

Axis Control Blocks for S7-1500 / S7-1500T and S7-1200 G2

LAxisCtrl for SIMATIC

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1 Library Overview

What you get

This document describes the LAxisCtrl block library. The block library provides you with the tested code with clearly defined interfaces. They can be used as a basis for your task to be implemented.

A key concern of the document is to describe

- all blocks of the block library
- the functionality implemented through these blocks.

Furthermore, this documentation shows possible fields of application and helps you integrate the library into your STEP 7 project using step-by-step instructions.

Scope of application

- STEP 7 Professional V20
- Motion Control V9.0
- S7-1500 CPU as of firmware 4.0
- S7-1500T CPU as of firmware 4.0

- STEP 7 Basic V20
- Motion Control V8.0
- S7-1200 G2 CPU as of firmware 1.0

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1.1 Different user scenarios

Possible application(s) for the LAxisCtrl library

The following section shows a scenario for a possible application of the LAxisCtrl library:

Scenario

The library can be used for any type of motion control applications. The included axis function blocks control the basic functionality of a single axis. The axis function blocks simplify the programming as well as the quick commissioning and testing.

Also additional functionality is included to control the motor holding brake and gives feedback about the status of an axis.

The blocks according to their axis type can offer the following functionalities:

- Enable / disable axis
- Reset of an axis (acknowledgment of the errors at the technology object / restart of the technology object)
- Jogging (incremental / continuous)
- Move axis at velocity / speed setpoint (position-controlled / non position-controlled)
- Stop / fast stop
- Moving / stopping an axis with force / torque limiting with and without fixed stop detection
- Homing (active / passive / setting of a position value / absolute encoder adjustment / homing on fixed stop)
- Positioning (absolute / relative)
- Superimposed relative positioning
- Superimposed halt
- Gearing (absolute / relative / velocity)
- Camming (offset and scaling for master and slave, cyclic and non-cyclic cam disk, different synchronization modes)
- Gear out / cam out
- Phasing (shift leading value of an existing synchronous operation)
- Offset (shift following value of an existing synchronous operation)
- Stop and disable a slave axis without desynchronizing (synchronizedMotionSimulation)
- Changing the velocity, position, gear ratio, phase shift and offset on-the-fly
- Providing status information of the axis (statusWord, errorWord, warningWord)
- Unconditionally opening and closing of the holding brake

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The axis function blocks are based on the PLCopen function blocks available in the system. Interfaces and the behavior of the axis FBs are compliant with the PLCopen specification taking into account the behavior of *execute* and *enable* inputs.

More information about the PLCopen function blocks can be found in \3\ and \4\.

There are five different axis function blocks available in the LAxisCtrl library. They differ in supported motion functionality and mandatory data type of the technology object which is controlled by the axis FB. The following table gives you an overview of the different FBs and the supported motion functionality.

Table 1-1: Supported motion control functionality of LAxisCtrl function blocks for S7-1500/S7-1500T

Prefix	**LAxisCtrl_**				
Functionality	**SyncAxis Camming**[1]	**SyncAxis RelGearing**	**PosAxis**	**SpeedAxis**	**ExtEncoder**
enableAxis	X	X	X	X	X
resetAxis	X	X	X	X	X
openBrake	X	X	X	X	
jog	X	X	X	X	
moveVelocity	X	X	X	X	
stop	X	X	X	X	
fastStop	X	X	X	X	
torqueLimiting	X	X	X	X	
homing	X	X	X		X
posRelative	X	X	X		
posAbsolute	X	X	X		
posSuperimposed	X	X	X		
haltSuperimposed	X	X	X		
gearInRelative	X	X			
gearInAbsolute	X				
gearInVelocity	X				
gearOutCamOut	X				
camIn	X				
phasing	X				
offset	X				
synchronizedMotion Simulation	X				

[1] For using the LAxisCtrl_SyncAxisCamming FB a S7-1500T CPU is required

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Table 1-2: Supported motion control functionality of LAxisCtrl function blocks for S7-1200 G2

Prefix	**LAxisCtrl_**				
Functionality	**SyncAxis Camming**	**SyncAxis RelGearing**	**PosAxis**	**SpeedAxis**	**ExtEncoder**
enableAxis	X	X	X	X	X
resetAxis	X	X	X	X	X
openBrake	X	X	X	X	
jog	X	X	X	X	
moveVelocity	X	X	X	X	
stop	X	X	X	X	
fastStop	X	X	X	X	
torqueLimiting					
homing	X	X	X		X
posRelative	X	X	X		
posAbsolute	X	X	X		
posSuperimposed					
haltSuperimposed					
gearInRelative	X	X			
gearInAbsolute					
gearInVelocity					
gearOutCamOut	X				
camIn	X				
phasing	X				
offset					
synchronizedMotion Simulation					

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1.2 Hardware and software requirements

Requirements for this library

To be able to use the functionality of the library described in this document, the following hardware and software requirements must be met:

Hardware

Table 1-3 Hardware components

No.	Component	Article number	Alternative
1.	CPU 1513-1 PN	6ES7513-1AM03-0AB0	Other S7-1500 CPU with FW V4.0
2.	or CPU 1515T-2 PN	6ES7515-2TN03-0AB0	Other S7-1500T CPU with FW V4.0
3.	or CPU 1214C DC/DC/DC	6ES7214-1AH50-0XB0	Other S7-1200 G2 CPU with FW V1.0

Software

Table 1-4 Software components

No.	Component	Article number	Quantity
1.	STEP 7 Professional V20	6ES7822-1A.24-..	1
2.	or STEP 7 Basic V20	6ES7822.0A.24-..	1

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1.3 Library resources

What will you find in this section?

The following section gives you an overview of the size of the blocks of the LAxisCtrl library in the main and load memory (S7-1500T).

Overall size

The overall size of all blocks of the LAxisCtrl library in the main memory needed for operating a TO_SynchronousAxis with a S7-1500T CPU is 18 Kbytes in the code work memory, 3 Kbytes in the data work memory and 447 Kbytes in the load memory. The Technology object(s) needs additional memory.

Size of the individual blocks

Table 1-5 Size of the blocks[1]

Block	Symbol	Size in main memory [Kbytes]	Size in load memory [Kbytes]
FB 30600	LAxisCtrl_SyncAxisCamming	27.3	391.2
FB 30601	LAxisCtrl_SyncAxisRelGearing	17.6	268.2
FB 30602	LAxisCtrl_PosAxis	16.8	256.8
FB 30603	LAxisCtrl_SpeedAxis	6.5	115
FB 30604	LAxisCtrl_ExtEncoder	2.8	59
FB 30605	LAxisCtrl_GetAxisStatusWord	0.5	16
FB 30606	LAxisCtrl_GetAxisWarningWord	0.3	10.1
FB 30607	LAxisCtrl_GetAxisErrorWord	0.3	10
FB 30608	LAxisCtrl_BrakeControl[2]	0.4	14
FB 30609	LAxisCtrl_GetExtEncoderStatusWord	0.2	7.6
FB 30610	LAxisCtrl_GetExtEncoderWarningWord	0.2	8.2
FB 30611	LAxisCtrl_GetExtEncoderErrorWord	0.2	8.2
DB 30600	InstLAxisCtrl_SyncAxisCamming	3.8	21.6
DB 30601	InstLAxisCtrl_SyncAxisRelGearing	2.4	16.9
DB 30602	InstLAxisCtrl_PosAxis	2.2	16.3
DB 30603	InstLAxisCtrl_SpeedAxis	1.6	13
DB 30604	InstLAxisCtrl_ExtEncoder	1.2	11
DB 30605	InstLAxisCtrl_GetAxisStatusWord	0.1	2.4
DB 30606	InstLAxisCtrl_GetAxisWarningWord	0.08	1.9
DB 30607	InstLAxisCtrl_GetAxisErrorWord	0.08	1.9
DB 30608	InstLAxisCtrl_BrakeControl	2.5	0.1
DB 30609	InstLAxisCtrl_GetExtEncoderStatusWord	0.07	1.7
DB 30610	InstLAxisCtrl_GetExtEncoderWarningWord	0.08	1.8
DB 30611	InstLAxisCtrl_GetExtEncoderErrorWord	0.08	1.8

[1] Instance data blocks (prefix InstLAxisCtrl_) are not delivered with the library. They will be generated automatically with the call of a function block.
[2] This block is included in library LAxisCtrl_Addon.

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2 Blocks of the Library

What will you find in this section?

This chapter lists and explains all blocks of the LAxisCtrl library. Before that, however, you are informed of the blocks that are essentially involved in the implementation of the functionality.

2.1 List of the blocks

The following table lists all blocks of the LAxisCtrl library.

Table 2-1 List of blocks

Block	Symbol	Classification
FB 30600	LAxisCtrl_SyncAxisCamming	In-house development
FB 30601	LAxisCtrl_SyncAxisRelGearing	In-house development
FB 30602	LAxisCtrl_PosAxis	In-house development
FB 30603	LAxisCtrl_SpeedAxis	In-house development
FB 30604	LAxisCtrl_ExtEncoder	In-house development
FB 30605	LAxisCtrl_GetAxisStatusWord	In-house development
FB 30606	LAxisCtrl_GetAxisWarningWord	In-house development
FB 30607	LAxisCtrl_GetAxisErrorWord	In-house development
FB 30608	LAxisCtrl_BrakeControl	In-house development
FB 30609	LAxisCtrl_GetExtEncoderStatusWord	In-house development
FB 30610	LAxisCtrl_GetExtEncoderWarningWord	In-house development
FB 30611	LAxisCtrl_GetExtEncoderErrorWord	In-house development

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2.2 Explanation of the blocks

The interfaces and the controlling of the LAxisCtrl function blocks is based on the PLCopen standard V2.0 with taking into account behavior of *execute* and *enable* inputs.

The function blocks are implemented in Structured Control Language (SCL). They are programmed for use in a cyclic task.

Activation and deactivation of the function blocks

The axis function blocks are activated via the *enable* input. This input is level-sensitive. With a falling edge the functionality of the FB is stopped and the technology object (TO) will be disabled if it is active.

Selection of the functionality

The functionalities of the axis function blocks are divided into three groups:

- General axis functions (enable axis, reset axis, passive/direct homing, torque limiting)
- Functions in the basic coordinate system (positioning, move axis at velocity setpoint, jogging, stop, fast stop, active homing, all synchronous motion commands)
- Superimposed functions (superimposed positioning, superimposed halt, phasing, offset)

To use the commands a configuration is necessary, e.g. for dynamics or positions.

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2.2.1 General axis functions

The general axis functions are independent from other motion commands. They can be executed along with basic or superimposed motion commands (e.g. passive homing along with move velocity or torque limiting along with other motion commands).

The functionality and their respective output signals are described below:

Enable axis

The start mode (position-controlled / non position-controlled) of enabling the axis is configured at <configuration>.power.startMode.

Table 2-2 Output signals for enable axis function

Functionality	***axisEnabled***
enableAxis (enable logic)	The technology object is enabled. Motion commands can be executed.

Reset axis

The parameter Restart of the MC_RESET command can be found at <configuration>.generalSettings.resetWithRestart.

Table 2-3 Output signals for reset axis function

Functionality	***resetActive***
resetAxis (execute logic)	Reset/Restart of the axis is being executed

Home axis (passive / direct)

All parameters for homing functionality can be found at <configuration>.homing. The *homingCommandAborted* output is set if the actual command is aborted by an external command.

Table 2-4 Output signals for homing function

Functionality	***homingCommandBusy***	***homingCommandDone***	***homingCommandAborted***
homing (execute logic)	Homing command is being executed	Homing command has completed without error	Homing command has been aborted

Torque limiting

All parameters for torque limiting functionality can be found in <configuration>.torqueLimiting.

Table 2-5 Output signals for torque limiting function

Functionality	***inLimitation***	***inClamping***
torqueLimiting (enable logic)	The drive is operating at the force/torque limit	The axis remains at the fixed stop position (clamping), the axis position is within the positioning tolerance

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2.2.2 Functions of basic motion coordinate system

When processing a command, the respective output <*command*>*Selected* is set. At the same time one of the three outputs *commandBusy, commandDone* or *commandAborted* is set. Commands in the basic coordinate system can replace each other. The *commandAborted* output is set if the actual command is aborted by an external command.

Table 2-6 Output signals for functions of basic motion coordinate system

Functionality	*commandBusy*	*commandDone*	*inVelocity*	*startSync*	*inSync*
Jog with mode continuous (enable logic)	Jogging is active		Setpoint velocity reached		
Jog with mode incremental (enable logic)	Jogging is active	Increment completed			
moveVelocity (execute logic)	Move velocity is being executed		Setpoint velocity reached		
Stop (execute logic)	Stop command[1] is being executed	Axis stopped			
fastStop (execute logic)	Fast stop command[1] is being executed	Axis stopped			
homing (active) (execute logic)	(see: *homingCommandBusy*) / (see: *homingCommandDone*)				
posAbsolute (execute logic)	Absolute positioning is being executed	Position reached			
posRelative (execute logic)	Relative positioning is being executed	Position reached			
gearInRelative (execute logic)	Relative gearing is being executed				Synchronization finished
gearInAbsolute (execute logic)	Absolute gearing is being executed			Synchronization started	Synchronization finished
gearInVelocity (execute logic)	Velocity gearing is being executed			Synchronization started	Synchronization finished
gearOutCamOut (execute logic)	End gearing / camming is being executed	Desynchronization finished		Desynchronization started	
camIn (execute logic)	Camming is being executed	End of profile reached (Mode ONCE)		Synchronization started	Synchronization finished

NOTE All configuration parameters for the basic motion commands can be found in <configuration>.<command>.

[1] MC_Halt is triggered internally

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Apart from the basic functionalities provided with the PLCopen blocks in the system, following additional functionality is available in the axis function blocks:

Stop / Fast stop

There are two different commands for stopping an axis available in the axis function blocks. The *stop* command is executed with its dynamic values and is replaceable by other basic motion commands. With the *fastStop* command it is possible to stop with alternative dynamic values. Furthermore it is possible to configure if the *fastStop* is replaceable by other commands of this instance of the axis control function block.

NOTE

All configuration parameters of stop / fastStop can be found at <configuration>.stop / <configuration>.fastStop.
For the stop and fastStop functionality, the MC_Halt instruction is used internally.

Incremental jog

“Incremental jog” enhances the jog functionality with moving a specified maximum distance (increment). If the increment is completed and input *jogForward* or j*ogBackward* is still set, the axis stops automatically. A new increment can be started with a rising edge of *jogForward* or *jogBackward* input.

NOTE

Parameters for dynamics configuration of “Incremental jog” command are evaluated at rising edge of the command.

The type of jogging is set via <configuration>.jog.mode. The default value for mode is 0 (continuous jogging).

There are different modes for jog functionality available:

- Mode 0: Continuous jogging – axis is moved at velocity / speed setpoint as long as a jog input is set.
- Mode 1: Incremental jogging – every rising edge at a jog input starts a new increment
- Mode 2: Incremental jogging – continue the last increment until it is completed. After finishing a new rising edge starts a new increment.

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Homing on fixed stop

The “Homing on fixed stop” functionality is an additional active homing function of the axis control function block. It can be used to home an axis when detecting a fixed stop. The functionality is started with a rising edge at input *homing*. An active torque limiting command will be aborted.

NOTE

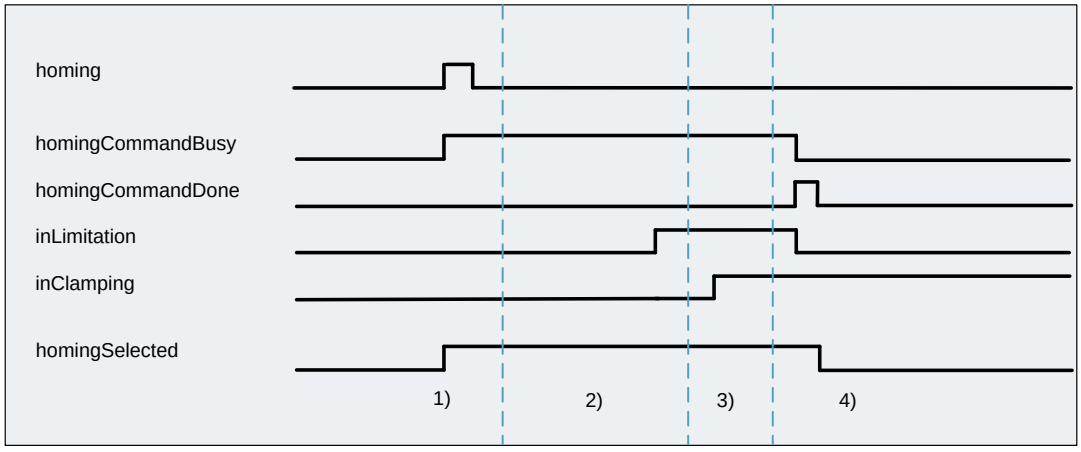
All configuration parameters for the homing functionality can be found in <configuration>.homing. The “Homing on fixed stop” function is selected with the configuration parameter *extendedMode*. The configuration parameter *mode* (homing mode) is then not effective. The internally used homing mode for the “Homing on fixed stop” function depends on the sensor type of the operative encoder of the axis, see <TO>.Sensor[1..4].Type. For incremental encoders a direct homing (absolute) is performed when the axis is in clamping. For absolute encoders an absolute encoder adjustment (absolute) is performed when the axis is in clamping.

The “Homing on fixed stop” functionality requires the configuration of the torque limit (>0).

The direction for the “Homing on fixed stop” functionality is taken from the operative encoder setting, see <TO>.Sensor[1..4].ActiveHoming.Direction.

The following dynamic values are used for the “Homing on fixed stop” functionality:
- velocity := <TO>.Homing.ReferencingVelocity
- acceleration := <TO>.DynamicDefaults.Acceleration
- deceleration := <TO>.DynamicDefaults.Deceleration
- jerk := <TO>.DynamicDefaults.Jerk

Figure 2-1: Timing diagram of the homing on fixed stop functionality



Note: extendedMode '0' (Homing on fixed stop) is described below

1. The “Homing on fixed stop” function is started with a rising edge of input *homing*. When processing the functionality, the respective outputs *homingSelected* and *homingCommandBusy* are set. The axis is moving with the configured active homing dynamics.
2. If the axis is reaching the fixed stop or is in limitation the output *inLimitation* is set. The following error value of the axis is increasing.
3. The fixed stop is detected after the axis reached the maximum following error configured in <TO>.Clamping.FollowingErrorDeviation. The output *inClamping*

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is set. After setting the home position, the following error decreases because of a positioning to home position.

4. Process is finished and output *homingCommandDone* is set at least one cycle and at most as long as the input *homing* is set. The outputs *homingCommandBusy* and *homingSelected* are reset. Furthermore the axis is still in clamping and has to be moved out of positioning window (away from fixed stop) for resetting *inClamping*. The extendedMode '1' (Homing on fixed stop with moving out of clamping) or '2' (Homing on fixed stop with moving to target position) can be used to perform the move out automatically.

NOTE Torque limitation is active until the axis leaves the positioning window.

After *homingCommandDone* is set, it is possible to start a new *torqueLimiting* command to move the axis (away from fixed stop) in a torque limited motion.

2.2.3 Superimposed motion functions

When processing a command, the respective output <*command*>*Selected* is set. At the same time one of the three outputs *superimposedBusy, superimposedDone* or *superimposedAborted* is set. A superimposed motion function can be executed in addition to a basic function. The *superimposedAborted* output is set if the actual command is aborted by an external command.

Table 2-7: Output signals for superimposed motion functions

Functionality	***superimposedBusy***	***superimposedDone***	***superimposedAborted***
posSuperimposed (execute logic)	Superimposed positioning is being executed	Superimposed position command has completed without error	Superimposed position command has been aborted
haltSuperimposed (execute logic)	Superimposed halt is being executed	Superimposed halt command has completed without error	Superimposed halt command has been aborted

NOTE All configuration parameters for superimposed motion commands can be found in <configuration>.<functionality>.

NOTE The phasing and the offset command is handled in the same way as a superimposed command. The execution status can be evaluated at the superimposed outputs of the axis function blocks.

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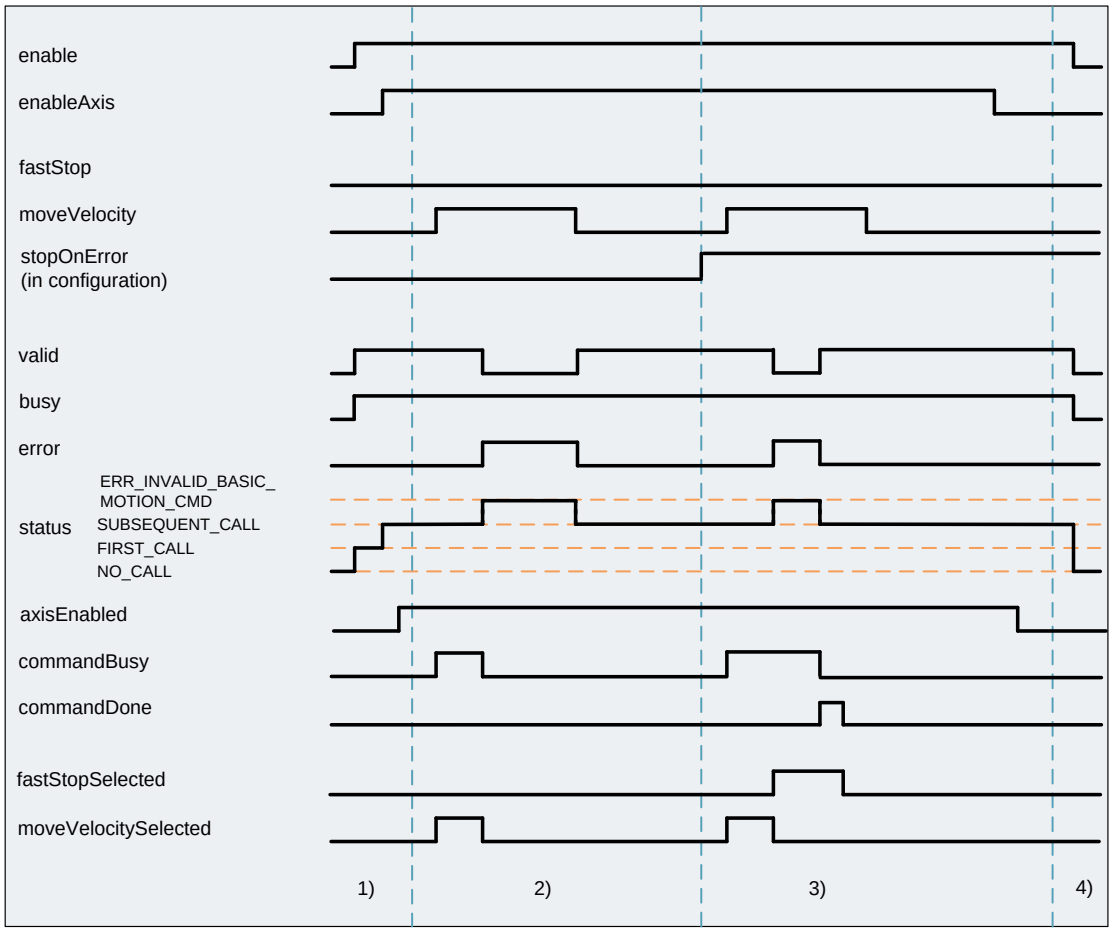
2.2.4 Additional features of axis function blocks

Stop on error

The “Stop on error” functionality is an additional feature of the axis function block. If an error occurs during execution of commands, the axis is stopped automatically. The stop of the axis is executed with the fast stop command with respective dynamic values.

NOTE By default “Stop on error” is enabled (TRUE). For disabling the functionality the <configuration>.generalSettings.stopOnError must be reset.

Figure 2-2: Timing diagram showing error case without and with StopOnError functionality



1. The function block is activated by setting the *enable* input. After enabling the FB, the output status is changing to STATUS_FIRST_CALL and afterwards to STATUS_SUBSEQUENT_CALL. In these states the axis can be enabled by setting the input *enableAxis*. After enabling the axis, the output *axisEnabled* is set and the technology object accepts motion control commands. With enabling the axis, the position-controlled or non position-controlled mode is activated at the axis and the actual values of the axis are valid. The processing of the FB is indicated with *busy* = TRUE and *valid* = TRUE.
2. A new *moveVelocity* command is executed with a rising edge at the input *moveVelocity*. When processing the functionality, the respective output *moveVelocitySelected* is set.

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The *stopOnError* functionality is deactivated in the configuration. An error occurred while processing *moveVelocity* command. The corresponding error code is written to the output *status*. After the error is cleared, e. g. by resetting the command inputs, the output *error* is reset and *valid* is set. Reset of the diagnostic information is done with the next rising edge of *execute*.

3. The *stopOnError* functionality is activated in the configuration. When the error occurs during *moveVelocity* command is active, a fast stop command will be executed automatically to stop the axis. The error is cleared when fast stop command is finished.
4. When the axis is disabled, the output *axisEnabled* is reset after stopping axis movements. The outputs *busy* and *valid* are set as long as the function block is processing. By deactivating the function block the output *status* changes to STATUS_NO_CALL.

Automatic abort of waiting synchronous commands

This additional functionality is automatically aborting waiting synchronous commands (camIn, gearInAbsolute) if a new basic motion functionality is selected.

NOTE By default “Abort of waiting synchronous commands” is enabled (TRUE). For disabling the functionality the <configuration>.generalSettings.abortWaitingSyncCmd must be reset.

Change setpoint values on the fly

By default the motion control commands only accept a new parameterization (e.g. setpoint velocity or position) when a rising edge at the *execute* input is detected. The “Change setpoint on the fly” functionality allows changing setpoint values while the command is active (input is set) without retriggering.

NOTE By default “Change setpoint on the fly” is disabled (FALSE). For enabling the functionality the respective parameter must be set in configuration, e.g. for positioning <configuration>.posAbsolute.positionChangeOnTheFly.

Direction parameter in relative positioning commands

This functionality offers the possibility to specify the direction of relative positioning commands (*posRelative* or *posSuperimposed*) via configuration parameter. That’s equivalent to the direction parameterization of the absolute positioning command (*posAbsolute*) in case of modulo axes. If the direction is set to positive or negative the sign of the distance is not taken into account.

NOTE By default the direction is set by the sign of the distance parameter. If a movement in positive or negative direction is required and the sign should not be taken into account, the parameter <configuration>.posRelative.direction or <configuration>.posSuperimposed.direction have to be changed.

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Keep synchronous operation active when disabling slave axis

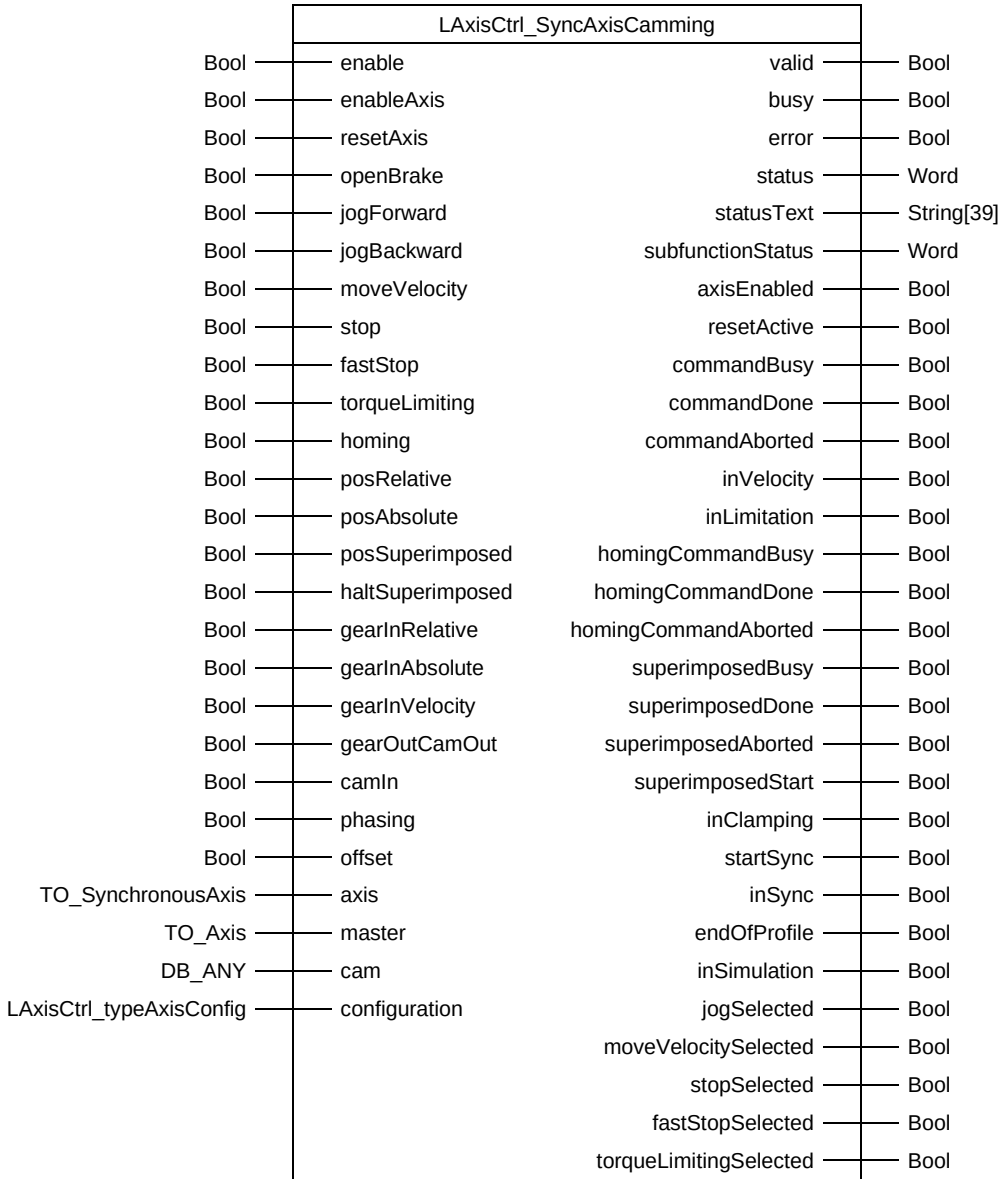
With this functionality an active synchronous operation on the following axis, controlled by the axis FB, can be simulated. As a result, a synchronous operation remains active when the axis is disabled by resetting the *enableAxis* input. The axis does not have to be synchronized again after being enabled again. This can be used to keep an axis synchronized e.g. when safety doors are opened.

NOTE By default the simulation of synchronous operation is disabled. For enabling the functionality the parameter <configuration>.power.syncMotionSimulation has to be set.

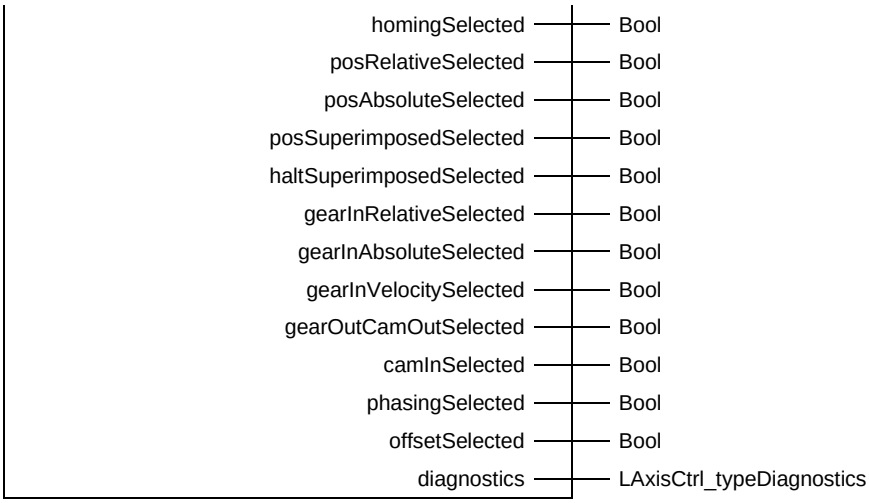
2.2.5 FB LAxisCtrl_SyncAxisCamming (FB 30600)

Figure

Figure 2-3: Block diagram of *LAxisCtrl_SyncAxisCamming*



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Principle of operation

The LAxisCtrl_SyncAxisCamming function block allows operating a synchronous axis with a S7-1500T CPU or a S7-1200 G2 CPU.

For using the LAxisCtrl_SyncAxisCamming function block it is mandatory to connect an axis of data type TO_SynchronousAxis to input *axis.*

Furthermore it is necessary to connect a master axis (at least data type TO_PositioningAxis) or an external encoder at the input *master*.

If no camming functionality is required, the input *cam* can be left unconnected.

Supported functionalities:

- Enable / disable axis
- Reset of an axis (acknowledgment of the errors at the technology object / restart of the technology object)
- Jogging (incremental / continuous)
- Move axis at velocity / speed setpoint (position-controlled / non position-controlled)
- Stop / fast stop
- Moving / stopping an axis with force / torque limiting with and without fixed stop detection
- Homing (active / passive / setting of a position value / absolute encoder adjustment / homing on fixed stop)
- Positioning (absolute / relative)
- Superimposed relative positioning
- Superimposed halt
- Gearing (absolute / relative / velocity)
- Camming (offset and scaling for master and slave, cyclic and non-cyclic cam disk, different synchronization modes)
- Gear out / cam out
- Phasing (shift leading value of an existing synchronous operation)
- Offset (shift following value of an existing synchronous operation)

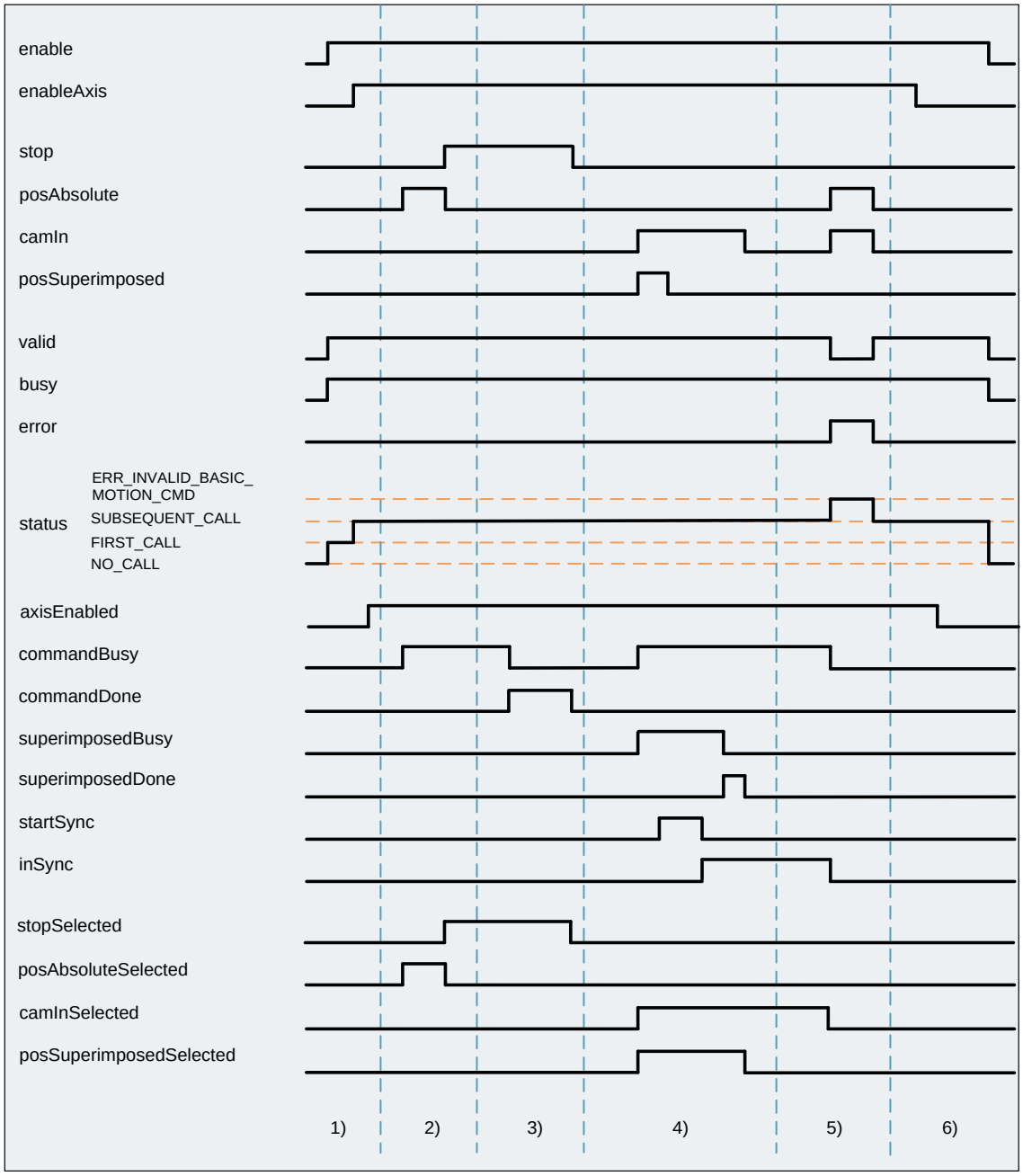
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- Stop and disable a slave axis without desynchronizing (synchronizedMotionSimulation)
- Changing the velocity, position, gear ratio, phase shift and offset on-the-fly
- Unconditionally opening and closing of the holding brake

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Function characteristics

Figure 2-4: Timing diagram of the LAxisCtrl_SyncAxisCamming function block



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1. The function block is activated by setting the *enable* input. After enabling the FB, the output status is changing to STATUS_FIRST_CALL and afterwards to STATUS_SUBSEQUENT_CALL. In these states the axis can be enabled by setting the input *enableAxis*. After enabling the axis, the output *axisEnabled* is set and the technology object accepts motion control commands. With enabling the axis, the position-controlled or non position-controlled mode is activated at the axis and the actual values of the axis are valid. The processing of the FB is indicated with *busy* = TRUE and *valid* = TRUE.
2. An absolute positioning command is executed with a rising edge at the input *posAbsolute*. When processing the functionality, the respective output *posAbsoluteSelected* is set.
   While positioning is active a stop command is triggered. To show that a stop command is active the output *stopSelected* is set. An active basic motion command is indicated via the *commandBusy* output. Only one basic motion command can be active at the same time.
3. The output *commandBusy* is set as long as the command is not finished. When the axis is in standstill (standstill window reached), the output *commandDone* is set at least one cycle and at most as long as the input *stop* is set. *stopSelected* is handled in the same way as the *commandDone* output.
4. A camming operation is started with a rising edge at the input *camIn*. At the same time a superimposed positioning command is started via input *posSuperimposed*. The outputs *commandBusy*, *superimposedBusy*, *camInSelected* and *posSuperimposedSelected* show that both motion commands are active at once. When the axis reached the superimposed position, the output *superimposedBusy* is reset and *superimposedDone* is set at least one cycle and at most as long as the input *posSuperimposed* is set. If the start condition of the synchronization is fulfilled, the output *startSync* is set. After successful synchronization the output *inSync* is set.
5. An error occurred while processing a motion command. The corresponding error code is written to the output *status*. After the error is cleared, e. g. by resetting the command inputs, the output *error* is reset and *valid* is set. Reset of the diagnostic information is done with the next rising edge of *execute*.
6. When the axis is disabled, the output *axisEnabled* is reset after stopping axis movements. The outputs *busy* and *valid* are set as long as the function block is processing. By deactivating the function block the output *status* changes to STATUS_NO_CALL.

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Input parameters

Table 2-8 Input parameters of *LAxisCtrl_SyncAxisCamming*

Parameter	Data type	Comment
enable	Bool	TRUE: Enable functionality of FB
enableAxis	Bool	TRUE: Set axis enable; FALSE: Remove axis enable. MC_Power is used internally
resetAxis	Bool	Rising edge: Acknowledgment of technology alarms or restart of the axis (depending on configuration). MC_Reset is used internally
openBrake	Bool	TRUE: Unconditionally open holding brake if axis is not enabled (e.g. for service purposes). Note: Do not modify this input while disabling of the axis is active (input enableAxis := FALSE and output axisEnabled = TRUE). MC_SetAxisSTW is used internally
jogForward	Bool	Rising edge: Move an axis in jog mode (forward); Falling edge: Stop jogging. MC_MoveJog is used internally
jogBackward	Bool	Rising edge: Move an axis in jog mode (backward); Falling edge: Stop jogging. MC_MoveJog is used internally
moveVelocity	Bool	Rising edge: Move an axis at constant velocity/speed. MC_MoveVelocity is used internally
stop	Bool	Rising edge: Brake an axis until it comes to a standstill. Note: MC_Halt is triggered internally
fastStop	Bool	Rising edge: Brake an axis until it comes to a standstill (with fastStop dynamics). Note: MC_Halt is triggered internally
torqueLimiting	Bool	TRUE: Enable force/torque limiting. MC_TorqueLimiting is used internally
homing	Bool	Rising edge: Home axis. MC_Home is used internally
posRelative	Bool	Rising edge: Move an axis relative to its position when execution of the job began. MC_MoveRelative is used internally
posAbsolute	Bool	Rising edge: Move an axis to an absolute position. MC_MoveAbsolute is used internally
posSuperimposed	Bool	Rising edge: Start a superimposed positioning. MC_MoveSuperimposed is used internally
haltSuperimposed	Bool	Rising edge: Decelerate a superimposed motion to zero velocity. MC_HaltSuperimposed is used internally
gearInRelative	Bool	Rising edge: Start a gearing operation (relative). MC_GearIn is used internally
gearInAbsolute	Bool	Rising edge: Start a gearing operation (absolute). MC_GearInPos is used internally
gearInVelocity	Bool	Rising edge: Start a gearing operation (velocity synchronous). MC_GearInVelocity is used internally
gearOutCamOut	Bool	Rising edge: End a gearing/camming operation. MC_GearOut/MC_CamOut is used internally
camIn	Bool	Rising edge: Start a camming operation. MC_CamIn is used internally
phasing	Bool	Rising edge: Start a phasing operation. MC_PhasingRelative/MC_PhasingAbsolute is used internally
offset	Bool	Rising edge: Start an offset operation. MC_OffsetRelative/MC_OffsetAbsolute is used internally

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Parameter	Data type	Comment
axis	TO_SynchronousAxis	Reference to axis technology object to be controlled
master	TO_Axis	Reference to leading axis technology object for synchronous motion
cam	DB_ANY	Cam technology object
configuration	LAxisCtrl_typeAxisConfig	Structure for parameters

Output parameters

Table 2-9 Output parameters of *LAxisCtrl_SyncAxisCamming*

Parameter	Data type	Comment
valid	Bool	TRUE: Valid set of output values available at the FB
busy	Bool	TRUE: FB is working and new output values can be expected
error	Bool	TRUE: An error occurred while processing the FB
status	Word	Current status of FB (16#0000 - 16#7FFF: Status of the FB, 16#8000 - 16#FFFF: Error identification)
statusText	String[#STATUS_TEXT_LENGTH]	Text of current status of FB
subfunctionStatus	Word	Status of internally called subfunctions (ErrorID of Motion Control instructions)
axisEnabled	Bool	TRUE: The technology object is enabled. Motion commands can be executed.
resetActive	Bool	TRUE: Reset/Restart of the axis is active
commandBusy	Bool	TRUE: The selected basic motion command is being executed
commandDone	Bool	TRUE: The selected basic motion command has completed without error
commandAborted	Bool	TRUE: The selected basic motion command has been aborted
inVelocity	Bool	TRUE: The setpoint velocity/speed was reached and will be maintained
inLimitation	Bool	TRUE: The drive is operating at the force/torque limit
homingCommandBusy	Bool	TRUE: Homing command is being executed
homingCommandDone	Bool	TRUE: Homing command has completed without error
homingCommandAborted	Bool	TRUE: Homing command has been aborted
superimposedBusy	Bool	TRUE: The selected superimposed motion command is being executed
superimposedDone	Bool	TRUE: The selected superimposed motion command has completed without error
superimposedAborted	Bool	TRUE: The selected superimposed motion command has been aborted
superimposedStart	Bool	TRUE: The selected superimposed motion is active
inClamping	Bool	TRUE: The drive is kept at the fixed stop (clamping), the axis position is within the positioning tolerance

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Parameter	Data type	Comment
startSync	Bool	TRUE: The axis is synchronizing to the leading axis / desynchronizing from the leading axis (Note: signal is only valid for the currently selected synchronous functionality, see outputs 'gearInAbsoluteSelected', 'gearInVelocitySelected', 'gearOutCamOutSelected' or 'camInSelected')
inSync	Bool	TRUE: The axis is synchronized to the leading axis (Note: signal is only valid for the currently selected synchronous functionality, see outputs 'gearInRelativeSelected', 'gearInAbsoluteSelected', 'gearInVelocitySelected' or 'camInSelected')
endOfProfile	Bool	TRUE: The end of the cam has been reached. The output is displayed for at least one call when the cam is used cyclically
inSimulation	Bool	TRUE: Synchronous operation is being simulated
jogSelected	Bool	TRUE: Jogging is active
moveVelocity Selected	Bool	TRUE: Moving with constant velocity/speed is active
stopSelected	Bool	TRUE: Stopping is active
fastStopSelected	Bool	TRUE: Stopping is active (with fastStop dynamics)
torqueLimiting Selected	Bool	TRUE: Force/Torque limiting is active
homingSelected	Bool	TRUE: Homing is active
posRelative Selected	Bool	TRUE: Relative positioning is active
posAbsolute Selected	Bool	TRUE: Absolute positioning is active
posSuperimposed Selected	Bool	TRUE: Superimposed positioning is active (See also outputs: superimposedBusy, superimposedDone, superimposedAborted)
haltSuperimposed Selected	Bool	TRUE: Superimposed halting is active (See also outputs: superimposedBusy, superimposedDone, superimposedAborted)
gearInRelative Selected	Bool	TRUE: Relative gearing is active (See also outputs: commandBusy, commandDone, commandAborted, inSync)
gearInAbsolute Selected	Bool	TRUE: Absolute gearing is active (See also outputs: commandBusy, commandDone, commandAborted, startSync, inSync)
gearInVelocity Selected	Bool	TRUE: Velocity gearing is active (See also outputs: commandBusy, commandDone, commandAborted, startSync, inSync)
gearOutCamOut Selected	Bool	TRUE: End a gearing/camming operation is active (See also outputs: commandBusy, commandDone, commandAborted, startSync)
camInSelected	Bool	TRUE: Camming is active (See also outputs: commandBusy, commandDone, commandAborted, startSync, inSync)
phasingSelected	Bool	TRUE: Phasing is active (See also outputs: superimposedBusy, superimposedDone, superimposedAborted, superimposedStart)

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Parameter	Data type	Comment
offsetSelected	Bool	TRUE: Offset is active (See also outputs: superimposedBusy, superimposedDone, superimposedAborted, superimposedStart)
diagnostics	LAxisCtrl_type Diagnostics	Diagnostics structure

Status displays

Table 2-10 *LAxisCtrl_SyncAxisCamming* status displays

Status	Meaning	Remedy / notes
16#7000	STATUS_NO_CALL	No call of FB
16#7001	STATUS_FB_FIRST_CALL	First cycle of FB after enabling
16#7002	STATUS_SUBSEQUENT_CALL	FB enabled

Error displays for wrong operation

Table 2-11 *LAxisCtrl_SyncAxisCamming* error displays for wrong operation

Status	Meaning	Remedy / notes
16#8001	ERR_INVALID_BASIC_MOTION_CMD	Invalid basic command selected (e.g. rising edge at 2 or more basic motion command inputs)
16#8002	ERR_INVALID_EXTENDED_CMD	Invalid extended command selected (e.g. rising edge at torque limiting and homing on fixed stop)
16#8003	ERR_INVALID_SUPERIMPOSED_ MOTION_CMD	Invalid superimposed command selected (e.g. rising edge at 2 or more superimposed motion command inputs)

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Error displays for wrong parameterization

Table 2-12 *LAxisCtrl_SyncAxisCamming* error displays for wrong parameterization

Status	Meaning	Remedy / notes
16#8201	ERR_INVALID_JOG_MODE	Invalid jog mode selected
16#8202	ERR_INVALID_HOMING_ EXTENDED_MODE	Invalid extended homing mode selected
16#8203	ERR_TORQUE_LIMITING_NOT_ ALLOWED	Error during extended homing command - torque limiting not allowed during homing on fixed stop is active or axis in clamping
16#8204	ERR_INVALID_JOG_DIR	Invalid direction selected (jog forward and jog backward)
16#8205	ERR_INVALID_POS_RELATIVE_DIR	Invalid direction is set for relative positioning command
16#8206	ERR_INVALID_POS_ SUPERIMPOSED_DIR	Invalid direction is set for superimposed positioning command
16#8207	ERR_HOMING_MODE_NOT_ ALLOWED	Passive/Direct homing is not allowed during extended homing mode (homing on fixed stop process) is active
16#8208	ERR_MODULO_NOT_ALLOWED	Extended homing mode (homing on fixed stop process) is not allowed with modulo axis

16#8209	ERR_INVALID_TORQUE_LIMIT	Configured torque limit value for extended homing mode (homing on fixed stop process) = 0
16#820A	ERR_INVALID_VELOCITY	Configured velocity (in technology object) for active homing = 0
16#820C	ERR_INVALID_TARGET_POSITION	Invalid target position configured for extended homing mode
16#820D	ERR_INVALID_GEAROUT_CAMOUT_MODE	Error invalid mode for gearOutCamOut instruction
16#820E	ERR_INVALID_SYNCHRONIZED_EXTENDED_MODE	Error invalid extended mode for synchronized motion simulation functionality

Error displays for internal faults

Table 2-13 *LAxisCtrl_SyncAxisCamming* error displays for internal faults

Status	Meaning	Remedy / notes
16#8600	ERR_MC_POWER	Error occurred during MC_POWER command
16#8601	ERR_MC_RESET	Error occurred during MC_RESET command
16#8602	ERR_MC_HOME	Error occurred during MC_HOME command
16#8603	ERR_MC_TORQUELIMITING	Error occurred during MC_TORQUELIMITING command
16#8604	ERR_MC_HALT	Error occurred during MC_HALT command
16#8605	ERR_MC_MOVEJOG	Error occurred during MC_MOVEJOG command (continuous jogging)
16#8606	ERR_MC_MOVEVELOCITY	Error occurred during MC_MOVEVELOCITY command
16#8607	ERR_MC_MOVERELATIVE	Error occurred during MC_MOVERELATIVE command
16#8608	ERR_MC_MOVEABSOLUTE	Error occurred during MC_MOVEABSOLUTE command
16#8609	ERR_MC_MOVESUPERIMPOSED	Error occurred during MC_MOVESUPERIMPOSED command
16#860A	ERR_MC_GEARIN	Error occurred during MC_GEARIN command
16#860B	ERR_MC_PHASINGABSOLUTE	Error occurred during MC_PHASINGABSOLUTE command
16#860C	ERR_MC_PHASINGRELATIVE	Error occurred during MC_PHASINGRELATIVE command
16#860D	ERR_MC_CAMIN	Error occurred during MC_CAMIN command
16#860E	ERR_MC_GEARINPOS	Error occurred during MC_GEARINPOS command
16#860F	ERR_MC_SYNCHRONIZEDMOTION SIMULATION	Error occurred during MC_SYNCHRONIZEDMOTIONSIMULATION command
16#8610	ERR_MC_OFFSETABSOLUTE	Error occurred during MC_OFFSETABSOLUTE command
16#8611	ERR_MC_OFFSETRELATIVE	Error occurred during MC_OFFSETRELATIVE command
16#8612	ERR_MC_CAMOUT	Error occurred during MC_CAMOUT command
16#8613	ERR_MC_GEAROUT	Error occurred during MC_GEAROUT command

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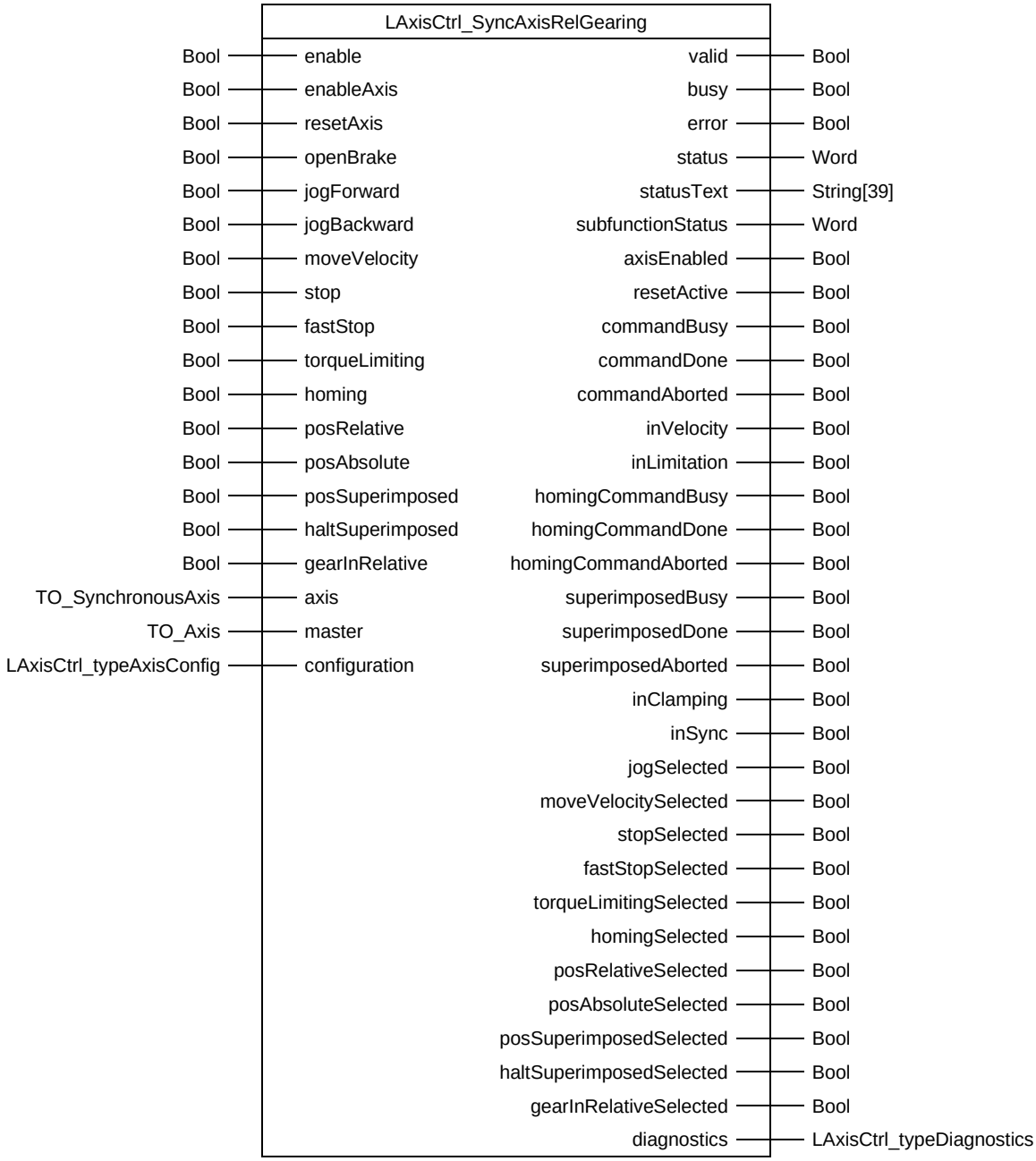
Status	Meaning	Remedy / notes
16#8614	ERR_MC_HALTSUPERIMPOSED	Error occurred during MC_HALTSUPERIMPOSED command
16#8615	ERR_MC_GEARINVELOCITY	Error occurred during MC_GEARINVELOCITY command
16#8700	ERR_UNDEFINED_FB_STATE	Error due to an undefined FB state
16#8701	ERR_UNDEFINED_RESET_STATE	Error due to an undefined reset state
16#8702	ERR_UNDEFINED_BASIC_MOTION _STATE	Error due to an undefined basic motion state
16#8703	ERR_UNDEFINED_TORQUE_ LIMITING_STATE	Error due to an undefined torque limiting state
16#8704	ERR_UNDEFINED_INCREMENTAL_ JOG_STATE	Error due to an undefined incremental jog state
16#8705	ERR_UNDEFINED_INCREMENTAL_ JOG_SUBSTATE	Error due to an undefined incremental jog substate
16#8706	ERR_UNDEFINED_EXTENDED_ HOMING_STATE	Error due to an undefined homing state
16#8707	ERR_UNDEFINED_EXTENDED_ HOMING_SUBSTATE	Error due to an undefined homing substate
16#8708	ERR_UNDEFINED_SUPER IMPOSED_MOTION_STATE	Error due to an undefined superimposed motion state
16#8709	ERR_UNDEFINED_MOTION_ SIMULATION_STATE	Error due to an undefined synchronized motion simulation state
16#870A	ERR_UNDEFINED_MAIN_ SELECTION_STATE	Error due to an undefined main selection state

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2.2.6 FB LAxisCtrl_SyncAxisRelGearing (FB 30601)

Figure

Figure 2-5: Block diagram of *LAxisCtrl_SyncAxisRelGearing*



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Principle of operation

The LAxisCtrl_SyncAxisRelGearing function block allows operating a synchronous axis with a S7-1500 or S7-1500T CPU or a S7-1200 G2 CPU.

For using the LAxisCtrl_SyncAxisRelGearing function block it is mandatory to connect an axis of data type TO_SynchronousAxis to input *axis.*

Furthermore it is necessary to connect a master axis (at least data type TO_PositioningAxis) or an external encoder at the input *master*.

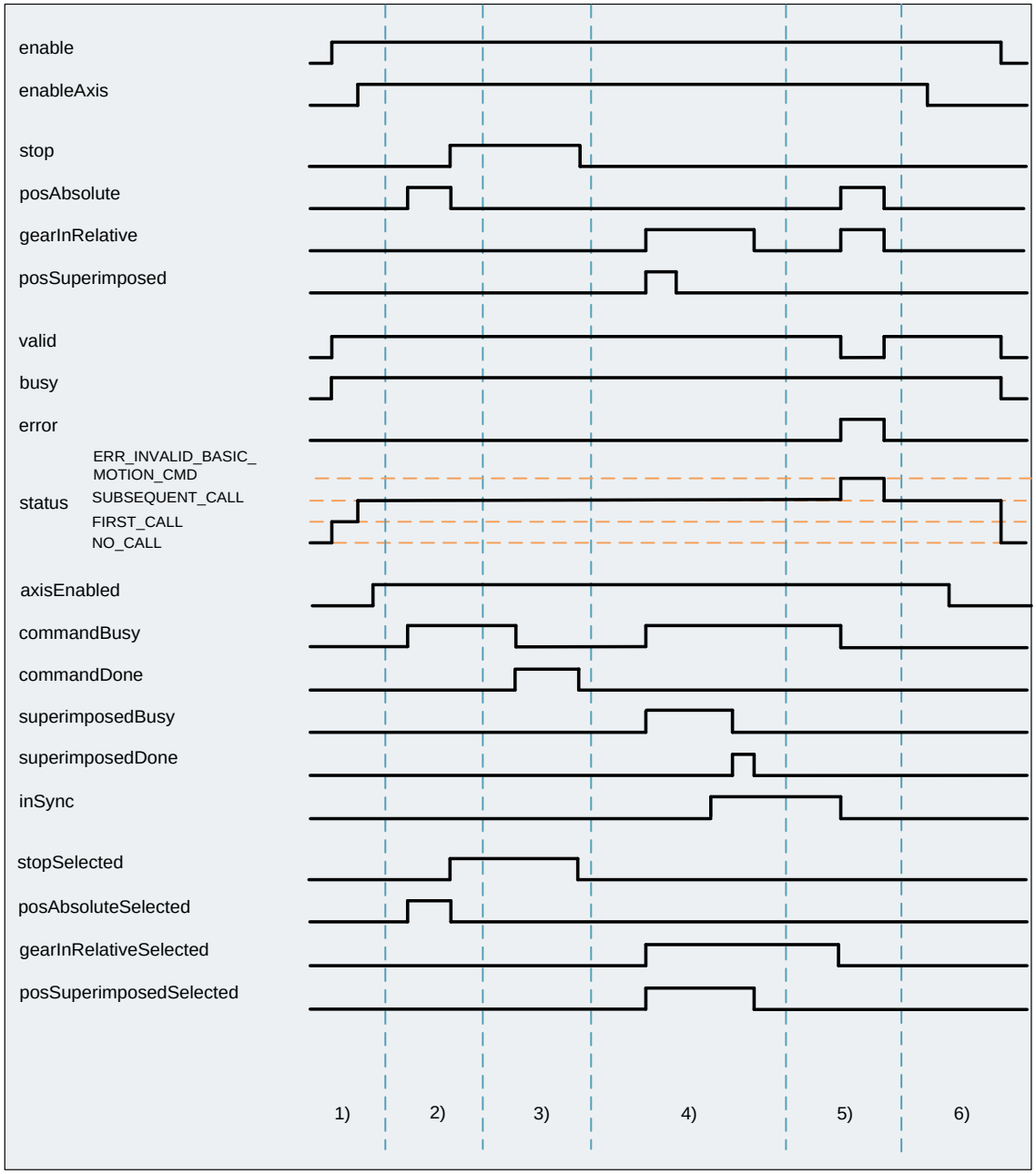
Supported functionalities:

- Enable / disable axis
- Reset of an axis (acknowledgment of the errors at the technology object / restart of the technology object)
- Jogging (incremental / continuous)
- Move axis at velocity / speed setpoint (position-controlled / non position-controlled)
- Stop / fast stop
- Moving / stopping an axis with force / torque limiting with and without fixed stop detection
- Homing (active / passive / setting of a position value / absolute encoder adjustment / homing on fixed stop)
- Positioning (absolute / relative)
- Superimposed relative positioning
- Superimposed halt
- Relative gearing
- Changing the velocity, position and gear ratio on-the-fly
- Unconditionally opening and closing of the holding brake

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Function characteristics

Figure 2-6: Timing diagram of the LAxisCtrl_SyncAxisRelGearing function block



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1. The function block is activated by setting the *enable* input. After enabling the FB, the output status is changing to STATUS_FIRST_CALL and afterwards to STATUS_SUBSEQUENT_CALL. In these states the axis can be enabled by setting the input *enableAxis*. After enabling the axis, the output *axisEnabled* is set and the technology object accepts motion control commands. With enabling the axis, the position-controlled or non position-controlled mode is activated at the axis and the actual values of the axis are valid. The processing of the FB is indicated with *busy* = TRUE and *valid* = TRUE.
2. An absolute positioning command is executed with a rising edge at the input *posAbsolute*. When processing the functionality, the respective output *posAbsoluteSelected* is set.
   While positioning is active a stop command is triggered. To show that a stop command is active the output *stopSelected* is set. An active basic motion command is indicated via the *commandBusy* output. Only one basic motion command can be active at the same time.
3. The output *commandBusy* is set as long as the command is not finished. When the axis is in standstill (standstill window reached), the output *commandDone* is set at least one cycle and at most as long as the input *stop* is set. *stopSelected* is handled in the same way as the *commandDone* output.
4. A relative gearing operation is started with a rising edge at the input *gearInRelative*. At the same time a superimposed positioning command is started via input *posSuperimposed*. The outputs *commandBusy*, *superimposedBusy*, *gearInRelativeSelected* and *posSuperimposedSelected* show that both motion commands are active at once. When the axis reached the superimposed position, the output *superimposedBusy* is reset and *superimposedDone* is set at least one cycle and at most as long as the input *posSuperimposed* is set. After successful synchronization the output *inSync* is set.
5. An error occurred while processing a motion command. The corresponding error code is written to the output *status*. After the error is cleared, e. g. by resetting the command inputs, the output *error* is reset and *valid* is set. Reset of the diagnostic information is done with the next rising edge of *execute*.
6. When the axis is disabled, the output *axisEnabled* is reset after stopping axis movements. The outputs *busy* and *valid* are set as long as the function block is processing. By deactivating the function block the output *status* changes to STATUS_NO_CALL.

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Input parameters

Table 2-14 Input parameters of *LAxisCtrl_SyncAxisRelGearing*

Parameter	Data type	Comment
enable	Bool	TRUE: Enable functionality of FB
enableAxis	Bool	TRUE: Set axis enable; FALSE: Remove axis enable. MC_Power is used internally
resetAxis	Bool	Rising edge: Acknowledgment of technology alarms or restart of the axis (depending on configuration). MC_Reset is used internally
openBrake	Bool	TRUE: Unconditionally open holding brake if axis is not enabled (e.g. for service purposes). Note: Do not modify this input while disabling of the axis is active (input enableAxis := FALSE and output axisEnabled = TRUE). MC_SetAxisSTW is used internally
jogForward	Bool	Rising edge: Move an axis in jog mode (forward); Falling edge: Stop jogging. MC_MoveJog is used internally

Parameter	Data type	Comment
jogBackward	Bool	Rising edge: Move an axis in jog mode (backward); Falling edge: Stop jogging. MC_MoveJog is used internally
moveVelocity	Bool	Rising edge: Move an axis at constant velocity/speed. MC_MoveVelocity is used internally
stop	Bool	Rising edge: Brake an axis until it comes to a standstill. Note: MC_Halt is triggered internally
fastStop	Bool	Rising edge: Brake an axis until it comes to a standstill (with fastStop dynamics). Note: MC_Halt is triggered internally
torqueLimiting	Bool	TRUE: Enable force/torque limiting. MC_TorqueLimiting is used internally
homing	Bool	Rising edge: Home axis. MC_Home is used internally
posRelative	Bool	Rising edge: Move an axis relative to its position when execution of the job began. MC_MoveRelative is used internally
posAbsolute	Bool	Rising edge: Move an axis to an absolute position. MC_MoveAbsolute is used internally
posSuperimposed	Bool	Rising edge: Start a superimposed positioning. MC_MoveSuperimposed is used internally
haltSuperimposed	Bool	Rising edge: Decelerate a superimposed motion to zero velocity. MC_HaltSuperimposed is used internally
gearInRelative	Bool	Rising edge: Start a gearing operation (relative). MC_GearIn is used internally
axis	TO_SynchronousAxis	Reference to axis technology object to be controlled
master	TO_Axis	Reference to leading axis technology for synchronous motion
configuration	LAxisCtrl_typeAxisConfig	Structure for parameters

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Output parameters

Table 2-15 Output parameters of*LAxisCtrl_SyncAxisRelGearing*

Parameter	Data type	Comment
valid	Bool	TRUE: Valid set of output values available at the FB
busy	Bool	TRUE: FB is working and new output values can be expected
error	Bool	TRUE: An error occurred while processing the FB
status	Word	Current status of FB (16#0000 - 16#7FFF: Status of the FB, 16#8000 - 16#FFFF: Error identification)
statusText	String[#STATUS_TEXT_LENGTH]	Text of current status of FB
subfunctionStatus	Word	Status of internally called subfunctions (ErrorID of Motion Control instructions)
axisEnabled	Bool	TRUE: The technology object is enabled. Motion commands can be executed.
resetActive	Bool	TRUE: Reset/Restart of the axis is active
commandBusy	Bool	TRUE: The selected basic motion command is being executed
commandDone	Bool	TRUE: The selected basic motion command has completed without error

Parameter	Data type	Comment
commandAborted	Bool	TRUE: The selected basic motion command has been aborted
inVelocity	Bool	TRUE: The setpoint velocity/speed was reached and will be maintained
inLimitation	Bool	TRUE: The drive is operating at the force/torque limit
homingCommand Busy	Bool	TRUE: Homing command is being executed
homingCommand Done	Bool	TRUE: Homing command has completed without error
homingCommand Aborted	Bool	TRUE: Homing command has been aborted
superimposed Busy	Bool	TRUE: The selected superimposed motion command is being executed
superimposed Done	Bool	TRUE: The selected superimposed motion command has completed without error
superimposed Aborted	Bool	TRUE: The selected superimposed motion command has been aborted
inClamping	Bool	TRUE: The drive is kept at the fixed stop (clamping), the axis position is within the positioning tolerance
inSync	Bool	TRUE: The axis is synchronized to the leading axis
jogSelected	Bool	TRUE: Jogging is active
moveVelocity Selected	Bool	TRUE: Moving with constant velocity/speed is active
stopSelected	Bool	TRUE: Stopping is active
fastStopSelected	Bool	TRUE: Stopping is active (with fastStop dynamics)
torqueLimiting Selected	Bool	TRUE: Force/Torque limiting is active
homingSelected	Bool	TRUE: Homing is active
posRelative Selected	Bool	TRUE: Relative positioning is active
posAbsolute Selected	Bool	TRUE: Absolute positioning is active
posSuperimposed Selected	Bool	TRUE: Superimposed positioning is active (See also outputs: superimposedBusy, superimposedDone, superimposedAborted)
haltSuperimposed Selected	Bool	TRUE: Superimposed halting is active (See also outputs: superimposedBusy, superimposedDone, superimposedAborted)
gearInRelative Selected	Bool	TRUE: Relative gearing is active (See also outputs: commandBusy, commandDone, commandAborted, inSync)
diagnostics	LAxisCtrl_type Diagnostics	Diagnostics structure

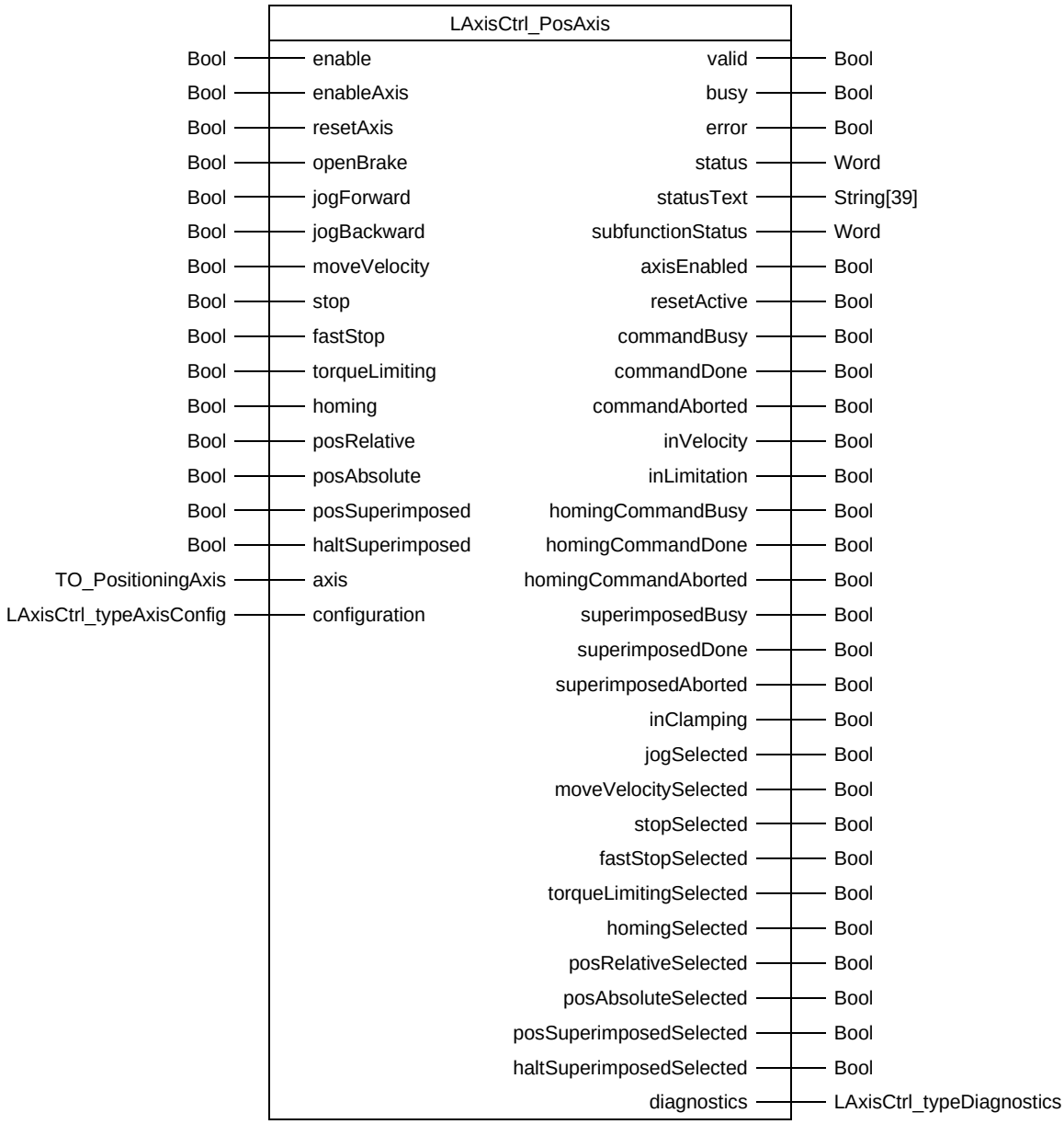
NOTE Status and error displays can be found in chapter 2.2.5

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2.2.7 FB LAxisCtrl_PosAxis (FB 30602)

Figure

Figure 2-7: Block diagram of *LAxisCtrl_PosAxis*



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Principle of operation

The LAxisCtrl_PosAxis function block allows operating a positioning axis with a S7-1500 or S7-1500T CPU or a S7-1200 G2 CPU.

For using the LAxisCtrl_PosAxis function block it is mandatory to connect an axis of data type TO_PositioningAxis or TO_SynchronousAxis to input *axis.*

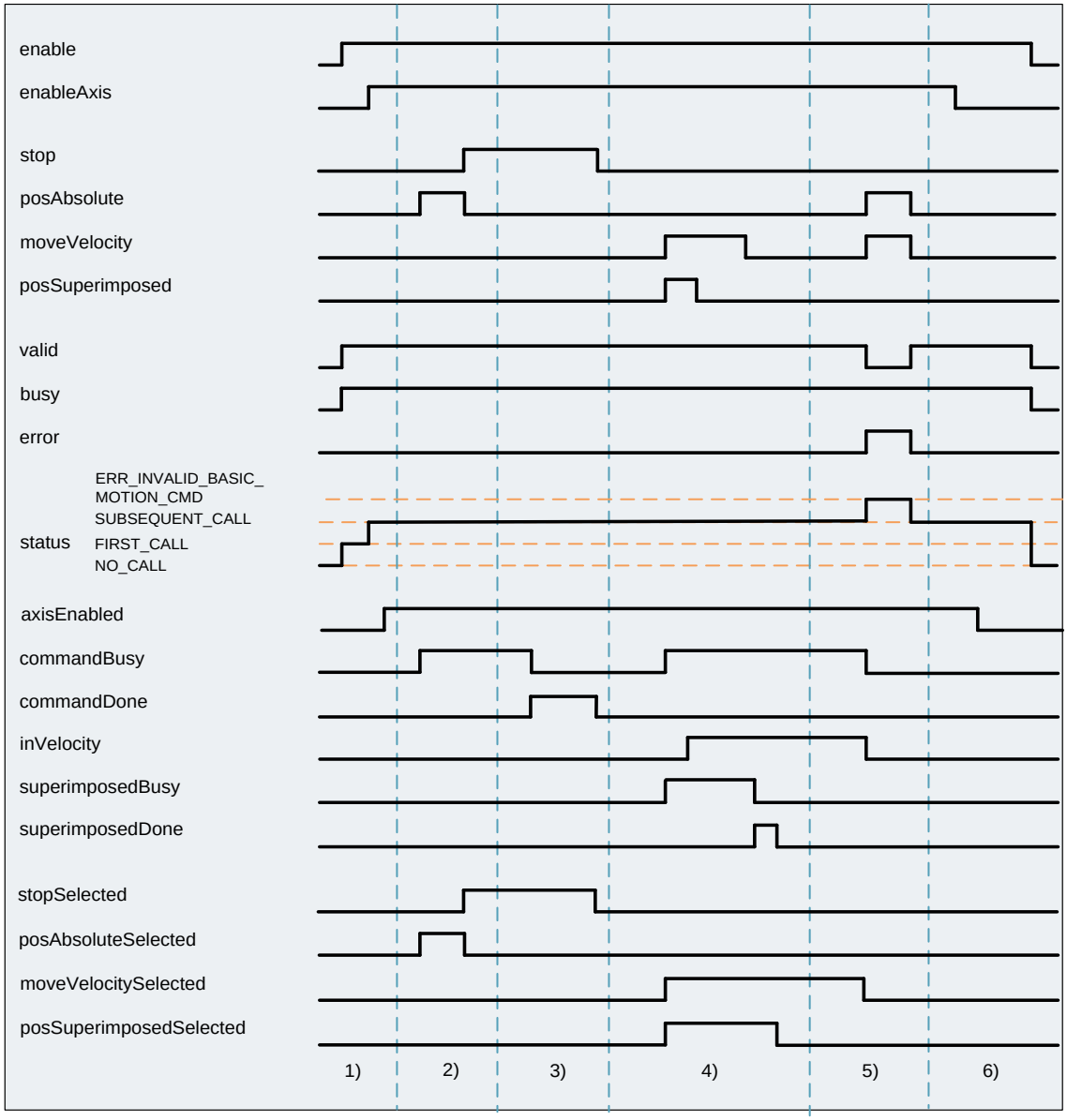
Supported functionalities:

- Enable / disable axis
- Reset of an axis (acknowledgment of the errors at the technology object / restart of the technology object)
- Jogging (incremental / continuous)
- Move axis at velocity / speed setpoint (position-controlled / non position-controlled)
- Stop / fast stop
- Moving / stopping an axis with force / torque limiting with and without fixed stop detection
- Homing (active / passive / setting of a position value / absolute encoder adjustment / homing on fixed stop)
- Positioning (absolute / relative)
- Superimposed relative positioning
- Superimposed halt
- Changing the velocity and position on-the-fly
- Unconditionally opening and closing of the holding brake

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Function characteristics

Figure 2-8: Timing diagram of the LAxisCtrl_PosAxis function block



1. The function block is activated by setting the *enable* input. After enabling the FB, the output status is changing to STATUS_FIRST_CALL and afterwards to STATUS_SUBSEQUENT_CALL. In these states the axis can be enabled by setting the input *enableAxis*. After enabling the axis, the output *axisEnabled* is set and the technology object accepts motion control commands. With enabling the axis, the position-controlled or non position-controlled mode is activated at the axis and the actual values of the axis are valid. The processing of the FB is indicated with *busy* = TRUE and *valid* = TRUE.
2. An absolute positioning command is executed with a rising edge at the input *posAbsolute*. When processing the functionality, the respective output *posAbsoluteSelected* is set.
   While positioning is active a stop command is triggered. To show that a stop command is active the output *stopSelected* is set. An active basic motion command is indicated

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via the *commandBusy* output. Only one basic motion command can be active at the same time.

3. The output *commandBusy* is set as long as the command is not finished. When the axis is in standstill (standstill window reached), the output *commandDone* is set at least one cycle and at most as long as the input *stop* is set. *StopSelected* is handled in the same way as the *commandDone* output.
4. A move velocity operation is started with a rising edge at the input *moveVelocity*. At the same time a superimposed positioning command is started via input *posSuperimposed*. The outputs *commandBusy*, *superimposedBusy*, *moveVelocitySelected* and *posSuperimposedSelected* show that both motion commands are active at once. When the axis reached the superimposed position, the output *superimposedBusy* is reset and *superimposedDone* is set at least one cycle and at most as long as the input *posSuperimposed* is set.
5. An error occurred while processing a motion command. The corresponding error code is written to the output *status*. After the error is cleared, e. g. by resetting the command inputs, the output *error* is reset and *valid* is set. Reset of the diagnostic information is done with the next rising edge of *execute*.
6. When the axis is disabled, the output *axisEnabled* is reset after stopping axis movements. The outputs *busy* and *valid* are set as long as the function block is processing. By deactivating the function block the output *status* changes to STATUS_NO_CALL.

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Input parameters

Table 2-16 Input parameters of *LAxisCtrl_PosAxis*

Parameter	Data type	Comment
enable	Bool	TRUE: Enable functionality of FB
enableAxis	Bool	TRUE: Set axis enable; FALSE: Remove axis enable. MC_Power is used internally
resetAxis	Bool	Rising edge: Acknowledgment of technology alarms or restart of the axis (depending on configuration). MC_Reset is used internally
openBrake	Bool	TRUE: Unconditionally open holding brake if axis is not enabled (e.g. for service purposes). Note: Do not modify this input while disabling of the axis is active (input enableAxis := FALSE and output axisEnabled = TRUE). MC_SetAxisSTW is used internally
jogForward	Bool	Rising edge: Move an axis in jog mode (forward); Falling edge: Stop jogging. MC_MoveJog is used internally
jogBackward	Bool	Rising edge: Move an axis in jog mode (backward); Falling edge: Stop jogging. MC_MoveJog is used internally
moveVelocity	Bool	Rising edge: Move an axis at constant velocity/speed. MC_MoveVelocity is used internally
stop	Bool	Rising edge: Brake an axis until it comes to a standstill. Note: MC_Halt is triggered internally
fastStop	Bool	Rising edge: Brake an axis until it comes to a standstill (with fastStop dynamics). Note: MC_Halt is triggered internally
torqueLimiting	Bool	TRUE: Enable force/torque limiting. MC_TorqueLimiting is used internally
homing	Bool	Rising edge: Home axis. MC_Home is used internally

Parameter	Data type	Comment
posRelative	Bool	Rising edge: Move an axis relative to its position when execution of the job began. MC_MoveRelative is used internally
posAbsolute	Bool	Rising edge: Move an axis to an absolute position. MC_MoveAbsolute is used internally
posSuperimposed	Bool	Rising edge: Start a superimposed positioning. MC_MoveSuperimposed is used internally
haltSuperimposed	Bool	Rising edge: Decelerate a superimposed motion to zero velocity. MC_HaltSuperimposed is used internally
axis	TO_PositioningAxis	Reference to axis technology object to be controlled
configuration	LAxisCtrl_typeAxisConfig	Structure for parameters

Output parameters

Table 2-17 Output parameters of *LAxisCtrl_PosAxis*

Parameter	Data type	Comment
valid	Bool	TRUE: Valid set of output values available at the FB
busy	Bool	TRUE: FB is working and new output values can be expected
error	Bool	TRUE: An error occurred while processing the FB
status	Word	Current status of FB (16#0000 - 16#7FFF: Status of the FB, 16#8000 - 16#FFFF: Error identification)
statusText	String[#STATUS_TEXT_LENGTH]	Text of current status of FB
subfunctionStatus	Word	Status of internally called subfunctions (ErrorID of Motion Control instructions)
axisEnabled	Bool	TRUE: The technology object is enabled. Motion commands can be executed.
resetActive	Bool	TRUE: Reset/Restart of the axis is active
commandBusy	Bool	TRUE: The selected basic motion command is being executed
commandDone	Bool	TRUE: The selected basic motion command has completed without error
commandAborted	Bool	TRUE: The selected basic motion command has been aborted
inVelocity	Bool	TRUE: The setpoint velocity/speed was reached and will be maintained
inLimitation	Bool	TRUE: The drive is operating at the force/torque limit
homingCommandBusy	Bool	TRUE: Homing command is being executed
homingCommandDone	Bool	TRUE: Homing command has completed without error
homingCommandAborted	Bool	TRUE: Homing command has been aborted
superimposedBusy	Bool	TRUE: The selected superimposed motion command is being executed
superimposedDone	Bool	TRUE: The selected superimposed motion command has completed without error
superimposed	Bool	TRUE: The selected superimposed motion command has

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Parameter	Data type	Comment
Aborted		been aborted
inClamping	Bool	TRUE: The drive is kept at the fixed stop (clamping), the axis position is within the positioning tolerance
jogSelected	Bool	TRUE: Jogging is active
moveVelocity Selected	Bool	TRUE: Moving with constant velocity/speed is active
stopSelected	Bool	TRUE: Stopping is active
fastStopSelected	Bool	TRUE: Stopping is active (with fastStop dynamics)
torqueLimiting Selected	Bool	TRUE: Force/Torque limiting is active
homingSelected	Bool	TRUE: Homing is active
posRelative Selected	Bool	TRUE: Relative positioning is active
posAbsolute Selected	Bool	TRUE: Absolute positioning is active
posSuperimposed Selected	Bool	TRUE: Superimposed positioning is active (See also outputs: superimposedBusy, superimposedDone, superimposedAborted)
haltSuperimposed Selected	Bool	TRUE: Superimposed halting is active (See also outputs: superimposedBusy, superimposedDone, superimposedAborted)
diagnostics	LAxisCtrl_type Diagnostics	Diagnostics structure

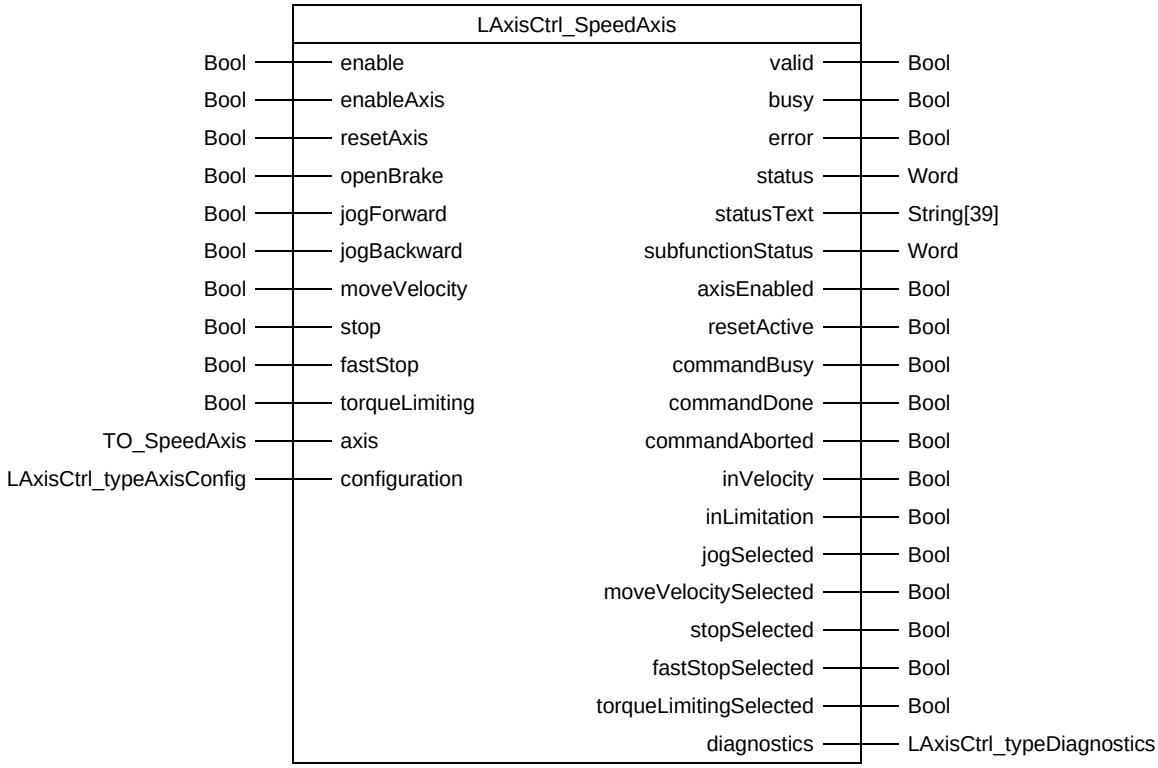
NOTE Status and error displays can be found at 2.2.5

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2.2.8 FB LAxisCtrl_SpeedAxis (FB 30603)

Figure

Figure 2-9: Block diagram of *LAxisCtrl_SpeedAxis*



Principle of operation

The LAxisCtrl_SpeedAxis function block allows operating a speed axis with a S7-1500 or S7-1500T CPU or a S7-1200 G2 CPU.

For using the LAxisCtrl_SpeedAxis function block it is mandatory to connect an axis of data type TO_SpeedAxis, TO_PositioningAxis or TO_SynchronousAxis to input *axis.*

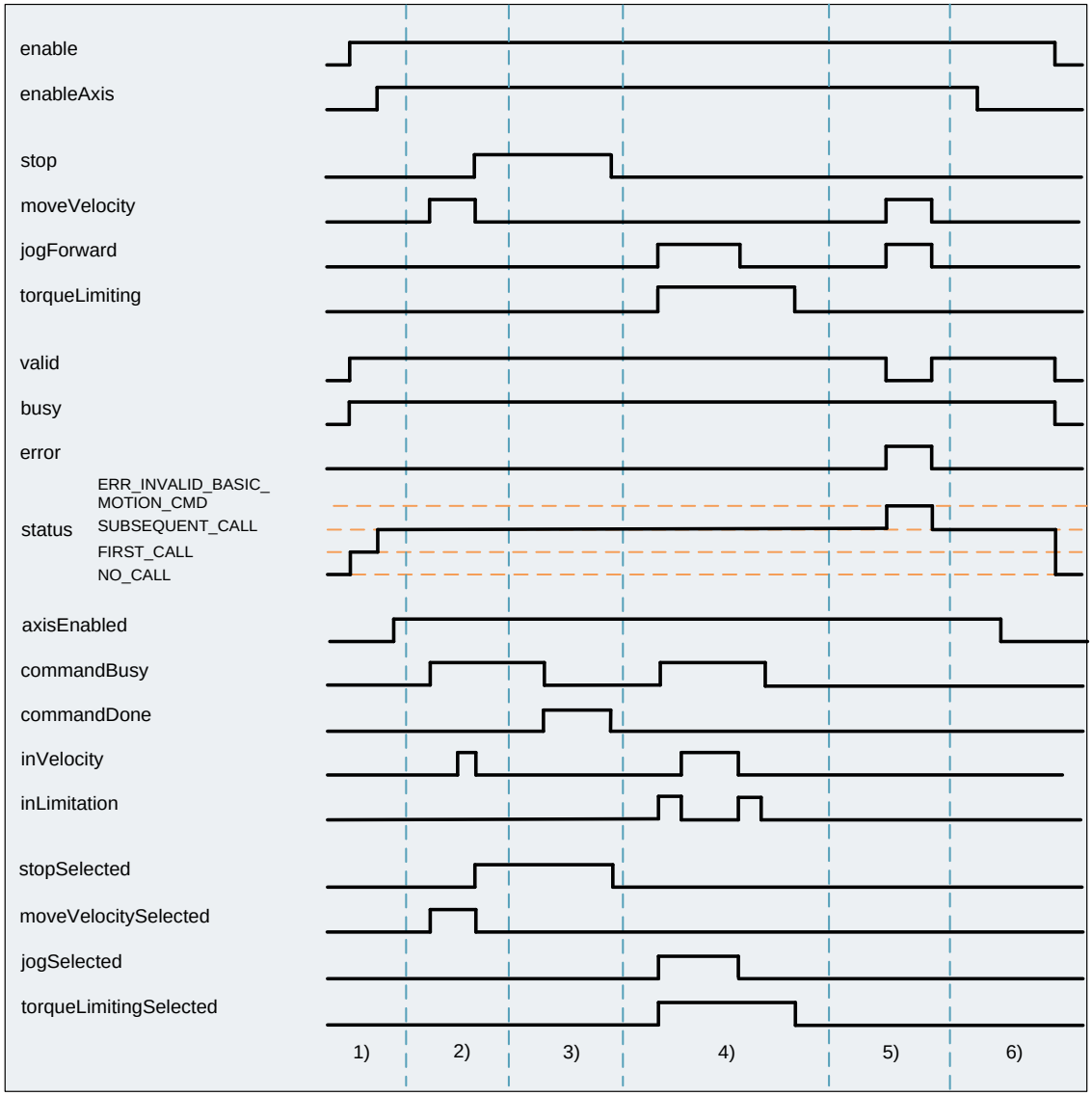
Supported functionalities:

- Enable / disable axis
- Reset of an axis (acknowledgment of the errors at the technology object / restart of the technology object)
- Continuous jogging
- Move axis at velocity / speed setpoint
- Stop / fast stop
- Moving / stopping an axis with force / torque limiting with and without fixed stop detection
- Changing the velocity on-the-fly
- Unconditionally opening and closing of the holding brake

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Function characteristics

Figure 2-10: Timing diagram of the LAxisCtrl_SpeedAxis function block



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1. The function block is activated by setting the *enable* input. After enabling the FB, the output status is changing to STATUS_FIRST_CALL and afterwards to STATUS_SUBSEQUENT_CALL. In these states the axis can be enabled by setting the input *enableAxis*. After enabling the axis, the output *axisEnabled* is set and the technology object accepts motion control commands. With enabling the axis the non position-controlled mode is activated at the axis and the actual values of the axis are valid. The processing of the FB is indicated with *busy* = TRUE and *valid* = TRUE.
2. A move velocity command is executed with a rising edge at the input *moveVelocity*. When processing the functionality, the respective output *moveVelocitySelected* is set. While the movement is active a stop command is triggered. To show that a stop command is active the output *stopSelected* is set. An active basic motion command is indicated via the *commandBusy* output. Only one basic motion command can be active at the same time.
3. The output *commandBusy* is set as long as the command is not finished. When the axis is in standstill (standstill window reached), the output *commandDone* is set at least one cycle and at most as long as the input *stop* is set. *stopSelected* is handled in the same way as the *commandDone* output.
4. A move velocity operation is started with a rising edge at the input *jogForward*. At the same time a torque limiting or force limiting is started via input *torqueLimiting*. The outputs *commandBusy*, *jogSelected* and *torqueLimitingSelected* show that both motion commands are active at once. The torque limiting command is active as long as the input *torqueLimiting* is set. The output *inLimitation* shows that the drive is operating at the force/torque limit (e. g. while acceleration and deceleration of the axis).
5. An error occurred while processing a motion command. The corresponding error code is written to the output *status*. After the error is cleared, e. g. by resetting the command inputs, the output *error* is reset and *valid* is set. Reset of the diagnostic information is done with the next rising edge of *execute*.
6. When the axis is disabled, the output *axisEnabled* is reset after stopping axis movements. The outputs *busy* and *valid* are set as long as the function block is processing. By deactivating the function block the output *status* changes to STATUS_NO_CALL.

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Input parameters

Table 2-18 Input parameters of *LAxisCtrl_SpeedAxis*

Parameter	Data type	Comment
enable	Bool	TRUE: Enable functionality of FB
enableAxis	Bool	TRUE: Set axis enable; FALSE: Remove axis enable. MC_Power is used internally
resetAxis	Bool	Rising edge: Acknowledgment of technology alarms or restart of the axis (depending on configuration). MC_Reset is used internally
openBrake	Bool	TRUE: Unconditionally open holding brake if axis is not enabled (e.g. for service purposes). Note: Do not modify this input while disabling of the axis is active (input enableAxis := FALSE and output axisEnabled = TRUE). MC_SetAxisSTW is used internally
jogForward	Bool	Rising edge: Move an axis in jog mode (forward); Falling edge: Stop jogging. MC_MoveJog is used internally
jogBackward	Bool	Rising edge: Move an axis in jog mode (backward); Falling edge: Stop jogging. MC_MoveJog is used internally
moveVelocity	Bool	Rising edge: Move an axis at constant velocity/speed. MC_MoveVelocity is used internally
stop	Bool	Rising edge: Brake an axis until it comes to a standstill. Note: MC_Halt is triggered internally
fastStop	Bool	Rising edge: Brake an axis until it comes to a standstill (with fastStop dynamics). Note: MC_Halt is triggered internally
torqueLimiting	Bool	TRUE: Enable force/torque limiting. MC_TorqueLimiting is used internally
axis	TO_SpeedAxis	Reference to axis technology object to be controlled
configuration	LAxisCtrl_typeAxisConfig	Structure for parameters

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Output parameters

Table 2-19 Output parameters of *LAxisCtrl_SpeedAxis*

Parameter	Data type	Comment
valid	Bool	TRUE: Valid set of output values available at the FB
busy	Bool	TRUE: FB is working and new output values can be expected
error	Bool	TRUE: An error occurred while processing the FB
status	Word	Current status of FB (16#0000 - 16#7FFF: Status of the FB, 16#8000 - 16#FFFF: Error identification)
statusText	String[#STATUS_TEXT_LENGTH]	Text of current status of FB
subfunctionStatus	Word	Status of internally called subfunctions (ErrorID of Motion Control instructions)
axisEnabled	Bool	TRUE: The technology object is enabled. Motion commands can be executed.
resetActive	Bool	TRUE: Reset/Restart of the axis is active
commandBusy	Bool	TRUE: The selected basic motion command is being executed
commandDone	Bool	TRUE: The selected basic motion command has completed without error
commandAborted	Bool	TRUE: The selected basic motion command has been aborted
inVelocity	Bool	TRUE: The setpoint velocity/speed was reached and will be maintained
inLimitation	Bool	TRUE: The drive is operating at the force/torque limit
jogSelected	Bool	TRUE: Jogging is active
moveVelocity Selected	Bool	TRUE: Moving with constant velocity/speed is active
stopSelected	Bool	TRUE: Stopping is active
fastStopSelected	Bool	TRUE: Stopping is active (with fastStop dynamics)
torqueLimiting Selected	Bool	TRUE: Force/Torque limiting is active
diagnostics	LAxisCtrl_type Diagnostics	Diagnostics structure

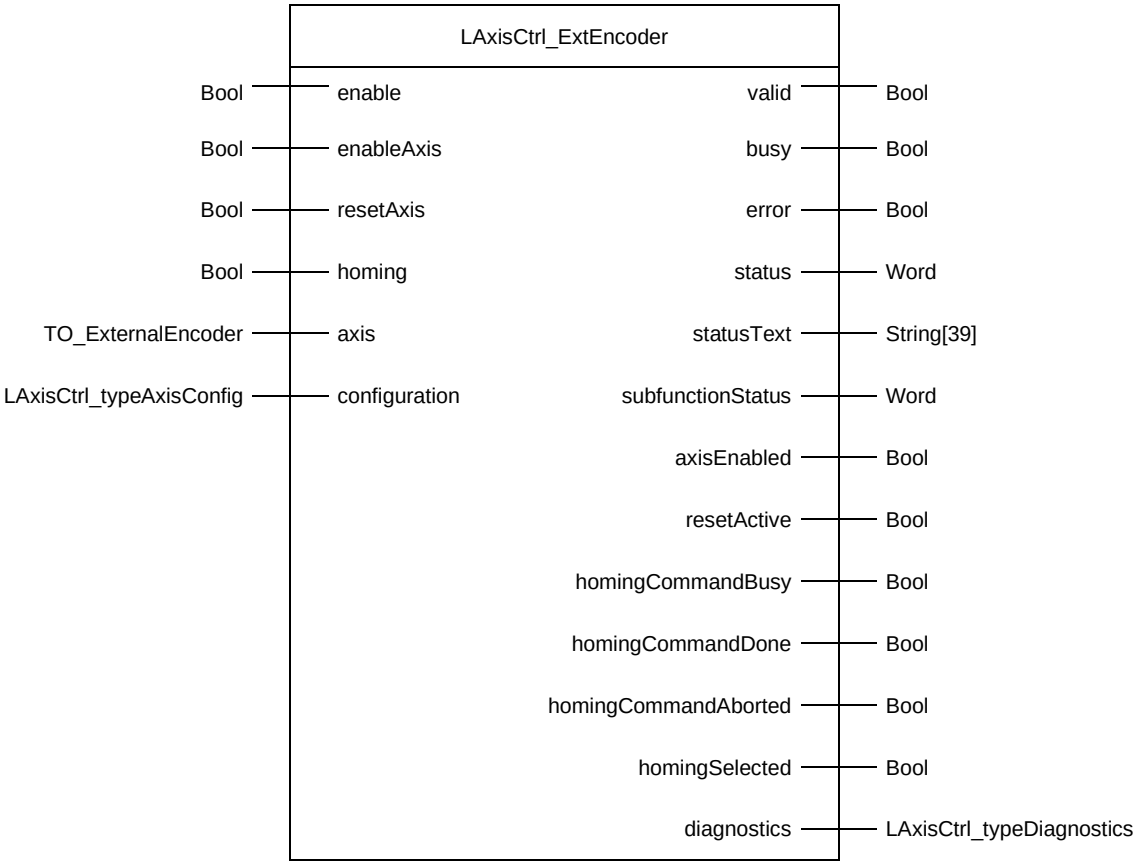
NOTE Status and error displays can be found in chapter 2.2.5

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2.2.9 FB LAxisCtrl_ExtEncoder (FB 30604)

Figure

Figure 2-11: Block diagram of *LAxisCtrl_ExtEncoder*



Principle of operation

The LAxisCtrl_ExtEncoder function block allows operating an external encoder with a S7-1500 or S7-1500T CPU or a S7-1200 G2 CPU.

For using the LAxisCtrl_ExtEncoder function block it is mandatory to connect an external encoder of data type TO_ExternalEncoder to input *axis.*

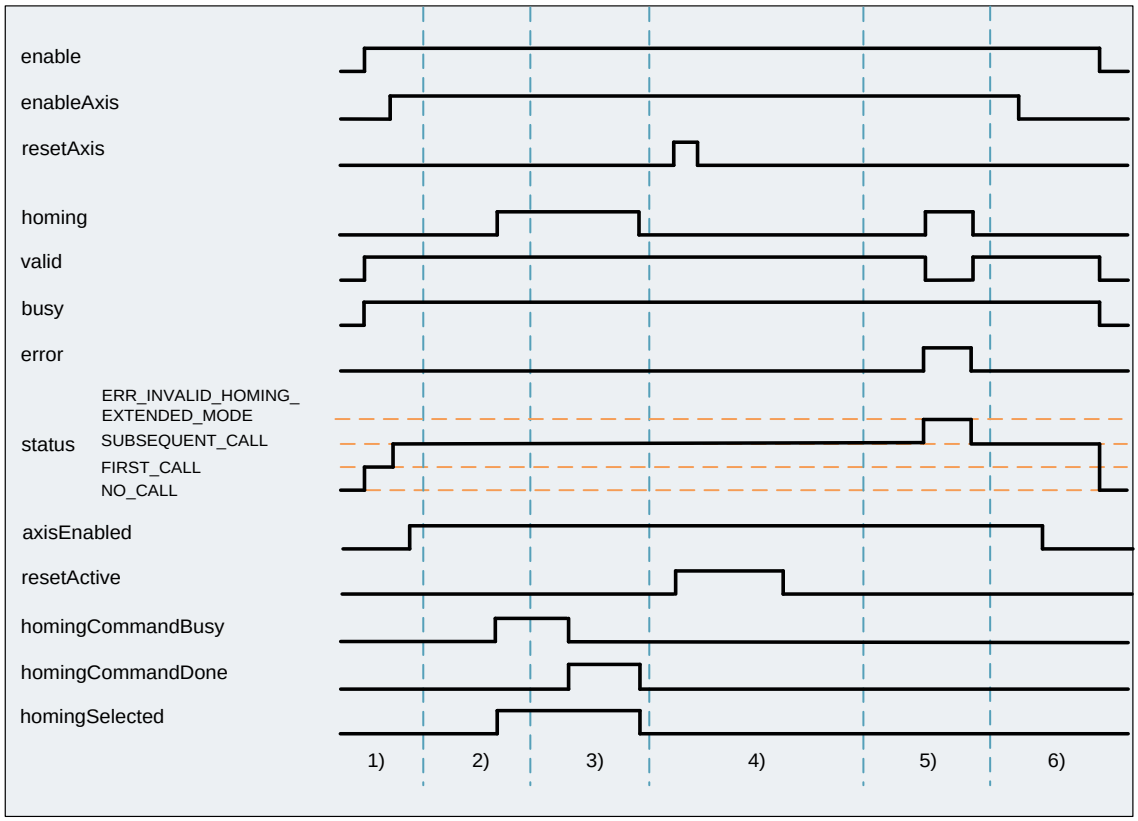
Supported functionalities:

- Enable / disable TO
- Reset of an TO (acknowledgment of the errors at the technology object / restart of the technology object)
- Homing (setting of a position value / absolute encoder adjustment)

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Function characteristics

Figure 2-12: Timing diagram of the LAxisCtrl_ExtEncoder function block



1. The function block is activated by setting the *enable* input. After enabling the FB, the output status is changing to STATUS_FIRST_CALL and afterwards to STATUS_SUBSEQUENT_CALL. In these states the external encoder can be enabled by setting the input *enableAxis*. After enabling the external encoder, the output *axisEnabled* is set and the technology object accepts motion control commands. With enabling the encoder, the actual values of the external encoder are valid. The processing of the FB is indicated with *busy* = TRUE and *valid* = TRUE.
2. A homing command is executed with a rising edge at the input *homing*. When processing the functionality, the respective output *homingSelected* is set. During the homing process the output *homingCommandBusy* is set.
3. The output *homingCommandBusy* is set as long as the command is not finished. When the homing is finished, the output *homingCommandDone* is set at least one cycle and at most as long as the input *homing* is set.
4. A reset operation is started with a rising edge at the input *reset*. As long as the command is busy, the output *resetActive* is set.
5. An error occurred while processing a motion command. The corresponding error code is written to the output *status*. After the error is cleared, e. g. by resetting the command inputs, the output *error* is reset and *valid* is set. Reset of the diagnostic information is done with the next rising edge of *execute*.
6. When the encoder is disabled, the output *axisEnabled* is reset. The outputs *busy* and *valid* are set as long as the function block is processing. By deactivating the function block the output *status* changes to STATUS_NO_CALL.

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Input parameters

Table 2-20 Input parameters of *LAxisCtrl_ExtEncoder*

Parameter	Data type	Comment
enable	Bool	TRUE: Enable functionality of FB
enableAxis	Bool	TRUE: Set axis enable; FALSE: Remove axis enable. MC_Power is used internally
resetAxis	Bool	Rising edge: Acknowledgment of technology alarms or restart of the axis (depending on configuration). MC_Reset is used internally
homing	Bool	Rising edge: Home axis. MC_Home is used internally
axis	TO_ExternalEncoder	Reference to axis technology object to be controlled
configuration	LAxisCtrl_typeAxisConfig	Structure for parameters

Output parameters

Table 2-21 Output parameters of *LAxisCtrl_ExtEncoder*

Parameter	Data type	Comment
valid	Bool	TRUE: Valid set of output values available at the FB
busy	Bool	TRUE: FB is working and new output values can be expected
error	Bool	TRUE: An error occurred while processing the FB
status	Word	Current status of FB (16#0000 - 16#7FFF: Status of the FB, 16#8000 - 16#FFFF: Error identification)
statusText	String[#STATUS_TEXT_LENGTH]	Text of current status of FB
subfunctionStatus	Word	Status of internally called subfunctions (ErrorID of Motion Control instructions)
axisEnabled	Bool	TRUE: The technology object is enabled. Motion commands can be executed.
resetActive	Bool	TRUE: Reset/Restart of the axis is active
homingCommandBusy	Bool	TRUE: Homing command is being executed
homingCommandDone	Bool	TRUE: Homing command has completed without error
homingCommandAborted	Bool	TRUE: Homing command has been aborted
homingSelected	Bool	TRUE: Homing is active
diagnostics	LAxisCtrl_typeDiagnostics	Diagnostics structure

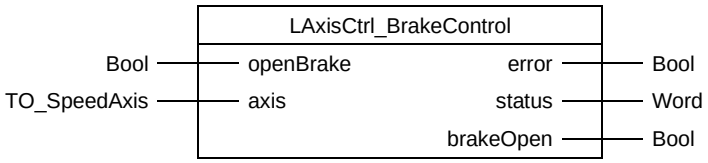
NOTE Status and error displays can be found in chapter 2.2.5

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2.2.10 FB LAxisCtrl_BrakeControl (FB 30608)[1]

Figure

Figure 2-13: Block diagram *of LAxisCtrl_BrakeControl*



Principle of operation

The LAxisCtrl_BrakeControl FB allows the unconditionally opening of a motor holding brake. For enabling the functionality the input *openBrake* must be set. The state of operation can be evaluated at the outputs *brakeOpen* and *status*.

NOTE The LAxisCtrl_BrakeControl FB has to be called in MC-PostServo organization block (OB95).
This block should only be used if the state of the holding brake is needed in the application.

NOTE All PROFIdrive telegrams with STW1 in PZD1 and ZSW2 in PZD4 e.g. telegrams 2-6, 105 or 106 are supported.
Only non-optimized DBs are supported when “Data block” option is chosen in the technology object.

NOTE Correct feedback will be given if parameter p2038 = 1

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Input parameters

Table 2-22: Input parameters of *LAxisCtrl_BrakeControl*

Parameter	Data type	Comment
openBrake	Bool	TRUE: Open holding brake (only valid with a drive that has a holding brake)
axis	TO_SpeedAxis	Reference to the axis of type TO_SpeedAxis, TO_PositioningAxis, TO_SynchronousAxis

Output parameters

Table 2-23: Output parameters of *LAxisCtrl_BrakeControl*

Parameter	Data type	Comment
error	Bool	TRUE: An error occurred while processing the FB
status	Word	Current status of FB (16#0000 - 16#7FFF: Status of the FB, 16#8000 - 16#FFFF: Error identification)
brakeOpen	Bool	TRUE: Holding brake is open (only valid with a drive that has a holding brake)

[1] This block is included in library LAxisCtrl_Addon.

Status and error displays

Table 2-24 *LAxisCtrl_BrakeControl* status and error displays

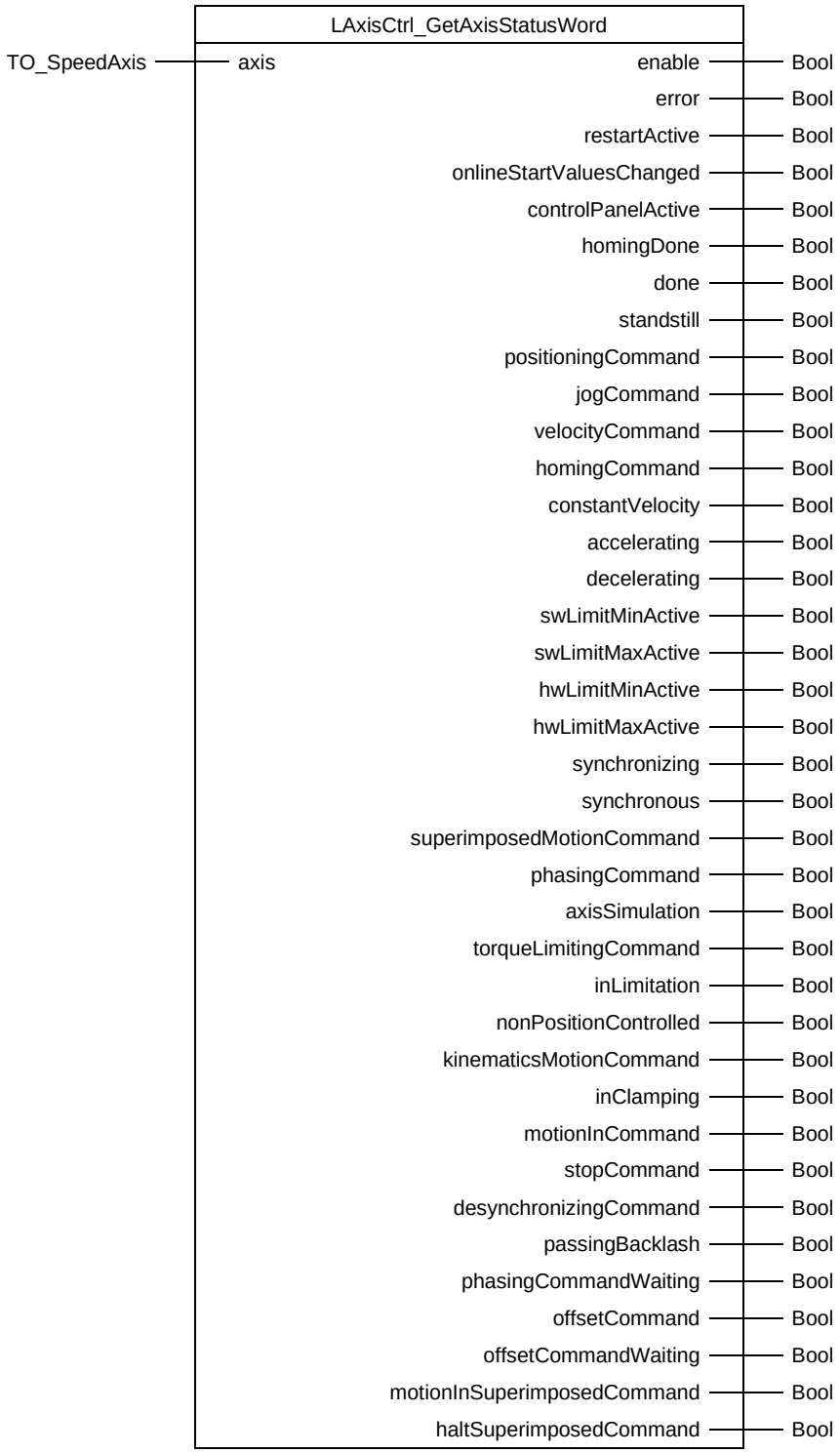
Status	Meaning	Remedy / notes
16#0000	STATUS_DONE	Brake successfully opened
16#7001	STATUS_BUSY	Busy state of FB
16#8401	ERR_OPTIMIZED_DB	Optimized DB is passed to TO; No brake control possible
16#8600	ERR_POKE	Error in POKE_BOOL command occurred
16#8601	ERR_PEEK	Error in PEEK_BOOL command occurred
16#8602	ERR_ATTR_DB	Error in ATTR_DB command occurred

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2.2.11 FB LAxisCtrl_GetAxisStatusWord (FB 30605)

Figure

Figure 2-14: Block diagram *of LAxisCtrl_GetAxisStatusWord*



Principle of operation

The LAxisCtrl_GetAxisStatusWord FB splits the status word of an axis into bits.

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Input parameters

Table 2-25 Input parameters of *LAxisCtrl_GetAxisStatusWord*

Parameter	Data type	Comment
axis	TO_SpeedAxis	Reference to the axis

Output parameters

Table 2-26 Output parameters of *LAxisCtrl_GetAxisStatusWord*

Parameter	Data type	Comment
enable	Bool	TRUE: The technology object has been enabled
error	Bool	TRUE: An error is present
restartActive	Bool	TRUE: A restart is active. The technology object is being reinitialized
onlineStartValues Changed	Bool	TRUE: The restart tags have been changed. For the changes to be applied, the technology object must be reinitialized
controlPanelActive	Bool	TRUE: The axis control panel is active
homingDone	Bool	TRUE: The technology object is homed
done	Bool	TRUE: No motion job is in progress and the axis control panel is deactivated
standstill	Bool	TRUE: The axis is at a standstill
positioningCommand	Bool	TRUE: A positioning command is active ("MC_MoveRelative", "MC_MoveAbsolute")
jogCommand	Bool	TRUE: An "MC_MoveJog" job is running
velocityCommand	Bool	TRUE: An "MC_MoveVelocity" job is running
homingCommand	Bool	TRUE: An "MC_Home" job is being processed
constantVelocity	Bool	TRUE: The velocity setpoint is reached. A constant velocity setpoint is output
accelerating	Bool	TRUE: An acceleration operation is active
decelerating	Bool	TRUE: A deceleration operation is active
swLimitMinActive	Bool	TRUE: A negative software limit switch has been approached or exceeded
swLimitMaxActive	Bool	TRUE: A positive software limit switch has been approached or exceeded
hwLimitMinActive	Bool	TRUE: A negative hardware limit switch has been approached or exceeded
hwLimitMaxActive	Bool	TRUE: A positive hardware limit switch has been approached or exceeded
synchronizing	Bool	TRUE: The axis synchronizes to a leading value
synchronous	Bool	TRUE: The axis moves synchronously to a leading value
superimposedMotion Command	Bool	TRUE: A "MC_MoveSuperimposed" job is running
phasingCommand	Bool	TRUE: A "MC_PhasingAbsolute" or "MC_PhasingRelative" job for the leading value shift is active
axisSimulation	Bool	TRUE: The technology object is in simulation
torqueLimitingCommand	Bool	TRUE: A "MC_TorqueLimiting" job is running

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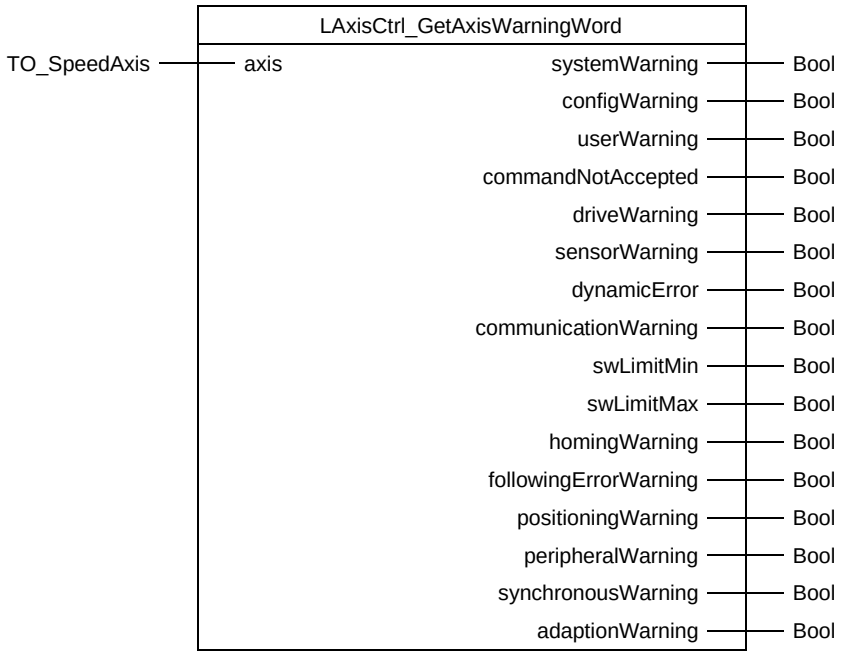
Parameter	Data type	Comment
inLimitation	Bool	TRUE: The drive operates at least at the threshold value (default 90%) of the torque limit/force limitation
nonPositionControlled	Bool	TRUE: The axis is not in position-controlled mode
kinematicsMotion Command	Bool	TRUE: The axis is used for a kinematics job
inClamping	Bool	TRUE: The axis is clamped at a fixed stop
motionInCommand	Bool	TRUE: A "MC_MotionIn" job is active
stopCommand	Bool	TRUE: A "MC_Stop" job is running. The technology object is locked
desynchronizingCommand	Bool	TRUE: A "MC_GearOut" job or "MC_CamOut" job is active. The following axis is desynchronized
passingBacklash	Bool	TRUE: The backlash is traversed. <TO>.ActualPosition does not hereby change
phasingCommandWaiting	Bool	TRUE: A "MC_PhasingAbsolute" or "MC_PhasingRelative" job for leading value shift is waiting
offsetCommand	Bool	TRUE: A "MC_OffsetAbsolute" or "MC_OffsetRelative" job for following value offset is active
offsetCommandWaiting	Bool	TRUE: A "MC_OffsetAbsolute" or "MC_OffsetRelative" job for following value offset is waiting
motionInSuperimposedCommand	Bool	TRUE: A "MC_MotionInSuperimposed" job is running
haltSuperimposedCommand	Bool	TRUE: A "MC_HaltSuperimposed" job is running

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2.2.12 FB LAxisCtrl_GetAxisWarningWord (FB 30606)

Figure

Figure 2-15: Block diagram *of LAxisCtrl_GetAxisWarningWord*



Principle of operation

The LAxisCtrl_GetAxisWarningWord FB is splitting the warning word of an axis into bits.

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Input parameters

Table 2-27 Input parameters of *LAxisCtrl_GetAxisWarningWord*

Parameter	Data type	Comment
axis	TO_SpeedAxis	Reference to the axis

Output parameters

Table 2-28 Output parameters of *LAxisCtrl_GetAxisWarningWord*

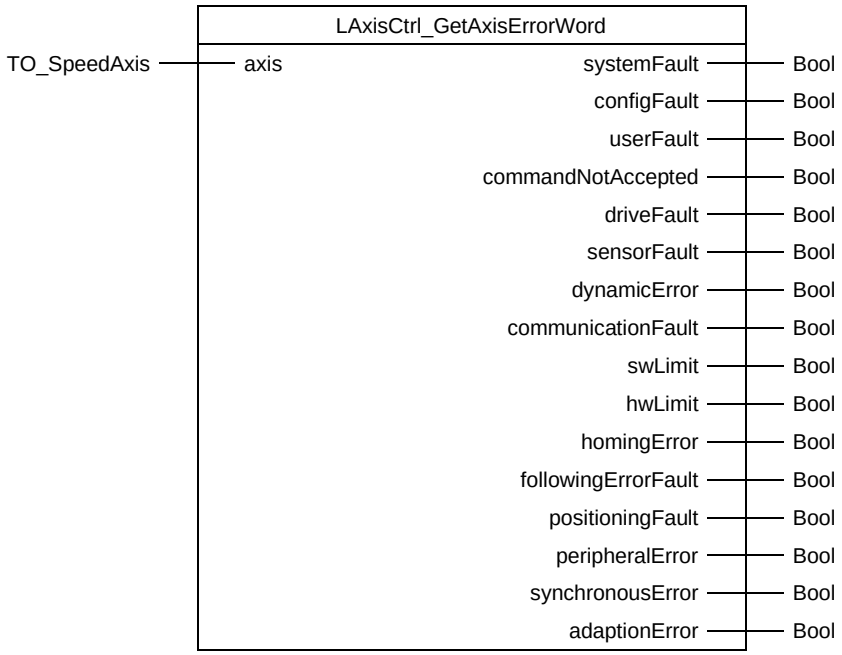
Parameter	Data type	Comment
systemWarning	Bool	TRUE: A system-internal error has occurred
configWarning	Bool	TRUE: Configuration error (One or several configuration parameters are adjusted internally)
userWarning	Bool	TRUE: Error in user program at a Motion Control instruction or its use
commandNotAccepted	Bool	TRUE: Job cannot be executed. A Motion Control instruction cannot be executed because the necessary conditions have not been met
driveWarning	Bool	TRUE: Warning of the drive. When a warning message is pending at the drive that does not result in a TO alarm, this bit is not set. Evaluate the drive warnings directly using the status word of the drive
sensorWarning	Bool	TRUE: Error in encoder system
dynamicError	Bool	TRUE: Specified dynamic values are limited to permissible values
communicationWarning	Bool	TRUE: Communication error (Missing or faulty communication)
swLimitMin	Bool	TRUE: The negative software limit switch has been approached
swLimitMax	Bool	TRUE: The positive software limit switch has been approached
homingWarning	Bool	TRUE: Error during homing operation (The homing cannot be completed)
followingErrorWarning	Bool	TRUE: Warning limit of following error monitoring reached/exceeded
positioningWarning	Bool	TRUE: Positioning error
peripheralWarning	Bool	TRUE: Error accessing a logical address
synchronousWarning	Bool	TRUE: Error during synchronous operation (The leading axis specified in the Motion Control instruction was not configured as a possible leading axis)
adaptionWarning	Bool	TRUE: Error in automatic data transfer

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2.2.13 FB LAxisCtrl_GetAxisErrorWord (FB 30607)

Figure

Figure 2-16: Block diagram *of LAxisCtrl_GetAxisErrorWord*



Principle of operation

The LAxisCtrl_GetAxisErrorWord FB is splitting the error word of an axis into bits.

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Input parameters

Table 2-29 Input parameters of *LAxisCtrl_GetAxisErrorWord*

Parameter	Data type	Comment
axis	TO_SpeedAxis	Reference to the axis

Output parameters

Table 2-30 Output parameters of *LAxisCtrl_GetAxisErrorWord*

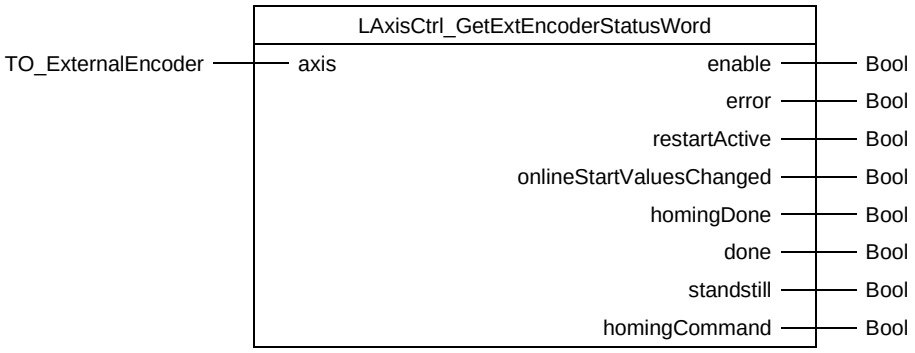
Parameter	Data type	Comment
systemFault	Bool	TRUE: System fault (A system-internal error has occurred)
configFault	Bool	TRUE: Configuration error (One or more configuration parameters are inconsistent or invalid)
userFault	Bool	TRUE: User fault (Error in user program at a Motion Control instruction or its use)
commandNotAccepted	Bool	TRUE: Job cannot be executed. A Motion Control instruction cannot be executed because the necessary conditions have not been met
driveFault	Bool	TRUE: Error in drive
sensorFault	Bool	TRUE: Error in encoder system
dynamicError	Bool	TRUE: Specified dynamic values are limited to permissible values
communicationFault	Bool	TRUE: Communication error (Missing or faulty communication)
swLimit	Bool	TRUE: Software limit switch reached or overtraveled
hwLimit	Bool	TRUE: Hardware limit switch reached or overtraveled
homingError	Bool	TRUE: Error during homing operation (The homing cannot be completed)
followingErrorFault	Bool	TRUE: Following error limits exceeded
positioningFault	Bool	TRUE: Positioning error
peripheralError	Bool	TRUE: Error accessing a logical address
synchronousError	Bool	TRUE: Error during synchronous operation (The leading axis specified in the Motion Control instruction was not configured as a possible leading axis)
adaptionError	Bool	TRUE: Error in automatic data transfer

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2.2.14 FB LAxisCtrl_GetExtEncoderStatusWord (FB 30609)

Figure

Figure 2-17: Block diagram *of LAxisCtrl_GetExtEncoderStatusWord*



Principle of operation

The LAxisCtrl_GetExtEncoderStatusWord FB splits the status word of an external encoder into bits.

Input parameters

Table 2-31 Input parameters of *LAxisCtrl_GetExtEncoderStatusWord*

Parameter	Data type	Comment
axis	TO_ExternalEncoder	Reference to the external encoder

Output parameters

Table 2-32 Output parameters of *LAxisCtrl_GetExtEncoderStatusWord*

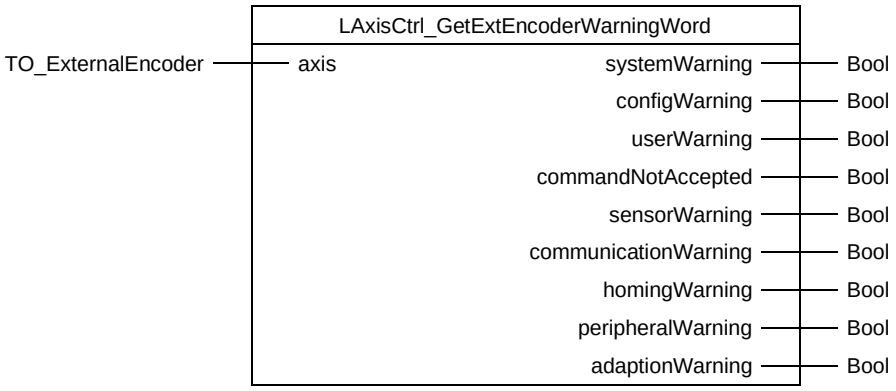
Parameter	Data type	Comment
enable	Bool	TRUE: The technology object has been enabled
error	Bool	TRUE: An error is present
restartActive	Bool	TRUE: A restart is active. The technology object is being reinitialized
onlineStartValues Changed	Bool	TRUE: The restart tags have been changed. For the changes to be applied, the technology object must be reinitialized
homingDone	Bool	TRUE: The technology object is homed
done	Bool	TRUE: No motion job is in progress and the axis control panel is deactivated
standstill	Bool	TRUE: The external encoder is at a standstill
homingCommand	Bool	TRUE: A "MC_Home" job is being processed

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2.2.15 FB LAxisCtrl_GetExtEncoderWarningWord (FB 30610)

Figure

Figure 2-18: Block diagram *of LAxisCtrl_GetExtEncoderWarningWord*



Principle of operation

The LAxisCtrl_GetExtEncoderWarningWord FB is splitting the warning word of an external encoder into bits.

Input parameters

Table 2-33 Input parameters of *LAxisCtrl_GetExtEncoderWarningWord*

Parameter	Data type	Comment
axis	TO_ExternalEncoder	Reference to the external encoder

Output parameters

Table 2-34 Output parameters of *LAxisCtrl_GetExtEncoderWarningWord*

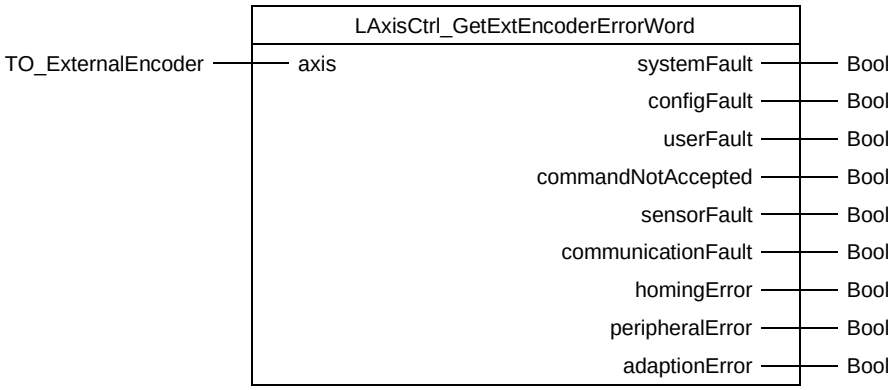
Parameter	Data type	Comment
systemWarning	Bool	TRUE: A system-internal error has occurred
configWarning	Bool	TRUE: Configuration error (One or several configuration parameters are adjusted internally)
userWarning	Bool	TRUE: Error in user program at a Motion Control instruction or its use
commandNotAccepted	Bool	TRUE: Job cannot be executed. A Motion Control instruction cannot be executed because the necessary conditions have not been met
sensorWarning	Bool	TRUE: Error in encoder system
communicationWarning	Bool	TRUE: Communication error (Missing or faulty communication)
homingWarning	Bool	TRUE: Error during homing operation (The homing cannot be completed)
peripheralWarning	Bool	TRUE: Error accessing a logical address
adaptionWarning	Bool	TRUE: Error in automatic data transfer

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2.2.16 FB LAxisCtrl_GetExtEncoderErrorWord (FB 30611)

Figure

Figure 2-19: Block diagram *of LAxisCtrl_GetExtEncoderErrorWord*



Principle of operation

The LAxisCtrl_GetExtEncoderErrorWord FB is splitting the error word of an external encoder into bits.

Input parameters

Table 2-35 Input parameters of *LAxisCtrl_GetExtEncoderErrorWord*

Parameter	Data type	Comment
axis	TO_ExternalEncoder	Reference to the external encoder

Output parameters

Table 2-36 Output parameters of *LAxisCtrl_GetExtEncoderErrorWord*

Parameter	Data type	Comment
systemFault	Bool	TRUE: System fault (A system-internal error has occurred)
configFault	Bool	TRUE: Configuration error (One or more configuration parameters are inconsistent or invalid)
userFault	Bool	TRUE: User fault (Error in user program at a Motion Control instruction or its use)
commandNot Accepted	Bool	TRUE: Job cannot be executed. A Motion Control instruction cannot be executed because the necessary conditions have not been met
sensorFault	Bool	TRUE: Error in encoder system
communication Fault	Bool	TRUE: Communication error (Missing or faulty communication)
homingError	Bool	TRUE: Error during homing operation (The homing cannot be completed)
peripheralError	Bool	TRUE: Error accessing a logical address
adaptionError	Bool	TRUE: Error in automatic data transfer

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2.2.17 PLC data types

LAxisCtrl_typeAxisConfig

Table 2-37: Parameter of *LAxisCtrl_typeAxisConfig*

Parameter	Data type	Comment
generalSettings	LAxisCtrl_typeGeneralSettings	Configuration of general settings
power	LAxisCtrl_typePower	Configuration of MC_POWER function
jog	LAxisCtrl_typeJog	Configuration of JOG function
moveVelocity	LAxisCtrl_typeMoveVelocity	Configuration of MC_MOVEVELOCITY function
stop	LAxisCtrl_typeStop	Configuration of MC_HALT function
fastStop	LAxisCtrl_typeFastStop	Configuration of MC_HALT function (alternative dynamics)
torqueLimiting	LAxisCtrl_typeTorqueLimiting	Configuration of MC_TORQUELIMITING function
homing	LAxisCtrl_typeHoming	Configuration of HOMING function
posRelative	LAxisCtrl_typePosRelative	Configuration of MC_MOVERELATIVE function
posAbsolute	LAxisCtrl_typePosAbsolute	Configuration of MC_MOVEABSOLUTE function
posSuperimposed	LAxisCtrl_typePosSuperimposed	Configuration of MC_MOVESUPERIMPOSED function
haltSuperimposed	LAxisCtrl_typeHaltSuperimposed	Configuration of MC_HALTSUPERIMPOSED function
gearInRelative	LAxisCtrl_typeGearInRelative	Configuration of MC_GEARIN function
gearInAbsolute	LAxisCtrl_typeGearInAbsolute	Configuration of MC_GEARIN_POS function
gearInVelocity	LAxisCtrl_typeGearInVelocity	Configuration of MC_GEARINVELOCITY function
camIn	LAxisCtrl_typeCamIn	Configuration of MC_CAMIN function
gearOutCamOut	LAxisCtrl_typeGearOutCamOut	Configuration of MC_GEAROUT / MC_CAMOUT function
phasing	LAxisCtrl_typePhasing	Configuration of MC_PHASING function
offset	LAxisCtrl_typeOffset	Configuration of MC_OFFSET function

LAxisCtrl_typeGeneralSettings

Table 2-38: Parameter of *LAxisCtrl_typeGeneralSettings*

Parameter	Data type	Comment
stopOnError	Bool	TRUE: In case of error the axis will be stopped automatically with fastStop dynamics (default: TRUE)
resetWithRestart	Bool	TRUE: Reinitialization of the technology object and acknowledgment of pending technology alarms. The technology object is reinitialized with the configured start values; FALSE: Acknowledgment of queued technology alarms (default: FALSE)
abortWaitingSyncCmd	Bool	TRUE: Abort waiting synchronous command (MC_GEARINPOS, MC_CAMIN) in case of new basic motion command automatically (default: TRUE)

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LAxisCtrl_typePower

Table 2-39: Parameter *of LAxisCtrl_typePower*

Parameter	Data type	Comment
startMode	DInt	0: Enable axis not position-controlled; 1: Enable axis position-controlled (This parameter is ignored when a speed axis or external encoder is used) (default: 1)
stopMode	Int	0: Emergency stop; 1: Immediate stop; 2: Stop with maximum dynamic values; 3: Coasting down (default: 0)
syncMotionSimulation	Bool	TRUE: Start the simulation of synchronous operation automatically with falling edge at *enableAxis*; FALSE: No simulation of synchronous operation (default: FALSE)
syncMotionSimulationExtendedMode	Int	Only valid if 'syncMotionSimulation' = TRUE: -1: Start the simulation of synchronous operation only if the axis is in synchronous operation; 0: Start the simulation of synchronous operation independently from the synchronous operation state (default: -1)
externalMC_PowerCall	Bool	TRUE: MC_POWER instance is not called, i.e. the axis can be powered on via an externally called MC_POWER instance. Note: The config flag is directly taken into account. The user is responsible for a consistent changeover. The input 'enableAxis' is not effective. The status of the output 'axisEnabled' is generated via StatusWord Bit 0 and not via MC_Power.STATUS and .BUSY information. The 'syncMotionSimulation' functionality is not working (default: FALSE)

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LAxisCtrl_typeJog

Table 2-40: Parameter of *LAxisCtrl_typeJog*

Parameter	Data type	Comment
velocity	LReal	Velocity for jogging (Value > 0.0: The specified value is used; Value = 0.0: Permitted; Value < 0.0: The absolute value of the specified value is used) (default: 0.0)
acceleration	LReal	Acceleration for jogging (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
deceleration	LReal	Deceleration for jogging (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
jerk	LReal	Jerk for jogging (Value > 0.0: Smooth velocity profile, the specified value is used; Value = 0.0: Trapezoidal velocity profile; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)

Parameter	Data type	Comment
positionControlled	Bool	TRUE: Position-controlled mode; FALSE: Non position-controlled operation (default: TRUE)
increment	LReal	Increment/distance for incremental jogging (default: 0.0)
mode	DInt	0: Continuous jogging; 1: Incremental jogging new increment (starts with new increment); 2: Incremental jogging continue increment (continue the last increment if not completed) (default: 0)

LAxisCtrl_typeMoveVelocity

Table 2-41: Parameter of *LAxisCtrl_typeMoveVelocity*

Parameter	Data type	Comment
velocity	LReal	Velocity/Speed for motion process (Value = 0.0: Permitted). Please see also parameter *direction*. (default: 0.0)
acceleration	LReal	Acceleration setpoint for motion process (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
deceleration	LReal	Deceleration setpoint for motion process (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
jerk	LReal	Jerk for motion process (Value > 0.0: Smooth velocity profile, the specified value is used; Value = 0.0: Trapezoidal velocity profile; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
direction	Int	Motion direction of the axis (0: The sign of the velocity parameter defines the direction; 1: Positive direction; 2: Negative direction) (default: 0)
positionControlled	Bool	TRUE: Position-controlled mode; FALSE: Non position-controlled operation (default: TRUE)
velocityChangeOnTheFly	Bool	TRUE: Changing velocity on-the-fly while the command is active and the corresponding input is set; FALSE: Velocity change requires a new rising edge at *moveVelocity* input (default: FALSE)

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LAxisCtrl_typeStop

Table 2-42: Parameter *of LAxisCtrl_typeStop*

Parameter	Data type	Comment
deceleration	LReal	Deceleration setpoint for stop (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
jerk	LReal	Jerk for stop (Value > 0.0: Smooth velocity profile, the specified value is used; Value = 0.0: Trapezoidal velocity profile; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
abortAcceleration	Bool	TRUE: The acceleration is set to 0.0 at the start of the job, and the deceleration immediately builds up; FALSE: The current acceleration at the start of the job is reduced using the configured jerk. Afterwards, the deceleration builds up (default: FALSE)
haltMode	DInt	Select the motion which is to be stopped (0: The basic motion and the superimposed motion are stopped; 1: The basic motion is stopped. The superimposed motion remains active) (default: 0)

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LAxisCtrl_typeFastStop

Table 2-43: Parameter of *LAxisCtrl_typeFastStop*

Parameter	Data type	Comment
deceleration	LReal	Deceleration for fast stop (Value > 0.0: The specified value is used; Value <= 0.0: Emergency deceleration of the technology object is used) (default: -1.0)
jerk	LReal	Jerk for fast stop (Value > 0.0: Smooth velocity profile, the specified value is used; Value = 0.0: Trapezoidal velocity profile; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
abortAcceleration	Bool	TRUE: The acceleration is set to 0.0 at the start of the job, and the deceleration immediately builds up; FALSE: The current acceleration at the start of the job is reduced using the configured jerk. Afterwards, the deceleration builds up (default: FALSE)
replaceStopPossible	Bool	TRUE: Fast stop command can be replaced by another command (default: FALSE)

LAxisCtrl_typeTorqueLimiting

Table 2-44: Parameter of *LAxisCtrl_typeTorqueLimiting*

Parameter	Data type	Comment
limit	LReal	Value of force/torque limiting (in the configured unit of measurement) (Value >= 0.0: The specified value is used; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
mode	DInt	0: Force/Torque limiting; 1: Fixed stop detection (default: 0)

LAxisCtrl_typeHoming

Table 2-45: Parameter of *LAxisCtrl_typeHoming*

Parameter	Data type	Comment
position	LReal	The specified value is used according to the selected "Mode" (default: 0.0)
mode	Int	Operating mode; 0: Direct homing (absolute); 1: Direct homing (relative); 2: Passive homing (without reset); 3: Active homing; 5: Active homing (Position parameter has no effect); 6: Absolute encoder adjustment (relative); 7: Absolute encoder adjustment (absolute); 8: Passive homing ; 9: Abort passive homing; 10: Passive homing (Position parameter has no effect); 11: Set setpoint position (absolute); 12: Shift the setpoint position (relative); 13: Incremental encoder adjustment (default: 0)
sensor	DInt	Only relevant for S7-1500T: Selection of the absolute encoder ("Mode" = 6, 7) or incremental encoder ("Mode" = 13) to be calibrated; 0: Operative encoder; 1..4: Encoder 1..4 (S7-1500T) (default: 0)
extendedMode	DInt	-1: No extended homing mode (parameter “mode” is effective); 0: Homing on fixed stop; 1: Homing on fixed stop with moving out of clamping; 2: Homing on fixed stop with moving to target position (default: -1)
extendedModeTorque Limit	LReal	Value of the torque/force for extended homing mode (default: 0.0)
extendedModeTarget Position	LReal	Target position when 'extendedMode' = 2

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LAxisCtrl_typePosRelative

Table 2-46: Parameter of *LAxisCtrl_typePosRelative*

Parameter	Data type	Comment
distance	LReal	Distance for the positioning process (default: 0.0)
velocity	LReal	Velocity setpoint for relative positioning (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
acceleration	LReal	Acceleration setpoint for relative positioning (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
deceleration	LReal	Deceleration setpoint for relative positioning (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
jerk	LReal	Jerk for relative positioning (Value > 0.0: Smooth velocity profile, the specified value is used; Value = 0.0: Trapezoidal velocity profile; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
direction	DInt	Motion direction of the axis (0: The sign of the distance parameter defines the direction; 1: Positive direction; 2: Negative direction) (default: 0)

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LAxisCtrl_typePosAbsolute

Table 2-47: Parameter *of LAxisCtrl_typePosAbsolute*

Parameter	Data type	Comment
position	LReal	Absolute target position (default: 0.0)
velocity	LReal	Velocity setpoint for absolute positioning (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
acceleration	LReal	Acceleration setpoint for absolute positioning (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
deceleration	LReal	Deceleration setpoint for absolute positioning (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
jerk	LReal	Jerk for absolute positioning (Value > 0.0: Smooth velocity profile, the specified value is used; Value = 0.0: Trapezoidal velocity profile; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
direction	Int	Motion direction of the axis (1: Positive direction; 2: Negative direction; 3: Shortest way) (default: 1)
positionChangeOnTheFly	Bool	TRUE: Changing position on-the-fly while the command is active and the corresponding input is set; FALSE: Position change requires a new rising edge at *posAbsolute* input (default: FALSE)
velocityChangeOnTheFly	Bool	TRUE: Changing velocity on-the-fly while the command is active and the corresponding input is set; FALSE: Velocity change requires a new rising edge at *posAbsolute* input (default: FALSE)

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LAxisCtrl_typePosSuperimposed

Table 2-48: Parameter *of LAxisCtrl_typePosSuperimposed*

Parameter	Data type	Comment
distance	LReal	Distance for superimposed positioning (default: 0.0)
velocityDiff	LReal	Maximum velocity deviation compared to the active motion (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
acceleration	LReal	Acceleration for positioning (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
deceleration	LReal	Deceleration for positioning (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
jerk	LReal	Jerk for positioning (Value > 0.0: Smooth velocity profile, the specified value is used; Value = 0.0: Trapezoidal velocity profile; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
direction	DInt	Motion direction of the axis (0: The sign of the distance parameter defines the direction; 1: Positive direction; 2: Negative direction) (default: 0)

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LAxisCtrl_typeHaltSuperimposed

Table 2-49: Parameter *of LAxisCtrl_typeHaltSuperimposed*

Parameter	Data type	Comment
deceleration	LReal	Deceleration of the superimposed motion (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: The deceleration configured in "Technology object > Configuration > Extended parameters > Dynamic default values" is used. <TO>.DynamicDefaults.Deceleration) (default: -1.0)
jerk	LReal	Jerk of the superimposed motion (Value > 0.0: Constant-acceleration velocity profile of the superimposed motion; the specified jerk is used; Value = 0.0: Trapezoidal velocity profile of the superimposed motion; Value < 0.0: The jerk configured in "Technology object > Configuration > Extended parameters > Dynamic default values" is used. <TO>.DynamicDefaults.Jerk) (default: -1.0)
abortAcceleration	Bool	TRUE: The acceleration of the superimposed motion is set to 0.0 at the start of the job, the deceleration builds up immediately; FALSE: The current acceleration of the superimposed motion at the start of the job is reduced using the configured jerk. Afterwards, the deceleration builds up (default: FALSE)

LAxisCtrl_typeGearInRelative

Table 2-50: Parameter of *LAxisCtrl_typeGearInRelative*

Parameter	Data type	Comment
ratioNumerator	DInt	Gear ratio numerator (permitted integer values: -2147483648 to 2147483647; value 0 not permitted) (default: 1)
ratioDenominator	DInt	Gear ratio denominator (permitted integer values: 1 to 2147483647) (default: 1)
acceleration	LReal	Acceleration for synchronization (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
deceleration	LReal	Deceleration for synchronization (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
jerk	LReal	Jerk for synchronization (Value > 0.0: Smooth velocity profile, the specified value is used; Value = 0.0: Trapezoidal velocity profile; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
ratioChangeOnTheFly	Bool	TRUE: Changing gear ratio on-the-fly while the command is active and the corresponding input is set; FALSE: Ratio change requires a new rising edge at *gearInRelative* input (default: FALSE)

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LAxisCtrl_typeGearInAbsolute

Table 2-51: Parameter of *LAxisCtrl_typeGearInAbsolute*

Parameter	Data type	Comment
ratioNumerator	DInt	Gear ratio numerator (permitted integer values: -2147483648 to 2147483647; value 0 not permitted) (default: 1)
ratioDenominator	DInt	Gear ratio denominator (permitted integer values: 1 to 2147483647) (default: 1)
masterSyncPosition	LReal	Synchronous position of leading axis (default: 0.0)
slaveSyncPosition	LReal	Synchronous position of following axis (default: 0.0)
syncProfileReference	DInt	Type of synchronization (0: Synchronization in advance using dynamic parameters; 1: Synchronization in advance using leading value distance; 3: Subsequent synchronization using leading value distance; 4: Subsequent synchronization using leading value distance starting from current leading value position with calculated synchronous position of the following axis; 5: Subsequent synchronization using leading value distance with calculated synchronous position of the following axis) (default: 1)
masterStartDistance	LReal	Leading value distance when "SyncProfileReference" = 1, 3, 4, 5 (default: 0.0)
velocity	LReal	Velocity for synchronization (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) when "SyncProfileReference" = 0 (default: -1.0)
acceleration	LReal	Acceleration for synchronization (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) when "SyncProfileReference" = 0 (default: -1.0)
deceleration	LReal	Deceleration for synchronization (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) when "SyncProfileReference" = 0 (default: -1.0)
jerk	LReal	Jerk for synchronization (Value > 0.0: Smooth velocity profile, the specified value is used; Value = 0.0: Trapezoidal velocity profile; Value < 0.0: Use of the default value configured in the technology object) when "SyncProfileReference" = 0 (default: -1.0)
syncDirection	DInt	Direction for synchronization only in effect for axes with activated modulo setting (1: Forward direction; 2: Backward direction; 3: Shortest way) (default: 1)

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Parameter	Data type	Comment
ratioChangeOnTheFly	Bool	TRUE: Changing gear ratio on-the-fly while the command is active and the corresponding input is set; FALSE: Ratio change requires a new rising edge at *gearInAbsolute* input (default: FALSE)

LAxisCtrl_typeGearInVelocity

Table 2-52: Parameter of *LAxisCtrl_typeGearInVelocity*

Parameter	Data type	Comment
continuousUpdate	Bool	TRUE: Specify gear ratio continuously; FALSE: Specify gear ratio once at the start of the job with a positive edge (default: FALSE)
ratioNumerator	DInt	Gear ratio numerator (permitted integer values: -2147483648 to 2147483647; value 0 not permitted) (default: 1)
ratioDenominator	DInt	Gear ratio denominator (permitted integer values: 1 to 2147483647) (default: 1)
acceleration	LReal	Acceleration for the synchronization (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: The acceleration configured in "Technology object > Configuration > Extended parameters > Dynamic default values" is used. <TO>.DynamicDefaults.Acceleration) (default: -1.0)
deceleration	LReal	Deceleration for the synchronization (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: The deceleration configured in "Technology object > Configuration > Extended parameters > Dynamic default values" is used. <TO>.DynamicDefaults.Deceleration) (default: -1.0)
jerk	LReal	Jerk for the synchronization (Value > 0.0: The specified value is used; Value = 0.0: No jerk limitation; Value < 0.0: The jerk configured in "Technology object > Configuration > Extended parameters > Dynamic default values" is used. <TO>.DynamicDefaults.Jerk) (default: -1.0)
positionControlled	Bool	Position control of the following axis (TRUE: Position-controlled mode; FALSE: Non-position-controlled operation) (default: FALSE)

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LAxisCtrl_typeCamIn

Table 2-53: Parameter of *LAxisCtrl_typeCamIn*

Parameter	Data type	Comment
masterOffset	LReal	Offset of the leading values of the cam (The cam technology object is not changed) when "SyncProfileReference" = 0, 1, 3, 4, 7 (default: 0.0)
slaveOffset	LReal	Offset of the following values of the cam (The cam technology object is not changed) when "SyncProfileReference" = 0, 1, 3, 4, 6 (default: 0.0)
masterScaling	LReal	Scaling the leading values of the cam (default: 1.0)
slaveScaling	LReal	Scaling the following values of the cam (default: 1.0)
masterSyncPosition	LReal	Position of the leading axis (relative to the start position of the cam), from which the axes are synchronous and synchronization is complete (The value must be within the definition of the cam) when "SyncProfileReference" = 0, 1, 6. Position of the leading axis (relative to the start position of the cam) from which the synchronization begins (The value must be within the definition of the cam) when "SyncProfileReference" = 3. Position of the leading axis (relative to the start position of the cam to be changed), from which the axes are synchronous (The value must be within the definition of the cam to be changed) when "SyncProfileReference" = 2, 5, 7 (default: 0.0)
syncProfileReference	DInt	Synchronization profile (0: Synchronization in advance using dynamic parameters; 1: Synchronization in advance using leading value distance; 2: Direct synchronous setting; 3: Subsequent synchronization using leading value distance; 4: Subsequent synchronization using leading value distance starting from current leading value position; 5: Direct synchronous setting at the end of the cam; 6: Synchronization in advance using leading value distance starting from current leading value position; 7: Direct synchronous setting at specific leading value position) (default: 1)
masterStartDistance	LReal	Leading value distance when "SyncProfileReference" = 1, 3, 4, 6 (default: 0.0)
velocity	LReal	Velocity for synchronization (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) when "SyncProfileReference" = 0 (default: -1.0)
acceleration	LReal	Acceleration for synchronization (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) when "SyncProfileReference" = 0 (default: -1.0)

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Parameter	Data type	Comment
deceleration	LReal	Deceleration for synchronization (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) when "SyncProfileReference" = 0 (default: -1.0)
jerk	LReal	Jerk for synchronization (Value > 0.0: Smooth velocity profile, the specified value is used; Value = 0.0: Trapezoidal velocity profile; Value < 0.0: Use of the default value configured in the technology object) when "SyncProfileReference" = 0 (default: -1.0)
applicationMode	DInt	Application of the cam (0: Once/not cyclic; 1: Cyclic (absolute application on the following value side); 2: Cyclic appending (continuously appending on the following value side)) (default: 0)
syncDirection	DInt	Direction for synchronization only in effect for axes with activated modulo setting (1: Forward direction; 2: Backward direction; 3: Shortest way) when "SyncProfileReference" = 0, 1, 3, 4, 6 (default: 1)

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LAxisCtrl_typeGearOutCamOut

Table 2-54: Parameter of *LAxisCtrl_typeGearOutCamOut*

Parameter	Data type	Comment
slavePosition	LReal	Stop position of following axis (default: 0.0)
syncProfileReference	DInt	Type of desynchronization (0: Desynchronize using dynamic behavior; 1: Desynchronize using leading value distance; 5: Cancel only a pending gearing / camming) (default: 1)
masterStopDistance	LReal	Leading value distance when "SyncProfileReference" = 1 (default: 0.0)
deceleration	LReal	Deceleration for desynchronization (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) when "SyncProfileReference" = 0 (default: -1.0)
jerk	LReal	Jerk for desynchronization (Value > 0.0: Smooth velocity profile, the specified value is used; Value = 0.0: Trapezoidal velocity profile; Value < 0.0: Use of the default value configured in the technology object) when "SyncProfileReference" = 0 (default: -1.0)
syncOutDirection	DInt	Desynchronization direction (1: Positive direction; 2: Negative direction; 3: Current direction) (default: 3)
gearOutCamOutMode	DInt	-1: Automatic detection whether to use a MC_GearOut or MC_CamOut; 0: Use of MC_GearOut; 1: Use of MC_CamOut (default: -1)

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LAxisCtrl_typePhasing

Table 2-55: Parameter of *LAxisCtrl_typePhasing*

Parameter	Data type	Comment
phaseShift	LReal	Absolute or relative leading value shift (default: 0.0)
velocity	LReal	Velocity for leading value shift, added to synchronous operation motion (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
acceleration	LReal	Acceleration for leading value shift, added to synchronous operation motion (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
deceleration	LReal	Deceleration for leading value shift, added to synchronous operation motion (Value > 0.0: The specified value is used; Value = 0.0: Not permitted; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
jerk	LReal	Jerk for leading value shift, added to synchronous operation motion (Value > 0.0: Smooth velocity profile, the specified value is used; Value = 0.0: Trapezoidal velocity profile; Value < 0.0: Use of the default value configured in the technology object) (default: -1.0)
profileReference	DInt	Type of traversing of the leading value offset (0: Only with gearing: Traverse leading value offset using dynamics parameters; 1: Traverse leading value offset via leading value distance starting from current leading value position; 2: Traverse leading value offset from leading value position "StartPosition"; 5: Cancel only one waiting job for the leading value offset) (default: 0)
phasingDistance	LReal	Leading value distance (Distance of the leading axis during the traversing of the leading value offset) when "ProfileReference" = 1, 2 (default: 0.0)
startPosition	LReal	Leading value position starting from which the leading value offset is traversed when "ProfileReference" = 2 (default: 0.0)
direction	DInt	Direction of the leading value distance (1: Positive direction; 2: Negative direction; 3: Current direction) when "ProfileReference" = 1, 2 (default: 3)
phaseAbsolute	Bool	Indicates the type of phase shift. TRUE: Shift the leading value as an absolute shift; FALSE: Shift the leading value relative to the existing leading value shift (default: TRUE)
phaseShiftChange OnTheFly	Bool	TRUE: Changing phase shift on-the-fly at absolute phasing while the command is active and the corresponding input is set; FALSE: Phase shift change requires a new rising edge at phasing input (default: FALSE)

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LAxisCtrl_typeOffset

Table 2-56: Parameter of *LAxisCtrl_typeOffset*

Parameter	Data type	Comment
offset	LReal	Absolute or relative offset shift (default: 0.0)
profileReference	DInt	Type of traversing of the following value offset (1: Traverse following value offset using leading value distance starting from the current effective leading value position; 2: Traverse following value offset using leading value distance from the effective leading value position "StartPosition"; 5: Cancel only one waiting job for the following value offset) (default: 1)
offsetDistance	LReal	Effective leading value distance while traversing the following value offset when "ProfileReference" = 1, 2 (default: 0.0)
startPosition	LReal	Effective leading value position starting from which the following value offset is traversed when "ProfileReference" = 2 (default: 0.0)
direction	DInt	Direction of the leading value distance (1: Positive direction; 2: Negative direction; 3: Current direction) when "ProfileReference" = 1, 2 (default: 3)
offsetAbsolute	Bool	Indicates the type of the offset shift. TRUE: Shift the following value as an absolute shift; FALSE: Shift the following value relative to the existing following value shift (default: TRUE)
offsetChangeOnTheFly	Bool	TRUE: Changing offset shift on-the-fly at absolute offset shift while the command is active and the corresponding input is set; FALSE: Offset shift change requires a new rising edge at offset input (default: FALSE)

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LAxisCtrl_typeDiagnostics

Table 2-57: Parameter of *LAxisCtrl_typeDiagnostics*

Parameter	Data type	Comment
status	Word	Status of FB when error occurred (default: 16#0000)
subfunctionStatus	Word	ErrorID of called subfunction (default: 16#0000)
basicMotionState	DInt	Current basic motion state when error occurred (default: 0)
superimposedMotionState	DInt	Current superimposed motion state when error occurred (default: 0)

3 Working with the Library

What will you find in this section?

This chapter consists of instructions for integrating the LAxisCtrl library into your STEP 7 project and instructions for using the library blocks.

3.1 Integrating the library into STEP 7

The table below lists the steps for integrating the LAxisCtrl library into your STEP 7 project. Subsequently, you can use the blocks of the LAxisCtrl library.

Note The following section assumes that a STEP 7 project exists.

Table 3-1: Integrating the library into STEP 7

No.	Action
1.	Extract the library LAxisCtrl_V1_x_x.zip to a local folder.
2.	In TIA Portal select “Options” -> “Global libraries” -> “Open library…”.
3.	Browse to the file LAxisCtrl.al20.
4.	It can be found in the subfolder LAxisCtrl of the extracted zip file.
5.	Open the global library in read-only mode.

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3.2 Integrating the library blocks into STEP 7

The table below lists the steps for integrating the blocks of the LAxisCtrl library into your STEP 7 program.

Figure 3-1: Integrating the library blocks into STEP 7

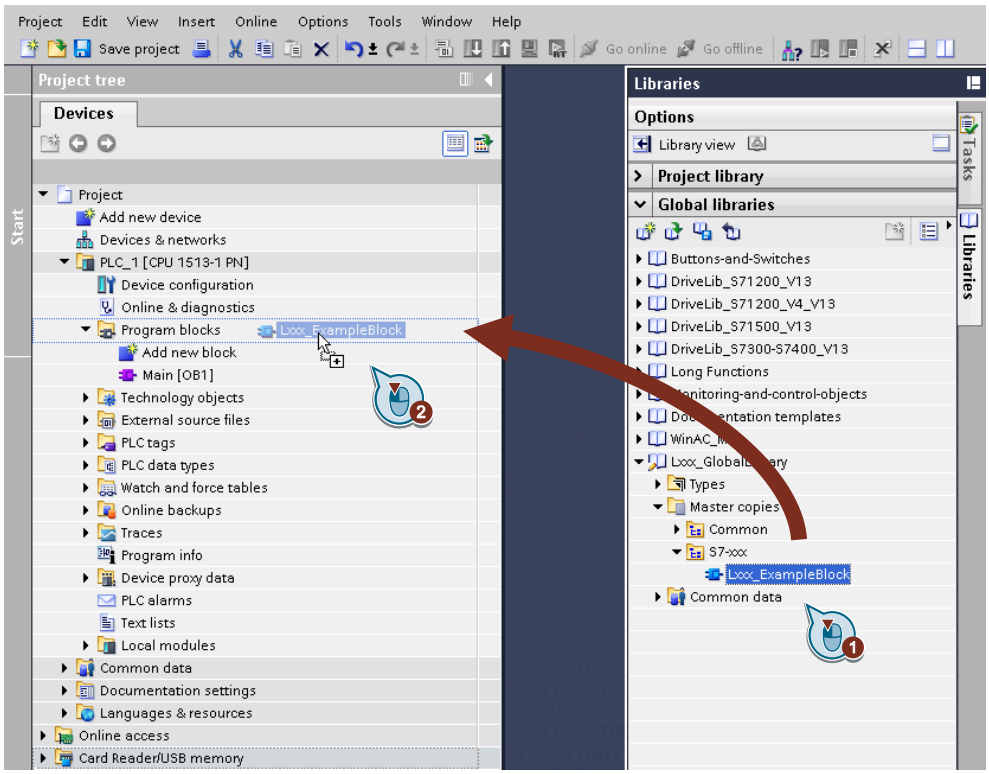


Table 3-2: Integrating the library blocks for S7-1500/S7-1500T into STEP 7

No.	Action
1.	Copy the folder *LAxisCtrl_Types* in subfolder “S7-1500/S7-1500T” with Drag & Drop into the “PLC data types” in the PLC.
2.	Copy the FBs, according to your axes and requested functionality, from folder “*S7-1500/S7-1500T → LAxisCtrl_Blocks*” with Drag & Drop into the “Program blocks” in the PLC. Alternatively you can copy the whole *LAxisCtrl_Blocks* folder.
3.	If you have a S7-1500T CPU and want to use the full functionality, copy the “*S7-1500T → LAxisCtrl_Blocks*” with Drag & Drop into the “Program blocks” in the PLC.
4.	Now the blocks can be configured and called in the user program.

Table 3-3: Integrating the library blocks for S7-1200 G2 into STEP 7

No.	Action
1.	Copy the folder *LAxisCtrl_Types* in subfolder “S7-1200 G2” with Drag & Drop into the “PLC data types” in the PLC.
2.	Copy the FBs, according to your axes and requested functionality, from folder “S7-1200 G2 → *LAxisCtrl_Blocks*” with Drag & Drop into the “Program blocks” in the PLC. The corresponding internally needed sub-blocks must be copied manually from subfolder “InternalSubBlocks”. Alternatively you can copy the whole *LAxisCtrl_Blocks* folder.
3.	Now the blocks can be configured and called in the user program.

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4 Notes and Support

What will you find in this section?

This chapter provides further support in handling the described LAxisCtrl library.

Note

Parameter comments in the programming editor are only available in language 'English (United States)'

NOTE

The start values of instance data blocks (prefix Inst / inst or postfix _DB) of the LAxisCtrl blocks must not be changed for example via "Creating a snapshot of the actual values" and afterwards "Copying the snapshot to the start values". Otherwise, a proper functionality of the blocks can no longer be guaranteed.

4.1 Read actual values of TOs

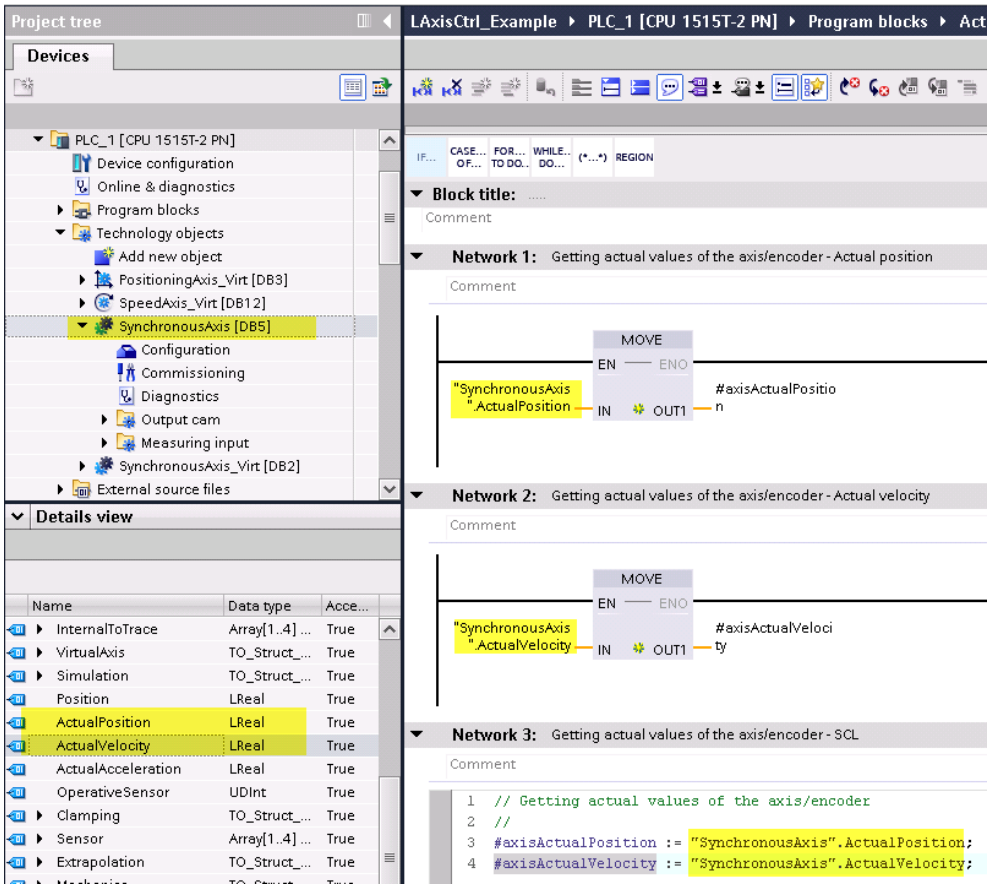
The actual values like position or velocity of the axis and external encoder are not available at the outputs of the axis function blocks.

To get values (e.g. actual position, velocity setpoint) or other parameters (e.g. modulo length) of the axis or external encoder you have to look into the motion data block of the according technology object.

The example shows how reading of actual position and actual velocity from technology object “SynchronousAxis” works.

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Figure 4-1: Read actual values of TO



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5 Related literature

Table 5-1

	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Download page of this entry https://support.industry.siemens.com/cs/ww/en/view/109925893
\3\	SIMATIC S7-1500/S7-1500T Axis functions V9.0 as of STEP 7 V20 https://support.industry.siemens.com/cs/ww/en/view/109974348
\4\	SIMATIC S7-1500/S7-1500T synchronous operation functions V9.0 as of STEP 7 V20 https://support.industry.siemens.com/cs/ww/en/view/109974350

6 Application support

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7 History

Table 7-1

Version	Date	Modifications
V1.0	10/2016	First version
V1.0	04/2017	Added information about FB LAxisCtrl_BrakeControl
V1.0	12/2017	Added information about LAxisCtrl_GetExtEncoderXXXWord Scope of application is now STEP 7 Professional V15 (Motion Control V4.0, firmware V2.5)
V1.2	05/2021	Scope of application is now STEP 7 Professional V17 (Motion Control V6.0, firmware V2.9)
V1.2	07/2021	Table LAxisCtrl_typeGearOutCamOut added
V1.3	12/2022	Scope of application is now STEP 7 Professional V18 (Motion Control V7.0, firmware V3.0) Support of MC_HaltSuperimposed and MC_GearInVelocity Additional notes added to section "Homing on fixed stop"
V1.4	04/2025	Scope of application is now STEP 7 Basic/Professional V20 SIMATIC S7-1200 G2 is supported LAxisCtrl_GetExtEncoderStatusWord.standstill added LAxisCtrl_typePower.externalMC_PowerCall added LAxisCtrl_typeStop.haltMode added (Motion Control V9.0)