Win-GRAF EMP2K User Manual

English Ver. 1.0.0, AUG. 2022

WARRANTY

All products manufactured by ICP DAS are warranted against defective materials for a period of one year from the date of delivery to the original purchaser.

WARNING

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SUPPORT

EMP-2848M

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1. Introduction

The EMP2K library is used in the Win-GRAF Workbench user program for the EMP-2848M series hardware. The library can be divided into EtherCAT function blocks and motion control function blocks.

The motion control function blocks are based on the technical specifications of function blocks for PLCopen motion control. PLCopen motion control function block complies with IEC 61131-3 standard.

The PLCopen motion standard provides a way to have standard application libraries that are reusable for multiple hardware platforms. This lowers development, main-tenance, and support costs while eliminating confusion. this standardization is done by defining libraries of reusable components. In this way the programming is less hardware dependent, the reusability of the application software increased, the cost involved in training and support reduced, and the application becomes scalable across different control solutions.

2.PLCopen Function Blocks

2.1. Description

The motion control function blocks are based on the technical specifications of function blocks for PLCopen motion control. For detailed descriptions of the PLCopen function blocks, please refer to the following PLCopen technical specification document.

Part 1 - PLCopen Function Blocks for Motion Control

2.2. General Rules

Please refer to PLCopen technical specification document Part1 "Technical Specification, PLCopen - Technical Committee 2 - Task Force, Function blocks for motion control (Formerly Part 1 and Part 2), Version 2.0" section "2.4. FB interface" description.

2.3. FB State Diagram

Please refer to PLCopen technical specification document Part1 "Technical Specification, PLCopen - Technical Committee 2 - Task Force, Function blocks for motion control (Formerly Part 1 and Part 2), Version 2.0" section "2.1. The State Diagram" description.

2.4. EMP2K Based on PLCopen Motion Control Function Blocks

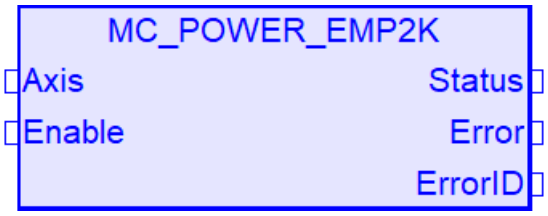
Category		Function blocks
Administrative	Single Axis	MC_Power_EMP2K
		MC_ReadStatus_EMP2K
		MC_ReadAxisError_EMP2K
		MC_ReadParameter_EMP2K
		MC_WriteParameter_EMP2K
		MC_ReadActualPosition_EMP2K
		MC_ReadActualVelocity_EMP2K
		MC_ReadAxisInfo_EMP2K
		MC_ReadMotionState_EMP2K
		MC_SetPosition_EMP2K
		MC_SetOverride_EMP2K
		MC_TouchProbe_EMP2K
		MC_Reset_EMP2K
		MC_AbortTrigger_EMP2K
Motion	Single Axis	MC_Home_EMP2K
		MC_Stop_EMP2K
		MC_Halt_EMP2K

		MC_MoveAbsolute_EMP2K
		MC_MoveRelative_EMP2K
		MC_MoveAdditive_EMP2K
		MC_MoveVelocity_EMP2K
		MC_CSV_MoveVelocity_EMP2K
	Multiple Axis	MC_GearIn_EMP2K
		MC_GearOut_EMP2K

3. Motion Control Function Blocks

3.1. Single-Axis Function Blocks

3.1.1. MC_Power_EMP2K



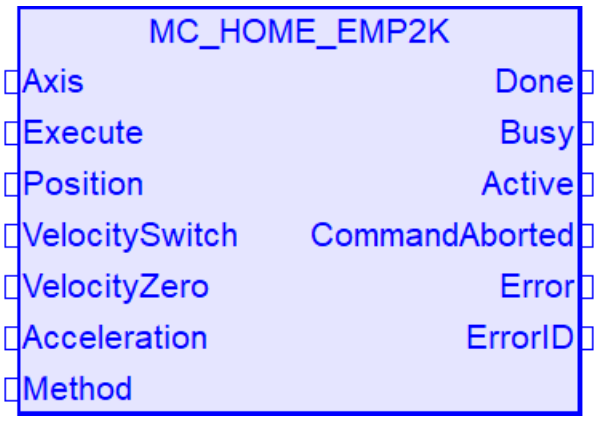
Functional Description

This Function Block controls the power stage (On or Off).

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Enable	BOOL	As long as 'Enable' is true, power is being enabled
Output	Status	BOOL	Effective state of the power stage TRUE: Power On FALSE: Power Off
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.1.2. MC_Home_EMP2K



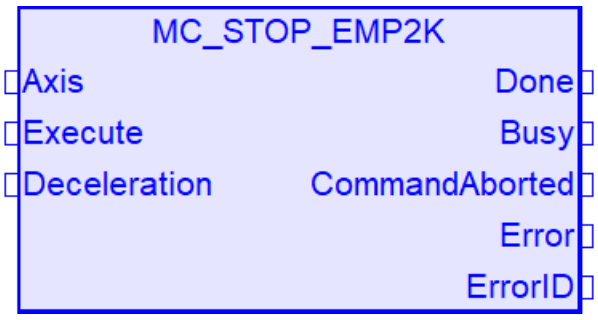
Functional Description

This Function Block commands the axis to perform the 'search home' sequence.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Execute	BOOL	Start the motion at rising edge
	Position	LREAL	Absolute position when the reference signal is detected (u)
	VelocitySwitch	LREAL	Speed during search for switch (u/s)
	VelocityZero	LREAL	Speed during search for zero (u/s)
	Acceleration	LREAL	Homing acceleration (u/s^2)
	Method	USINT	Homing metho
Output	Done	BOOL	Reference known and set sucessfully
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Active	BOOL	Indicates that the FB has control on the axis
	CommandAborted	BOOL	'Command' is aborted by another command
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.1.3. MC_Stop_EMP2K



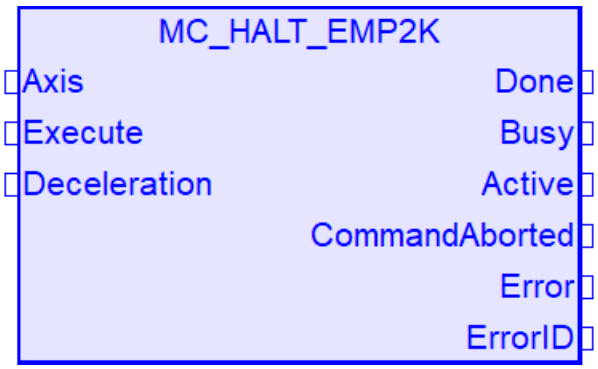
Functional Description

This Function Block commands a controlled motion stop and transfers the axis to the state 'Stopping'. It aborts any ongoing Function Block execution.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Execute	BOOL	Start the action at rising edge
	Deceleration	LREAL	Value of the Deceleration (u/s^2)
Output	Done	BOOL	Zero velocity reached
	Busy	BOOL	The FB is not finished and new output values are to be expected
	CommandAborted	BOOL	'Command' is aborted by another command
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.1.4. MC_Halt_EMP2K



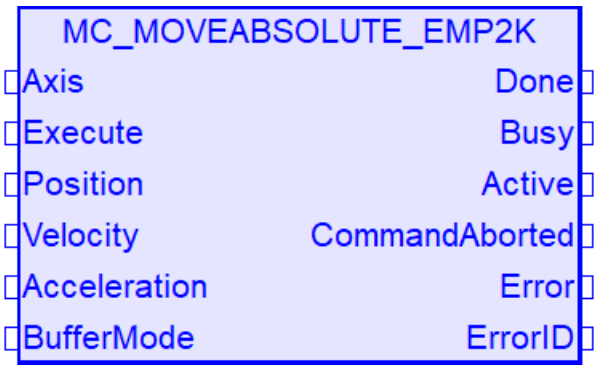
Functional Description

This Function Block commands a controlled motion stop. The axis is moved to the state 'DiscreteMotion', until the velocity is zero. With the 'Done' output set, the state is transferred to ‘Standstill’.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Execute	BOOL	Start the action at rising edge
	Deceleration	LREAL	Value of the Deceleration (u/s^2)
Output	Done	BOOL	Zero velocity reached
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Active	BOOL	Indicates that the FB has control on the axis
	CommandAborted	BOOL	'Command' is aborted by another command
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.1.5. MC_MoveAbsolute_EMP2K



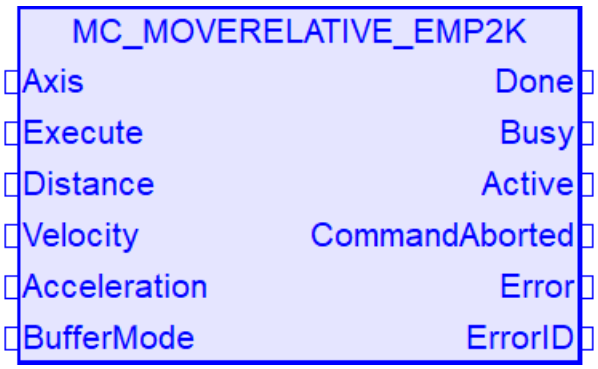
Functional Description

This Function Block commands a controlled motion to a specified absolute position.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Execute	BOOL	Start the motion at rising edge
	Position	LREAL	Commanded Position for the motion (u)
	Velocity	LREAL	Value of the maximum Velocity (u/s)
	Acceleration	LREAL	Value of the Acceleration (u/s^2)
	BufferMode	MC_BUFFER_MODE	Buffered modes. Refer to B.2.1 MC_BUFFER_MODE_EMP2K
Output	Done	BOOL	Commanded position finally reached
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Active	BOOL	Indicates that the FB has control on the axis
	CommandAborted	BOOL	'Command' is aborted by another command
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.1.6. MC_MoveRelative_EMP2K



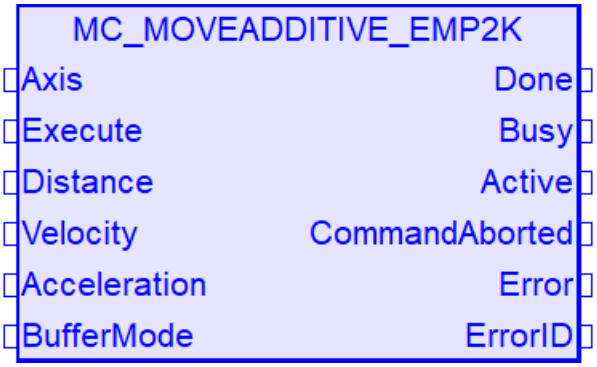
Functional Description

This Function Block commands a controlled motion of a specified distance relative to the set position at the time of the execution.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Execute	BOOL	Start the motion at rising edge
	Distance	LREAL	Relative distance for the motion (u)
	Velocity	LREAL	Value of the maximum Velocity (u/s)
	Acceleration	LREAL	Value of the Acceleration (u/s^2)
	BufferMode	MC_BUFFER_MODE	Buffered modes. Refer to B.2.1 MC_BUFFER_MODE_EMP2K
Output	Done	BOOL	Commanded distance reached
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Active	BOOL	Indicates that the FB has control on the axis
	CommandAborted	BOOL	'Command' is aborted by another command
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.1.7. MC_MoveAdditive_EMP2K



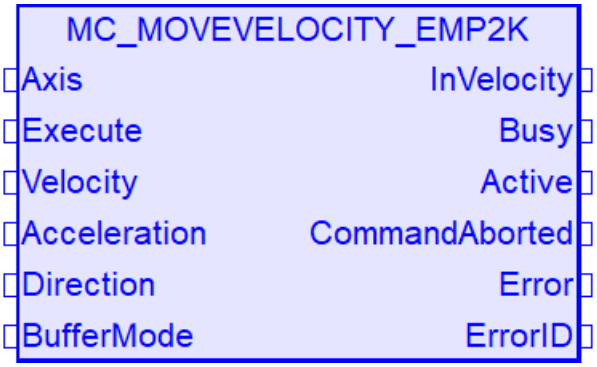
Functional Description

This Function Block commands a controlled motion of a specified relative distance additional to the most recent commanded position in the axis state 'DiscreteMotion'.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Execute	BOOL	Start the motion at rising edge
	Distance	LREAL	Relative distance for the motion (u)
	Velocity	LREAL	Value of the maximum Velocity (u/s)
	Acceleration	LREAL	Value of the Acceleration (u/s^2)
	BufferMode	MC_BUFFER_MODE	Buffered modes. Refer to B.2.1 MC_BUFFER_MODE_EMP2K
Output	Done	BOOL	Commanded distance reached
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Active	BOOL	Indicates that the FB has control on the axis
	CommandAborted	BOOL	'Command' is aborted by another command
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.1.8. MC_MoveVelocity_EMP2K



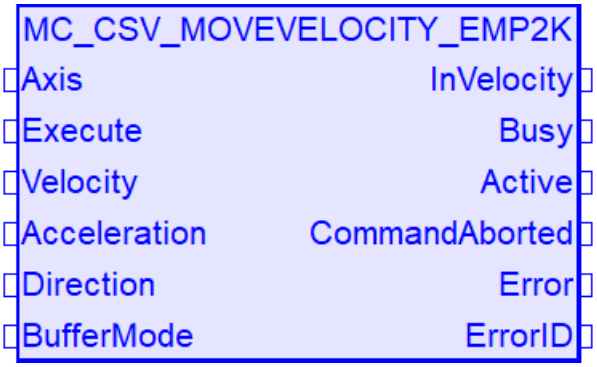
Functional Description

This Function Block commands a never ending controlled motion at a specified velocity. Implemented in Cyclic Synchronous Position mode.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Execute	BOOL	Start the motion at rising edge
	Velocity	LREAL	Value of the maximum Velocity (u/s)
	Acceleration	LREAL	Value of the Acceleration (u/s^2)
	Direction	MC_DIRECTION_EMP2K	Direction. Refer to B.2.2 MC_DIRECTION_EMP2K
	BufferMode	MC_BUFFER_MODE_EMP2K	Buffered modes. Refer to B.2.1 MC_BUFFER_MODE_EMP2K
Output	InVelocity	BOOL	Commanded velocity reached
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Active	BOOL	Indicates that the FB has control on the axis
	CommandAborted	BOOL	'Command' is aborted by another command
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.1.9. MC_CSV_MoveVelocity_EMP2K



Functional Description

This Function Block commands a never ending controlled motion at a specified velocity. Implemented in Cyclic Synchronous Velocity mode.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Execute	BOOL	Start the motion at rising edge
	Velocity	LREAL	Value of the maximum Velocity (u/s)
	Acceleration	LREAL	Value of the Acceleration (u/s^2)
	Direction	MC_DIRECTION_EMP2K	Direction. Refer to B.2.2 MC_DIRECTION_EMP2K
	BufferMode	MC_BUFFER_MODE_EMP2K	Buffered modes. Refer to B.2.1 MC_BUFFER_MODE_EMP2K
Output	InVelocity	BOOL	Commanded velocity reached
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Active	BOOL	Indicates that the FB has control on the axis
	CommandAborted	BOOL	'Command' is aborted by another command
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.1.10. MC_SetPosition_EMP2K

Functional Description

This Function Block shifts the coordinate system of an axis by manipulating both the set-point position as well as the actual position of an axis with the same value without any movement caused.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Execute	BOOL	Start setting position in axis
	Position	LREAL	Position unit, means 'Distance' if 'Relative'= TRUE (u)
	Relative	BOOL	TRUE: relative distance FALSE: absolute position
Output	Done	BOOL	'Position' has new value
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.1.11. MC_SetOverride_EMP2K

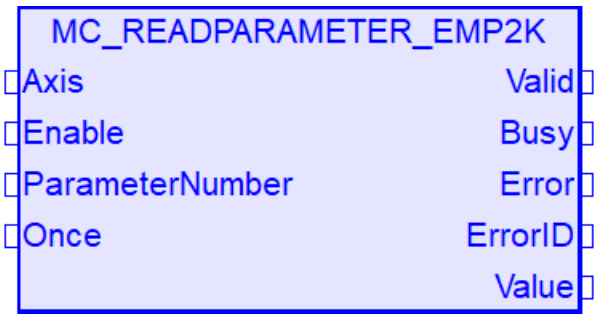
Functional Description

This Function Block sets the values of override for the whole axis, and all functions that are working on that axis.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Enable	BOOL	If SET, it writes the value of the override factor continuously. If RESET it should keep the last value.
	VelFactor	LREAL	New override factor for the velocity
Output	Enabled	BOOL	Override factor is set successfully
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.1.12. MC_ReadParameter_EMP2K



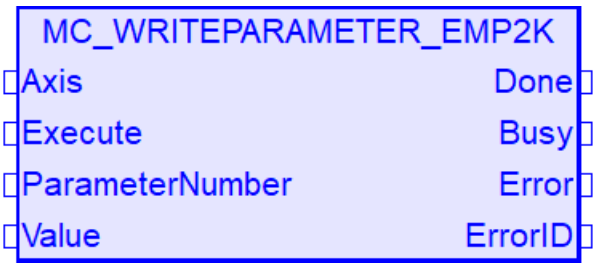
Functional Description

This Function Block returns the value of a vendor specific parameter.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Enable	BOOL	Get the value of the parameter while enabled
	ParameterNumber	INT	Number of the parameter. Refer to Appendix C. Parameter Number
	Once	BOOL	TRUE: once FALSE: continuously
Output	Valid	BOOL	A valid output is available at the FB
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes
	Value	LREAL	Value of the specified parameter

3.1.13. MC_WriteParameter_EMP2K



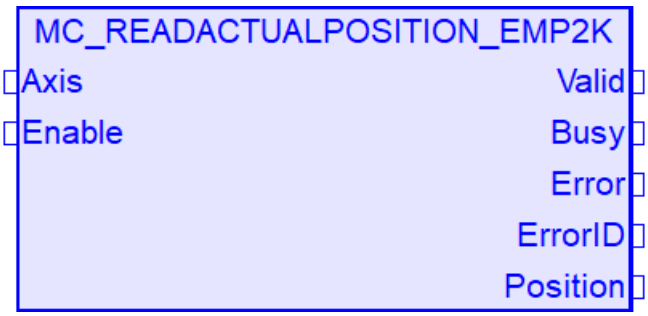
Functional Description

This Function Block modifies the value of a vendor specific parameter.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Execute	BOOL	Write the value of the parameter at rising edge
	ParameterNumber	INT	Number of the parameter. Refer to Appendix C. Parameter Number
	Value	LREAL	New value of the specified parameter
Output	Done	BOOL	Parameter successfully written
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.1.14. MC_ReadActualPosition_EMP2K



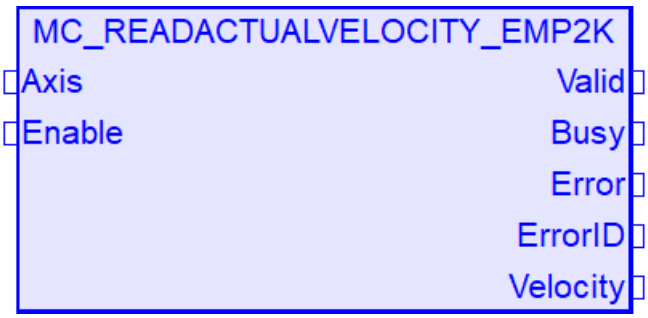
Functional Description

This Function Block returns the actual position.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Enable	BOOL	Get the value of the parameter continuously while enabled
Output	Valid	BOOL	A valid output is available at the FB
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes
	Position	LREAL	New absolute position (u)

3.1.15. MC_ReadActualVelocity_EMP2K



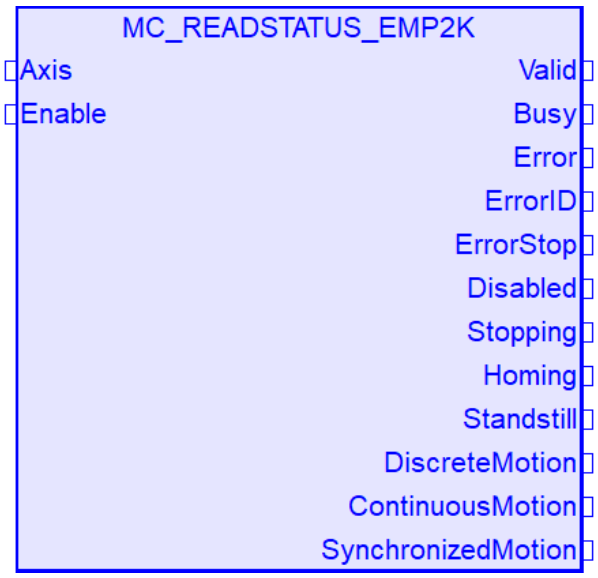
Functional Description

This Function Block returns the actual velocity.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Enable	BOOL	Get the value of the parameter continuously while enabled
Output	Valid	BOOL	A valid output is available at the FB
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes
	Velocity	LREAL	The value of the actual velocity (u/s)

3.1.16. MC_ReadStatus_EMP2K



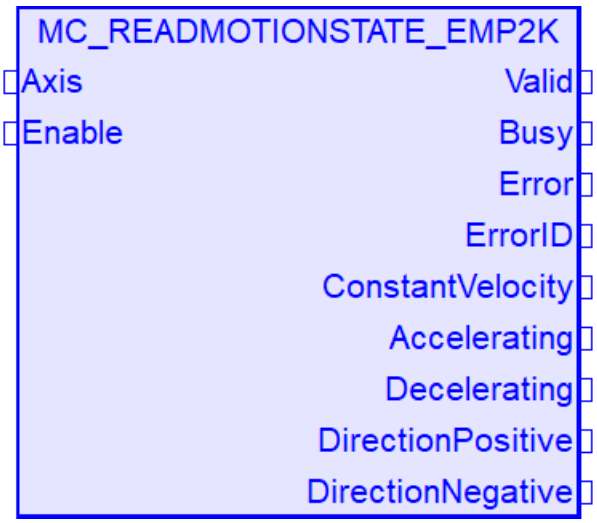
Functional Description

This Function Block returns in detail the status of the state diagram of the selected axis.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Enable	BOOL	Get the value of the parameter continuously while enabled
Output	Valid	BOOL	A valid output is available at the FB
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes
	ErrorStop	BOOL	See state diagram
	Disabled	BOOL	See state diagram
	Stopping	BOOL	See state diagram
	Homing	BOOL	See state diagram
	Standstill	BOOL	See state diagram
	DiscreteMotion	BOOL	See state diagram
	ContinuousMotion	BOOL	See state diagram
	SynchronizedMotion	BOOL	See state diagram

3.1.17. MC_ReadMotionState_EMP2K



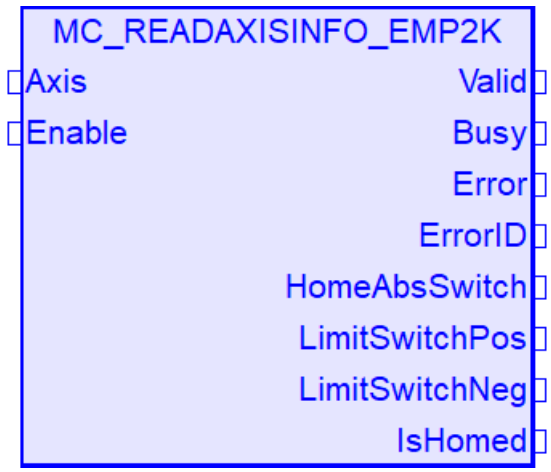
Functional Description

This Function Block returns in detail the status of the axis with respect to the motion currently in progress.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Enable	BOOL	Get the value of the parameter continuously while enabled
Output	Valid	BOOL	True if a valid set of outputs available
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes
	ConstantVelocity	BOOL	Velocity is constant
	Accelerating	BOOL	Increasing the absolute value of the velocity
	Decelerating	BOOL	Decreasing the absolute value of the velocity
	DirectionPositive	BOOL	The position is increasing
	DirectionNegative	BOOL	The position is decreasing

3.1.18. MC_ReadAxisInfo_EMP2K



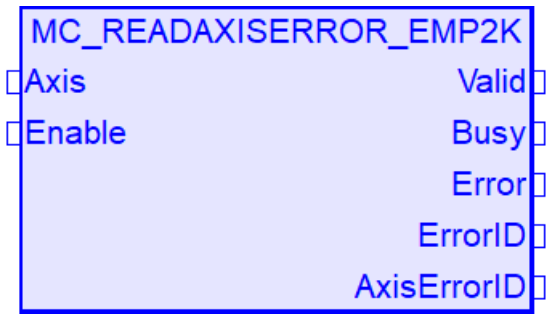
Functional Description

This Function Block reads information concerning an axis.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Enable	BOOL	Get the value of the parameter continuously while enabled
Output	Valid	BOOL	True if a valid set of outputs available
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes
	HomeAbsSwitch	BOOL	Digital home switch input is active
	LimitSwitchPos	BOOL	Positive hardware end switch is active
	LimitSwitchNeg	BOOL	Negative hardware end switch is active
	IsHomed	BOOL	The absolute reference position is known for the axis (axis is homed)

3.1.19. MC_ReadAxisError_EMP2K



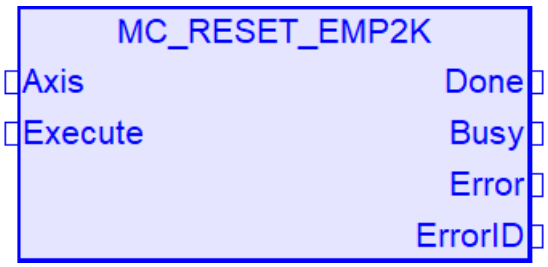
Functional Description

This Function Block presents general axis errors not relating to the Function Blocks.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Enable	BOOL	Get the value of the parameter continuously while enabled
Output	Valid	BOOL	True if a valid output is available at the FB
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes
	AxisErrorID	UDINT	The value of the axis error. Refer to Appendix A. Error Codes

3.1.20. MC_Reset_EMP2K



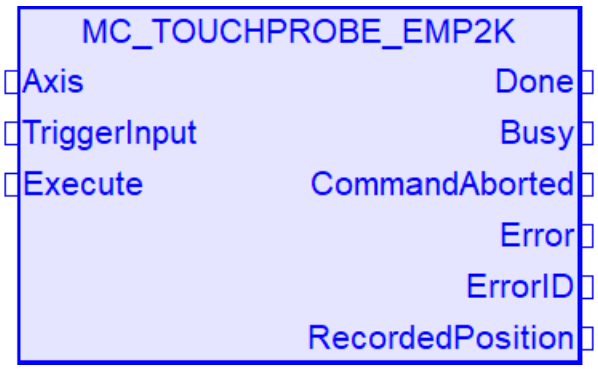
Functional Description

This Function Block makes the transition from the state 'ErrorStop' to 'Standstill' or 'Disabled' by resetting all internal axis-related errors – it does not affect the output of the FB instances.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
Input	Execute	BOOL	Resets all internal axis-related errors
Output	Done	BOOL	'Standstill' or 'Disabled' state is reached
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.1.21. MC_TouchProbe_EMP2K



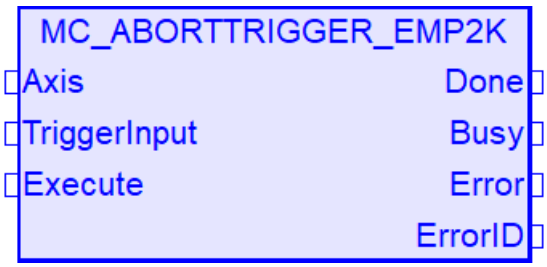
Functional Description

This Function Block is used to record an axis position at a trigger event.

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
	TriggerInput	MC_TRIGGER_REF_EMP2K	Reference to the trigger signal source. Refer to B.1.1 MC_TRIGGER_REF_EMP2K
Input	Execute	BOOL	Starts touch probe recording at rising edge
Output	Done	BOOL	Trigger event recorded
	Busy	BOOL	The FB is not finished and new output values are to be expected
	CommandAborted	BOOL	'Command' is aborted by another command (MC_AbortTrigger)
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes
	RecordedPosition	LREAL	Position where trigger event occurred (u)

3.1.22. MC_AbortTrigger_EMP2K



Functional Description

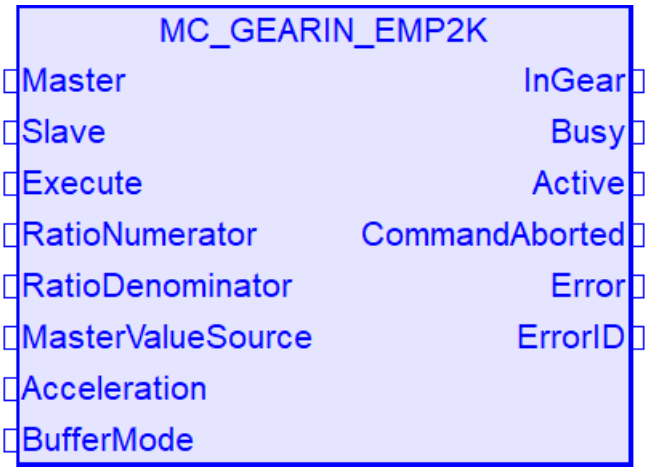
This Function Block is used to abort function blocks which are connected to trigger events (e.g. MC_TouchProbe)

Variables

In-Out	Name	Data type	Description
In-Out	Axis	AXIS_REF_EMP2K	Reference to the axis
	TriggerInput	MC_TRIGGER_REF_EMP2K	Reference to the trigger signal source. Refer to B.1.1 MC_TRIGGER_REF_EMP2K
Input	Execute	BOOL	Aborts trigger event at rising edge
Output	Done	BOOL	Trigger functionality aborted
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.2. Multi-Axis Function Blocks

3.2.1. MC_GearIn_EMP2K



Functional Description

This Function Block commands a ratio between the VELOCITY of the slave and master axis.

Variables

In-Out	Name	Data type	Description
In-Out	Master	AXIS_REF_EMP2K	Reference to the master axis
	Slave	AXIS_REF_EMP2K	Reference to the slave axis
Input	Execute	BOOL	Start the gearing process at the rising edge
	RatioNumerator	INT	Gear ratio Numerator
	RatioDenominator	UINT	Gear ratio Denominator
	MasterValueSource	MC_SOURCE_EMP2K	Defines the source for synchronization. Refer to B.2.5 MC_SOURCE_EMP2K
	Acceleration	LREAL	Acceleration for gearing in (u/s^2)
	BufferMode	MC_BUFFER_MODE_EMP2K	Buffered modes. Refer to B.2.1 MC_BUFFER_MODE_EMP2K
Output	InGear	BOOL	Is TRUE if the set value = the commanded value
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Active	BOOL	Indicates that the FB has

			control on the axis
	CommandAborted	BOOL	'Command' is aborted by another command
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

3.2.2. MC_GearOut_EMP2K

Functional Description

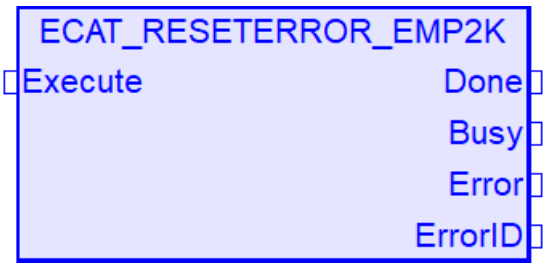
This Function Block disengages the Slave axis from the Master axis.

Variables

In-Out	Name	Data type	Description
In-Out	Slave	AXIS_REF_EMP2K	Reference to the slave axis
Input	Execute	BOOL	Start disengaging process at the rising edge
Output	Done	BOOL	Disengaging completed
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

4.EtherCAT Function Blocks

4.1. ECAT_ResetError_EMP2K



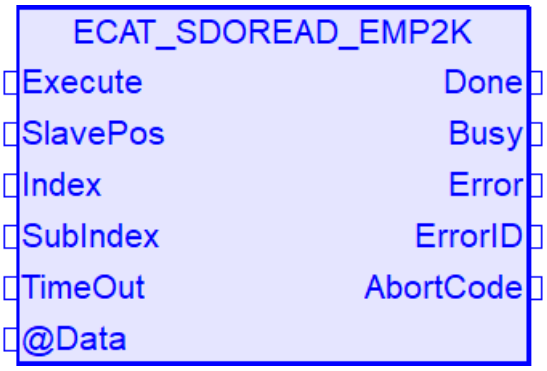
Functional Description

Reset EtherCAT error status

Variables

In-Out	Name	Data type	Description
Input	Execute	BOOL	Reset error
Output	Done	BOOL	Reset error successfully
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes

4.2. ECAT_SDORead_EMP2K



Functional Description

This function block allows data to be read from an object dictionary of an EtherCAT slave through an SDO (Service Data Object) access.

Variables

In-Out	Name	Data type	Description
Input	Execute	BOOL	Start the action at rising edge
	SlavePos	UINT	Slave positon. (ENI file configuration position)
	Index	UINT	Index of the object
	SubIndex	USINT	Subindex of the object
	TimeOut	UDINT	Maximum time that must not be exceeded when the function block is executed.
In-Out	Data	ANY	Read data buffer
Output	Done	BOOL	Read the object successfully
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes
	AbortCode	UDINT	SDO abort code

4.3. ECAT_SDOWrite_EMP2K

Functional Description

With this function block, an object can be written from the object directory of the EtherCAT slave via SDO (Service Data Object) download.

Variables

In-Out	Name	Data type	Description
Input	Execute	BOOL	Start the action at rising edge
	SlavePos	UINT	Slave positon. (ENI file configuration position)
	Index	UINT	Index of the object
	SubIndex	USINT	Subindex of the object
	TimeOut	UDINT	Maximum time that must not be exceeded when the function block is executed.
	Data	ANY	Write data
Output	Done	BOOL	Read the object successfully
	Busy	BOOL	The FB is not finished and new output values are to be expected
	Error	BOOL	An error has occurred within the Function Block
	ErrorID	UDINT	Error identification. Refer to Appendix A. Error Codes
	AbortCode	UDINT	SDO abort code

Appendix A. Error Codes

Error Code	Description
-1000	Kernel system call
-1001	Invalid slave number
-1002	Allocate data
-1003	Slave count exceed maximum support count
-1004	Get parameter
-1005	Invalid master handle
-1006	Invalid slave handle
-1007	Mutex lock
-1008	Runtime is in running mode, the operation cannot be performed
-1009	Protocol not supported
-1010	Data size mismatch
-1011	SDO request error
-1012	SDO request not executed
-1013	Slave does not exist
-1014	Range error
-1015	EtherCAT port link down
-1016	EtherCAT AL state is not in Operational
-1017	EtherCAT Working Counter error
-1018	EtherCAT communications cycle exceeded
-1019	EtherCAT network configuration mismatch
-1020	Runtime is in edit mode, the operation cannot be performed
-1021	Kernel communication errors
-1022	Not initialized
-1023	Failure to initialize from ENI

Error Code	Description
-2001	Motion control data not initialized
-2002	Invalid motion control number
-2003	Get motion control parameters
-2004	Motion control Mutex lock
-2005	Motion control axis not active
-2006	Set homing parameters
-2007	Homing error
-2008	Drive fault occurred
-2009	Positive limit input detected
-2010	Negative limit input detected
-2011	Motion control queue full

-2012	In Motion, the operation cannot be performed
-2013	In Stopping, the operation cannot be performed
-2014	In Homing, the operation cannot be performed
-2015	Exceeding software limit position
-2016	Invalid velocity
-2017	Invalid acceleration
-2018	Invalid deceleration
-2019	Invalid buffer mode
-2020	Invalid direction
-2021	Function not supported

Appendix B. Data Type

B.1 Structure

B.1.1 MC_TRIGGER_REF_EMP2K

Name	Data Type	Description
TouchProbeID	MC_TRIGGER_TOUCH_PROBE_ID_EMP2K	Selects the capture unit of the drive. Refer to B.2.3 MC_TRIGGER_TOUCH_PROBE_ID_EMP2K
Source	MC_TRIGGER_SOURCE_EMP2K	Specify the Servo Drive trigger signal. Refer to B.2.4 MC_TRIGGER_SOURCE_EMP2K

B.2 Enum

B.2.1 MC_BUFFER_MODE_EMP2K

No.	Name	Description
0	mcAborting	Start FB immediately (default mode)
1	mcBuffered	Start FB after current motion has finished
2	mcBlendingLow	The velocity is blended with the lowest velocity of both FBs
3	mcBlendingPrevious	The velocity is blended with the velocity of the first FB
4	mcBlendingNext	The velocity is blended with velocity of the second FB (Not supported)
5	mcBlendingHigh	The velocity is blended with highest velocity of both FBs (Not supported)

B.2.2 MC_DIRECTION_EMP2K

No.	Name	Description
0	mcPositiveDirection	Positive direction
1	mcShortestWay	Shortest way (Not supported)
2	mcNegativeDirection	Negative direction
3	mcCurrentDirection	Current direction

B.2.3 MC_TRIGGER_TOUCH_PROBE_ID_EMP2K

No.	Name	Description
0	mcTouchProbe1	TouchProbe 1
1	mcTouchProbe2	TouchProbe 2

B.2.4 MC_TRIGGER_SOURCE_EMP2K

No.	Name	Description
0	mcEXT	Z-phase signal
1	mcZeroPulse	External input

B.2.5 MC_SOURCE_EMP2K

No.	Name	Description
0	mcSetValue	Synchronization on master command position
1	mcActualValue	Synchronization on master actual position

Appendix C. Parameter Number

The parameters defined below have been standardized by PLCopen.

PN	Name	R/W	Description
1	CommandedPosition	R	Commanded position
2	SWLimitPos	R/W	Positive Software limit switch position (Not supported)
3	SWLimitNeg	R/W	Negative Software limit switch position (Not supported)
4	EnableLimitPos	R/W	Enable positive software limit switch (Not supported)
5	EnableLimitNeg	R/W	Enable negative software limit switch (Not supported)
6	EnablePosLagMonitoring	R/W	Enable monitoring of position lag (Not supported)
7	MaxPositionLag	R/W	Maximal position lag (Not supported)
8	MaxVelocitySystem	R	Maximal allowed velocity of the axis in the motion system
9	MaxVelocityAppl	R/W	Maximal allowed velocity of the axis in the application
10	ActualVelocity	R	Actual velocity
11	CommandedVelocity	R	Commanded velocity
12	MaxAccelerationSystem	R	Maximal allowed acceleration of the axis in the motion system
13	MaxAccelerationAppl	R/W	Maximal allowed acceleration of the axis in the application
14	MaxDecelerationSystem	R	Maximal allowed deceleration of the axis in the motion system (Not supported)
15	MaxDecelerationAppl	R/W	Maximal allowed deceleration of the axis in the application (Not supported)
16	MaxJerkSystem	R	Maximum allowed jerk of the axis in the motion system (Not supported)
17	MaxJerkAppl	R/W	Maximum allowed jerk of the axis in the application (Not supported)

Revision History

Revision	Date	Description
1.0	2022/08	Initial issue