1
	Unit	n/a
Busy	**Description**	Indicates this function block is executing
	Data type	BOOL
	Range	0, 1
	Unit	n/a
Active	**Description**	Indicates this move is the Active move
	Data type	BOOL
	Range	0, 1
	Unit	n/a
CommandAborted	**Description**	Indicates the move was aborted
	Data type	BOOL
	Range	0, 1
	Unit	n/a
Error	**Description**	Indicates an invalid input was specified or no MC_CamIn move was active
	Data type	BOOL
	Range	0, 1
	Unit	n/a
ErrorID	**Description**	Indicates the error if the Error output is high
	Data type	INT
	Range	—
	Unit	n/a

1.2.5.19.5 Usage

This function block disengages the slave axis from a MC_CamIn move and then leaves the axis running at its current velocity. The axis continues to run at this velocity until this move is aborted.

1.2.5.20.6 Related Functions

MC_CamIn

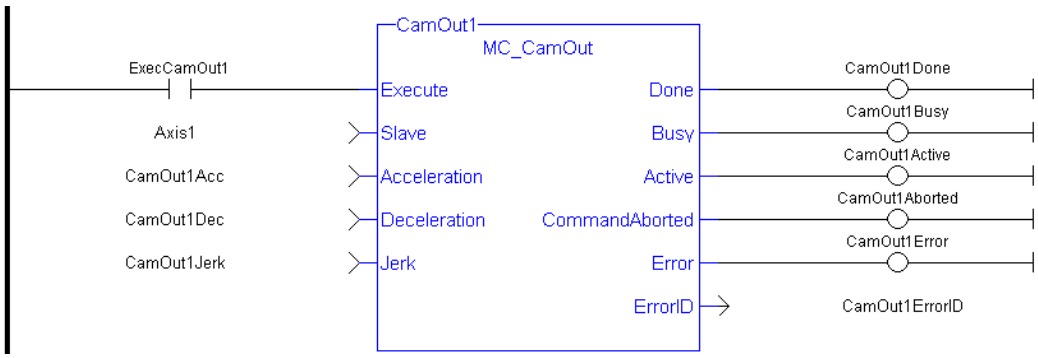
MC_CamTblSelect

1.2.5.21.7 Example

1.2.5.22.8.1 Structured Text

```
(* MC_CamOut ST example *)

Inst_MC_CamOut
(ExecCamOut1,Axis1,CamOut1Acc,CamOut1Dec,CamOut1Jerk);

//Inst_MC_CamOut is an instance of MC_CamOut
```

1.2.5.23.9.2 Ladder Diagram



See also MC_CamIn for examples.

1.2.5.24 MC_CamTblSelect

1.2.5.25.1 Description

This Function Block is defined to read and initialize the specified profile, returning an ID to be used with MC_CamIn function block.

1.2.5.26.2 Arguments

1.2.5.27.3.1 Input

Execute

Description	Requests to queue the slave gear ratio move
Data type	BOOL
Range	0, 1

	Unit	n/a
	Default	—
CamTable	**Description**	Profile name as defined in the CAM Profile Properties dialog
	Data type	STRING
	Range	—
	Unit	n/a
	Default	—
Periodic	**Description**	Selects if the profile is periodic (see also Usage section)
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
MasterAbsolute	**Description**	Selects if master profile is absolute or relative (see also Usage section)
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
SlaveAbsolute	**Description**	Selects if Slave profile is absolute or relative (see also Usage section)
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—

1.2.5.28.4.2 Output

Done	**Description**	Indicates the function block has completed successfully
	Data type	BOOL
	Range	0, 1
	Unit	n/a
Busy	**Description**	Indicates this function block is executing
	Data type	BOOL
	Range	0, 1
	Unit	n/a

Error	**Description**	Indicates an invalid input was specified
	Data type	BOOL
	Range	0, 1
	Unit	n/a
ErrorID	**Description**	Indicates the error if the Error output is high
	Data type	INT
	Range	—
	Unit	n/a
CamTableID	**Description**	Indicates the ID number of the profile to be used with MC_CamIn
	Data type	INT
	Range	0 - 255
	Unit	n/a

1.2.5.29.5 Usage

- Each positive transition of the **Enable** input will create a unique Cam ID and store the profile information in a table. The number of unique Cam IDs is limited to 256. If the application attempts to create more than 256 Cam IDs, the **Error** output will be true and the **ErrorID** output will be `22` (`Too Many Profiles`). It is only necessary to call MC_CamTblSelect once for each Profile/Periodic/MasterAbsolute/SlaveAbsolute configuration to be used.
- The **Periodic** input selects if the profile is to repeat each cycle. If the profile is not periodic and the master axis moves beyond the profile range, the slave stops at the end of the profile.

> **NOTE** If the master axis moves back into the profile range, the slave resumes following the profile.

- If the **MasterAbsolute** input is ON, the profile is in reference to the Master axis position. If the MasterAbsolute input is OFF, the profile is in reference to the Master axis position at the time the MC_CamIn function block is executed.
- Similarly, the **SlaveAbsolute** input selects if the slave positions are in reference to the Slave axis position or the Slave axis position at the time the MC_CamIn function block is executed.

> **TIP** If the SlaveAbsolute input is set to TRUE, the axis jumps back to the starting position. If you set this input to FALSE, the axis will no longer jump back; but rather, as the profile repeats, the slave moves relative to the start of each period.

1.2.5.30.6 Related Functions

MC_CamIn

MC_CamOut

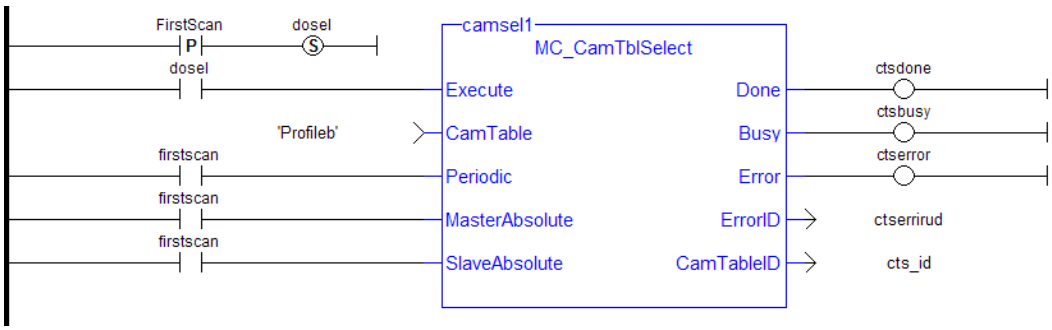
1.2.5.31.7 Example

1.2.5.32.8.1 Structured Text

```
(* MC_CamTblSelect ST example *) //call this function block
every scan until "Done"

Inst_MC_CamTblSelect(DoSelect, 'Profileb', TRUE, TRUE, TRUE );
//Inst_MC_CamTblSelect is instance of MC_CamTblSelect

CamSelDone := Inst_MC_CamTblSelect.Done; //store Done output to
user defined variable

IF CamSelDone = TRUE THEN//when function block is "done" store

CamTableID := Inst_MC_CamTblSelect.CamTableID; //CamTableID in
user defined variable

END_IF;
```

See also how this function is used in the Hole punch project here

1.2.5.33.9.2 Ladder Diagram



See also MC_CamIn for examples.

1.2.5.34 MC_GearIn

1.2.5.35.1 Description

This function block performs a slave axis move which follows the master axis based on the ratio specified by RatioNumerator and RatioDenominator.

```
SlaveCommandPosition = MasterActualPosition * RatioNumerator /
RatioDenominator
```

When this command is executed, the slave axis accelerates or decelerates (using the Acceleration, Deceleration, and Jerk) to the target velocity determined by the master axis velocity and the ratio. When the slave axis reaches a velocity within the “In Gear” bandwidth around the target velocity, it locks on to the master, and the InGear output goes high.

For example if the “In Gear” bandwidth is set to 0.1 User Units per second, the InGear output will turn on if the slave velocity is within +/- 0.1 User Units per second of the target velocity.

The slave axis then continues to follow the master axis until this move is aborted.

Time to Reach the Target Velocity

While following the master, gearing functions can generate large accelerations. If the gearing function is aborted while the axis is currently accelerating, and the aborting function block has small non-zero Jerk or small acceleration values, it can take a long time to reach the target velocity, or position of the aborting function block. If the Jerk and/or acceleration of the aborting function cannot be increased to suitable values, it may be desirable to:

- Abort the gearing function with an MC_GearOut with higher accelerations and/or Jerk values (or zero jerk value),
- Execute the next MC motion function block.

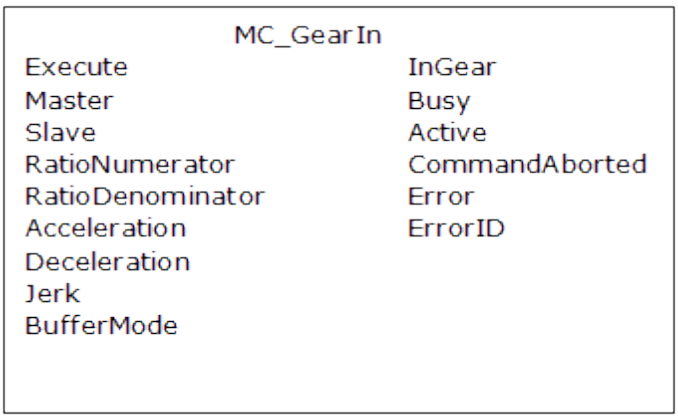
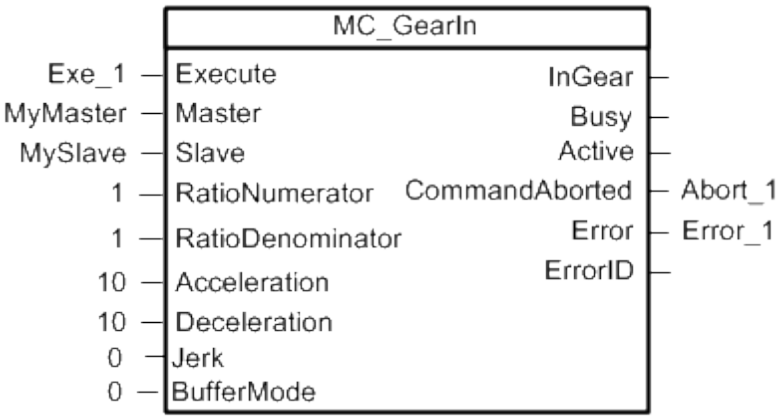
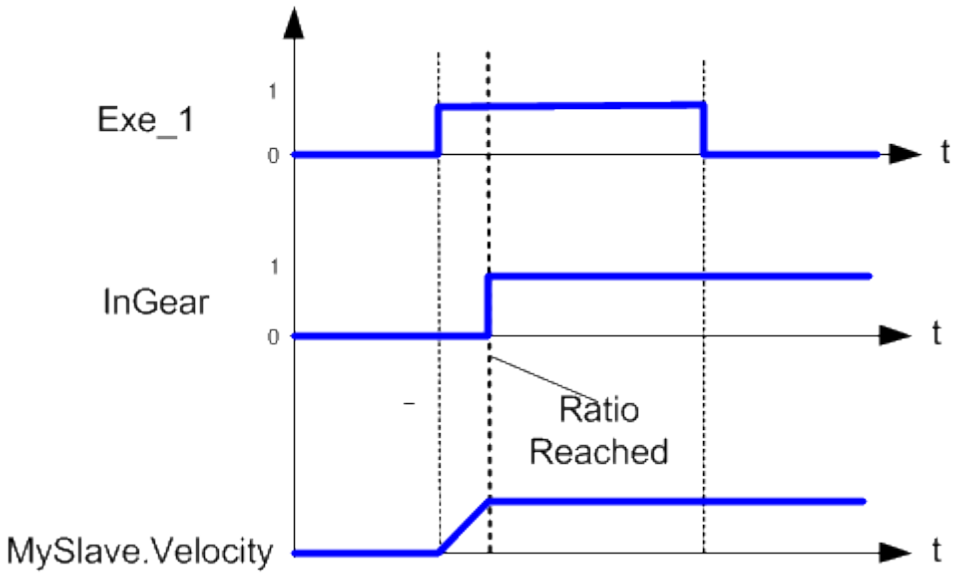


Figure 1-63: MC_GearIn

1.2.5.36.2 Time Diagram





1.2.5.37.3 Arguments

1.2.5.38.4.1 Input

Execute	**Description**	Requests to queue the slave gear ratio move
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Master	**Description**	Name of a declared instance of the AXIS_REF library function
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
Slave	**Description**	AXIS_REF.AXIS_NUM is the slave axis number
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
RatioNumerator	**Description**	Numerator of master/slave ratio
	Data type	DINT
	Range	[-2147483648, 2147483647]
	Unit	n/a
	Default	—

RatioDenominator	**Description**	Denominator of master/slave ratio
	Data type	DINT
	Range	[-2147483648, 2147483647]
	Unit	n/a
	Default	—
Acceleration	**Description**	Trapezoidal: Acceleration rate S-curve: Maximum acceleration
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Deceleration	**Description**	Trapezoidal: Deceleration rate S-curve: Unused
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Jerk	**Description**	Trapezoidal: 0 S-curve: Constant jerk
	Data type	LREAL
	Range	—
	Unit	User unit/sec^3
	Default	—
BufferMode	**Description**	0 = abort 1 = buffer
	Data type	SINT
	Range	[0,1]
	Unit	n/a
	Default	—
Slave	**Description**	AXIS_REF.AXIS_NUM is the slave axis number
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
RatioDenominator	**Description**	Denominator of master/slave ratio
	Data type	DINT
	Range	[-2147483648, 2147483647]

	Unit	n/a
	Default	—

1.2.5.39.5.2 Output

InGear	**Description**	Indicates the slave axis is locked on to the master axis
	Data type	BOOL
Busy	**Description**	High from the moment the Execute input goes high until the time the move is ended
	Data type	BOOL
Active	**Description**	Indicates this move is the Active move
	Data type	BOOL
CommandAborted	**Description**	Indicates the move was aborted
	Data type	BOOL
Error	**Description**	Indicates an invalid input was specified or the move was terminated due to an error
	Data type	BOOL
ErrorID	**Description**	Indicates the error if Error output is set to TRUE
	Data type	INT
Active	**Description**	Indicates this move is the Active move
	Data type	BOOL

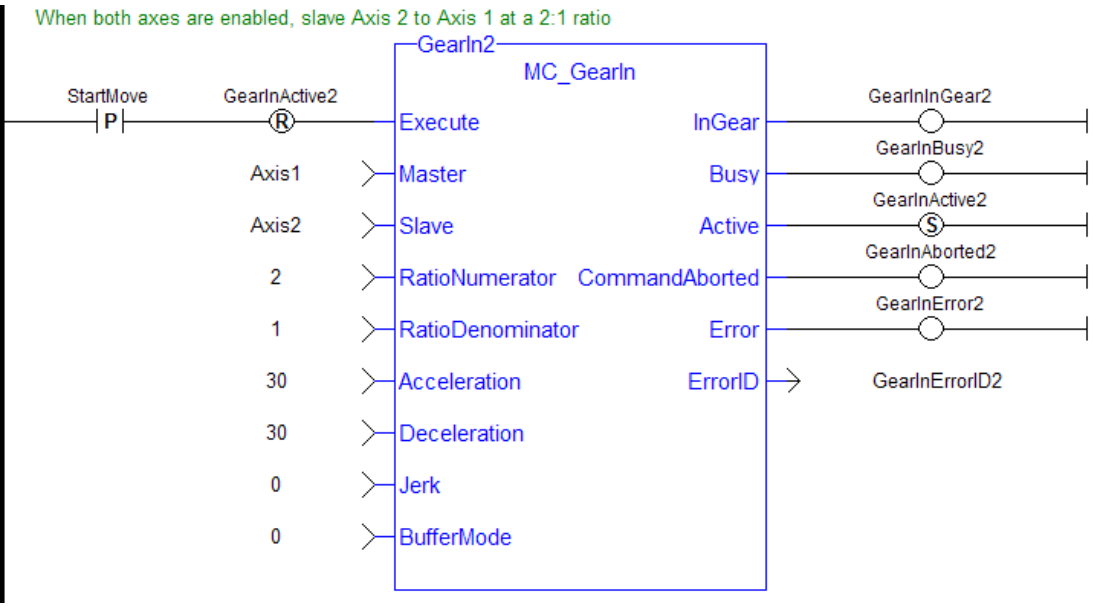
1.2.5.40.6 Example

1.2.5.41.7.1 Structured Text

```
(* MC_GearIn ST example *)
   Inst_MC_GearIn( GearInReq, Axis1, Axis2, 2, 1, 150.0, 150.
0, 0, 0 );
//Inst_MC_GearIn is an instance of MC_GearIn
```

See also how this function is used in the Hole punch project here

1.2.5.42.8.2 Ladder Diagram



1.2.5.43 MC_GearInPos

1.2.5.44.1 Description

This function block performs a slave axis move which follows the master axis based on the ratio specified by RatioNumerator and RatioDenominator.

```
SlaveCommandPosition = MasterActualPosition *
RatioNumerator / RatioDenominator
```

This function block also allows the application to specify sync positions for the master and slave axes. It is the point in which the master and slave axes become engaged in synchronous motion. When the master axis reaches the MasterStartDistance from the MasterSyncPosition, the slave axis begins to accelerate to the target velocity determined by the master axis velocity and the ratio. The slave axis arrives at the target velocity and the SlaveSyncPosition at the same time the master axis arrives at the MasterSyncPosition. At that time, the slave is locked on to the master and follows the master at the ratio specified. The slave axis continues to follow the master axis until this move is aborted.

Time to Reach the Target Velocity

While following the master, gearing functions can generate large accelerations. If the gearing function is aborted while the axis is currently accelerating, and the aborting function block has small non-zero Jerk or small acceleration values, it can take a long time to reach the target velocity, or position of the aborting function block. If the Jerk and/or acceleration of the aborting function cannot be increased to suitable values, it may be desirable to:

- Abort the gearing function with an MC_GearOut with higher accelerations and/or Jerk values (or zero jerk value),
- Execute the next MC motion function block.

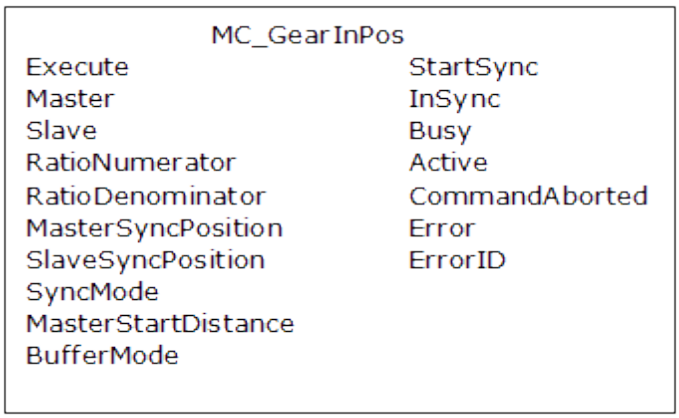
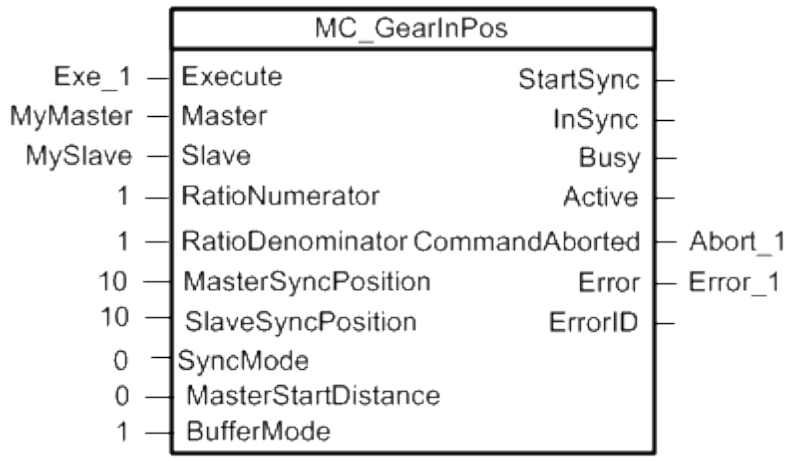
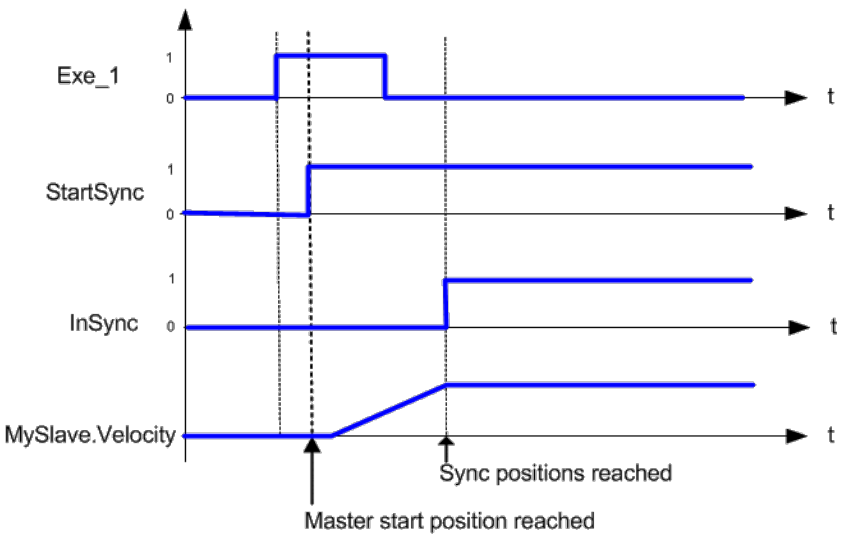


Figure 1-64: MC_GearInPos

1.2.5.45.2 Time Diagram





1.2.5.46.3 Arguments

1.2.5.47.4.1 Input

Execute	Description	Requests to queue the slave gear ratio move
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Master	Description	Name of a declared instance of the AXIS_REF library function
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
Slave	Description	AXIS_REF.AXIS_NUM is the slave axis number
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
RatioNumerator	Description	Numerator of master/slave ratio
	Data type	DINT
	Range	[-2147483648, 2147483647]
	Unit	n/a
	Default	—
RatioDenominator	Description	Denominator of master/slave ratio
	Data type	DINT
	Range	[-2147483648, 2147483647]
	Unit	n/a
	Default	—
MasterSyncPosition	Description	Master axis sync position
	Data type	LREAL
	Range	—
	Unit	n/a
	Default	—
SlaveSyncPosition	Description	Slave axis sync position
	Data type	LREAL
	Range	—
	Unit	n/a
	Default	—
SyncMode	Description	for future enhancements

	Data type	INT
	Range	—
	Unit	n/a
	Default	—
MasterStartDistance	Description	When the master axis reaches this distance before MasterSyncPosition, the slave axis begins its lock-on process
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—
BufferMode	Description	1 = buffer
	Data type	SINT
	Range	[1]
	Unit	n/a
	Default	—

1.2.5.48.5.2 Output

StartSync	Description	Indicates that the master axis has reached the MasterStartDistance from the MasterSyncPosition and the lock-on process has begun
	Data type	BOOL
InSync	Description	Indicated the slave axis is locked on to the master axis
	Data type	BOOL
Busy	Description	High from the moment the Execute input goes high until the time the move is ended
	Data type	BOOL
Active	Description	Indicates this move is the Active move
	Data type	BOOL

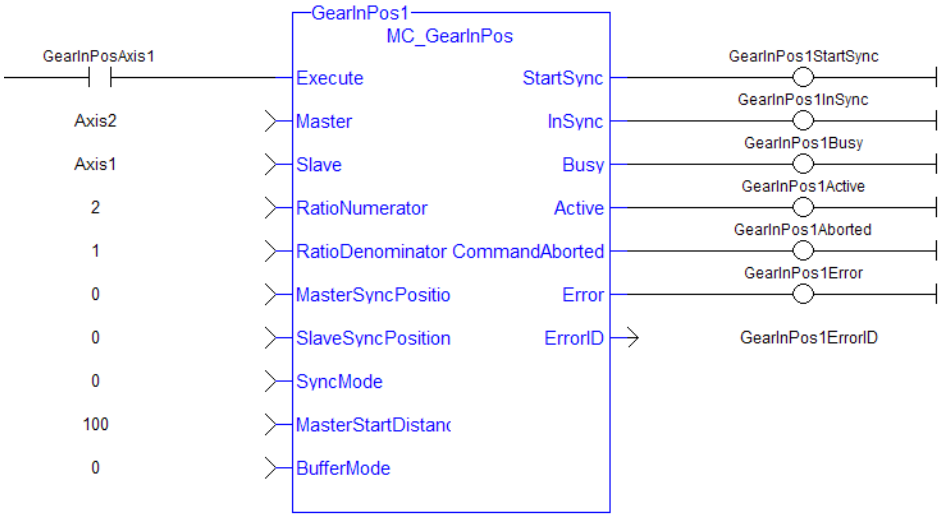
CommandAborted	Description	Indicates the move was aborted
		NOTE If the abort arises because the inputs cause inconsistent motion, then this FB: • performs no motion • sets an error flag • set the ErrorID to 13
	Data type	BOOL
Error	Description	Indicates an invalid input was specified or the move was terminated due to an error
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT

1.2.5.49.6 Example

1.2.5.50.7.1 Structured Text

```
(* MC_GearInPos ST example *)

Inst_MC_GearInPos( GearInPosReq, Axis1, Axis2, 2, 1, 0, 0, 0,
100.0, 0 );

//Inst_MC_GearInPos is instance of MC_GearInPos

GearInPosSync:= Inst_MC_GearInPos.InSync; //store InSync output
into user defined variable
```

1.2.5.51.8.2 Ladder Diagram



1.2.5.52 MC_GearOut

1.2.5.53.1 Description

This function block:

- aborts the active MC_GearIn or MC_GearInPos move,
- disengages the axis from its master,
- and commands the axis to continue at its current velocity.

Like a MC_MoveVelocity move, the control continues to command the axis to move at this velocity until this MC_GearOut move is aborted. The Acceleration, Deceleration and Jerk input parameters are applied if this command velocity is modified by the MC_SetOverride function block. If this function block is called and the active move is not a MC_GearIn or MC_GearInPos move, this function block returns an error and the active move is not aborted.

NOTE The MC_GearOut is done when the slave axis is disengaged from the master axis. Once done, the MC_GearOut will remain busy and active until it is aborted by a different motion function block. This is different behavior than most other motion function blocks. The MC_GearOut function block represents an exception to the exclusivity rule as the **Done** and **Active** outputs may be true at the same time.

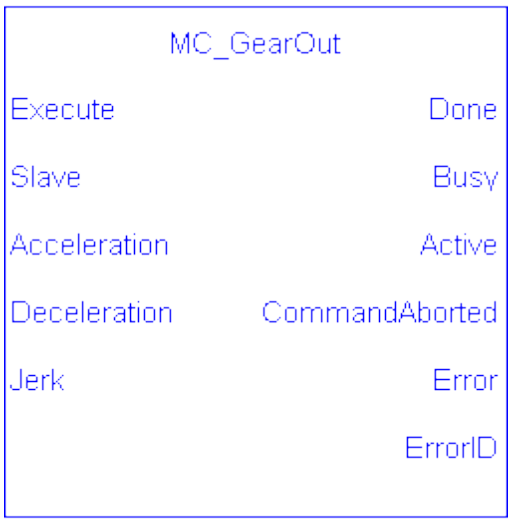


Figure 1-65: MC_GearOut

1.2.5.54.2 Arguments

1.2.5.55.3.1 Input

Execute	Description	Requests to disengage the slave axis from a MC_GearIn or MC_GearInPos move
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Slave	Description	Name of a declared instance of the AXIS_REF library function
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
Acceleration	Description	Trapezoidal: Acceleration rate S-curve: Maximum acceleration
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Deceleration	Description	Trapezoidal: Deceleration rate S-curve: Unused
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—

Jerk	Description	Trapezoidal: 0 S-curve: Constant jerk
	Data type	LREAL
	Range	—
	Unit	User unit/sec^3
	Default	—

1.2.5.56.4.2 Output

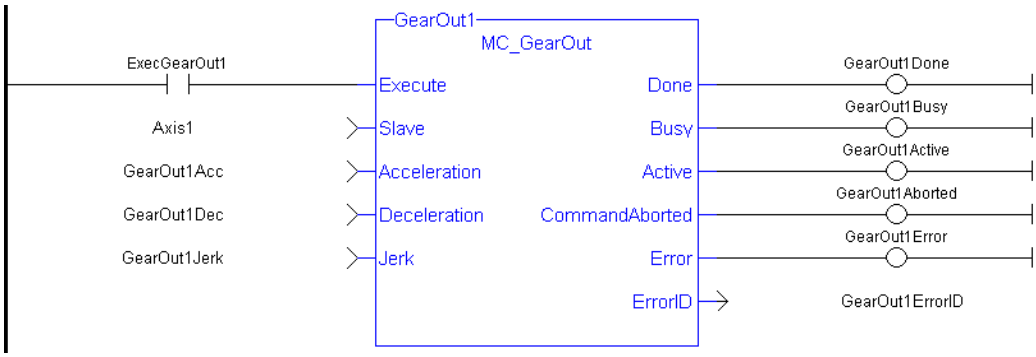
Done	Description	Indicates the axis is disengaged from its master
	Data type	BOOL
Busy	Description	Indicates the function is executing
	Data type	BOOL
Active	Description	Indicates this move is the Active move
	Data type	BOOL
CommandAborted	Description	Indicates the move was aborted
	Data type	BOOL
Error	Description	Indicates an invalid input was specified or no MC_GearIn or MC_GearInPos move is active
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT

1.2.5.57.5 Example

1.2.5.58.6.1 Structured Text

```
(* MC_GearOut ST example *)

Inst_MC_GearOut
(ExecGearOut1,Axis1,GearOut1Acc,GearOut1Dec,GearOut1Jerk);

//Inst_MC_GearOut is instance of MC_GearOut
```

1.2.5.59.7.2 Ladder Diagram



1.2.5.60 MC_Phasing

1.2.5.61.1 Description

This function block performs a master position phase shift for the slave axis. The phase shift is applied like a traditional single-axis move with a velocity setpoint and acceleration and deceleration rates. Phasing has its own Profile Generator and its own queue. Phase shifts can be aborted and blended with additional phase shifts. The amount of phase shift is added to the total master offset as the phase shift is executing.

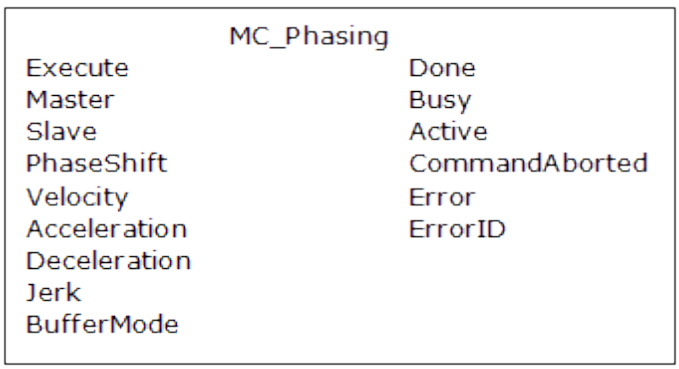


Figure 1-66: MC_Phasing

1.2.5.62.2 Arguments

1.2.5.63.3.1 Input

Execute	Description	Requests to queue the phase shift
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Master	Description	Name of a declared instance of the AXIS_REF library function.)
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—

Slave	Description	AXIS_REF.AXIS_NUM is the slave axis number
	Data type	AXIS_REF
	Range	[1,256]
	Unit	n/a
	Default	—
PhaseShift	Description	Amount of phase shift
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—
Velocity	Description	Velocity setpoint
	Data type	LREAL
	Range	—
	Unit	User unit/sec
	Default	—
Acceleration	Description	Trapezoidal: Acceleration rate S-curve: Maximum acceleration
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Deceleration	Description	Trapezoidal: Deceleration rate S-curve: Unused
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Jerk	Description	Trapezoidal: 0 S-curve: Constant jerk
	Data type	LREAL
	Range	—
	Unit	User unit/sec^3
	Default	—
BufferMode	Description	0 = abort 1 = buffer 2 = blend to active 3 = blend to next 4 = blend to low velocity 5 = blend to high velocity
	Data type	SINT
	Range	[0,5]
	Unit	n/a
	Default	—

1.2.5.64.4.2 Output

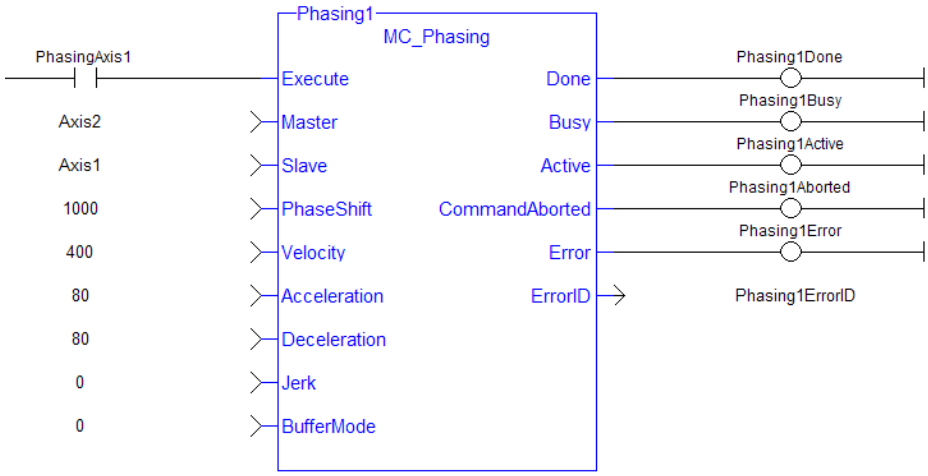
Done	Description	Indicates the phase shift has been completely applied
	Data type	BOOL
Busy	Description	High from the moment the Execute input is one-shot to the time the move is ended
	Data type	BOOL
Active	Description	Indicates this phase shift is the active phase shift
	Data type	BOOL
CommandAborted	Description	Indicates the move was aborted
	Data type	BOOL
Error	Description	Indicates an invalid input was specified or the move was terminated due to an error
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT

1.2.5.65.5 Example

1.2.5.66.6.1 Structured Text

```
(* MC_Phasing ST example *) //Inst_MC_Phasing is an instance of
MC_Phasing function block

Inst_MC_Phasing(PhasingAxis1, Axis2, Axis1, 1000.0,100.0, 200.0,
200.0, 0, 0 );
```

1.2.5.67.7.2 Ladder Diagram



1.2.5.68 MC_SyncSlaves

1.2.5.69.1 Description

This function block allows the application to specify what slave axes are to be synchronized and which master they follow. After this function block is executed successfully, all the slave axes specified at the SlaveList input start their slave moves (i.e. MC_GearIn, MC_CamIn, etc.) on the same servo interrupt for a synchronized slave start. When a slave move is commanded for one of the slave axes listed, the slave move is queued but the motion is held off until all of the listed slaves have queued their slave moves.

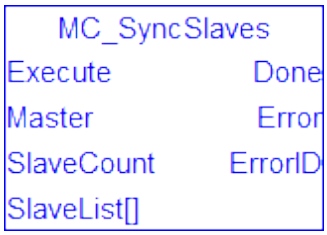


Figure 1-67: MC_SyncSlaves

1.2.5.70.2 Arguments

1.2.5.71.3.1 Input

Execute	Description	A positive transition of this input causes the function block to execute
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—
Master	Description	Master axis identifier
	Data type	AXIS_REF
	Range	1 - 256
	Unit	n/a
	Default	—

SlaveCount	Description	The number of slave axes listed in the SlaveList array input that are to be synchronized. This number must not be greater than the declared size of the SlaveList array. If this number is 0, the list of synchronized slaves for the specified Master axis is cleared.
	Data type	AXIS_REF
	Range	1-256 The AXIS_NUM element of the AXIS_REF structure must be in the range [1-256]
	Unit	n/a
	Default	—
SlaveList	Description	The list of slave axes that are to be synchronized. Each element of this array contains a unique axis number. The axis number must not be the same as the Master axis number.
	Data type	UINT
	Range	1-32
	Unit	n/a
	Default	—

1.2.5.72.4.2 Output

Done	Description	Indicates the synchronized slave assignments were completed without error
	Data type	BOOL
Error	Description	Indicates an invalid input was specified
	Data type	BOOL
ErrorID	Description	Indicates the error if Error output is set to TRUE
	Data type	INT

1.2.5.73.5 Usage

Call MC_SyncSlaves to specify the slave axes to synchronize.

Call each slave move (e.g. MC_GearIn) for each slave axis. The motion is held off until all the slave moves have been queued.

After all the slave moves have been queued, the interpolation for all the slave axes begin on the same servo interrupt, providing a synchronized start.

The master axis can be in motion prior to this sequence, or the master can be commanded after all the slave moves are queued.

1.2.5.74.6 Related Functions

MC_GearIn

MC_GearInPos

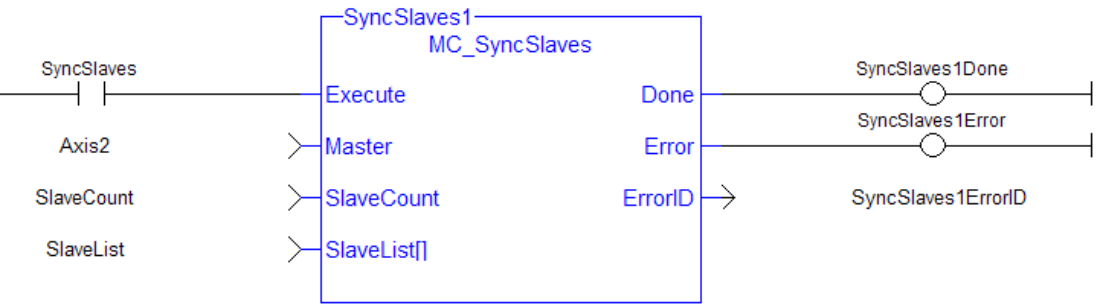
MC_CamIn

1.2.5.75.7 Example

1.2.5.76.8.1 Structured Text

```
(* MC_SyncSlaves ST example *)

// Inst_MC_SyncSlaves is an instance of MC_SyncSlaves function
block

Inst_MC_SyncSlaves( SyncSlaves, Axis1, SlaveCount, SlaveList );
```

1.2.5.77.9.2 Ladder Diagram



1.2.6 Reference

1.2.6.1 MC_Reference (Function Block)

1.2.6.2.1 Description

This function block is used to execute a fast home to a switch. If the application selects to reference to the index mark of an encoder, or the null of a resolver (which is typical), the new position value is assigned to the position of the index of the encoder (or the null of the resolver) and not the position of the switch. The ECATWriteSDO function block is used to setup the trigger event and any desired preconditions. **This function block utilizes the Position Capture Mode of the AKD.**

NOTE At this time, position capture is not available for PLCopen axes assigned to the secondary feedback input (digitizing axes). Therefore, MC_Reference cannot be used to home digitizing axes at this time.

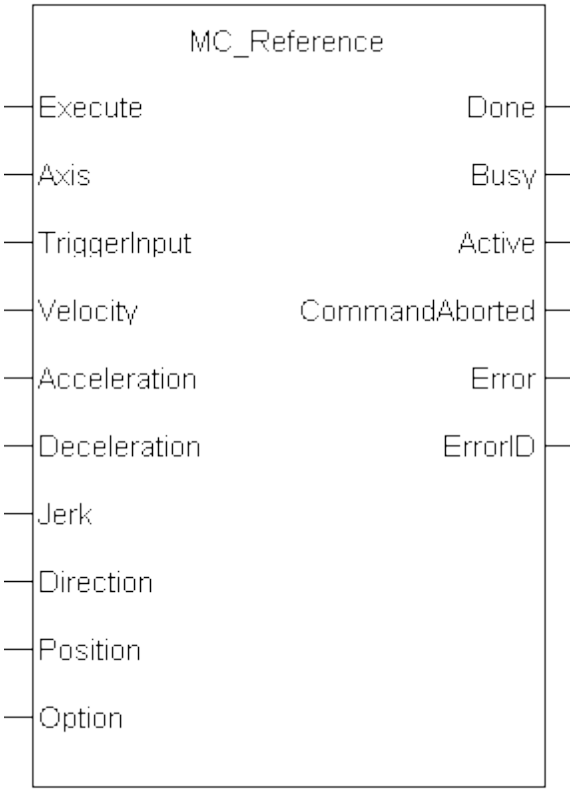


Figure 1-68: MC_Reference

1.2.6.3.2 Arguments

1.2.6.4.3.1 Input

Execute

Description	Requests to queue the MC_Reference move and arms reference trigger events
Data type	BOOL
Range	0, 1
Unit	n/a
Default	—

Axis

Description	Name of a declared instance of the AXIS_REF library function.)
Data type	AXIS_REF
Range	[1,256]
Unit	n/a
Default	—

TriggerInput	Description	TRIGGER_REF structure defines the trigger INT InputID: 0 = Capture Engine 0 1 = Capture Engine 1 Range is [0,1] For information on configuring the capture engines, refer to AKD Capture Engine Configuration. INT Direction; 1 = rising edge of trigger, 2 = falling edge of trigger INT Trigid; must be zero
	Data type	TRIGGER_REF
	Range	See Description above
	Unit	n/a
	Default	—
Velocity	Description	Commanded velocity for the reference move
	Data type	LREAL
	Range	—
	Unit	User unit/sec
	Default	—
Acceleration	Description	Commanded acceleration for the reference move
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Deceleration	Description	Commanded deceleration for the reference move
	Data type	LREAL
	Range	—
	Unit	User unit/sec^2
	Default	—
Jerk	Description	Commanded jerk for the reference move (if zero, then trapezoidal acc/dec is used)
	Data type	LREAL
	Range	—
	Unit	User unit/sec^3
	Default	—
Direction	Description	Commanded Direction of the reference
	Data type	SINT

	Range	[0,1]
	Unit	n/a
	Default	—
Position	Description	Position of the axis at the reference location
	Data type	LREAL
	Range	—
	Unit	User unit
	Default	—
Option	Description	Option identifier for Resolvers/Modulo reference. 0 = Use latched position for reference 1 = use resolver position of nearest null for reference 2 pole resolver 2 = use resolver position of nearest null for reference 4 pole resolver 3 = use resolver position of nearest null for reference 6 pole resolver 4 = use resolver position of nearest null for reference 8 pole resolver 5 = use resolver position of nearest null for reference 10 pole resolver … 15 = use resolver position of nearest null for reference 30 pole resolver
	Data type	SINT
	Range	[0,15]
	Unit	n/a
	Default	—

1.2.6.5.4.2 Output

Done	Description	Indicates the reference move and position adjustment is complete
	Data type	BOOL
Busy	Description	Indicates this function block is executing
	Data type	BOOL
Active	Description	Indicates this move is the Active move
	Data type	BOOL

CommandAborted	Description	Indicates the move was aborted
	Data type	BOOL
Error	Description	Indicates an invalid input, or the move was terminated due to an error
	Data type	BOOL
ErrorID	Description	Indicates the error if the Error output is high
	Data type	INT

1.2.6.6.5 Usage

The following lists the steps for homing a PLCopen axis, using the MC_Reference function block. Not all of the steps are necessary depending on the configuration and the homing cycle design.

The sequence of events of a PLCopen homing cycle consists of the following steps:

- Ensure Axis is not on Reference switch.
  If a switch is used in the homing cycle for the event or precondition to the event, check to ensure the axis is not already tripping the switches that trigger the event and precondition. If it is, move the axis off the switches.
- Configure AKD capture engine
  Configuration of the AKD capture engine is performed by writing drive CAN objects via SDO. It is accomplished with the ECATWriteSdo function. **The AKD Capture mode must be set to POSITION CAPTURE.**
  The available configurations are discussed in paragraph "**AKD Capture Engine Configuration**" . Example AKD capture engine configurations and reference examples are discussed in paragraph "**PLCopen Homing Methods**".
- Call the MC_REFERENCE function to initiate optional homing motion and to arm the AKD capture engine
  The MC_Reference function block selects the trigger edge (rising or falling edge) and arm the capture. Then, it optionally moves the axis to the reference location as directed by inputs to this function. When the AKD indicates that the capture event has occurred, the coordinate system is shifted so that the reference position input to this function block is set to the reference location. Then, the reference motion is stopped.
- Wait for the completion of the MC_Reference function block
  The application is notified by the completion, abort or error of the homing by the MC_Reference function block.
- Upon completion of the MC_Reference function block, the axis can be moved to the home position with a MC_MoveAbsolute function block.

TIP Once the MC_Reference block is queued, but before it is completed, the cycle can be aborted with a MC_Halt or MC_Stop function block or by queuing a new motion function block with the Abort selected for buffer mode.

1.2.6.7.6 Related Functions

ECATWriteSdo

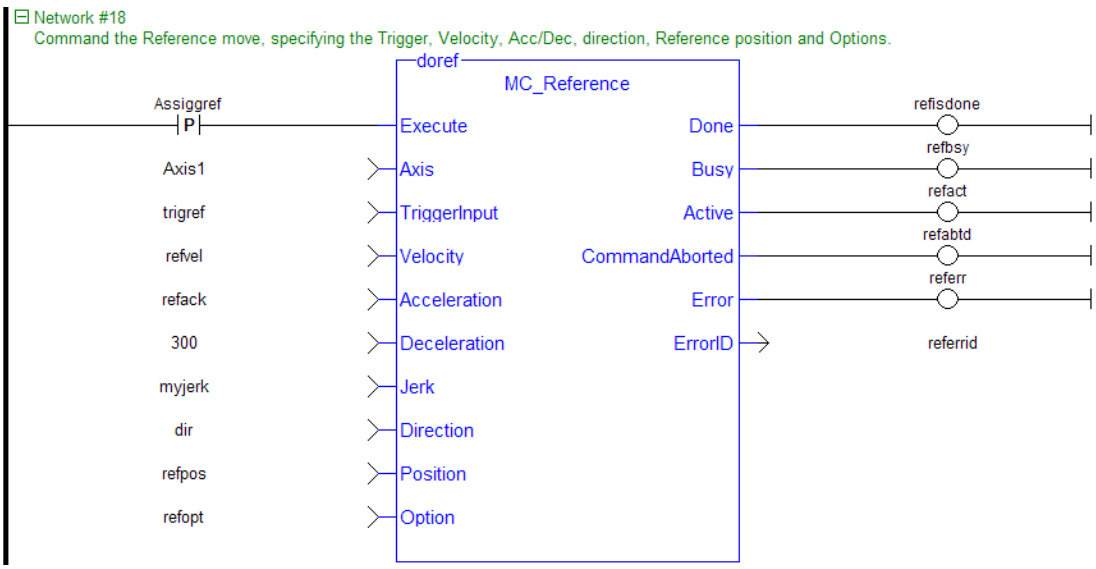
MC_MoveAbsolute

1.2.6.8.7 Example

1.2.6.9.8.1 Structured Text

```
(* MC_Reference ST example *)
TriggerInput.InputID := 0; //configure the reference InputID
TriggerInput.DIRECTION := 1; //configure the reference direction
Inst_MC_Reference( RefReq, Axis1, TriggerInput, 20.0, 100.0,
100.0, 100.0, 0, 0.0, 0 );
```

1.2.6.10.9.2 Ladder Diagram



1.2.6.11 MC_SetPosition (Function)

1.2.6.12.1 Description

This function has been deprecated by the MC_SetPos function block.

2 Fieldbus Library

2.1 EtherCAT Library

Name	Object Type	Description
DriveParamRead	SDO	Reads a drive parameter (ASCII format)
DriveParamWrite	SDO	Writes a drive parameter (ASCII format)
ECATGetObjVal	PDO	Reads cyclic drive parameter (String format) by returning the value of an EtherCAT PDO element
ECATGetStatus	PDO	Reads cyclic status word (Index 6041)
ECATReadData	PDO	Reads cyclic parameter (byte offset format)
ECATReadSdo	SDO	Reads parameter (32 bit format) using SDO command
ECATSetControl	PDO	Manipulates the state of a drive by setting its control word (Index 6040)
ECATWriteData	PDO	Writes cyclic parameter (byte offset format)
ECATWriteSdo	SDO	Writes parameter (32 bit format) using SDO command

Table 2-1: List of EtherCAT FB

The four EtherCAT SDO function blocks are activated by the CANopen over EtherCAT (CoE) protocol in a client/server mode.

- The client (aka EtherCAT master) is the KAS Runtime application
- The servers (aka EtherCAT slaves) are the drives and I/O nodes where data can be retrieved

The SDO function blocks only support the reading and writing of 32-bit values. It is the fundamental size of CANopen SDO calls.

Why use ECATReadSdo and ECATWriteSdo FBs?

The ECATReadSdo and ECATWriteSdo response time is faster and therefore is typically preferred over the DriveParamRead and DriveParamWrite.

Why use the DriveParam FBs?

The two reasons to prefer the DriveParam FBs are:

- They allow direct use of the parameter name
  (e.g. IL.LIMITP instead of the SDO index: 356Eh)
- They can be used to setup a drive terminal in the HMI application
  (which is similar to the Terminal view available in the AKD widget embedded in the KAS IDE)

See some stats about the CPU load

Increase of CPU load when calling SDO function blocks

	Mid-range IPC (Celeron 1.2GHz)	High-range IPC (Core 2 Duo 1.86GHz)
Mean	**60 µs**	**30 µs**
Min	48 µs	24 µs
Max	64 µs	38 µs

(these values have been computed with the TraceTimes command)

2.1.1 EtherCAT Library - Drive

These function blocks are used to work with drive parameters that are not supported by ML and MC function blocks.

They support reading and writing drive parameters using the non-cyclic SDO channel in the EtherCAT network. The ASCII name for the parameter is used as an input.

2.1.1.1.1 Execution Time

These function blocks typically take a longer time to execute (up to ten cycles to finish executing).
It takes the same amount of time to Read or Write a parameter.

> **NOTE** It takes more than one cycle to execute these function blocks (but less than 100 ms).

2.1.1.2.2.1 Reason

It is not only linked to the SDO ASCII communication. Because these FBs are waiting for the AKD drive to responds, the execution time can also increase due to the load of the AKD firmware at the time you call them.

2.1.1.3.3.2 Result

The PLC code is overrunning the cycle duration. as explained in paragraph "**Tasking Model / Scheduling**".
As a consequence, you can see the following message in the Controller Log window:

"The Virtual Machine missed 1 cycle(s) of PLC execution"

2.1.1.4.4.3 Solution

When this happens we recommend to:

- Use these function blocks sparingly in programs
- Rely on the EtherCAT read/write SDO function blocks whenever possible
- Smooth the load of the PLC code by executing these function blocks at the required update rate.

See some stats about the FB execution time

- **Max** time to consider when executing a single Drive Parameter command (i.e. before the Done output becomes True): **60 ms**

	4 kHz	1 kHz
Mean	**20 ms**	**11 ms**
Min	15 ms	9 ms
Max	45 ms	58 ms

- When sending multiple commands to a single drive, only one command can be sent at a time. Therefore the time to execute multiple commands is:
  Number of commands x *Execution time of a single command*

2.1.1.5 DriveParamRead (Function Block)

2.1.1.6.1 Description

This function block reads a drive parameter by sending an ASCII command to a drive.

See also some **stats** about the execution time here.

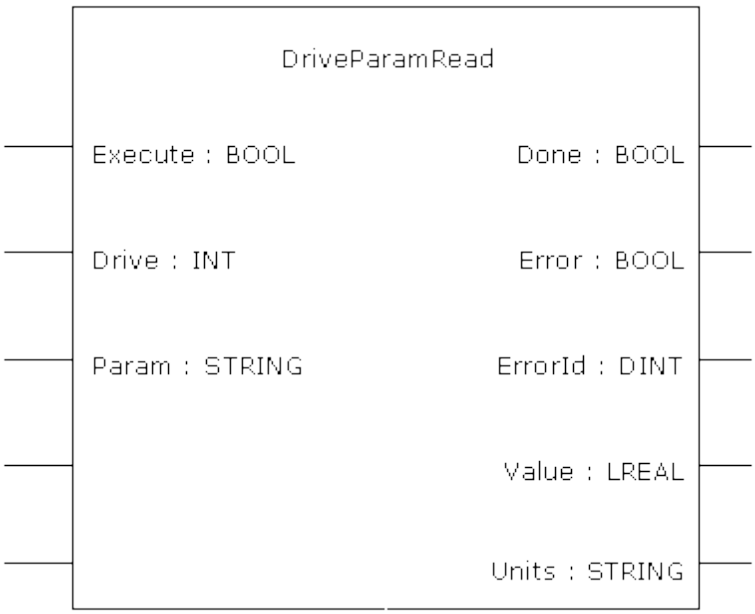


Figure 2-1: DriveParamRead

NOTE

This function block uses *and reserves* the EtherCAT SDO Channel. The SDO Channel will remain reserved until the done output is "true". Therefore, this FB should be called at each cycle until the done output is true. If it is not called at each cycle the rest of SDO communication (the AKD GUI Views, for example) will be blocked.

Using this FB in SFC P0 or P1 steps is not recommended as these steps are executed only once. If this FB is used in P0 or P1 then it must be used in an SFC N step to ensure the FB completes.

2.1.1.7.2 Arguments

2.1.1.8.3.1 Input

Execute

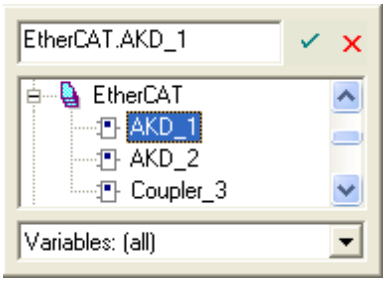
Description	On the rising edge of Execute, a drive parameter is read.

> **NOTE** The function block only handles one request at a time. If Execute is toggled quickly so that another rising edge occurs before the function block has completed, the function block does not issue a second read command.

Data type	BOOL
Range	0, 1
Unit	n/a
Default	—

Drive

Description	The address of the drive from which data is read. The first node usually has the value '1001'. The second node usually has the value '1002'. Alternately, you can use the members of the EtherCAT structure to specify a drive's address when you create the variable.



Data type	INT
Range	—
Unit	n/a
Default	—

Param	Description	The parameter to read.
	Data type	STRING
	Range	—
	Unit	n/a
	Default	—

2.1.1.9.4.2 Output

Done	Description	Indicates whether the DriveParamRead function block has completed without error.
	Data type	BOOL
	Unit	n/a
Error	Description	Indicates whether the DriveParamRead function block call has completed with error:
	Data type	BOOL
	Unit	n/a
ErrorID	Description	The DriveParamRead error result if Error is TRUE (see list of Error Codes in table below). Upon success, Error is set to zero.
	Data type	DINT
	Unit	n/a

Error Code	Value, dec (hex)	Description
ECERR_OK	0	The SDO call succeeded
ECERR_DEVICE_ INVALIDINDEX	1795 (0x703)	An invalid value for the Index input was specified
ECERR_DEVICE_ INVALIDACCESS	1796 (0x704)	Reading of the variable is not permitted
ECERR_DEVICE_ INVALIDDATA	1798 (0x706)	Invalid parameter value (s) in SDO index and/or sub-index
ECERR_DEVICE_NOTREADY	1799 (0x707)	device is not in a ready state, network is not in operational
ECERR_DEVICE_NOTFOUND	1804 (0x70C)	EtherCAT device not found
ECERR_DEVICE_SYNTAX	1805 (0x70D)	An unexpected error occurred
ECERR_DEVICE_ INVALIDSTATE	1810 (0x712)	The EtherCAT device is in an invalid state
ECERR_DEVICE_TIMEOUT	1817 (0x719)	The EtherCAT device failed to respond, timing out

Error Code	Value, dec (hex)	Description
ECERR_DEVICE_ INSERTMAILBOX	1826 (0x722)	Error while inserting the mailbox command into internal FIFO
ECERR_DEVICE_ UNKNOWNMAILBOXCMD	1828 (0x724)	The master sent an unknown mailbox command to the slave
ECERR_DEVICE_ INVALIDADDR	1832 (0x728)	Can't send a mailbox command to the specified slave
ECERR_DEVICE_ INVALIDOFFSET	1827 (0x723)	An invalid value for the SubIndex input was specified
ECERR_DEVICE_PARAM_ ACCESS_ERROR	1920 (0x780)	Unknown error occurred while accessing parameter
ECERR_DEVICE_PARAM_ NOT_FOUND	1921 (0x781)	Parameter was not found
ECERR_DEVICE_PARAM_ NOT_INTEGER	1922 (0x782)	Parameter is a floating-point value. Integer value required.
ECERR_DEVICE_VALUE_IS_ NEGATIVE	1923 (0x783)	No negative values allowed. Value specified was negative.
ECERR_DEVICE_VALUE_OUT_ OF_RANGE	1924 (0x784)	Value is out of data-range
ECERR_DEVICE_VALUE_ GREATER_THAN_MAX	1925 (0x785)	Value bigger than maximum
ECERR_DEVICE_VALUE_ LOWER_THAN_MIN	1926 (0x786)	Value lower than minimum
ECERR_CLIENT_ERROR	2048 (0x800)	Error in Mailbox response to a previously sent mailbox command
ECERR_CLIENT_TIMEOUT	2049 (0x801)	The SDO command timed out
ECERR_CLIENT_ INVALIDPARM	2050 (0x802)	An invalid value was specified
ECERR_CLIENT_ INVALIDSIZE	2051 (0x803)	An invalid value for the size input was specified

Table 2-2: List of EtherCAT Error Codes

Value

Description	The value of the drive parameter. Value is only set when the function block has successfully completed.
Data type	LREAL
Unit	n/a

Units	Description	The units of the drive parameter. Value is only set when the function block has successfully completed.
	Data type	STRING
	Unit	n/a

2.1.1.10.5 Usage

Use this FB to read drive parameters that are not supported by other function blocks. Examples would be motor temperature, drive bus voltage, Present drive limit settings, present regen loading, drive display, and fault history.

2.1.1.11.6 Related Functions

DriveParamWrite

2.1.1.12.7 Example

2.1.1.13.8.1 Structured Text

```
(* Read PL.KP on first AKD Drive on EtherCAT network *)
(* The code continually calls the FB (without re-executing it) until
the first execution is done, then reads the returned value from the
drive and reset the FB *)

IF ReadPropGain then
   Inst_DriveParamRead1( 1, 1001, 'PL.KP' );
End_If;

On Inst_DriveParamRead1.Done do
   Inst_DriveParamRead1( 0, 1001, 'PL.KP' );
   PositionProportionalGain := Inst_DriveParamRead1.Value; (* Reads
the returned value from the drive *)
   ReadPropGain := 0; (* Reset the FB *)
End_DO;
```

See example with animation

```
IF FALSE  ReadPropGain FALSE  then
   Inst_DriveParamRead1( 1, 1001, 'PL.KP' );
End_If;


On Inst_DriveParamRead1.Done  TRUE  do
   Inst_DriveParamRead1( 0, 1001, 'PL.KP' );
    PositionProportionalGain 94.999000  := Inst_DriveParamRead1.Value 94.999000 ;
   ReadPropGain FALSE  := 0;
End_DO;
```

2.1.1.14 DriveParamWrite (Function Block)

2.1.1.15.1 Description

This function block writes a drive parameter by sending an ASCII command to a drive.

See also some **stats** about the execution time here.

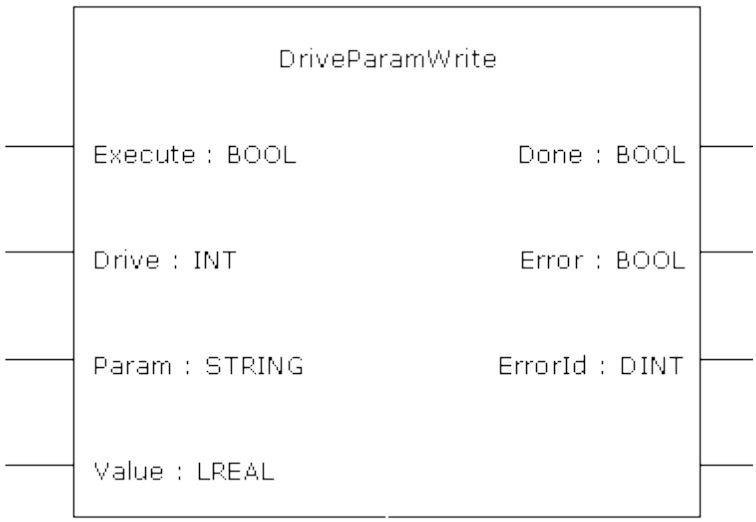


Figure 2-2: DriveParamWrite

NOTE This function block uses *and reserves* the EtherCAT SDO Channel. The SDO Channel will remain reserved until the done output is "true". Therefore, this FB should be called at each cycle until the done output is true. If it is not called at each cycle the rest of SDO communication (the AKD GUI Views, for example) will be blocked.

Using this FB in SFC P0 or P1 steps is not recommended as these steps are executed only once. If this FB is used in P0 or P1 then it must be used in an SFC N step to ensure the FB completes.

2.1.1.16.2 Arguments

2.1.1.17.3.1 Input

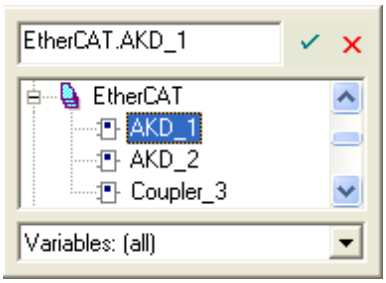
Execute

Description	On the rising edge of Execute, a drive parameter is set.

NOTE The function block only handles one request at a time. If Execute is toggled quickly so that another rising edge occurs before the function block has completed, the function block does not issue a second write command.

Data type	BOOL
Range	0, 1

	Unit	n/a
	Default	—
Drive	Description	The address of the drive to which data is written to. The first node usually has the value '1001'. The second node usually has the value '1002'. Alternately, you can use the members of the EtherCAT structure to specify a drive's address when you create the variable.



	Data type	INT
	Range	—
	Unit	n/a
	Default	—
Param	Description	The parameter to write.
	Data type	STRING
	Range	—
	Unit	n/a
	Default	—
Value	Description	The value to set the drive parameter to.
	Data type	LREAL
	Range	—
	Unit	n/a
	Default	—

2.1.1.18.4.2 Output

Done	Description	Indicates whether the DriveParamWrite function block has completed without error.
	Data type	BOOL
	Unit	n/a
Error	Description	Indicates whether the DriveParamWrite function block call has completed with error.
	Data type	BOOL
	Unit	n/a

ErrorID	Description	The DriveParamWrite error result if Error is TRUE (see "Table 2-2: List of EtherCAT Error Codes " on page 274) Upon success, Error is set to zero.
	Data type	DINT
	Unit	n/a

2.1.1.19.5 Usage

The function block can be used to change drive parameters. Common examples include tuning parameters and changing drive limits such as peak current.

2.1.1.20.6 Related Functions

DriveParamRead

2.1.1.21.7 Example

2.1.1.22.8.1 Structured Text

```
(* Write 58.000 to PL.KP of first AKD Drive on EtherCAT
network *)

Inst_DriveParamWrite( TRUE, 1001, 'PL.KP', 58 );
```

2.1.2 EtherCAT Library - SDO

These function blocks are used to work with drive or remote I/O parameters that are not supported by ML and MC function blocks.

Drive or remote I/O parameters that have an associated SDO number can be read and written using these function blocks.

NOTE It takes more than one cycle to execute these function blocks (but less than 100 ms).

See some stats about the FB execution time

- There is a small difference in timing when running EtherCAT at 2ms compared to other frequencies.

	0.25, 0.5, 1ms	2ms
Mean	9ms	14ms
Min	3ms	8ms
Max	16ms	24ms

- **Max** time to consider when executing a single SDO command, (i.e. before the Done output becomes true): **24ms**.
- When sending multiple commands to a single drive, only one command can be sent at a time. Therefore the time to execute multiple commands is:
  Number of commands x *Execution time of a single command*

- When commands are sent to different AKD drives at the same time, the requests do not interfere with each other. So you can be confident the function finishes execution in the same max time as to one drive

2.1.2.1 ECATReadSdo (Function Block)

2.1.2.2.1 Description

This function block reads a 32-bit word from I/O nodes using a CANopen SDO read command. Is is typically used to query the status of inputs.

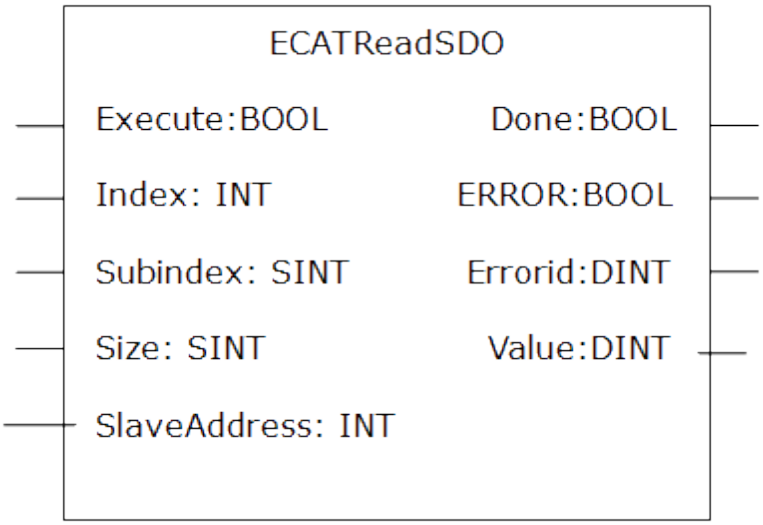


Figure 2-3: ECATReadSdo

2.1.2.3.2.1 State Diagram

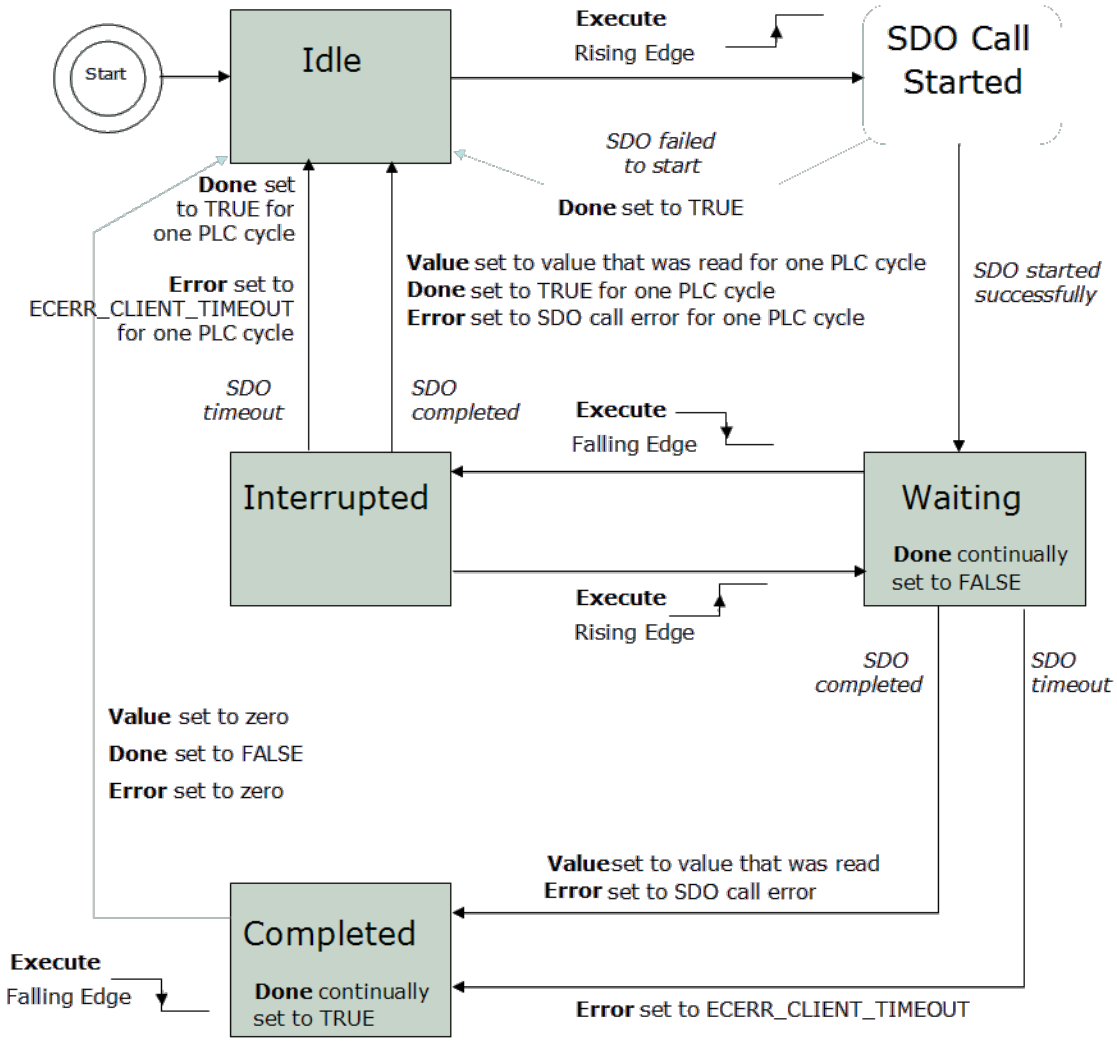


Figure 2-4: ECATReadSdo State Diagram

NOTE

This function block uses *and reserves* the EtherCAT SDO Channel. The SDO Channel will remain reserved until the done output is "true". Therefore, this FB should be called at each cycle until the done output is true. If it is not called at each cycle the rest of SDO communication (the AKD GUI Views, for example) will be blocked.

Using this FB in SFC P0 or P1 steps is not recommended as these steps are executed only once. If this FB is used in P0 or P1 then it must be used in an SFC N step to ensure the FB completes.

2.1.2.4.3 Arguments

2.1.2.5.4.1 Input

Execute

Description	On the rising edge of Execute, an SDO read command is issued.

> **NOTE** The function block only handles one SDO command at a time. If Execute is toggled quickly so that another rising edge occurs before the SDO command has completed, the function block does not issue a second SDO command.

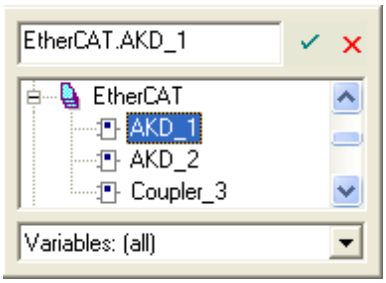
Data type	BOOL
Range	0, 1
Unit	n/a
Default	—

Index

Description	The object directory index of the data to be read. For more details, refer to: • Communication SDOs • Manufacturer specific SDOs • Profile specific SDOs
Data type	INT
Range	—
Unit	n/a
Default	—

Subindex

Description	The sub-index of the object directory variable to be read. For more details, refer to: • Communication SDOs • Manufacturer specific SDOs • Profile specific SDOs
Data type	SINT
Range	—
Unit	n/a
Default	—

Size	Description	The size (number of bytes) to write.
	Data type	SINT
	Range	1 - 4
	Unit	n/a
	Default	—
SlaveAddress	Description	The EtherCAT address of the slave from which data is written to. The first node usually has the value '1001'. The second node usually has the value '1002'. Alternately, you can use the members of the EtherCAT structure to specify a drive's address when you create the variable.
		
	Data type	INT
	Range	—
	Unit	n/a
	Default	—

2.1.2.6.5.2 Output

Done	Description	Indicates whether the SDO call has completed without error.
	Data type	BOOL
	Unit	n/a
Error	Description	Indicates whether the SDO call has completed with error:
	Data type	BOOL
	Unit	n/a
ErrorID	Description	The SDO call error result, if Error is TRUE (see). Upon success, Error is set to zero.
	Data type	DINT
	Unit	n/a

Value	Description	The value of the object directory variable being read. Value is only set when an SDO read command has successfully completed.
	Data type	DINT
	Unit	n/a

2.1.2.7.6 Related Functions

ECATWriteSDO

2.1.2.8.7 Example

2.1.2.9.8.1 Structured Text

```
(* Read PL.KP on first AKD Drive on EtherCAT network *)
Inst_ECATReadSdo( TRUE, 16#3542, 0, 4, 1001 );
PositionProportionalGain := Inst_ECATReadSdo.Value;
```

2.1.2.10 ECATWriteSdo (Function Block)

2.1.2.11.1 Description

This function block writes a 32-bit word to I/O nodes using a CANopen SDO write command.

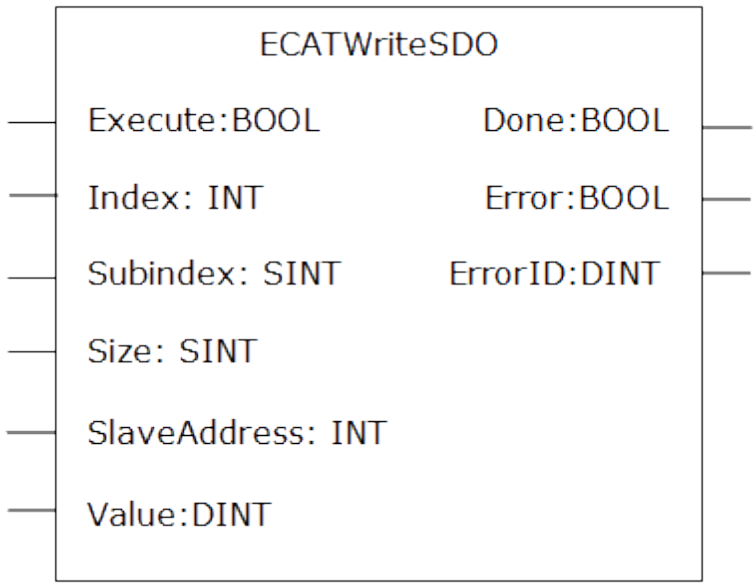


Figure 2-5: ECATWriteSdo

2.1.2.12.2.1 State Diagram

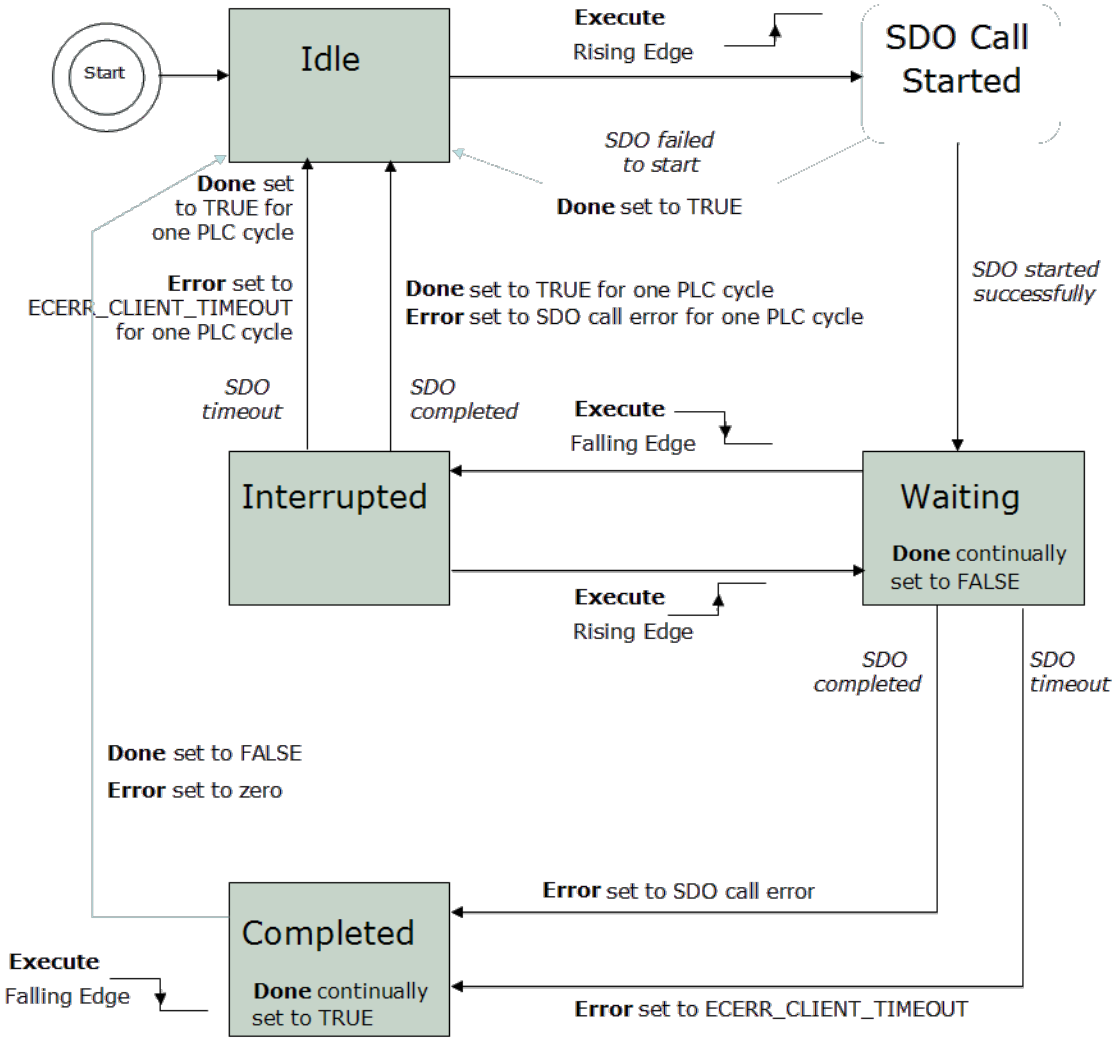


Figure 2-6: ECATWriteSdo State Diagram

NOTE

This function block uses *and reserves* the EtherCAT SDO Channel. The SDO Channel will remain reserved until the done output is "true". Therefore, this FB should be called at each cycle until the done output is true. If it is not called at each cycle the rest of SDO communication (the AKD GUI Views, for example) will be blocked.

Using this FB in SFC P0 or P1 steps is not recommended as these steps are executed only once. If this FB is used in P0 or P1 then it must be used in an SFC N step to ensure the FB completes.

2.1.2.13.3 Arguments

2.1.2.14.4.1 Input

Execute

Description	On the rising edge of Execute, an SDO write command will be issued.

> **NOTE** The function block will only handle one SDO command at a time. If Execute is toggled quickly so that another rising edge occurs before the SDO command has completed, the function block will not issue a second SDO command.

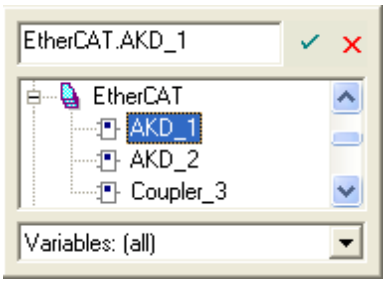
Data type	BOOL
Range	0, 1
Unit	n/a
Default	—

Index

Description	The object directory index of the data to be written to. For more details, refer to: • Communication SDOs • Manufacturer specific SDOs • Profile specific SDOs
Data type	INT
Range	—
Unit	n/a
Default	—

Subindex

Description	The sub-index of the object directory variable to be written to. For more details, refer to: • Communication SDOs • Manufacturer specific SDOs • Profile specific SDOs
Data type	SINT
Range	—
Unit	n/a
Default	—

Size	Description	The size (number of bytes) to write.
	Data type	SINT
	Range	1 - 4
	Unit	n/a
	Default	—
SlaveAddress	Description	The EtherCAT address of the slave from which data will be written to. The first node usually has the value '1001'. The second node usually has the value '1002'. Alternately, you can use the members of the EtherCAT structure to specify a drive's address when you create the variable.
		
	Data type	INT
	Range	—
	Unit	n/a
	Default	—
Value	Description	The value to write to the object directory variable.
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—

2.1.2.15.5.2 Output

Done	Description	Indicates whether the SDO call has completed without error.
	Data type	BOOL
	Unit	n/a
Error	Description	Indicates whether the SDO call has completed with error:
	Data type	BOOL
	Unit	n/a
ErrorID	Description	The SDO call error result, if Error is TRUE (see). Upon success, Error is set to zero.

Data type	DINT
Unit	n/a

2.1.2.16.6 Related Functions

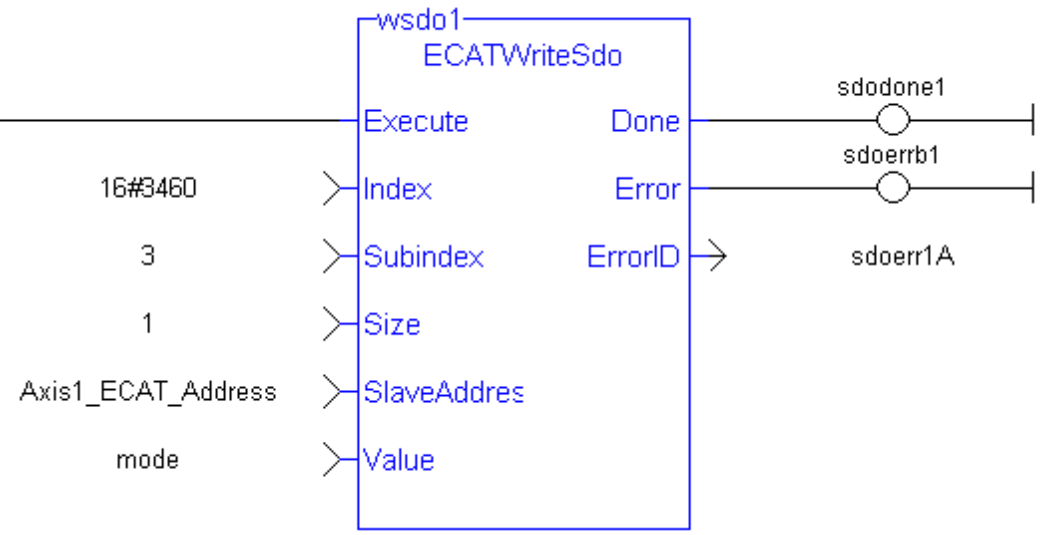
ECATReadSDO

2.1.2.17.7 Example

2.1.2.18.8.1 Structured Text

```
(* Write 58.000 to PL.KP of first AKD Drive on EtherCAT
network *)

Inst_ECATWriteSdo( TRUE, 16#3542, 0, 4, 1001, 58000 );
```

2.1.2.19.9.2 Ladder Diagram



2.1.3 EtherCAT Library - Debug

The following function blocks support advanced functionality typically used for diagnostic support.

Most information available in these function blocks is also available in a ML and MC function block.

2.1.3.1 ECATReadData (Function)

IMPORTANT This is a low level function and it should only be used carefully by **advanced users**.

2.1.3.2.1 Description

This function allows a direct access to the memory image of the EtherCAT frame which is sent or received when you need to debug your application. You access the EtherCAT image element by giving the offset in the image and the size of the element.

If you have a device other than the drive, ECATReadData is used for more than just debug. It is used to get the status of the module (e.g. Stepper I/O slice).

2.1.3.3.2 Arguments

2.1.3.4.3.1 Input

Offset	Description	Offset from the beginning of the frame
	Data type	UINT
	Range	0-*size of frame* (maximum size of an Ethernet frame is 1500)
	Unit	n/a
	Default	—
Nbytes	Description	Number of bytes to read
	Data type	SINT
	Range	1, 2 or 4
	Unit	bytes
	Default	—
Direction	Description	Direction of the frame (true = output image, false = input image).
	Data type	BOOL
	Range	0, 1
	Unit	n/a
	Default	—

2.1.3.5.4.2 Output

Value	Description	Value of the EtherCAT frame
	Data type	DINT
	Unit	n/a

2.1.3.6.5 Related Functions

ECATGetObjVal

2.1.3.7.6 Example

2.1.3.8.7.1 Structured Text

```
// Read 4 bytes starting at offset 26 of the output image

Position := ECATReadData(26, 4, true);
```

2.1.3.9 ECATWriteData (Function)

IMPORTANT This is a low level function and it should only be used carefully by **advanced users**.

2.1.3.10.1 Description

Modify the EtherCAT process image by directly writing values in it.

If you have a device other than the drive, ECATWriteData is used for more than just debug. It is used to set the status of the module (e.g. Stepper I/O slice) in the case your project is based on an external XML file because it contains unsupported EtherCAT Device.

2.1.3.11.2 Arguments

2.1.3.12.3.1 Input

Offset	Description	Byte offset from the beginning of the process image where data is to be written
	Data type	UINT
	Range	0 - 1500
	Unit	n/a
	Default	—
Nbytes	Description	Number of bytes to write
	Data type	SINT
	Range	1, 2 or 4
	Unit	bytes
	Default	—
Value	Description	Value to be written in the image. Only the number of bytes specified by Nbytes is copied.
	Data type	DINT
	Range	[-2147483648, 2147483648]
	Unit	n/a
	Default	—

2.1.3.13.4.2 Output

Default (.Q)	Description	True if data was written
	Data type	BOOL
	Unit	n/a

2.1.3.14.5 Related Functions

ECATReadData

2.1.3.15 ECATGetObjVal (Function)

NOTE This function block is deprecated as of KAS v2.7. The recommended best practice is to map a PLC variable to a PDO object.

2.1.4 EtherCAT Library - Status

The following function blocks support advanced functionality typically used for diagnostic support.

Most information available in these function blocks is also available in ML and MC function blocks.

2.1.4.1 ECATGetStatus (Function)

2.1.4.2.1 Description

Return the status word of the designated drive (SDO 0x6041).

The status machine for the status word corresponds to the CANopen status machine.

The Function Block receives the status word through the cyclic EtherCAT PDO communications. The status word is captured in every instance of fixed PDO mapping.

2.1.4.3.2 Arguments

2.1.4.4.3.1 Input

Address	Description	EtherCAT address of the drive
	Data type	DINT
	Range	[0, 65535]
	Unit	n/a
	Default	—

2.1.4.5.4.2 Output

Status	Description	Status word of the drive as defined in the EtherCAT profile for the S300/S400/S600/S700. Compatible with CiA 402 definition of status word (CANopen object 0x6041).
	Data type	UINT
	Unit	n/a

2.1.4.6.5 Related Functions

ECATSetControl

2.1.4.7.6 Example

2.1.4.8.7.1 Structured Text

```
(*******************************************************)
(* read EtherCAT axis status (Bit3: Fault, Bit7: Warning) *)
(*******************************************************)
ECATStatus := ECATGetStatus(AxisAddress); //Read the ECAT Status
Word (SDO 6041) of the Axis


IF AxisAddress > 1000 THEN
(*******************************************************)
(* timer to read cyclically SDOs *)
(*******************************************************)
```

2.1.4.9 ECATSetControl (Function)

2.1.4.10.1 Description

Manipulate the state of a drive by setting its control word (SDO 06040).

The status machine for the control word corresponds to the CANopen status machine.

The Function Block transmits the control word through the cyclic EtherCAT PDO communications. The control word is captured in every instance of fixed PDO mapping.

2.1.4.11.2 Arguments

2.1.4.12.3.1 Input

Address	Description	EtherCAT address of the drive
	Data type	DINT
	Range	[0, 65535]
	Unit	n/a
	Default	—
Control	Description	Control word of the drive as defined in the EtherCAT profile for the S300/S400/S600/S700. Compatible with CiA 402 definition of control word (CANopen object 0x6040).
	Data type	UINT
	Range	—
	Unit	n/a
	Default	—

2.1.4.13.4.2 Output

Default (.Q)	Description	Returns true when function successfully executes (i.e. if the control word was successfully set)
	Data type	BOOL
	Unit	n/a

2.1.4.14.5 Related Functions

ECATGetStatus

This page intentionally left blank.

3 System Library

Name	Description
PrintMessage	Generate an output message in the log windows.
GetCtrlErrors	Get a list of the active errors and alarms on the controller.
ClearCtrlErrors	Clears the list of active errors and alarms on the controller.

Table 3-1: List of System Functions

3.1 PrintMessage (Function)

3.1.1 Description

The PrintMessage block is used to generate a log message with any wanted strings in the log message window.

3.1.1.1 About the Source

PrintMessage use the PLC message type. So, to display all messages generated by PrintMessage, go to the log configuration and select the DEBUG level for the PLC source.

3.1.1.2 About the Level

The message could be sent with a logging level from 0 to 4 that qualifies its importance. The highest level, 4, logs critical messages (available levels are: debug, informational, warning, error and Critical).

Keep in mind that only Error and Critical messages a generated by default. If you want to force the system to generate every message level, go into the log configuration and change the settings to the desired level.

IMPORTANT

Enabling all messages can slow down the application's execution. To avoid locking up communications between the IDE and Runtime, you must never include a print statement in your program that prints to the log every update cycle.

See at the configuration settings for more details.

3.1.2 Arguments

3.1.2.1 Input

Level	Description	Level of the logged message. In other words, the importance of it. Keep in mind that not all messages are displayed in the log windows by default. Only Error and Critical messages a displayed. So, in order to show lower level, it is needed to change the log settings. PrintMessage logs PLC messages.
	Data type	DINT
	Range	[0 , 4] Defines are: LEVEL_DEBUG, LEVEL_INFO, LEVEL_WARNING, LEVEL_ERROR, LEVEL_CRITICAL
	Unit	n/a
	Default	—
Message	Description	Content of the message. A string of 255 characters maximum.
	Data type	String

Range	1 to 255 characters
Unit	n/a
Default	—

3.1.2.2 Output

Default (.Q)	Description	Returns true when function successfully executes
	Data type	BOOL
	Unit	n/a

3.1.3 Usage

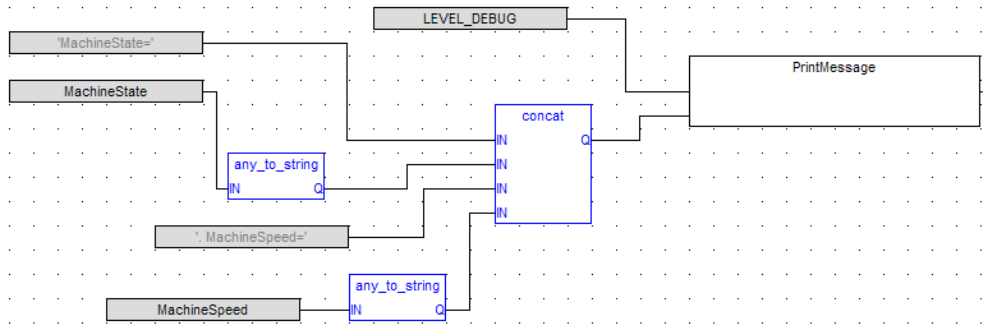
```
PrintMessage( LEVEL_DEBUG, 'Message string to be logged' );
```

3.1.4 Example

3.1.4.1 Structured Text

```
// It's possible to create a temporary variable with the
message.
MESSAGE := CONCAT( 'MachineState=', ANY_TO_STRING(MachineState),
'. MachineSpeed=', ANY_TO_STRING(MachineSpeed) );


// Then print the message to the log window
PrintMessage( LEVEL_INFO, MESSAGE );
PrintMessage( LEVEL_WARNING, MESSAGE );
PrintMessage( LEVEL_ERROR, MESSAGE );


// Or to create the string directly in the function call:
PrintMessage( LEVEL_CRITICAL, CONCAT( 'MachineState=', ANY_TO_
STRING(MachineState), '. MachineSpeed=', ANY_TO_STRING
(MachineSpeed) ) );
```

3.1.4.2 Function Block Diagram



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About Kollmorgen

Kollmorgen is a leading provider of motion systems and components for machine builders. Through world-class knowledge in motion, industry-leading quality and deep expertise in linking and integrating standard and custom products, Kollmorgen delivers breakthrough solutions that are unmatched in performance, reliability and ease-of-use, giving machine builders an irrefutable marketplace advantage.

For assistance with your application needs, visit www.kollmorgen.com or contact us at:

North America
KOLLMORGEN
203A West Rock Road
Radford, VA 24141 USA

Internet www.kollmorgen.com
E-Mail support@kollmorgen.com
Tel.: +1 - 540 - 633 - 3545
Fax: +1 - 540 - 639 - 4162

Europe
KOLLMORGEN Europe GmbH
Pempelfurtstraße 1
40880 Ratingen, Germany

Internet www.kollmorgen.com
E-Mail technik@kollmorgen.com
Tel.: +49 - 2102 - 9394 - 0
Fax: +49 - 2102 - 9394 - 3155

Asia
KOLLMORGEN
Rm 2205, Scitech Tower, China
22 Jianguomen Wai Street

Internet www.kollmorgen.com
E-Mail sales.asia@kollmorgen.com
Tel.: +86 - 400 666 1802
Fax: +86 - 10 6515 0263