

SIEMENS

SIMATIC

S7-300 CPU 317T: Technology Functions

Manual

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We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

Siemens AG 2004
Technical data subject to change.

Preface

Purpose of this manuals

This manual gives you a complete overview of the optional software package "S7-Technology". The programming model, the individual technological objects and the individual function blocks according to PLCopen are explained.

It is designed for STEP 7 programmers and persons who work in the configuration, commissioning and automation system service with Motion Control application sector.

Required basic knowledge

To understand this manual you require a general knowledge in the automation technology and motion control field.

Users should be familiar in operating computers and programming devices on a Windows 2000 Professional or XP operating system platform. Adequate knowledge of the STEP 7 standard software is essential, because the optional software package "S7-Technology" is based on this software. The appropriate knowledge base is found in the "Programming with STEP 7" manual.

Range of validity of this manual

This manual applies to the optional software package "S7-Technology" V 2.0 or higher. In the chapter "What's New in S7 Technology V 2.0?" you will find the differences in functionality and specifications of this version in comparison to the "S7 Technology" optional software package version V1.0.

Position in the world of documentation

This manual forms part of the 317T-2 DP CPU documentation package.

Manual	Purpose
Getting Started CPU 317T-2 DP: Commissioning	Based on a practical example, this Getting Started guides you through the steps in commissioning a fully functional application.
CPU Data Reference Manual CPU Data: CPU 317T-2 DP	Describes the operation, functions and technical data of a 317T-2 DP CPU. There you will also find changes and enhancements not included in the installation manual for your 317T-2 DP CPU.
Manual CPU 317T: Technology functions In this manual you find:	Describes the various technological functions: <ul style="list-style-type: none"> • Applications and usage • Basics and configuration • Download, testing and diagnostics • PLCopen functions
Product Information Connecting SIMOVERT MASTERDRIVES MC to the Technology CPU	Describes how to connect and commission the SIMOVERT Master drive MC to the CPU317T-2 DP.
Product Information Connecting SIMODRIVE 611U to the Technology CPU	Describes how to connect and commission SIMODRIVE 611 U to the CPU317T-2 DP.
Equipment Manual ADI – Analog Drive Interface for 4 Axes	Describes how to connect and commission the ADI 4 to the CPU 317T-2 DP as well as other SIMOTION operating units.
Installation Manual S7-300 PLCs: Installation: 31xC CPU and 31x CPU	Describes the engineering, installation, networking and commissioning of an S7-300.
Module Data Reference Manual S7-300 PLCs: Module data	Describes the functions and the technical data of signal modules, power supply modules and interface modules.
Operations list CPU 31xC, CPU 31x IM 151-7CPU, BM 147-1CPU, BM 147-2CPU	Lists the instruction set of the CPUs and the corresponding execution times. List of executable blocks (OBs/SFCs/SFBs) and their execution times.

Further Support

If you have any technical questions, please get in touch with your Siemens representative or agent responsible.

You will find your contact person at:

<http://www.siemens.com/automation/partner>

You will find a guide to the technical documentation offered for the individual SIMATIC Products and Systems here at:

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The online catalog and order system is found at:

<http://mall.ad.siemens.com/>

Training Centers

Siemens offers a number of training courses to familiarize you with the SIMATIC S7 automation system. Please contact your regional training center or our central training center in D 90327 Nuremberg, Germany for details:

Telephone: +49 (911) 895-3200.

Internet: <http://www.sitrain.com>

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Additional information about our Technical Support can be found on the Internet pages <http://www.siemens.com/automation/service>

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- The newsletter, which constantly provides you with up-to-date information on your products.
- The right documents via our Search function in Service & Support.
- A forum, where users and experts from all over the world exchange their experiences.
- Your local representative for Automation & Drives.
- Information on field service, repairs, spare parts and more under "Services".

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1 What's new in S7-Technology V2.0

Extended project data volume

S7	V1.0	V2.0
Axes	16	32
Cam disks	16	32
Output cam	16	32
Measuring input	4	16
External encoders	4	16

Further information on project data volume and operating conditions are found here

This extended project data volume is available after you upgrade the firmware of the Technology CPU and of the integrated technology.

Synchronous technology processing in the user program with OB65

The technology synchronization interrupt OB65 a technology interrupt which is called and processed synchronously to the update of technology DBs. OB65 can be used to evaluate current and consistent data of technology DBs (see also Technology DB updates).

Encoder / data record changeover

S7-Technology V2.0 supports encoder and data record changeover in runtime.

You can use the encoder changeover function to determine the material position, for example, the axes in position, in systems containing several actual value encoders.

Use data record changeover to modify axis parameters (controller parameters, for example) when the system is in run.

Use of DP(DRIVE) for standard DP slaves (V0)

DP(DRIVE) supports only standard DP slaves (V0). DP standard slaves (V0) can be mapped to the I/O image DP(DRIVE) of the integrated technology, and evaluated using the technology functions "MC_ReadPeriphery" and "MC_WritePeriphery".

Enhanced functions for stand-alone axes

MC_MoveAbsolute MC_MoveRelative, MC_MoveVelocity

At the new *Mode* input parameter, you can decide whether to override the active motion, or to continue with the new motion after a stop, or to overlay it with the new speed.

New and enhanced functions for synchronism

- MC_GearIn
The new input parameter *PhaseShift* can be used to set a phase shift between a master and following axis.
- MC_Phasing
The technology function is now also available for gearing.

New superimposing synchronization functions

These new superimposing synchronization functions can be used to process parts on-the-fly.

- MC_CamInSuperImposed, MC_CamOutSuperImposed
The technology functions "MC_CamInSuperImposed" and "MC_CamOutSuperImposed" start or end superimposing camming between the leading and following axes.
- MC_GearInSuperImposed, MC_GearOutSuperImposed
The technology functions "MC_GearInSuperImposed" and "MC_GearOutSuperImposed" start or end superimposing gearing between the leading and following axes.
- MC_PhasingSuperImposed
Use the technology function "MC_PhasingSuperImposed" to define a phase shift of the leading axis to the following axis in the coordinate system of superimposing synchronism.

New and improved cam disk function

- MC_GetCamPoint
The new technology function "MC_GetCamPoint" allows you to determine the position of the leading and following axes at an existing cam disk.
- MC_CamSectorAdd
The performance of the technology function "MC_CamSectorAdd" with respect to the insertion of interpolation points was significantly improved.

New and enhanced basic functions

- **MC_Reset**
It is now possible to restart based on a specific cam disk. The restart function restores the cam disk originally configured in S7T Config. During the restart of a technology object, the system continues to process new commands output to other technology objects.
- **MC_ReadSysParameter**
The new input parameter *Index* allows read access to multiple instances of a parameter.
In combination with the new functionality of MC_WriteParameter, the user can now save a backup copy of the data of an absolute value encoder adjustment in preparation for a CPU replacement.
- **MC_WriteParameter**
The new *Index* input parameter can be used to write to several instances of parameter sets / data records.
In combination with the new functionality of MC_ReadParameter, the user can now save a backup copy of the data of an absolute value encoder adjustment in preparation for a CPU replacement.
- **MC_ReadPeriphery, MC_WritePeriphery**
The new technology functions "MC_ReadPeriphery" and "MC_WritePeriphery" provide read / write access to the I/O image DP(DRIVE) of the integrated technology. This functionality allows you to write the I/O image of a standard slave connected to DP(DRIVE) to the I/O image DP(DRIVE) of the integrated technology, for example.
- **MC_ReadDriveParameter, MC_WriteDriveParameter**
The new technology functions "MC_ReadDriveParameter" and "MC_WriteDriveParameter" provide read / write access to the parameters of a drive connected to DP(DRIVE).

Operating SINAMICS Terminal Modules TM15 and TM17 High Feature in combination with the SINAMICS S120 system

S7-Technology V2.0 supports the operation of SINAMICS Terminal Modules TM15 and TM17 High Feature in combination with the SINAMICS S120 system. The Terminal Modules can be used as measuring sensor inputs and (high speed) cam outputs.

Order numbers are found under "Available components and systems."

Comfortable cam disk programming using the optional SCOUT CamTool

S7-Technology V2.0 supports the optional SCOUT CamTool V2.1 SP1. The SCOUT CamTool offers the following benefits:

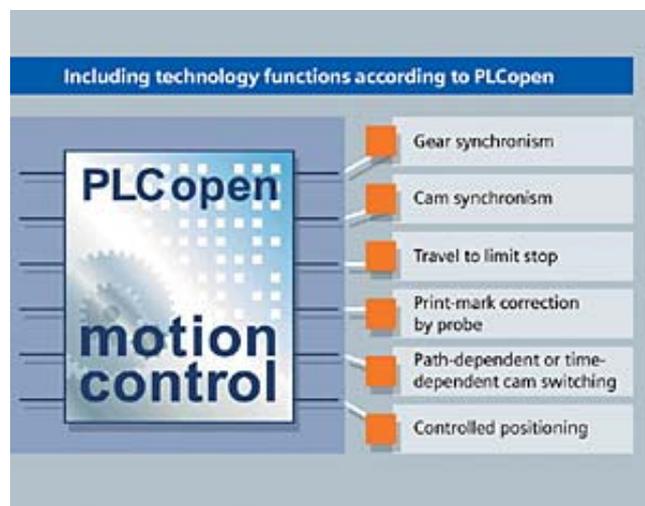
- Precise, graphic visualization of the cam
- Quick and easy cam definition by means of drag-and-drop of cam elements
- Quick and easy cam tuning by means of "dragging at the profile"
- Simultaneous visualization of the position, velocity, acceleration and jerk profile has an immediate effect on the maximum velocity, the motor torque required and on mechanical load.
- Tuning the velocity, acceleration or jerk parameters of the cam

Order numbers are found under "Available components and systems."

2 Application and usage

2.1 Compact and integrated

The Technology CPU integrates Motion Control functions into a SIMATIC CPU, and thus combines the functionality of a SIMATIC S7-300 CPU with PLCopen-compliant Motion Control functions.



The Technology CPU is totally integrated into the SIMATIC system, and thus into the TIA environment. It demonstrates its high performance in particular in the field of coupled motion operations.

2.2 The familiar "SIMATIC world"

The Technology CPU is a standard SIMATIC CPU, with integrated Motion Control functionality. S7-300 programs of existing projects can thus be copied to this CPU.

The Technology CPU is programmed in the SIMATIC programming languages, for example, LAD/FBD/STL.

All PLC and Motion Control functions are executed in a single user program. There is no need to learn any additional programming language, because users can rely on their current S7 know-how.

The technology system is configured in the user-friendly environment of STEP 7 with the help of S7T Config. There you set up all your system essentials, such as the mechanical data, drives, control circuits, default values, monitoring functions, cams, measuring sensors, cam disks, and lots more.

2.3 Integrated PLCopen-compliant motion control functions in STEP 7

The PLCopen-compliant Motion Control functions of your Technology CPU let you to directly utilize your Motion Control know-how. The interfaces, functions and runtime of Motion Control are fully compliant with PLCopen specifications. This is a great help for accomplishing your engineering, commissioning and service tasks.

The standardized interface allows a virtually seamless integration of function blocks for initiating motion control commands into the user program.

2.4 Available components and systems

Valid for firmware version V3.1.x of the integrated technology

SIMATIC Technology CPU / software

Components required to use a SIMATIC Technology CPU:

Function	Product	Order number
SIMATIC Technology CPU	CPU 317T-2DP	6ES7317-6TJ10-0AB0
Micro Memory Card	MMC 4 MB (or more)	6ES7953-8LM11-0AA0
Optional "S7-Technology" software package	SIMATIC S7-Technology V2.0	6ES7864-1CC20-0YX0
STEP 7	STEP 7 V5.3 SP1	6ES7810-4CC07-0Yxx

In addition to the optional "S7-Technology" software package, you can also use the software product shown below:

Function	Product	Order number
SCOUT CamTool	SCOUT CamTool V2.1	6AU1810-0FA21-0XA0

PROFIBUS DP(DRIVE)

Components for technological tasks operating in synchronized mode on DP(DRIVE), valid at the time this manual was released for printing:

Product	Order number
SIMODRIVE	
SIMODRIVE 611 universal	6SN1118-XN00-0AAx
SIMODRIVE 611 universal HR	6SN1114-0NB0X-0AAx
Optional module Motion Control with PROFIBUS DP (for SIMODRIVE 611U)	6SN1114-0NB01-0AA0
SIMODRIVE POSMO CA	6SN2703-3AAx
SIMODRIVE POSMO CD	6SN2703-2AAx
SIMODRIVE POSMO SI	6SN24x
SIMODRIVE sensor single-turn / synchro-flange	6FX2001-5FP12
SIMODRIVE sensor, single-turn / clamping flange	6FX2001-5QP12
SIMODRIVE sensor multi-turn / synchro-flange	6FX2001-5FP24
SIMODRIVE sensor multi-turn / clamping flange	6FX2001-5QP24
MICROMASTER 4	
COMBIMASTER 411	6ES6401-0PB00-0AA0
MICROMASTER 420	6ES6400-1PB00-0AA0
MICROMASTER 430	6ES6400-1PB00-0AA0
MICROMASTER 440	6ES6400-1PB00-0AA0
MASTERDRIVES with communication module CBP2	
Motion Control	6SE7090-0XX84-0FF5
Motion Control Plus	6SE7090-0XX84-0FF5
Vector Control CUVC	6SE7090-0XX84-0FF5
Vector Control Plus	6SE7090-0XX84-0FF5
Note the order number suffix "Gxx" for communication module CBP2 when placing your order.	
SINAMICS	
SINAMICS S120	6SL3040-0MA00-0AAx
Terminal Module TM15 *	6SL3055-0AA00-3FA0
Terminal Module TM17 High Feature *	6SL3055-0AA00-3HA0
SINUMERIK	
ADI4	6FC5211-0BA01-0AA1
SIMATIC ET 200M **	
IM 153-2 High Feature	6ES7153-2BA00-0XB0
SM 331 AI8x14Bit	6ES7331-7FH00-0AB0
SM 331 AI8x14Bit	6ES7331-7FH01-0AB0
SM 321 DI16xDC24V	6ES7321-1BH01-0AA0
SM 321 DI16xDC24V, Alarm	6ES7321-7BH01-0AB0
SM 322 DO16xDC24V/0,5A	6ES7322-1BH10-0AA0

Product	Order number
SIMATIC ET 200S **	
IM 151-1 High Feature	6ES7151-1BA00-0AB0
2AI I 2WIRE HS	6ES7134-4GB51-0AB0
2AI I 4WIRE HS	6ES7134-4GB61-0AB0
2AI U HS	6ES7134-4FB51-0AB0
2DI DC24V HF	6ES7131-4BB00-0AB0
4DI UC24..48V	6ES7131-4CD00-0AB0
4DI DC24 HF	6ES7131-4BD00-0AB0
2DO DC24V/0,5A HF	6ES7132-4BB00-0AB0
2DO DC24V/0,2A HF	6ES7132-4BB30-0AB0
4DO DC24V/0,5A ST	6ES7132-4BD00-0AA0

* For additional high-speed cams, hardware limit switches and measuring sensors.

** For additional cams and hardware limit switches.

Components configurable in HW Config are listed in the "Hardware catalog" dialog box of HW Config. To do so, select the "SIMATIC Technology CPU" profile in HW Config.

The current component list is always found in the latest SW version, provided your S7-Technology is updated to this version.

DP-V0 slaves on DP(DRIVE)

In addition to ET 200M and ET 200S, you can operate further I/O as DP-V0 slave on DP(DRIVE). However, some restrictions apply.

Interrupts are not available, i.e. DP-V0 slaves can not be operated in continuous synchronized mode on DP(DRIVE), and longer response times are to be expected.

Positioning drive POSMO A

A positioning drive POSMO A can be operated on the DP/MPI segment of the 317T-2 DP CPU. It is implemented by means of special FBs of the "Posmo A Library". Posmo A library is not available for DP(DRIVE).

Product	Order number
SIMODRIVE POSMO A	6SN21x

Hardware and software requirements

For information on HW and SW requirements for using the "S7-Technology V2.0" optional package, refer to Readme.wri on your product CDROM.

2.5 Project data volume and operating conditions

Valid for firmware version V3.1.x of the integrated technology

When you plan your Motion Control tasks, make allowances for the following project data volume and operating conditions listed.

Project data volume (CPU 317T)

- 32 axes (virtual or physical)
- 32 cams
Eight cams can be output as "high-speed cams" at the integrated outputs of the Technology CPU. A further 24 cams can be implemented via distributed I/O (ET 200M or ET 200S, for example.) These cams can be integrated as "high-speed cams" at the TM15 and TM17 High Feature.
- 32 cam disks
- 16 measuring sensors
- 16 external encoders

Note

The maximum number of technology objects (TOs) may not exceed 64. 18 axes, 22 cam disks, 18 cams, 5 measuring sensors, 1 external encoder = 64 TOs, for example.)

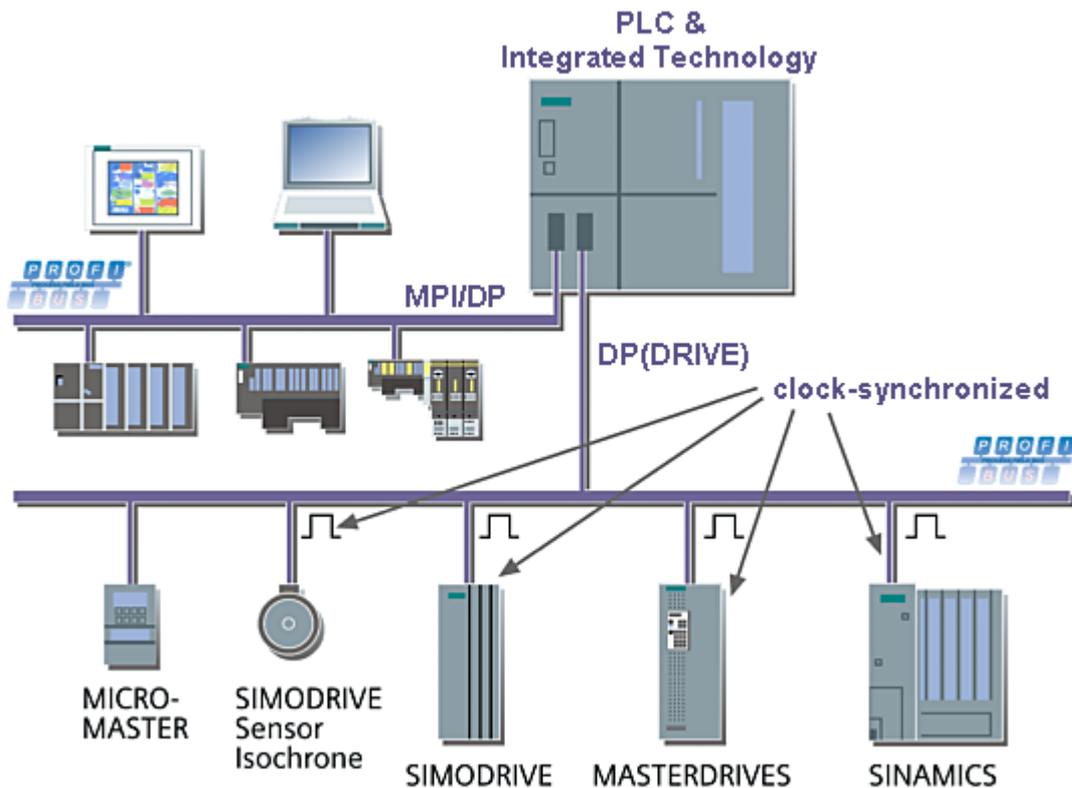
Operating conditions

- The system can be configured using S7-Technology V2.0 and STEP 7 V5.3 + SP1 or higher.
- All HW components required by the integrated technology must be connected to DP(DRIVE).
- In the user program, you can address up to 64 bytes of input and 64 bytes of output data of the integrated technology. Inputs and outputs available:
 - 4 integrated inputs of the Technology CPU
The integrated inputs can be used either for analysis functions in the user program, or for technological tasks. Mixed mode is not possible.
 - 8 integrated outputs of the Technology CPU
(exclusive use as with integrated inputs)
 - Inputs and outputs of distributed I/O on DP(DRIVE)
- Distributed I/O not required by the integrated technology should preferably be connected to the MPI/DP interface of the Technology CPU.
- Programming devices, text-based displays and OPs may not be operated on DP(DRIVE).
- Up to 210 Motion Control commands can be active simultaneously.
- The typical cycle time of technology functions in the user program is 80 µs.

2.6 Components and their tasks

2.6.1 Hardware components

The hardware components of a Motion Control solution with a Technology CPU are shown in the figure below:



Control elements and integrated technology

The control unit of the Technology CPU can handle all tasks of a standard CPU of the S7-300 family. The integrated technology controls, evaluates and monitors all hardware components which are connected to DP(DRIVE), and are required for solving Motion Control tasks. The Technology CPU is equipped with four integrated digital inputs and eight digital outputs which should be used primarily for Motion Control tasks.

MPI/DP

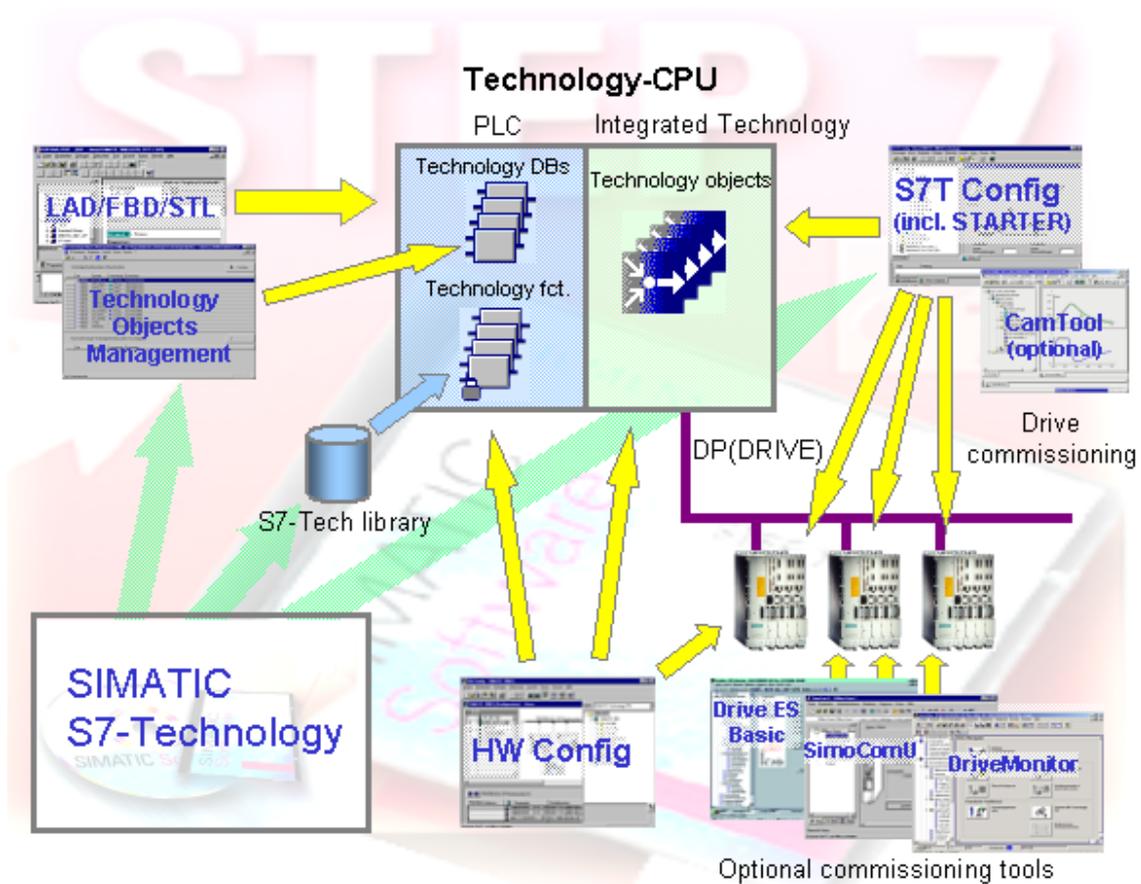
At the MPI/DP interface of the PLC, you can operate standard PROFIBUS components such as programming devices, text-based displays, operator panels and DP field devices.

DP(DRIVE)

The 317T-2 DP CPU operates the PROFIBUS interface DP(DRIVE) in clock-synchronized mode. All HW components addressed by the integrated technology must be present on the DP(DRIVE) system. This includes component of the MICROMASTER, SIMODRIVE, MASTERDRIVES, SINAMICS families and the SIMODRIVE Sensor.

2.6.2 Engineering tools

Motion Control applications are always configured and programmed in STEP 7. The figure below shows you the various tools available for configuring your Motion Control application.



SIMATIC STEP 7

STEP 7 is the platform for configuring and programming the Technology CPU. All engineering tools required are called in SIMATIC Manager of STEP 7.

SIMATIC S7-Technology

SIMATIC S7-Technology is an optional software package you need to configure Motion Control functionality of your Technology CPU. Setup fully integrates SIMATIC S7-Technology into the STEP 7 system. Setup installs the following tools alongside with S7-Technology:

- Technology Objects Management
- S7-Tech library
- S7T Config, including STARTER

LAD/FBD/STL

You program the user program and Motion Control commands in the LAD/FBD/STL block editor. In your user program, read out the actual values of your Motion Control application, and analyze the messages and error information.

Technology Objects Management

You create and delete technology DBs in "Technology Objects Management." You also use "Technology Objects Management" to rename technology DBs, or assign different block numbers.

S7-Tech library

S7-Tech is a library of PLCopen-compliant technology functions you call in the user program as FB. These are used to control your Motion Control commands.

S7T Config

In S7T Config, you configure the technology objects you require to solve your Motion Control task. S7T Config contains the STARTER code for drives of the MICROMASTER and SINAMICS family.

CamTool (optional)

SCOUT CamTool can be ordered separately and can be used to create cam disks on a comfortable graphic interface.

HW Config

HW Config is used to configure the hardware of your Technology CPU, and the subnets connected to DP/MPI and DP(DRIVE) interfaces.

Drive ES Basic / SimoCom U / DriveMonitor

The optional Drive ES Basic and/or the stand-alone tools SimoCom U (SIMODRIVE) or DriveMonitor (MASTERDRIVE) software packages can be used to commission the drives.

Technology DBs

Technology DBs can be used in the user program to read the actual data of technology objects such as the actual values and status of an axis, or error information.

Technology functions

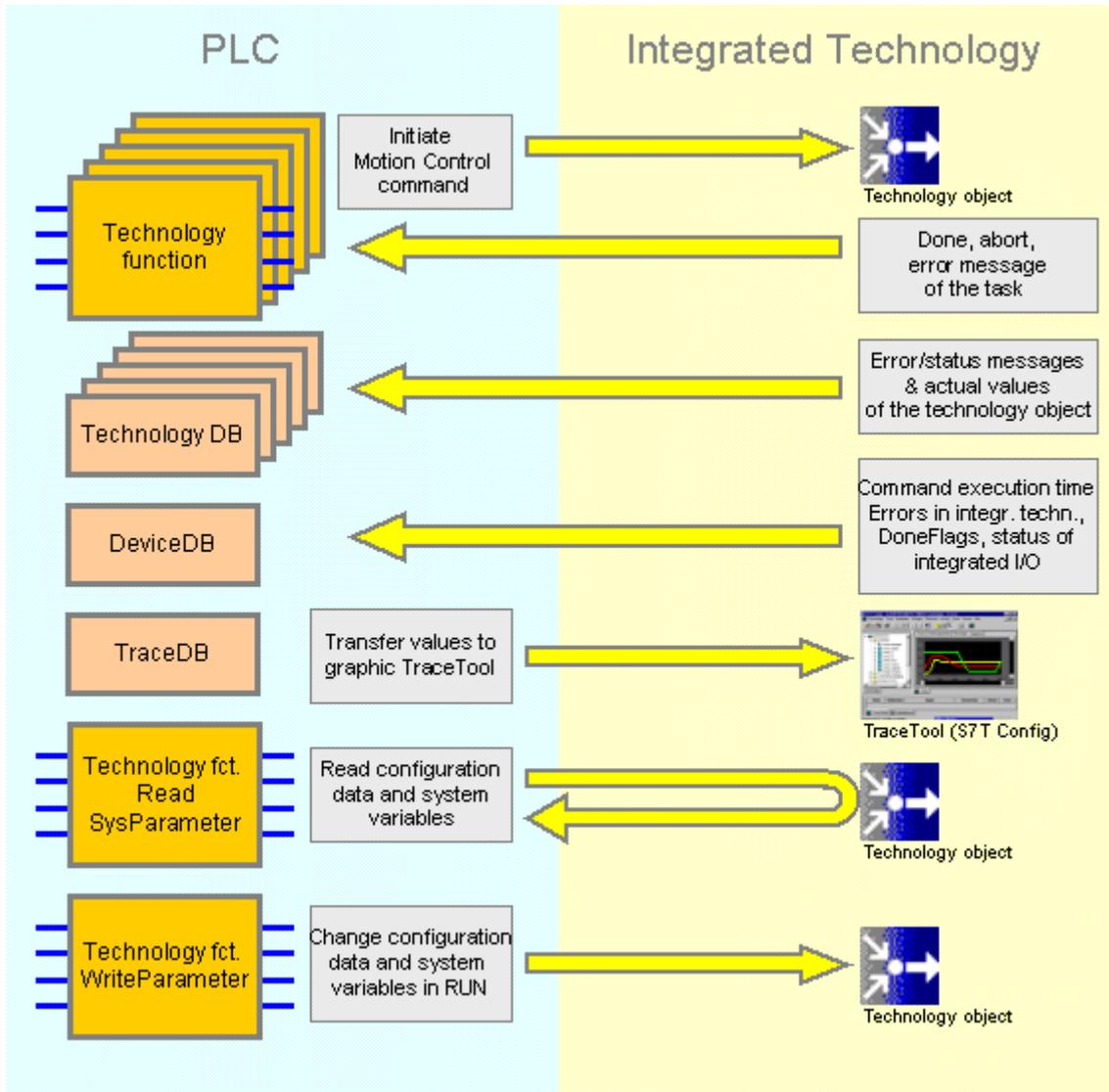
The PLCopen-compliant technology functions are called in the user program of the PLC. Technology functions form the command interface to technology objects. The output parameters of technology functions can be made available in the user program to control the status of Motion Control tasks.

Technology objects

Physical drives are mapped to technology objects which describe their properties. Each technology object is mapped to a technology DB in the STEP 7 user program where it indicates its status. Technology objects can be interconnected and logically linked to hardware components. All technology objects such as axes, cam disks, cam runners, measuring sensors or external encoders are configured in S7T Config.

2.6.3 Technology functions and technology DBs

Technology functions and technology DBs form the user interface to the integrated technology. Their tasks are shown in the figure below:



Technology functions

The Technology CPU uses the technology functions to initiate all motion control commands. The integrated technology executes all commands in the order by which they are initiated by the PLC.

Motion Control commands address the technology objects you configured in S7T Config. Technology objects are addressed using the number of the corresponding technology DB.

The commands are initiated by a signal transition (positive edge) at the *Execute* or *Enable* input parameters. The output parameters of the technology functions provide ready and abort messages of the command, or error messages if a command could not be initiated.

Technology DB

The integrated technology writes the process values of the technology object to the assigned technology DB. This includes status and error messages output during command execution and are also written to the technology DB.

The technology DBs of the automation system are not always retentive and write-protected, irrespective of their set object properties.

MCDevice DB

The status of the integrated technology is mapped to the MCDevice technology DB. This DB contains information on the maximum and average execution times of Motion Control commands and errors in the integrated technology.

In addition, MCDevice offers you the option of indicating the status of the integrated I/O and 32 done messages (*DoneFlags*) of some of the technology functions. Define which done messages are indicated at the *DoneFlag* input parameter of the technology function.

Trace DB

The TraceTool function of S7T Config is tool for the graphic analysis of system parameters and process values.

In addition to the system parameters of the integrated technology, you can record up to 8 variables of the S7 user program (2 x DINT values, 2 x DWORD values and 4 x REAL values.). Here, the Trace technology DB forms the interface between the PLC and the integrated technology.

The ReadSysParameter / WriteParameter technology functions

It may prove necessary to temporarily change configuration data and system variables of the integrated technology while the system is in RUN. The "MC_ReadSysParameter" technology function reads the configuration data and system variables, and "MC_WriteParameter" overwrites these. Changes at these parameters are **non-retentive**.

3 Technology objects

3.1 Axes - Basics

3.1.1 Axis technologies

Axis technologies

The "Axis" technology object can be configured as "Velocity-controlled axis", "Positioning axis" or "Synchronization axis". The various axis technologies differ according to the functions provided at the axis.

Function	Velocity-controlled axis	Positioning axis	Synchronization axis
Changeover of the data record	X	X	X
RPM or velocity preset	X	X	X
Motion with torque reduction	X	X	X
Positioning	-	X	X
Moving to fixed end stop	-	X	X
Homing	-	X	X
Advanced functions			
Measuring input	-	X	X
Cam	-	X	X
Synchronized motion (gear, cam)	-	-	X
Superimposed synchronized motion (gear / cam)	-	-	X

Special operating modes

- **Following mode**

In following mode, the position / velocity controllers of the drive are disabled. Inherent motions or dynamic braking is not possible at the axis. The actual position value and the velocity setpoint are updated. This allows you to detect external triggering of axis motions.

Following mode is not possible at virtual axes.

- **Simulation mode**

The simulation mode is used to test the programmed sequences in the PLC without moving the axis in the process, based on Trace recordings.

This mode is only available for physical axes.

In simulation mode, all axes must be connected and fully functional. An axis is simulated internally by setting the actual values equal to the setpoint values. In simulation mode, the following error is always zero.

3.1.2 Axis types

You can set two different types of axes in your axis configuration. The axis type (linear or rotary, each also as modulo axis) is in essence determined by mechanical conditions and by the units in which the axis-specific variables are computed, for example, the position or velocity.

- **Linear axes**

Linear axes are usually configured where the traversing range is mechanically limited. The position profile is linear within the traversing range. Basic physical units of the motions are the length units such as millimeter.

- **Rotary axes**

Rotary axes are usually configured for a rotary motion range. The traversing range is not limited mechanically. Basic physical units of the motions are rotatory units such as degrees. Rotary axes are usually also configured for operation as modulo axis.

Linear and rotary axes can be configured for operation as modulo axes. In this case, the axis position is defined (reference and actual values) within a range which is determined by the modulo start value, as the low limit, and by the modulo start value plus modulo length as high limit.

Example: A rotary axis with a traversing range from 0° to 360° has a modulo start value of 0°, and a modulo length of 360°. The axis position is reset to 0° when it exceeds its high limit of 360°. When it passes the low limit (0°), the axis position is set to the modulo start value plus the modulo length (360°). The position profile is linear within the modulo length.

Note

The position value increments continuously when linear or rotary axes are operated as infinite axes driven only in one direction (axis not configured as modulo axis). The variables representing the setpoint and actual position values are of the data type REAL, at a resolution of 23 binary digits (mantissa). The effect is, that the axis positioning accuracy deteriorates with increasing position values. Hence, you should preferably use modulo axes for infinite axis mode, or reset the position to zero at appropriate times.

3.1.3 Physical and virtual axes

When we speak of axes in this documentation, we always refer to physical and virtual axes.

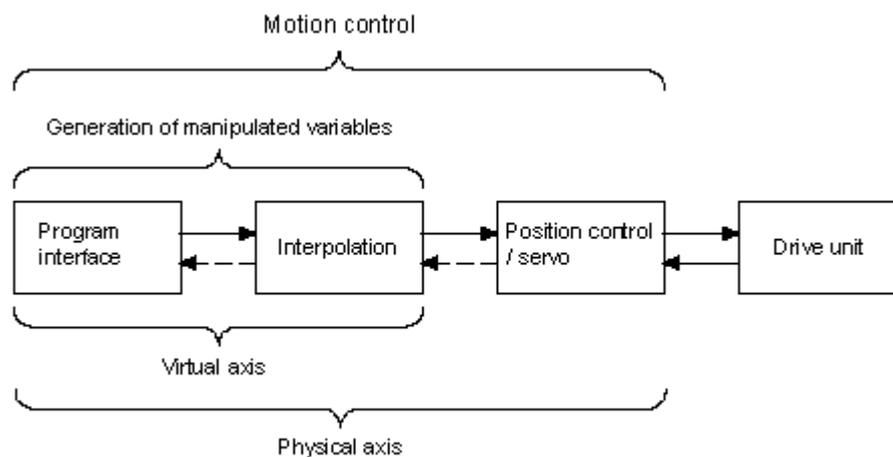
- **Physical axis**

This axis features a motion control, drive and encoder interface

- **Virtual axis**

This axis features command variable generation, but does not have closed-loop control or a drive or encoder interface. Setpoint values and actual values are always equal. The virtual axis is usually operated as auxiliary axis, for example, to generate the reference values for several physical axes when operated as leading axis in a synchronization compound.

Difference between a physical and a virtual axis (example of a positioning axis)



3.1.4 "Axis" - "drive" difference

The "Axis" technology object forms the interface between the user program and the drive. It receives motion control commands from the user program in the PLC, and then executes and monitors their runtime.

The axis communicates on the PROFIBUS with the drive that contains the velocity and power controller.

Drives are configured and commissioned separately from the axis.

Functional interface to the drive

The Technology CPU supports operation of digital drives (SIMODRIVE 611 universal, MASTERDRIVES MC, for example) via DP(DRIVE) interface and analog drives via ADI4. The interface between the technology object and the drive component is here formed by a specified telegram which must be selected and configured according to the functionality of each component.

These telegrams are used to exchange data between the PLC (technology object) and the drive component (drive, for example). Example: control words, status signals or encoder information.

Note

An axis can only execute the functions the connected drive actually supports. Available functions, for example, operation with SIMODRIVE 611U or MASTERDRIVES MC, are described in the converter documentation; see also the relevant product descriptions.

3.1.5 Dynamic Servo Control (DSC)

The position of position-controlled axes (positioning and synchronization axes) can be controlled either in the CPU or in the drive, provided the control method **Dynamic Servo Control (DSC) is supported**.

DSC imposes the effective dynamic action of the position controller in the drive on the frequency of the velocity control loop.

DSC allows you to set a higher K_v sampling rate. This increases the dynamic response to sequential control variables and compensation of manipulated variables in highly dynamic drives. DSC is supported by all drives which support telegram 5 or 6, or 105 and 106.

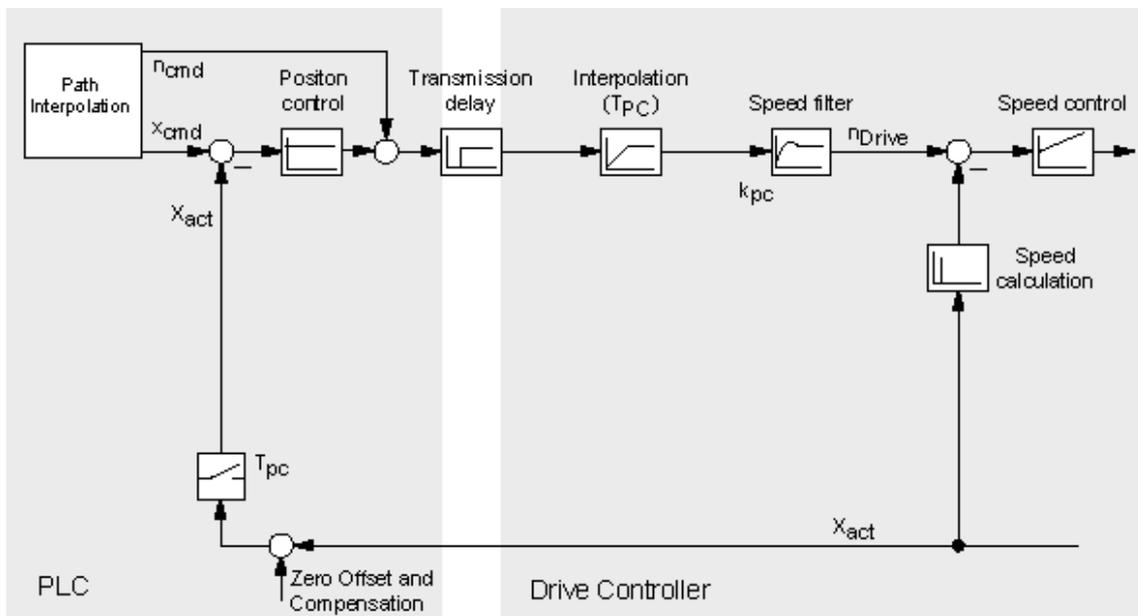
DSC is only useful in P-action mode of the position controller.

Note

The position controller must be tuned, see chapter "Commissioning the position controllers of positioning axes".

Position control loop without DSC

Structure of a position-control loop with the velocity setpoint interface to the drive without DSC.

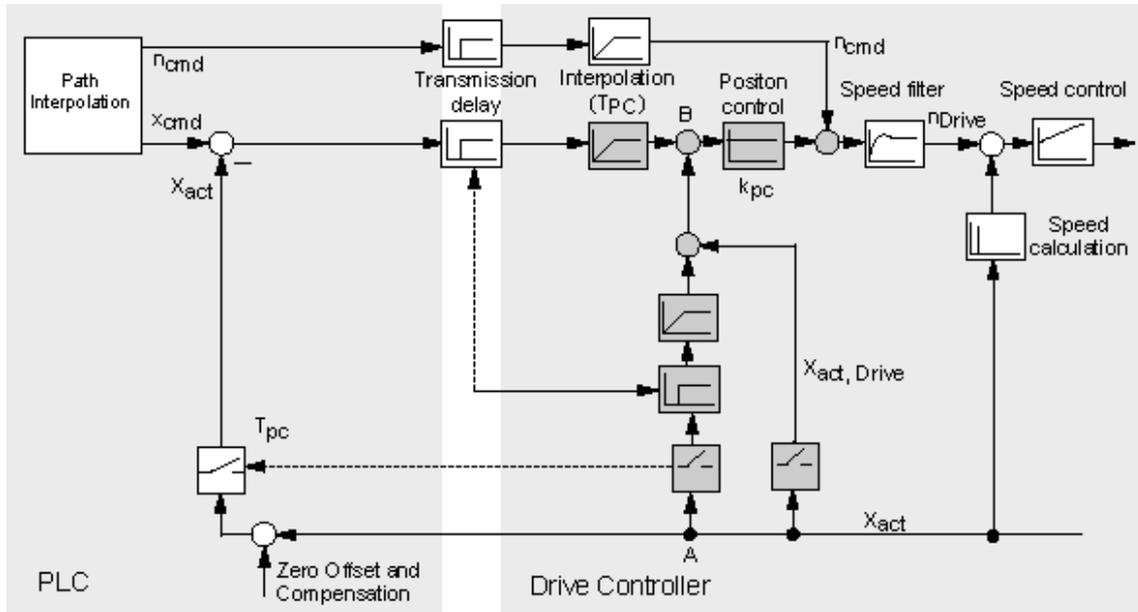


n_{cmd} : command speed
 x_{cmd} : command position
 x_{act} : actual position

T_{pc} : position controller sampling rate
 k_{pc} : position controller gain

Position control loop with DSC

DSC functionality can also be used for direct derivative feedback of the actual position calculated internally at the drive:



3.1.6 Homing

At position-controlled axes, input and indication of the position refer to the coordinate system of the axis. The coordinate system of the axis must be aligned to the physical position of the axis mechanism.

For incremental encoders, if you want to establish a direct reference to the position, you must synchronize the actual value system of the axis after every activation. Absolute value encoders must be adjusted **once only**.

Note

Whether motion commands with absolute destination coordinates can only be executed in homed state is depends on the axis configuration.

Motion commands with relative position setting (MC_MoveRelative) can also be executed with an axis that is not homed.

Axes retain their homed status when the CPU goes into stop.

Incremental encoders are synchronized by means of the technology function "MC_Home". This sets

- the homing position coordinate, or
- the homing coordinate minus the homing position offset for active homing at a defined mechanical position of the axis.

The measurement of this defined mechanical position is triggered by the zero pulse of the measuring system, or by a proximity switch (BERO.)

Note

After an axis is reinitialized (restart), it must be homed again when an incremental measuring system is used.

Homing modes

- **Active homing**

A special traversing motion is executed for this type of homing. A currently busy motion command is first canceled. The following homing modes can be set in S7T Config:

- Homing with BERO (homing output cam) and zero mark
- Homing with BERO only
- Homing with zero mark only.

- **Passive homing**

The homing function does not trigger an axis motion in this case. Any busy motion commands are not affected. Configurable homing modes:

- Homing with BERO (homing output cam) and zero mark
- Homing with BERO only
- Homing with zero mark only.

- **Direct homing**

The axis position is set regardless of homing cams (zero marks or BEROs). When the axis is to be homed at a precise mechanical position, the axis must be at a zero velocity during the process.

- **Adjusting the position value**

An offset value is deducted from the current axis position value. Current motions and homing are not influenced by this setting.

- **Correcting the internal axis coordinate system**

An offset value is deducted from the actual position value of the base or superimposing coordinate system. Current motions and homing are not influenced by this setting.

Note

Device-specific properties

When homing with BERO and zero mark, the BERO can be connected to the integrated inputs of the CPU or to a DP slave connected to DP(DRIVE).

When homing with BERO only, the BERO must be connected to the input device, e.g. at the drive, at ADI4.

For further information on device-specific, marginal conditions and additional parameter settings, refer to the supplementary information on SIMODRIVE 611U, MASTERDRIVE-MC or ADI4 on the CD-ROM for your product and to the equipment manuals.

3.1.7 Absolute encoder adjustment

The technology functions MC_Home (*Mode* = 5) and MC_ExternalEncoder (*Mode* = 6) are used to add the absolute value encoder offset for axis operation and external encoders.

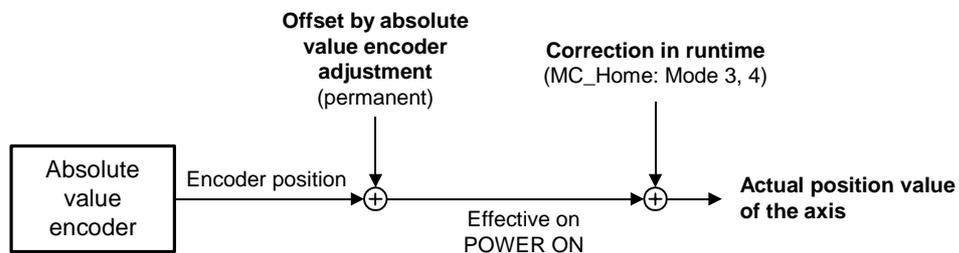
The current position of an axis with absolute value encoder is set to a required value. This shifts (offsets) the absolute position of the absolute value encoder. This offset is stored permanently and remains in effect for use in the next adjustment of the absolute value encoder. Execute this function **once** when you commission the PLC.

The offset is cleared if the Technology CPU changes from STOP to RUN and the TO is invalid (for example, if the Technology CPU is started up without MMC.)

To adjust the absolute value encoder:

1. Disable the software limit switches, because otherwise you can not adjust the absolute value encoders.
2. Move the axis to the relevant reference position, then adjust the absolute value encoder (MC_Home or MC_ExternalEncoder technology function)
3. Enable the software limit switches as required.

Note that the adjustment of the absolute value encoder only offsets the encoder value. The offset of the absolute value encoder adjustment and the value of the absolute value encoder are decisive for determining the position after POWER OFF or restart (MC_Reset, *Restart* = TRUE.) During operation, the current actual position is also affected by the modulo settings of the axis, and by positioning or position adjustment control commands.



3.1.8 Data set changeover

Introduction

You can create several axis data records to change controller parameters or toggle motor encoder mode to machine encoder mode while the system is in run, for example.

The axes listed below support multiple data records:

- Velocity-controlled axes
- Positioning axes
- Synchronization axes

Virtual axes support only one data record.

Configuration

Create a data record in the axis configuration dialog of S7T Config, and then program it using the axis wizard. Use the "MC_ChangeDataset" technology function to change the data record in RUN.

3.2 "Velocity-controlled axis" technology object



Use the "Velocity-controlled axis" technology object if the axis position is insignificant, i.e. if you only want to preset, control and monitor the rpm or velocity of an axis.

Operating modes

Axis operating modes

- Velocity-controlled
- Simulation

Functions

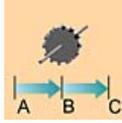
- Velocity preset
- Motion with torque reduction

Technology functions

Technology functions available for the technology object:

MC_Power	MC_Reset	MC_Stop
MC_Halt	MC_MoveVelocity	MC_ReadSysParameter
MC_WriteParameter	MC_SetTorqueLimit	MC_ChangeDataset

3.3 "Positioning axis" technology object



Use the positioning axis technology object to preset, control and monitor the position of an axis.

Operating modes

Axis operating modes

- Position-controlled
- Following mode
- Simulation

Functions

- Motion with velocity preset
- Motion with torque reduction
- Positioning
- Moving to fixed end stop
- Homing

Positioning

In position-controlled mode, the axis is moved to a programmed target position. The target position can be set "relative" or "absolute". You can specify the direction of movement and the rotary direction of modulo axes.

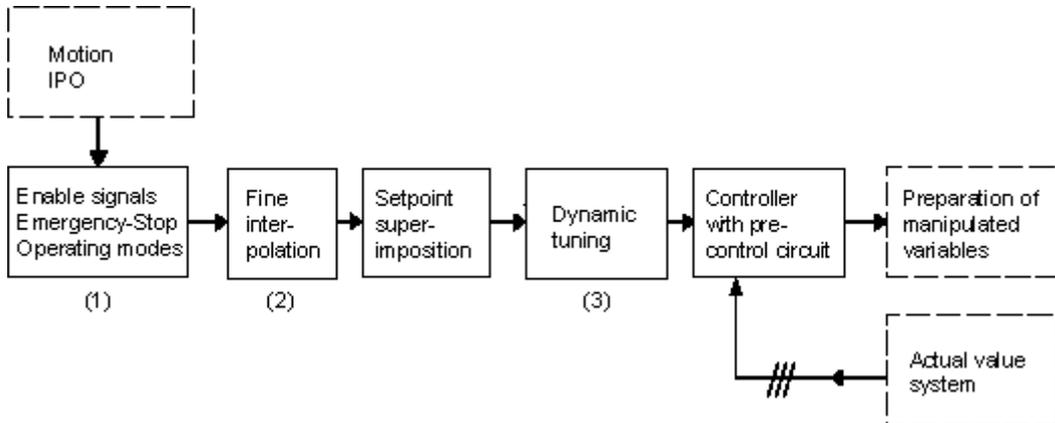
Technology functions

Technology functions available for the technology object:

MC_Power	MC_Reset	MC_Home
MC_Stop	MC_Halt	MC_MoveAbsolute
MC_MoveRelative	MC_MoveAdditive	MC_MoveSuperImposed
MC_MoveVelocity	MC_MoveToEndPos	MC_ReadSysParameter
MC_WriteParameter	MC_SetTorqueLimit	MC_ChangeDataset

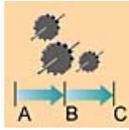
3.3.1 Block diagram: Positioning axis with position control

The figure below shows the block diagram of a position-controlled axis:



- (1) If an enable or emergency-off signal is not set, IPO in following mode, i.e. IPO setpoint = IPO actual value
- (2) adjustable; linear, constant velocity, direct
- (3) PT2 element with T1, T2

3.4 "Synchronization axis" technology object



Use the "Synchronization axis" technology object if you want to use a control value based on the motion and position of a leading axis (the synchronized axis follows leading axis).

Operating modes

Axis operating modes

- Position-controlled
- Following mode
- Simulation

Functions

Use the "Synchronization axis" technology object to integrate the following functions:

- Motion with velocity preset
- Motion with torque reduction
- Positioning
- Moving to fixed end stop
- Homing
- Synchronized motion (gearing / camming)
- Superimposed synchronized motion (gearing / camming)

Technology functions

Technology functions available for the technology object:

MC_Power	MC_Reset	MC_Home
MC_Stop	MC_Halt	MC_MoveAbsolute
MC_MoveRelative	MC_MoveAdditive	MC_MoveSuperImposed
MC_MoveVelocity	MC_MoveToEndPos	MC_GearIn
MC_CamIn	MC_GearOut	MC_CamOut
MC_Phasing	MC_ReadSysParameter	MC_WriteParameter
MC_SetTorqueLimit	MC_ChangeDataset	MC_GearInSuperimposed
MC_GearOutSuperimposed	MC_CamInSuperimposed	MC_CamOutSuperimposed
MC_PhasingSuperimposed		

3.4.1 Structure of the "Synchronization axis" technology object

Synchronization objects and following axes are separate objects, but form a common synchronous axis.

The "Synchronous Operation" and "Axis" technology objects have a reciprocal effect on each other depending on their respective operating modes and which commands are in effect.

If an error has occurred only at the synchronization object, the following axis can still continue positioning, but not synchronous operation. In order to avoid this effect, always acknowledge the errors. Errors at the "Axis" technology object therefore have a direct reciprocal effect on the synchronization object functions.

Axis stop also triggers the stop of synchronous motion.

3.4.2 Synchronization compound

The "Synchronization axis" technology object can be used to interconnect axes to form a synchronization compound.

Example

A leading axis generates a control value. The synchronization object processes this value, based on defined criteria (gear ratio, scaling, offset, cam disk) and assigns it to the following axis as command variable.

Note

The control values and following values are coupled without physical conversion in the relevant assigned units. If, for example, the leading axis is a linear axis (in mm units), and the following axis is a rotary axis (in degree units), then one millimeter is proportional to one degree, at a conversion ratio of 1:1.

Example of mechanical synchronism

Gear synchronism is given, for example, when two mechanically coupled rollers are driven by the same motor.

The camming model could be a cam gear with a mechanical cam and sensing mechanism.

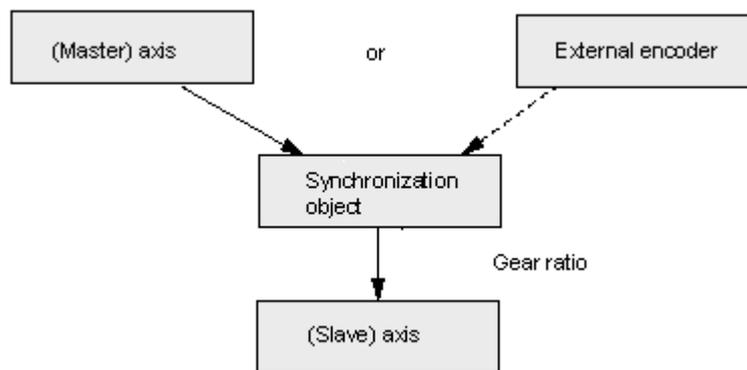
The synchronization and sync off FBs of a synchronization compound correspond with the function of a mechanical coupling.

Synchronization compound

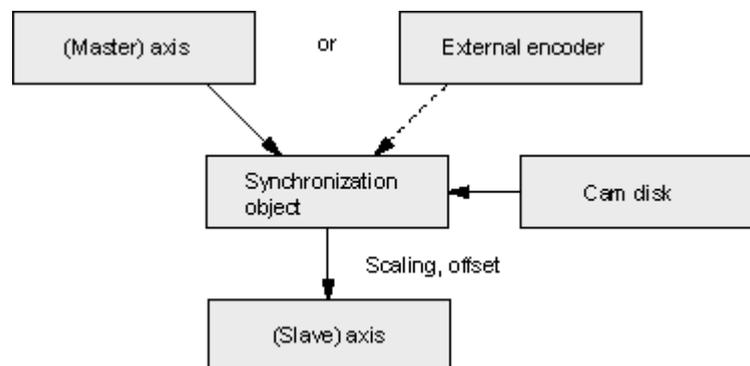
A synchronization compound consists at least of these elements:

- A leading axis that provides the control value. Leading axes can be formed by positioning axes, synchronization axes, virtual axes or external encoders.
- A synchronization object
- A following axis

Objects for gearing:



Objects for gearing:

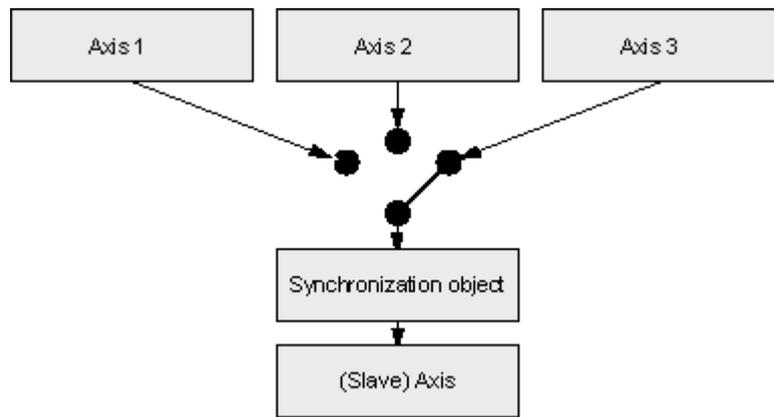


Control value coupling

A following axis can be interconnected with multiple control values by means of the synchronization object. Of these control values, however, only one can be evaluated at any given time. The control value can be preset based on the value output at positioning axes, synchronization axes, virtual axes or external encoders.

To change over to a different control value, call FB "MC_GearIn" (gearing) or "MC_CamIn" (camming) again in the user program. Use the FBs "MC_GearInSuperimposed" and "MC_CamInSuperimposed" for superimposing synchronization commands.

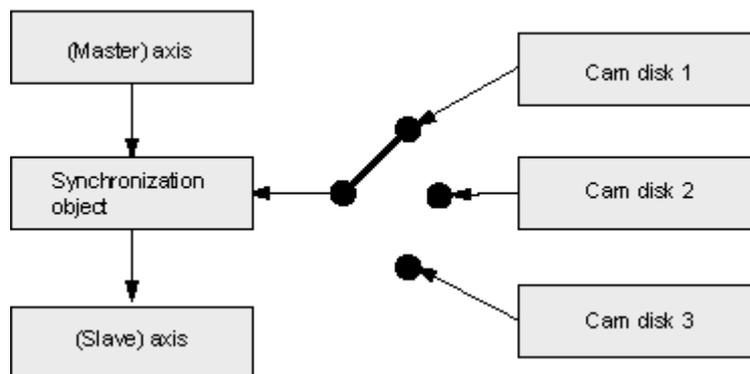
Example of a synchronization object with multiple control values



Cam disk coupling

In the same way, you can use multiple cam disks in a synchronization compound. You can use the FBs "MC_CamIn" or FB "MC_CamInSuperimposed" in the user program for dynamic changeover of the cam disks.

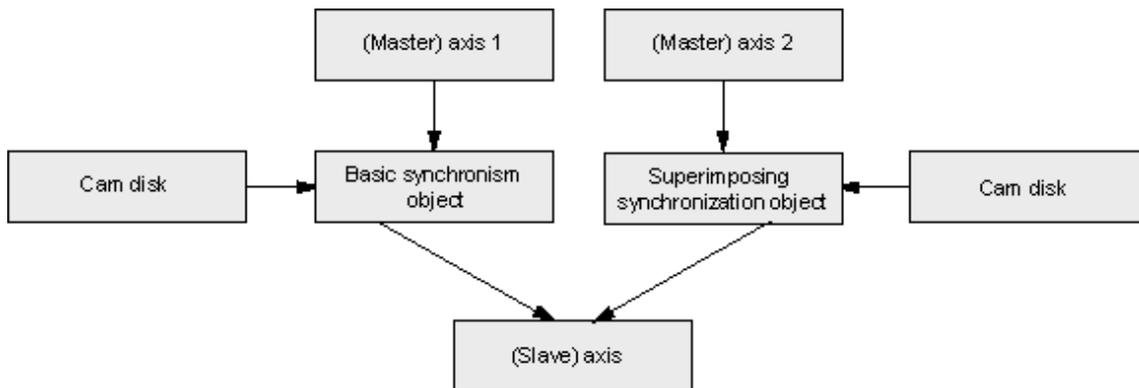
Example of a cam synchronization compound



Superimposing synchronism

A superimposed synchronized motion has the same effect on the basic motion of an axis (motion or synchronism) as a superimposed positioning motion.

The interconnection conditions for superimposing synchronism and basic synchronism are identical. Same as a superimposing synchronization object, you can also logically link a basic synchronism object with several leading axes or cam disks.



Rules

The following rules apply to the interconnection:

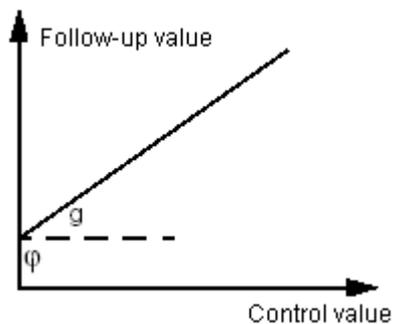
- Control values can be used in multiple instances. A leading axis can provide the control value for multiple following axes. Positioning axes, synchronization axes, virtual axes or external encoders can determine control values.
- The synchronization object can be interconnected with multiple control values and cams. Allowances must be made in the configuration of the synchronization object for all combinations required for operation.
- An axis may have up to synchronization objects (basic synchronism and superimposing synchronism.)

3.4.3 Gearing

At the MC_GearIn and MC_GearInSuperImposed technology functions, you define the gear ratio as a function of the ratio between two integers, and the offset. You can modify the offset at later time by means of the MC_Phasing and MC_PhasingSuperImposed technology functions.

Response characteristics

The response characteristic for gearing can be expressed as a linear relationship between the control value and the slave value.



Following value = $g \cdot \text{control value} + \varphi$
 g = gear ratio (transmission ratio)
 φ = offset

Direction

The gear ratio can be defined as positive or negative value. The resultant response:

- **Positive gear ratio:** All axes run in the same direction.
- **Negative gear ratio:** The axes run in countering direction.

Absolute or relative gearing

Absolute or relative gearing can be set at input parameter *Absolute*.

- **Absolute gearing** establishes an absolute relationship between the leading and following axes.

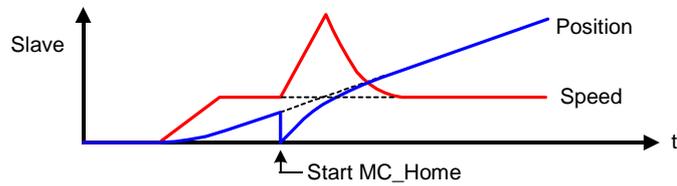
An offset between the leading and following axes is compensated during synchronization based on the value defined at the technology function.

- **Relative gearing** establishes a relative relationship between the leading and following axes.

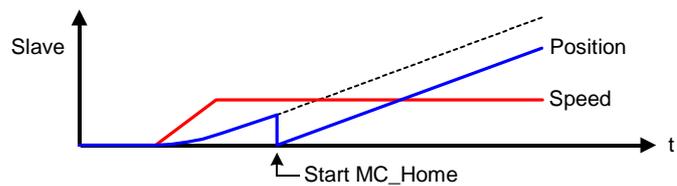
Any offset developing between the axes after the start of synchronization is **not** compensated. The offset between the positions of the axes is set at random and is determined by the time of their synchronization.

Setting new axis positions in synchronized mode

Absolute coupling results in a compensating motion that eliminates the difference of the setpoint positions:



Relative coupling does not result in a compensating motion, i.e. the offset changes:



A new axis position is set at the technology function "MC_Home" (*Mode = 3 or 4*).

3.4.4 Camming

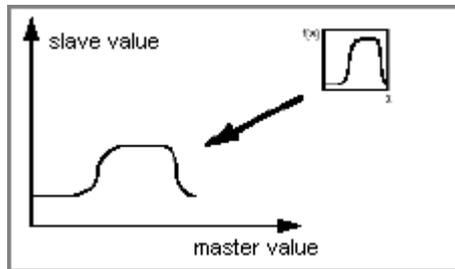
Camming is characterized by **adynamic ratio** between the leading and following axes, and by the phase shift. The transmission ratio is described by a **cam disk** (transfer function).

Scaling and offset of the cam disk used is possible on both the leading axis and the following axis. This allows an individual adjustment of the cam disk definition and range.

Synchronization to a position within the cam is also possible, as is a cam changeover at the end of a currently active cam.

Response characteristics

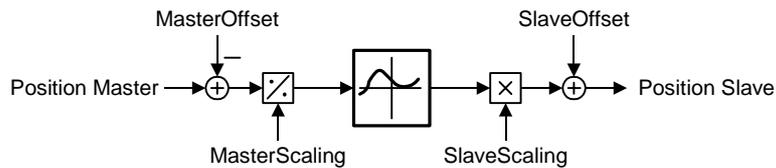
The transmission characteristics of camming are determined by a cam disk ($y = f(x)$).



Scaling and Offset

The scaling and offset of the cam function for camming can be set both at the leading axis and at the following axis by means of the technology function for cam synchronization. The configured cam disk is not modified by the call of the "MC_CamIn" technology function.

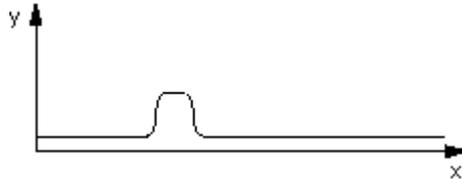
Transmission steps in camming



Acyclic or cyclic cam disk mode

At input parameter *CyclicMode* of the technology function for cam synchronization, you can set acyclic (*CyclicMode* = 0) or cyclic (*CyclicMode* = 1) mode.

- Acyclic mode means, that the cam disk is executed once only. Synchronism is terminated when the cam disk has reached its end position. Example:



(x = control value; y = slave value)

- In cyclic cam disk mode, the leading axis are calculate as modulo to the cam disk length. As with gearing, the coupling can be terminated by programming an abort. Example:



(x = control value; y = slave value)

Absolute and relative camming

The input parameters *MasterAbsolute* and *SlaveAbsolute* of the technology function "MC_CamIn" can be used to set absolute or relative camming.

- When **absolute camming** is set, the control values based on the cam disk domain, and the slave values based on the range of values of the cam disk, are interpreted as being absolute.

The system compensates any offset developing between the leading and following axis during synchronization. When synchronism is reached, a defined phase relationship is established between the control value and the slave value.

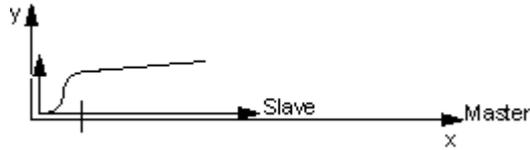
For absolute camming, the start and end values of the modulo axes should be identical, because otherwise unwanted step jumps may occur.

- When **relative camming** is set, the cam disk is tracked starting at the start value of camming.

This means that any offsets between the control value and the slave value are **not** compensated for during synchronization.

The absolute and relative synchronism settings available are shown below.

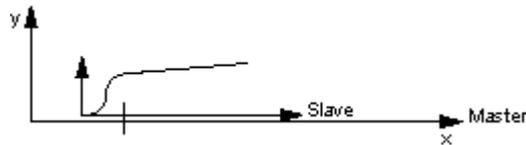
Absolute synchronism between the leading and following axes



$MasterAbsolute = 1; SlaveAbsolute = 1$

In the cam disk, the absolute position of the leading axis is always assigned the absolute position of the following axis.

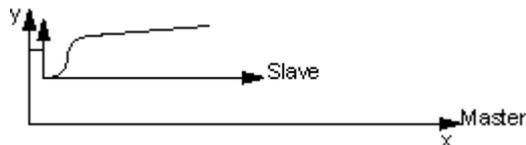
Relative synchronism to the leading axis



$MasterAbsolute = 0; SlaveAbsolute = 1$

The master position is insignificant for synchronization. The master / slave coupling mode is defined according to the transfer function of the programmed cam disk, but with random offset at the master.

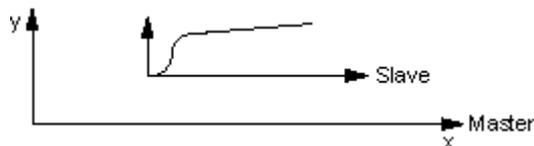
Relative synchronism to the following axis



$MasterAbsolute = 1; SlaveAbsolute = 0$

The slave position is insignificant for synchronization. The master / slave coupling mode is defined according to the transfer function of the programmed cam disk, but with random offset at the slave.

Relative synchronism to the leading and following axes



$MasterAbsolute = 0; SlaveAbsolute = 0$

The master / slave coupling mode is defined according to the transfer function of the programmed cam disk, but with random offset both at the leading and on the following axes.

Correction of synchronous motions

Synchronous motions can be corrected by switching over to scaling and offset of the control value and the slave value.

Other options include:

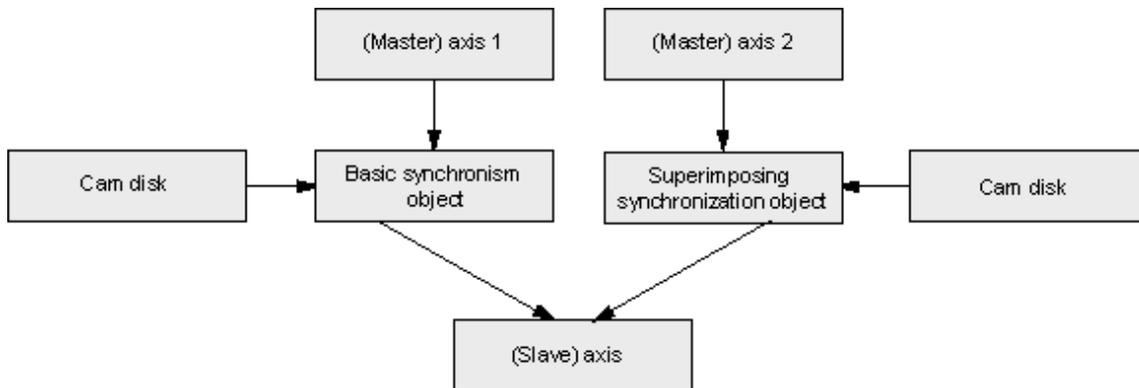
- Offset and scaling on the cam itself
- On-the-fly setting of the reference point on the control value source and the following axis
- superimposing positioning

Note

Any point of the cam can be set as the starting point for camming. This can be the starting point, termination point, or any point within the cam.

3.4.5 Superimposing synchronism

You can configure a superimposing synchronism for cam and gearing. This is done by configuring an additional synchronization object at the synchronization axis. Cross-referencing synchronization objects is impossible.



Configuring axes with superimposing synchronism

A superimposing synchronization object is configured in analog to a synchronization object.

Superimposed motion

Relative to the basic motion of an axis (motion or synchronism), a superimposing synchronism has the same effect as a superimposing positioning motion.

Only one superimposing motion can be applied to an axis at any given time:

- superimposing positioning motion, or
- superimposing synchronism

Superimposing synchronism can thus be active without concurrently active base motion or base synchronism.

For further information on superimposing motions at an axis, refer to the corresponding description of the technological functions.

Coordinates

The base synchronization object is referenced to the base coordinates when the axis operates in absolute synchronism and the slave position is defined.

The superimposing synchronization object is referenced to the superimposing coordinates when the axis operates in absolute synchronism and the slave position is defined.

Synchronism with reference to base coordinates and superimposing synchronism with reference to superimposing coordinates do not influence each other.

The sum coordinate is derived from the base and superimposing coordinates.

Absolute and relative synchronism

You can program and execute a relative or absolute superimposing synchronism in the synchronization function (with absolute reference to the superimposing coordinates!)

Monitoring

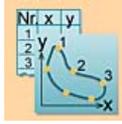
The output values of a synchronization object (and thus the motion element of superimposing axis synchronism) can be read from the system variable **currentSlaveData** at the synchronization object.

Synchronization monitoring/states

The axis variables and monitoring functions are always referenced to overall synchronism.

Error message (synchronization errors at the synchronization axis) are reported to all interconnected synchronization objects.

3.5 "Cam disk" technology object



Use the "Cam disk" technology object to implement complex motion structures. A "Cam disk" defines the dependency between the slave position and the position of a leading axis.

A cam disk describes a position-specific transmission behavior between a control value source such as a virtual positioning axis or external encoder (input variable) and a following axis (synchronization axis, output variable.)

The "Cam disk" technology object is configured in S7T Config. The cam profile can be defined in S7T Config or in the user program.

- The cams are created in S7T Config, based on interpolation points or segments. Use the Scout CamTool or CamEdit programs to apply the cams.
- The cam can be defined in the user program, in the "MC_CamSectorAdd" and "MC_CamInterpolate" technology functions. Before you do so, reset the cam disk by executing the "MC_CamClear" technology function.

Technology functions

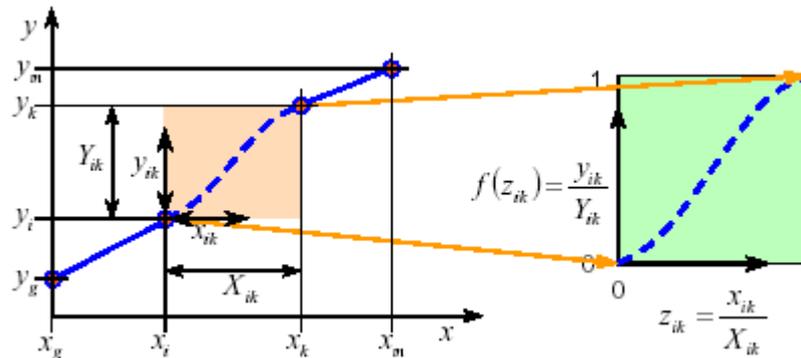
Technology functions available for the technology object:

MC_Reset	MC_ReadSysParameter	MC_WriteParameter
MC_CamClear	MC_CamSectorAdd	MC_CamInterpolate
MC_GetCamPoint		

3.5.1 Normalization

When a cam disk is defined based on segments, the various cam segments can be provided in a standard form and normalized to factor 1, i.e. the range of values and the defined range corresponds with the completed interval [0,1].

Mapping of a physical cam segment to the normalized range



Alternatively, the segments can also be entered in the physical range.

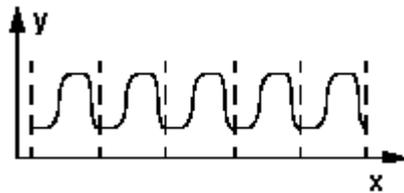
Advantages of normalization

- Motion is clearly defined for similar tasks
- Independent of physical units and ranges of master and slave

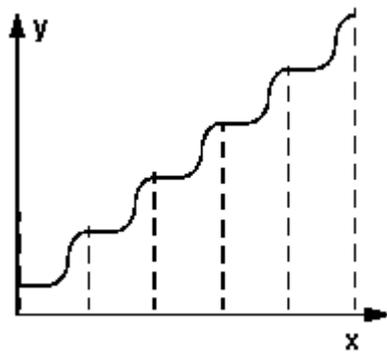
3.5.2 Using a cam disk

A cam disk can be configured for non-cyclic (single operation), cyclic relative (continuous) or cyclic absolute (return to interpolation point) operation.

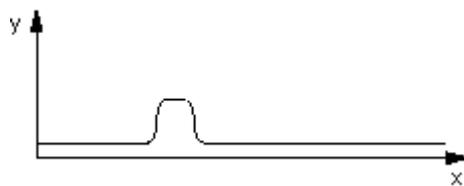
Example of cam application using absolute cycle
(x = control value; y = tracking value)



Example of cam application using relative cycle
(x = control value; y = tracking value)

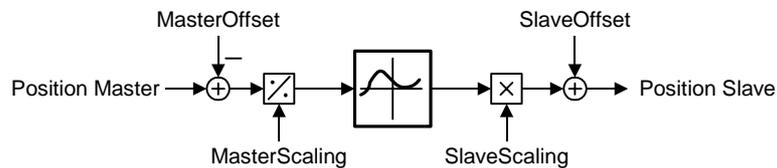


Example of non-cyclic operation of a cam disk
(x = control value; y = slave value)



3.5.3 Scaling and Offset

The defined areas and range of values of cam disks can be adapted in S7T Config to meet the requirements of various applications. The function can be expanded or compressed (scaled), and shifted (offset).



The scaling and offset of the cam disk can not be modified by the user program.

3.5.4 Interpolation

At a cam which is defined by means of polynomials and interpolation points, gaps in the defined area can be filled by interpolation.

During interpolation of a cam disk

- the cam disk definition is verified to eliminate ambiguous values in the defined area, for example
- continuity and marginal conditions are checked
- missing areas are supplemented.

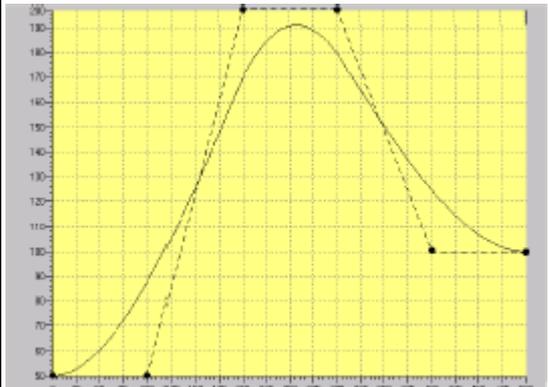
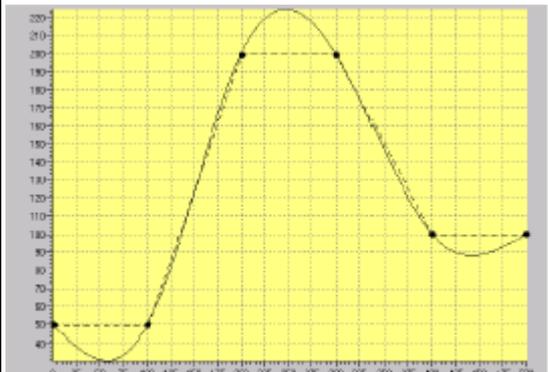
Note

After interpolation, new polynomials or interpolation points can only be added after resetting the cam with MC_CamClear.

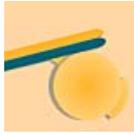
During interpolation and in the continuity check, the properties of master and following axes are neglected.

Interpolation modes

Interpolation modes you can select from the "Interpolation tab in S7T Config in order to correct discontinuous areas when you create a cam disk:

Interpolation	Description	Example
LINEAR	Linear interpolation	
B_SPLINE	Approximation with Bezier splines, i.e. cam profile along the interpolation points	
C_SPLINE	Interpolation with cubic splines, i.e. cam profile through the interpolation points	

3.6 "Output Cam" technology object



Use the "Output cam" technology object to generate switching signals based on the axis position. The switching signals can be output to the integrated outputs of the technology CPU or to the outputs of a standard slave at DP(DRIVE).

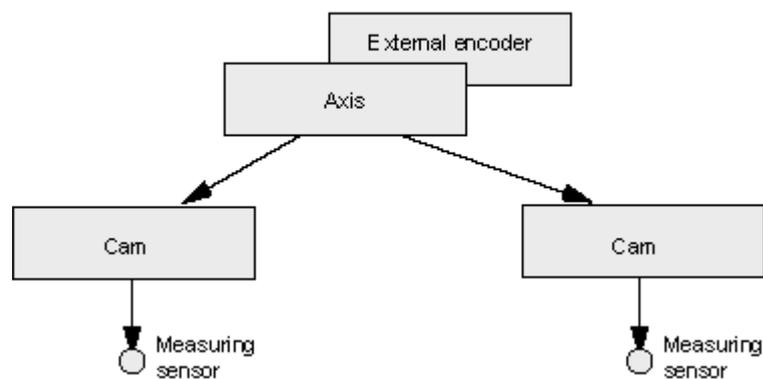
The Technology CPU distinguishes between the cams listed below:

- **Position-based cam**
Position-based cams are set when the ON position is reached, and reset when the OFF position is reached.
- **Switching cams**
Switching cams are set when the ON position is reached and must be reset in the user program.
- **Time-based cam**
Time-based cams are set for the duration of a defined pulse period when the ON position is reached.

Interconnections

The "Cam" technology object can be interconnected with the following technology objects:

- Positioning axes
- Synchronization axes
- External encoders



Reference to actual position value or position setpoint

Technology object	Reference to actual position value possible	Reference to position setpoint possible
Physical positioning axes	X	X
Physical axes for synchronized operation	X	X
Virtual axes	-	X
External encoders	X	-

Modulo settings do not influence cam functionality.

Technology functions

Technology functions available for the technology object:

MC_Reset	MC_CamSwitch	MC_CamSwitchTime
MC_ReadSysParameter	MC_WriteParameter	

3.6.1 Position-based cam

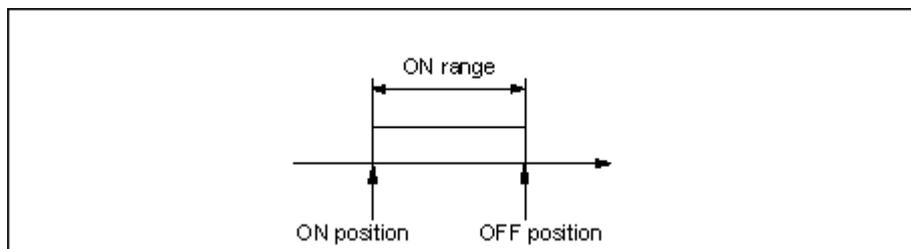
Note

The definition of the ON range applies to modulo axes with cyclic motion range.

ON range

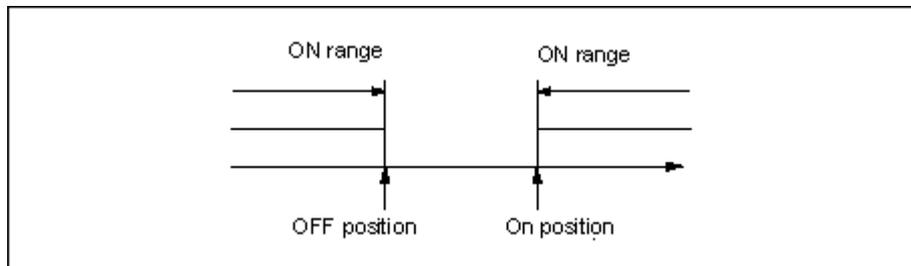
The ON range of position-based cams is defined by the distance between the On and OFF positions in **positive** counting direction.

The ON position value is lower than that of the OFF position:



The ON range is out of range if it exceeds the OFF range.

The ON position value is higher than that of the OFF position:



Switching response

The switching response of position-based cams is determined by the ON and OFF positions. An additional **effective direction** may be defined.

Switching action based on	The position-based cam is active	The position-based cam is inactive
ON position, OFF position	<ul style="list-style-type: none"> when the cam is enable with MC_CamSwitch when the position lies within the ON range when the position value is shifted to the ON range of the cam 	<ul style="list-style-type: none"> when the position is out of range of the ON or OFF position when the position value is shifted out of the ON range *
Force direction	<ul style="list-style-type: none"> when the position lies within the ON range and the effective direction corresponds with the motion direction 	<ul style="list-style-type: none"> when the position is out of range of the ON or OFF position when the motion direction is not the same as the set effective direction. when the position value is shifted out of the ON range *
Hysteresis		when the cam moves out of the hysteresis range

* The position value of the interconnected object may change rapidly when the object is homed or its coordinate system is shifted.

Inverted output

This function inverts the active and inactive signals of the cam output.

3.6.2 Switching cams

Switching response

The switching action of switching cams is determined by the ON and OFF positions, and by the direction of movement.

Switching action based on	Switching cam switches on	Switching cam switches off
ON position, OFF position	when the cam is enabled by means of FB MC_CamSwitch when the ON position is reached.	when the cam is disabled by means of FB MC_CamSwitch
Force direction	when the direction of movement matches the effective direction	

Note

The cam is not switched if the axis does not move explicitly over the ON position, e.g. by setting the actual value.

Inverted switching response

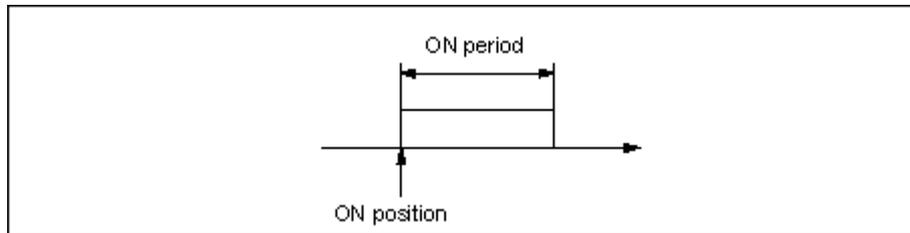
The cam is switched **ON** when it is locked by FB "MC_CamSwitch".

Note

The cam is switched **OFF** at the ON position, if the motion direction corresponds with the effective direction or the cam is enabled by means of FB "MC_CamSwitch".

3.6.3 Time-based cam

Switching response



The switching response of time-based cams is determined by the ON and OFF positions. An additional **effective direction** may be defined.

Switching action based on	The time-based cam is switched on	The time-based cam is switched off
Switch-on position	at the ON position	
ON duration		when the configured interval has expired
Force direction	at the ON position, if the motion direction corresponds with the effective direction	when the configured interval has expired

Note

Time-based cams can not be retriggered.

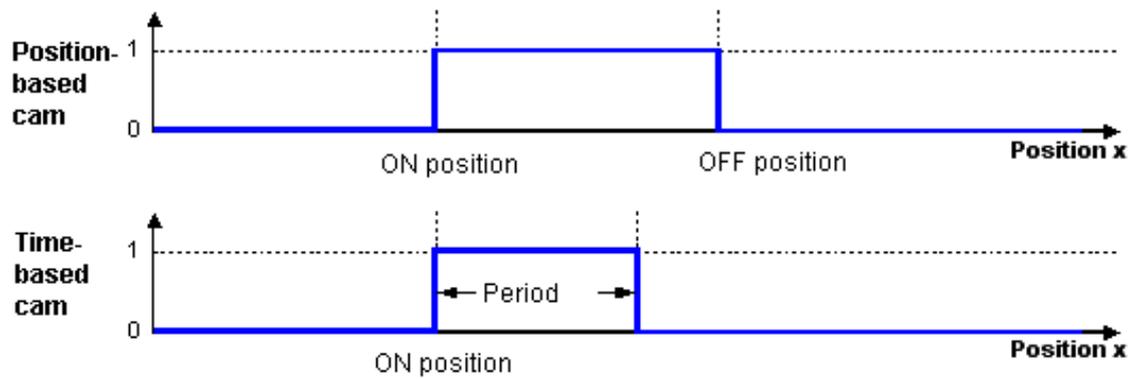
Inverted output

To invert the output, the time-based cam is active, and is deactivated at the switching position for the duration of the specified time.

3.6.4 Response, effective direction

Response

The diagram below shows the ON and OFF switching characteristics of cams, without hysteresis, derivative time or OFF delay:



The switching characteristics are determined only by the position (setpoint position or actual position).

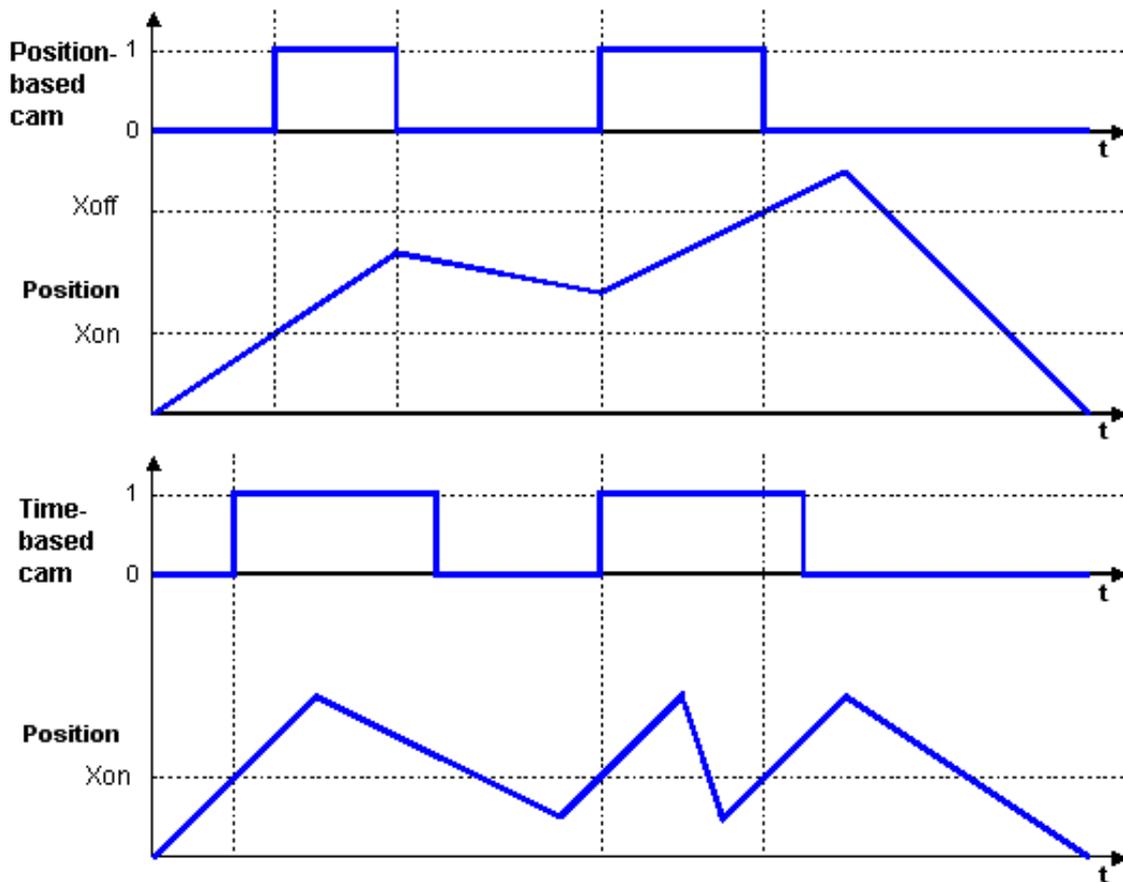
Effective direction

You can define an effective direction when you enable the cam. The cam is only switched if the motion corresponds with the set effective direction.

Options available:

Effective direction	Response
Positive	The cam is switched only with positive direction of the motion.
Positive and negative	The cam is switched independent of the motion direction.
Negative	The cam is switched only with negative direction of the motion.
Current sense of rotation	With this setting, the cam switches only in the currently set direction of rotation. Standstill is a positive direction of rotation.

The diagram below shows the effects of the effective direction (effective direction *Positive*)

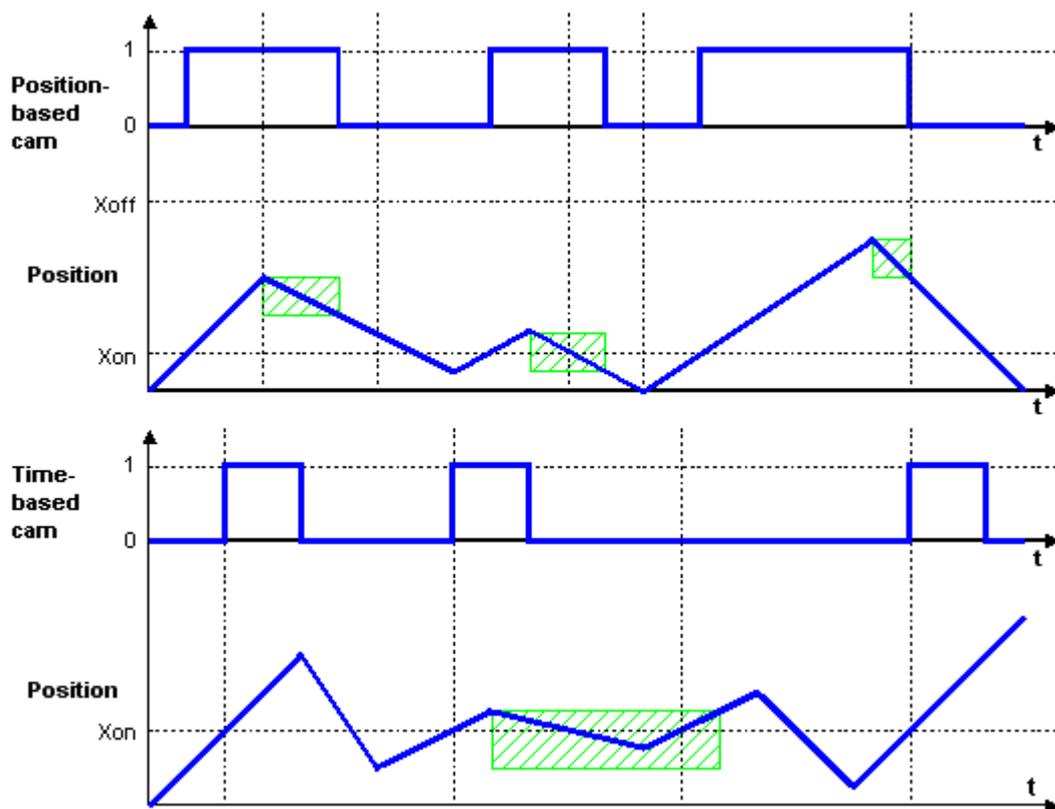


3.6.5 Hysteresis

Mechanical backlash may cause fluctuation of the actual position value, and thus unwanted transitions of the cam switching state. These unwanted switching states can be prevented by setting a hysteresis.

Conditions for the hysteresis

- The hysteresis is not enabled until the direction has been reversed.
- The direction of movement is not redefined within the hysteresis.
- Within the hysteresis, the switching status of position-based cams is not changed.
- If modified cam switching conditions are detected after the cam has moved out of the hysteresis window, this current switching status is set.



The height of the green hatched area corresponds with the hysteresis.

Hysteresis

The high limit of the hysteresis is set to 25% of the modulo axis working range, and to 25% of the non-modulo axis range. The working range is defined by the software limit switches. The working range is not limited if a SW limit switch does not exist. You receive an error message if this maximum is exceeded.

- **Hysteresis for position-based cams**

The hysteresis is enabled immediately after a reversal is detected. Position-based cams are switched off when they move out of the hysteresis window.

- **Hysteresis for time-based cams**

The OFF response of a time-based cam is determined by its ON period, not by the hysteresis.

This is set at the *Hysteresis* input parameter of the "MC_CamSwitch" technology function or FB "MC_CamSwitchTime".

3.6.6 Derivative-action times

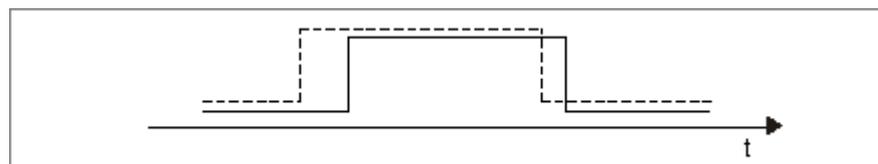
To compensate for the switching times of digital outputs and connected switching elements, it is possible to specify derivative-action times. These are derived from the sum total of all delay times.

Settings for the activation and deactivation times can contain positive or negative values. A negative activation time must be entered if the cam is to be switched before its programmed start position.

This is set at the *Delay* input parameter of the "MC_CamSwitch" or "MC_CamSwitchTime" technology functions. To maximize switching accuracy:

- Determine the system delay time, based on several measurements at a constant velocity.
- Set the derived mean value as derivative-action time at input parameter *Delay*.

The result is a switching accuracy of +/- 70 μ s of the high-speed output cams at the integrated outputs of the Technology CPU. The absolute switching accuracy (distance or angle) is derived from the set switching accuracy and the current velocity.



—— Derivative-action time = 0; - - - - Derivative-action time < 0

Note

The calculation of dynamic adjustments is based on the actual axis velocity at the time of its internal initiation.

The derivative-action time must allow for DP communication times.

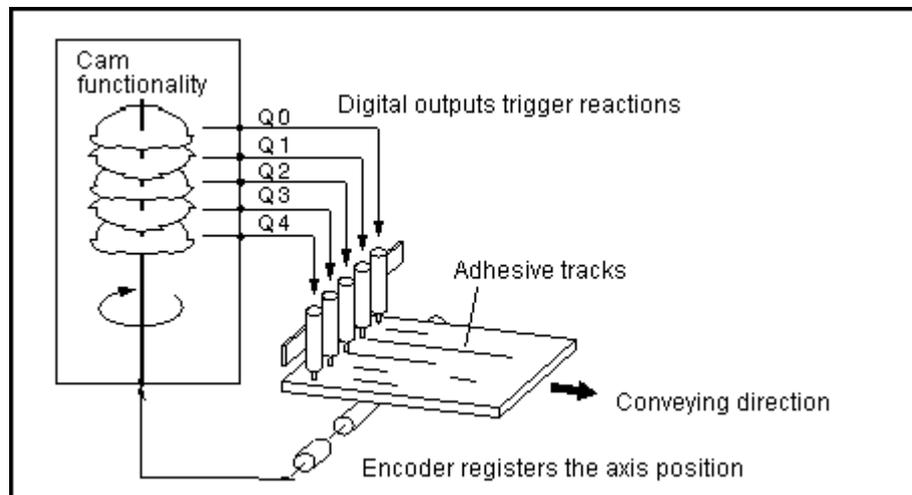
Long derivative-action times (over a modulo cycle) may cause substantial fluctuation of the switching positions at the actual value cams (actual value profile). Setpoint output cams should be used in this case.

The system allows for the specified derivative-action times when the output cams are calculated and managed. A cam based on the derivative action times is not reset dynamically after it is switched, irrespective whether the actual velocity has changed or not.

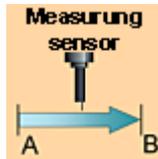
The dynamic derivative-action for modulo axes can be greater than one modulo length. The system does not **group** switching operations. One switching operation is active in the system at any given point in time. A switching cycle is completed when the cam is switched off.

3.6.7 Example of an electronic cam control

Lines of glue are applied to a board. The cams are assigned to an external encoder. Cams assigned to defined outputs are switched on and off at preset positions.



3.7 "Measuring input" technology object



Use the "Measuring input" technology object for precise and fast recording of actual position values.

In S7T Config, you can assign a measuring sensor to an axis or to a single external encoder. Connect the measuring sensor to a digital input of the drive component, or to a TM15/TM17 High Feature module.

The measurement of actual position values is initiated by means of the Motion Control command "MC_MeasuringInput" in the user program of the CPU. The operating range of the measuring sensor can here be limited by means of a start and end value.

The actual position value is recorded and saved at the positive or negative edge of the measuring sensor signal. The measuring function can be triggered at both edges, provided the component used supports this mode.

Technology functions

Technology functions available for the technology object:

MC_Reset	MC_MeasuringInput	MC_ReadSysParameter
MC_WriteParameter		

3.7.1 Interconnection, Connection - Measuring sensors

- In S7T Config, the "Measuring sensor" TO can only be inserted at the "Axis" and "External encoder" TOs.
- Each "Measuring sensor" technology object only has a single axis or a single external encoder assigned to it.
- The measuring sensor input must be located either at the corresponding drive component, or at a TM15/TM17 High Feature module. The measuring sensor inputs are indicated specially at the corresponding hardware, or have to be configured there as measuring sensor inputs. The number of measuring sensors available depends on the hardware used.

Other digital inputs at DP(DRIVE) can not be used as measuring sensor inputs.

The digital measuring sensor input used for the "Measuring sensor" TO is configured for the TM15/TM17 High Feature module in S7T Config.

- Several "Measuring sensor" technology objects can be configured for a positioning axis, synchronization axis or for an external encoder.

However, "Measuring sensor" technology objects may **not** be active simultaneously.

- Measuring sensors may not be configured for use with virtual axes.
- Measuring sensors can not be configured for operation on velocity-controlled axes.

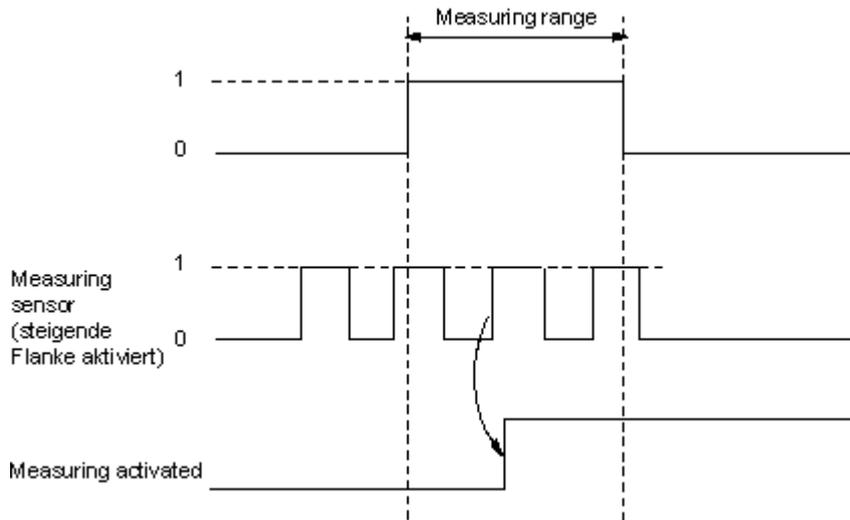
Enabling / disabling

Measuring sensors are enabled/disabled by means of FB "MC_MeasuringInput".

3.7.2 Measuring range

The measuring command may be valid across the entire range, or be limited to a start and end position (active range).

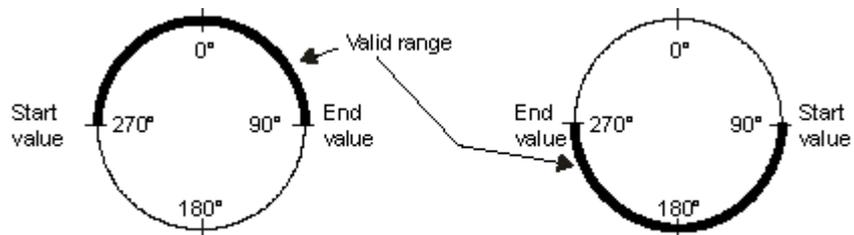
The measurement can be restricted to a defined measuring range. The measurement will be triggered only when the position lies within the measuring range.



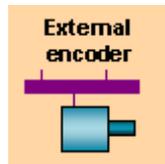
If a trigger signal is not received within the measuring range, the measuring command is canceled and a FB error is indicated at the Technology DB.

For non-modulo axes, the sequence in which the start and end values are specified is irrelevant. If the initial value is greater than the end value, the two values are exchanged.

If the start value is greater than the end value in a modulo axis, the validity range is extended from the start value over the modulo transition of the axis to the end value.



3.8 "External encoder" technology object



Use the "External encoder" technology object to provide a control value to the technology CPU, based on the position or angle of a mechanical component. This information can also be passed directly as actual value to the runtime of a process visualization system.

The "External encoder" technology object returns the actual position, velocity and acceleration values of a path measurement system, without active influence on the drive component.

Technology functions

Technology functions available for the technology object:

MC_Reset	MC_ExternalEncoder	MC_ReadSysParameter
MC_WriteParameter		

3.8.1 Interconnection, Connection - External encoders

Interconnection

The "External encoder" technology object can be interconnected with the following technology objects:

- "Synchronization axis" TO as leading axis
- "Cam" TO as actual position value
- "Measuring sensor" TO as actual position value

Connection

External encoders can be connected to the ADI4, or to the encoder inputs of DP drives. The SIMODRIVE Sensor Isochron is connected to PROFIBUS (telegram 81).

Examples

- On the SIMODRIVE 611U, the second encoder interface on a double-axis module can be used to connect an external encoder.
- A second encoder can be connected to MASTERDRIVES MC via an encoder module.
- Clocked PROFIBUS encoders can be operated directly on DP(DRIVE).

3.8.2 Synchronization - External encoders

The Technology CPU supports various homing modes. The reference position of the external encoder can be set in FB 432 "MC_ExternalEncoder", at the *Mode* input.

Homing with incremental encoders

- **Direct homing** (*Mode* = 2 and 4)

Setting the homing position; the value of the homing position coordinate is assigned to the current encoder position.

- **Passive homing / On-the-fly homing** (*Mode* = 3 and 5)

The value of the homing position coordinate is assigned to the current encoder position as the encoder is moving:

- when the zero mark is reached (default setting)
- when the BERO is reached (adjustment in the Expert list)
- when the next zero mark after BERO is reached (adjustment in the Expert list)

The distance to go between the BERO and the zero mark can be monitored by means of the zero mark monitoring function.

Synchronization of incremental encoders can be configured in the expert list.

4 Configuration

4.1 Overview - configuration

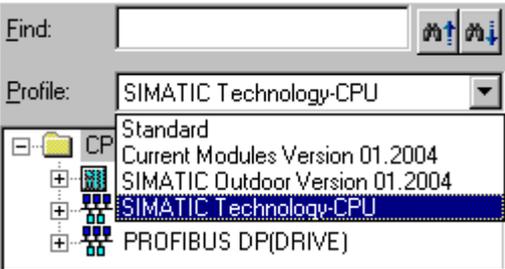
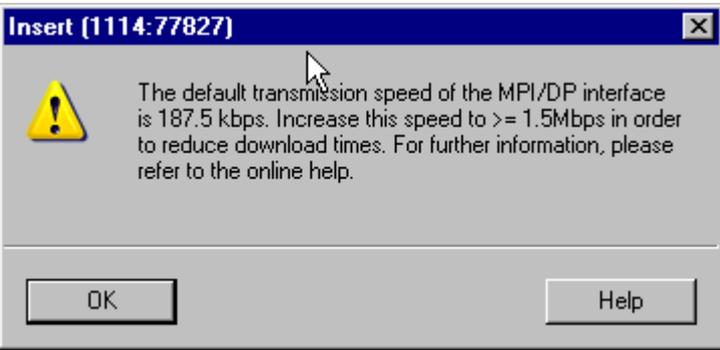
Steps in executing motion control commands:

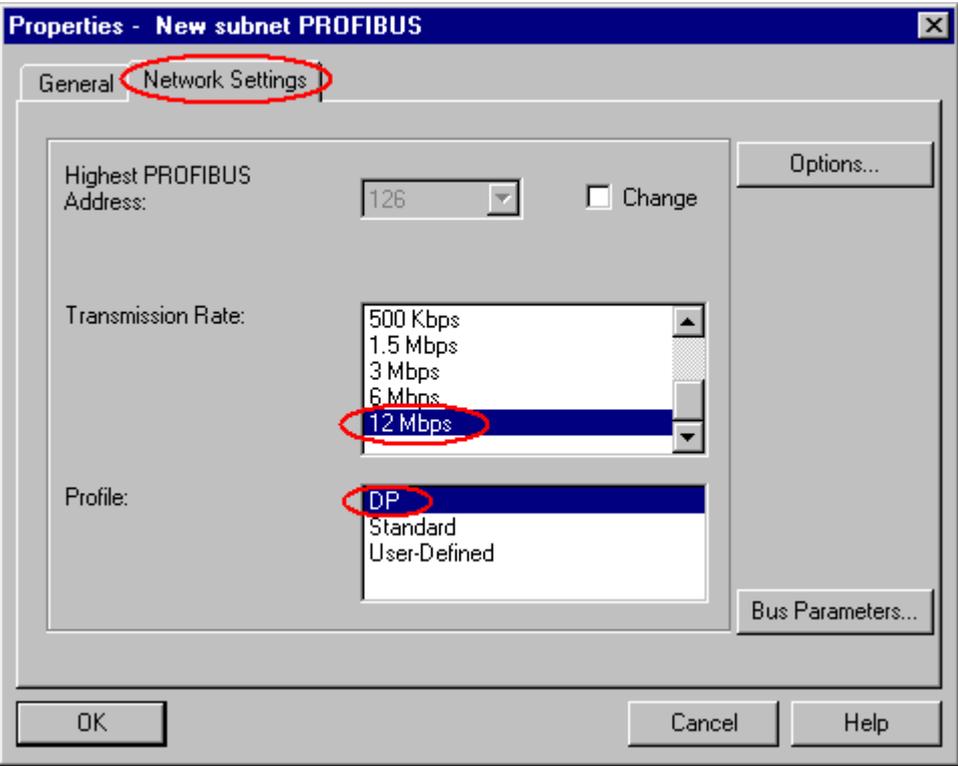
Tool	Step
STEP 7/SIMATIC Manager	Create a project
HW Config:	Configure the technology CPU
	Configure the drives
	Station > Save and compile
S7T Config	Configuring axes
	Configure the technology objects
	Technology > Save and compile all
Technology Objects Management	Creating and managing technology DBs
LAD/FBD/STL	Program the function blocks
STEP 7/SIMATIC Manager	Download the user program to the MMC, including the system data

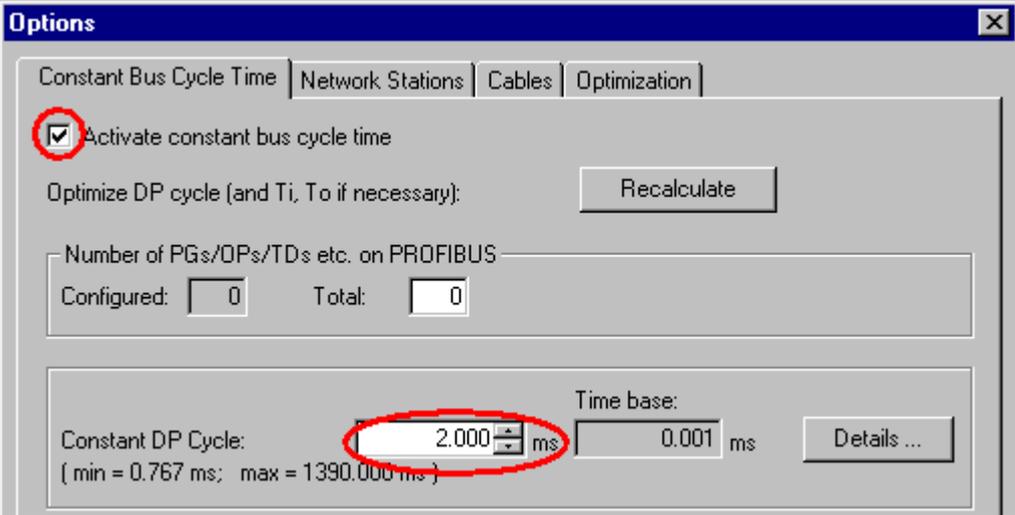
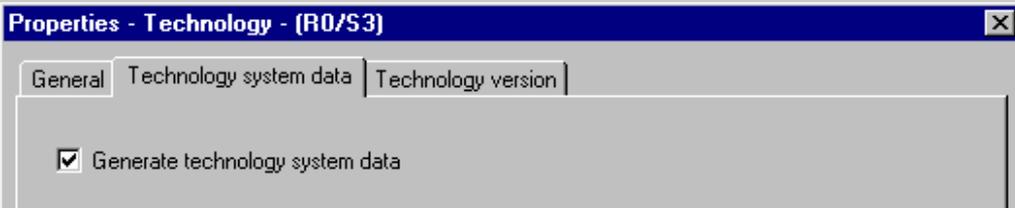
4.2 Configuring the Technology CPU and Drives in HW Config

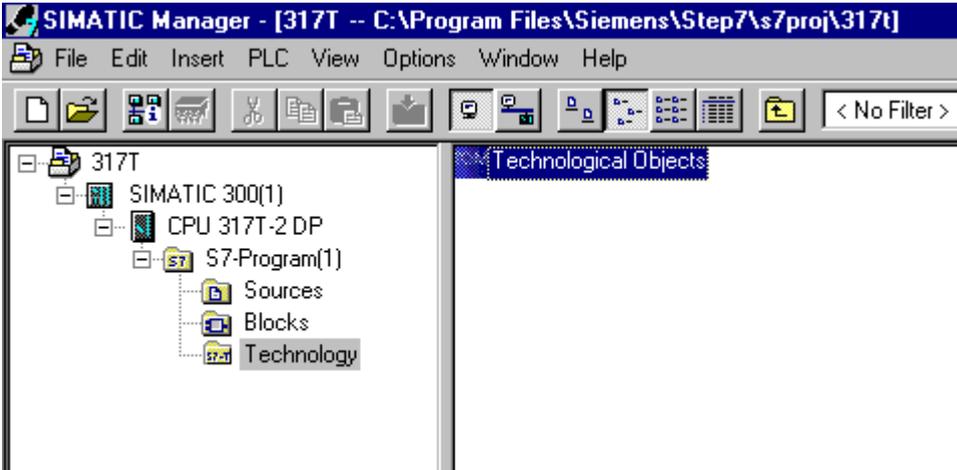
4.2.1 Configuring the Technology CPU in HW Config

To configure the Technology CPU:

Step	Description
1.	In SIMATIC Manager, create a new project and add a SIMATIC 300 station.
2.	Open HW Config by selecting the "SIMATIC 300" station and double-clicking "Hardware."
3.	In the "Hardware catalog" view, select the hardware profile "SIMATIC Technology CPU" from the "Profile" drop-down list. 
4.	Copy a profile from the "Hardware Catalog" to the HW Config dialog box.
5.	Add the "PS 307 5A" power supply module to the profile by means of drag-and-drop.
6.	Drag-and-drop the relevant Technology CPU from the Hardware catalog to the selected line of the profile. This opens a message window.  <p>Minimize transfer times by increasing the transmission velocity of the MPI/DP interface. Further information is found in the help dialog of the message box.</p>
7.	Close the message box. In the next dialog box, set the PROFIBUS properties of DP(DRIVE).
8.	Click "New" to create a new "Subnet" (DP master system). Make sure the Technology CPU is the only master station at the DP(DRIVE) master system.

Step	Description
9.	<p>Select the "Network settings" tab from the PROFIBUS network properties dialog box.</p>  <p>Set a transmission velocity of 12 Mbps. Do not change the "DP" setting of the PROFIBUS network profile.</p>

Step	Description
10.	<p>Click "Options". In the next dialog box, set the "Activate constant bus cycle time" check box.</p>  <p>For the constant DP bus cycle time, enter the synchronized cycle time you want use for synchronized operation the drive components on the DP(DRIVE). Observe the device-specific properties and the project data volume of the components you want to operate on DP(DRIVE).</p> <p>Do not change the remaining default settings in this dialog box.</p> <p>Note: You can also set up your drives in the properties dialog boxes. The constant DP bus cycle and the cycle time are then automatically enabled or synchronized.</p>
11.	Close all dialog boxes of HW Config by clicking "OK".
12.	Increase the transmission velocity of the MPI/DP interface (see step 6.) Save and compile the hardware configuration data, then download these to the PLC.
13.	<p>In HW Config, double-click the technology (slot 3), then select the "Technology System Data" tab. Set the "Generate Technology System Data" and confirm the settings with "OK."</p> 

Step	Description
14.	<p>Save and compile the hardware configuration data, then download these to the PLC. Adapt the PG / PC interface.</p> <p>The hardware configuration and the firmware of the integrated technology are downloaded to the PLC.</p> <p>Result: After you compiled the data, the project dialog box in SIMATIC Manager shows the "technology" folder with its "Technology objects" object.</p>  <p>The screenshot shows the SIMATIC Manager interface. The title bar reads 'SIMATIC Manager - [317T -- C:\Program Files\Siemens\Step7\s7proj\317t]'. The menu bar includes File, Edit, Insert, PLC, View, Options, Window, and Help. The toolbar contains various icons for file operations and project management. The main window is divided into two panes. The left pane shows a project tree with the following structure: 317T (expanded) -> SIMATIC 300(1) (expanded) -> CPU 317T-2 DP (expanded) -> S7-Program(1) (expanded) -> Sources, Blocks, and Technology (expanded). The right pane is titled 'Technological Objects' and is currently empty.</p>

4.2.2 I/O address areas of the integrated technology

The I/O address area of the integrated technology is organized in two areas.

I/O address area of the I/O image DP(DRIVE)

Address area 0 to 63 is maintained in the integrated technology as I/O image DP(DRIVE). Any addresses of the integrated technology or of standard slaves on DP(DRIVE) written to this address area can be read in the user program by means of the technology function "MC_ReadPeriphery" or written by means of the "MC_WritePeriphery" technology function. Addresses accessed by technology objects may not be located in this address area.

I/O address areas accessed by technology objects

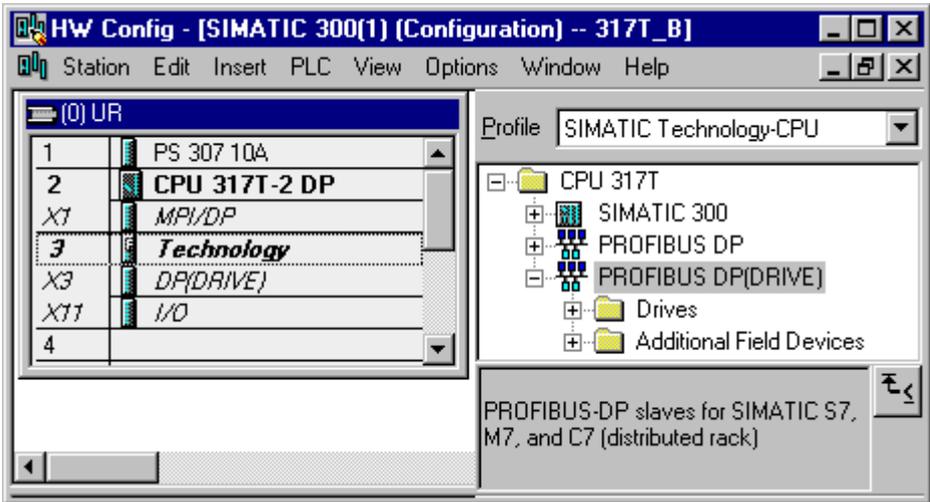
Addresses accessed by technology objects must be located in address area 64 to 1023. The "MC_ReadPeriphery" and "MC_WritePeriphery" technology functions can not be used to access this address area.

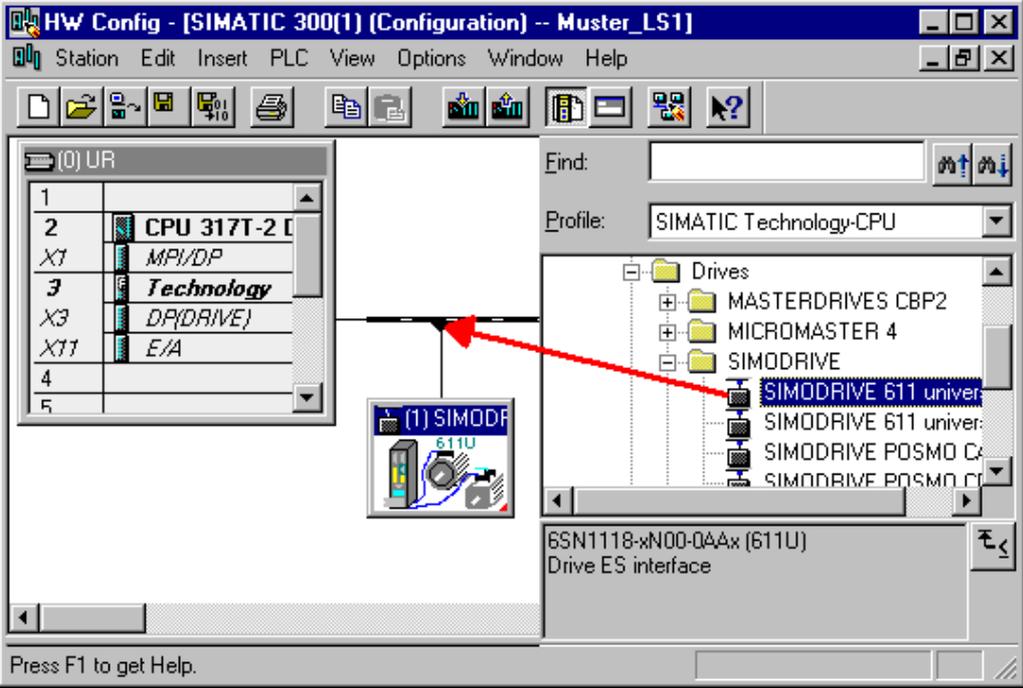
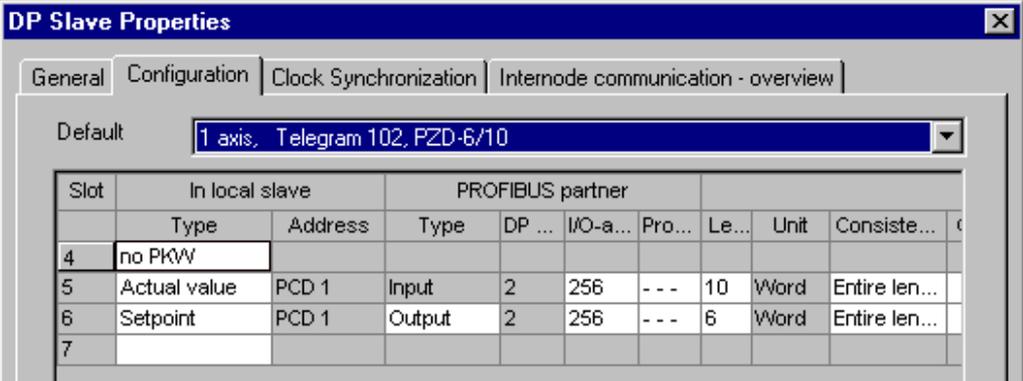
4.2.3 Configuring drives in HW Config

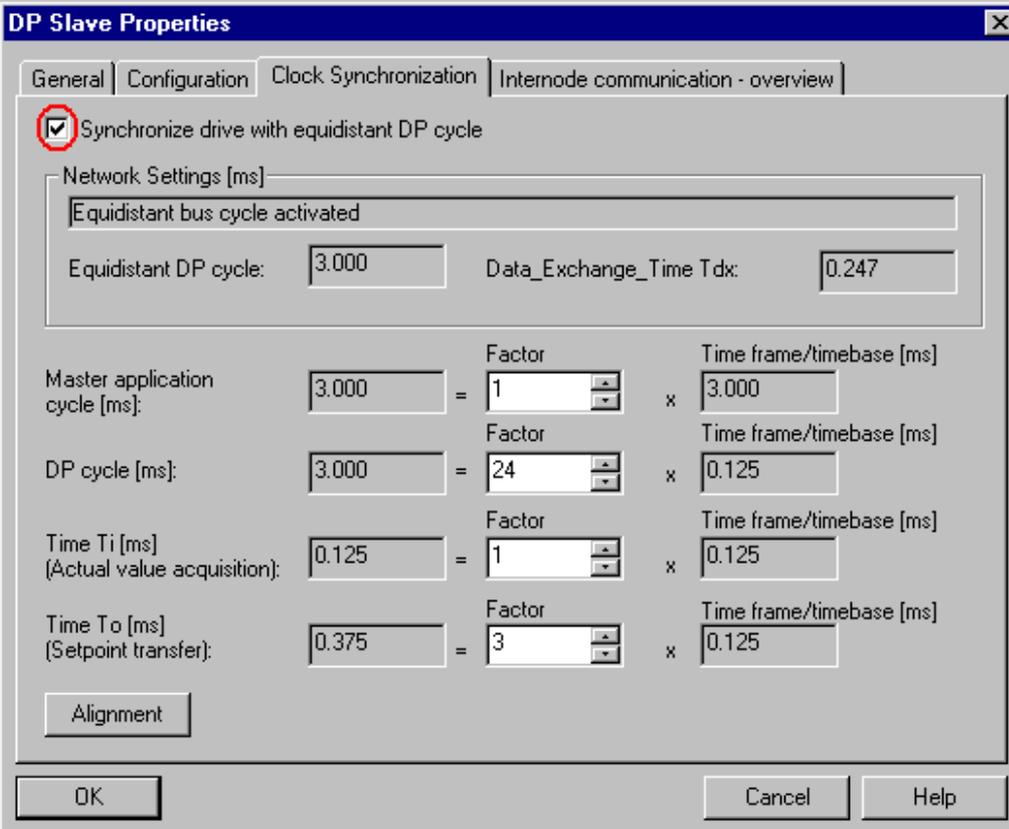
Basic procedure

The steps below show the basic procedure in configuring the drives, based on the example of a SIMODRIVE 611.

For detailed information on the HW Configuration of drives, refer to the product information and to the relevant drive documentation.

Step	Description																
1.	<p>In the Hardware catalog, open the "CPU 317T > PROFIBUS DP(DRIVE) > Drives > SIMODRIVE" folder.</p>  <p>The screenshot shows the 'HW Config' window for a SIMATIC 300(1) configuration. The main area displays a rack configuration table:</p> <table border="1"> <thead> <tr> <th colspan="2">(0) UR</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>PS 307 10A</td> </tr> <tr> <td>2</td> <td>CPU 317T-2 DP</td> </tr> <tr> <td>X1</td> <td>MPI/DP</td> </tr> <tr> <td>3</td> <td>Technology</td> </tr> <tr> <td>X3</td> <td>DP(DRIVE)</td> </tr> <tr> <td>X11</td> <td>I/O</td> </tr> <tr> <td>4</td> <td></td> </tr> </tbody> </table> <p>The right-hand pane shows a tree view of the hardware catalog with the following structure:</p> <ul style="list-style-type: none"> CPU 317T <ul style="list-style-type: none"> SIMATIC 300 <ul style="list-style-type: none"> PROFIBUS DP <ul style="list-style-type: none"> PROFIBUS DP(DRIVE) <ul style="list-style-type: none"> Drives Additional Field Devices <p>At the bottom of the right pane, there is a note: "PROFIBUS-DP slaves for SIMATIC S7, M7, and C7 (distributed rack)".</p>	(0) UR		1	PS 307 10A	2	CPU 317T-2 DP	X1	MPI/DP	3	Technology	X3	DP(DRIVE)	X11	I/O	4	
(0) UR																	
1	PS 307 10A																
2	CPU 317T-2 DP																
X1	MPI/DP																
3	Technology																
X3	DP(DRIVE)																
X11	I/O																
4																	

Step	Description																																																											
2.	<p>Select the drive component (example: "SIMODRIVE 611 universal"), then drag-and-drop it to the DP master system.</p>  <p>The "Properties – PROFIBUS interface SIMODRIVE 611 U DP2, DP3" opens.</p>																																																											
3.	<p>Configure the relevant PROFIBUS address, for example, 4. Confirm with "OK." The "Properties - Drive" dialog box opens. Close the dialog box with "OK."</p>																																																											
4.	<p>Change to the "Configuration" tab of the "DP Slave properties" dialog box, then select the relevant telegram (example: telegram 102 for SIMODRIVE 611 universal with one axis to use the axis as positioning or synchronization axis without DSC and with torque reduction.)</p>  <table border="1"> <thead> <tr> <th rowspan="2">Slot</th> <th colspan="2">In local slave</th> <th colspan="7">PROFIBUS partner</th> </tr> <tr> <th>Type</th> <th>Address</th> <th>Type</th> <th>DP ...</th> <th>I/O-a...</th> <th>Pro...</th> <th>Le...</th> <th>Unit</th> <th>Consiste...</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>no PKW</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td>Actual value</td> <td>PCD 1</td> <td>Input</td> <td>2</td> <td>256</td> <td>---</td> <td>10</td> <td>Word</td> <td>Entire len...</td> </tr> <tr> <td>6</td> <td>Setpoint</td> <td>PCD 1</td> <td>Output</td> <td>2</td> <td>256</td> <td>---</td> <td>6</td> <td>Word</td> <td>Entire len...</td> </tr> <tr> <td>7</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>For details on selecting telegrams and on supported function, refer to "Selecting the telegram type".</p>	Slot	In local slave		PROFIBUS partner							Type	Address	Type	DP ...	I/O-a...	Pro...	Le...	Unit	Consiste...	4	no PKW									5	Actual value	PCD 1	Input	2	256	---	10	Word	Entire len...	6	Setpoint	PCD 1	Output	2	256	---	6	Word	Entire len...	7									
Slot	In local slave		PROFIBUS partner																																																									
	Type	Address	Type	DP ...	I/O-a...	Pro...	Le...	Unit	Consiste...																																																			
4	no PKW																																																											
5	Actual value	PCD 1	Input	2	256	---	10	Word	Entire len...																																																			
6	Setpoint	PCD 1	Output	2	256	---	6	Word	Entire len...																																																			
7																																																												

Step	Description
5.	<p>Select the "Cycle synchronization" tab, then set the "Synchronize drive with equidistant DP cycle" check box.</p>  <p>The DP cycle time is applied and shown on this dialog box due to the settings you made in the PROFIBUS network configuration. The DP cycle coefficient is adapted accordingly.</p> <p>If you do not configure the cycle time in the network properties, the coefficients must be adapted in this dialog box in order to obtain the relevant cycle time (example: 16 for a DP cycle of 2.00 ms.)</p> <p>The DP cycle of the DP(DRIVE) interface is always an integer multiple of 0.5 ms, and is mainly determined by the number and type of components to be operated on the network.</p> <p>Note the drive-specific help in this dialog box when you determine the DP cycle.</p>
6.	<p>For this example set the "To" time coefficient to obtain a time of 0.5 ms. Do not change the default value of the "Ti" coefficient.</p>
7.	<p>Confirm with "Calibration".</p> <p>Click the button to make the changes described below:</p> <ul style="list-style-type: none"> • The constant bus cycle time is enabled • The DP cycle in the master system is adapted to the drive properties • All drive components of the same family receive the same parameters
8.	<p>Close the dialog box with "OK."</p>
9.	<p>Save and compile the hardware configuration data, then download these to the PLC.</p> <p>To generate system data for the HW Configuration and technology firmware, set the "Generate technology system data" check box in the technology properties dialog box.</p>

Note

Drive components of different families must be calibrated manually. To do so, note down the set values and then transfer these to the corresponding dialog boxes.

4.2.4 Selecting the telegram type

The telegram for communication with the drive must be defined in HW Config. Which telegram you select is determined by the axis function required, for example, torque limiting or DSC, or by the functionality of the drive used.

Note

When changing the telegram type of a drive component in HW Config, you also need to adapt the selection of the telegram type in the interface configuration of the corresponding technology object in S7T Config.

Communication with digital drives via PROFIBUS DP takes place in accordance with the PROFIdrive specification, Version 3.

Supported technologies and telegram types:

Telegram types and functionality:

Telegram type	Short description / functionality
1	n-setpoint interface 16 bits
2	n-setpoint interface 32 bits without encoder
3	n-setpoint interface 32 bits with encoder 1
4	n-setpoint interface 32 bits with encoders 1 and 2
5	n-setpoint interface 32 bits with DSC and encoder 1
6	n-setpoint interface 32 bits with DSC and encoders 1 and 2
101	n-setpoint interface with torque reduction
102	n-setpoint interface with encoder 1 and torque reduction
103	n-setpoint interface with encoder 1 and encoder 2 and torque reduction
105	n-setpoint interface with DSC and encoder 1 and torque reduction
106	n-setpoint interface with DSC and encoder 1 encoder 2 and torque reduction

Drives and telegram types:

Drive component	Technology objects	Interface	Configurable standard telegram types
SIMODRIVE			
SIMODRIVE 611 universal	velocity axis, positioning axis, synchronization axis, external encoder, measuring sensor, cam	Digital	1 to 6, 101, 102, 103, 105, 106 **
SIMODRIVE 611 universal HR	velocity axis, positioning axis, synchronization axis, external encoder, measuring sensor, cam	Digital	1 to 6, 101, 102, 103, 105, 106 **
SIMODRIVE POSMO CA/CD	velocity axis, positioning axis, synchronization axis, external encoder, measuring sensor, cam	Digital	1 to 6, 101, 102, 103, 105, 106
SIMODRIVE POSMO SI	velocity axis, positioning axis, synchronization axis, measuring sensor, cam	Digital	1, 2, 3, 5, 101, 102, 105
SIMODRIVE sensor isochronous	External encoder	Digital	81
MICROMASTER 4			
COMBIMASTER 411	Velocity axis	Digital *	1
MICROMASTER 420	Velocity axis	Digital *	1
MICROMASTER 430	Velocity axis	Digital *	1
MICROMASTER 440	Velocity axis	Digital *	1
MASTERDRIVES			
Motion Control	velocity axis, positioning axis, synchronization axis, external encoder, measuring sensor, cam	Digital	1 to 6
Motion Control Plus	velocity axis, positioning axis, synchronization axis, external encoder, measuring sensor, cam	Digital	1 to 6
Vector Control CUVC	Velocity axis	Digital *	1, 2
Vector Control Plus	Velocity axis	Digital *	1, 2
SINAMICS			
SINAMICS S120	velocity axis, positioning axis, synchronization axis, external encoder, measuring sensor, cam	Digital	1 to 6, 102, 103, 105, 106
Terminal Module TM15	Measuring input Output cam	Digital	-
Terminal Module TM17 High Feature	Measuring sensor Cam	Digital	-
SINUMERIK			
ADI4	velocity axis, positioning axis, synchronization axis, external encoder, measuring sensor, cam	Digital	3
SIMATIC			
ET 200M, ET 200S	Cam	Digital	-

* The drive does not support operation on a clocked PROFIBUS.

** For details, refer to the supplementary description of 611U.

4.3 Using Technology Objects Management

4.3.1 Starting Technology Objects Management

Use S7T Config to configure the technology objects for your motion control task.

The technology DBs form the interface between the user program and the technology objects. Technology DBs are managed in "Technology Objects Management."

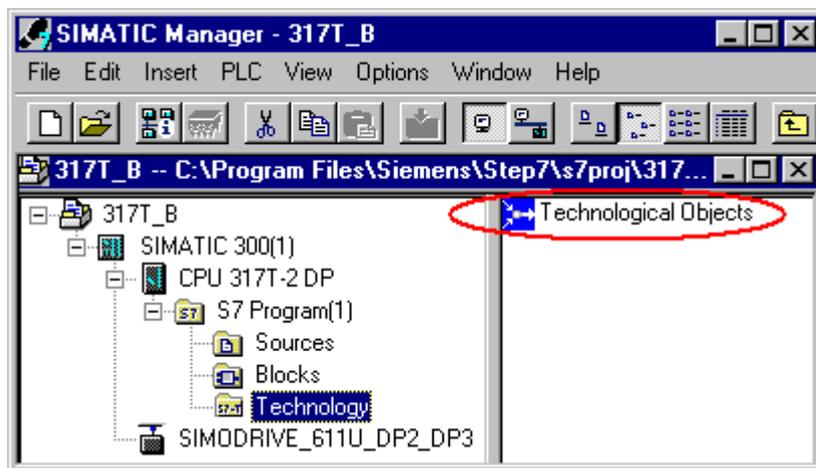
"Technology Objects Management" can be used in parallel to SIMATIC Manager.

Requirements

- SIMATIC Manager is opened.
- The Technology CPU was configured in HW Config, and the configuration is saved.

Starting Technology Objects Management

In SIMATIC Manager, select "Technology objects" from the "Technology" folder to run "Technology Objects Management."

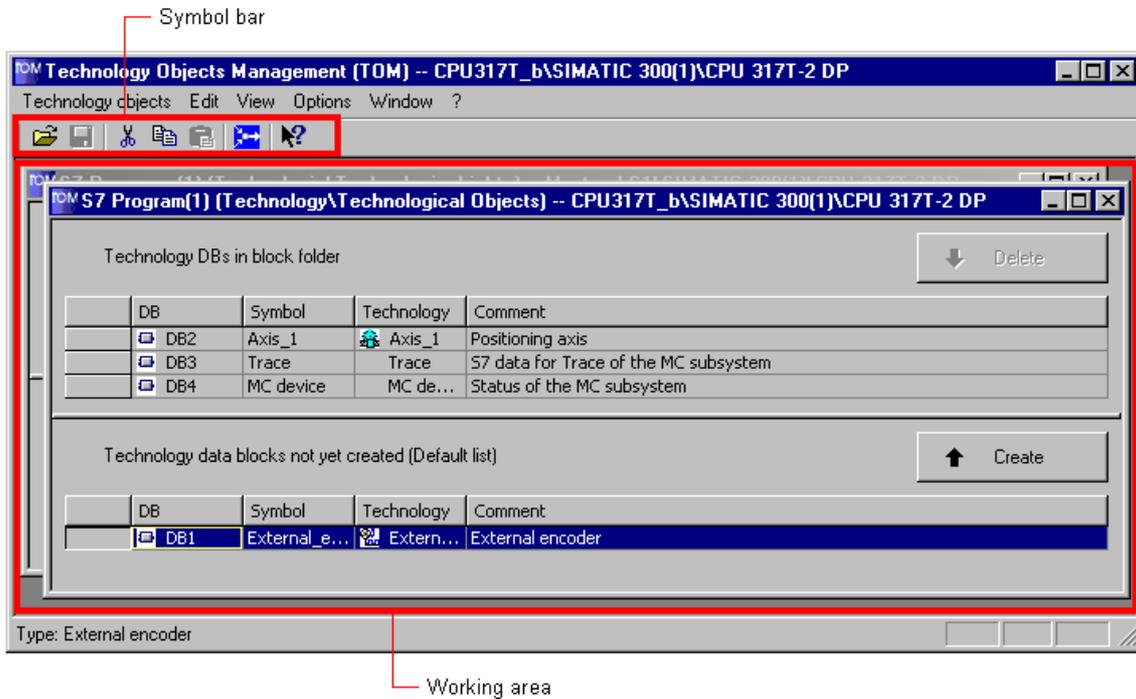


Select the "Technology objects" object, then select **Edit > Open object** in SIMATIC Manager.

You can also start S7T Config without running "Technology Objects Management. In SIMATIC Manager, select "Technology objects" from the "Technology" folder, and then select *Options > Configure technology*. Using the menu command in SIMATIC Manager to start S7T Config is useful in a scenario where you do not create any new technology objects, and therefore do not have to create any new technology DBs.

4.3.2 Technology Objects Management, user interface

Layout of "Technology Objects Management":



Toolbar

This toolbar contains the most important menu commands.

Working area

Each STEP 7 project you open appears in a separate window. Each window shows all existing technology DBs:

- The upper area of the window shows the technology DBs you already created.
- The bottom section of the window lists the technology objects for which you have not generated any technology DBs yet.

4.3.3 Technology Objects Management, operating

"Technology Objects Management" is used to manage the technology DBs of a STEP 7 project.

In the working area of "Technology Objects Management", you can open a separate window for each configured station containing a Technology CPU.

In the active window, you can:

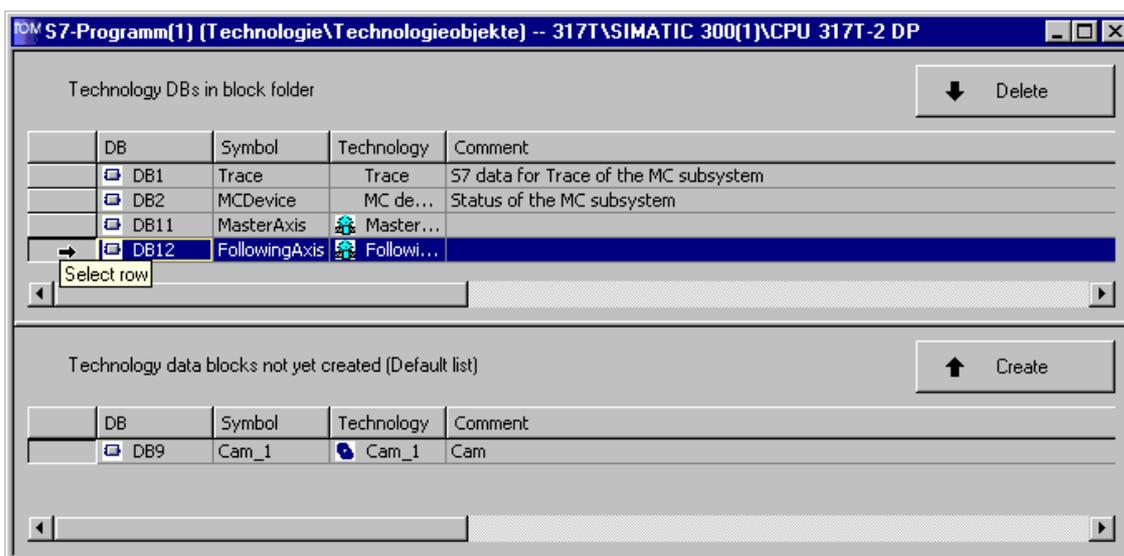
- Create or delete technology DBs
- Starting S7T Config

Requirements

- The configuration of the Technology CPU is completed in S7T Config, saved and compiled.

Creating or deleting technology DBs

Select one or several technology DBs you want to create or delete:



Next, click "Create" or "Delete."

Note

For further information on operating "Technology Objects Management", refer to the corresponding Online Help system.

Starting S7T Config

To run S7T Config, select **Options > Configure technology**.

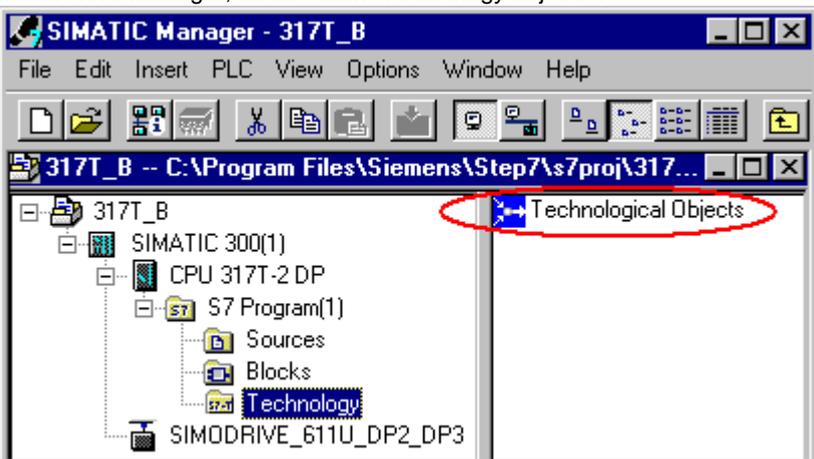
4.3.4 Creating and managing technology DBs

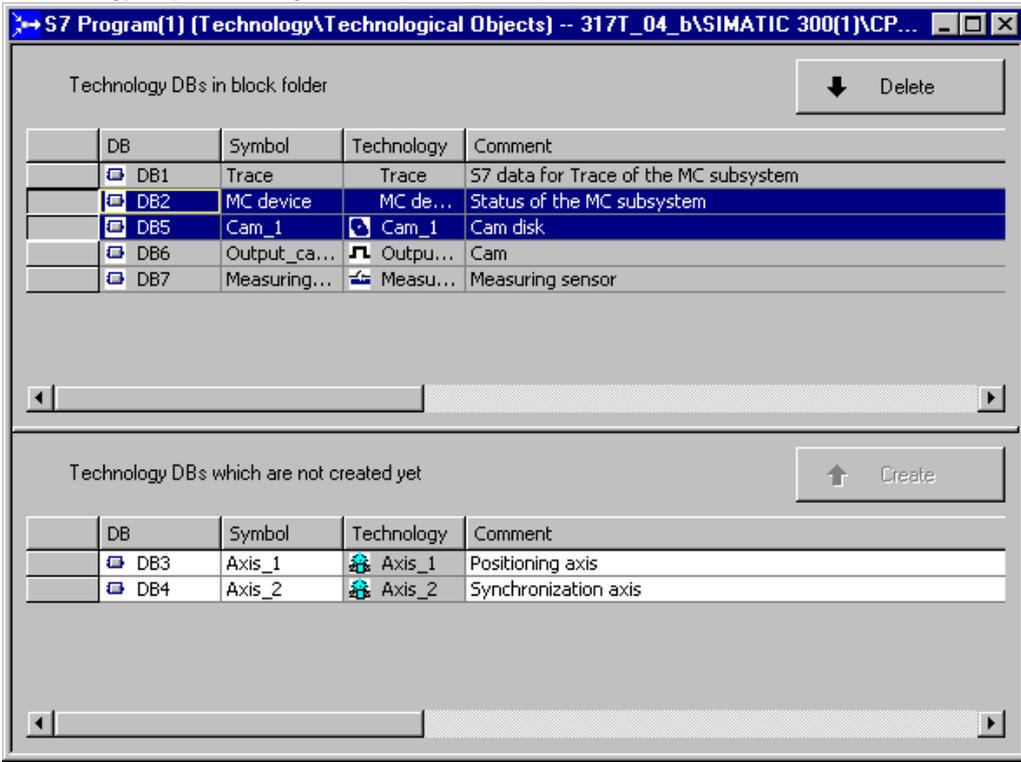
Technology objects are accessed by means of the technology DBs. You should therefore generate the technology DBs in "Technology Objects Management" before you create the user program.

Requirements

- You have completed the configuration of your Technology CPU and of the drives in HW Config, and concluded it with **Station > Save and compile**.
- The configuration of the Technology CPU is completed in S7T Config and saved.

Example: How to rename a technology DB

Step	Description
1.	<p>In SIMATIC manager, double-click "Technological objects".</p> 

Step	Description
	<p>"Technology Objects Management" opens. (Example):</p>  <p>You selected the DBs you want to create.</p>
2.	From the "Technology DBs in the block folder", select the relevant line to rename its DB.
3.	Click "Delete"
4.	Edit the block number in the "Technology DBs which are not created yet" area
5.	Select the line showing the DB you want to create.
6.	Click "Create"

Note

If already downloaded to the CPU, delete the renamed technology DB from the CPU. You can then download the renamed technology DB with the new DB number to the CPU.

Note

Copied technology DBs in the block folder of SIMATIC Managers must be verified. The corresponding DBs are no valid technology DBs if,

- they are marked red in the dialog box mentioned earlier (in this case, select "Technology DBs in block folder", and then click "Delete"),
- they are not listed in the dialog box mentioned earlier (in this case, delete the block from the block folder of SIMATIC Manager).

4.4 Using S7T Config

4.4.1 Starting S7T Config

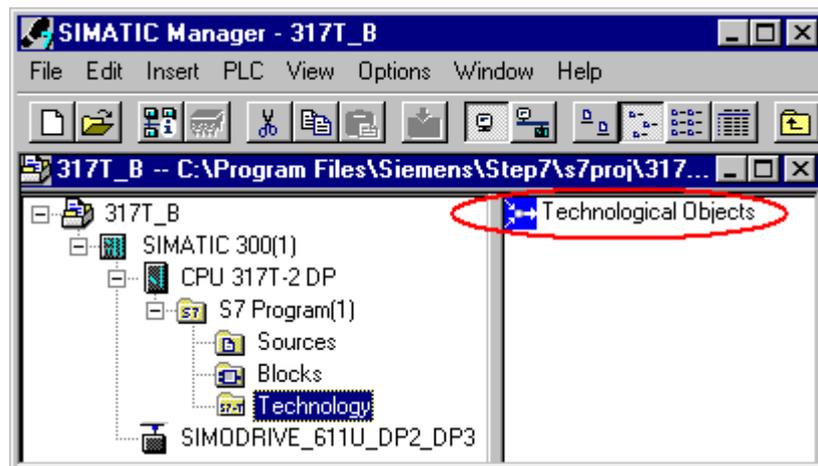
Requirements

- SIMATIC Manager is opened.
- The Technology CPU was configured in HW Config, and the configuration is saved.

Starting S7T Config

S7T Config is included in your optional S7-Technology software package, and provides comfortable features for programming the technology objects of your motion control command.

To start S7T Config in SIMATIC Manager, select the object "Technology objects" from the "Technology" folder. The object is only visible if the Technology CPU is configured in HW Config and compiled.



Select the "Technology objects" object, then select **Edit > Open Object** in order to run "Technology Objects Management."

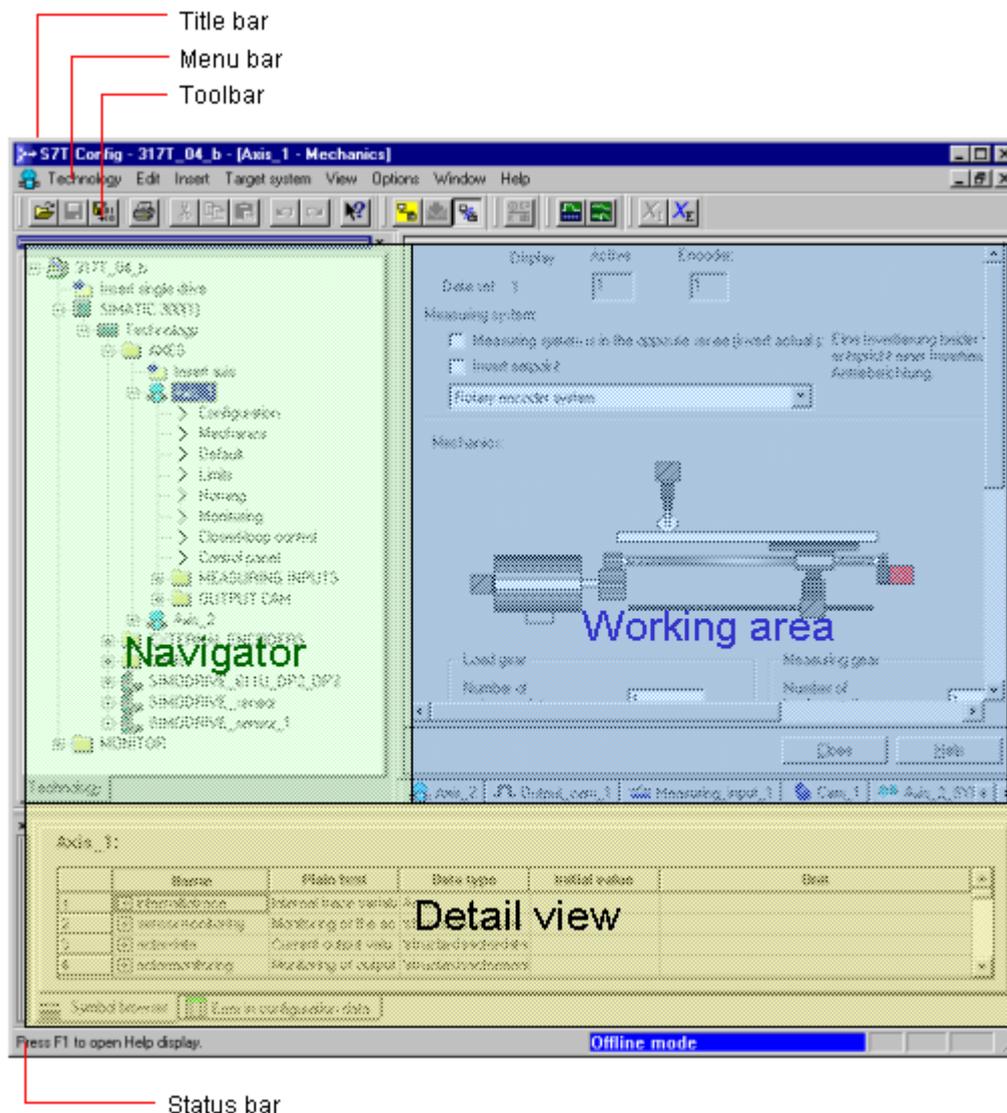
In "Technology Objects Management," select **Options > Configure technology** to edit the technology objects in S7T Config. S7T Config starts automatically if you have not created any technology objects yet.

You can also start S7T Config without running "Technology Objects Management." Select the "Technology objects" object from the "Technology" folder in SIMATIC Manager, and then select **Options > Configure technology**. Using the menu command in SIMATIC Manager to start S7T Config is useful in a scenario where you do not create any new technology objects, and therefore do not have to create any new technology DBs.

4.4.2 The user interface of S7T Config

Use S7T Config to configure the technology objects for your motion control command.

S7T Config opens with the user interface shown below:



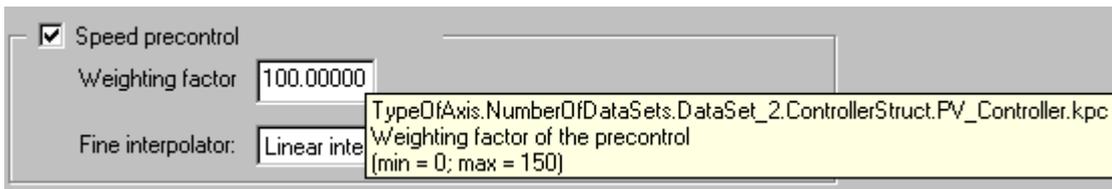
Navigator

The Navigator shows the project structure of the technology and the assignment of the configured technology objects. Identical objects are visualized by the same symbols. In Online mode, the symbols are highlighted on a colored background if a communication connection to this object does not exist, or if the project data in S7T Config and data in the PLC are inconsistent. Double-click an object to open the corresponding configuration dialog box on the working area.

Working area

The working area shows the dialog boxes for configuring the technology objects, e.g. configuration, default, limits. The tab elements indicate the technology objects for which a corresponding dialog box is opened. The view may show several open dialogs for technology objects.

All editable parameters are assigned hi and lo limits which are indicated in a short information in S7T Config.



Detail view

The detail view provides information on the elements selected from the Navigator. Various tabs are opened, depending on the object you selected. The number of tabs also depends on the number of active dialog boxes on the working area and on the project status (offline or online).

To view object information in the detail view:

1. Select the relevant object in the project navigator. The detail view shows all tabs available for this object.
2. Click the tab in the detail view. The tab content is shown.

Title bar

The title bar contains the project name, and description of the active configuration dialog box of the selected technology object.

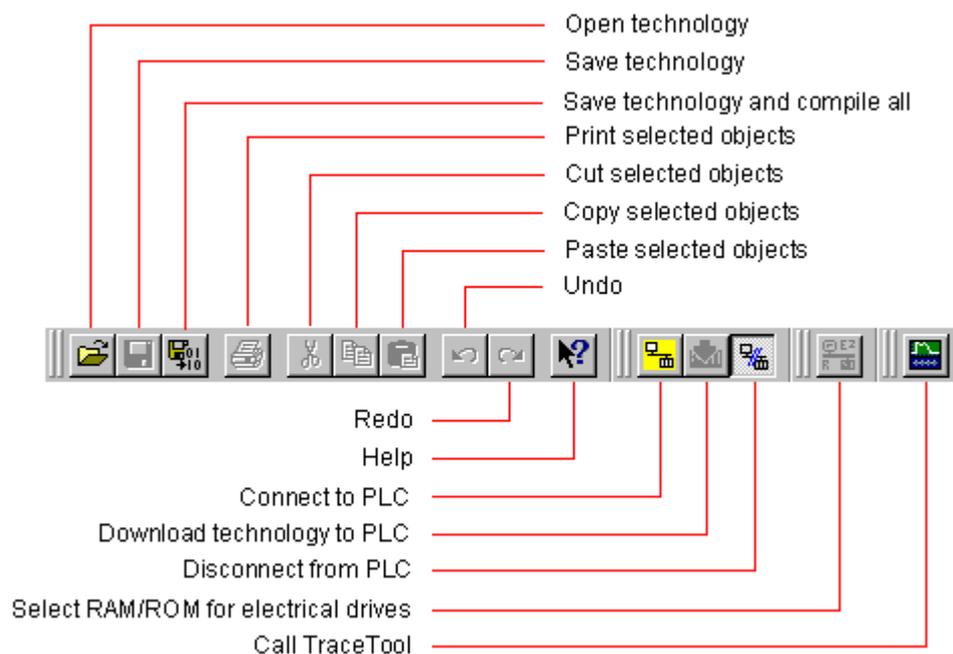
Menu bar

The menu bar contains the menus currently available in S7T Config.

Toolbar

The toolbar contains icons which provide quick access to frequently used and currently available menu commands by means of mouse click. You can view the short info of the button by holding the mouse cursor briefly on the icon; the status bar provides further information.

A grayed out symbol indicates that a function can not be executed in the current operational state.



Status bar

The status bar provides context-sensitive information and indicates the project status (offline or online -mode).

Offline mode

In offline mode, there is no communication between S7T Config and the Technology CPU. In this mode, you can create new technology objects, configure drives by means of the integrated STARTER, and compile the technology.

Online mode

In online mode, S7T Config communicates with the Technology CPU. In this mode, you can perform diagnostics, download new project data to the device, and edit parameters in the CPU.

A consistency check is performed on the technology when you change to online mode. This test verifies that the devices, drives and technology objects you configured in the technology are actually present or connected. If any deviations or errors are detected (example: project data in the PLC does not match the offline configuration in S7T Config), the relevant objects are highlighted on a red background in the Navigator.



Caution

In order to ensure synchronized control of the drives, do not connect the programming device (PG/PC) to the DP(DRIVE) interface.

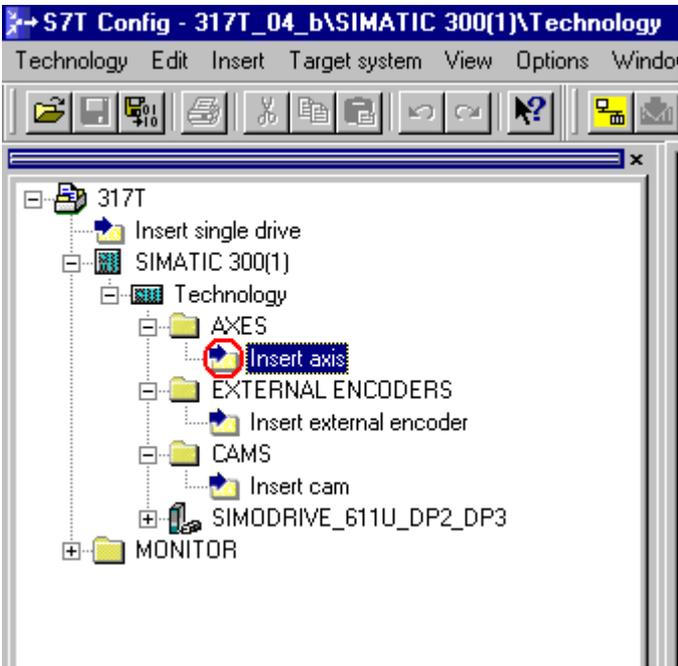
4.5 Configuring axes

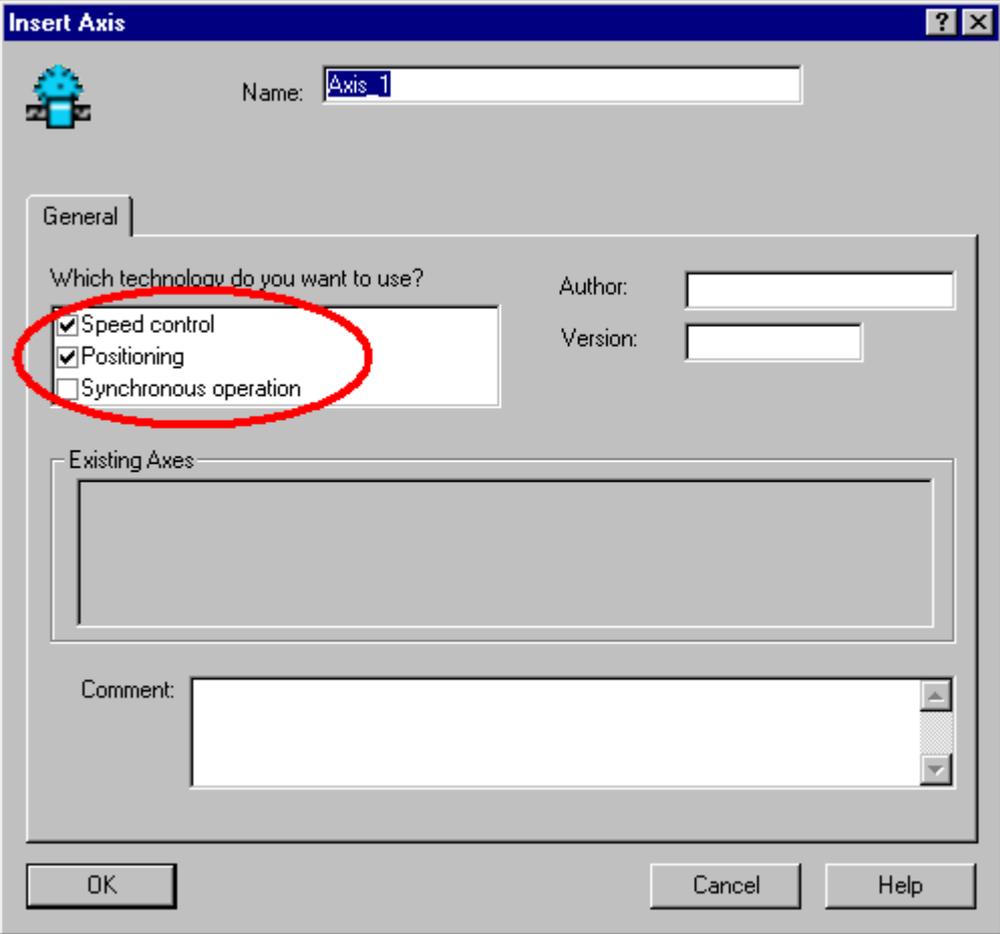
Requirements

- The data of the Technology CPU are configured in HW Config and are compiled.

Inserting a new axis in S7T Config

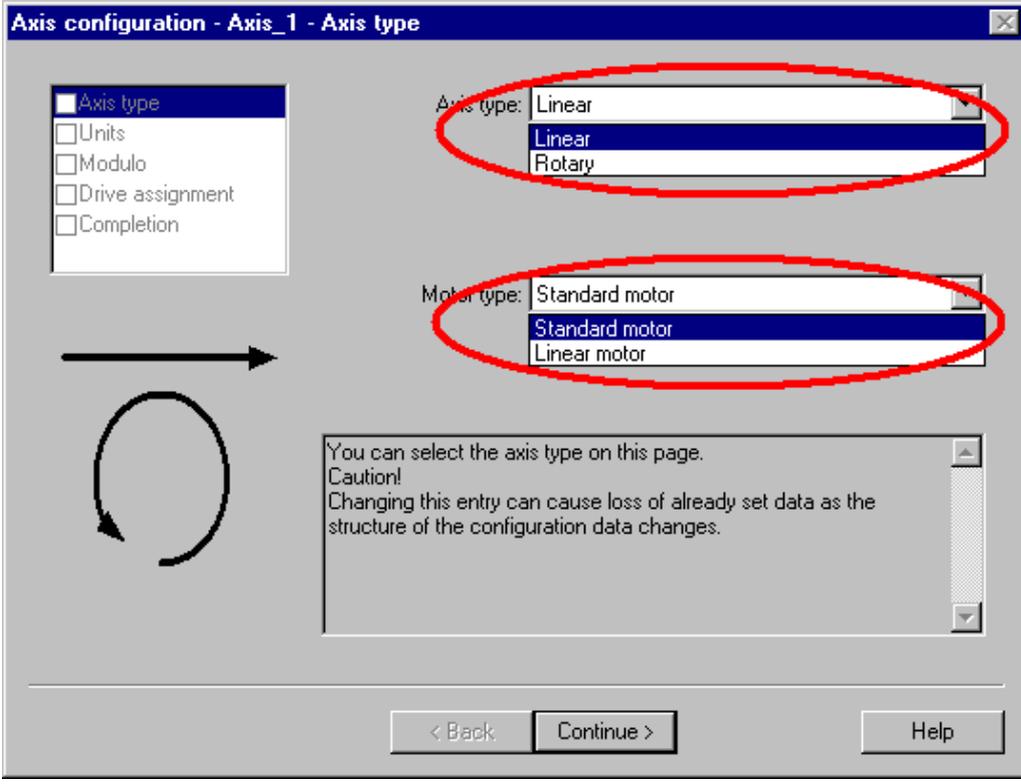
The steps below demonstrate the basic procedure of inserting and configuring an axis, based on the example of a positioning axis.

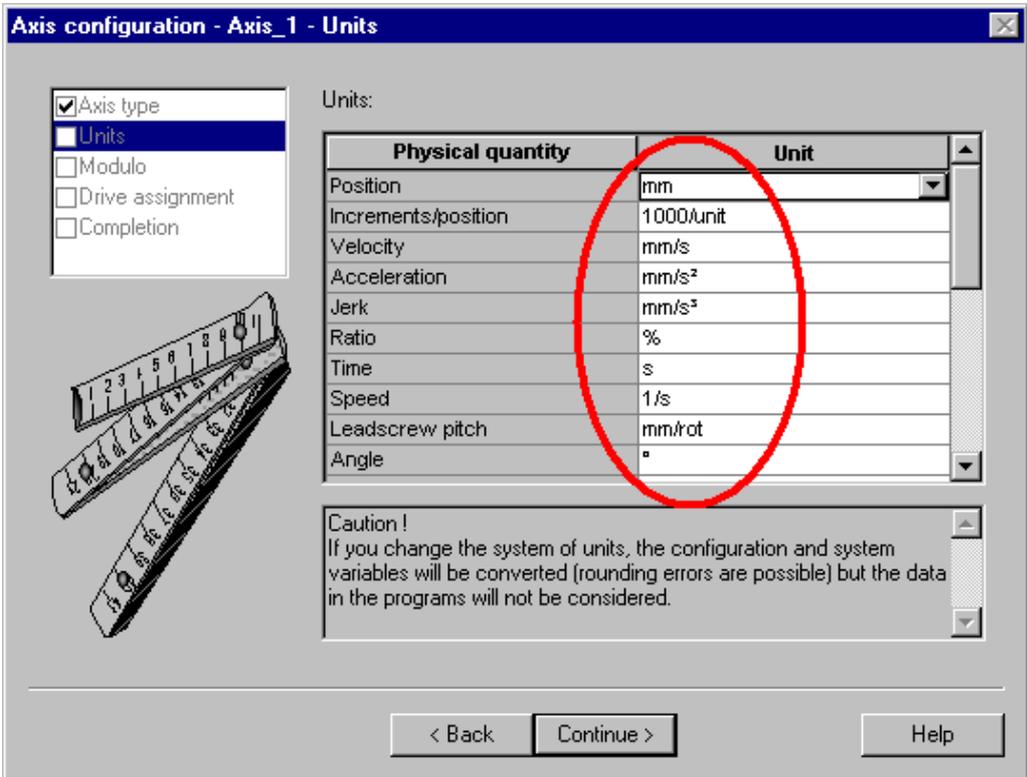
Step	Description
1.	<p>In the Navigator of S7T Config, double-click "Insert axis".</p>  <p>The screenshot shows the S7T Config Navigator window. The title bar reads 'S7T Config - 317T_04_b\SIMATIC 300(1)\Technology'. The menu bar includes 'Technology', 'Edit', 'Insert', 'Target system', 'View', 'Options', and 'Window'. The toolbar contains various icons for file operations. The main pane displays a tree view of the project structure:</p> <ul style="list-style-type: none"> 317T <ul style="list-style-type: none"> Insert single drive SIMATIC 300(1) <ul style="list-style-type: none"> Technology <ul style="list-style-type: none"> AXES <ul style="list-style-type: none"> Insert axis (highlighted with a red circle) EXTERNAL ENCODERS Insert external encoder CAMS <ul style="list-style-type: none"> Insert cam SIMODRIVE_611U_DP2_DP3 MONITOR

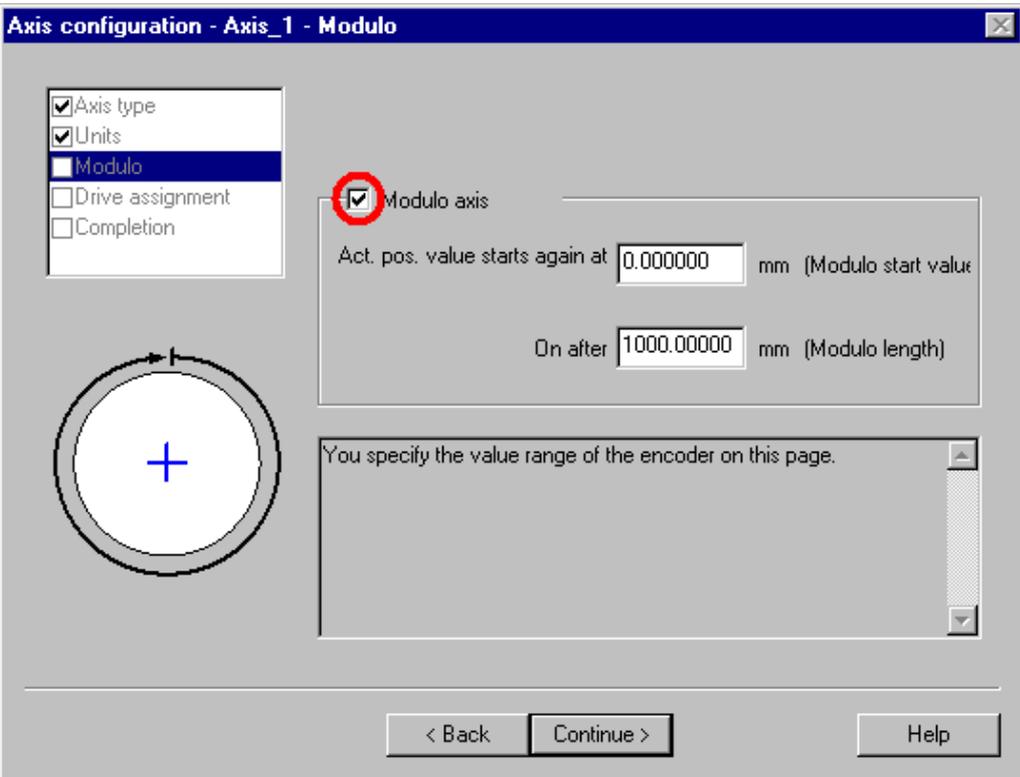
Step	Description
2.	<p>For this example of a positioning axis configuration, select the "Positioning" technology from the "General" tab.</p> <p>Disable the "Positioning" technology when you configure a velocity-controlled axis.</p>  <p>You may also edit the name, name an author, and add the version number or a comment. "Technology Objects Management" applies the name of the technology object as symbolic name for the technology DB of the object in STEP 7.</p>
3.	<p>Click "OK"</p> <p>Result: The Axis Wizard appears.</p>

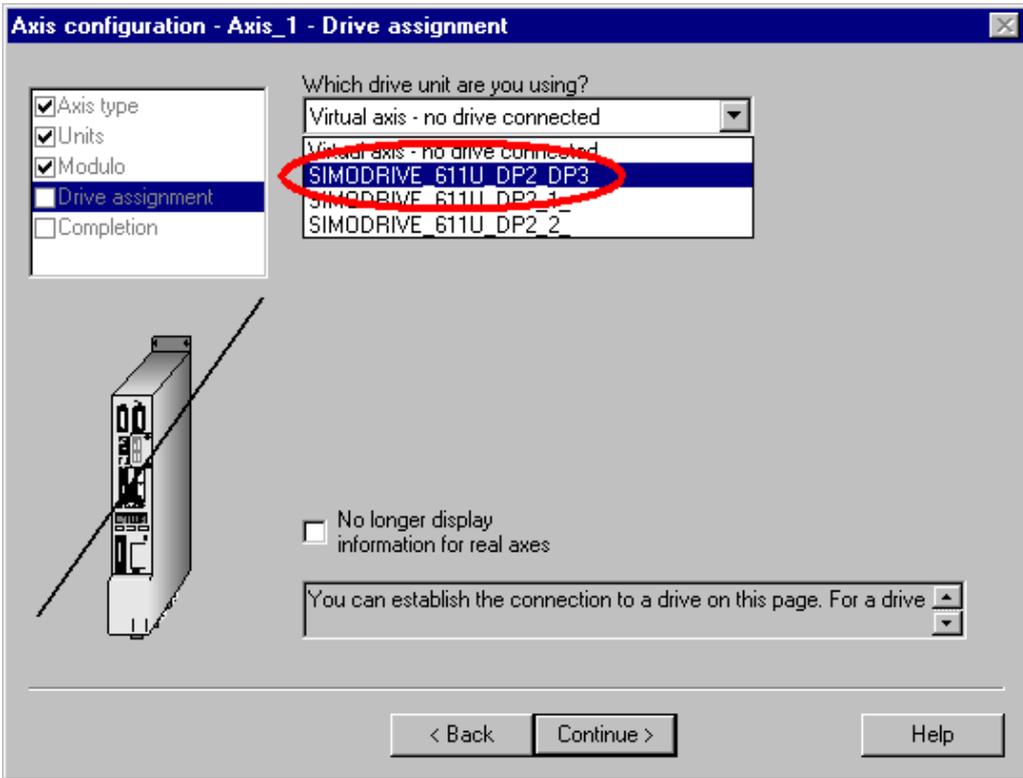
Note

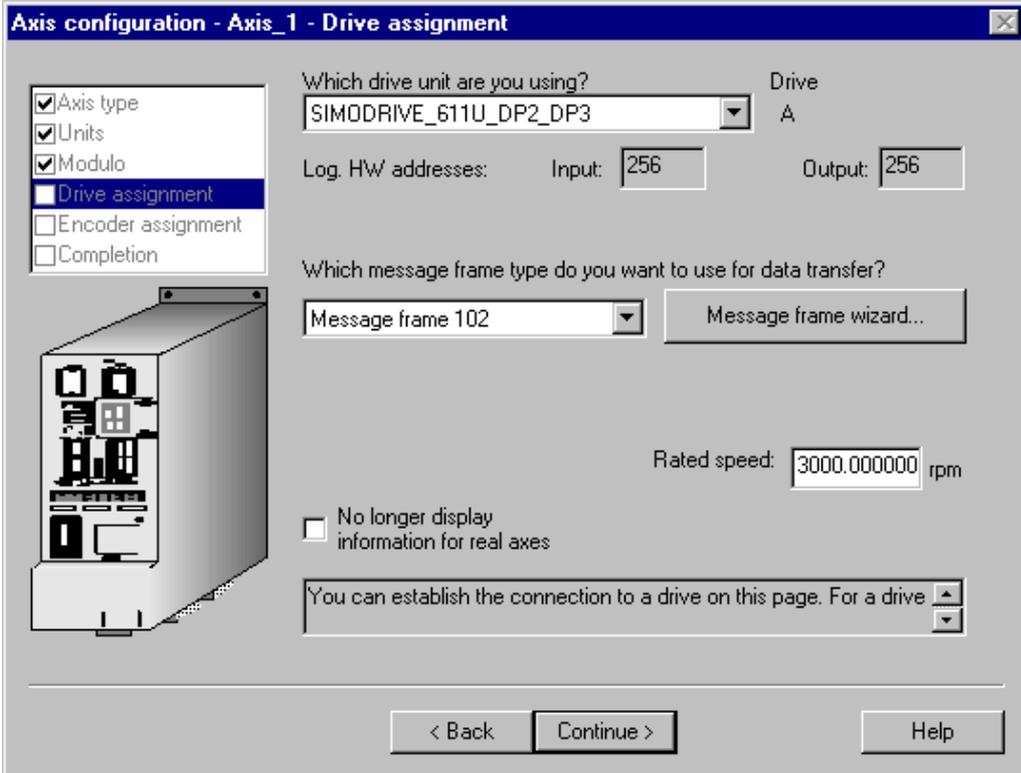
The technology (velocity control, positioning, synchronous operation) of a new is defined once when you configure it. To change the technology at a later time, you must delete and create the axis again.

Step	Description
4.	<p>In the dialog box shown below, select the Axis type and the Motor type.</p>  <p>Click "Continue"</p>

Step	Description																						
5.	<p>From the list in the next dialog box, select the physical units you want to use when programming the axis and the user program.</p>  <table border="1"> <thead> <tr> <th>Physical quantity</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>Position</td> <td>mm</td> </tr> <tr> <td>Increments/position</td> <td>1000/unit</td> </tr> <tr> <td>Velocity</td> <td>mm/s</td> </tr> <tr> <td>Acceleration</td> <td>mm/s²</td> </tr> <tr> <td>Jerk</td> <td>mm/s³</td> </tr> <tr> <td>Ratio</td> <td>%</td> </tr> <tr> <td>Time</td> <td>s</td> </tr> <tr> <td>Speed</td> <td>1/s</td> </tr> <tr> <td>Leadscrew pitch</td> <td>mm/rot</td> </tr> <tr> <td>Angle</td> <td>°</td> </tr> </tbody> </table> <p>Caution! If you change the system of units, the configuration and system variables will be converted (rounding errors are possible) but the data in the programs will not be considered.</p> <p>< Back Continue > Help</p> <p>Note: This selection applies only to this axis. The list may also show physical units which are irrelevant to this axis due to its configuration.</p> <p>Example: by setting a position unit in [mm], the value "1000.0" at the <i>Position</i> input of FB "MC_MoveAbsolute" is proportional to a position value of 1000.0 mm.</p> <p>Caution: Numerical values in the user programs (e.g. for motion commands) are not converted into the newly selected units. They always refer to the configured unit!</p> <p>Click "Continue"</p>	Physical quantity	Unit	Position	mm	Increments/position	1000/unit	Velocity	mm/s	Acceleration	mm/s ²	Jerk	mm/s ³	Ratio	%	Time	s	Speed	1/s	Leadscrew pitch	mm/rot	Angle	°
Physical quantity	Unit																						
Position	mm																						
Increments/position	1000/unit																						
Velocity	mm/s																						
Acceleration	mm/s ²																						
Jerk	mm/s ³																						
Ratio	%																						
Time	s																						
Speed	1/s																						
Leadscrew pitch	mm/rot																						
Angle	°																						

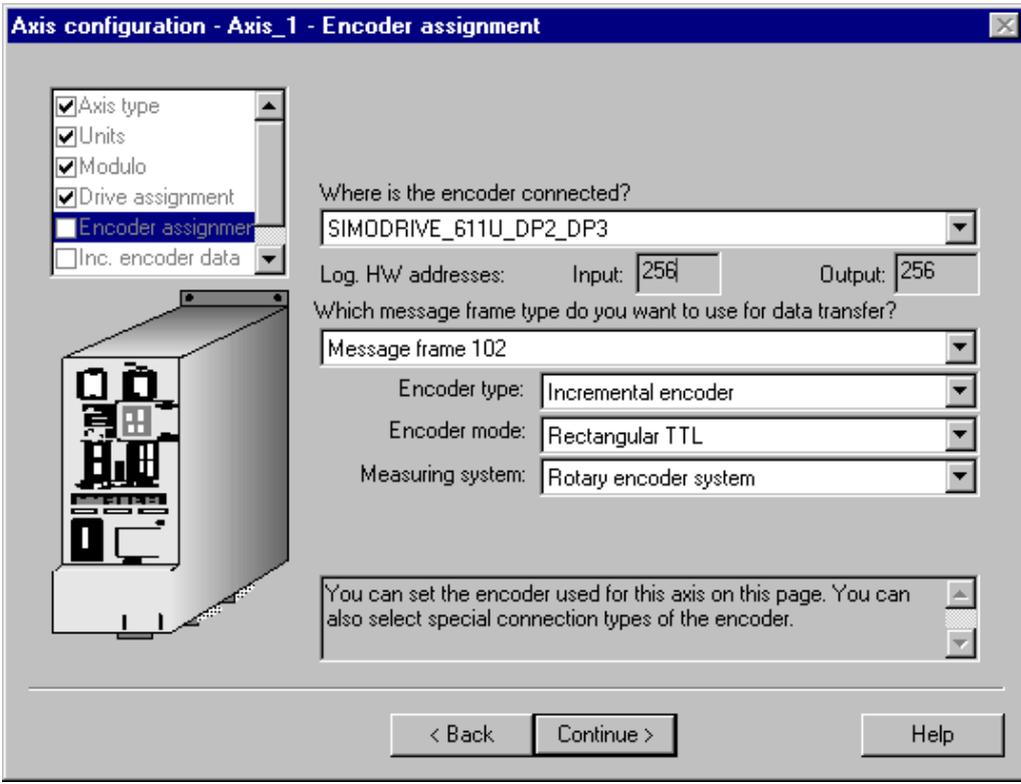
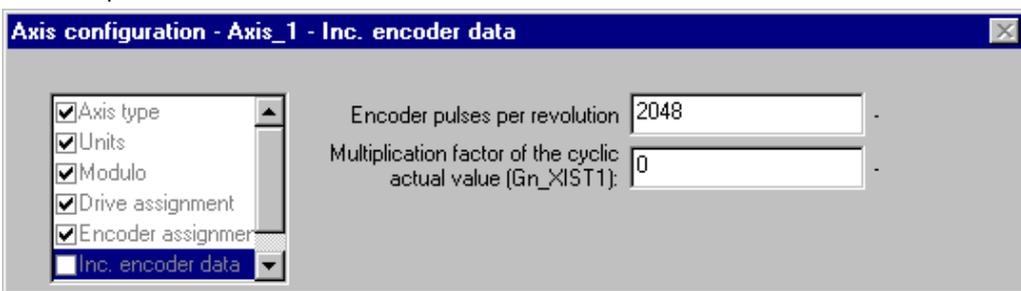
Step	Description
6.	<p>Set the "Modulo axis" check box, then type in the required modulo length and start value if you are going to operate the axis in modulo mode.</p>  <p>Click "Continue"</p>

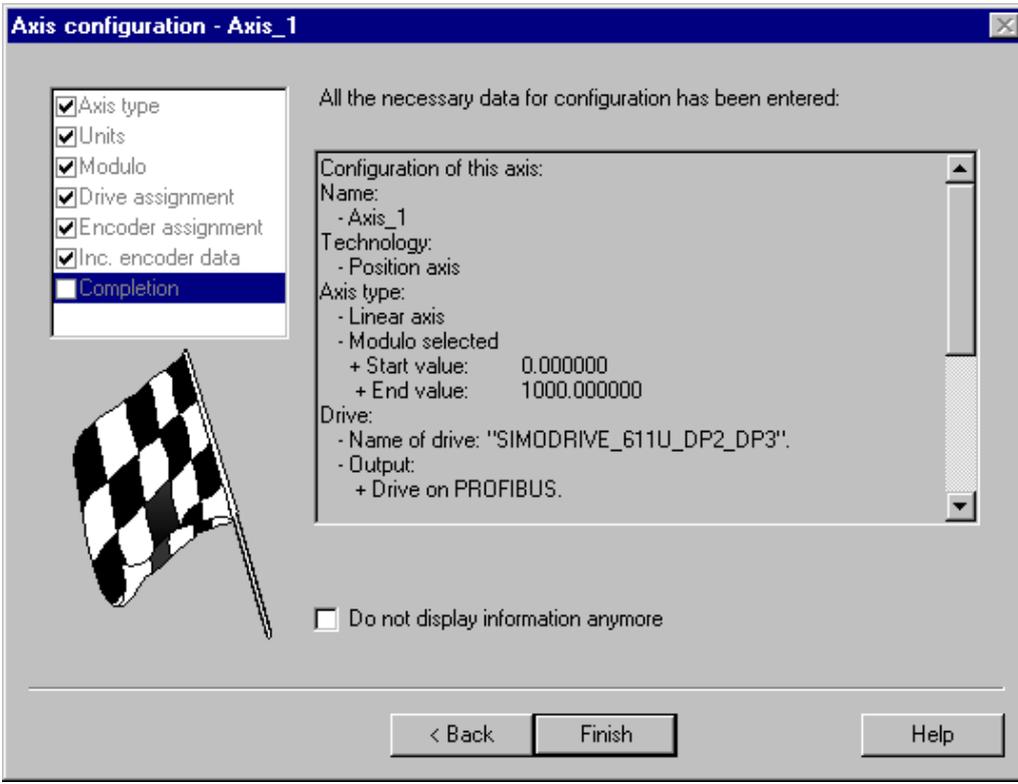
Step	Description
7.	<p>On the next dialog box, configure the connection of the axis to a specific drive component.</p> <div>  </div> <p>The drop-down list shows all drives configured in HW Config. Drives already connected do not appear in this list. To allocate a logic control function to the drive in a synchronization compound, select the "virtual axis" drive component.</p>

Step	Description
8.	<p>If a physical drive is selected, the dialog box provides additional options.</p>  <p>Select a relevant "Axis" from the "Drive" field if the selected drive is a multiple axis module (SIMODRIVE 611 universal double axis module, ADI 4, SINAMICS S120, for example.).</p> <p>The view boxes "log. HW addresses", "Input" and "Output" show the drive's logical addresses you set in the drive configuration in HW Config.</p> <p>During a reconfiguration the message type set in HW Config is entered as the default setting in the fold-down list box (also refer to Selecting the Message Type). If the telegram set in HW Config is unknown or was edited by the user, and thus does not match any known standard telegram, the telegram wizard helps you to make the correct selection from a drop-down list.</p> <p>Enter the rated velocity of the motor in "Rated rpm" This value is relevant for the velocity rating and must therefore correspond with the drive configuration.</p> <p>Click "Continue"</p> <p>Result: The "Interaction axis - drive" dialog box opens. Confirm the dialog box with "OK." The S7T Config Online Help opens. Close the Online Help and continue with the axis configuration.</p>

Note

The telegram type you configured in S7T Config for the interface of the technology object for the drive component must match the telegram type of the component configured in HW Config.

Step	Description
<p>9.</p>	<p>In the next dialog box, you can select the encoder of the drive.</p>  <p>Assign the default encoder of which the values are to be transferred to the CPU by means of the telegram configured in HW Config (usually the encoder that is directly connected to the drive.) You can select a different encoder for axis position detection from the list of configured encoders.</p> <p>Open the drop-down list and select the telegram type used to exchange encoder data. Default is the telegram configured in HW Config.</p> <p>In the "Encoder type", "Encoder mode" and "Measuring system" drop-down lists, define the settings specified in the encoder documentation, or the settings used in the drive configuration.</p> <p>Click "Continue"</p>
<p>10.</p>	<p>In the next dialog box, configure the encoder resolution and the multiplication factor of the cyclic actual value.</p> <p>For information on the encoder resolution, refer to the encoder documentation. Align the multiplication factor of the cyclic actual value with the values used in the configuration of the drive component.</p>  <p>Click "Continue" to continue the axis configuration.</p>

Step	Description
11.	<p>You have now completed the axis configuration.</p>  <p>Close the axis configuration by clicking "Finish."</p> <p>Result: The "Interaction axis - drive" dialog box opens. Confirm the dialog box with "OK." You have completed a positioning axis configuration with the help of the Axis Wizard.</p>

4.5.1 Adding a data record for data record changeover

Introduction

The "MC_ChangeDataset" technology function can be used to perform a data record changeover at an axis. You can create data records for velocity-controlled axes, positioning axes and synchronization axis. Virtual axes always have only one data record.

The data record changeover function can be used, for example, to toggle between the motor encoder and the machine encoder, or the edit controller parameters.

Warning

When editing data record parameters, note that some of the parameters must be identical in the data records:

- parameters changing the structure (different controller types such as PV or PID controllers, for example)
- important activating parameters (following monitoring on/off, DSC on/off, for example)

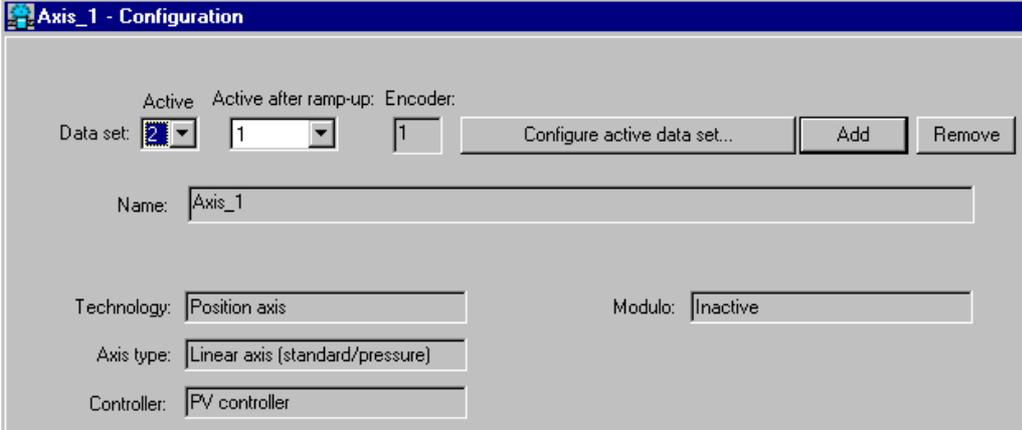
The consistency check reports any illegal technology parameter settings when you configure data records in S7T Config.

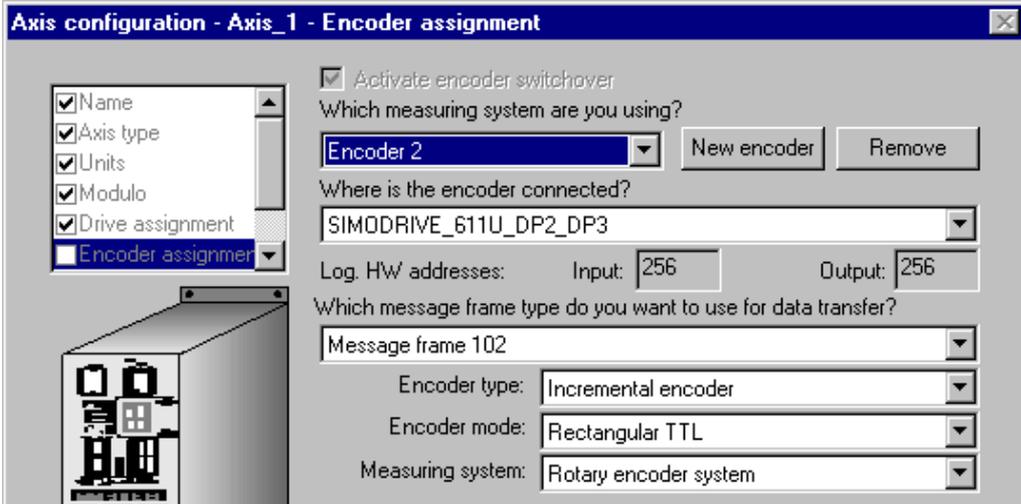
Requirements

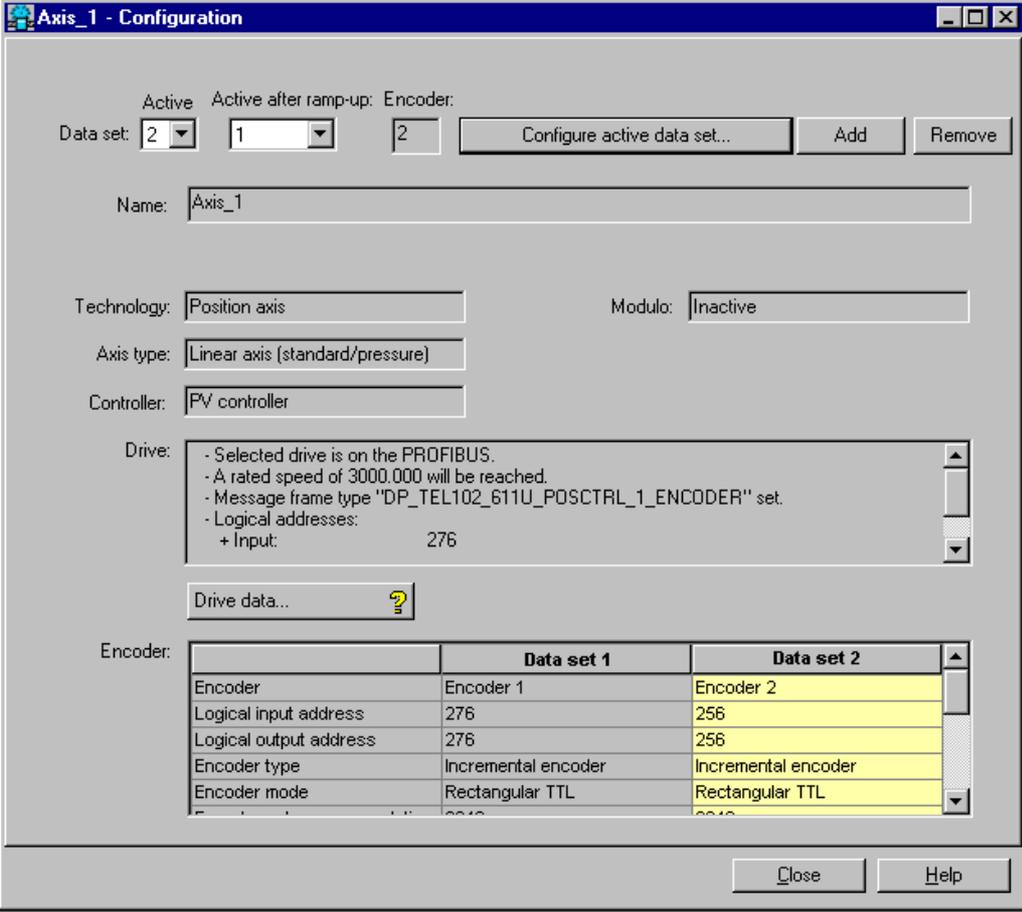
- Axis is configured.

Adding a new data record

Proceed as shown below to configure a further data record.

Step	Description
1.	In the Navigator of S7T Config, open the configuration dialog box of the axis to which you want to add a data record.
2.	Set the "data record changeover" check box. The check box is hidden if the axis already contains several data records.
3.	Click "Add." Result: A new data record is added to the axis. 
4.	Click "configure active data record". Confirm the "reconfigure active data record" message with "Yes." Result: The Axis Wizard appears.
5.	Use the axis wizard to configure the data record. Note: The technology used is set once when you create the axis. You can not use a second data record to change the axis technology.
6.	You may also perform an encoder changeover using the data record changeover function. Do so by setting the "enable encoder changeover" check box on the "Axis configuration - Encoder assignment" dialog box. Otherwise, ignore this step and the next. Click "new encoder" to create the second encoder. Result: a drop-down list opens from which you can select an encoder for this data record.

Step	Description
7.	<p>Select the connection and telegram type for the second encoder. Finally, enter the encoder information ("Encoder type", "Encoder mode" and "Measuring system").</p> <p>In the encoder configuration, select the settings specified in the encoder documentation, or the settings you made in the configuration of the drive component to which the encoder is connected.</p>  <p>Click "Next." Continue by editing the steps in the wizard, and finalize your configuration.</p>

Step	Description
8.	<p>In the axis configuration dialog box, select the data record to be loaded after CPU startup ("active after startup".)</p>  <p>Result: the "Encoder" table lists the encoders configured for the axis.</p>

Deleting a data record of an axis

To delete a data record, select it from the axis configuration dialog box. Next, click "Delete." The data record is deleted.

Changeover of the data record

Use FB "MC_ChangeDataset" to change the data record in RUN.

In S7T Config, you can change the data record in each axis dialog box (mechanical parameters or limits, for example.)

4.5.2 Configuration - Axis

The **Axis > Configuration** dialog box shows the axis and drive settings.

To edit these settings, click "Configure active data record".

Active: Active after ramp-up: Encoder:

Data set: 1

Name:

Technology: Modulo:

Axis type: Start value: mm

Controller: Length: mm

Drive:

- Selected drive is on the PROFIBUS.
- A rated speed of 3000.000 will be reached.
- Message frame type "DP_TEL102_611U_POSCTRL_1_ENCODER" set.
- Logical addresses:
- + Input: 256

Encoder:

	Data set 1
Encoder	Encoder 1
Logical input address	256
Logical output address	256
Encoder type	Incremental encoder
Encoder mode	Rectangular TTL

This dialog box also contains functions for managing data records and data record changeover. For technology objects supporting several data records, you can:

- create new data records,
- delete data records,
- define which data record for the technology object is loaded at CPU startup, and
- reconfigure the selected data record.

4.5.3 Mechanical settings of the axis and encoder

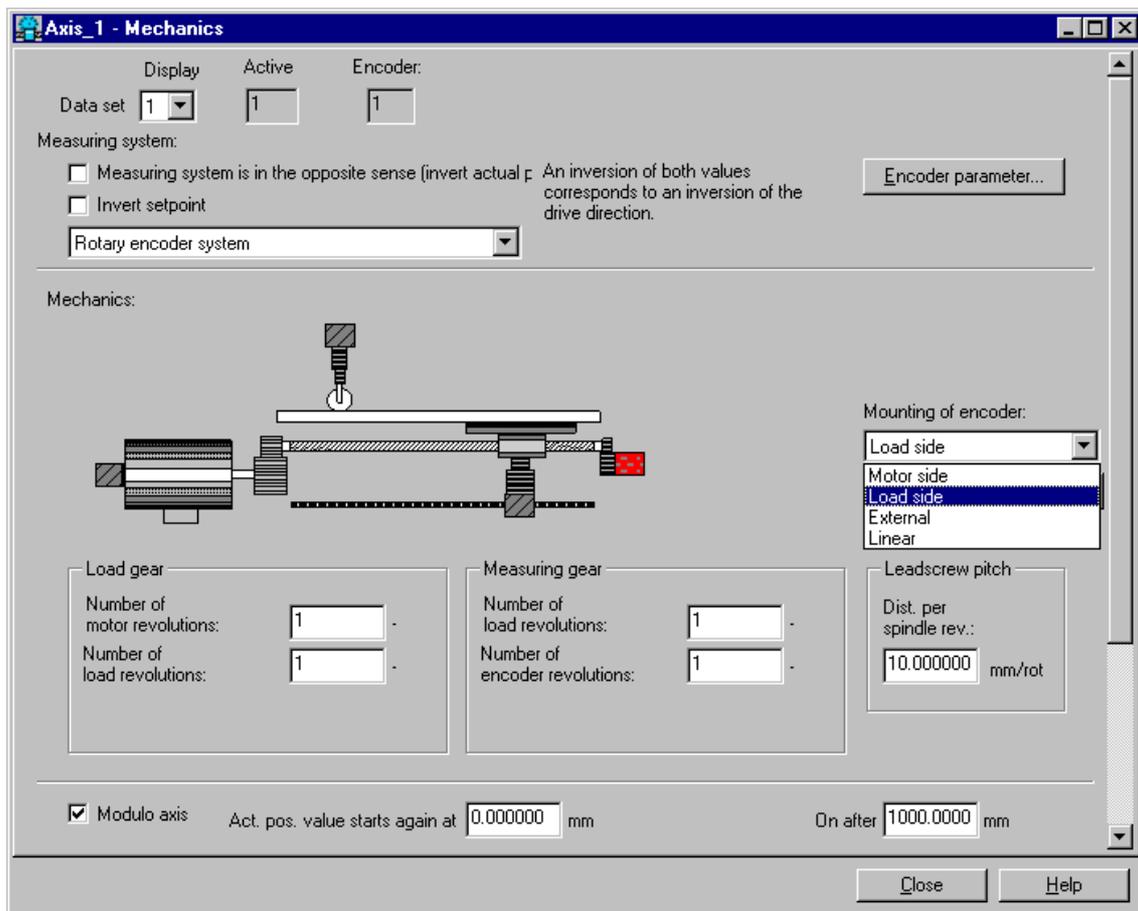
The mechanical properties of the axis and encoder are set in the **Axis > Mechanics** dialog boxes.

For the axis:

- Definition of the drive direction
- Specification of the gear load
- Definition of the spindle pitch for a linear axis
- Modulo settings
- Settings for the compensation of backlash on reversal

For the encoder:

- Specification of the measuring gears
- Settings for the compensation of backlash on reversal
- Mounting of encoder



Marginal conditions of the determination of gear parameters

The configuration may return error messages indicating inconsistent gear parameters. Selection of the wrong configuration data may lead to internal overflows in the integrated technology. You can define suitable parameters using the following formula:

$$f_1 = \text{measuring gear nominator} \cdot 360 \cdot \text{internal resolution} \cdot \text{load gear nominator}$$

$$f_2 = \text{measuring gear nominator} \cdot \text{encoder resolution} \cdot \text{actual value coefficient} \cdot \text{nominator load gear nominator}$$

Next, determine the greatest common divisor **k** of **f₁** and **f₂**, and place it into the following formula:

$$f_{11} = (f_1/k) < 2\text{exp}32$$

$$f_{22} = (f_2/k) < 2\text{exp}32$$

The results of **f₁₁** and **f₂₂** must be smaller than **2exp32**. If this is not the case, check whether you can reach values below maximum in **f₁₁** and **f₂₂** by changing the parameters in the formulae **f₁** and **f₂**.

If configuration errors persist, regardless whether **f₁₁** and **f₂₂** satisfy requirements as described earlier or not, check the following value:

$$f_3 = \text{modulo length} \cdot \text{internal resolution}$$

You can now determine the greatest common divisor **k₂** of **f₃** and **f₁₁**, and the insert it into the next formula:

$$f_{31} = ((f_3 \cdot f_{22} \cdot f_{11}) / (k_1 \cdot k_2)) < 2\text{exp}63$$

At this point, check whether the value in **f₃₁** is lower than that in **2exp63**. If not, consider reducing the modulo length. You could also modify the parameters in the **f₁** and **f₂** formulae. When doing so, however, make sure that the conditions of **f₁₁** and **f₂₂** are still satisfied.

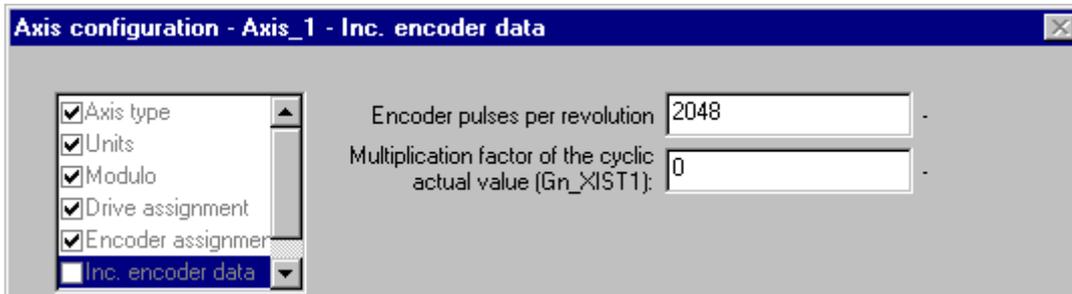
Parameter description

Parameter	Comments	Axis configuration data
Measuring gear nominator	Denominator of the measuring gear ratio	AdaptDrive.numFactor AdaptExtern. numFactor AdaptLoad.numFactor
Measuring gear nominator	Denominator of the measuring gear ratio	AdaptDrive.denFactor AdaptExtern. denFactor AdaptLoad.denFactor
Load gear nominator	Nominator of the load gear ratio	Gear.numFactor
Load gear denominator	Denominator of the load gear ratio	Gear.denFactor
Internal resolution	Internal increments / position unit	Determined in the configuration by means of the axis wizard.
Actual value coefficient	= X with DP drive	X with incremental encoder: IncEncoder.incResolution MultiplierCyclic X with absolute value encoder: AbsEncoder.absResolution.MultiplierCyclic

A FAQ dealing with this issue and containing a corresponding calculation tool is available on the Internet <http://www.siemens.com/automation/service&support>.

4.5.4 High resolution

Encoder pulses can be evaluated in the drive at a higher resolution, depending on the encoder registration and type. The configuration of signal evaluation in the drive must be interconnected with the "Multiplication factor of the cyclic actual value" parameter in the axis configuration in S7T Config.



Example

An incremental encoder is connected to SIMODRIVE 611U and returns 2048 p/rev (encoder scaling). By default, the drive multiplies this number of pulses by a coefficient of 2048 (2exp11.) This factor must be entered at the "Multiplication factor of the cyclic actual value" parameter.

Default

The default "Multiplication factor of cyclic actual value" is set to "0." In this case, the system automatically uses the multiplication factor of 2048 (2exp11.)

4.5.5 Default

In the **Axis > Default** dialog box, select the "Dynamics" tab to adjust the default dynamic values of the axis. These values come into effect when you set negative dynamic values at the FBs in the user program.

Default values can be set for the:

- direction
- Velocity
- Acceleration
- Deceleration
- Jerk
- Velocity profile
- Stop time

Axis_1 - Default

Default values can be used in the user program. Information on this can be found in the documentation of the function blocks.

Dynamics

Direction: Positive

Velocity: 100.000000 mm/s

Jerk: 1000000.000000 mm/s³

Acceleration: 1000.000000 mm/s²

Jerk: 1000000.000000 mm/s³

Velocity profile: Trapezoidal velocity profi

Deceleration: 1000.000000 mm/s²

Jerk: 1000000.000000 mm/s³

Stopping time: 0.000000 s

The screenshot shows a velocity profile graph with a blue line. The line starts at a low velocity, ramps up linearly to a constant velocity, then ramps down linearly to zero velocity. The constant velocity is indicated by the 'Velocity' field. The ramps are labeled with 'Jerk' values, and the constant velocity section is labeled with 'Acceleration' and 'Deceleration' values. The 'Velocity profile' dropdown is set to 'Trapezoidal velocity profi'. The 'Stopping time' field is set to 0.000000 s.

Stop time

The time set at "Stopping time" comes into effect when a moving axis is disabled and *Stop mode* = 2 is set at the MC_Power parameter.

Velocity profile

The velocity profile defines the response of the axis during startup, deceleration, and velocity changes.

The technology functions do not use the default value. Use input parameter *Jerk* to edit the velocity profile.

You can choose the following profiles:

- **Trapezoidal**

The trapezoidal profile is used for linear acceleration in positive and negative direction of movement (*jerk* = 0).

- **Smooth**

The profile shows a linear acceleration, the jerk profile is controllable (*jerk* \neq 0).

4.5.6 Limits

The mechanical limits for velocity, acceleration and jerk are set in the **Axis > Limits** dialog boxes. Available tabs:

- "Position and velocity"
- "Dynamic response"
- "Fixed end stop"

4.5.6.1 Position and velocity

In the "Position and velocity" tab of the **Axis > Limits** dialog box, you can

- monitor the HW limit switches
- monitor the software limit switches, and adjust and enable these.
- Set the velocity limits
- Set the emergency-off deceleration

The screenshot shows the 'Position and velocity' tab of the 'Axis > Limits' dialog box. It is divided into several sections:

- Hardware limit switch:** Includes a checked 'Active' checkbox, a 'Negative log. address' field with value '66', a 'Positive log. address' field with value '66', and a 'Bit number' dropdown set to '0'. A diagram shows a horizontal axis with a central point and two vertical bars representing limit switches on either side.
- Software limit switch:** Includes a checked 'Active' checkbox, a 'Negative log. address' field with value '-1000000000000.00 mm', a 'Positive log. address' field with value '1000000000000.000 mm', and a diagram showing a similar axis with limit switches.
- Velocity limits:** Includes a 'Max. velocity' field with value '500.000000 mm/s', a 'Pos. prog. velocity' field with value '> 1000000000000.000 mm/s', and a checked 'Absolute values' checkbox. A graph shows velocity (V) on the y-axis and time (t) on the x-axis. The graph features a blue curve that ramps up to a red horizontal plateau and then ramps down.
- Emergency stop delay:** Includes a field with value '10000.000000 mm/s²'.

Below the software limit switch section, there is explanatory text: 'There are two different limits: - Limits which must never be exceeded because of mechanical reasons. - Limits which can be modified by programs.'

Emergency-off deceleration

The set emergency-off deceleration comes into effect when a moving axis is disabled and *Stop mode* = 0 is set at the MC_Power parameter.

4.5.6.2 Hardware limit switches

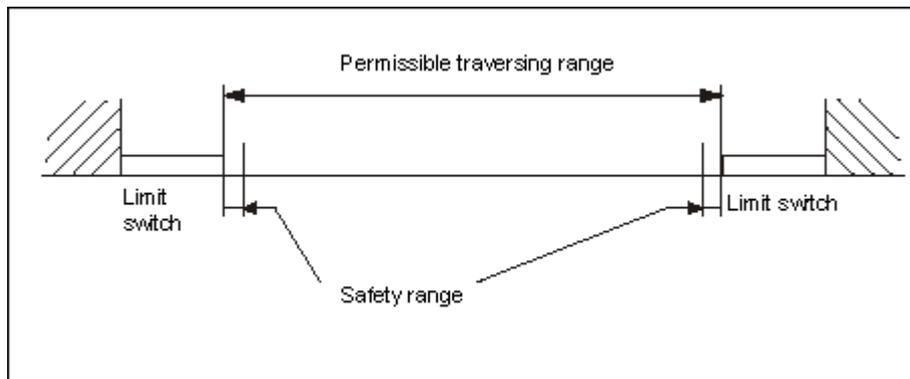
Hardware limit switch monitoring is enabled in the **Axis > Limits** dialog box, in the "Position and velocity" tab. Hardware limit switch monitoring is used to limit the operating range of an axis, or to protect the machine.

Connection

HW limit switches can be connected via four integrated digital inputs of the Technology CPU, or the I/O operated on DP(DRIVE) (ET 200, SINAMICS S120 with TM15/TM17, for example.)

Traversing range

Traversing limits are monitored by means of the HW limit switches connected to the digital inputs. HW switches are always break action switches, and should always be active outside the permissible traversing range.



Release motion

An axis triggering a HW limit switch is stopped with error messages 8013 and 804B. It is released out of the range of the HW limit switch (release motion) as described below:

- **Manual release**

The axis is returned manually to the permissible traversing range. The error message at the technology DB can not be acknowledged until the axis is released.

- **Release motion with drive**

The error at the axis technology DB is acknowledged, but the error message and the *LimitSwitchActive* status bit remain active. The axis can now be moved into its permitted traversing range. A reverse motion command once again triggers an axis error. The *LimitSwitchActive* status can be acknowledged after the axis has moved out of the range of the limit switch.

The current position of the axis upon reaching the HW limit switch is saved. Only when this position, plus a safety range, has been overrun is the axis considered to have left the limit switch.

Warning

Once the HW limit switch has been overrun, the controller must **not** be switched off in order to avoid a conflict between the polarity monitoring of the HW limit switches and the overrun monitoring of the HW limit switches in the direction of the permissible range. In this case, the axis must be moved into the permitted range without hardware limit switch monitoring. There, monitoring can be enabled again.

At **power on** of the PLC, the axis must be located in the permissible traversing range.

Internal states are lost if the axis overruns the HW limit switch and the configuration is reloaded. The relevant data can only be reloaded without loss of the approach information if the axis is positioned within the valid range.

Exception: Disabling of limit position monitoring after a polarity error.

Safety range

The safety range of the HW limit switches is calculated based on the configured resolution of the physical unit system of the axis.

Safety range = 1000 / (increments / position)

Example: A linear axis is assigned the position unit "mm" and an accuracy (increments / position) of "1000/unit" in the "Configure units" dialog box, i.e. the axis position is calculated with an accuracy of 0.001 mm. The safety range in this example is a multiple of 1000 of the accuracy: 1 mm.

4.5.6.3 Software limit switches

Open the **Axis > Limits** dialog box, then select the "Position and velocity" tab to configure the SW limits switches and enable monitoring. Software limit switches should lie within the range of the HW limit switches with reference to the traversing range in order to limit the working range of an axis, for example.

The response of software limit switches is determined by the axis configuration with respect to the homing function. The software limit switches of an axis configured for the execution of absolute motion commands in homed mode ("Homing required: Yes" in the Axis > Homing dialog box) are not monitored if the axis is not homed. However, if those commands can be executed when the axis is not homed ("Homing required: No" in the Axis > Homing dialog box), all software limit switches are monitored, irrespective of the homing state of the axis.

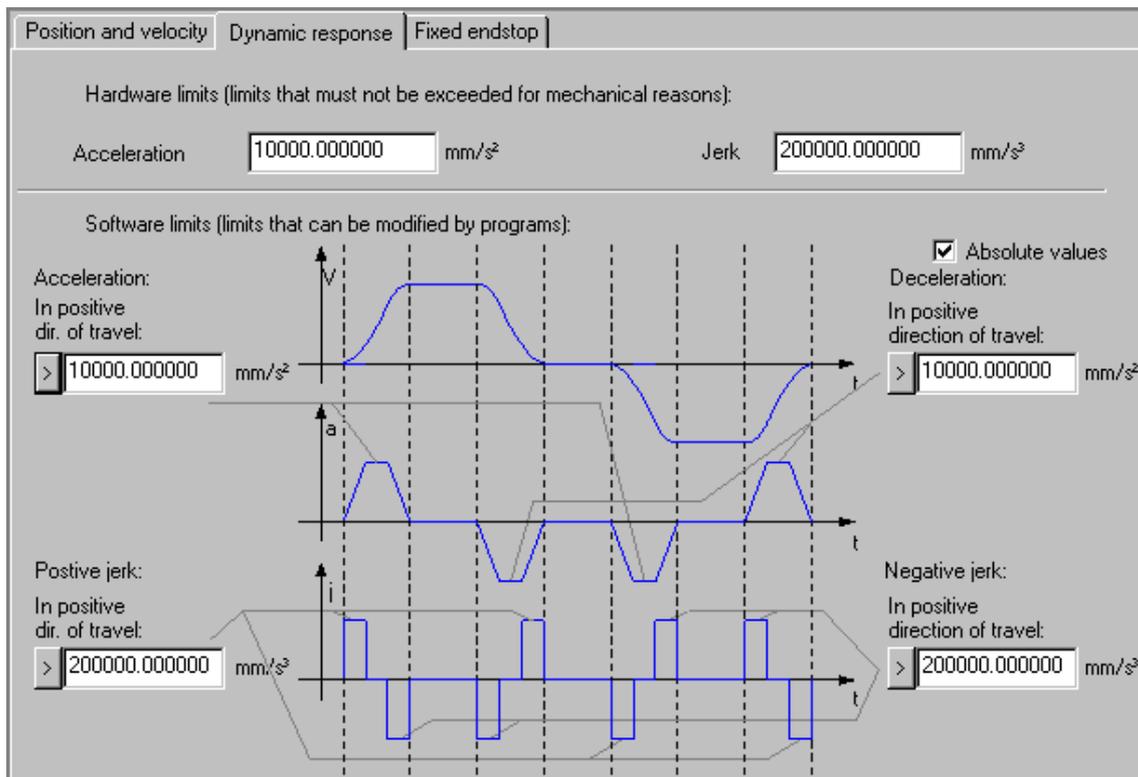
4.5.6.4 Dynamic response

In the "Dynamic response" tab of the **Axis > Limits** dialog box, you can adjust the HW limits (mechanical) and the SW limits.

The set deceleration limit comes into effect when a moving axis is disabled and, and `MC_Power FastStop = 1`.

The **status-based** acceleration model is enabled (default) by setting the "Absolute values" check box.

The **direction-based** acceleration model is enabled by resetting the "Absolute values" check box. In this case, additional parameters are displayed.



Status-dependent acceleration

- **Acceleration**
Axis acceleration, irrespective of the direction.
- **Deceleration**
Axis deceleration, irrespective of the direction.

Direction-based acceleration

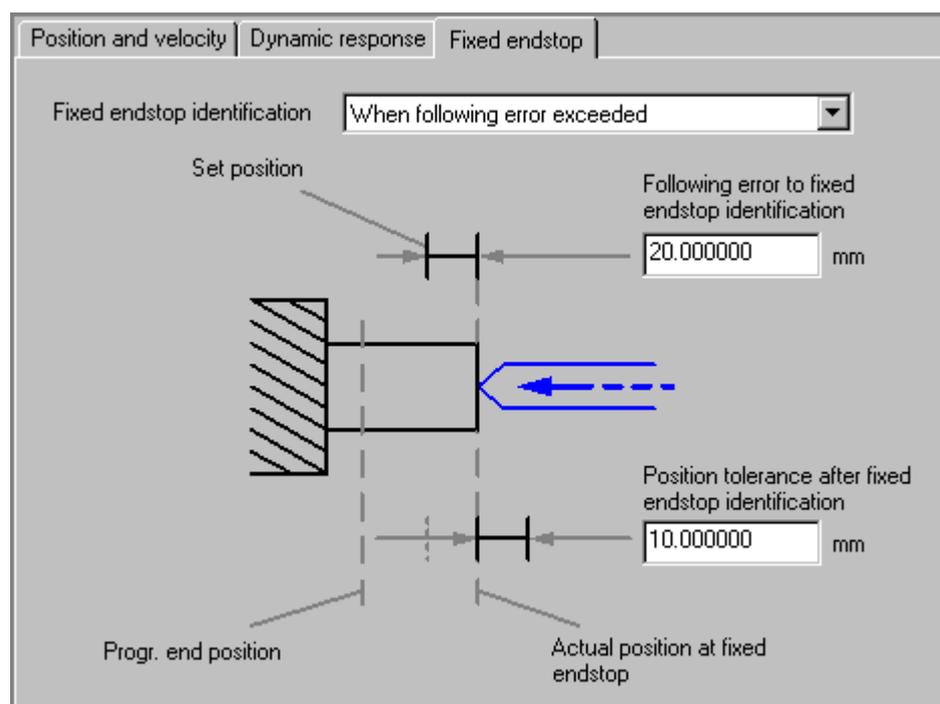
- **Acceleration**
Acceleration in positive direction, deceleration in negative direction.
 - **Deceleration**
Acceleration in negative direction, deceleration in the positive direction.
- Dynamic direction control parameters are useful, for example, for suspended axes.

4.5.6.5 Fixed end stop

At the "Fixed end stop" tab of the **Axis > Limits** dialog box, you can enable fixed end stop detection, and set the corresponding detection mode:

- following error event
- torque over limits event

When the selected condition is satisfied, the "fixed end stop" status is reached. Following error monitoring is disabled when "Approach fixed end stop" is enabled.



Following error limits violation

Note

When the approach to fixed end stop, and fixed end stop detection when following error limits are violated functions are set, the value configured for "Position tolerance after fixed end stop detection" should be significantly less than that for "Following error at fixed end stop detection."

Torque over maximum

The fixed end stop detection function "at violation of torque limits" requires that the digital drive of the axis supports torque limiting, and that a corresponding telegram is set for drive communication, Example: telegram 102 or 105.

Approach to fixed end stop

The "MC_MoveToEndPos" enables the "Approach to fixed end stop" function, and thus sets a clamping torque after the axis reaches the fixed end stop. This operation is referred to as **clamping**.

The motion is stopped when the axis reaches the fixed end stop, and the control remains active. The setpoint value at the position controller input is held constant. New commands directing the motion towards the clamping position are canceled, while new motion control commands directed towards release are executed and thus reduce torque. The start position for new motion control commands in release direction is the setpoint position of the axis.

The setpoint position of the axis is derived from the position value at the fixed end stop

- plus the following error when the **Following error violation** function is set,
- plus the clamping tolerance at the fixed end stop, with **torque limits violation**.

Marginal conditions of fixed end stop detection

- The "Approach fixed end stop" function is reset when the axis moves out of the clamping tolerance window.
- A new command can also be output to toggle the direction of torque when clamping is active.
- Non-stepped torque transitions, torque retention over a defined time period and torque profiles can be implemented in the user program.
- The approach to the fixed end stop (clamping) can be disabled by setting a reverse positioning command.
- A reversal command MC_MoveToEndPos is not permitted and is ignored.
- A mechanical break of the end stop is monitored by means of the actual value of the axis (clamping tolerance window monitoring).
- The torque limit of the drive is set in [N/m] at input parameter *Torque* of the "MC_MoveToEndPos" technology function.
- If the command is busy and the fixed end stop not detected, the system reacts as with active torque limiting.

4.5.7 Homing

4.5.7.1 Introduction

Position-controlled axes equipped with incremental motor measuring systems must be referenced to the position of the mechanical system of the machine each time they are switched on. The axis is synchronized during homing based on the input of a certain position value at a defined position of the drive mechanism.

Axes can be homed in:

- active mode (reference point approach)
- passive mode (homing on-the-fly)
- direct mode (with position preset)

Detailed settings depend on the measuring systems available for measuring the homing position and on the motion an axis may perform for homing.

4.5.7.2 Active homing

Active homing

Active homing can be configured in S7T Config, in the **Axis > Homing** dialog box, "Homing" tab.

There modes are available for active homing:

- Homing with BERO (homing cam) and zero mark
- Homing with BERO only
- Homing with zero mark only.

Start of the homing function:

MC_Home	<i>Mode = 0</i>	Determination of the homing position, based on the axis configuration
	<i>Mode = 1</i>	Determination of the homing position, based on the axis configuration
	<i>Position = x</i>	The homing position is assigned the value at input parameter Position.

After successful homing, the status *Statusword.HomingDone = TRUE* is indicated in the technology DB of the axis.

Active homing in "BERO and zero mark" mode

When you start homing with the "MC_Home" command, the axis first approaches the BERO (homing cam) and secondly the referencing zero mark, according to the axis configuration. The diagram shown in the lower section of the figure shows the resultant motion profile.

Meaning of the various parameters:

Parameter	Value	Description
Homing required	Yes	The axis must be homed in order to execute absolute motion commands.
	No	The axis must not be homed in order to execute absolute motion commands.
Homing mode		For this homing mode: Homing mode: "BERO and zero mark"
Zero mark	Before BERO	The axis is homed to the zero mark which lies, with reference to the direction of the reference point approach, before the BERO
	After BERO	The axis is homed to the zero mark which lies, with reference to the direction of the reference point approach, after the BERO
Start reference point approach	Positive direction	Reference point approach in positive direction.
	Negative direction	Reference point approach in negative direction.
Logical address of the BERO	[byte address]	Logical byte address of the BERO. The BERO can be connected to the integrated inputs of the Technology CPU, or to the I/O on DP(DRIVE).
Bit number	[number of the bit]	Bit address of the signal used for BERO.

Parameter	Value	Description
Approach velocity		Velocity at which the axis approaches the BERO.
Entry velocity		Velocity at which the axis approaches the (shifted) homing position after detection of the zero mark.
Shutdown velocity		Velocity at which the axis approaches the zero mark after detection of the BERO.
Homing position offset		A homing position offset shifts the homing position by the configured distance. The axis moves along the configured distance at a velocity defined in Approach Velocity, starting at the synchronization position with zero mark. Modulo axes always take the shortest distance.
Max. distance to BERO	Disabled	Distance up to BERO detection not monitored
	Enabled	Monitoring of the distance between the start of the reference point approach and BERO detection. If the difference in this distance exceeds the configured distance, the corresponding technology DB indicates error 801D. The reference point approach is canceled.
Max. distance to zero mark	Disabled	Distance to go to the zero mark is not monitored
	Enabled	Monitors the distance an axis travels between the BERO and the zero mark. If the difference in this distance exceeds the configured distance, the corresponding technology DB indicates error 801D. The reference point approach is canceled.

Time-based execution of the reference point approach

- Phase 1: Approach to BERO (homing cam)

The axis starts its reference point approach at the configured approach velocity and in the direction set in "Direction of reference point approach." The approach to BERO (Phase 1) ends when the BERO (homing cam) is reached.

In addition, the distance between start position of the reference point approach and the BERO position can be monitored by setting "Max. distance to BERO" check box. The homing operation is canceled with error if the BERO is not detected within the configured distance after the start of the reference point approach.

- Phase 2:
Synchronization with zero mark

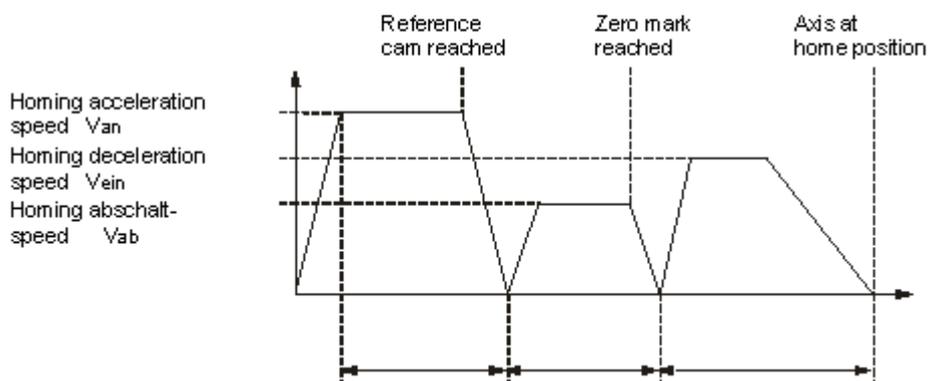
After it reaches the BERO, the axis accelerates / decelerates to shutdown velocity, and approaches the zero mark derived from the combined settings of "zero mark" (after or before BERO) and "Direction of reference point approach" (positive or negative.) The PLC synchronizes the axis to the first zero mark detected after the BERO is detected in accordance with the configuration. The axis position is set to the default value minus the homing position offset value defined in "Homing position coordinate" (*Mode = 0*) or at input parameter *Position* (*Mode = 1*.)

You can also monitor the distance an axis travels between the BERO and the zero mark by setting the "Max. distance to zero mark" check box. The reference point approach is canceled with error if the zero mark is not found within the specified distance after the BERO is detected.

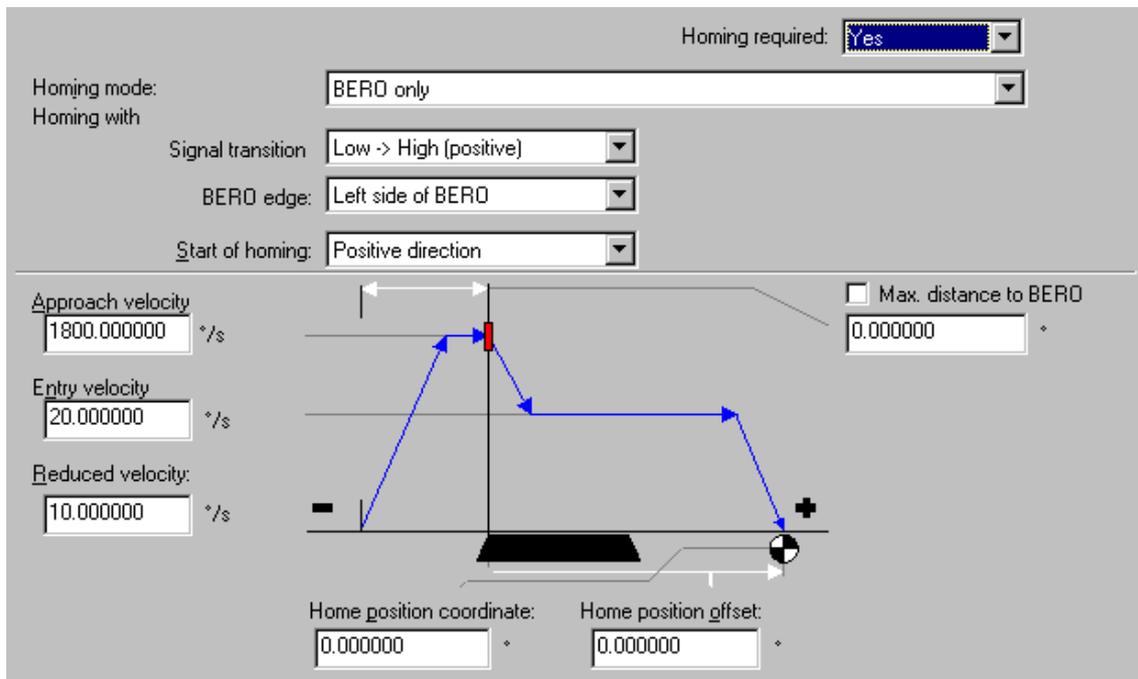
- Phase 3:
Reference point approach

After the zero mark is detected, the axis accelerates / decelerates to approach velocity and approaches the homing position.

If a homing position offset was configured, the axis approaches the homing position along the corresponding distance, starting at the synchronization position. The traversing direction is determined by the sign of the homing point offset value and by the length of the deceleration ramp after zero mark detection, if the homing position lies within the deceleration ramp.



Active homing in "BERO Only" mode



An axis started with the "MC_Home" homing command approaches the homing BERO in accordance with the configuration. The diagram shown in the lower section of the figure shows the resultant motion profile.

Meaning of the various parameters:

Parameter	Value	Description
Homing required	Yes	The axis must be homed in order to execute absolute motion commands.
	No	The axis must not be homed in order to execute absolute motion commands.
Homing mode		For this homing mode: Homing mode: "BERO only"
Signal transition	Low -> High (positive)	The motion is referenced to the positive edge of the BERO detection signal (setting according to edge evaluation in the drive component.)
	High -> Low (negative)	The motion is referenced to the negative edge of the BERO detection signal (setting according to edge evaluation in the drive component.)
BERO signal edge	Left side of BERO	The signal transition is measured viewed from the left side of the BERO, in direction of the reference point approach.
	Right side of the BERO	The signal transition is measured viewed from the right side of the BERO, in direction of the reference point approach.

Parameter	Value	Description
Start reference point approach	Positive direction	Reference point approach in positive direction.
	Negative direction	Reference point approach in negative direction.
Approach velocity		Velocity at which the axis approaches the BERO.
Entry velocity		Velocity at which the axis approaches the (shifted) homing position after detection of the zero mark.
Shutdown velocity		Velocity at which the axis approaches the homing position coordinate after detection of the BERO.
Homing position offset		A homing position offset shifts the homing position by the configured distance. The axis moves by a configured distance after its synchronization at the BERO edge at the velocity defined under Homing Velocity. Modulo axes always take the shortest distance.
Max. distance to BERO	Disabled	Distance up to BERO detection not monitored
	Enabled	Monitoring of the distance between the start of the reference point approach and BERO detection. If the difference in this distance exceeds the configured distance, the corresponding technology DB indicates error <i>801D</i> . The reference point approach is canceled.

Note

To home the axis to BERO, interconnect the BERO as digital input with the measured value input of the drive component.

Note

In order to execute reference point approach in "BERO only" homing mode, select "Signal transition" and "BERO edge" values which correspond with the drive configuration or functionality. The "Signal transition" and "BERO edge" parameters do not configure the measuring function in the drive, but rather reflect their functionality in order to control axis motion according to the configuration.

For information on the configuration of BERO detection, refer to the relevant product information or to the drive manuals.

Time-based execution of the reference point approach

- Phase 1: Synchronization to BERO

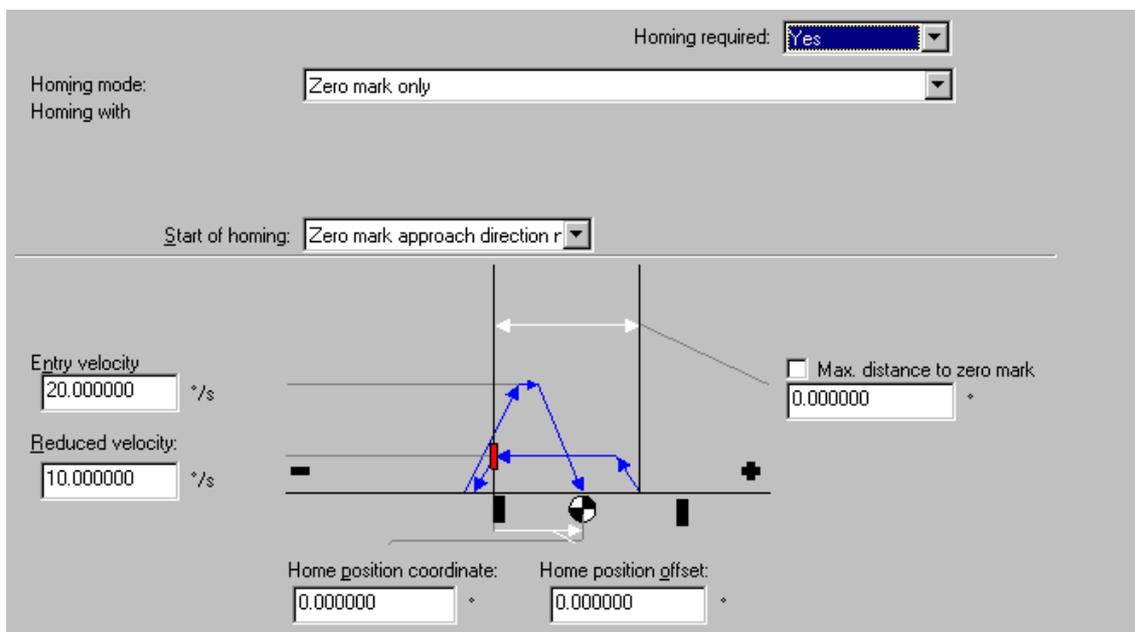
The axis starts its reference point approach at the configured approach velocity and in the direction set in "Direction of reference point approach." Synchronization ends at the BERO (phase 1) when the configured signal transition (configured at the drive component) is detected at the BERO signal. The axis position is set to the default value minus the homing position offset value defined in "Homing position coordinate" (*Mode = 0*) or at input parameter *Position* (*Mode = 1*.)

You can also monitor the distance an axis travels between the start of reference point approach and detection of the signal edge by setting the "Max. distance to BERO" check box. Homing is canceled with error if the edge is not detected between the start of reference point approach and the end of the configured distance.
- Phase 2: Approach to homing position

After the configured signal edge is detected, the axis accelerates / decelerates at shutdown velocity to the homing point coordinate.

If a homing position offset was configured, the axis approaches the homing position along the corresponding distance, starting at the synchronization position. The traversing direction is determined by the sign of the homing point offset value and by the length of the deceleration ramp after zero mark detection, if the homing position lies within the deceleration ramp.

Active homing in "Zero mark only" mode



Homing without to zero mark is used, for example, in axes for which the encoder sets only one zero mark in the entire traversing range of the axis. This homing command moves the axis to the zero mark. Once the axis detects the zero mark, the homing position offset is applied at homing velocity. The axis position has now assumed the value defined in the homing position coordinate. The diagram shown in the lower section of the figure shows the resultant motion profile.

Meaning of the various parameters:

Parameter	Value	Description
Homing required	Yes	The axis must be homed in order to execute absolute motion commands.
	No	The axis must not be homed in order to execute absolute motion commands.
Homing mode		For this homing mode: Homing mode: "zero mark only"
Start reference point approach	Positive approach direction to zero mark	Reference point approach in positive direction.
	Negative approach to zero mark	Reference point approach in negative direction.
Entry velocity		Velocity at which the axis approaches the (shifted) homing position after detection of the zero mark.
Shutdown velocity		Velocity at which the axis starts reference point approach and approaches the zero mark.
Homing position offset		The homing position offset function shifts the homing position by a configured distance, i.e. the axis moves along a configured distance behind the zero mark detection position at a velocity defined under Homing Velocity. Modulo axes always take the shortest distance.
Max. distance to zero mark	Disabled	Distance to go to the zero mark is not monitored
	Enabled	Monitors the distance an axis travels between the BERO and the zero mark. If the difference in this distance exceeds the configured distance, the corresponding technology DB indicates error 801D. The reference point approach is canceled.

Time-based execution of the reference point approach

- Phase 1: Synchronization to zero mark
 The axis starts its reference point approach at the configured shutdown velocity in the direction set in "Direction of reference point approach." Synchronization with zero mark (phase 1) ends with the detection of the zero mark. The axis position is set to the default value minus the homing position offset value defined in "Homing position coordinate" (*Mode = 0*) or at input parameter *Position (Mode = 1.)*
 You can also monitor the distance an axis travels between the start of reference point approach and zero mark detection by setting the "Max. distance to zero mark" check box. Homing is canceled with error if the zero mark is not detected between the start of reference point approach and the end of the configured distance.
- Phase 2:
 Approach to homing position
 After the configured signal edge is detected, the axis accelerates / decelerates at homing velocity to the homing point coordinate.
 If a homing position offset was configured, the axis approaches the homing position along the corresponding distance, starting at the synchronization position. The traversing direction is determined by the sign of the homing point offset value and by the length of the deceleration ramp after zero mark detection, if the homing position lies within the deceleration ramp.

4.5.7.3 Passive/On-the-fly homing

Passive homing can be set in the "Passive homing" tab of the **Axis > Homing** dialog box of S7T Config. The difference to active homing is, that the motion required for homing is not initiated by the homing command.

Three passive homing modes are available:

- Passive homing with BERO (homing cam) and zero mark
- Passive homing with BERO only
- Passive homing with zero mark only.

Start of the homing function:

MC_Home	<i>Mode = 2</i> <i>Position = x</i>	At the homing position, the current position is assigned the value at input parameter <i>Position</i> .
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After successful homing, the status *Statusword.HomingDone = TRUE* is indicated in the technology DB of the axis.

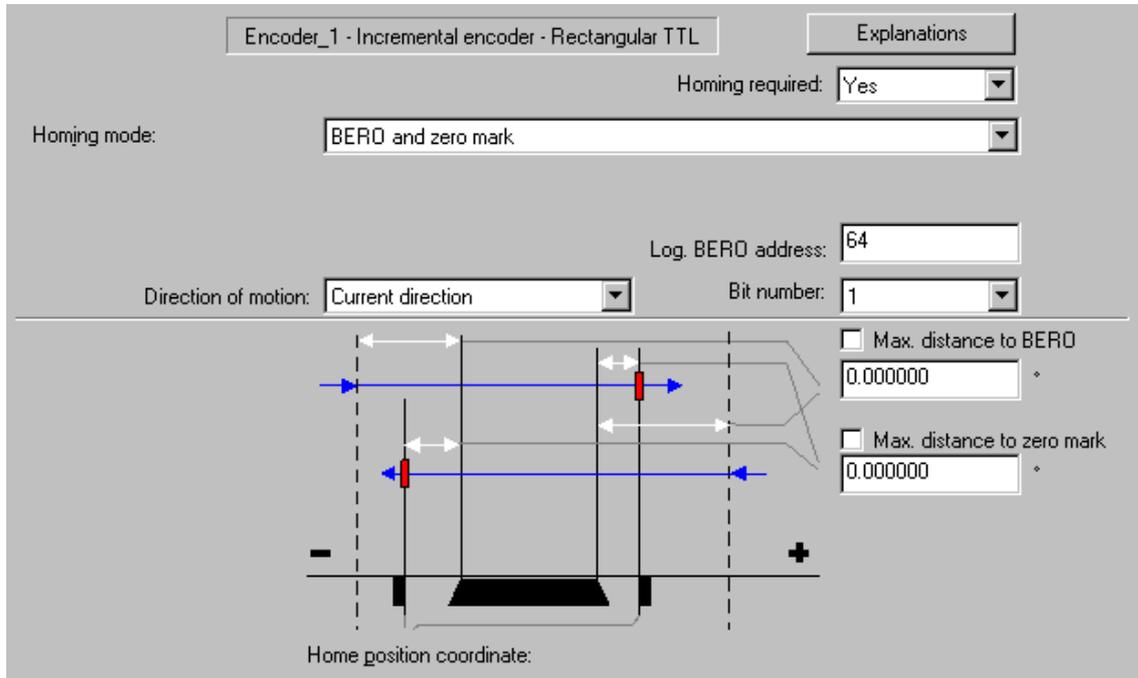
Note

Note that not all drive components support all homing mode or measured signal evaluation functions. For details, refer to the documentation of the drive components used.

Note

Triggering of zero mark or BERO monitoring during a passive homing operation is indicated by a corresponding error message at the technology DB. The current axis motion is terminated in this case.

Passive homing in "BERO and zero mark" mode



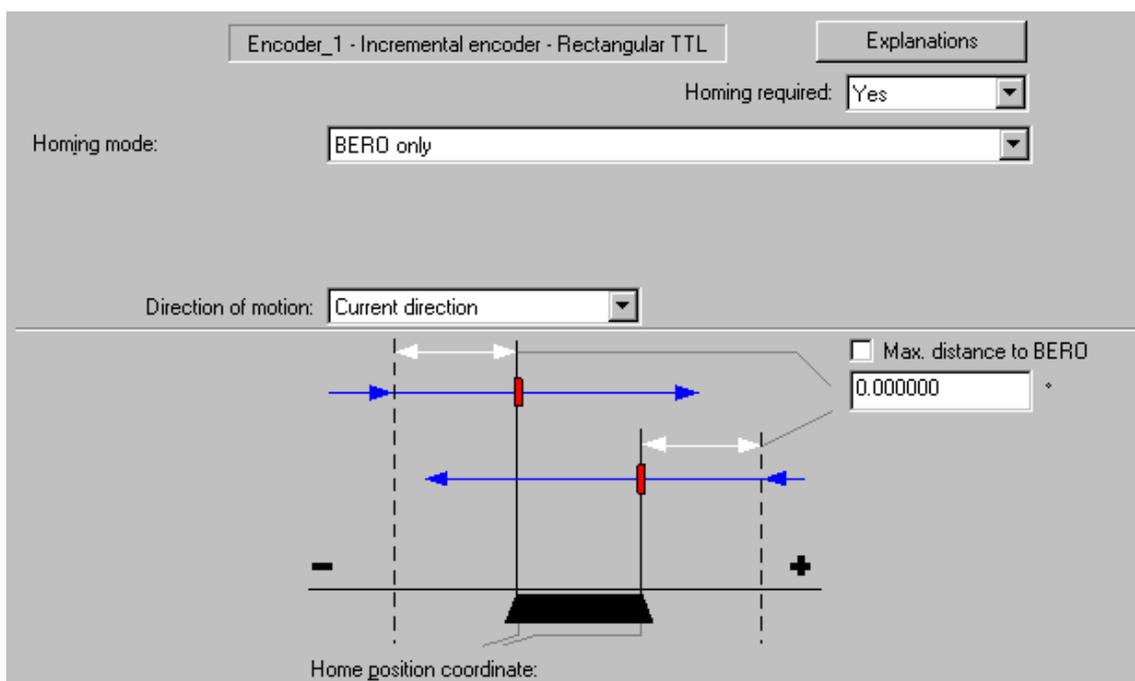
After the BERO has been overtravelled, the next zero mark triggers axis homing. At the homing position, the axis position is set to the position value defined at input parameter *Position* of the "MC_Home" technology function.

Meaning of the various parameters:

Parameter	Value	Description
Homing required	Yes	The axis must be homed in order to execute absolute motion commands.
	No	The axis must not be homed in order to execute absolute motion commands.
Homing mode		For this homing mode: Homing mode: "BERO and zero mark"
Direction of movement	Positive direction	The axis is only homed with positive approach direction to the zero mark.
	Negative direction	The axis is only homed with negative approach direction to the zero mark.
	Current direction	The axis is homed when it reaches the next zero mark.
Logical address of the BERO	[byte address]	Logical byte address of the BERO. The BERO can be connected to the integrated inputs of the Technology CPU, or to the I/O on DP(DRIVE).
Bit number	[number of the bit]	Bit address of the signal used for BERO.

Parameter	Value	Description
Max. distance to BERO	Disabled	Distance up to BERO detection not monitored
	Enabled	Monitoring of the distance between the start of the homing function and BERO detection. If the difference in this distance exceeds the configured distance, the corresponding technology DB indicates error 801D. The homing function is canceled.
Max. distance to zero mark	Disabled	Distance to go to the zero mark is not monitored
	Enabled	Monitors the distance an axis travels between the BERO and the zero mark. If the difference in this distance exceeds the configured distance, the corresponding technology DB indicates error 801D. The homing function is canceled.

Passive homing in "BERO only" mode



Axis homing starts with the detection of the configured edge of the BERO signal. The axis is set to the position value at the Position input of the technology function "MC_Home."

Meaning of the various parameters:

Parameter	Value	Description
Homing required	Yes	The axis must be homed in order to execute absolute motion commands.
	No	The axis must not be homed in order to execute absolute motion commands.
Homing mode		For this homing mode: Homing mode: "BERO only"
Direction of movement	Positive direction	Reference point approach in positive direction.
	Negative direction	Reference point approach in negative direction.
	Current direction	Reference point approach in negative direction.
BERO signal edge	Left side of BERO	Direction of movement: positive Axis homing is triggered at the positive edge. Direction of movement: negative Axis homing is triggered at the negative edge.
	Right side of the BERO	Direction of movement: positive Axis homing is triggered at the negative edge. Direction of movement: negative Axis homing is triggered at the positive edge.
Max. distance to BERO	Disabled	Distance up to BERO detection not monitored
	Enabled	Monitoring of the distance between the start of the reference point approach and BERO detection. If the difference in this distance exceeds the configured distance, the corresponding technology DB indicates error <i>801D</i> . The homing function is canceled.

Note

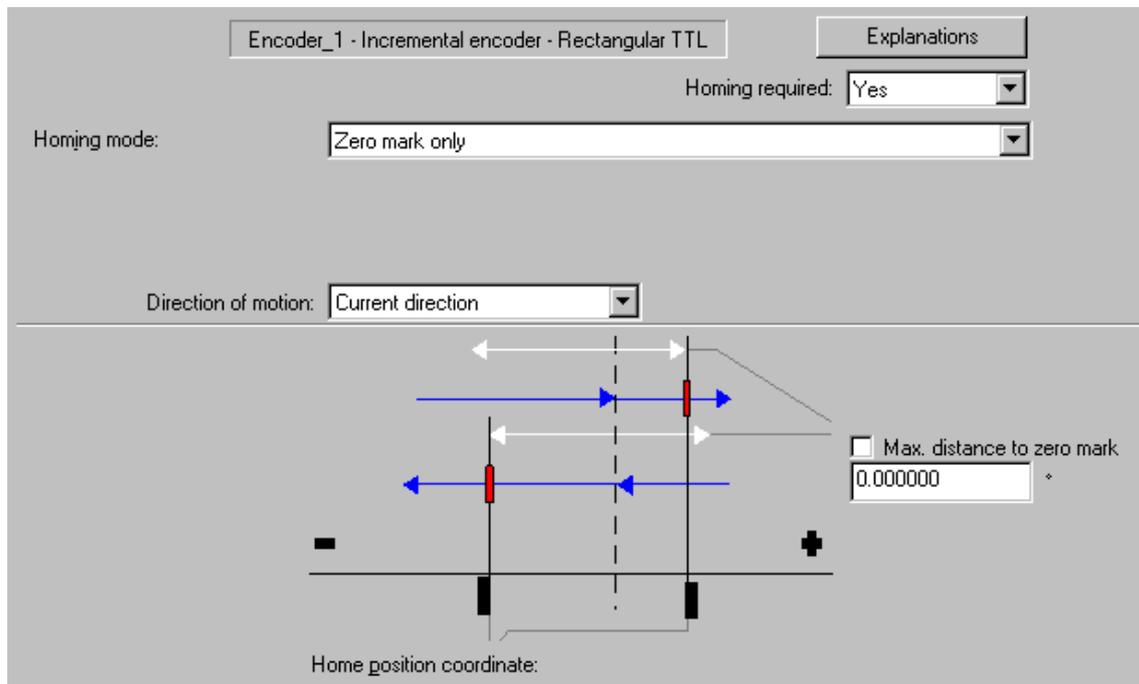
To home the axis to BERO, interconnect the BERO as digital input with the measured value input of the drive component.

Note

In order to execute the homing function in "BERO only" mode, select "Direction of movement" and "BERO edge" values which correspond with the configuration or drive functionality for detecting the BERO edge. The "BERO edge" and "Direction of movement" parameters do not configure the measuring function in the drive, but rather reflect its functionality.

For information on the configuration of BERO detection, refer to the relevant product information or to the drive manuals.

Passive homing in "Zero mark only" mode



Homing in "Zero mark only" mode is used, for example, at axes equipped with an encoder which outputs only one zero mark in the entire traversing range of the axis.

Axis homing starts with the detection of the zero mark. At the time of zero mark detection, the axis position value is set to the position value at input parameters *Position* of the "MC_Home" technology function.

Meaning of the various parameters:

Parameter	Value	Description
Homing required	Yes	The axis must be homed in order to execute absolute motion commands.
	No	The axis must not be homed in order to execute absolute motion commands.
Homing mode		For this homing mode: Homing mode: "Zero mark only"
Direction of movement	Positive direction	The axis is only homed with negative approach direction to the zero mark.
	Negative direction	The axis is only homed with positive approach direction to the zero mark.
	Current direction	The axis is homed when it reaches the next zero mark.
Max. distance to zero mark	Disabled	Distance to go to the zero mark is not monitored
	Enabled	The function monitors the distance an axis travels between the start of its homing function and detection of the zero mark. If the difference in this distance exceeds the configured distance, the corresponding technology DB indicates error 801D. The homing function is canceled.

Passive homing in "Preset" mode

"Zero mark only" mode is used when the configured encoder outputs a zero mark, otherwise "BERO only" mode is set. This is the default mode when you create a new axis in S7T Config.

4.5.7.4 Direct homing

The current position of the axis is defined by the value at the "MC_Home" technology function. A homing position offset is not in effect. The function does not execute a motion. The axis is homed when the command is executed.

Start of the homing function:

MC_Home	Mode = 3 Position = x	Direct homing: The current position is assigned the value at input parameter Position.
---------	--------------------------	---

After successful homing, the status *Statusword.HomingDone = TRUE* is indicated in the technology DB of the axis.

4.5.7.5 Position correction

A correction value is deducted from the actual position value of the axis. In contrast to other homing modes, the axis maintains its homing state (homed / not homed) in this case.

The position correction function can also be used to manipulate the setpoint values of the various coordinate systems (base coordinate system, superimposing coordinate system). This is of significance in superimposing camming, in order to be able generate a reference within a cam disk.

Start of the homing function:

MC_Home	Mode = 4 Position = x	Actual value correction (position value = actual position - position parameter.)
	Mode = 6 Position = x	Setpoint value correction in the base coordinate system (position value = actual position - position parameter.)
	Mode = 7 Position = x	Setpoint value correction in the superimposing coordinate system (position value = actual position - position parameter.)

Position correction does not influence the *Statusword.HomingDone* status at the axis technology DB.

4.5.7.6 Traversing with a non-homed axis

In the **Axis > Homing** dialog box, you specify whether the absolute positioning function is available at an axis which is not homed.

Optional settings for "Homing required":

- No: Relative and absolute motions are possible. The software limit switches are monitored.
- Yes: relative motion only. The software limit switches are not monitored as long as the axis is not homed.

4.5.8 Monitoring functions

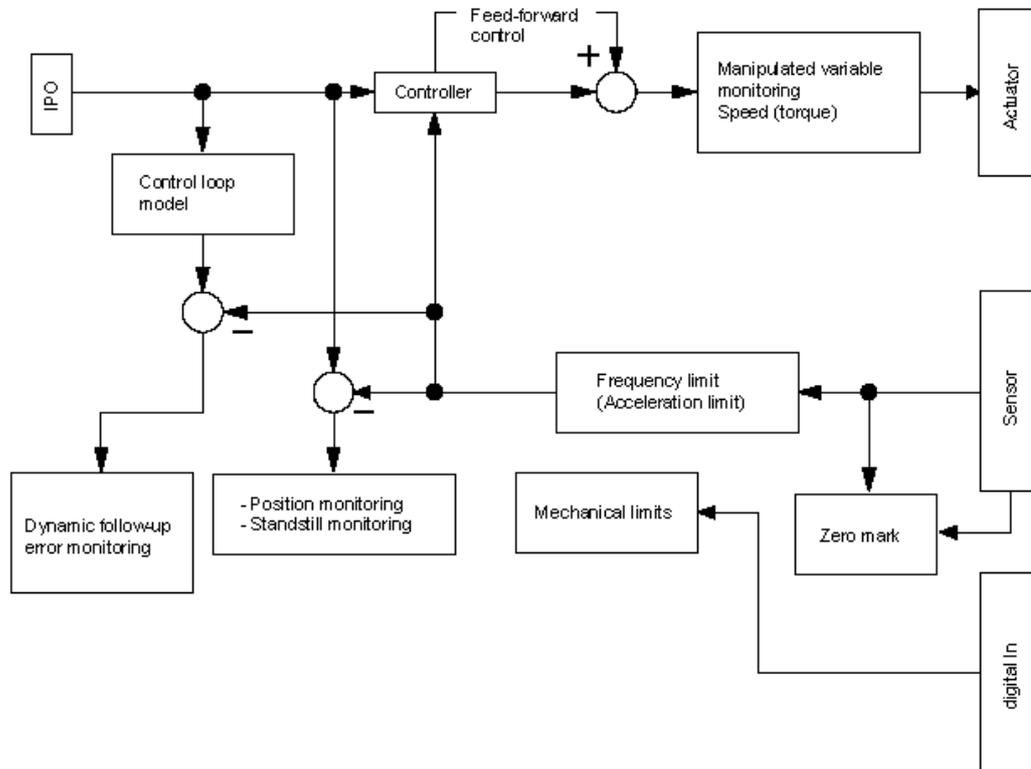
4.5.8.1 Overview - Monitoring functions

Axis monitoring functions you can configure in S7T Config:

Monitoring	Velocity axis	Positioning axis	Synchronizati on axis
Velocity error monitoring	X	-	-
Positioning monitoring	-	X	X
Dynamic following error monitoring	-	X	X
Standstill signal	X	X	X
Software limit switches	-	X	X
Hardware limit switches	X	X	X
Synchronization monitoring	-	-	X
Manipulated variable monitoring (always enabled)	X	X	X
Encoder limit frequency monitoring	X (only with encoder)	X	X

Positioning axis monitoring

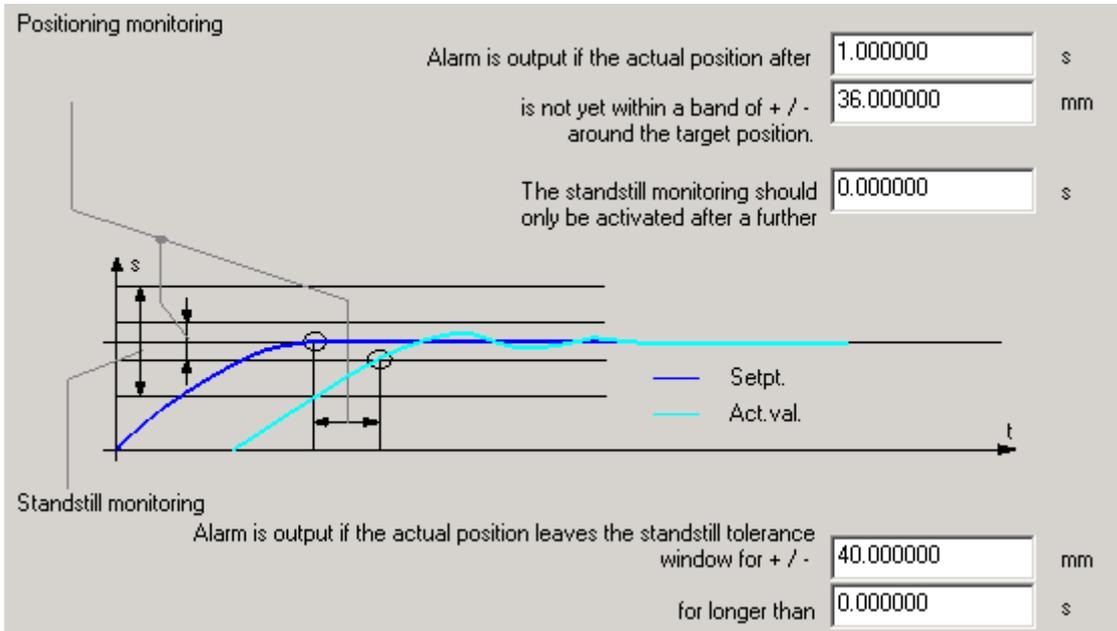
The figure below shows an example of a positioning axis monitoring function:



Errors are reported at the *ErrorStatus* parameter of the technology DB.

4.5.8.2 Positioning and standstill monitoring

At the **Axis > Monitoring functions** dialog box, "Positioning and standstill monitoring" tab, set the limit values for monitoring positioning of position-controlled and synchronization axes.



The "Positioning and standstill monitoring" tab shows whether you set the **Positioning** or **Synchronism** technology for the axis.

Positioning monitoring

At the end of a positioning motion, the function monitors the approach to the set position. Define a positioning window and a time tolerance indicating the point in time at which the end position must have been reached. Monitoring is enabled at the end of setpoint value interpolation.

You can also set a minimum dwell time in the positioning window, which is to expire before a positive feedback of the positioning command is received. This time can be used for oscillating processes and control loops, for which the tolerance window should be less than the overshoot amplitude.

A positive feedback of the positioning command is output when the actual value reaches the positioning window.

When positioning monitoring is triggered, the axis technology DB indicates error *8019*.

Standstill monitoring

Standstill monitoring is enabled when the position setpoint of a positioning command is equal to the value at the destination position, and the delay time for setting standstill monitoring.

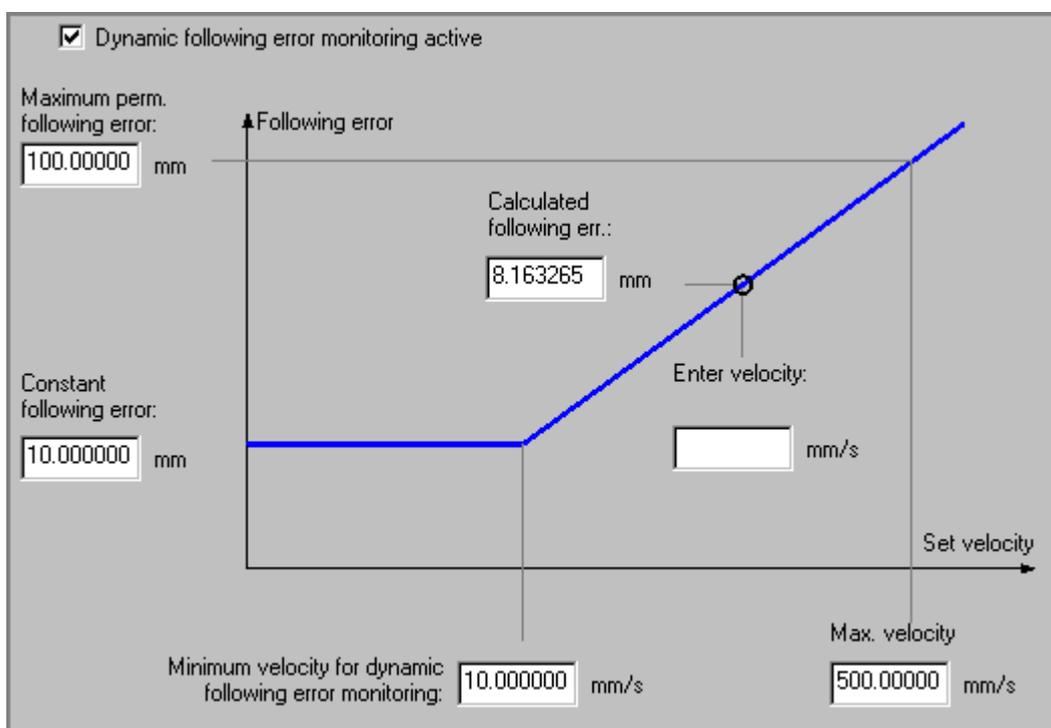
Standstill monitoring is triggered when the axis moves out of the configured standstill velocity tolerance window for any time longer than the configured time. When standstill monitoring is triggered, the axis technology DB indicates error *8018*.

4.5.8.3 Dynamic following error monitoring

Dynamic following error monitoring can be enabled in the "Following error monitoring" tab of the **Axis > Monitoring functions** dialog box.

Following error monitoring of a position-controlled axis is based on the calculated following error. Any offset between the actual and setpoint position values higher than the configured limit of the following error triggers error 8016 at the axis. The permitted following error depends on the velocity setpoint of the axis in this case.

At velocity values lower than the configured minimum, the permitted following error is constant and is configured at the "constant following error" parameter. Above this limit, the following error increases linearly up to a maximum value which is defined by the "maximum permitted following error" parameter at maximum velocity. The permissible maximum following error is reached when the axis has reached maximum velocity.



The "Enter velocity value" input box allows the user to verify the set values of following error monitoring in order to determine the permissible maximum following error at the set velocity.

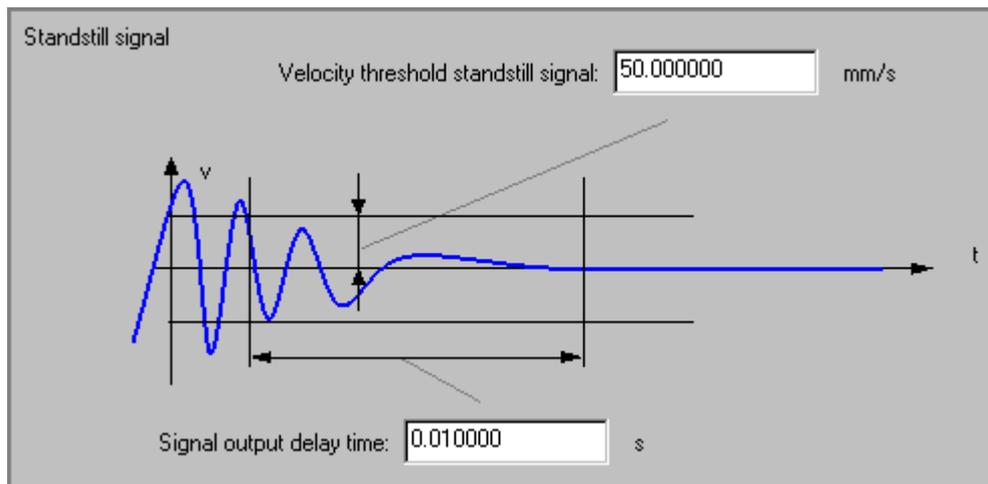
The "Following error monitoring" tab is shown for position-controlled physical axes.

4.5.8.4 Standstill signal

Select the "Standstill signal" tab of the **Axis > Monitoring functions** dialog box to set the velocity threshold and delay time.

The standstill signal sets the "Standstill" bit in the status word of the technology DB, if the current velocity is below the configured velocity threshold at least for the duration of the set delay time.

At velocity-controlled and positioning axes, this override takes place in velocity-controlled operation. At the positioning axis, the override is triggered when it reaches the positioning window.



4.5.8.5 Synchronization monitoring

In the "Synchronization monitoring" tab of the **Axis > Monitoring functions** dialog box, you can enable synchronization error monitoring at the following axis.

Possible settings:

- setpoint monitoring mode (with or without jerk), including the relevant tolerance
- enabling actual value monitoring, including the relevant tolerance
- which errors are output at the leading axis (actual values, setpoint values).

The screenshot shows a dialog box with two tabs: "Standstill signal" and "Synchronous operation monitoring". The "Synchronous operation monitoring" tab is selected. The settings are as follows:

- Activate setpoint monitoring: With jerk
- Setpoint tolerance: 10.000000 mm
- Activate actual value monitoring: Yes
- Actual value tolerance: 0.000000 mm
- Report error of master axis: Setpoints

The "Synchronization monitoring" tab indicates that you have assigned the **synchronism** technology to the axis.

4.5.8.6 Manipulated variable monitoring

The maximum values of the manipulated variables are limited when used for monitoring the configured velocity limits. The technology DB outputs a warning if the values of manipulated variables exceed a configurable maximum.

The maximum possible acceleration, and thus the maximum torque, is monitored based on the rise of the value in the manipulated variable.

The maximum values of the axis are defined in the **Axis > Limits dialog box** at the "Position and velocity" tab.

4.5.9 Control

4.5.9.1 Position control

Static and dynamic controller data and friction compensation are configured in the **Axis > Control** dialogs.

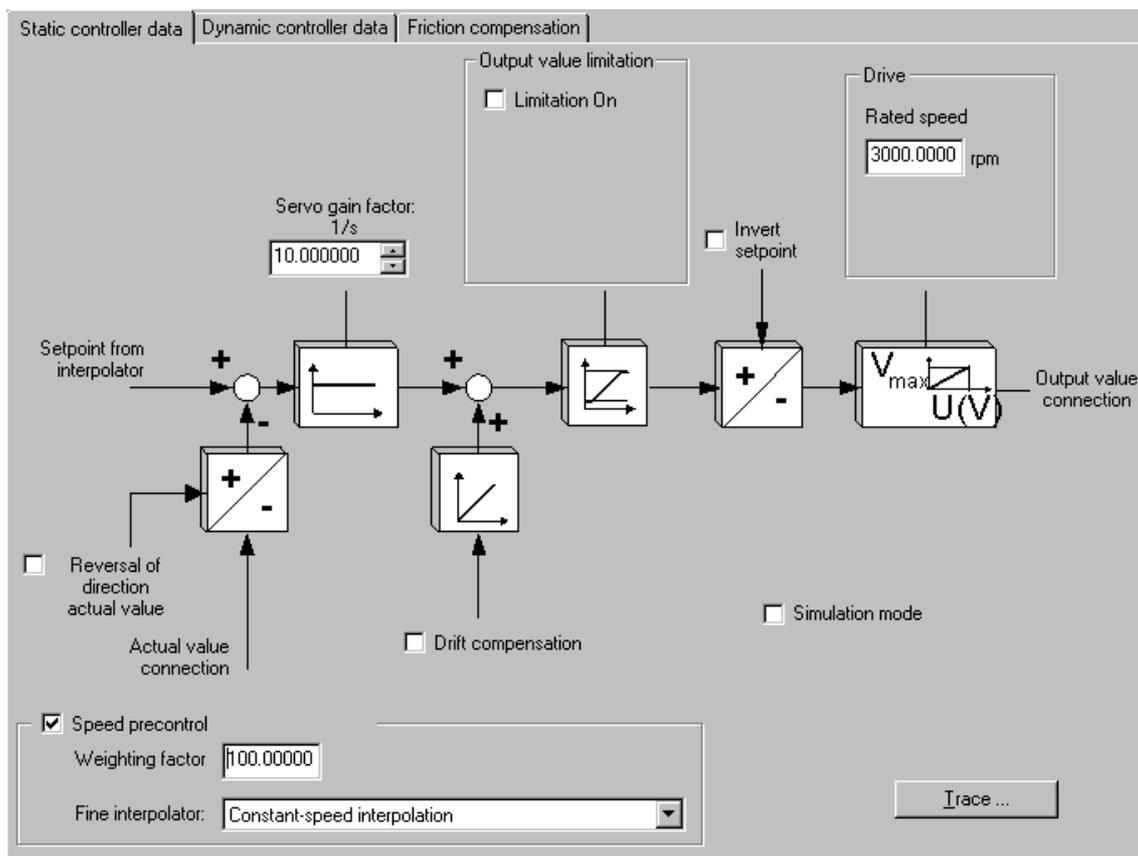
Set the "Expert mode" check box to indicate in addition to the "Static controller data" tab, the "Dynamic controller data" and "Friction compensation" tabs.

The controller and monitoring functions are enabled when **position control is active**. Following error monitoring is disabled in torque limiting mode.

The controllers are inactive when position control is **disabled**, for example, in following mode. Encoder systems, actual value calculation and monitoring functions influence the actual values. Compensating functions are ignored.

4.5.9.2 Static controller data

Select the "Static controller data" tab from the **Axis > Closed-loop control** dialog box to adjust the position control of the axes.



Fine interpolator

The Fine interpolator function is used to generate interim setpoint values when the interpolator and the controller have a different duty factor. Settings available at the fine interpolator:

- No interpolation
- Linear interpolation
- Constant velocity interpolation
- Constant acceleration interpolation

Manipulated variable limiting

Manipulated variable limiting sets an absolute hi and lo limit value of the control range. This limitation is applied prior to inversion.

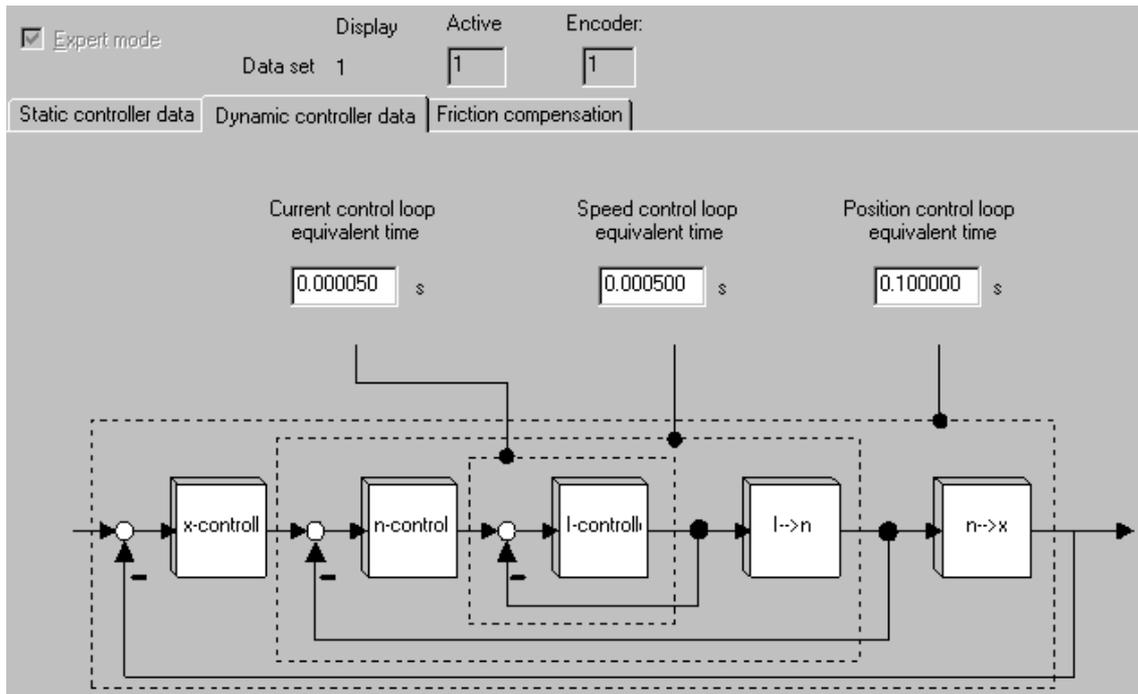
Note

Reverse motion interlock (position controller in the drive) is not enabled when DSC (Dynamic Servo Control) is set. The reverse motion interlock therefore needs to be generated in the drive when DSC is enabled.

4.5.9.3 Dynamic controller data

In "Dynamic controller data" tab of the **Axis > Closed-loop control** dialog box, you can adjust the dynamic response of the axes, e.g. to match their response in synchronous operation. The "Dynamic controller data" tab is available when you set expert mode in the "Static controller data" tab.

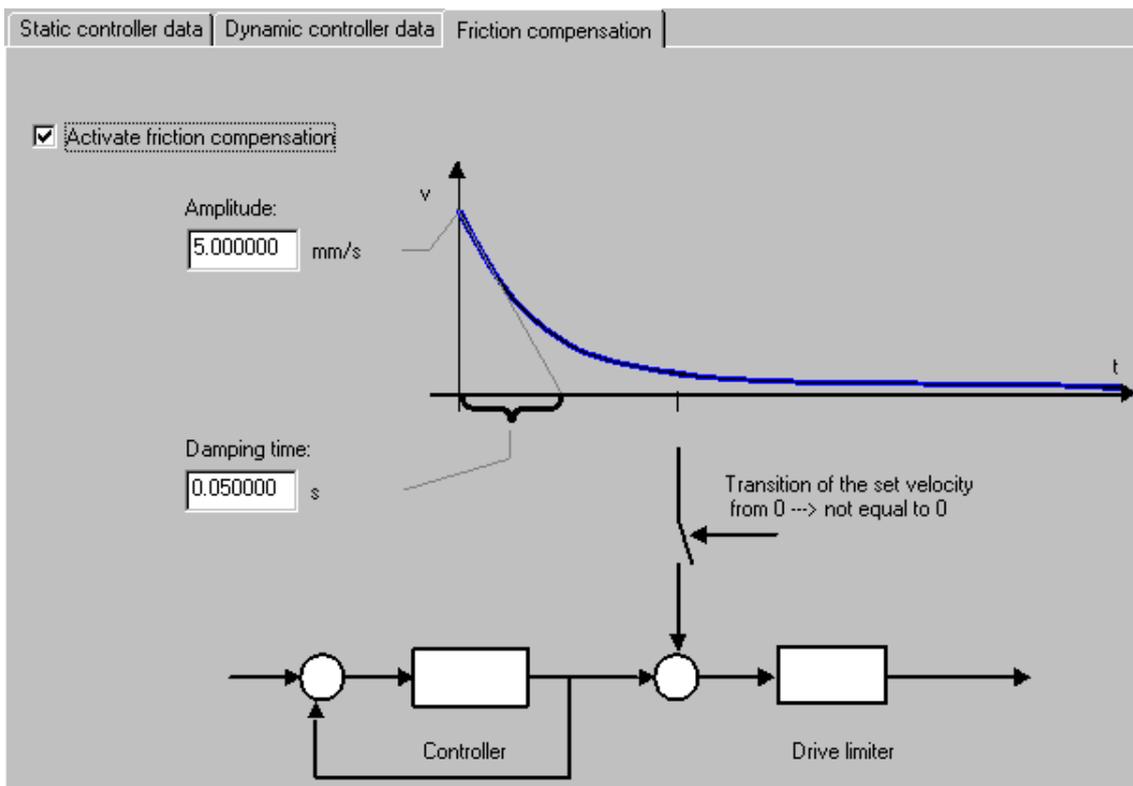
The setpoint branch of the control loop contains a configurable dynamic filter which you can use to adjust the dynamic response of the axes.



4.5.9.4 Friction compensation

You can enable friction compensation in the "Friction compensation" tab of the **Axis > Closed-loop control** dialog box. The "Friction compensation" tab is available when expert mode is set on the "Static data of closed loop control" tab.

A simple method of compensation is available to overcome the forces of static friction. At the start of the axis from zero velocity, a DT1 element adds a static friction compensation signal to the manipulated variable. You configure static friction compensation by setting the amplitude and attenuation time.

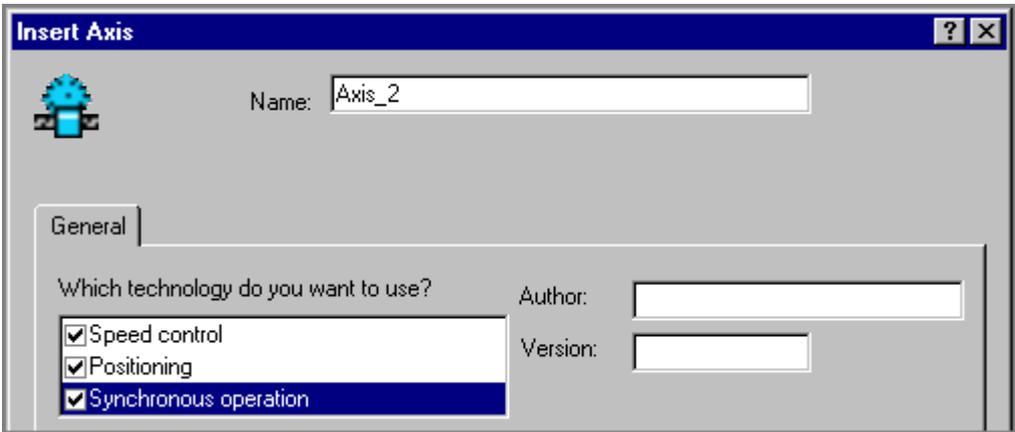


4.6 Configuring synchronization axes

Requirements

- The data of the Technology CPU are configured in HW Config and are compiled.

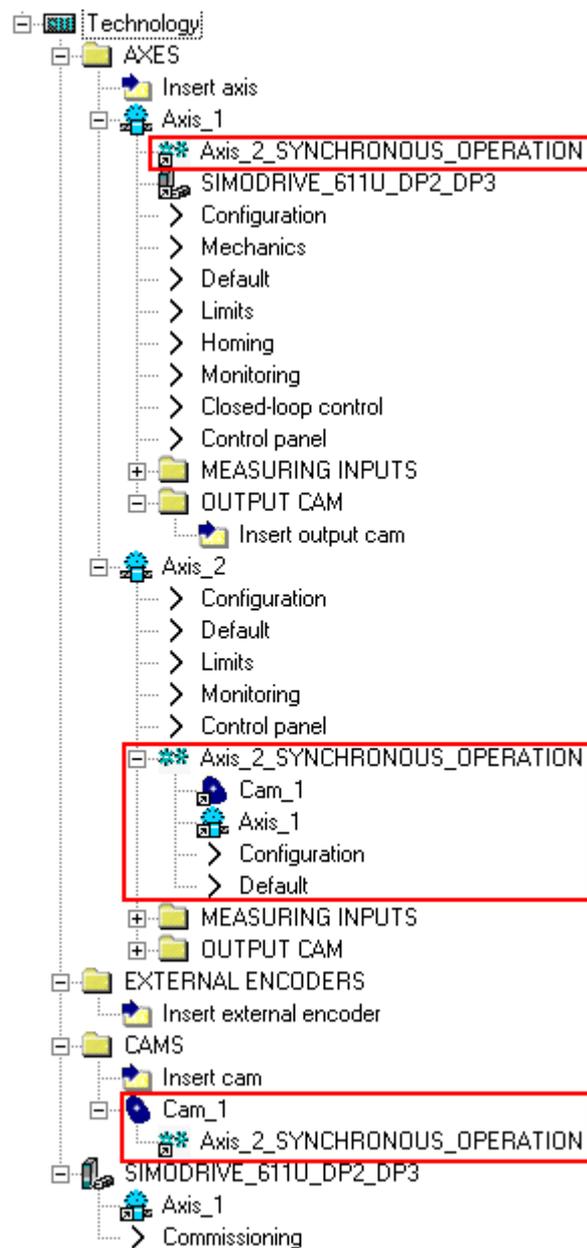
How to insert a synchronization axis in S7T Config

Step	Description
1.	In the S7T Config navigator, double-click "Insert axis".
2.	<p>When you configure the axis, enable the synchronous operation technology.</p>  <p>This technology requires the "Positioning" and "Velocity control" technologies. You may not, therefore, disable these technologies.</p>
3.	<p>Perform the steps as described in chapter "Configuring axes".</p> <p>Result: the synchronization axis appears in the Navigator of S7T Config. The synchronization object is created automatically for the relevant axis. The object is automatically assigned the name of the axis, with the suffix "_synchronism".</p>

View in the Navigator

The leading axes and cam disks assigned to the synchronization axis are indicated by logically linked symbols:

- below the synchronization object
- below the cams used
- below the leading axes (axes, external encoders)



Further procedure

For synchronous operation, assign the synchronization axis the corresponding leading axes and / or cam disks.

4.6.1 Assigning leading axes and cam disks

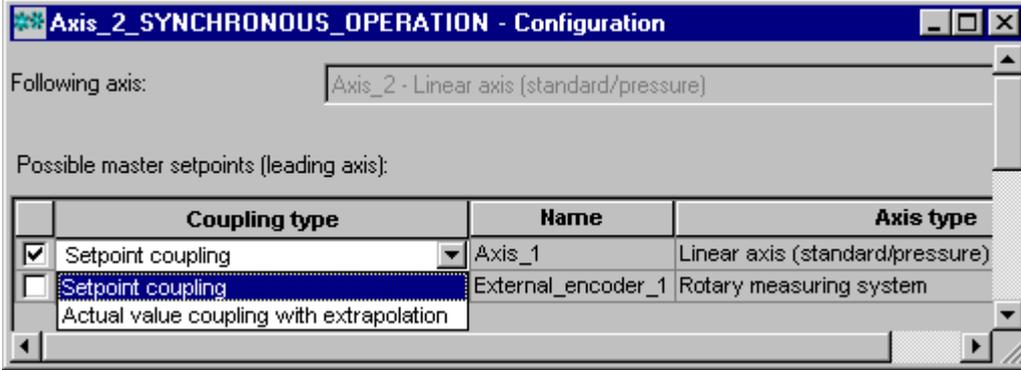
In your configuration of a synchronization compound you need to assign a leading axis to the synchronization axis. In order to be able to run a synchronization compound in camming mode, the synchronization axis should also be logically linked with a cam disk.

Requirements

- A synchronization axis was added in S7T Config.
- A leading axis and a cam disk were added in S7T Config.

How to assign leading axes and cam disks to a synchronization axis

The principle is shown in the next steps.

Step	Description
1.	In the S7T Config Navigator, double-click _ SYNCHRONOUS_OPERATION in the <axis name> synchronization object.
2.	In the next dialog box, assign a leading axis to the synchronization axis. To do so, set the check box in the left column, and then select the relevant coupling mode. For physical axes, select either Setpoint coupling or Actual value coupling . External encoders support only actual value coupling, and virtual axes only support setpoint coupling. 
3.	Click "Close" Result: The synchronization axis is assigned the leading axes and cam disks.

You may interconnect the synchronization axis with several leading axes. Which one of axes is to provide the control value to the synchronization axis is determined in runtime by calling the relevant technology function, for example, MC_GearIn or "MC_CamInSuperImposed".

4.6.2 Configuring superimposing synchronism

A synchronization axis consists of an axis object and a synchronization object. Both objects are generated when you create the axis. You configure superimposing synchronism by assigning the synchronization axis an additional synchronization object which coordinates the motions to be superimposed.

A synchronization axis may contain up to two synchronization objects:

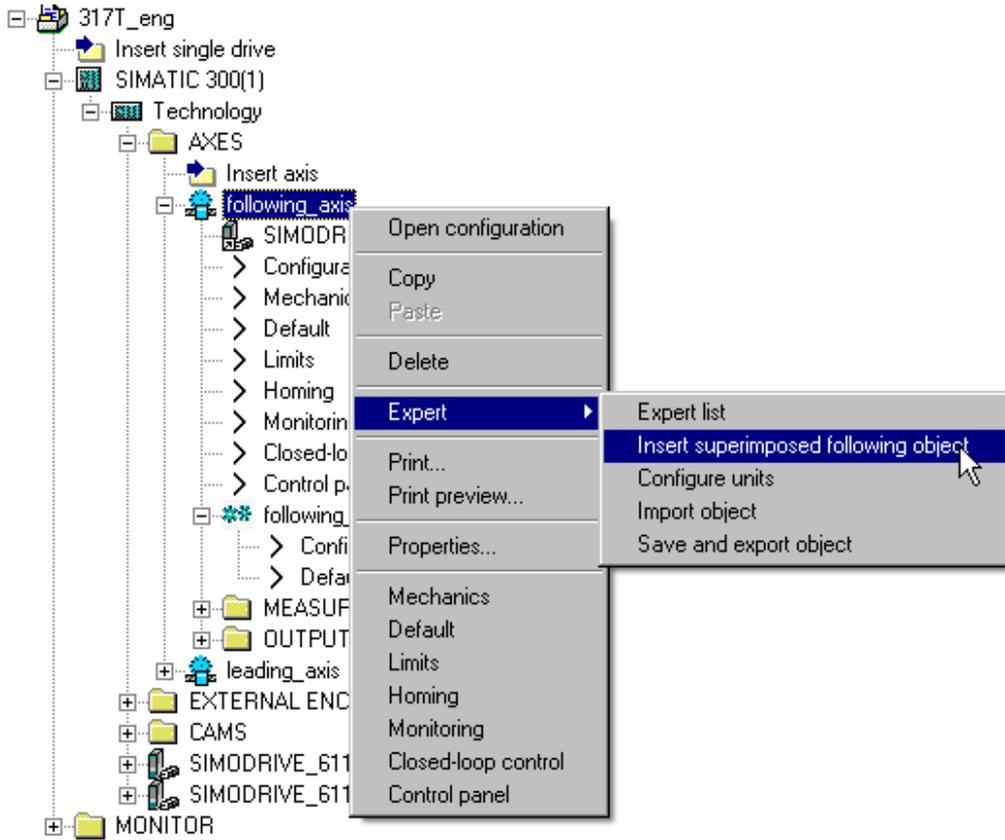
- one synchronization object for base synchronism, and
- a synchronization object for superimposing synchronism.

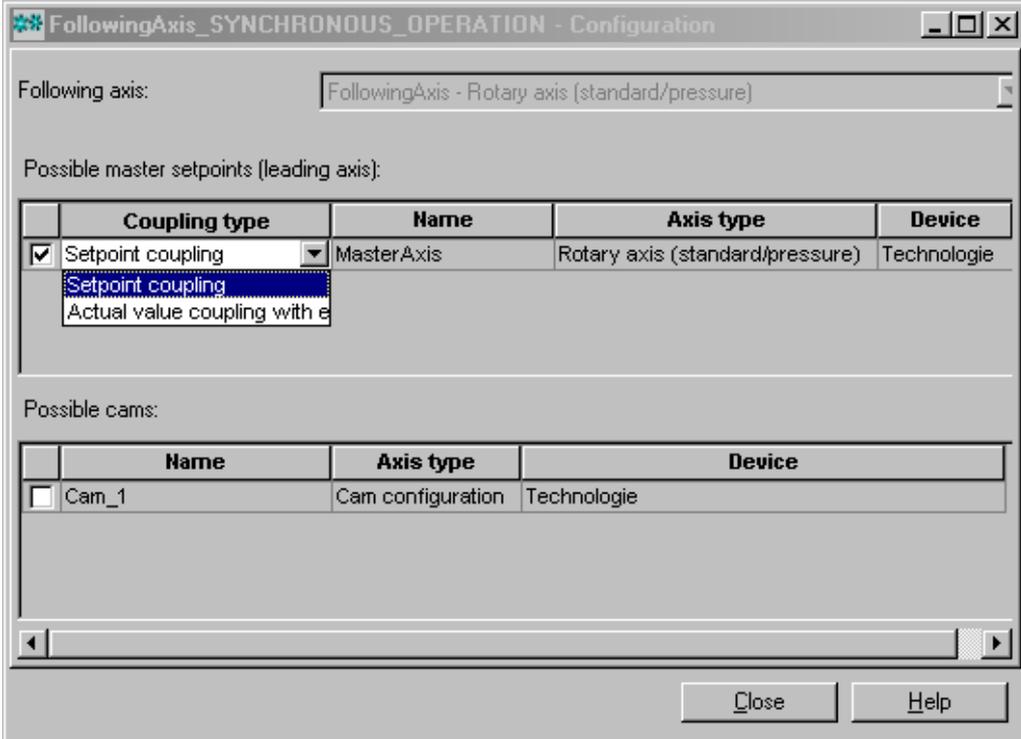
Requirements

- A synchronization axis was configured in S7T Config.
- A superimposing synchronization object was not configured for the axis

Configuring a superimposing synchronization object

In the next steps you are shown the basic procedure of configuring a superimposing synchronization object.

Step	Description
1.	<p>In S7T Config Navigator, select the synchronization axis for which you want to configure superimposing synchronism, then select Expert > Add superimposed synchronization object.</p>  <p>The screenshot shows the S7T Config Navigator tree structure. The 'following_axis' object is selected, and a context menu is displayed. The 'Expert' option is highlighted, and a sub-menu is open, showing 'Insert superimposed following object' as the selected option. Other options in the context menu include 'Open configuration', 'Copy', 'Paste', 'Delete', 'Print...', 'Print preview...', 'Properties...', 'Mechanics', 'Default', 'Limits', 'Homing', 'Monitoring', 'Closed-loop control', and 'Control panel'.</p> <p>Result: the Navigator shows a second synchronization object under synchronization axis.</p>
2.	<p>Double-click Configuration of the second synchronization object to open the configuration dialog box.</p>

Step	Description
3.	<p>Finalize the synchronization compound of the superimposing synchronism by assigning it a leading axis (including cam disks as required.) Set the corresponding check boxes, then select the coupling mode at the leading axes.</p>  <p>The synchronization-specific parameters of the superimposing synchronization object are configured and assigned values same as for base synchronism.</p>

Distinguishing synchronization objects

Whether the synchronization object at a synchronization axis is a base synchronism or superimposing synchronism is defined in the configuration parameter SyncingMotion.motionImpact in the expert list of the synchronization object.

SyncingMotion.motionImpact	STANDARD (0)	Base synchronism
	SUPERIMPOSED_MOTION (1)	Superimposing synchronism

4.6.3 Synchronization

Coupling to the control value during synchronization or sync off operations can be defined differently, depending on the application.

This is defined by the:

- Synchronization mode
- Synchronization position
- Value of the synchronization position
- Synchronization criterion
- the direction of synchronization (modulo axes only)

You can set the following sync modes in the "Dynamics" tab of the **Synchronous operation > Default** dialog box:

- **Leading axis-related synchronization profile:** Synchronization and sync off based on control values
- **Time-related synchronization profile:** Synchronization and sync off based on dynamic values

Synchronization based on a leading axis-specific synchronization profile

The screenshot shows the 'Dynamics' tab of a configuration dialog. A red box highlights the 'Profile setting' dropdown menu, which is currently set to 'Leading-axis-related synchronization profile'. Below this, the 'Length-related synchronization' section contains two input fields: 'Synchronization length' with the value '100.000000' and 'Desynchronization length' with the value '200.000000'. The 'Time-related synchronization' section displays a trapezoidal velocity profile graph. The graph's peak velocity is set to '100.000000 %/s'. The acceleration and deceleration phases are both set to '1000.000000 %/s²', and the jerk for both is set to '1000000.000000 %/s³'. The 'Velocity profile' dropdown is set to 'Trapezoidal velocity profi'.

The leading axis-specific synchronization profile is defined by the "Synchronization length" and "Desynchronization length" parameters.

Synchronization length	Distance during synchronization
Desynchronization length	Distance during termination of synchronism

For synchronization based on leading axis values, define a start or end value for synchronization and a synchronization length ("Synchronization length" or "Desynchronization. length") based on the control value.

A synchronization profile is determined. That is, a dynamic transition is calculated independently of the dynamic response characteristic of the control value.

The velocities at the margins of the synchronization process are constant.

The synchronization length specified in the dialog forms the basis for the definition of the synchronization range with reference to the control value. The cams are synchronized by means of the technology functions "MC_GearIn" (gearing) or "MC_CamIn" (camming), or "MC_GearInSuperImposed" (superimposing gearing), or by starting camming with FB 441 "MC_CamInSuperImposed" superimposing camming).

Input parameter *Mode* at the technology functions determines whether to fetch the values for the synchronization profile from S7T Config (*Mode* = 0), or whether to use the dynamic defaults of the block (*Mode* = 1).

Note

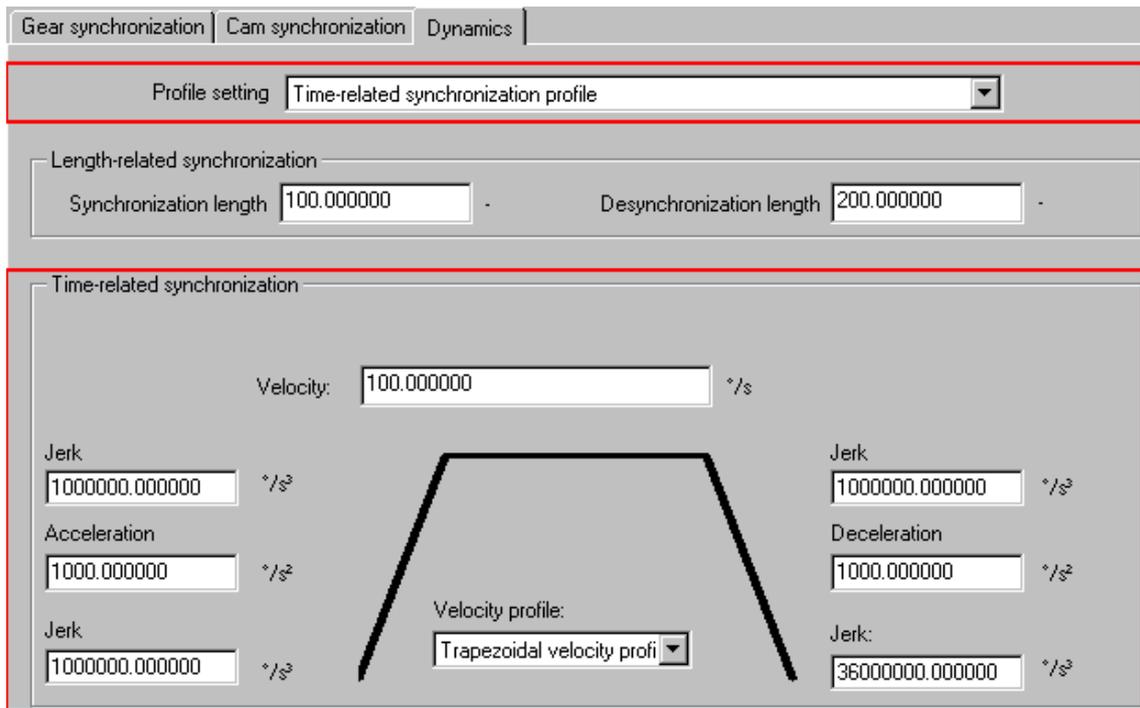
The synchronization profile is calculated only in relation to the **synchronization length** and not in relation to the limitation in the following axis.

For this reason, the dynamic response limitation only occurs in the following axis.

Synchronization by means of time-based synchronization profile

Based on the dynamic parameters set in S7T Config or at the block input, the operation for time-based synchronization is executed after the start of the synchronization function.

Input parameter *Mode* at the technology functions determines whether to fetch the values for the synchronization profile from S7T Config (*Mode* = 0), or whether to use the dynamic defaults of the block (*Mode* = 1).



The time-based synchronization profile is defined by the "Jerk", "Acceleration", "Deceleration", "Velocity" and "Velocity profile" parameters.

Jerk	Jerk settings for the velocity transitions listed below: <ul style="list-style-type: none"> • Jerk at the start of acceleration • Jerk at the end of acceleration • Jerk at the start of deceleration • Jerk at the end of deceleration
Acceleration	Acceleration value during axis synchronization.
Deceleration	Deceleration value during axis deceleration.
Velocity	Maximum velocity of the axis during synchronization. The final velocity depends on synchronization conditions.
Velocity profile	Velocity profiles available: <ul style="list-style-type: none"> • Trapezoidal velocity profile • Constant velocity profile

Retarded and advanced synchronization

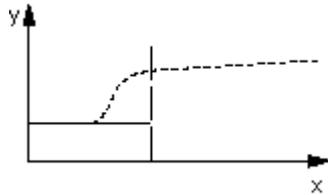
We distinguish between **advanced synchronization** and **retarded synchronization**.

	Synchronization start point...	Synchronization end point...
Advanced synchronization	calculated by the system, based on preset dynamic values and control value response.	implicitly or directly defined based on the slave position.
Retarded synchronization	implicitly or directly defined based on the slave position.	derived from dynamic values and control value response.

Note

During synchronization of a synchronization axis with default dynamic variables, for which the start point of synchronization is defined, the following axis accelerates up to its target velocity with hyperbolic action.

Advanced synchronization



In advanced synchronization mode, the synchronization motion starts:

- at the start point of synchronization and with optimal time-based synchronization, based on the preset dynamic response parameters, and at a constant master setpoint value (dynamic control value.)
- Immediately, if an optimal synchronization time can not be calculated, and the synchronization position can be reached (for example, if the control value is static.)

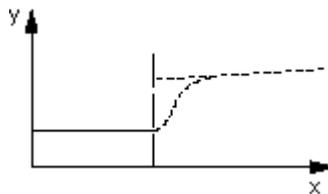
Note

If an optimal synchronization is not possible, a reverse motion may be generated.

Any change in the velocity control value is applied to the dynamic values of the synchronization process. A warning message is output if the configured tolerance limit is violated.

If the control value sign reverses during synchronization, synchronization is canceled with error.

Retarded synchronization



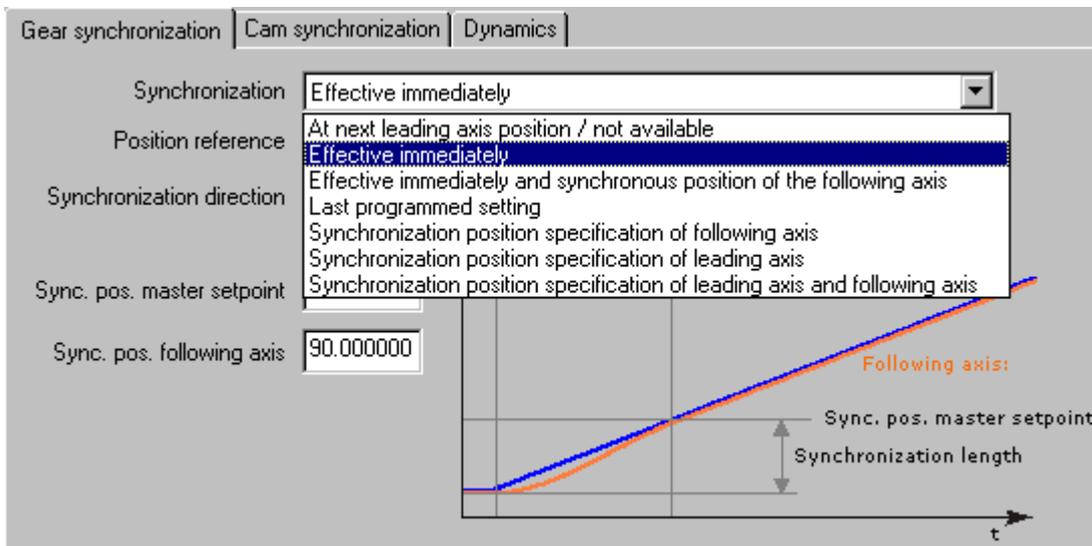
In retarded synchronization mode

- the synchronization motion starts when the start criterion is satisfied
- only a trapezoidal velocity profile is supported

If a velocity profile with constant acceleration is set, a "Dynamic response of motion profiles ... can not be maintained" alarm is generated, and the system automatically switches over to a trapezoidal velocity profile.

4.6.4 Synchronization

You can set the synchronization conditions in the "Gear synchronization" and "Cam synchronization" tab of the **Synchronous operation > Default** dialog box.



The synchronization condition is selected from the "Synchronization" drop-down list:

Setting	Meaning
Effective immediately	Synchronization starts immediately after the start of the function. The settings in "Sync. pos. master setpoint", "Sync. pos. following axis" and "Position reference" are not evaluated.
Preset synchronization position of the leading axis	The synchronization criterion is applied irrespective of the leading axis position. The synchronization position is defined in "Sync. pos. master setpoint." The setting in "Sync. pos. following axis" is ignored.
Preset synchronization position of the following axis (only for gearing)	The synchronization criterion is applied irrespective of the following axis position. The synchronization position is defined in "Sync. pos. following axis." The setting in "Sync. pos. master setpoint" is ignored.
Transition at the end of the active cam disk (only with camming)	This can only be set with relative leading axis reference. Synchronization criterion is the control value position at the end of the current cam disk cycle. The setting in "Sync. pos. following axis" is ignored.

Setting	Meaning
Default synchronization position of the leading and following axes	<p>The synchronization criterion is applied irrespective of the leading axis position. The synchronization position is defined in "Sync. pos. master setpoint."</p> <p>In addition, an offset at the following axis is generated, based on the setting in "Sync. pos. following axis", i.e., the following axis is not synchronized based on its programmed position (e.g. by means of cam disk), but rather based on the position "Sync. pos. following axis" plus the absolute position value of the following axis in relation to the cam disk.</p> <p>Example: The following axis is coupled to the leading axis by means of a cam disk. The cam disk is set, so that the leading axis position = 50, and the following axis position = 70. When "Sync. pos. following axis" = 80, the following axis is synchronized at leading axis position = 50, while the following axis position = 150. Cam disk coupling is maintained (with unchanged scaling), but with a new offset of 80.</p>
Effective immediately and synchronization position of the following axis	<p>Synchronization starts immediately after the start of the function. The phase shift developing between the leading and following axes is determined by the slave position at the start of the function. The offset is thus compensated by the acceleration ramp of the following axis. The synchronization motion is determined by dynamic preset.</p> <p>The setting in "Sync. pos. master setpoint" is ignored.</p>
Most recent setting	Not applicable

Position reference

Gear synchronization |
 Cam synchronization |
 Dynamics

Synchronization: Effective immediately

Position reference: Synchronize from synchronization position

Synchronization direction:
 Last programmed setting
 Synchronize before synchronization position
Synchronize from synchronization position
 Synchronize symmetrically to synchronization position

Sync. pos. master setpoint: 0.000000

Sync. pos. following axis: 90.000000

The synchronization mode is defined in the "Position reference" drop-down list:

Setting	Meaning
Synchronize starting at the synchronization position	Synchronization starts at the synchronization position. The synchronization length is derived from the time-based synchronization profile in dynamic data, and for a leading axis-specific synchronization profile from the "Synchronization length" parameter. The following axis is synchronized when this length has been passed.
Synchronize before the synchronization position is reached	In this synchronization mode, the following axis is in synchronism to the leading axis when it reaches the synchronization position. The starting point of synchronization with time-based synchronization profile is determined by the dynamic data, and with leading axis-specific synchronization profile by the "Synchronization length" parameter.
Synchronize symmetrically to synchronization position	In this mode, synchronism is reached at the middle of the synchronization length. Synchronized motion starts before the synchronization position is reached, and ends when this position is passed. The axes are synchronized based on the profile, with reference to the synchronization length or dynamic settings.
Most recent settings	Not applicable

Synchronization direction

The screenshot shows a configuration window with three tabs: "Gear synchronization", "Cam synchronization", and "Dynamics". The "Dynamics" tab is selected. The settings are as follows:

- Synchronization: Effective immediately
- Position reference: Synchronize from synchronization position
- Synchronization direction: Compatibility mode (dropdown menu is open showing options: Compatibility mode, Maintain direction of the following axis, Negative synchronization direction, Positive synchronization direction, Shortest distance without direction specification, User default / standard)
- Sync. pos. master setpoint: [indicated by a vertical line on the graph]
- Sync. pos. following axis: [indicated by a vertical line on the graph]

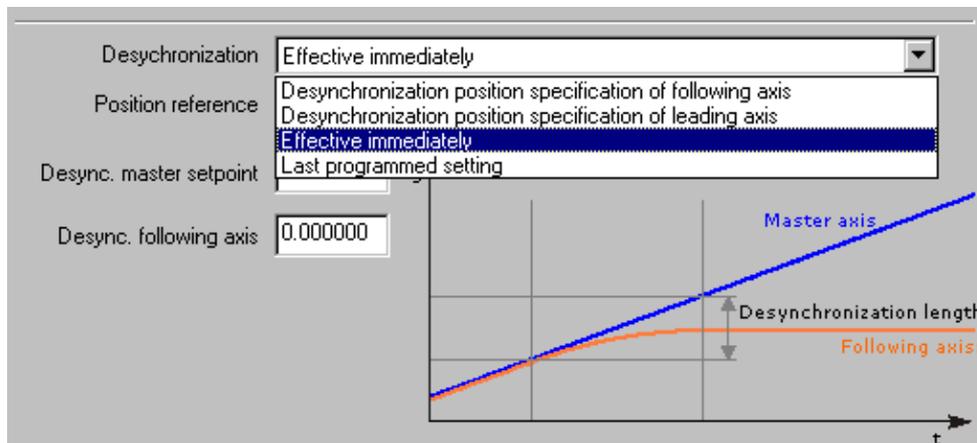
The graph below the settings shows two lines (blue and red) representing synchronization profiles over time (t). The blue line is a straight line starting from the origin. The red line starts at a later time and follows the blue line. A vertical double-headed arrow indicates the "Synchronization length" between the two lines. Another vertical line marks the "Sync. pos. master setpoint".

The sense of the synchronization movement is set in the "Synchronization direction" drop-down list. This setting is only available for modulo axes.

Setting	Meaning
User default / default	The default value can be set by means of the following configuration data in the expert list: Setting for gearing: userdefault.gearingsettings.synchronizingdirection (parameter 4291 for MC_ReadSysParamter, MC_WriteParameter) Settings for camming: userdefault.cammingsettings.synchronizingdirection (parameter 4270 for MC_ReadSysParamter, MC_WriteParameter)
Compatibility mode	Same reaction as in Version 3.0.x of the firmware of the integrated technology.
Shortest distance without direction preset	The following axis is synchronized within the shortest possible distance.
Negative direction of the synchronization motion	The direction of the synchronization motion is always negative.
Positive direction of the synchronization motion	The direction of the synchronization motion is always positive
Maintain the direction of the following axis	Synchronization is always determined by the direction of the following axis motion.

4.6.5 Desynchronization

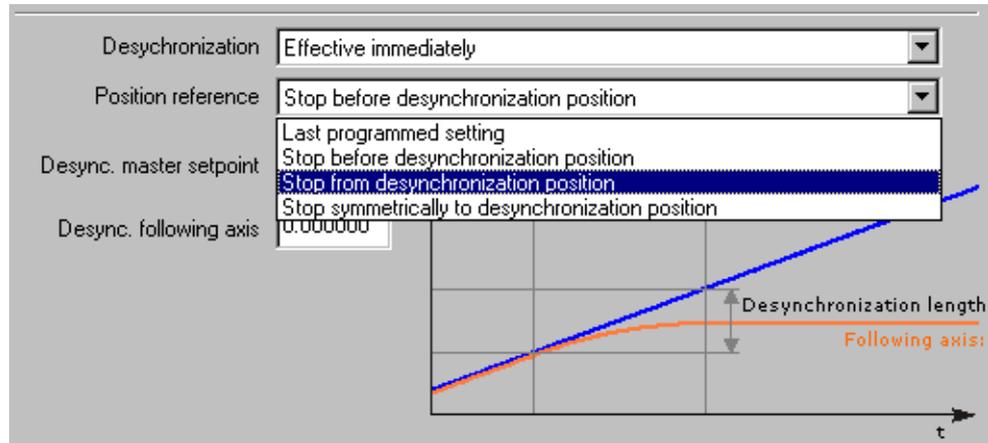
You can set the desynchronization conditions in the "Gear synchronization" and "Cam synchronization" tab of the **Synchronous operation > Default** dialog box.



The desynchronization condition is set in the "Desynchronization" drop-down list.

Setting	Meaning
Effective immediately	Desynchronization starts immediately after the start of the function. The settings in "DeSync master setpoint", "DeSync following axis" and "Position reference" are ignored.
Preset desynchronization position of the leading axis (gearing) At position of leading axis (synchronization cam)	Desynchronization starts, based on the leading axis position set in "DeSync master setpoint." The setting in "DeSync following axis" is ignored.
Preset of the following axis position for desynchronization (gear synchronization) At the leading axis position (synchronization cam)	Desynchronization starts based on the following axis position set in "DeSync following axis." The settings in "DeSync leading axis" are ignored.
End of cam disk cycle (only with camming)	Desynchronization starts at the end of the current cam disk cycle.
Most recent setting	Not applicable

Position reference



The desynchronization mode is set in the "Position reference" drop-down list:

Setting	Meaning
Stop at desynchronization position	Starts desynchronization at the desynchronization position. The desynchronization length is derived from dynamic data for a time-based synchronization profile, and from the "Desynchronization length" parameter for a leading axis-specific synchronization profile. Desynchronization starts after this length has been passed.
Stop before desynchronization position	In this mode, desynchronization starts when the axis reaches the Desynchronization position. The position at which the desynchronization motion is started is determined by the dynamic data when operating with time-based synchronization profile, and by the "Desynchronization length" parameter when operating with leading axis-specific synchronization profile.
Stop symmetrically to desynchronization position	In this mode, desynchronization starts when the axis reaches the middle of the desynchronization length. The desynchronization motion starts before the axis reaches the desynchronization position and ends when it overtravels this position. Desynchronization starts based on the profile, with reference to the desynchronization length or dynamic settings.
Most recent setting	Not applicable

4.6.6 Monitoring functions

The slave values and compensation at the following axis calculated at the synchronization object are monitored, with respect to the dynamic response of the following axis. Compensating motions will be generated accordingly.

The current maximum limits for velocity and acceleration (and jerk) on the axis influence this monitoring process.

If a motion can not be carried out, an attempt is made to follow the values as closely as possible with a compensatory motion specified by the maximum dynamic response values of the axis. The result is a setpoint error.

4.7 Configuring cam disks

Before a cam disk is used in the user program, the cam disk first has to be inserted in S7T Config as a "Cam disk" technology object.

To define the cam disk in the user program, use the "MC_CamClear", "MC_CamSectorAdd" and "MC_CamInterpolate" technology functions. The reference to the cam disk created in S7T Config is set at input parameter *CamTable* of the technology function. At this parameter, enter the number of the technology DB which was created for the cam disk.

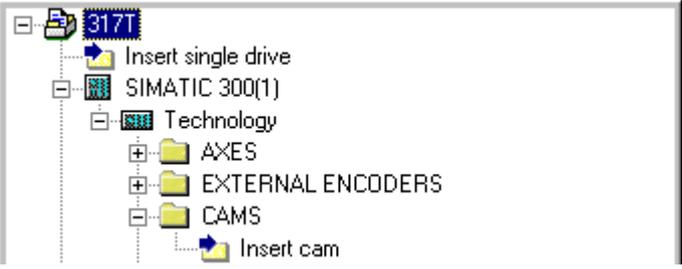
Cam disk operation is programmed in the user program using the "MC_CamIn" and "MC_CamInSuperimposed" technology functions. The cam disk is selected at input parameter *CamTable*. Prerequisite for use is the assignment to a corresponding synchronization configuration.

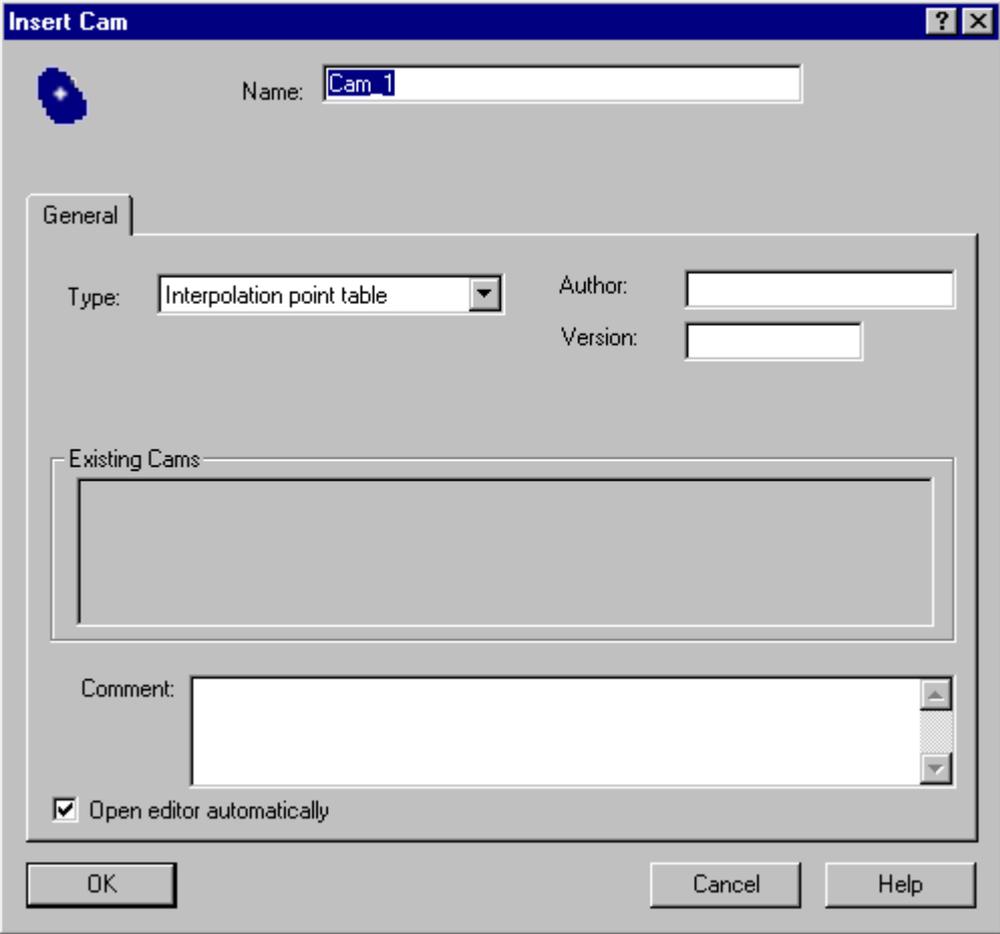
4.7.1 Inserting a cam disk

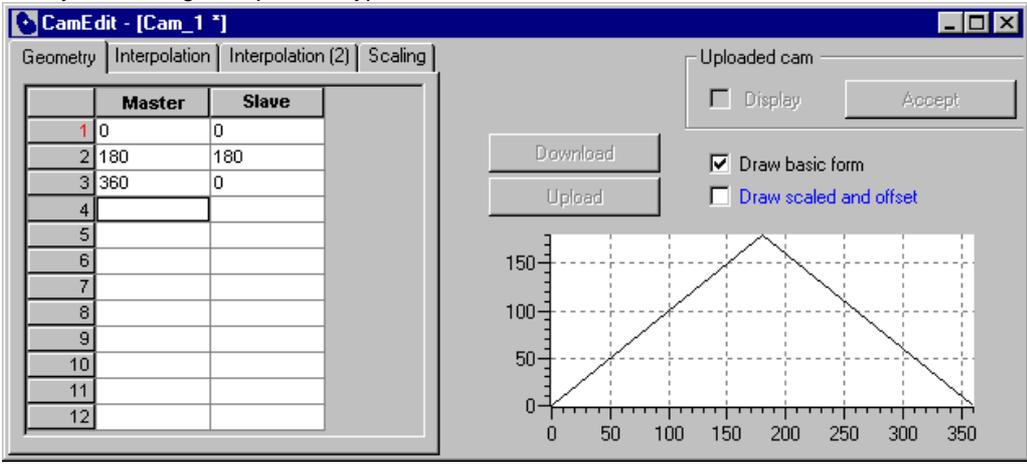
Requirements

- The data of the Technology CPU are configured in HW Config and are compiled.

How to insert a cam disk in S7T Config

Step	Description
1.	<p>To create a new cam disk in S7T Config using CamEdit, double-click "Insert cam disk" in the Navigator of S7T Config.</p>  <p>To create the cam disk using the optional SW package SCOUT CamTool, double-click "Insert cam disk with CamTool" (this entry is only visible if the optional package is installed.)</p> <p>In the next phases of this example, we shall refer only to CamEdit. For a detailed description of the functions and handling of SCOUT CamTool, refer to the "SIMOTION CamTool" manual.</p>

Step	Description
2.	<p>In the "Insert cam disk" dialog box, type in the name of the technology object and of the author, then add the version number and a comment. Select whether to define the cam disk by means of interpolation table or polynomials. Set the "Open editor automatically" check box in order to automatically open the cam configuration dialog box:</p>  <p>Click "OK" Result: The CamEdit dialog box opens.</p>

Step	Description
3.	<p>Define the cam disk by means of the interpolation table or polynomials, depending on the type. Modify the scaling, interpolation type of the cam disk.</p> 
4.	<p>Close CamEdit. Result: The technology object is inserted.</p>

Note

After it is interpolated, new polynomials or interpolation points can only be added after resetting the cam disk.

During interpolation and in the continuity check, the properties of leading and following axes are neglected.

4.7.2 Defining cam disks

In the **Insert cam** dialog box, you can choose to define the cam disk based on interpolation points or polynomials.

- **Definition based on interpolation points**

In the interpolation point table, the interpolation point are described by the formula $P = P(x,y)$. The order in which the value pairs are entered is irrelevant. They are automatically sorted in ascending order in the domain. S7T Config interpolates the cam disks according to the configured interpolation type.

- **Definition based on polynomials / segments**

The various polynomials are described in accordance with "VDI 2143, Motion Laws for Cam Mechanisms." The maximum degree of the polynomial is 6 and can also contain a trigonometry function.

Methods of cam disk definition

Both definition methods, i.e. by interpolation points or by polynomials, have their advantages and disadvantages. Your application determines which one of these methods meets requirements.

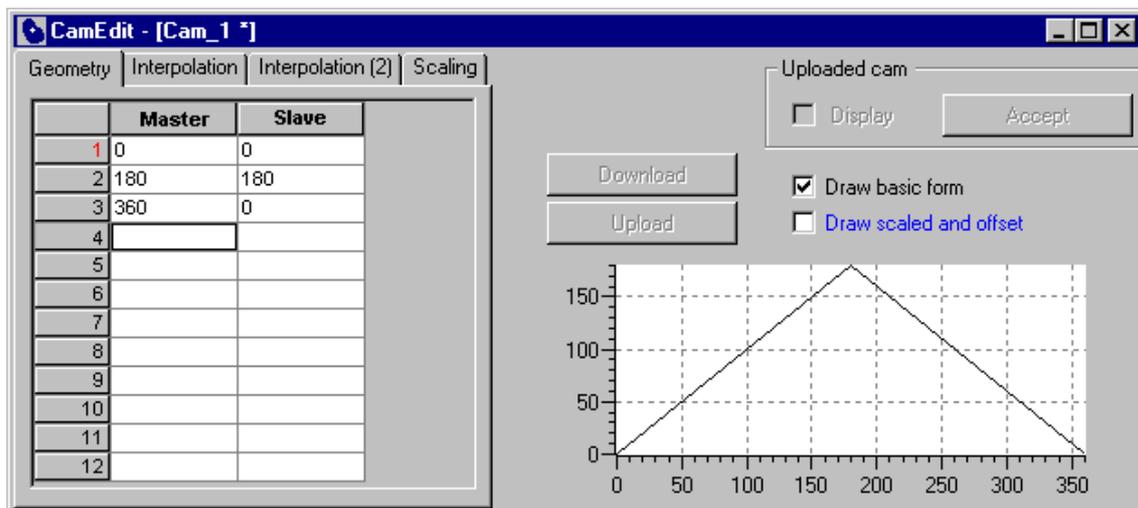
A combination of both methods in a cam disk is only possible in runtime by means of FB MC_CamSectorAdd.

	Definition based on interpolation points	Definition based on polynomials
Advantage	<ul style="list-style-type: none"> • Simple definition • Any algorithms can be mapped by interpolation points • Curve creation assisted by teaching • Simple interface to HMI 	<ul style="list-style-type: none"> • Fewer data used for definition • Standard transitions in accordance with VDI... • High-precision contour, constant transitions
Disadvantage	<ul style="list-style-type: none"> • Large number of interpolation points required for smooth contour 	<ul style="list-style-type: none"> • Complex arithmetic required for calculation of coefficients

4.7.3 Creating cam disks with CamEdit

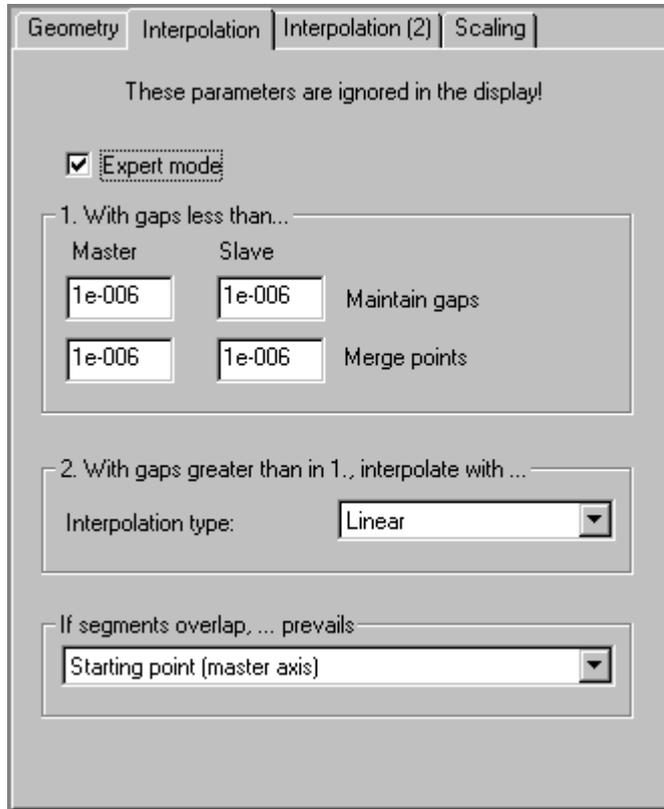
in the **CamEdit** dialog box you can

- call the VDI Wizard in order to define the cam disks,
- download or upload the cam disk definition in online mode,
- view the uploaded cam disk and apply it to the project
- view the basic shape of the cam disk (if scaling and offset were used.)

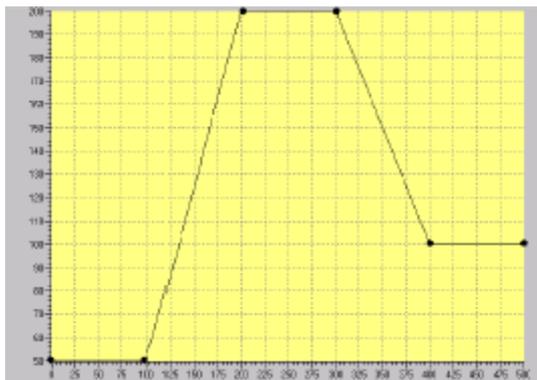


4.7.3.1 Interpolation

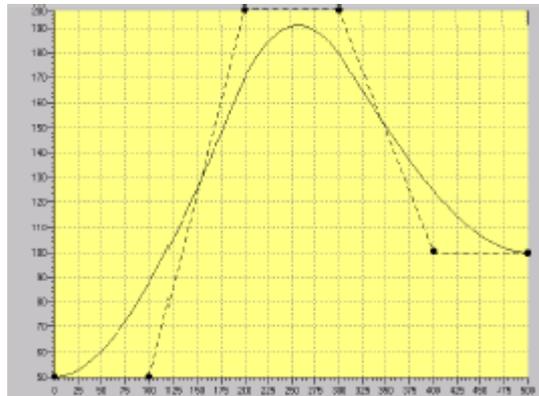
Select in the "Interpolation" tab of the **CamEdit** dialog box, to set the Interpolation mode you want to use to compensate any discontinuity (gaps):



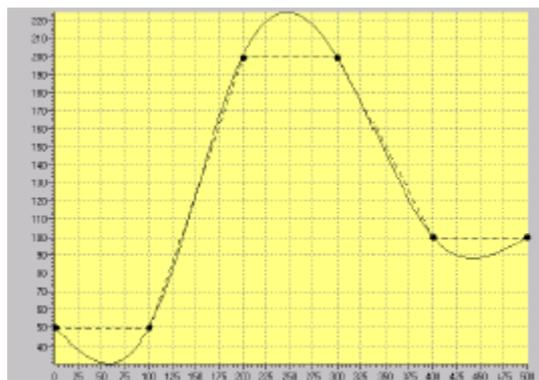
- **LINEAR:**
Linear interpolation



- **B_SPLINE:**
Approximation using Bezier splines, i.e., cam track along the interpolation points



- **C_SPLINE:** Interpolation with cubic splines, i.e. cam track through the interpolation points

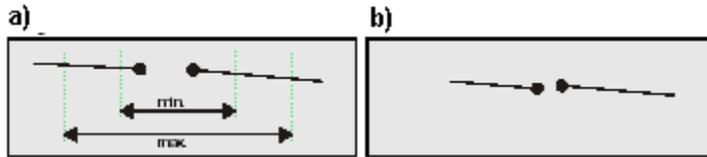


Set the "Expert mode" check box on the "Interpolation" tab to determine whether to check the **continuity** of a configured function. Continuity of the domain and of the range of values is checked separately.

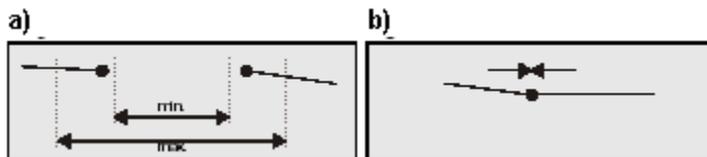
Correction options

Adjustment options (a = preset; b = result):

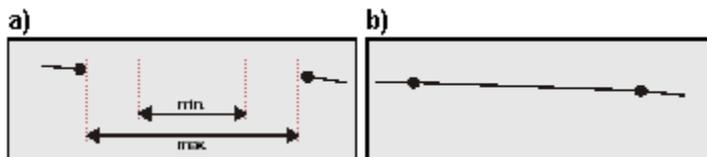
- If the absolute value of the spacing between segments or interpolation points is less than the minimum value, a correction is not made. The discontinuity point is retained. When this discontinuity point is accessed, the right-hand boundary point is output.



- If the absolute value of the spacing between segments is greater than the minimum value and less than the maximum value, correction is made by joining the segment end points. The mean value of the spacing of the function is used for the correction. The shape of the segments is affected as a result.



- If the absolute value of the spacing between segments exceeds a maximum value, a correction is made by performing an interpolation between the two segments. This results in insertion of a new segment.



Assessment of the domain and of the range of values

The point of discontinuity is corrected according to the evaluation for the domain and range of values.

Marginal conditions at the point of discontinuity:

Condition	Result
Deviation < minimum	Retain discontinuity
Minimum < deviation < maximum	Join segment end points
Deviation > maximum	Interpolation (new segment)

Overlapping segments

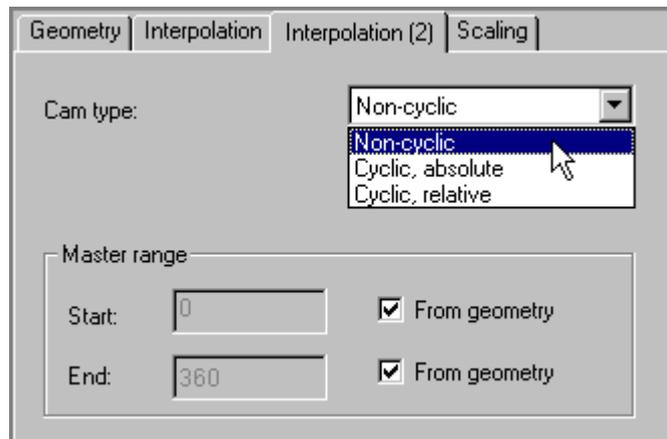
When segments overlap, you can choose a criterion for the interpolation:

- the start point of the leading axis
- the end points of the leading axis
- chronological sequence

4.7.3.2 Interpolation (2)

Cam disk type

In the "Interpolation(2)" tab of the **CamEdit** dialog box, you can set the marginal conditions for interpolation at a certain cam disk type.



Programmable conditions:

Cam type	Condition	Cam profile
Non-cyclic	None	The cam disk is tracked once only. The edge points and gradients can be define freely and are not influenced.
Cyclic, relative	Constant velocity	The first derivative of the function is equaled at the edge points. That is, the velocity at the start point of the cam is set equal to that at the end point.
Cyclic, absolute	Constant velocity and function (constant position)	At the edge points, the first derivative of the function is equaled to the function value. That is, the velocity at the start point of the cam is set equal to that at the end point. This also applies to the start and end positions of the cam.

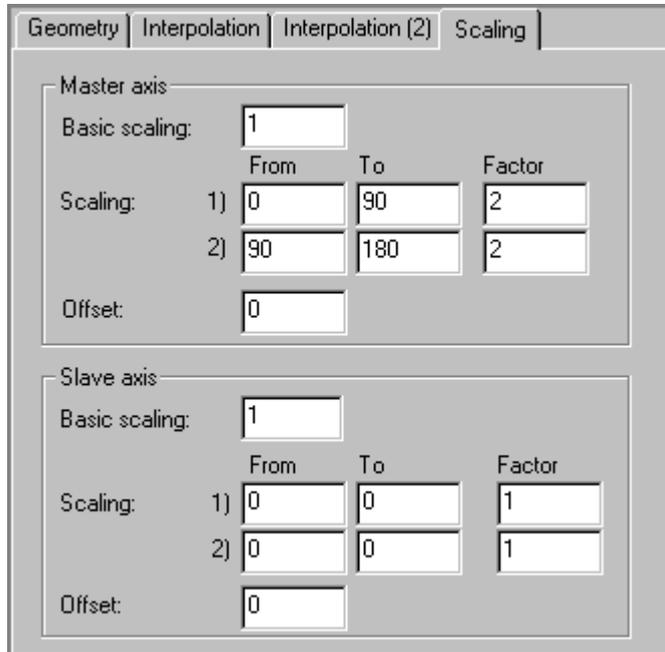
If the continuity condition can not be adhered to because of the selected interpolation method or the programmed geometry, a message is provided to that effect.

Master range

You define the edge points of the interpolation by setting the **master range**. A programmed geometry which lies in between the start and end position of the master range is discarded. If the start or end points are outside the range of the programmed geometry, this gap is extrapolated based on the interpolation method.

4.7.3.3 Scaling

Select the "Scaling" tab in the **CamEdit** dialog box to define the scaling and offset of the leading and following axes.



S7T Config distinguishes between basic and range scaling:

Scaling	Scaling point (catch point)
Basic scaling is applied to the complete cam disk by means of a definable factor.	Zero point of the coordinate axis
The range is scaled within a start and end point.	Start point of the specified range. The start point may be greater than the end point. In this case, the larger value is the pivot point for scaling (thus the starting point).

The leading and following axes can be scaled as follows:

- with basic scaling
- with two range scales (overlapping is possible),
- with offset

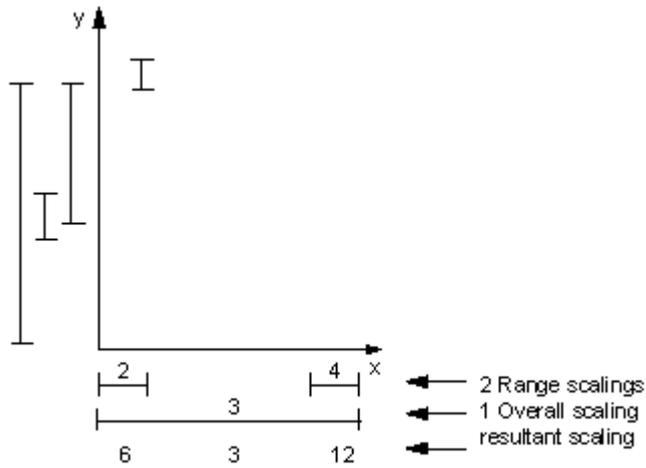
Note

If a scaled and/or offset cam disk is used in more than one object, the adjustments go into effect in all relevant objects.

Example

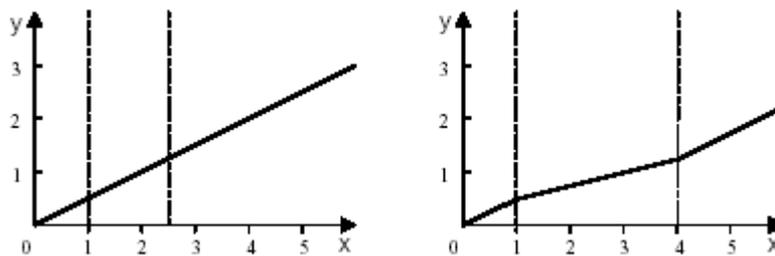
Scaling can be performed before or after segments and points are inserted or interpolated.

Scaling based on interpolation with Bezier or cubic splines will lead to a knee effect at the cam disk, irrespective of the interpolation!



Example

Scaling of the domain in the range from 1 to 2.5 by the factor 2:



4.7.4 Creating cam disks with CamTool

You can also use SCOUT CamTool to create and edit cam disks. This tool can be ordered separately. SCOUT CamTool offers the following benefits:

- Precise, graphic visualization of the cam
- Quick and easy cam definition by means of drag-and-drop of cam elements
- Quick and easy cam tuning by means of "dragging at the profile"
- Simultaneous visualization of the position, velocity, acceleration and jerk profile has an immediate effect on the maximum velocity, the motor torque required and on mechanical load.
- Tuning the velocity, acceleration or jerk parameters of the cam

The SCOUT CamTool SW is totally integrated into the user interface of S7T Config.

For detailed information on the functions and handling of this SW, refer to the "SIMOTION CamTool" manual.

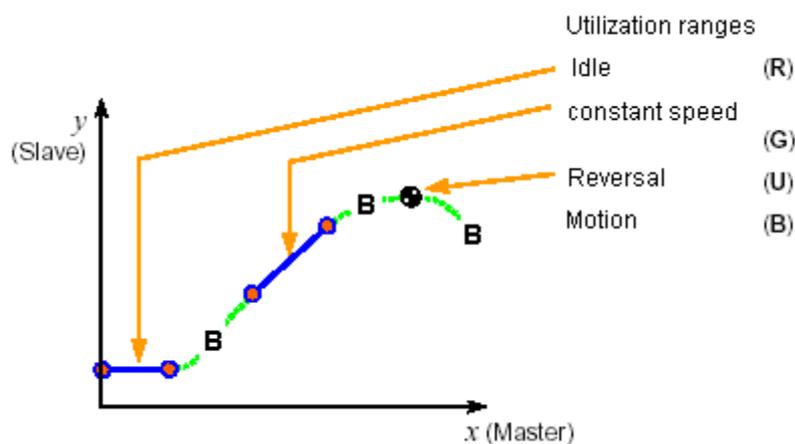
4.7.5 Motion laws to VDI

4.7.5.1 Working ranges and motion transitions

The VDI concept distinguishes between **Working ranges** and **motion transitions**:

- Working ranges correspond with the steps in a process. VDI distinguishes between four working ranges.
- Motion transitions represent transitions between working ranges. Although these are not directly relevant to the process, they must meet certain marginal conditions, e.g. constant velocity and acceleration.

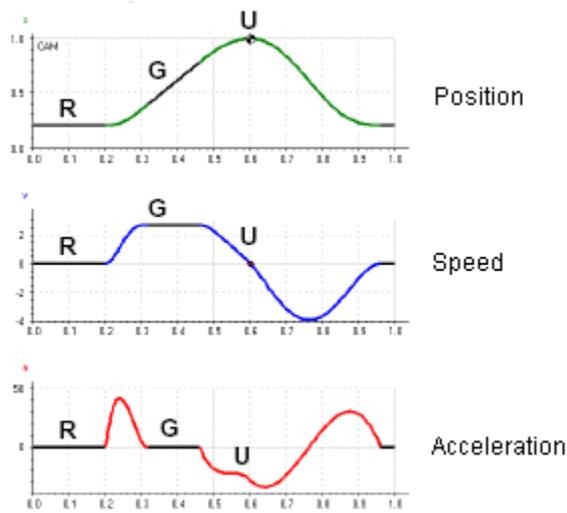
Working ranges



The VDI concept distinguishes between the following working ranges:

	Working range	Velocity (v)	Acceleration (a)
R	Dwell	= 0	= 0
V	Constant velocity	≠ 0	= 0
U	Reversal	= 0	≠ 0
B	Motion	≠ 0	≠ 0

Example of a cam with three working ranges



Motion transitions

Possible motion transitions in the various working ranges:

	R	G	U	B
R	$v=0$ $a=0$	$v=0$ $a=0$	$v=0$ $a=0$	$v=0$ $a=0$
G	$v \neq 0$ $a \neq 0$	$v \neq 0$ $a=0$	$v=0$ $a \neq 0$	$v \neq 0$ $a=0$
U	$v=0$ $a \neq 0$	$v=0$ $a \neq 0$	$v=0$ $a \neq 0$	$v=0$ $a \neq 0$
B	$v \neq 0$ $a \neq 0$			

Note

The **VDI Wizard** supports you in creating cam disks in S7T Config. Select **CamEdit** to open this tool.

4.7.5.2 Defining cam disk segments for motion control commands

Defining the working ranges

The **working ranges** of a motion control command are usually defined by the process.

Example:

1. A tool waits on a production line for a piece to pass by (dwell).
2. The tool is synchronized to the work piece and performs an action on the work piece (constant velocity).
3. The tool then returns to the waiting position (reversal).

The process starts over from the beginning.

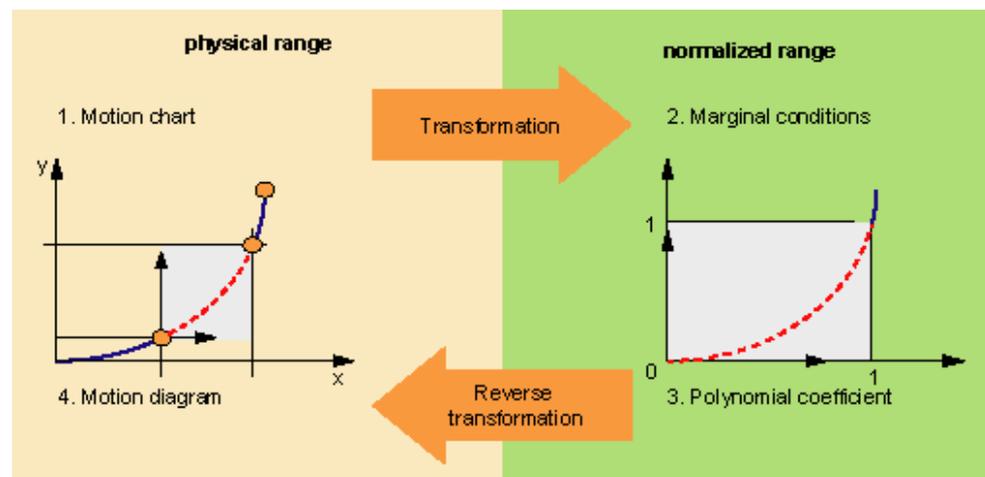
In order to implement this sequence, the segments of a cam must first be created to match the working ranges.

Creating motion transitions

You then define the motion transitions that satisfy certain conditions, e.g. jerk-free motion.

- This requires that the motion transition first be transformed to the normalized range.
- Make allowances for marginal conditions, i.e., position, velocity, and acceleration at the segment borders.
- In order to apply a polynomial defined in such a way, it must be transformed back into the physical range.

Creating motion transitions to VDI:



References

- VDI Directive 2143, Page 1: Motion Laws for Cam Mechanisms - Basic Theory, Düsseldorf: VDI-Verlag, 1980
- Volmer, J. (Publisher): Mechanism Design - Cam Mechanisms, 2. Release Berlin: Verlag Technik, 1989

4.8 Configuring cams

Before a cam is used in the user program, the cam first has to be inserted in S7T Config as a "Cam" technology object.

The function is programmed in the user program at FB "MC_CamSwitch". (position-based cams / switching cams) or "MC_CamSwitchTime" (time-based cams). The association to the cam created in S7T Config is set at the *CamSwitch* input, by entering the number of the relevant technology DB.

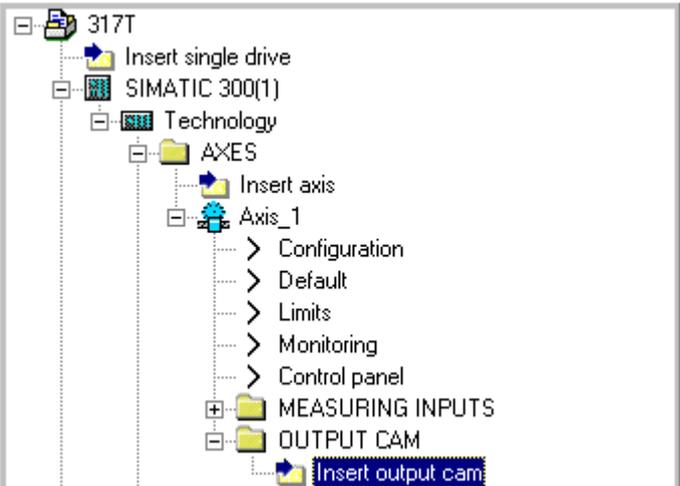
The ON / OFF conditions are configured directly at the block.

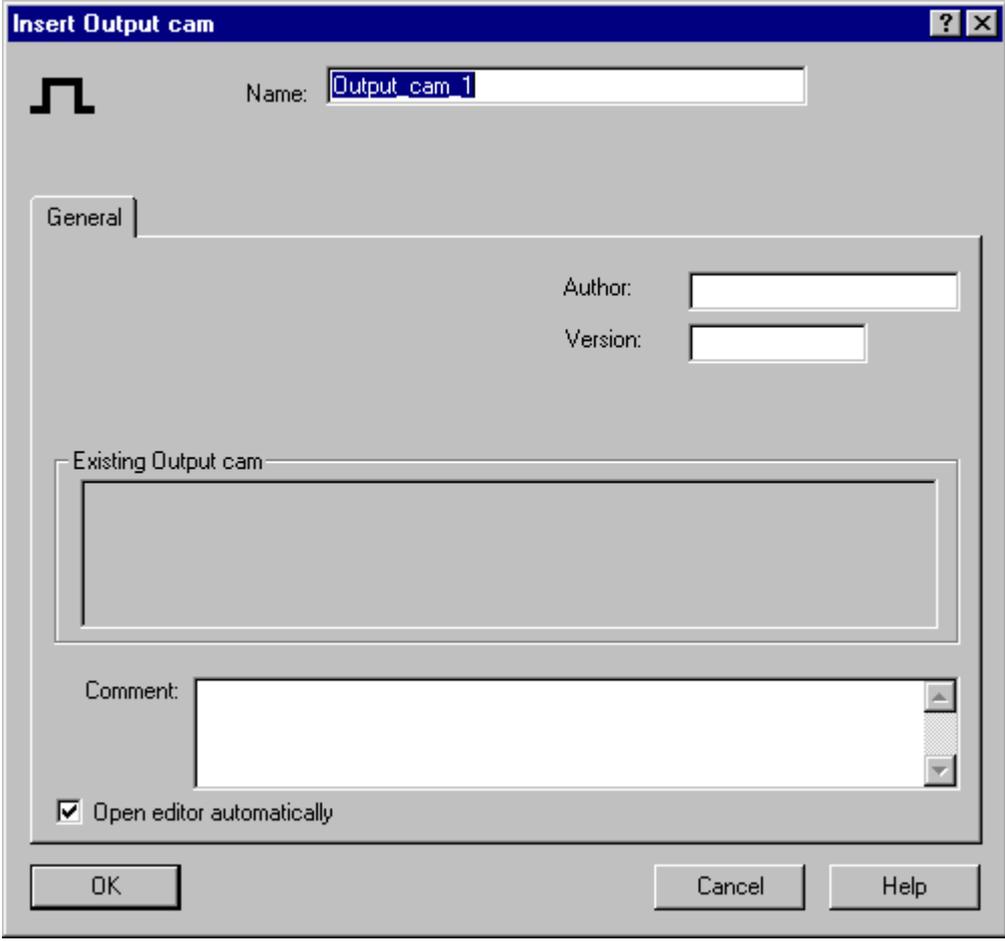
4.8.1 Inserting cams

Requirements

- The data of the Technology CPU are configured in HW Config and are compiled.
- An axis or external encoder is created in S7T Config.

How to insert a cam in S7T Config

Step	Description
1.	<p>In the S7T Config Navigator, double-click "Insert cam".</p> 

Step	Description
2.	<p>In the "Insert cam" dialog box, type in the name of the technology object and of the author, then add the version number and a comment. Set the "Open editor automatically" in order to open the cam configuration dialog box automatically:</p> 
3.	<p>Confirm your entries with "OK".</p> <p>Result: The technology object is inserted.</p>

Further procedure

Configure the cam in the **Cams > Configuration** dialog box.

4.8.2 Configuration

In the **Cams > Configuration** dialog box, you can set the following items for the "Cams" technology object:

- Output cam type: Position-based cams, time-based cams, or switching cams
- The system cycle in which the cam is calculated
- Reference values of the cam: setpoint or actual values
- Use of the cam as high-speed cam

Output_cam_1 - Configuration

Name: Output_cam_1

Output cam type: Position-based cam

Output cam cycle clock: IPD

Type of output cam values: Setpoints

High-speed output cam onboard High-speed output cam on the TM15/TM17 module

Output

Activate output

Logical operation: Logical OR

HW address: 66 Bit number: 0

Close Help

Note

Cams also take effect at non-homed axes.

Output

Set the "Enable output" check box to assign a HW address and a logic operation to the "Cam" technology object.

When output is disabled, the cam can be evaluated only in the software.

HW address

The cam is assigned to one output only. This may be an integrated digital output of the Technology CPU, a digital output on DP(DRIVE), for example at an ET 200 station, or an output in a TM15 or TM17 High-Feature module.

Several cams can be connected to the same output.

The switching accuracy of the cam is determined by :

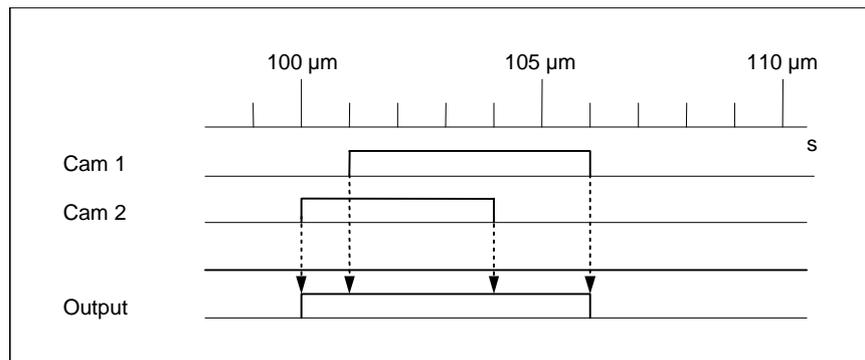
- The accuracy of I/O output,
- The priority of the cam in the system cycles,
- The compensation of constant delay times.

Logical operation

In the **Cams > Configuration** dialog box, you can determine whether to interconnect the cam with the output by means of a logical AND or OR operation.

As a result, all cams are ORed at the output, and are then logically linked by an AND operation.

Two ORed cams:



4.8.3 Highspeed cams

In order to enhance cam switching accuracy, enable the "High-speed cams" function in the **Cams > Configuration** dialog box.

Only the integrated outputs of the Technology CPU or the outputs of a TM15 or TM17 High Feature modules can be used as high-speed cam outputs, because these are supported by internal HW functions. High-speed cams configured for other modules on DP(DRIVE) are processed as "standard" cams.

The cams are calculated based on the IPO cycle or on the position controller cycle; High-speed cams should always be calculated based on the position controller cycle. Cam signal output is controlled by means of the position control cycle.

4.9 Configuring measuring sensors

Before a measuring sensor is used in the user program, the measuring sensor first has to be inserted in S7T Config as a "Measuring sensor" technology object.

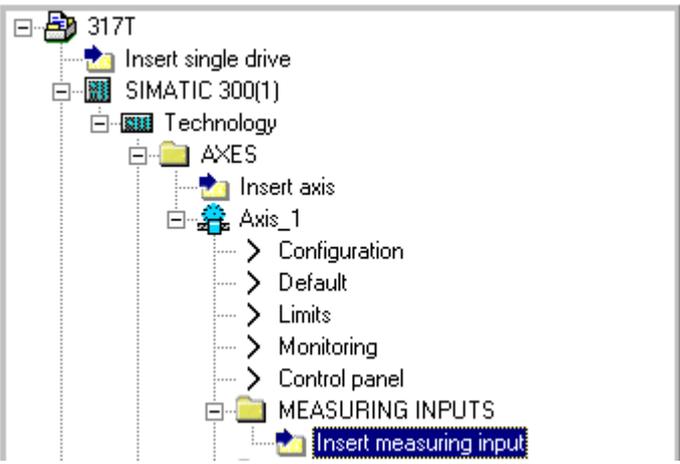
The function is programmed in the user program at FB "MC_MeasuringInput". There you enable and disable the measuring sensor in the various operating modes and define its measuring range. The association to the measuring sensor created in S7T Config is set at the *MeasuringInput* input, by entering the number of the relevant technology DB.

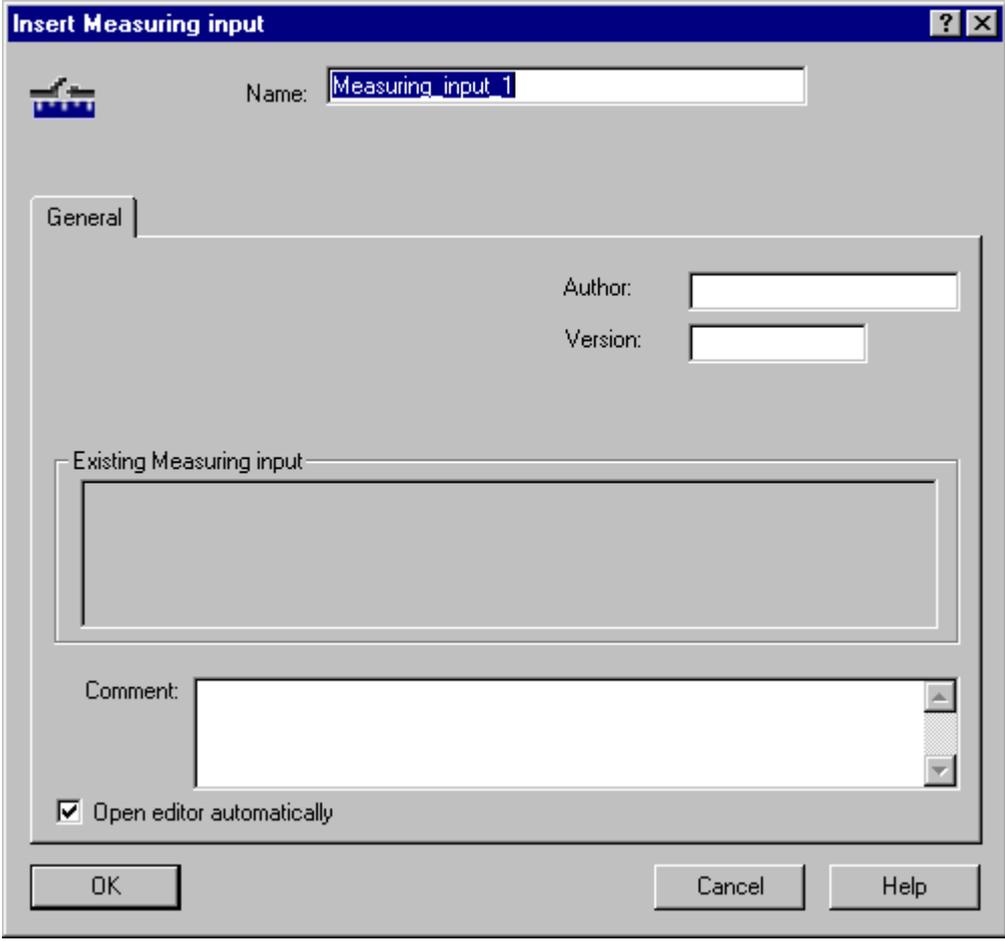
4.9.1 Adding a measuring sensor

Requirements

- The data of the Technology CPU are configured in HW Config and are compiled.
- An axis or external encoder was created in S7T Config.

How to add a measuring sensor in S7T Config

Step	Description
1.	<p>In the S7T Config navigator, double-click "Insert measuring input".</p> 

Step	Description
2.	<p>In the "Insert measuring sensor" dialog box, type in the name of the technology object and of the author, then add the version number and a comment. Set the "Open editor automatically" in order to open the measuring sensor configuration dialog box automatically:</p> 
3.	<p>Confirm your entries with "OK".</p> <p>Result: The technology object is inserted.</p>

Further procedure

In the **Measuring Input > Configuration** dialog box, configure the measuring sensor.

4.9.2 Configuration - Measuring Sensor

in the **Measuring input > Configuration** dialog box you can set the following functions for the "measuring input" technology object:

- Meas.input cycle clock: IPO, IPO2 or position control cycle clock. By default, the measurement results are written to the system variables of the technology object based on the interpolator cycle.
- The measuring sensor number: corresponds with the number of the measuring input used at the drive component (only if "Measuring sensor at TM15/TM17" is disabled.) One specific measuring input can be assigned to several measuring inputs.
- The system number: corresponds with the number of the encoder system used (if several encoders are configured at the axis, otherwise 1). One specific encoder system can be assigned to several measuring sensors.

Set the "monitor current status" check box to suppress short pulses (shorter than the position controller cycle) at the measuring sensor input. A measuring sensor triggered at the positive edge is not enabled until the signal status at the measuring sensor input was 0 for the duration of at least one position controller cycle.

If the measuring sensor input is located on a TM15/TM17 High Feature module, set the "Measuring sensor at TM15/TM17 module" check box in the configuration dialog.

The screenshot shows a configuration dialog box with a grey background. At the top, there is a checked checkbox labeled "Measuring input on the TM15/TM17 module". Below this, there are two input fields: "HW address:" with a text box containing "66", and "Bit number:" with a dropdown menu showing "0".

An input box opens after you set the check box, showing the byte address of the measuring sensor signal at DP(DRIVE), and a drop-down list in which you can select the corresponding bit number.

Note

The measuring sensor input must be located either on the drive component used, or on a TM15/TM17 High Feature module. Other digital inputs can not be used as measuring sensor inputs.

The measuring sensor can only be connected to the drive component containing the encoder input. If the encoder input is connected to SIMODRIVE, for example, you can only connect the measuring sensor to ADI4 if the ADI4 is also connected to SIMODRIVE.

4.10 Configuring external encoders

The encoder system of a drive, the encoder system of an ADI4, or the PROFIBUS encoder SIMODRIVE sensor be used as an external encoder.

Before external encoders are used in the user program, the hardware of the external encoder has to be configured in HW Config and the external encoder has to be inserted as an "External encoder" technology object in S7T Config. For information on configuring the encoder system in HW Config, refer to the drive description or description of the SIMODRIVE sensor.

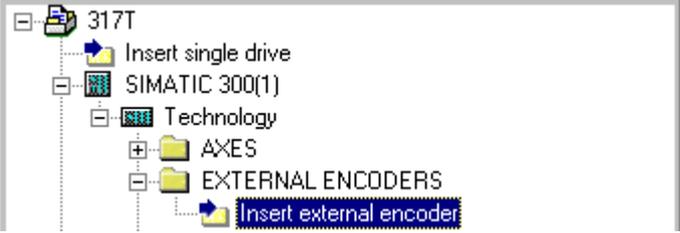
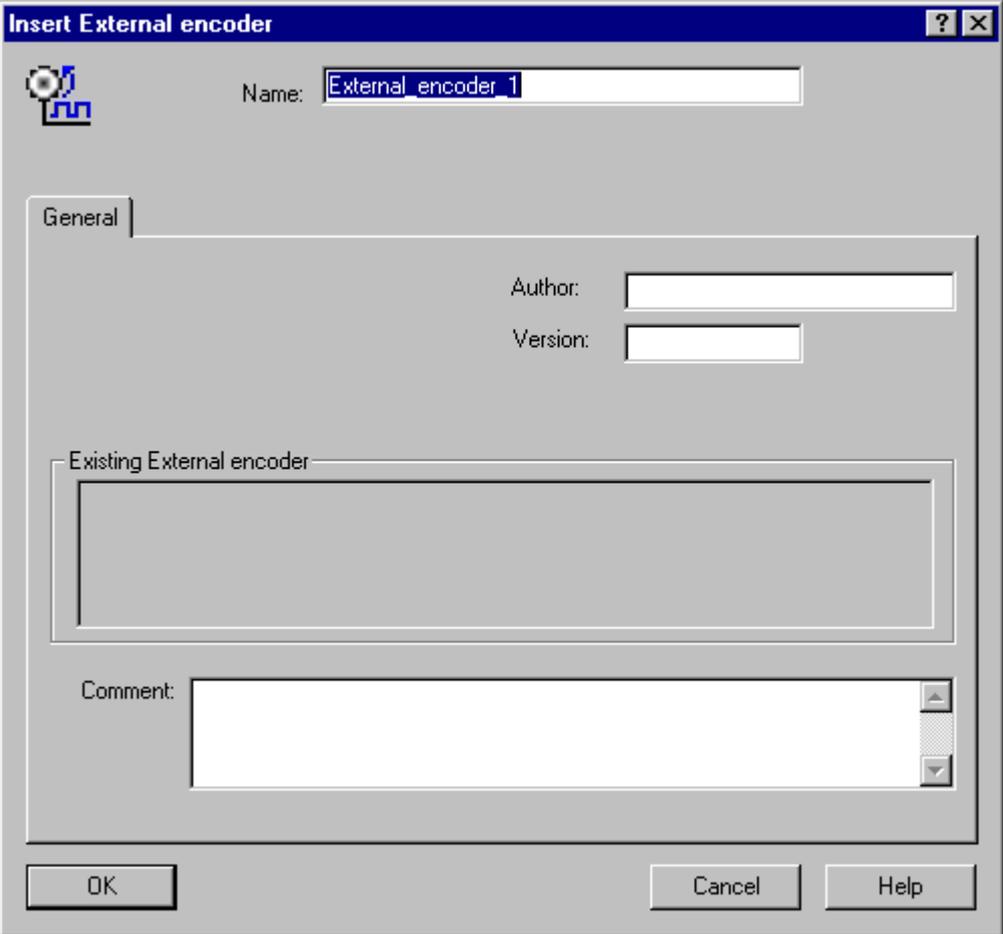
The function is programmed in the user program at FB "MC_ExternalEncoder". Here you program the enable and disable signals and the homing settings for the external encoder. The association to the external encoder created in S7T Config is set at the *Axis* input, by entering the number of the relevant technology DB.

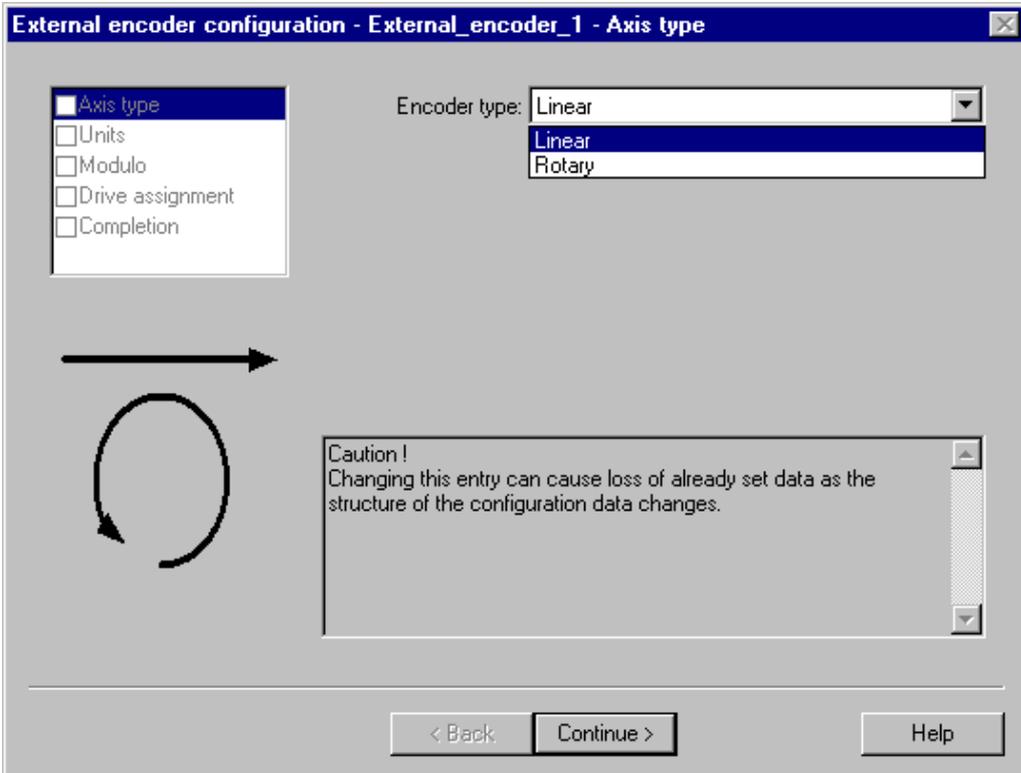
4.10.1 Inserting an External Encoder

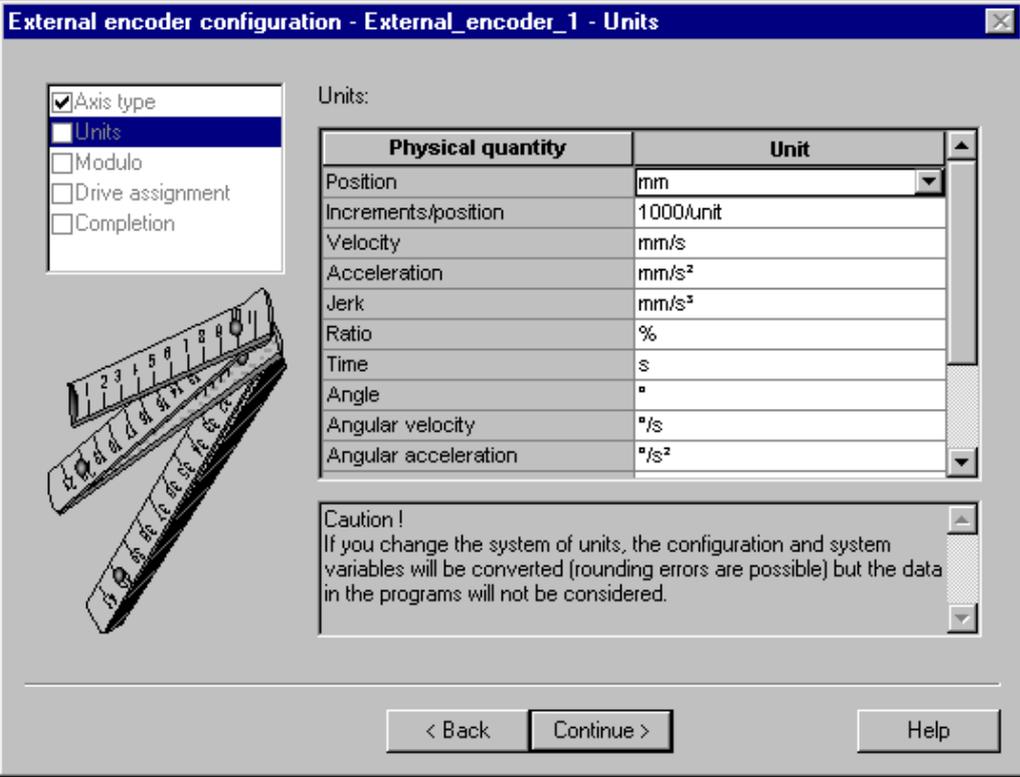
Requirements

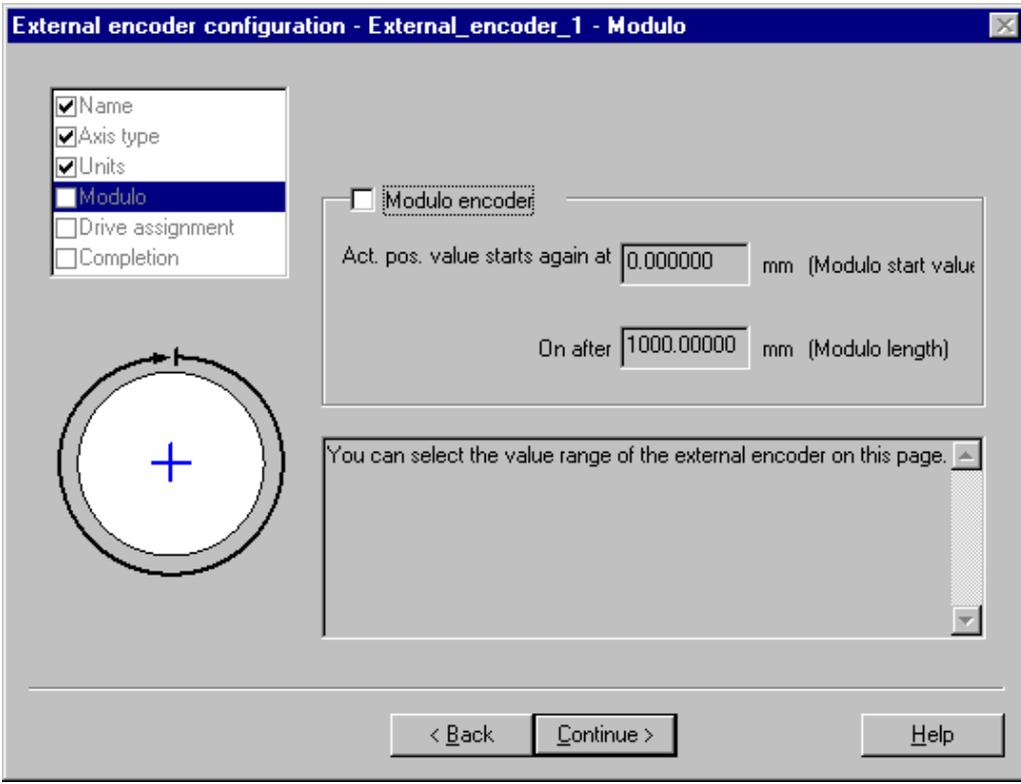
- The technology CPU has been configured in the HW Config.
- A drive with a free encoder system or a PROFIBUS encoder SIMODRIVE sensor has been configured in HW Config. If the PROFIBUS encoder SIMODRIVE sensor is used, it has to be operated in "synchronous" mode. Details are provided in the product information, or in the documentation of the encoder.
- The hardware configuration has been compiled and saved in HW Config.

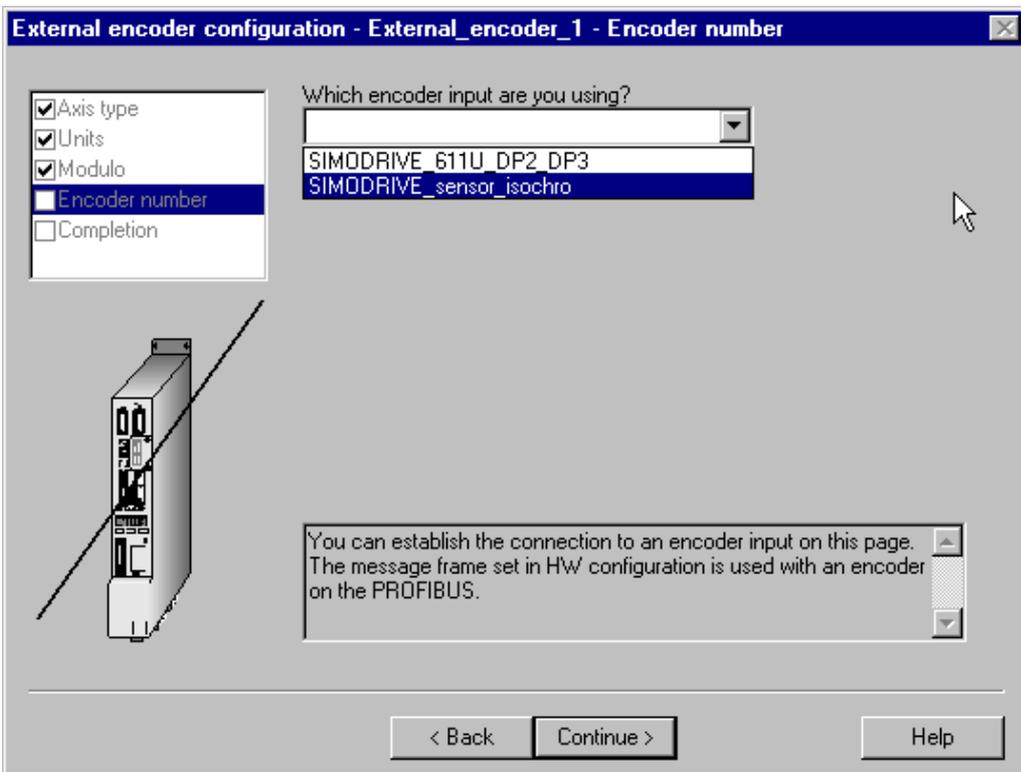
How to insert an external encoder in S7T Config

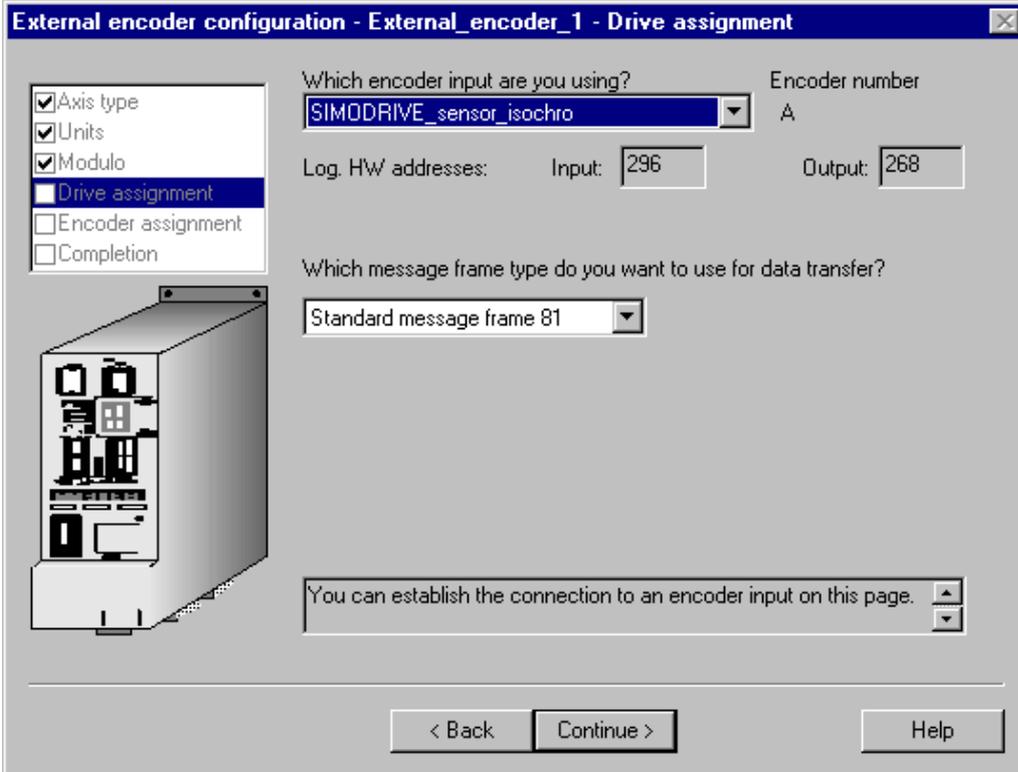
Step	Description
1.	<p>In the S7T Config navigator, double-click "Insert external encoder".</p> 
2.	<p>In the next dialog box, type in the name of the technology object and of the author, and add the version number and a comment.</p>  <p>Confirm your entries with "OK".</p>

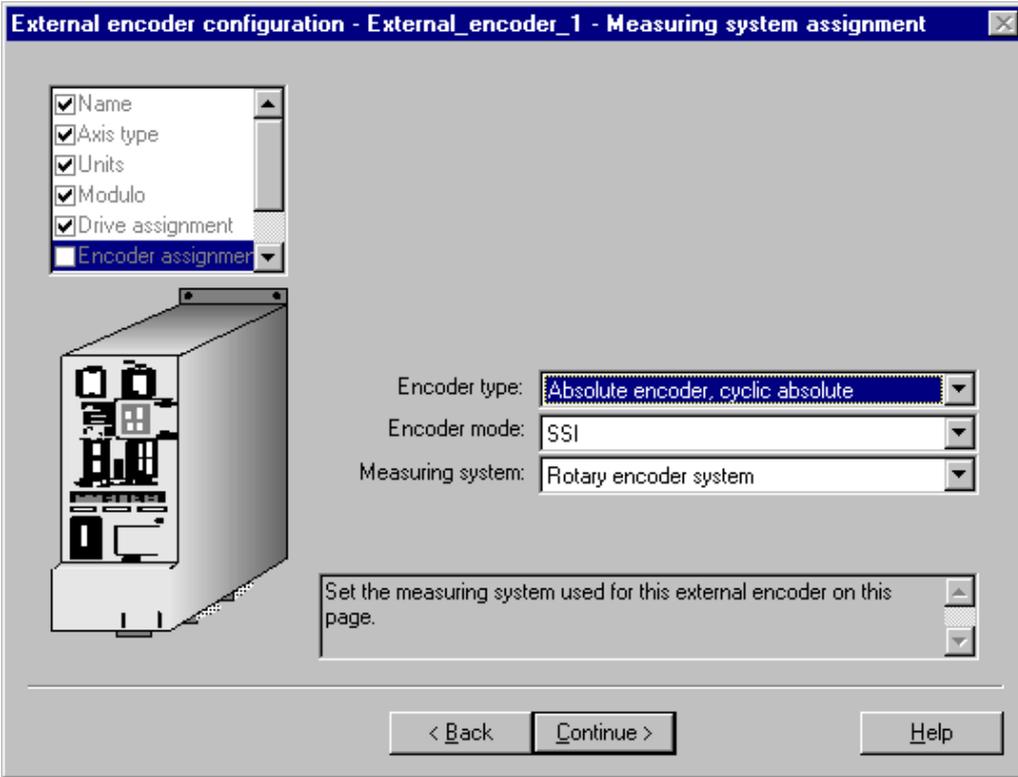
Step	Description
3.	<p>The "External encoder configuration" wizard appears. From the fold-down list select "the encoder type": linear or rotary.</p>  <p>Confirm your entry with "Continue".</p>

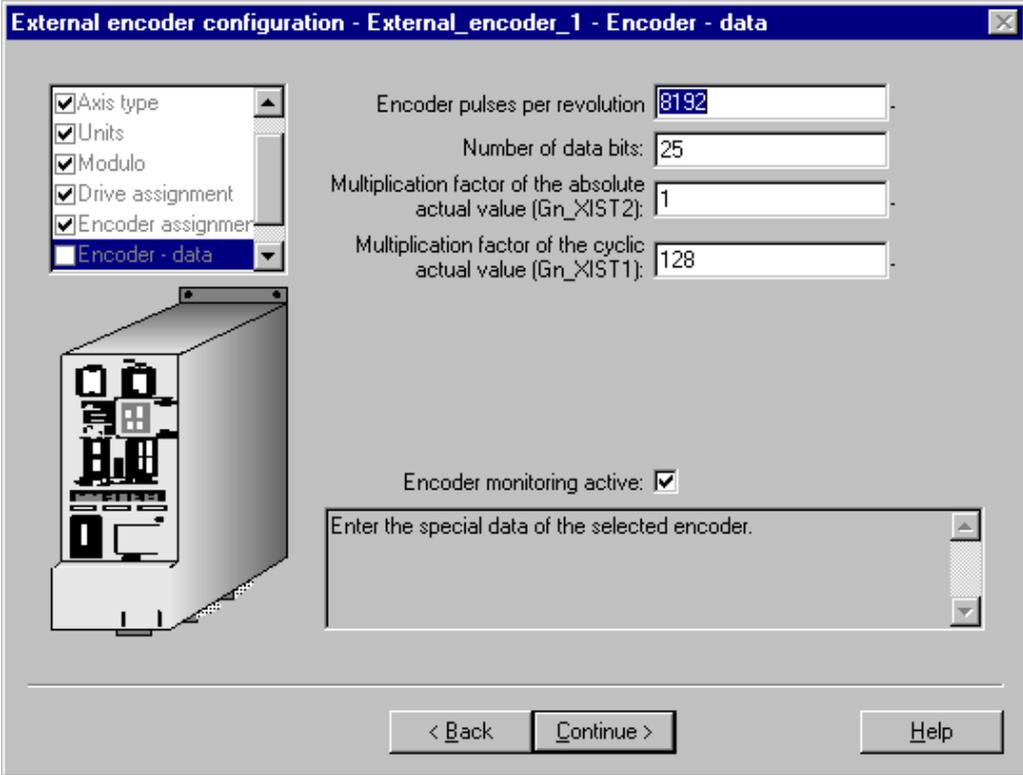
Step	Description
4.	<p>The "External encoder configuration units" dialog appears. Select the units, e.g. "Degrees".</p>  <p>Confirm your entries with "Continue".</p>

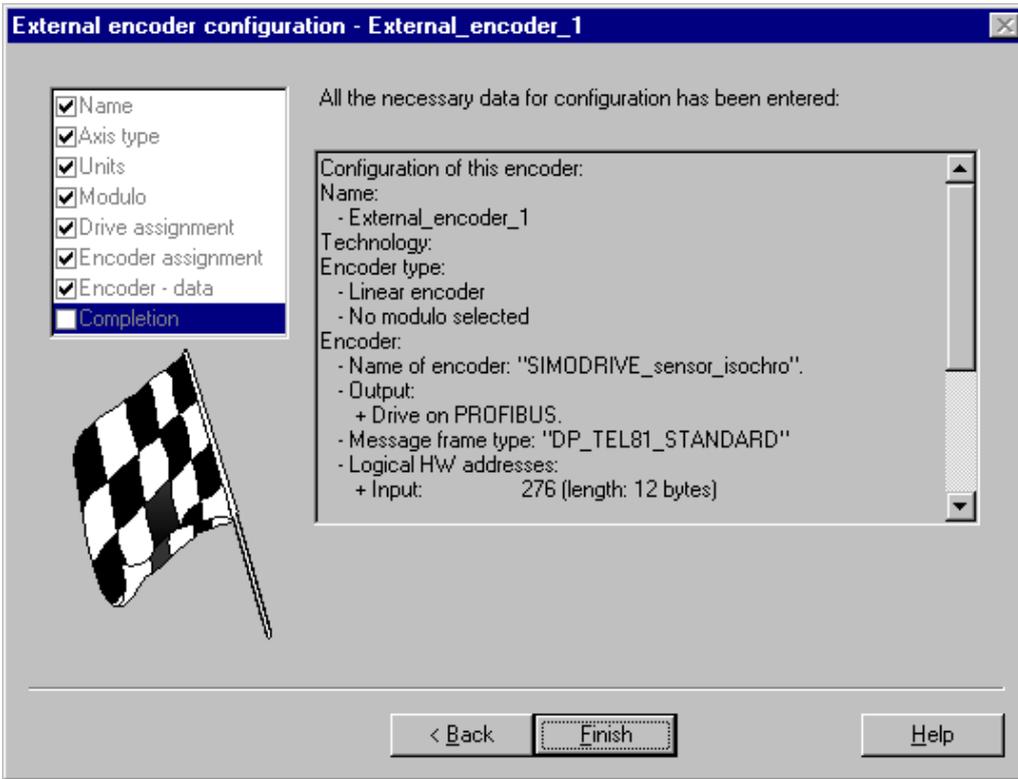
Step	Description
5.	<p>The "External encoder configuration - Modulo encoder" dialog appears.</p>  <p>To use the external encoder in modulo mode, i.e. the position values returned by the encoder refer to a traversing range which is defined by the modulo start and length values, set the check box and define those two values.</p> <p>The address information in HW Config is read.</p>

Step	Description
6.	<p>The "External encoder configuration - Encoder number" dialog appears.</p> <p>If several encoder systems are available, the "External encoder configuration - Encoder number" dialog box is opened. If only one drive or only one encoder system is configured in HW Config, the dialog box from Step 7 is displayed immediately.</p>  <p>From the drop-down list, select the relevant encoder system, or the drive component to which it is connected, for operation as external encoder.</p>

Step	Description
7.	<p>After the encoder has been selected, the dialog box displays additional information as well as a fold-down list from which the message type is selected.</p>  <p>In the case of encoder systems of drives the selected telegram type must correspond with the setting in HW Config (see also Selecting the telegram type).</p> <ul style="list-style-type: none"> Settings for SIMODRIVE sensor The "DP_message_frame_81_standard" message type must always be selected in case of the PROFIBUS encoders SIMODRIVE sensor. ADI4 Settings In the case of ADI4, "DP_Tel3" must always be selected as the message type. During the selection for the ADI4 the "Drive number" parameter is displayed as a fold-down list. From this drop-down list, select the encoder number which was configured for this encoder at AD14. <p>Confirm your entry with "Continue".</p>

Step	Description
8.	<p>The "External encoder configuration - encoder type / mode" dialog appears.</p>  <p>From the "Encoder type", "Encoder mode" and "Measuring system" drop-down lists, select the settings used in the configuration of the drive component or encoder. Details are found in the supplementary descriptions of SIMODRIVE 611 universal, MASTERDRIVES MC, ADI4 and SIMODRIVE Sensor, or in the relevant equipment manuals.</p> <p>Example of settings at the SIMODRIVE Sensor:</p> <ul style="list-style-type: none"> Encoder type: "Absolute value encoder, cyclic absolute" Encoder modes: "SSI" Measuring system: "Rotary encoder system" <p>Confirm your entries with "Continue".</p>

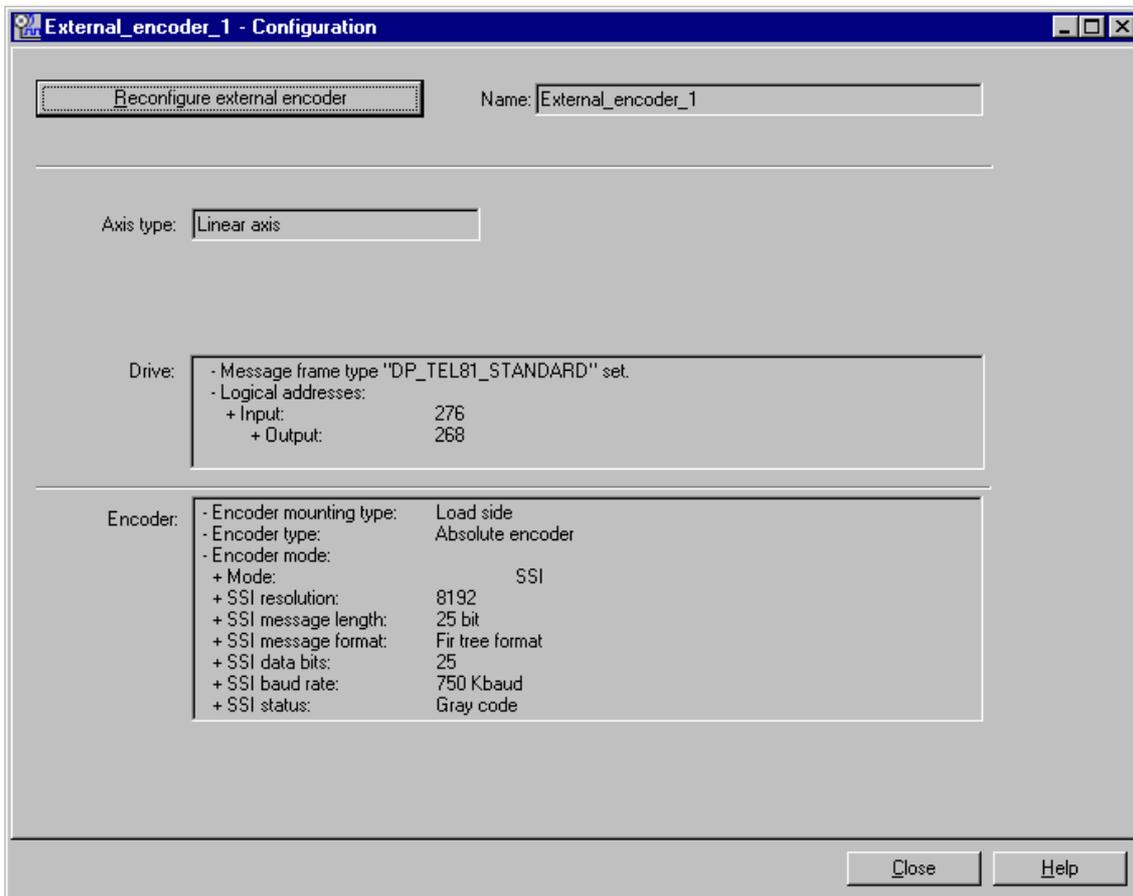
Step	Description																	
9.	<p>The "External encoder configuration - Encoder data" dialog box is displayed. The contents of the dialog box depends on the selected encoder type. The figure shows the dialog box for the SIMODRIVE Sensor encoder.</p>  <ul style="list-style-type: none"> • ADI4 Settings Enter the encoder data which you have configured in HW Config at the ADI4. • Settings for the encoder systems of the drives SIMODRIVE, MASTERDRIVES, etc. Enter the encoder data which you entered at the drive configuration. • Settings for SIMODRIVE sensor Enter the values for the SIMODRIVE sensor as shown below: <table border="1"> <thead> <tr> <th>Parameter</th> <th>Single-turn encoder</th> <th>Multi-turn encoder</th> </tr> </thead> <tbody> <tr> <td><i>Encoder pulses per revolution</i></td> <td>8192</td> <td>8192</td> </tr> <tr> <td><i>Multiplication factor of the absolute actual value</i></td> <td>1</td> <td>1</td> </tr> <tr> <td><i>Multiplication factor of the cyclic actual value</i></td> <td>524288</td> <td>128</td> </tr> <tr> <td><i>Number of data bits</i></td> <td>25</td> <td>25</td> </tr> </tbody> </table> <p>Confirm your entry with "Continue".</p>			Parameter	Single-turn encoder	Multi-turn encoder	<i>Encoder pulses per revolution</i>	8192	8192	<i>Multiplication factor of the absolute actual value</i>	1	1	<i>Multiplication factor of the cyclic actual value</i>	524288	128	<i>Number of data bits</i>	25	25
Parameter	Single-turn encoder	Multi-turn encoder																
<i>Encoder pulses per revolution</i>	8192	8192																
<i>Multiplication factor of the absolute actual value</i>	1	1																
<i>Multiplication factor of the cyclic actual value</i>	524288	128																
<i>Number of data bits</i>	25	25																

Step	Description
10.	<p>The dialog box below shows a summary of the configuration.</p>  <p>Close the wizard by clicking "Apply".</p> <p>Result: The technology object is inserted.</p>

4.10.2 Configuration - External Encoder

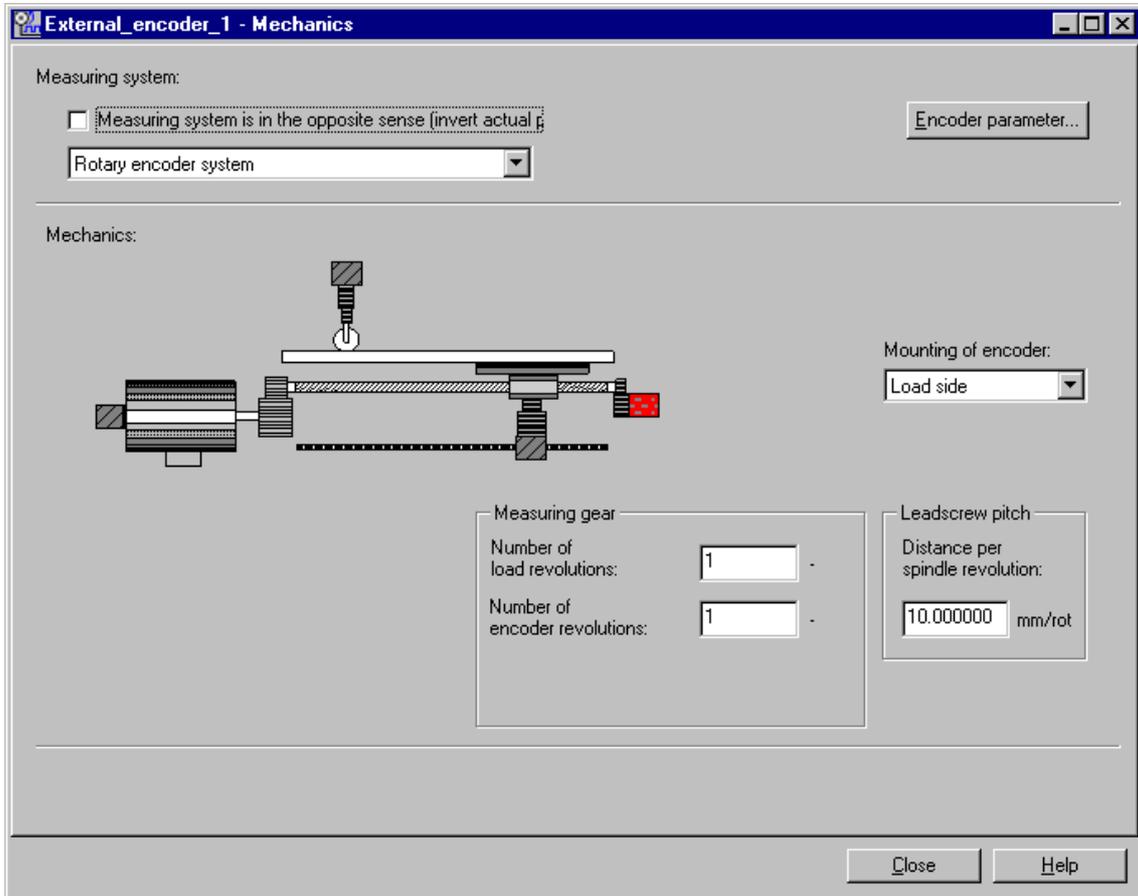
The **External encoder > Configuration** dialog box shows the drive and encoder settings.

After selecting the "Reconfigure external encoder" command button, you can use the encoder wizard to modify the settings.



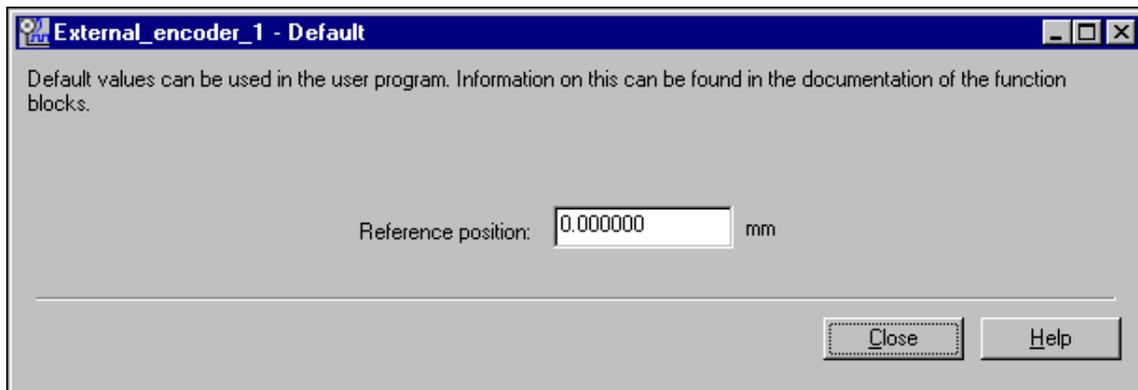
4.10.3 Mechanical Settings - External Encoder

In the **External encoder > Measuring System**, define the mechanical parameters of the external encoder..



4.10.4 Default - External Encoder

In the **External encoder > Default**, enter the **reference position** of the external encoder. The reference position is used to specify the position of the "External encoder" technology object within the coordinate system. This position specification can be used during the synchronization via the "MC_ExternalEncoder" technology function in the mode 4 and 5.



4.11 Copying configuration data of another station

In the next steps, you are shown how to reuse the HW and technology configuration data and the user program in a second station of the same project.

Conditions to be satisfied in the next steps:

- The HW Configuration of the source station is compiled and saved.
- The configuration data of the technology in S7T Config is compiled and saved in the source project.
- SIMATIC Manager is opened (S7T Config, HW Config etc. are closed)

Step	Description
1.	In SIMATIC Manager, select the source station, then select the Edit > Copy command.
2.	Select the destination project, then select the Edit > Paste command. After this insertion, a new station with a unique name is shown in the project. All STEP 7 components were copied to this new station.
3.	Open the hardware configuration for the new station. Add it to the configuration of the DP(DRIVE) interface, and of the MPI/DP interface as required, because the logical network links or the networks are not included in the copy operation. You should therefore create new network objects, and then adapt these to the synchronization cycle of the configured drive component.
4.	Save and compile the hardware configuration. Close HW Config.
5.	In SIMATIC Manager, select "Technology objects," and then run "Technology Objects Management" by selecting Edit > Open object . Adapt the generated technology DBs as required.

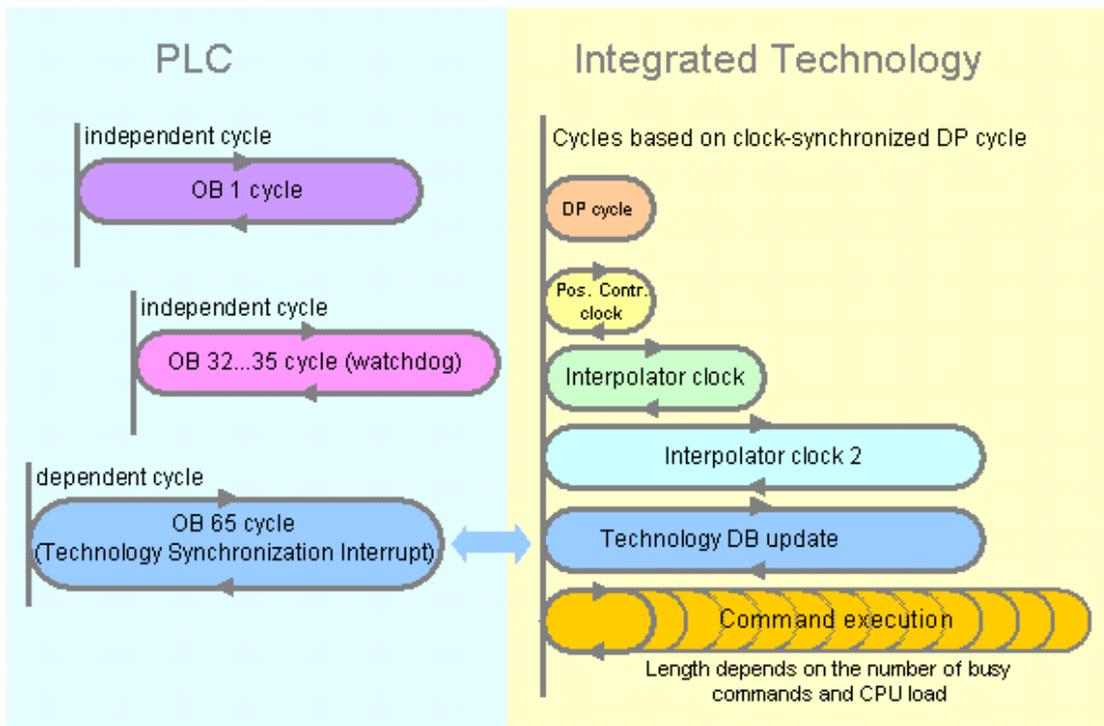
You have now created a new station that contains the corresponding data of the source station (save for the difference in names).

5 Programming

5.1 Time model

The figures below show the cycles and Technology CPU clocks and their meaning:

Cycles & clocks of the Technology CPU



The figure below shows the control cycles and the integrated technology.

Control cycles

- **OB1 cycle**
The length of the OB1 cycle is determined by the number of executed instructions. The OB1 cycle operated independent on the cycles of the integrated technology.
- **OB 32...35 cycle**
The watchdog OBs are called up to one second within a time pattern of 100 ms. The watchdog interrupts are called independent on the clock and cycles of the integrated technology.
- **OB 65 cycle**
The technology synchronization interrupt OB is called after each update of the technology DBs. The technology synchronization interrupt is thus coupled to the integrated technology.

Cycles of the integrated technology

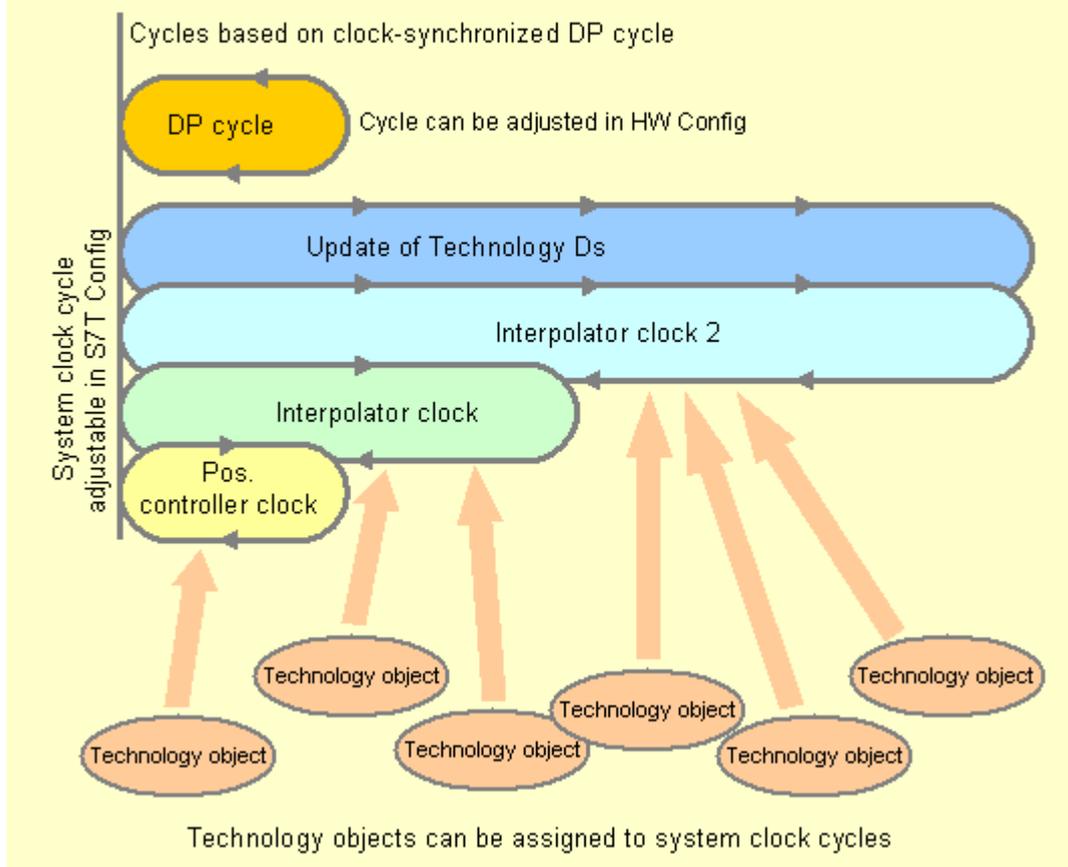
All cycles of the integrated technology are synchronized with the DP cycle:

- **DP cycle**
In the configuration in HW Config, you need to enable the constant bus cycle time at the DP(DRIVE). The integrated technology in combination with the synchronized components on DP(DRIVE) result in operation with synchronized cycle. The clock pulses and cycles of the integrated technology are thus synchronized with the DP cycle.
- **Position controller cycle clock**
The position controller cycle is used to calculate the position control of the axes, for example. The value of the position controller cycle can be set in S7T Config to a multiple of the DP cycle.
- **Interpolator cycle**
The interpolator cycle is primarily used to calculate control variables.
- **Interpolator cycle 2**
Interpolator cycle 2 performs the same tasks as the interpolator cycle, and can be used for low-priority technology objects.
- **Update of technology DBs**
The update cycle of the technology DB can be set in S7T Config as a multiple of the interpolator cycle. The technology synchronization interrupt OB is called after each update of the technology DBs.

Job execution

Command execution is not tied to a fixed cycle and depends on the number of busy commands and on CPU load. The maximum and average task execution time can be read from the *CmdLoopDuration* and *MaxLoopDuration* variable of the MCDevice technology DB.

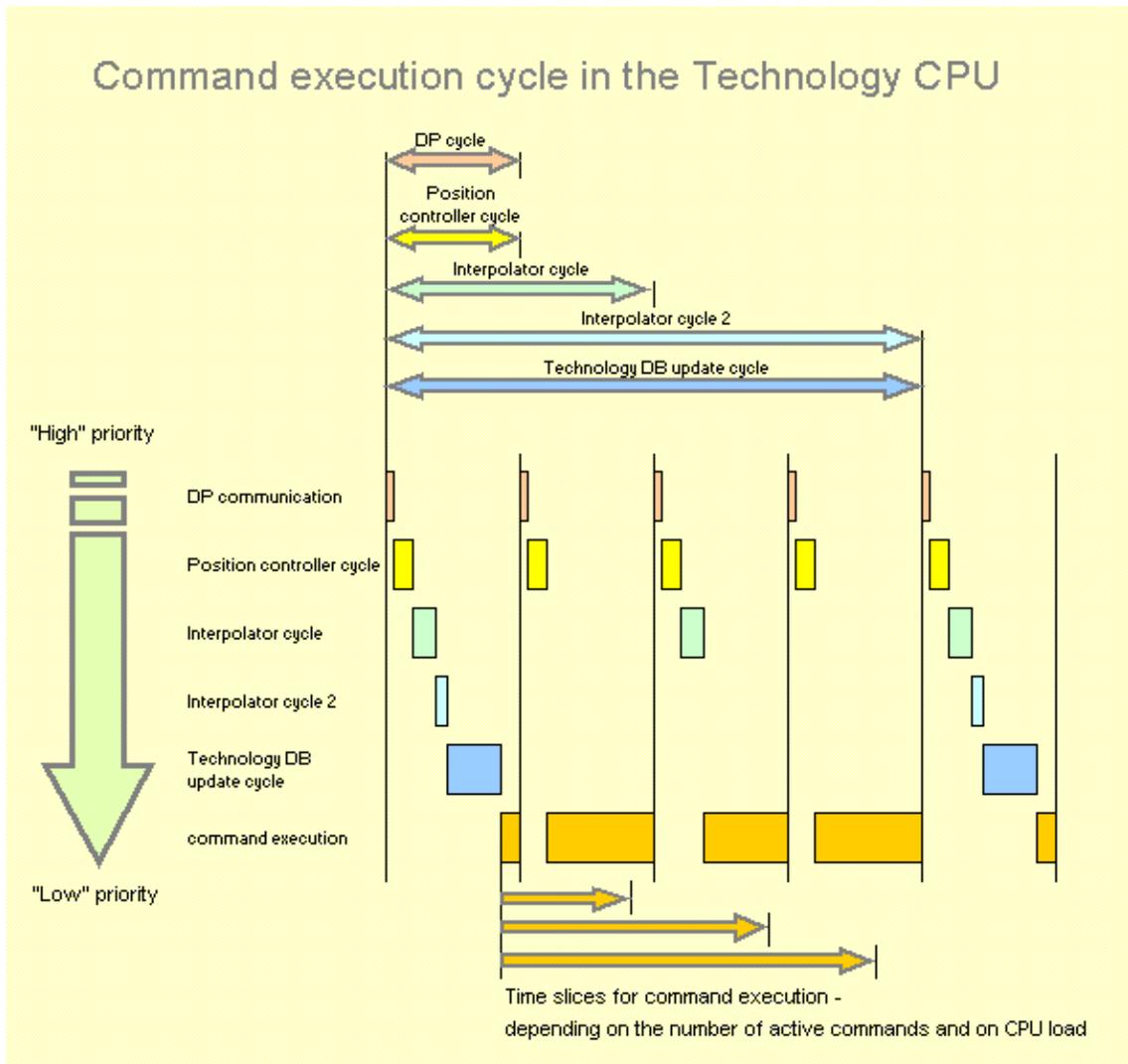
Technology objects can be assigned clock cycles



In order to tune utilization of system resources, you can reassign the technology objects a new command execution cycle. Assign the high-priority technology objects a shorter, and the low-priority technology objects a longer cycle.

For information on how to reassign the execution cycles of technology objects, refer to the chapter "Assigning technology system cycles". How to set the cycle lengths is described in chapter "Tuning technology system cycles".

The next figure shows the interaction between the cycles and their effect on command execution in the integrated technology:



The example shows the chronological order of execution across several position controller cycles.

The time required for the various cycles is indicated in small time slices, and varies with the number of configured technology objects. The time slices for the interpolator cycle, interpolator cycle 2 and the technology DB update cycle are not processed in all position controller cycles.

DP communication, the position controller cycle, interpolator cycle, interpolator cycle 2 and the technology DB update cycle are executed with descending priority.

The command executing functions utilize the time interval between two position controller cycles. The smaller this interval, the more time is left for command execution.

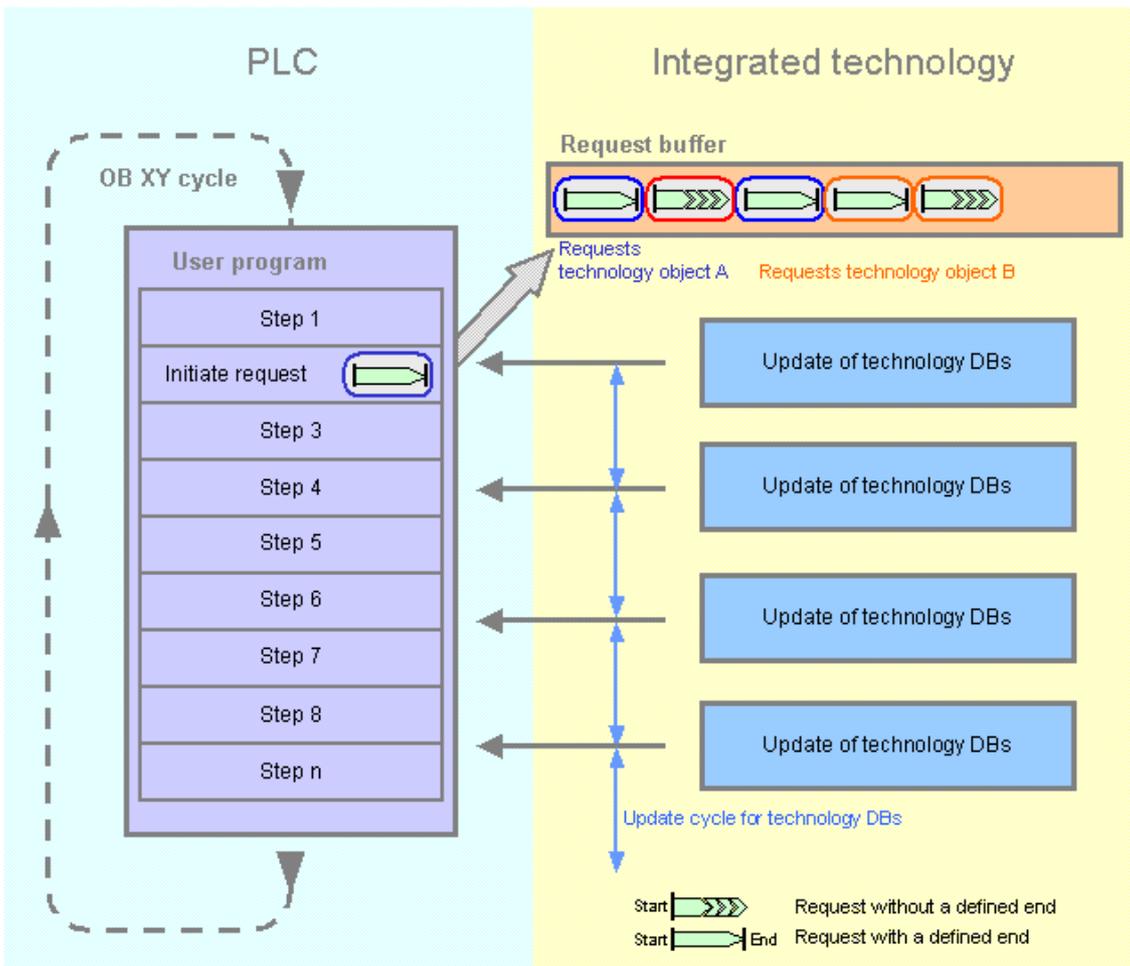
You can reduce a job execution time which requires several position controller cycles by taking the measures described below:

- Set a longer DP or position controller cycle
- Extend the update cycle for technology DBs
- Assign the low-priority technology objects the interpolator cycle 2. This reduces load on the position controller cycles and increases the time gaps for job execution.

5.2 Runtime and programming model

Runtime model

The figure below shows the command interface between the PLC and its integrated technology.

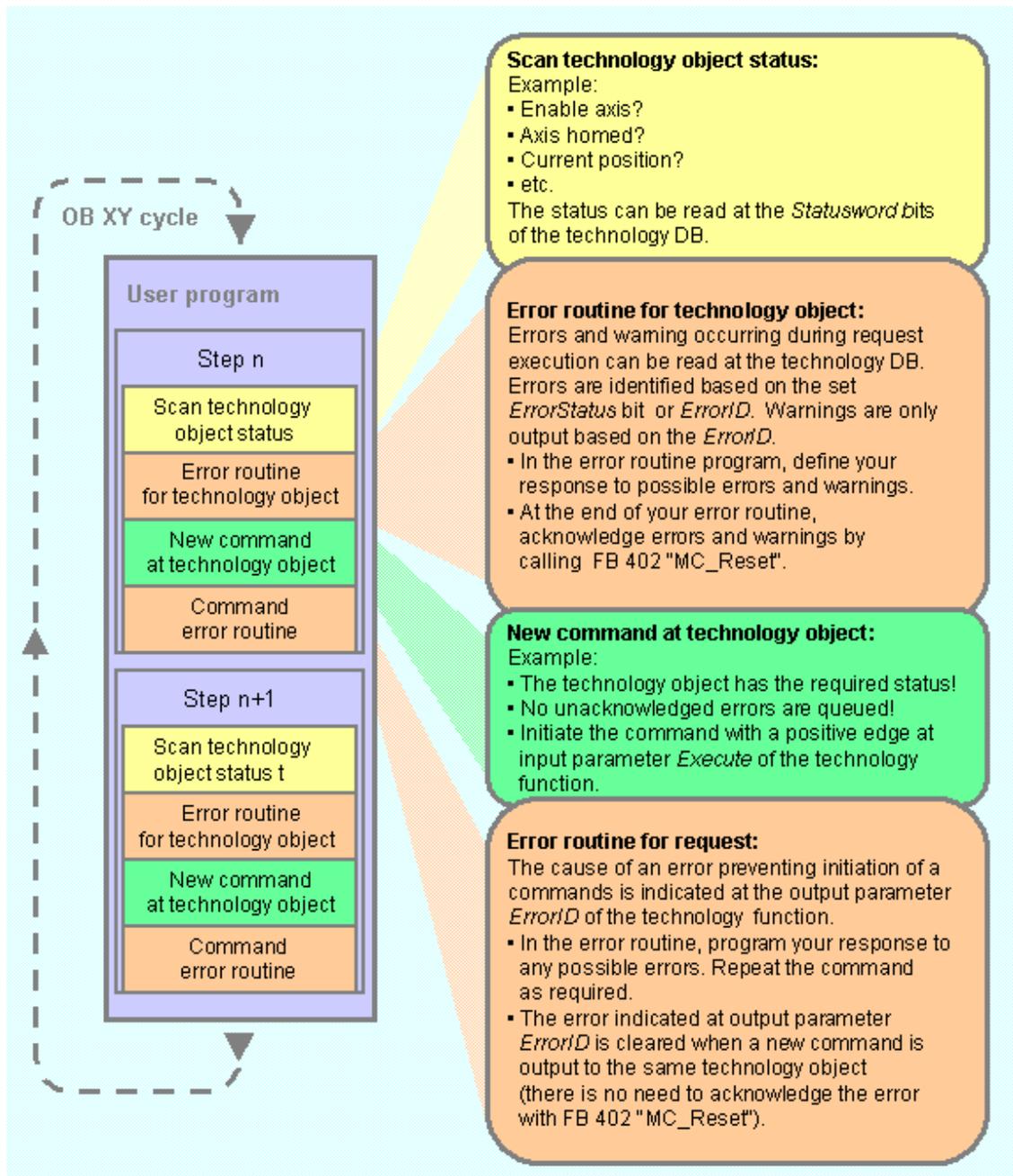


A command is initiated in the sequential user program (OB1 or watchdog interrupt OBs) and written to the output buffer of the integrated technology. Several commands can be busy at each one of the technology objects, without the need of having to wait until the discrete commands are processed.

The status and error messages, as well as the actual values of the technology object, are updated alongside with the technology DBs in the PLC. Updates are carried out asynchronously to the OB XY cycle, which means that corresponding updated actual values are available in multiple scan cycles in the user program.

Programming model

The figure below shows the structure of a user program. The step sequence is independent of processing in OB1 or in a watchdog interrupt cycle (OB32 to OB35).



Each command step consists of these subroutines:

- Query the status of the technology object
- Evaluate errors of the technology object
- initiate new command for the technology object
- Evaluate command errors

The programming model shown serves as a guideline. The previously shown timing and runtime models taken into consideration, the programming model can be customized to suit user requirements.

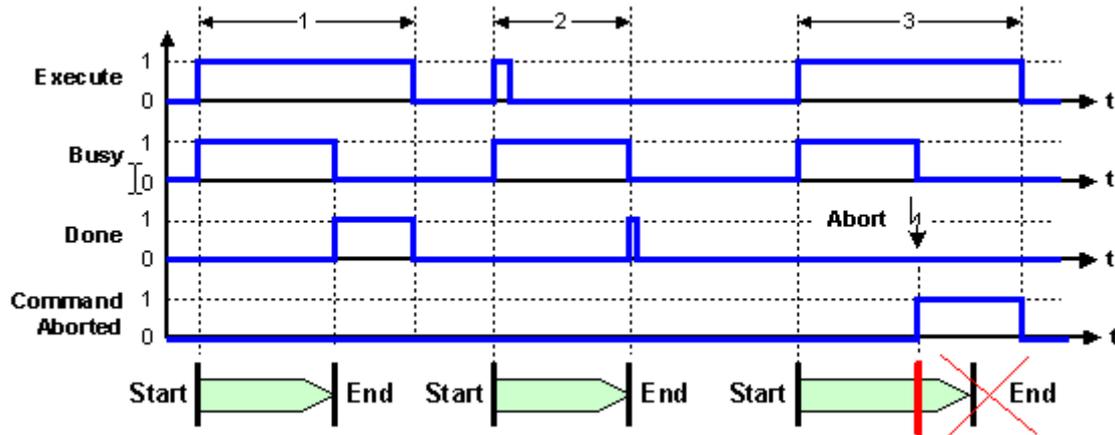
5.3 Monitoring busy commands

All technology functions provide status outputs for monitoring current commands. As long as the input parameter *Execute* is set to *TRUE*, the status messages are retained (does not apply to the technology function *MC_Stop*). When you set a short *Execute = TRUE* signal, the status messages are output only in one execution cycle (see example 2 in the figure below).

The *Busy* status bit indicates that the command is being executed, and that the output parameters of the technology function are being updated.

Commands with defined termination

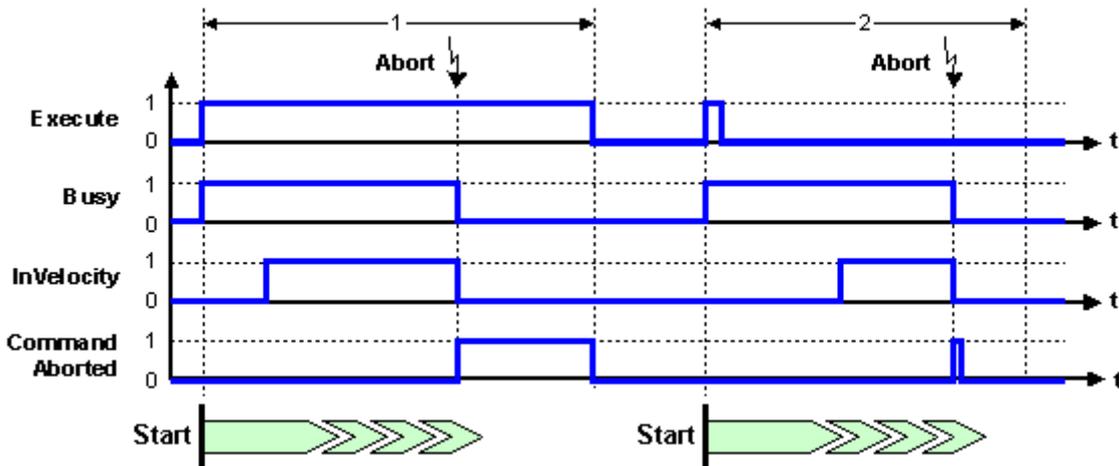
The technology function provides an output parameter *Done* to signal the completion of commands of this type (example 1). Output parameter *CommandAborted* is set (example 3) if the execution of such a command is prematurely aborted. This may be triggered by the start of a further command at the same technology object, or by an error event.



Commands without defined termination

These commands can not report completion and thus do not have an output parameter *Done*. Instead, they return a status message to indicate the first time the required operating state has been reached. If the axis is to be accelerated to a certain velocity, for example, the output parameter *InVelocity* (FB MC_MoveVelocity) is set to indicate the first time this velocity has been reached.

The command continues to be processed, and the FB outputs will be updated until the command is overridden or if an error occurs. The status of the technology function then changes and *CommandAborted* is set *TRUE*.



Overriding commands with the same FB

The application may require the override of a busy command with a command of the same type, e.g. positioning to 200 overrides positioning to 100. In this case, use a FB that has a different instance DB compared to the command you want to override. Otherwise, the busy ("old") command can no longer be monitored at the FB outputs. This may present a problem, in particular if the start of the new command is prevented as a result of error.

Each one of the instance DBs has its own input buffer. If commands with the same instance DB follow in rapid succession, a consistency problem may develop in the input buffer. New commands are thus rejected with error (0x804C) as long as the input buffer is busy. In this case, it is also no longer possible to monitor the command based on the FB outputs.

5.4 Errors and warnings at the technology function

The technology functions indicate any errors at the binary result bit (BRB) of the status word and at the *ErrorID* output parameter. The *Error* status bit is only set if an error preventing the execution of the command is detected immediately at the time this command is accepted.

Error evaluation with the BRB bit

The BRB bit value is 0 if an error has occurred during the execution of the technology function. The example below shows how you can evaluate the BRB bit in your user program:

```
CALL "MC_Power" , DB401
Axis      :=1
Enable   :=E5.0
Mode     :=0
StopMode:=0
Status   :=M100.0
Busy     :=M100.1
Error    :=M100.2
ErrorID  :=MW102
```

UN	BIE	
=	A	16.0

The BIB bit changes to 0 value if an error occurs. Output Q 16.0 is assigned the value *TRUE*.

Note

The output parameter values may be invalid if the BRB bit indicates an error during the execution of the technology function.

Hence, you should first evaluate the BRB bit after you have called the technology function. Next, check the *ErrorID* output parameter.

Warnings and errors at output parameter *ErrorID*

The *ErrorID* output parameter indicates an error (*ErrorID* = 8xxx) if the technology function was unable to initiate the command. A warning indication at the technology function (*ErrorID* = 00xx) is also associated with the command initiation.

When the technology function indicates an error, you need to call it either with appropriate parameters, or at a different point of time (provided the function is allowed.)

It is neither required, nor is it possible to acknowledge the errors or warnings. The error is cleared by resetting the *Enable* and *Execute* parameters.

Output parameter *CommandAborted*

If execution of the current command was aborted either by another command or as a result of error, output parameter *CommandAborted* reports an error status. If *ErrorStatus* of the technology DB does not indicate an error, the command was aborted by a successive command. An error at the integrated technology is indicated at *ErrorStatus* and has led to the abortion of job execution.

5.5 Errors at the MCDevice & Trace technology DBs

If the technology data blocks "MCDevice" or "Trace" are invalid, this is indicated in the corresponding technology DB. An error is also indicated if the technology DB was replaced by a more recent instance.

Error indications defined at the "MCDevice" and "Trace" technology DBs:

- The *ErrorID* variable
The *ErrorID* variable indicates the ErrorID of the most recently detected error (*ErrorID = 8xxx*).
The value of this variable is deleted by acknowledging it with *MC_Reset (Restart = FALSE)*.
- The *ErrorBuffer[0..2]* variable array (not in the "Trace" technology DB)
The *ErrorBuffer[0..2]* variable array is used to store the first three errors. The first error is written to ARRAY element 1, the second to ARRAY element 2, etc.
The value in this variable is deleted by acknowledging it with *MC_Reset (Restart = FALSE)*.

Acknowledging errors

Eliminate the cause of errors detected in the *ErrorID* variable (*ErrorID = 8xxx*). The errors indicated at the technology DB "MCDevice" and "Trace" can not be acknowledged.

5.6 Errors and warnings at the axes & external encoders technology DB

Errors or warnings occurring at the technology object while the command is being executed are indicated at the technology DB. This also applies when inconsistent or illogical dynamic values were passed.

The following error indications are defined at the technology DB for axes and external encoders:

- The *Statusword.Error* variable
This variable is *TRUE* if at least one error has occurred. Based on the *ErrorID*, the error can be evaluated at the *ErrorID* or *ErrorBuffer[0..2]* variables.
- The *Statusword.Errorstop* variable
The axis is being stopped / was stopped due to an error; the technology object may be disabled.
When the *Statusword.Errorstop* and *Statusword.Error* variables are *TRUE*, the error can be analyzed in *ErrorID* or *ErrorBuffer[0..2]*.
- The *ErrorID* variable
The *ErrorID* variable indicates the most recent error (*ErrorID = 8xxx*) or warning (*ErrorID = 00xx*) message of the technology object.
The value of this variable is deleted by acknowledging it with *MC_Reset* (*Restart = FALSE*).
- The *ErrorBuffer[0..2]* variable
The *ErrorBuffer[0..2]* variable array is used to store the first three errors or warnings (since the last acknowledgment). The first error is written to ARRAY element 1, the second to ARRAY element 2, etc.
The value in this variable is deleted by acknowledging it with *MC_Reset* (*Restart = FALSE*).
- The *ErrorStatus.xxx* variable
The *ErrorStatus.xxx* variable is used to indicate specific axis errors as bit information (note the comments in the technology DB).

Acknowledging warnings

Warnings at the (*ErrorID = 00xx*) technology DB may, but do not need to be acknowledged with *MC_Reset*.

However, note the data volume in the *ErrorBuffer[0..2]* variable array. You can keep the *ErrorBuffer[0..2]* variable array clear for any incoming error messages by acknowledging the errors in due time.

Acknowledging errors

To acknowledge all errors, first eliminate their cause, and then acknowledge with *MC_Reset* (*Restart = FALSE*). The technology object can then be enabled again by means of the *MC_Power* technology function.



Caution

Several unacknowledged errors may cause the CPU to go into STOP.

5.7 Errors and warnings at the cam disk & measuring sensor & output cam technology DB

Errors or warnings occurring at the technology object while the command is being executed are indicated at the technology DB. This also applies if inconsistent or illogical data were passed.

Error indications defined at the technology DB for cam disks, measuring encoders and output cams:

- The *ErrorID* variable
The *ErrorID* variable indicates the most recent error (*ErrorID* = 8xxx) or warning (*ErrorID* = 00xx) message of the technology object.
The value of this variable is deleted by acknowledging it with MC_Reset (*Restart* = FALSE).
- The *ErrorBuffer[0..2]* variable
The *ErrorBuffer[0..2]* variable array is used to store the first three errors or warnings (since the last acknowledgment). The first error is written to ARRAY element 1, the second to ARRAY element 2, etc.
The value in this variable is deleted by acknowledging it with MC_Reset (*Restart* = FALSE).

Acknowledging warnings

Warnings at the (*ErrorID* = 00xx) technology DB may, but do not need to be acknowledged with MC_Reset.

However, note the data volume in the *ErrorBuffer[0..2]* variable array. You can keep the *ErrorBuffer[0..2]* variable array clear for any incoming error messages by acknowledging the errors in due time.

Acknowledging errors

To acknowledge all errors, first eliminate their cause, and then acknowledge with MC_Reset (*Restart* = FALSE). The technology object can then be enabled again by means of the MC_Power technology function.



Caution

Several unacknowledged errors may cause the CPU to go into STOP.

5.8 Behavior of Virtual Axes

Virtual axes have a reference input variable, but do not have a position control system, nor a drive or an encoder interface. The process value of the virtual axis is always set equal to the setpoint value. The absence of the position control system, the drive and encoder interface lead to some particular aspects at job processing which are described below:

<Particular behavior of the variables *Statusword.DriveEnable*

If the enable of a virtual axis is removed at the *Enable* input parameter of *MC_Power*, the status of the *Statusword.DriveEnabled* variable of the corresponding technology DB remains TRUE.

The *Statusword.DriveEnable* variable is always *TRUE* at a virtual axis.

Parameter changes during the runtime of the technology CPU

- **Restart**
Because virtual axes do not have a position control system, drive or encoder interface, a restart is often not required when a parameter is modified, even if the contrary is stated in the help texts for the dialog boxes or in the list of technology parameters.
Whether a restart is required, is indicated in the variable *Statusword.RequestRestart* of the corresponding technology DB.
- **Parameter modifications**
All the parameters of the axes are listed in the list of technology parameters as well as in the dialog boxes of the DB Param.

Take into account that not all the parameters can be read or modified at virtual axes.

5.9 Symbolic programming with FC 400 "DB2INT"

Use FC 400 "DB2INT" of the "S7-Tech" if you want to use the symbolic name of the technology block for calling the technology functions.

The figure below shows how FC 400 "DB2INT" is used:

```
CALL "DB2Int"  
  DBref := "Axis_1"  
  RET_VAL := #TECH_DB  
  
CALL "MC_Power" , DB401  
  Axis := #TECH_DB  
  Enable :=  
  Mode :=  
  StopMode :=  
  Status :=  
  Busy :=  
  Error :=  
  ErrorID :=
```

1. Define a variable of the type INT (here: "TECH_DB").
2. Call FC 400 "DB2INT" by means of the "CALL" command.
3. Set the symbolic name of the technology DB at the input parameter *Dbref*.
4. Set the defined variable value at output parameter *RET_VAL*.
5. Next, use the "CALL" command (here: FB 401 "MC_Power") to call the technology function.
6. Set the value of the defined variable at input parameter *Axis* (for other FB, at the input parameters *Master*, *Slave*, *CamSwitch*, *MeasureInput* or *CamTable*).

5.10 Programming axis-specific parameter changes

The parameters of the technology objects are set in S7T Config can be edited at FB 407 "MC_WriteParameter" in the user program while Technology CPU is in RUN. These changes are valid until the next POWER OFF or CPU memory reset.

Some of the parameters are not validated until the addressed technology object is initialized again (restart). This is only possible when the technology object is locked. After power is cycled at the Technology CPU, the parameters set in S7T Config are valid again.

You basically have two options of changing parameters:

- By editing the corresponding input parameters.
- By editing the parameters in the instance DB of FB 407. You can select several instance DBs to edit different parameters.

Creating an instance DB for FB 407 "MC_WriteParameter"

1. In SIMATIC Manager, select the block folder.
2. Select the **Add > S7 block > Data block** to add a new block.
3. Assign the required name, then select "Instance DB" and the corresponding FB 407.
4. You can also define a symbolic name and a symbolic comment.
5. Close the application and confirm the new block with "OK".

Changing parameters by editing input parameter data

To change a parameter of a technology object, you require its parameter number, type, access mode and information on the permitted range of values. This information is available in the parameter list. However, it is advisable to use the configuration view of the instance DB, because there you can also search for parameters.

1. In SIMATIC Manager, open the instance DB (opens the "DB-Param" tool and shows the content of the instance DB in the parameter assignment view.)
2. Select the technology object you want to reconfigure from the drop-down list.
3. In the tree view, select the relevant group and the parameter.
4. Hold the mouse cursor briefly over the parameter entry. The short info shows you the parameter number, its type and access mode ("read, write"). Note down these values to enter them later at the FB input parameter. You can also print the List of technology parameters of the Online Help.

5. The "Value" field of the drop-down list, or the short info, provide you with information about permissible parameter values.
6. Close the parameter assignment view, then cancel or confirm the changes made in the next dialog box. The configured content of the instance DB is irrelevant when the data are provided at the FB input parameters.
7. In the user program, call FB 407 "MC_WriteParameter" by means of the instance DB and set the input parameter values you have noted down. Parameter assignment is initiated by a positive edge at the *Execute* input.

The advantage of this procedure is, that you only need one instance DB. Of disadvantage is, that you can edit only one parameter at a time, and that you have to wait for MC_WriteParameter to respond before you edit the next parameter.

Editing parameter with the help of different instance DBs

Each parameter change requires of you to create and configure a new instance DB.

1. In SIMATIC Manager, open the instance DB (opens the "DB-Param" tool and shows the content of the instance DB in the parameter assignment view.)
2. In the drop-down list, select the technology object that contains the parameter you want to edit with this instance DB.
3. In the tree view, select the relevant group and the parameter.
4. Select the required "Value" from the drop-down list or type in the value.
5. Close this dialog box and confirm your changes in the next dialog box.
6. In the user program, call FB 407 "MC_WriteParameter" with the required instance DB.
7. Provide **only** the input parameter *Execute* with data. The assignment of parameters based on the values of the instance DB is initiated with a positive at input parameter *Execute*.

Repeat this procedure until you have completed all parameter changes.

The advantage is here, that you can easily configure the parameters my means of DB-Param, and that you can edit several parameters in immediate succession, the disadvantage being, that you always require several DBs or a multiple instance DB.

6 Technology functions

6.1 Overview

Valid for firmware version V3.1.x of the integrated technology

Requirements

Motion control commands can be programmed with the help of function blocks, if

- the station configuration in HW Config was saved and compiled,
- the technology objects were added and configured in S7T Config,
- the technology DBs were created in the "Technology Objects Management" dialog box in S7T Config

Define the reference to the technology object by means of the number of the relevant technology DB.

Function blocks

Function blocks available for programming:

Function	No.	Name	Description
Stand-alone axis	FB 401	MC_Power	Enable / disable axis
	FB 403	MC_Home	Axis homing / setting
	FB 404	MC_Stop	Stop axis and prevent new motion commands
	FB 405	MC_Halt	Normal stop
	FB 409	MC_ChangeDataset	Changeover of the data record
	FB 410	MC_MoveAbsolute	Absolute positioning
	FB 411	MC_MoveRelative	Relative positioning
	FB 412	MC_MoveAdditive	Relative positioning to current target position
	FB 413	MC_MoveSuperImposed	superimposing positioning
	FB 414	MC_MoveVelocity	Motion with velocity preset
	FB 415	MC_MoveToEndPos	Move to fixed end stop / clamping
	FB 437	MC_SetTorqueLimit	Enable / disable torque reduction

Function	No.	Name	Description
Synchronous operation	FB 420	MC_GearIn	Start gearing
	FB 422	MC_GearOut	End gearing
	FB 421	MC_CamIn	Start camming
	FB 423	MC_CamOut	Stop camming
	FB 424	MC_Phasing	Change phase shift between leading and following axes
	FB 441	MC_CamInSuperimposed	Start superimposing camming
	FB 443	MC_CamOutSuperImposed	Stop superimposing camming
	FB 440	MC_GearInSuperimposed	Start superimposing gearing
	FB 442	MC_GearOutSuperimposed	Stop superimposing gearing
	FB 444	MC_PhasingSuperimposed	Change superimposing phase shift
Advanced functions	FB 430	MC_CamSwitch	Position-based cams / switching cams
	FB 431	MC_CamSwitchTime	Time-based cam
	FB 432	MC_ExternalEncoder	External encoders
	FB 433	MC_MeasuringInput	Measuring sensor
Cam	FB 434	MC_CamClear	Delete cam
	FB 435	MC_CamSectorAdd	Add cam segment
	FB 436	MC_CamInterpolate	Interpolate cam
	FB 438	MC_GetCamPoint	Read positions from cam disk
Basic function	FB 402	MC_Reset	Acknowledge errors / alarms
	FB 406	MC_ReadSysParameter	Read parameter
	FB 407	MC_WriteParameter	Changing parameters
	FB 450	MC_ReadPeriphery	Read technology I/O
	FB 451	MC_WritePeriphery	Write technology I/O
	FB 453	MC_ReadRecord	Read data record
	FB 454	MC_WriteRecord	Write data record
	FB 455	MC_ReadDriveParameter	Read drive parameters
	FB 456	MC_WriteDriveParameter	Write drive parameters

6.2 Technology functions - Single axis

6.2.1 FB 401 MC_Power - Enable / disable axis

Purpose

- The technology function "MC_Power" allows you to enable or disable an axis.
- You can define the operating mode of the axis
- You can define the emergency program for handling events such as a disabled axis or the CPU changing to STOP.

Applicable to

- Velocity axes
- Positioning axes
- Synchronization axes

Requirements

- No errors preventing enabling of the axis at the technology DB.
- The technology function may only be active once per axis

Overriding commands

An MC_Power command can not be canceled by any other command.

An MC_Power command does not cancel any other commands with *Enable = TRUE*.

An MC_Power cancels all other commands output to this TO with *Enable = FALSE*.

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Enable	BOOL	FALSE	As long as <i>Enable = TRUE</i> , the system attempts to enable the axis. The axis is enabled if there are no errors preventing that. An error that prevents enabling is queued at the relevant technology DB when both of the variables <i>Statusword.Error</i> and <i>Statusword.Errorstop</i> are set <i>TRUE</i> . A current command is canceled when <i>Enable = FALSE</i> .
Mode	INT	0	Axis mode: Value = 0: Default (according to axis configuration) Value = 1: reserved Value = 2: reserved Value = 3: following mode Value = 4: simulation mode
StopMode	INT	0	Value = 0: DefaultStop (emergency-off delay) Value = 1: FastStop (hardware limit of acceleration) Value = 2: TimeStop Value = 3: OFF2Stop Value = 4: GearStop

Output parameters

Parameter	Data type	Start value	Description
Status	BOOL	FALSE	Axis enable status: FALSE: disabled TRUE: Enabled The enable signal is reset when an error preventing enabling has occurred (indicated at the relevant technology DB - <i>Statusword.Error = TRUE</i> and <i>Statusword.Errorstop = TRUE</i>).
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

Warning

An axis switched off due to an error event is re-enabled with *Enable = TRUE* after the error is eliminated and acknowledged.

Note

The "MC_Power" technology function influences the following status bits of the *Statusword* variable of the technology DB:

- *DriveEnable*
- *FollowUpControl*
- *Simulation*

Recommended procedure for locking an axis

To lock an axis:

1. Shut down the drive.
2. Disable the axis after the drive has reached standstill (*Enable = FALSE*).

Parameter *Mode* - Operating mode

The drive is enabled with a positive edge at input *Enable*.

Axis technology	Possible operating modes	
	Physical axes	Virtual axes
Velocity axis	<i>Mode 0</i> : Velocity-controlled <i>Mode 3</i> : following mode <i>Mode 4</i> : simulation	<i>Mode 0</i> : Velocity-controlled
Positioning axis	<i>Mode 0</i> : Position-controlled <i>Mode 3</i> : following mode <i>Mode 4</i> : simulation	<i>Mode 0</i> : Position-controlled
Synchronization axis	<i>Mode 0</i> : Position-controlled <i>Mode 3</i> : following mode <i>Mode 4</i> : simulation	<i>Mode 0</i> : Position-controlled

Parameter *StopMode* - Emergency program

An emergency program is triggered when a drive is disabled while it is in RUN (negative edge at *MC_Power*), or when the CPU goes into STOP. The reaction of the axis to such situations can be defined at input *StopMode*. *StopMode* is set at the negative or positive edge at input parameter *Enable*.

The *StopMode* parameter is disabled when torque reduction is set. In this case, the axis is locked instantaneously, and the drive is brought to a standstill based on its internal ramp down settings.

When the CPU is set to STOP and the emergency program is started, the emergency program must be executed within the "maximum shutdown time." On expiration of the "maximum shutdown time", the CPU goes into STOP, and the drives do not stop according to the selected *StopMode*, but rather according to the drive configuration.

The "maximum shutdown time" can be configured in the S7T Config dialog box "System cycles" (menu command **PLC > Set System Cycles.**)

Any errors must be acknowledged with the "MC_Reset" technology function before the drive is restarted.

StopMode	Reaction of the axis
0: DefaultStop	The axis is ramped down by means of the delayed E-Stop function (S7T Config > Limits > "Position and velocity" > E-Stop).
1: FastStop	The axis is ramped down with maximum deceleration (S7T Config > limits > "Dynamic response" > Hardware limits tab.)
2: TimeStop	The axis is ramped down within the "Stop time" configured for the E-Stop function (S7T Config > Default > "Dynamics" > Stop time tab).
3: OFF2Stop	The drive is disabled by a pulse inhibit signal and trails to standstill (OFF2). The axis technology DB reports an error state when the enable signal is missing.
4: GearStop	Synchronized axes maintain their status until the master has reached standstill. The axis is then locked. In all other cases the axis is ramped down based on the preset in the axis configuration (e.g. velocity-controlled axes)

Note

When an axis is running in following mode, the selected *StopMode* is of no significance, because the axis can not be ramped down dynamically! This means, that a moving axis trails to standstill within an indefinite time.

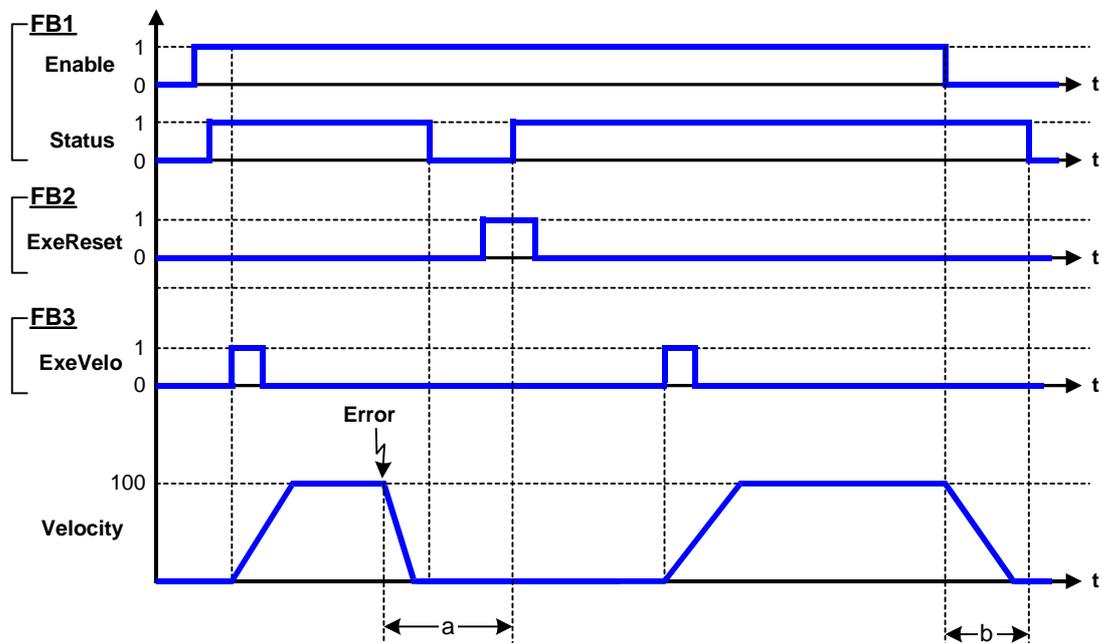
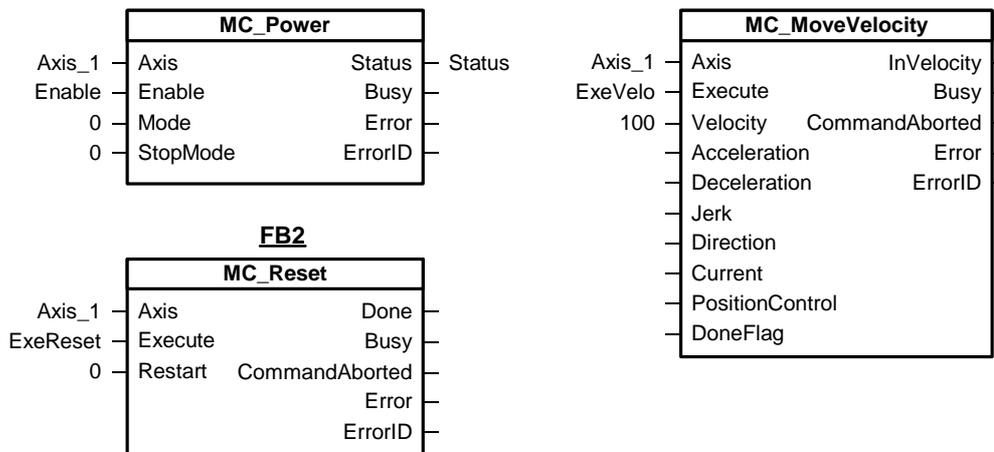
Warning

When *StopMode* = 4 and the cams are in synchronism, the following axis could restart before the leading axis has reached standstill !

MC_Power, MC_Reset - Example

The example demonstrates the interaction between the "MC_Power"_(axis enable), "MC_Reset" (acknowledge errors) technology functions and a technology function for axis motion (here "MC_MoveVelocity").

- a) The axis was enabled and accelerated to 100 rpm. An error has occurred, leading to reset of the axis enable signal. The error is eliminated and acknowledged with MC_Reset. The axis is then re-enabled.
- b) The axis was accelerated to 100 rpm. The enable (*Enable*) signal is removed from the technology function "MC_Power." The axis is ramped down over a defined time and then disabled.

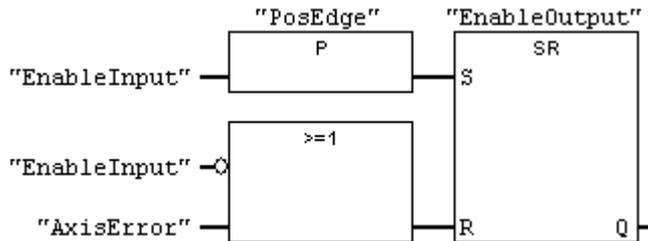


Edge-triggered axis enable signal

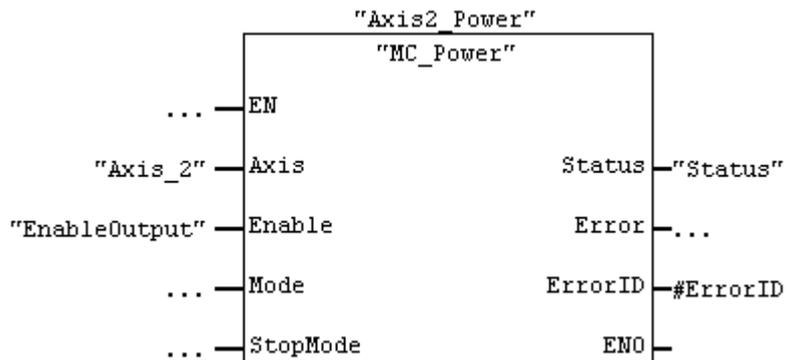
The "MC_Power" technology function enables the drive, based on the logical status at input *Enable*. Logic operations you can use to enable the drive only at the positive edge of a control signal:

Network 1 - Control logic for edge evaluation

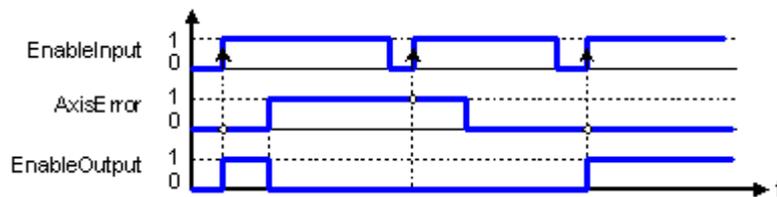
EnableInput	Control input for the axis enable signal
AxisError	0 no error 1 An error has occurred at the axis
EnableOutput	Output signal (output to "MC_Power"; enable input)



Network 2 - Axis enable signal with "MC_Power"



Corresponding signal diagram



MC_Power - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate of successive commands output to the technology by the user program is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	Concerns the input parameters <i>Mode</i> or <i>StopMode</i> . The <i>Mode</i> or <i>Stopmode</i> parameter contains an invalid value, e.g. <i>Mode = 129</i> .
8044	Task not supported by the technology object	Apply MC_Power to a cam, for example.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
804E	Permitted is only one instance per axis	The technology function may only be active at one instance per axis. Another MC_Power (<i>Busy = TRUE</i>) is already active at the specified axis. Use only one instance, or terminate the current command.
804F	Change of the axis at MC_Power is not permitted.	An axis was locked (<i>Enable 1->0</i>) while an axis other than the one set at the enable parameter was set at input parameter "Axis.". You can only disable an axis which was actually enabled by this instance of MC_Power.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.

6.2.2 FB 403 MC_Home - Axis homing / setting

Purpose

- The technology function "MC_Home" establishes a position-based relationship between the control and the mechanical system by means of a measuring system.
- The technology function "MC_Home" homes an axis or sets an actual position value.
- The mode for determining / setting the homing position is defined at the *Mode* input.
- The homing mode (active or passive) is determined only at the technology function. Active homing can be set in your axis configuration.
- The assigned position value is an absolute value, and allows absolute and relative motions based on its value.
- The function terminates when either the homing position or the assigned position is reached.
- Override characteristics with active homing, and when a further function is started during the motion (e.g. "MC_Stop".)
- Status information output as permanent signal, depending on *Execute*, or temporary in a cycle.
- Adjustment of the actual value
- For active homing, the direction and velocity of the axis for detecting the homing position are configured in the axis configuration (S7T Config.)
- Input parameter *Mode = 6* can be used to shift the position within the base coordinate system. Possible is only a shift which is relative to the setpoint value.
- Input parameter *Mode = 7* can be used to shift the position within the superimposing coordinate system. Possible is only a shift which is relative to the setpoint value.

Applicable to

- Positioning axes
- Synchronization axes

Limitations

Only *Mode* = 3, 4, 6 and 7 is possible at virtual axes

Only *Mode* = 0, 1, 2, 3, 4, 6 and 7 is possible at axes with incremental encoders

Only *Mode* = 3, 4, 5, 6 and 7 is possible for axes with absolute encoders

When "no mode" was selected in the homing configuration of the axis, only *Mode* = 3, 4, 6 and 7 are possible.

When *Mode* = 4, 6, 7 is set, the axis status does not change (homed / not homed).

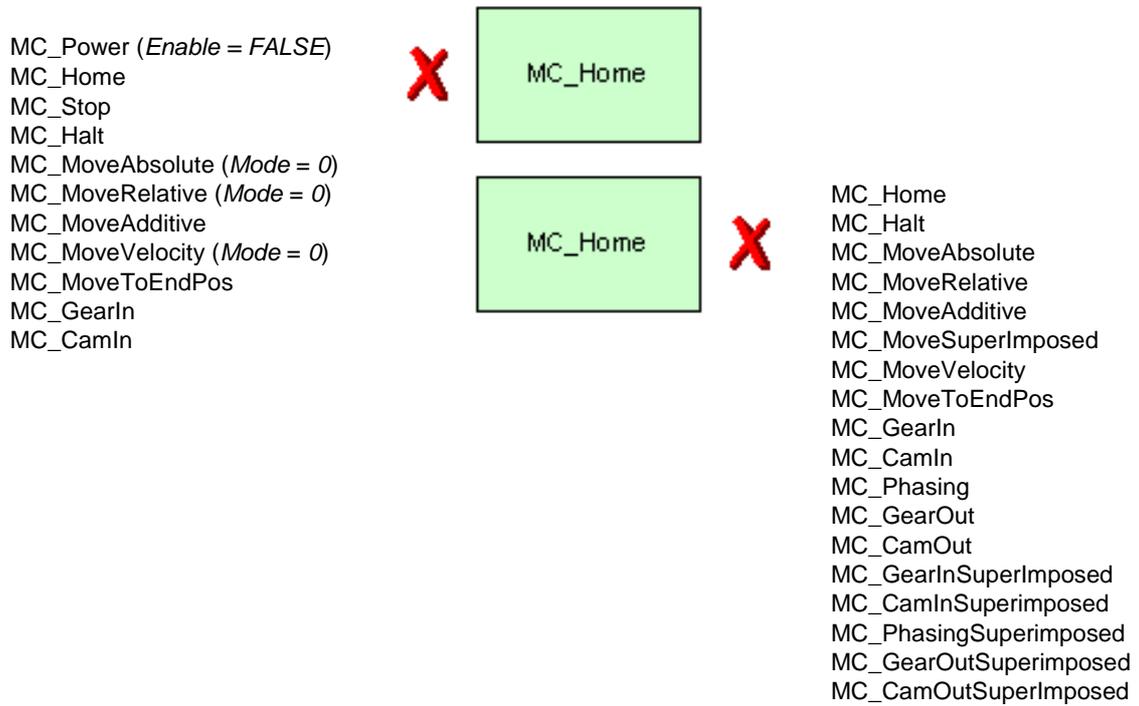
Requirements

- When *Mode* = 0, 1 and 2 is set, the axis has to be enabled for position control
- When *Mode* = 0 and 1 is set, no MC_Stop command may be being processed

Override characteristics

In active homing mode, the technology function MC_Home overrides current motion commands. Passive homing is superimposed, i.e. current motions are not canceled. The axis motion is determined by the active motion command(s). MC_Home does not override current commands. Vice versa, a new command does not override MC_Home.

Overriding commands



(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
Position	REAL	0.0	Absolute position at the axis homing position, or position setpoint or position correction value.
Mode	INT	0	<p>Homing mode:</p> <p>Value = 0: Active homing: Reference point approach according to axis configuration</p> <p>Value = 1: Active homing: Reference point approach according to axis configuration The homing position coordinate is assigned the value of Input parameter <i>Position</i>.</p> <p>Value = 2: Passive homing: Homing based on axis configuration. The homing position coordinate is assigned the value of input parameter <i>Position</i>.</p> <p>Value = 3: Direct homing: The current position is assigned the value of input parameter <i>Position</i>.</p> <p>Value = 4: Correction of the actual value (position value = actual position - Position parameter.)</p> <p>Value = 5: Absolute value encoder adjustment: The current position is assigned the value of input parameter <i>Position</i>. The position offset set by the absolute value adjustment is retained after power failure. Precise adjustment requires axis standstill.</p> <p>Value = 6: Correction of the setpoint in the base coordinate system. (position value = actual position - Position parameter)</p> <p>Value = 7: Correction of the setpoint in the superimposing coordinate system. (position value = actual superimposing position - Position parameter.)</p> <p>Please note that any position adjustments (<i>Mode</i> = 3, 4, 6 or 7) also affect the absolute value encoder adjustment. After POWER OFF or restart (<i>MC_Reset</i>, <i>Restart</i> = <i>TRUE</i>), only the absolute value encoder adjustment comes into effect.</p>
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

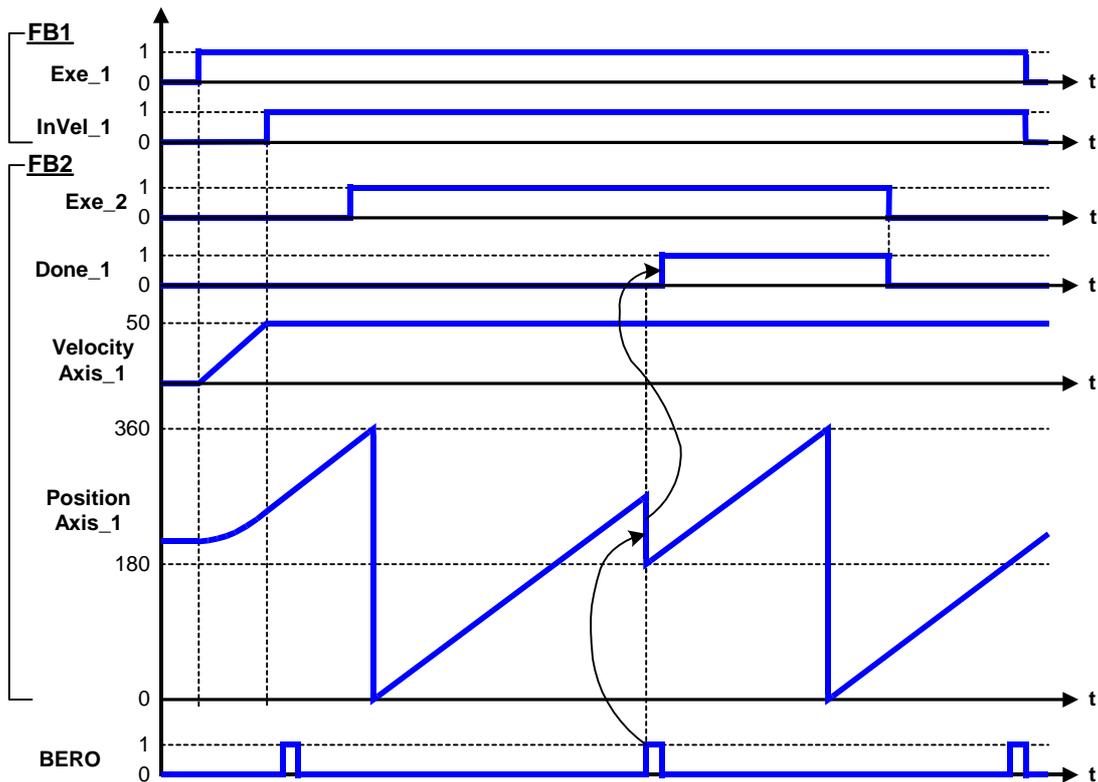
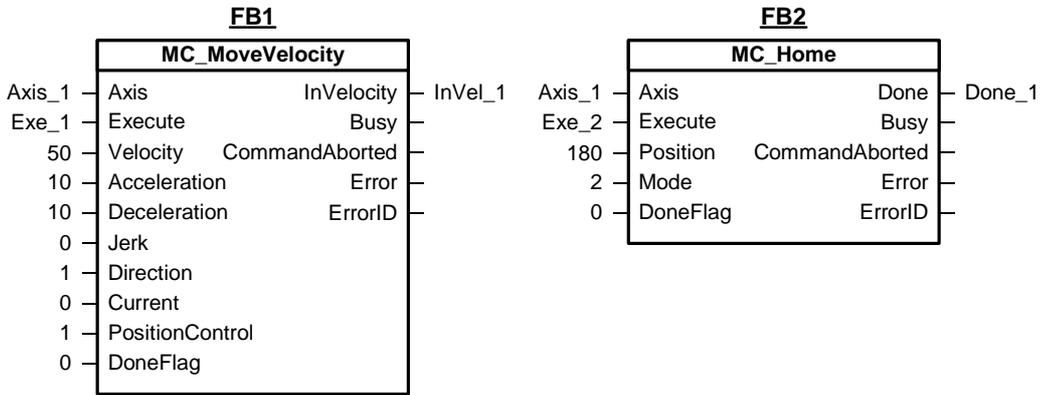
Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Command completed
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_Home - Example

The example demonstrates the reaction to on-the-fly homing.

Axis_1 is started with the call of MC_MoveVelocity. Passive homing is enabled (MC_Home; Mode = 2). At the next synchronization event (here: edge at the BERO), the actual position of the axis is set to 180°.



MC_Home - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing. Eliminate and acknowledge all queued errors and then enable the axis in the relevant mode (e.g. position-controlled).
8043	Illegal parameter value	Concerns input parameters <i>Mode</i> , <i>DoneFlag</i> and <i>Position</i> .
8044	Task not supported by the technology object	Send a homing command to a velocity-controlled axis or cam, for example.
8045	Illegal command with current status	An MC_Stop command is busy, for example.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)

ErrorID	Error message	Description / to correct or avoid error
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.2.3 FB 404 MC_Stop - Stop axes / prevent new motion commands

Purpose

- The "MC_Stop" technology function stops all motions and ramps the axis down to standstill. The standstill position is not defined.
- The command is done (*Done = TRUE*), when the axis is in standstill and *Execute = FALSE* is set, i.e. as long as *Execute = TRUE* is set, startup of the axis is inhibited. This also applies if the axis was locked in the meantime with MC_Power and then re-enabled.
- The dynamic response within the motion stop operation is determined at the input parameters *Jerk* and *Deceleration*.

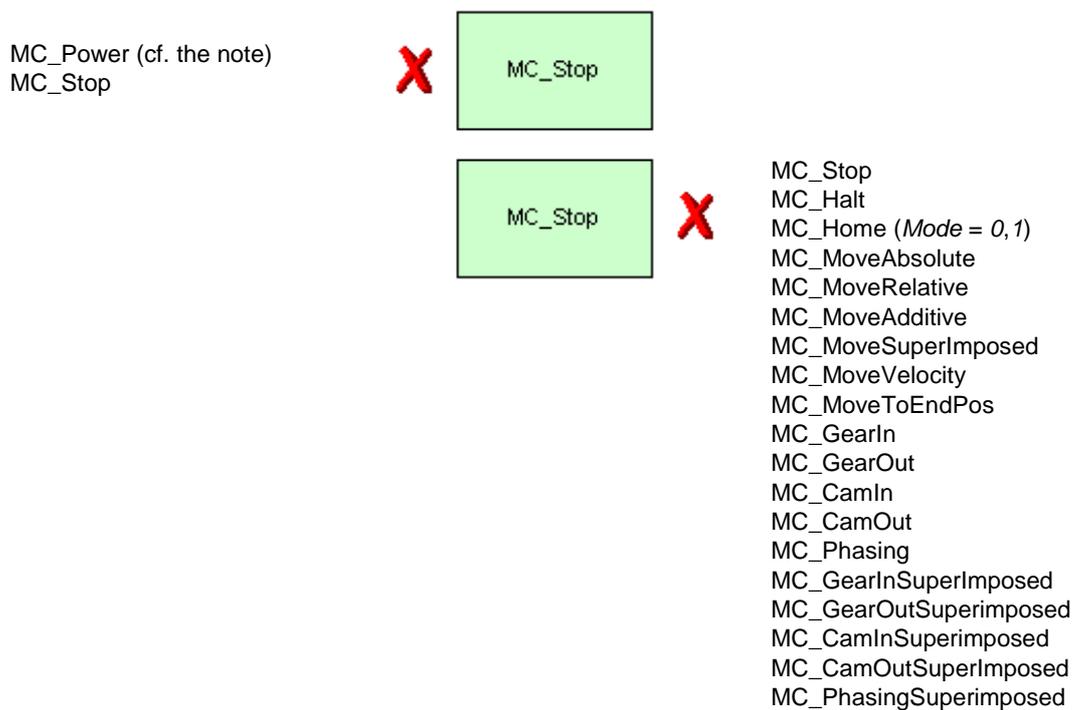
Applicable to

- Velocity axes
- Positioning axes
- Synchronization axes

Requirements

- For dynamic stop, the axis must be enabled for position or velocity control. The axis can not be ramped down dynamically when it is in following mode or locked state!

Overriding commands



(Cancellation relationships are shown in read direction)

Note

When MC_STOP is busy, you should not disable the axis with MC_Power. If this happens all the same, the STOP condition configured at MC_Power overrides the STOP motion configured at MC_Stop. The axis can not be moved dynamically with MC_Power as long as *Execute = TRUE* is set at MC_Stop.

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
Deceleration	REAL	-1.0	Deceleration (declining motor power): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk: Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

If the value for *Deceleration* > +1E+12, the axis is decelerated with the maximum delay.

If the value for *Jerk* > +1E+12, the axis is decelerated with the maximum jerk.



Warning

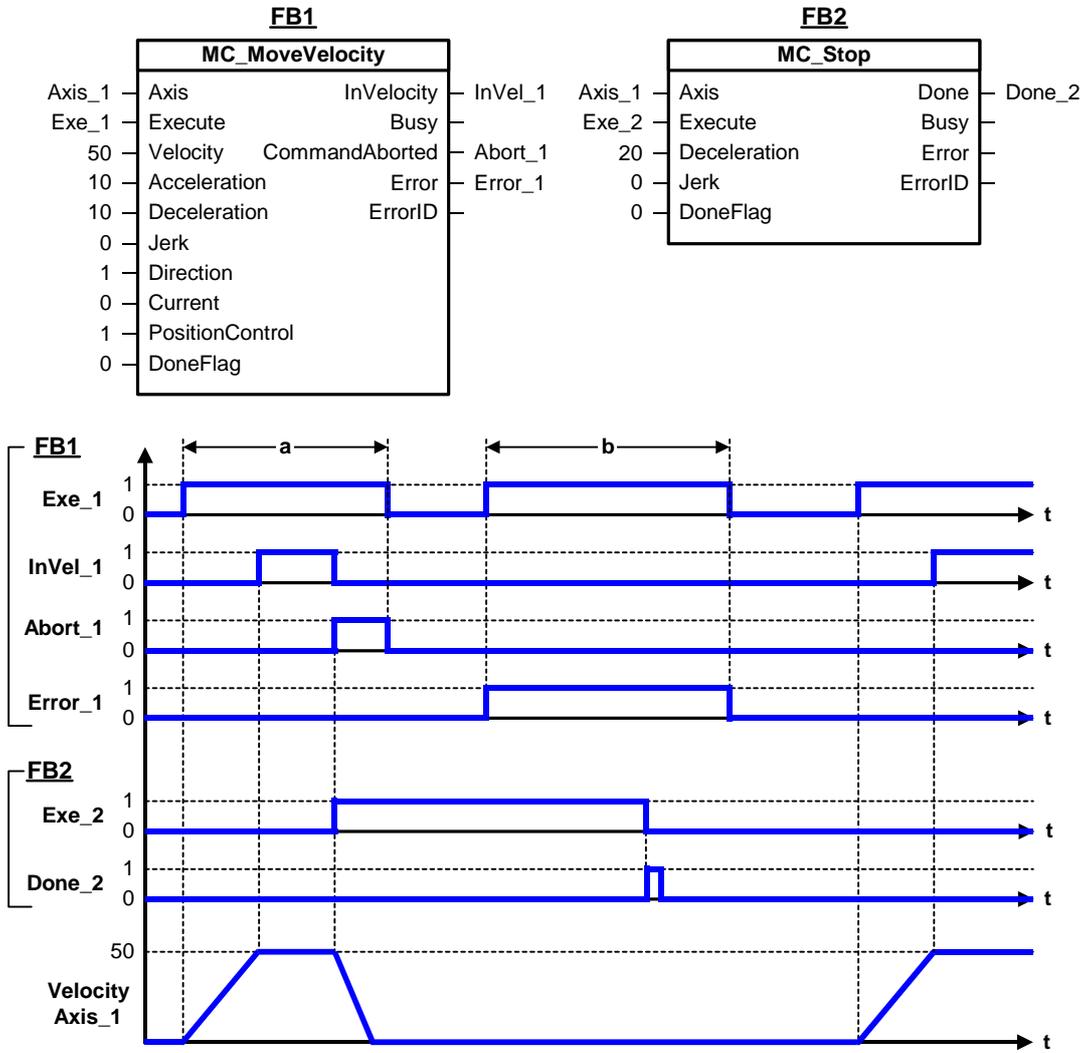
If a numerical value which can not be represented as a REAL value is specified at the *Deceleration* or *Jerk* input parameter, MC_Stop is **not** executed.

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Zero velocity reached and input <i>Execute</i> = FALSE (set for the duration of one cycle)
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_Stop - Example

- a) A rotary axis is ramped down by means of the technology function "MC_Stop."
- b) The axis rejects motion commands as long as parameter *Execute* = *TRUE* at the FB MC_Stop technology function. The MC_MoveVelocity technology function outputs an error message indicating the busy MC_Stop command.



MC_Stop - ErrorIDs

ErrorID	Warning message	Description / to correct or avoid error
0000	No error	-
0021	Dynamic values are being limited	The dynamic values of the command (<i>Deceleration</i> or <i>Jerk</i>) are limited because they exceed the configured limits.
0028	Invalid parameter value was ignored	Illegal value at an input parameter. The default value is used instead. Check the input parameter values and adjust these.

ErrorID	Error message	Description / to correct or avoid error
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8044	Task not supported by the technology object	Send MC_Stop to a cam, for example.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.

ErrorID	Error message	Description / to correct or avoid error
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.2.4 FB 405 MC_Halt - Normal stop

Purpose

- The "MC_Halt" technology function stops all motions and ramps the axis down to standstill.
- At the input parameters *Jerk* and *Deceleration*, you determine the dynamic response within the stop operation.
- The command is terminated when the axis has reached a standstill, or is canceled by a new motion command.
- The standstill position is not defined.

Applicable to

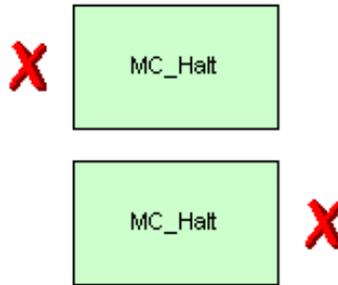
- Velocity axes
- Positioning axes
- Synchronization axes

Requirements

- The axis is enabled for velocity and position control
- No MC_Stop command busy

Overriding commands

MC_Power (*Enable = FALSE*)
 MC_Home (*Mode = 0, 1*)
 MC_Stop
 MC_Halt
 MC_MoveAbsolute (*Mode = 0*)
 MC_MoveRelative (*Mode = 0*)
 MC_MoveAdditive
 MC_MoveToEndPos
 MC_MoveVelocity (*Mode = 0*)
 MC_GearIn
 MC_CamIn



MC_Halt
 MC_Home
 MC_MoveAbsolute
 MC_MoveRelative
 MC_MoveAdditive
 MC_MoveSuperImposed
 MC_MoveVelocity
 MC_MoveToEndPos
 MC_GearIn
 MC_CamIn
 MC_Phasing
 MC_GearOut
 MC_CamOut
 MC_CamInSuperimposed
 MC_CamOutSuperImposed
 MC_GearInSuperImposed
 MC_GearOutSuperimposed
 MC_PhasingSuperimposed

(Cancellation relationships are shown in read direction)

Input parameters

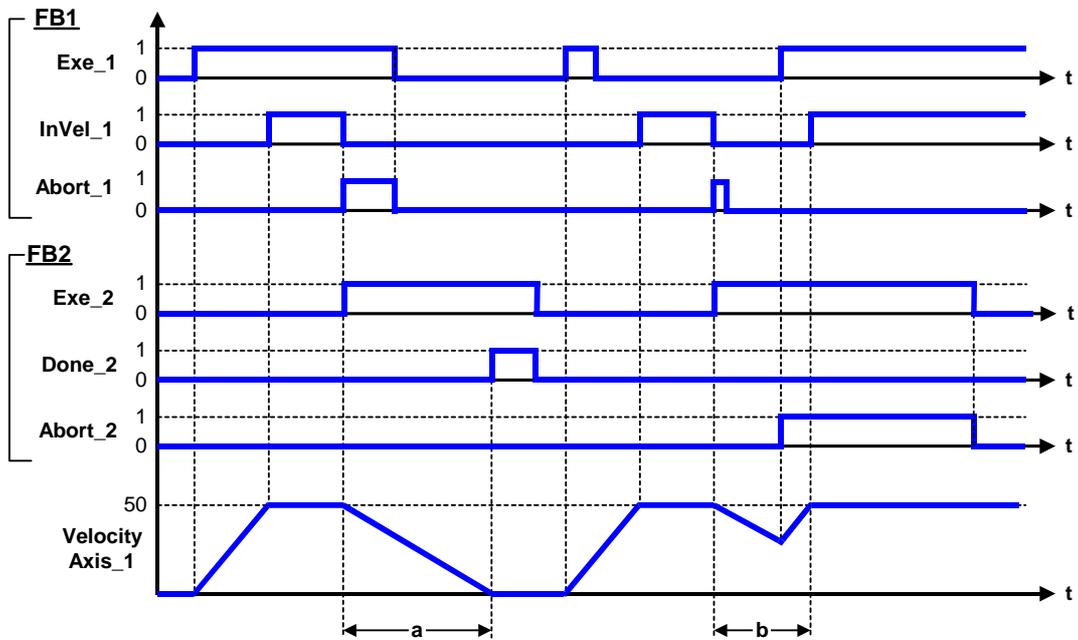
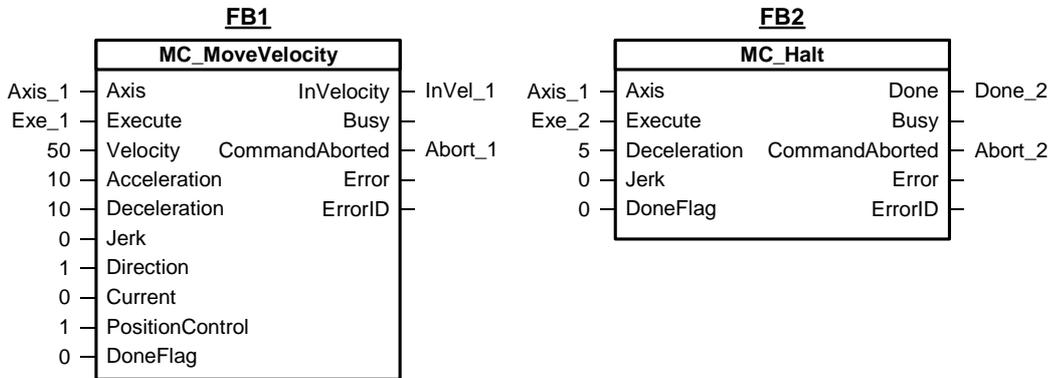
Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
Deceleration	REAL	-1.0	Deceleration (declining motor power): Value > 0: Use the specified value Value = 0: Not permitted (except if the axis is standing still) Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk: Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Zero velocity reached
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_Halt - Example

- a) A rotary axis is ramped down by means of the technology function "MC_Halt."
- b) Another motion command overrides the MC_Halt command. "MC_Halt" allows this, in contrast to "MC_Stop."



MC_Halt - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing. Eliminate and acknowledge all queued errors and then enable the axis in the relevant mode (e.g. position-controlled).
8043	Illegal parameter value	Concerns input parameter <i>DoneFlag</i> .
8044	Task not supported by the technology object	Send MC_Halt to an external encoder, for example.
8045	Illegal command with current status	An MC_Stop command is busy.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)

ErrorID	Error message	Description / to correct or avoid error
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.2.5 FB 409 MC_ChangeDataset - Changing the data set

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The technology function can be used to change between the data records of an axis.
- Several data records can be used, for example, to:
 - Change to other controller data when the system is in RUN.
 - Change the encoder used while the system is in RUN (motor encoder, machine encoder, ...).

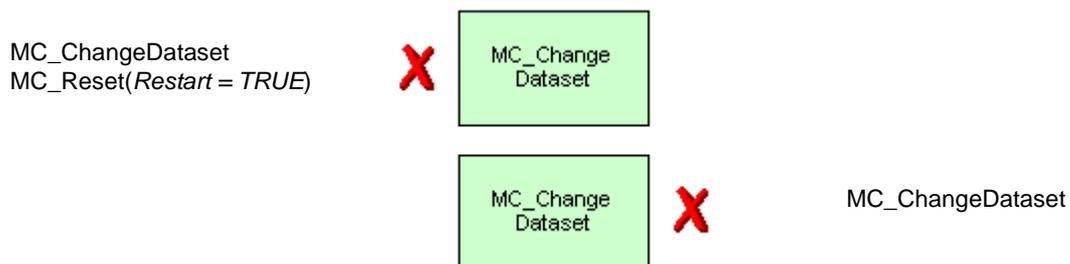
Applicable to

- Velocity axes
- Positioning axes
- Synchronization axes

Requirements

- The corresponding data records must have been configured at the relevant technology object.
- The encoders must be interconnected with the technology object in order to allow their change.

Overriding commands



(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the following axis technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
SyncEncoder	BOOL	FALSE	FALSE: no encoder calibration TRUE: with encoder calibration Input parameter <i>SyncEncoder</i> only has an effect if different encoders were specified in the data records.
Data set	INT	1	Number of the data record to be enabled.
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Data set was changed
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

Data record changeover time

The data record changeover time is determined by the configuration variable *TypeOfAxis.NumberOfDataSets.changeMode*. The variable can assume the values listed below:

- *NEVER*:
Data record changeover not allowed. "MC_ChangeDataset" is canceled with error (*ErrorID = 8045*).
- *IN_POSITION*: (default setting in S7T Config after insertion of an axis)
The data record is changed when the configured positioning window of the active motion is reached.
- *IN_STANDSTILL*:
The data record is changed when the standstill signal of the relevant axis is reached. The data record is changed immediately after the axis has reached standstill.
- *IMMEDIATELY*
The data record is changed immediately.

You can modify this response in the expert list of S7T Config. You could also edit the configuration variable at the technology function "MC_WriteParameter."

Warning

A different gear ratio setting in the data record changeover configuration may cause a jerk at the axis, regardless whether the axis is at a standstill or not

Hence, make sure that the drive is not enabled for position control.

Encoder calibration

If the encoder of the current data record and the new encoder do not match, an encoder calibration is performed based on input parameter *SyncEncoder*. The encoder calibrating function assigns the actual position value of the overridden encoder to the new encoder. After calibration, the function changes the data record.

Both encoders must operate at the same speed in order to ensure their precise calibration. A precise integration into the active process can not be ensured if any slip between the encoders is detected, or if one of the encoders is idle. Within the time expiring between encoder calibration and data record changeover, this would lead to the development of a difference in encoder values which can not be aligned.

Encoder calibration is repeated cyclically if the data record can not be changed immediately.

Warning

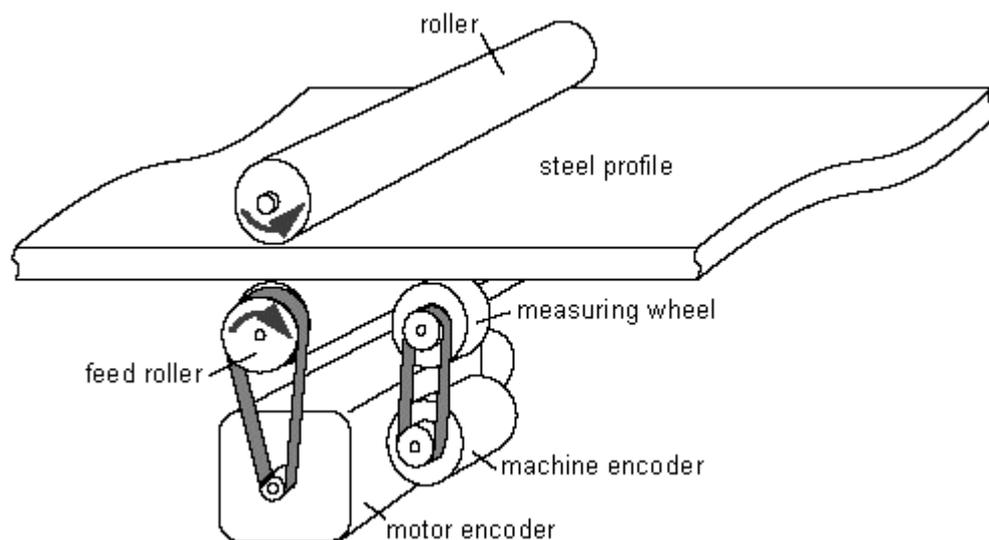
When you change the encoder alongside with the data record and do not calibrate the encoder, the axis may perform a compensating movement as a result of the different encoder positions.

MC_ChangeDataset - Example

The figure below shows the encoder changeover as a typical application of the "MC_ChangeDataset" technology function.

A steel profile produced in the form of infinite material is to be cut to equal lengths in a processing machine. AN additional machine encoder with measuring wheel is installed in order to reduce slip of the feed rollers.

The measuring wheel does not return a position value at the time a new steel profile is fed into the machine; positioning must therefore rely on the motor encoder. A sensor is used to register the position at which the measuring wheel detects the position of the steel profile. The sensor signal is then used with "MC_ChangeDataset" to change over from the motor encoder to the machine encoder (with or without encoder calibration, as required.) After the encoder changeover, the steel profile can be fed precisely for further processing in position-controlled operations.



MC_ChangeDataset - ErrorIDs

Valid for firmware version V3.1.x of the integrated technology

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	Concerns the input parameters <i>Dataset</i> or <i>DoneFlag..</i>
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	Example: <ul style="list-style-type: none"> The configuration variable <i>TypeOfAxis.NumberOfDataSets.changeMode</i> has assumed the value <i>NEVER</i>. Data set changeover is not possible. The technology object is currently being restarted with "MC_Reset."
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.

ErrorID	Error message	Description / to correct or avoid error
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.

6.2.6 FB 410 MC_MoveAbsolute - Absolute positioning

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_MoveAbsolute" technological function starts a the approach of the axis to an absolute position.
- Use the input parameters *Velocity*, *Jerk*, *Acceleration*, *Deceleration* to define the dynamic response during axis movement.
- The function is terminated when the destination position is reached.
- You can preset the direction of rotation of modulo axes.
- At input parameter *Mode* you can specify whether to trigger an active motion, to overlay the current motion, or to append the motion.

Applicable to

- Positioning axes
- Synchronization axes

Requirements

- The axis is enabled for position control
- The axis is homed, if "Homing required" was selected in the configuration
- No MC_Stop command busy
- Valid for appended and overlaying motions (*mode = 1, 2*):
 - A MC_CamIn or MC_GearIn has not been started
 - No synchronized operation.

Overriding commands

MC_MoveAbsolute (*Mode = 0*)
 MC_Power (*Enable = FALSE*)
 MC_Home (*Mode=0, 1*)
 MC_Stop
 MC_Halt
 MC_MoveRelative (*Mode = 0*)
 MC_MoveAdditive
 MC_MoveToEndPos
 MC_MoveVelocity (*Mode = 0*)
 MC_GearIn
 MC_CamIn



MC_MoveAbsolute
 Mode=0

MC_MoveAbsolute
 Mode=0



MC_MoveAbsolute (*Mode=0-2*)
 MC_Home
 MC_Halt
 MC_MoveRelative (*Mode=0-2*)
 MC_MoveAdditive
 MC_MoveSuperImposed
 MC_MoveVelocity (*Mode=0, 1*)
 MC_MoveToEndPos
 MC_GearIn
 MC_CamIn
 MC_Phasing
 MC_GearOut
 MC_CamOut
 MC_GearInSuperImposed
 MC_GearOutSuperImposed
 MC_PhasingSuperImposed
 MC_GearOutSuperImposed
 MC_CamOutSuperImposed

MC_MoveAbsolute (*Mode = 0*)
 MC_MoveAbsolute (*Mode=1,2*)*
 MC_Power (*Enable = FALSE*)
 MC_Home (*Mode=0, 1*)
 MC_Stop
 MC_Halt
 MC_MoveRelative (*Mode = 0*)
 MC_MoveRelative (*Mode=1,2*)*
 MC_MoveAdditive
 MC_MoveToEndPos
 MC_MoveVelocity (*Mode = 0*)
 MC_MoveVelocity (*Mode=1*)*
 MC_GearIn
 MC_CamIn



MC_MoveAbsolute
 Mode=1,2

MC_MoveAbsolute
 Mode=1,2



MC_MoveAbsolute (*Mode=1,2*)
 MC_MoveRelative(*Mode=1,2*)
 MC_MoveVelocity(*Mode=1*)

*

* Cancellation is possible as long as the motion is not activated.
 (Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
Position	REAL	0.0	Target position (negative or positive)
Velocity	REAL	-1.0	Maximum velocity (is not always reached): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Acceleration	REAL	-1.0	Acceleration (increasing motor power): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Deceleration	REAL	-1.0	Deceleration (declining motor power): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk: Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
Direction	INT	0	Direction preset for modulo axes: Value = 0: default in S7T Config * Value = 1: Positive sense of direction Value = 2: Shortest distance Value = 3: Negative sense of direction Value = 4: Current sense of direction (last used sense of direction)
Mode	INT	0	Override mode: Value = 0: Override motion: The current motion is canceled Value = 1: Append motion: The motion command is written to the command buffer the axis is stopped at the motion transition Value = 2: Overlay motion: The motion command is written to the command buffer the motion transition is overwritten
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

* Selection of the direction with "Determine based on sign of velocity setpoint" in the default setting of S7T Config is not useful, because negative velocity setpoint values can not be set at input parameter *Velocity*.

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Destination position reached
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_MoveAbsolute - Example of "Override motion"

The signal profile below shows the override reaction of the (*Mode = 0*) "MC_MoveAbsolute" technology function.

Phase "a"

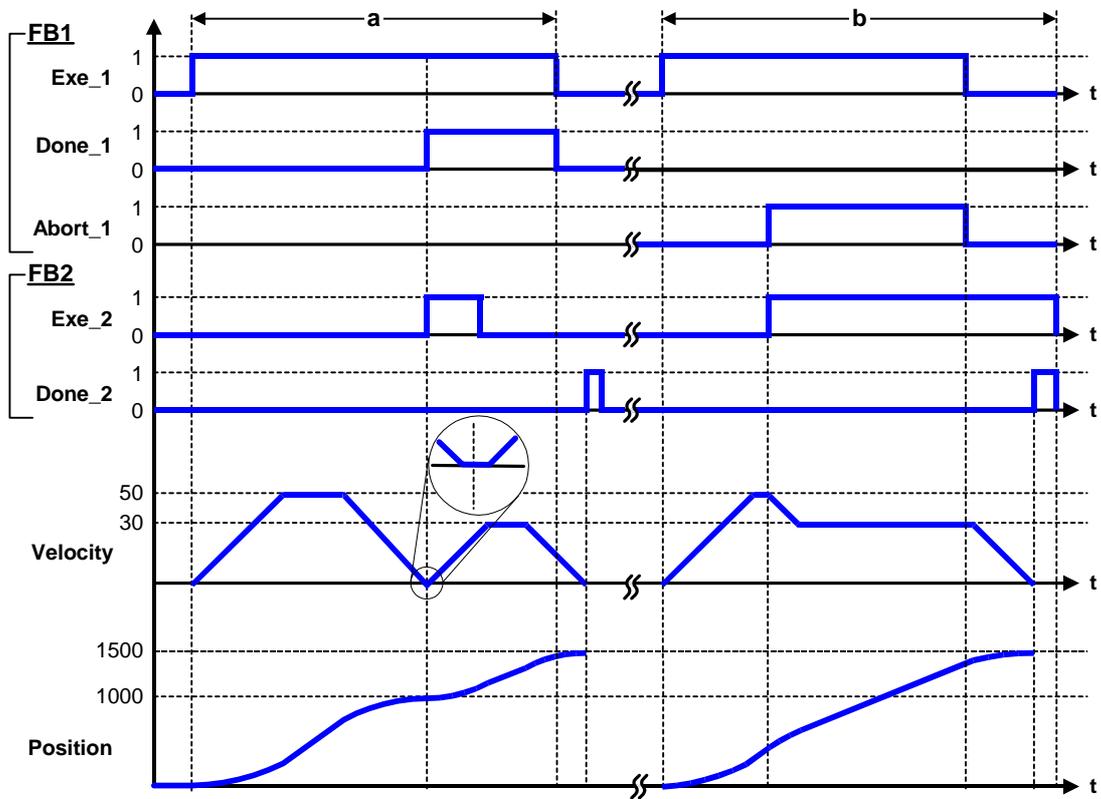
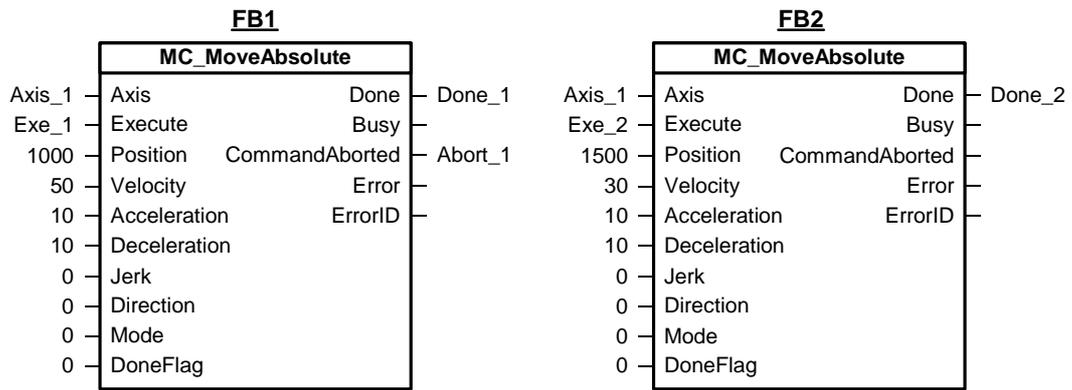
The first positive edge at input parameter *Execute (Exe_1)* of FB1 starts absolute positioning of the axis (*Axis_1*). *Done_1* reports that the absolute destination position *1000* has been reached.

In time with *Done_1 = TRUE*, the system starts a further positioning command at FB2 (input parameter *Execute (Exe_2)*). Reaction times during command execution lead to a brief standstill of the axis (see the zoomed visualization.) After this standstill, the axis approaches the (*Axis_1*) absolute position *1500*. *Done_2* outputs a corresponding signal when this position is reached.

Phase "b"

A further positive edge at input parameter *Execute (Exe_1)* of FB1 starts absolute positioning of the axis (*Axis_1*).

A further positioning command is started at FB2 before the destination position *1000* is reached (input parameter *Execute (Exe_2)*). *Abort_1* reports the cancellation of the current positioning command at FB1. The axis (*Axis_1*) is driven at the specified deceleration *Deceleration = 10* until it has reached *Velocity = 30*. *Done_2* outputs a message when the destination position *1500* is reached.



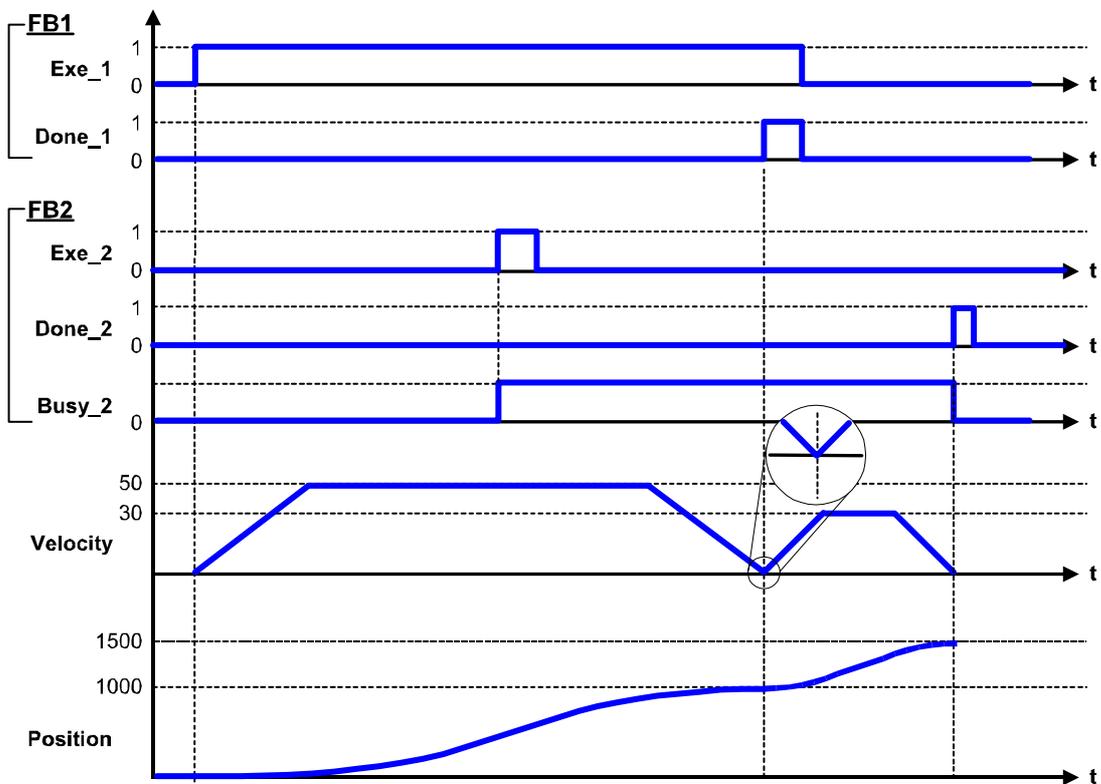
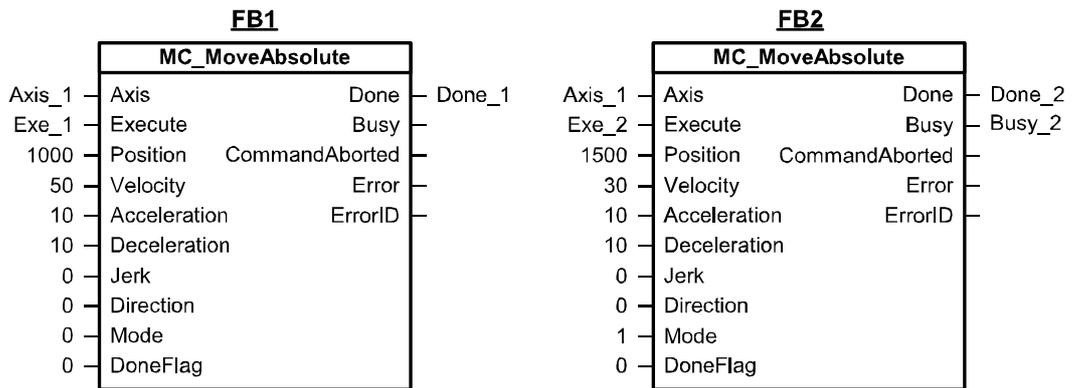
MC_MoveAbsolute - Example of "Append motion"

The signal profile below shows the "appending" reaction of the (*Mode = 1*) "MC_MoveAbsolute" technology function.

Absolute positioning is started with a positive edge at input parameter *Execute* (*Exe_1*) of FB1. The axis (*Axis_1*) accelerates to its final velocity *50* based on the set acceleration ramp (*Acceleration = 10*.) Before it reaches the destination position (*Position = 1000*), a further MC_MoveAbsolute command is started (positive edge *Exe_2* at FB2.) *Busy_2* reports that the new command is busy.

The current positioning command is not aborted, but rather "appended" by setting *Mode = 1* at FB2. "MC_MoveAbsolute" decelerates the axis with *Deceleration = 10*, and then approaches the destination position *1000*, According to the initiated command. Completion of the command is reported with *Done_1*.

When the destination position *1000* is reached, the system appends the second MC_MoveAbsolute command for immediate execution without time gap (see the zoom view.) The axis (*Axis_1*) approaches the destination position *1500*, based on the default acceleration and deceleration values. *Done_2* outputs a message when the destination position is reached, and *Busy_2* is toggled to *FALSE*.



MC_MoveAbsolute - Example of "Overlay motion 1"

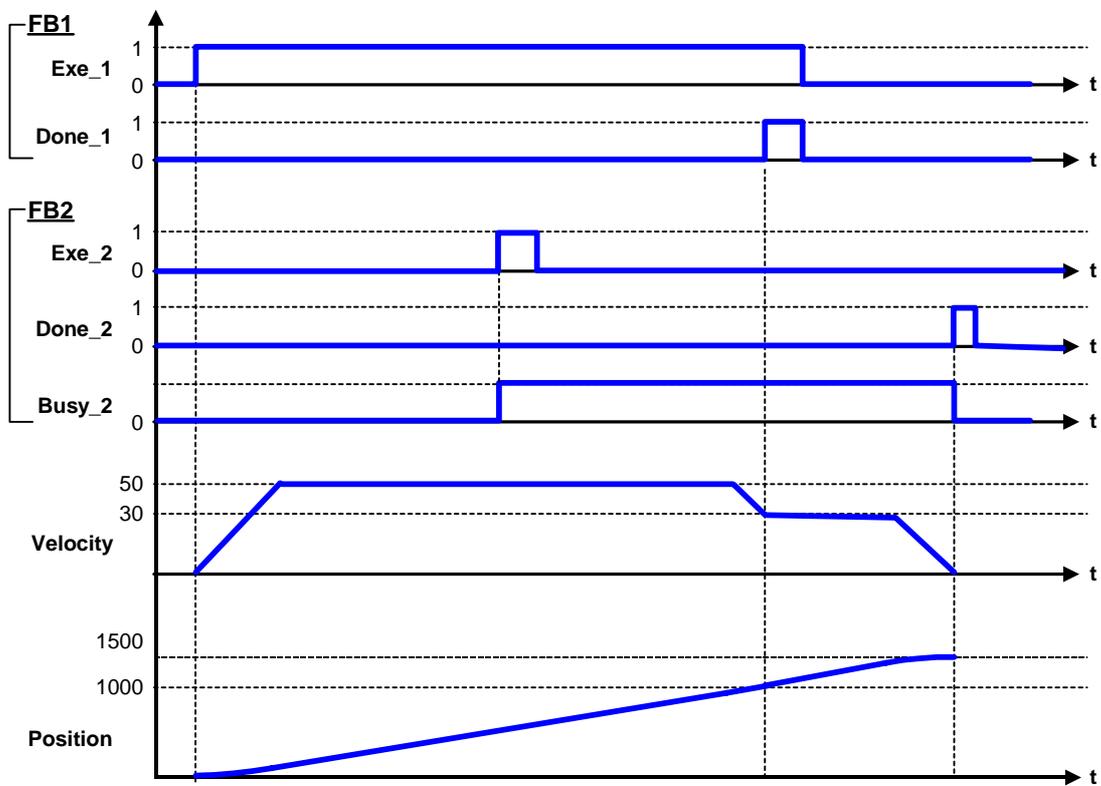
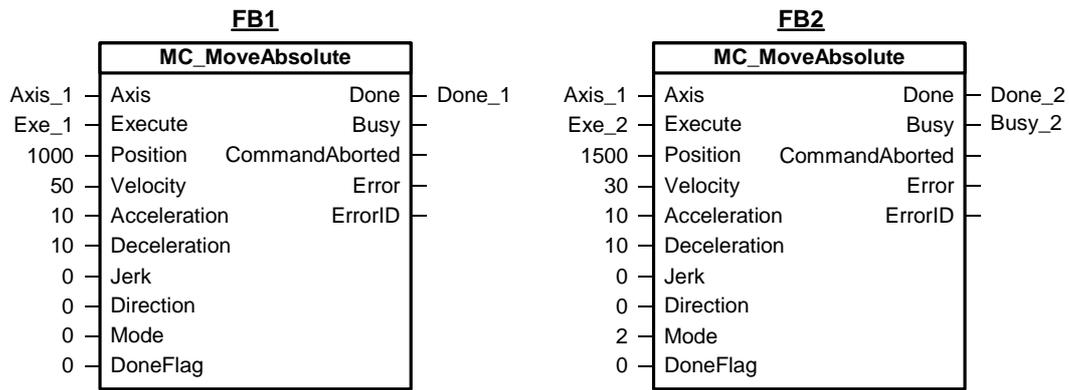
The signal profile shown below shows the "overlying" behavior of the technology function "MC_MoveAbsolute" (*Mode* = 2) in situations where the current velocity exceeds the new velocity.

Current velocity > new velocity

Absolute positioning is started with a positive edge at input parameter *Execute* (*Exe_1*) of FB1. The axis (*Axis_1*) accelerates to its final velocity 50 based on the set acceleration ramp (*Acceleration* = 10.) Before it reaches the destination position (*Position* = 1000), a further MC_MoveAbsolute command is started (positive edge *Exe_2* at FB2.) *Busy_2* reports that the new command is busy.

The current positioning command is not canceled, but rather "overlaid" by setting *Mode* = 2 at FB2. "MC_MoveAbsolute" decelerates with *Deceleration* = 10, so that the final velocity 30 defined in the overlying MC_MoveAbsolute command is reached at destination position 1000. Completion of the command is reported with *Done_1* at FB1.

After it reaches the destination position 1000, the axis (*Axis_1*) continues operation at a velocity of 30 and approaches the destination position 1500 with *Deceleration* = 10. *Done_2* reports the destination position, and *Busy_2* is toggled to *FALSE*.



MC_MoveAbsolute - Example of "Overlay motion 2"

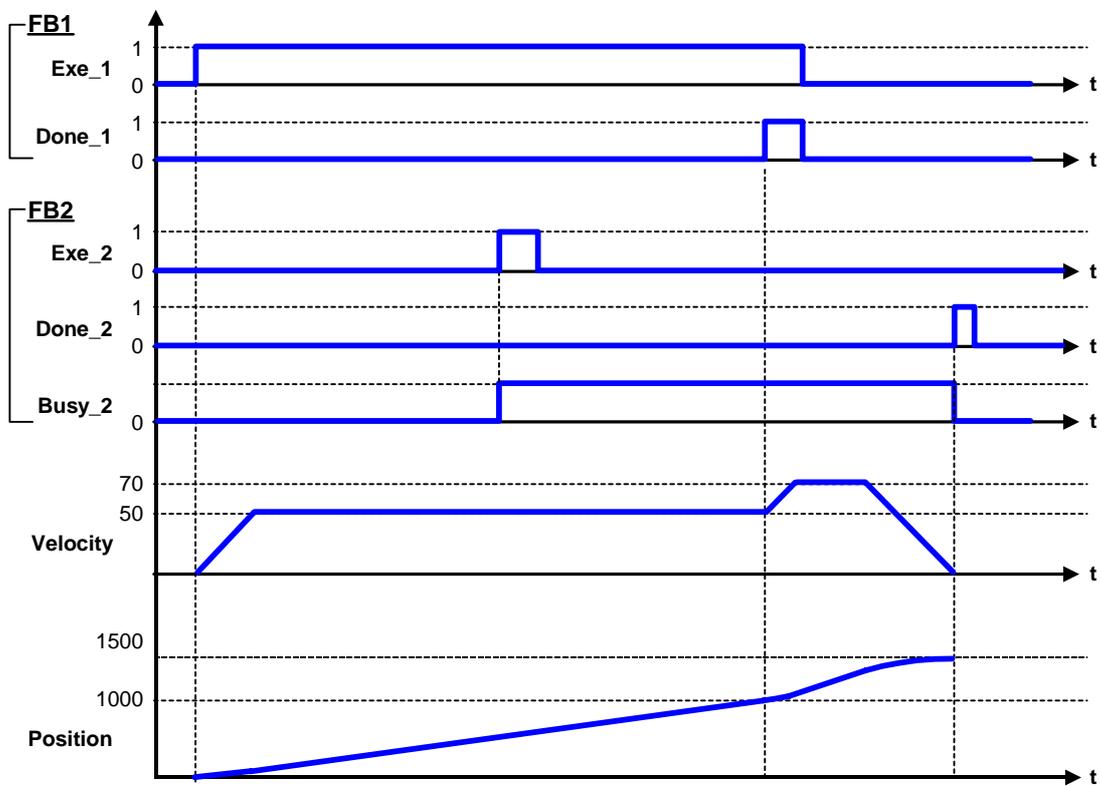
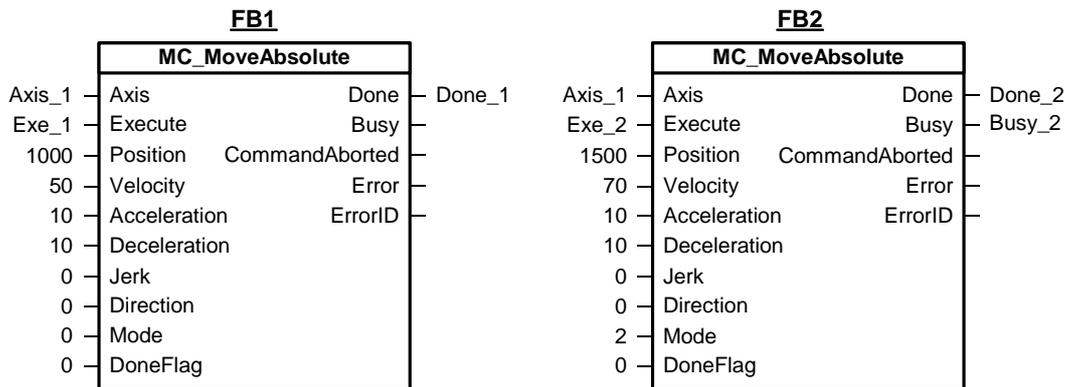
The signal profile shown below shows the "overlying" response of the technology function "MC_MoveAbsolute" (*Mode* = 2) in situations where the current velocity lower than the new velocity.

Current velocity new velocity

Absolute positioning is started with a positive edge at input parameter *Execute* (*Exe_1*) of FB1. The axis (*Axis_1*) accelerates to its final speed 50 based on the set acceleration ramp (*Acceleration* = 10.) Before it reaches the destination position (*Position* = 1000), a further MC_MoveAbsolute command is started (positive edge *Exe_2* at FB2.) *Busy_2* reports that the new command is busy.

The current positioning command is not canceled, but rather "overlaid" by setting *Mode* = 2 at FB2. "MC_MoveAbsolute" approaches destination position 1000 at the final speed 50 set by the first command. *Done_1* reports completion of the command at FB1.

After it has reached destination position 1000, the axis accelerates (*Axis_1*) with *Acceleration* = 10 to the final speed 70 set by the second command. The axis approaches destination position 1500 with *Deceleration* = 10. *Done_2* reports the destination position at FB2, and *Busy_2* is toggled to *FALSE* state.



MC_MoveAbsolute - Example of "Overlay motion 3"

The signal profile below shows the "overlapping" reaction of the (*Mode = 2*) "MC_MoveAbsolute" technology function with reversal.

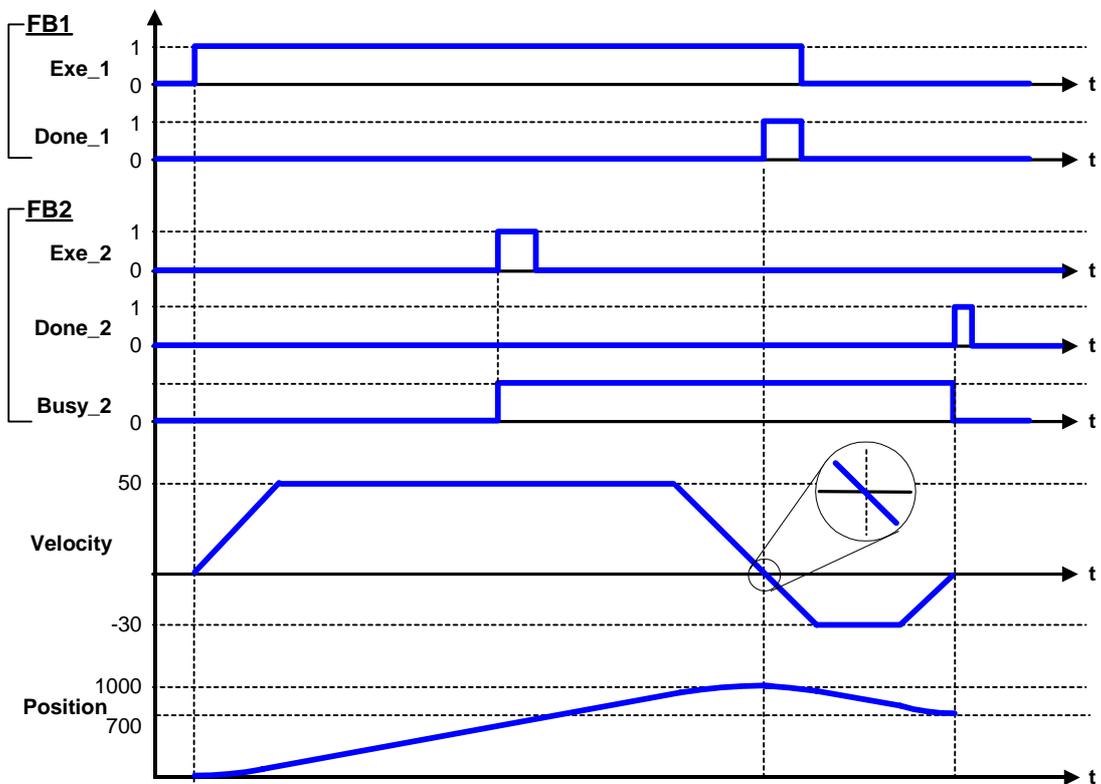
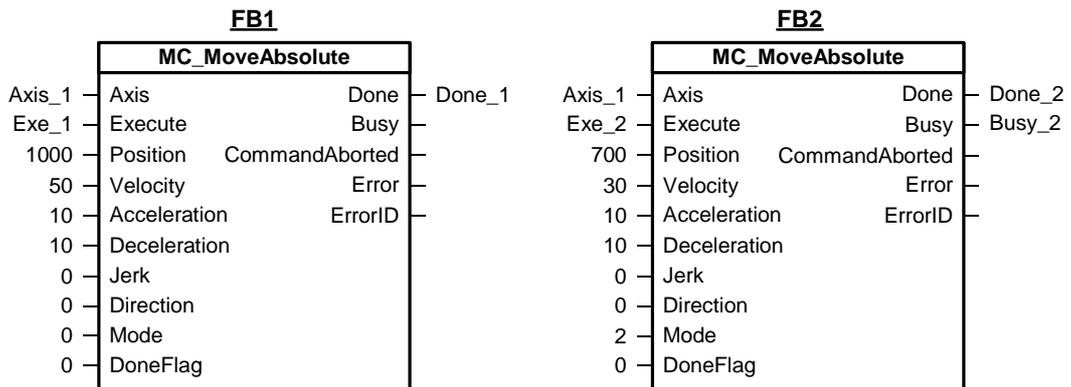
Reversal

Absolute positioning is started with a positive edge at input parameter *Execute* (*Exe_1*) of FB1. The axis (*Axis_1*) accelerates to its final speed *50* based on the set acceleration ramp (*Acceleration = 10*.) Before it reaches the destination position (*Position = 1000*), a further MC_MoveAbsolute command is started (positive edge *Exe_2* at FB2.) *Busy_2* reports that the new command is busy.

The current positioning command is not canceled, but rather "overlaid" by setting *Mode = 2* at FB2. The value of destination position *1000* of the currently busy MC_MoveAbsolute command is higher than destination position *700*. The next MC_MoveAbsolute must therefore reverse the sense of direction.

"MC_MoveAbsolute" decelerates the axis with *Deceleration = 10* in order to reach *0* at destination position *1000*. Completion of the command is reported with *Done_1* at FB1.

After it has reached destination position *1000*, the axis decelerates (*Axis_1*) with *Acceleration = 10* to the final speed *-30*. This is a bumpless transition, as the zoomed view shows. The axis approaches destination position *700* with *Deceleration = 10*. *Done_2* reports the destination position at FB2, and *Busy_2* is toggled to *FALSE* state.



MC_MoveAbsolute - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing. Eliminate and acknowledge all queued errors and then enable the axis in the relevant mode (e.g. position-controlled).
8043	Illegal parameter value	Concerns the input parameters <i>Direction</i> or <i>DoneFlag..</i>
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	MC_Stop is busy
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)

ErrorID	Error message	Description / to correct or avoid error
8055	Saving motion not allowed in current state	A save command can not be accepted at the current axis state. Reasons: <ul style="list-style-type: none"> • The axis is to be synchronized, or this synchronization process is currently busy. • Axis moves in synchronism.
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	Invalid floating-point format of at least one input parameter value. Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).

6.2.7 FB 411 MC_MoveRelative - Relative positioning

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_MoveRelative" technology starts an axis motion at a position relative position to the start position.
If the axis was already in motion at the start of command execution and a "motion override" was set with *Mode* = 0, the system uses its internal start position which is valid the start of command execution. Allowances must be made for the reaction time between the execution of a technology function and of a command, based on the load and cycle time.
- Use the input parameters *Velocity*, *Jerk*, *Acceleration*, *Deceleration* to define the dynamic response during axis movement.
- At input parameter *Mode* you can specify whether to trigger an active motion, to overlay the current motion, or to append the motion.

Applicable to

- Positioning axes
- Synchronization axes

Requirements

- The axis is enabled for position control
- No MC_Stop command busy
- Valid for saving and overlaying motions (*mode* = 1, 2):
 - An "MC_CamIn" or "MC_GearIn" has not been started
 - No synchronized operation.

Overriding commands

MC_MoveRelative (Mode = 0)
 MC_Power (Enable = FALSE)
 MC_Home (Mode=0, 1)
 MC_Stop
 MC_Halt
 MC_MoveAbsolute (Mode = 0)
 MC_MoveAdditive
 MC_MoveToEndPos
 MC_MoveVelocity (Mode = 0)
 MC_GearIn
 MC_CamIn



MC_MoveRelative
 Mode=0

MC_MoveRelative
 Mode=0



MC_MoveRelative (Mode=0-2)
 MC_MoveAbsolute (Mode=0-2)
 MC_Home
 MC_Halt
 MC_MoveAdditive
 MC_MoveSuperImposed
 MC_MoveVelocity (Mode=0, 1)
 MC_MoveToEndPos
 MC_GearIn
 MC_CamIn
 MC_Phasing
 MC_GearOut
 MC_CamOut
 MC_GearInSuperImposed
 MC_GearOutSuperImposed
 MC_PhasingSuperImposed
 MC_GearOutSuperImposed
 MC_CamOutSuperImposed

MC_MoveRelative (Mode = 0)
 MC_MoveRelative (Mode=1,2)*
 MC_Power (Enable = FALSE)
 MC_Home (Mode=0, 1)
 MC_Stop
 MC_Halt
 MC_MoveAbsolute (Mode = 0)
 MC_MoveAbsolute (Mode=1,2)*
 MC_MoveAdditive
 MC_MoveToEndPos
 MC_MoveVelocity (Mode = 0)
 MC_MoveVelocity (Mode=1)*
 MC_GearIn
 MC_CamIn



MC_MoveRelative
 Mode=1,2

MC_MoveRelative
 Mode=1,2



MC_MoveRelative (Mode = 1,2)

*

* Cancellation is possible as long as the motion is not activated.

(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
Distance	REAL	0.0	Positioning distance (negative or positive)
Velocity	REAL	-1.0	Maximum velocity (is not always reached): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Acceleration	REAL	-1.0	Acceleration (increasing motor power): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Deceleration	REAL	-1.0	Deceleration (declining motor power): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk: Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
Mode	INT	0	Override mode: Value = 0: Override motion: The current motion is canceled Value = 1: Append motion: The motion command is written to the command buffer. The axis stops at the motion transition Value = 2: Overlay motion: The motion command is written to the command buffer. The motion transition is overlaid.
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Destination position reached
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_MoveRelative - Example of "Override motion"

The signal profile below shows the override reaction of the (*Mode = 0*) "MC_MoveRelative" technology function.

Phase "a"

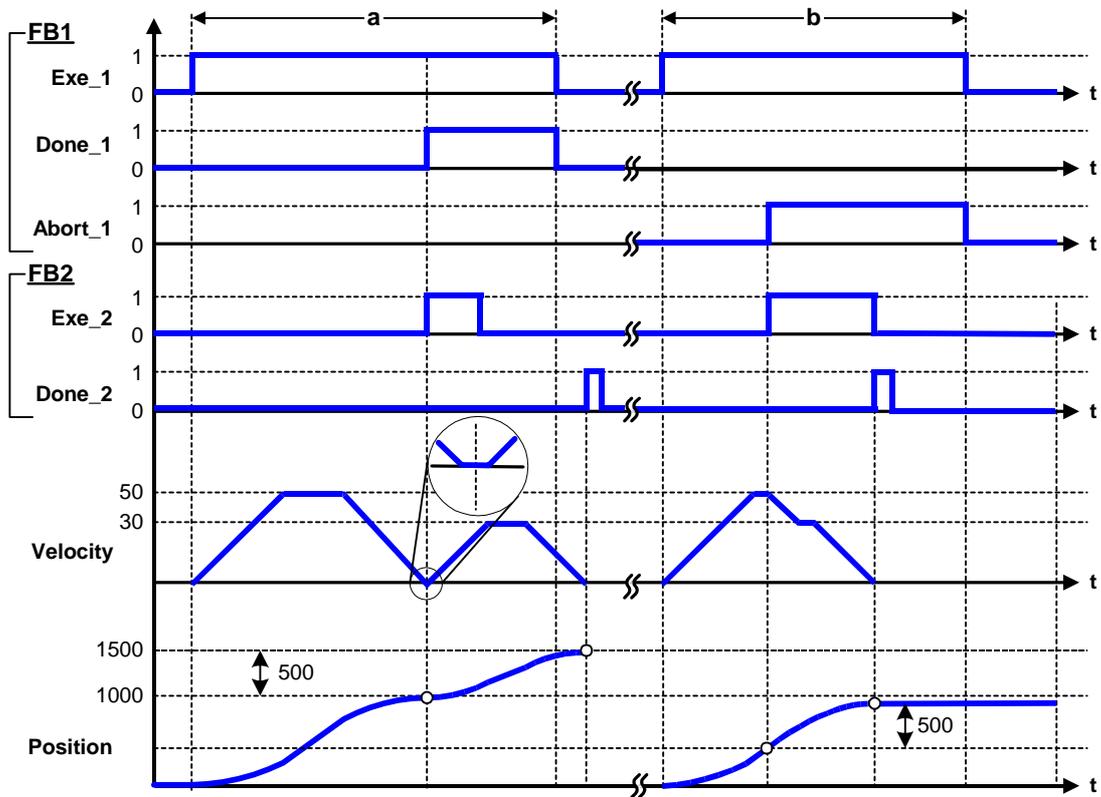
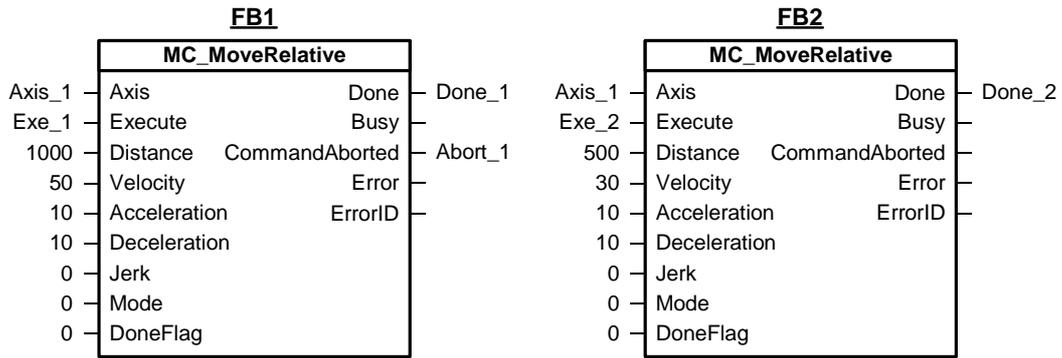
The first positive edge at input parameter *Execute* (*Exe_1*) of FB1 starts relative positioning of the axis (*Axis_1*). *Done_1* changes to *TRUE* when *Distance = 1000* is reached.

In time with *Done_1 = TRUE*, the system starts a further relative positioning command at FB2 (input parameter *Execute* (*Exe_2*)). Reaction times during command execution lead to a brief standstill of the axis (see the zoomed visualization.) After a brief stop, the axis (*Axis_1*) continues moving by a distance of *500*. *Done_2* reports conclusion of the command.

Phase "b"

A further positive edge at input parameter *Execute* (*Exe_1*) of FB1 starts relative positioning of the axis (*Axis_1*).

A further positioning command is started at FB2 before the destination position *1000* is reached (input parameter *Execute* (*Exe_2*)). *Abort_1* reports the cancellation of the current positioning command at FB1. The axis (*Axis_1*) is driven at the specified deceleration *Deceleration = 10* until it has reached *Velocity = 30*. *Done_2* outputs a message at FB2 when the axis has passed the *Distance = 500*.



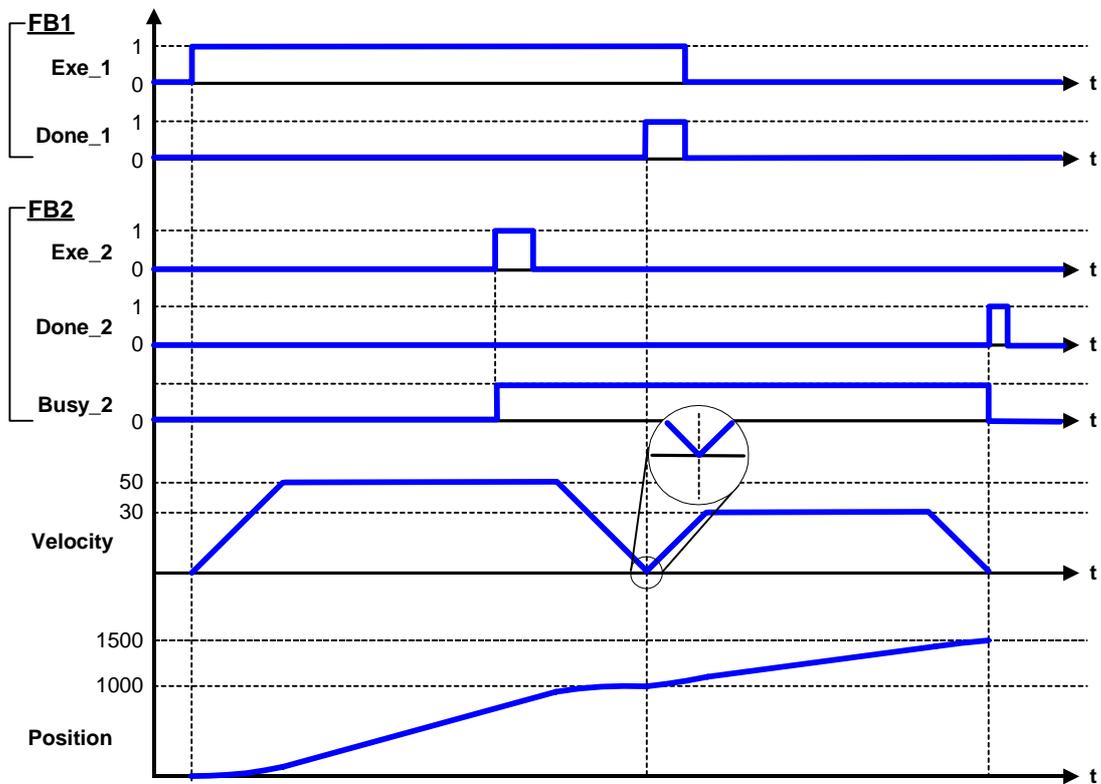
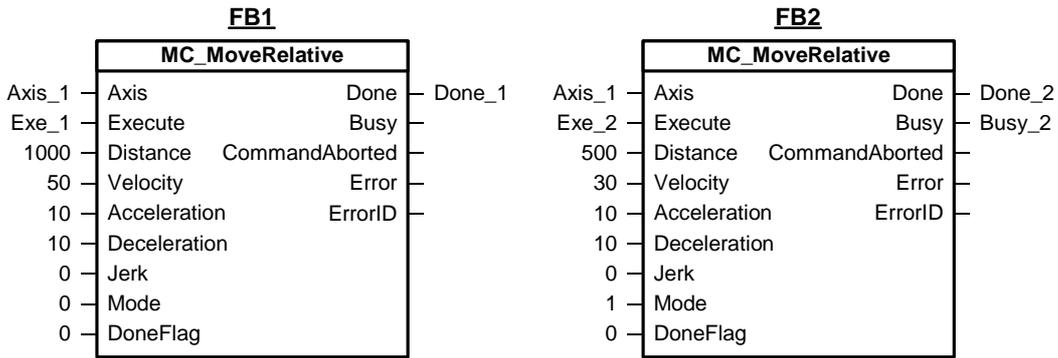
MC_MoveRelative - Example of "Append motion"

The signal profile below shows the "appending" reaction of the "MC_MoveRelative" technology function (*Mode = 1*).

Relative positioning is started with a positive edge at input parameter *Execute* (*Exe_1*) of FB1. The axis (*Axis_1*) accelerates to its final speed *50* based on the set acceleration ramp (*Acceleration = 10*.) Before it has traversed the specified distance (*Distance = 1000*), a further MC_MoveRelative command is started (positive edge *Exe_2* at FB2.) *Busy_2* reports that the new command is busy.

The current relative positioning command is not aborted, but rather "appended" by setting *Mode = 1* at FB2. "MC_MoveAbsolute" decelerates at *Deceleration = 10*, and travels the axis according to the initiated command by a distance of *1000*. *Done_1* reports completion of the command.

After the axis has traversed the distance *1000*, the system appends the second MC_MoveAbsolute motion command for immediate execution without time gap (see the zoom view.) The (*Axis_1*) moves by a distance of *500*, according to the set acceleration and deceleration values. *Done_2* is toggled to *TRUE* state, and *Busy_2* is toggled to *FALSE* state, if the axis has moved by a distance *Distance = 500*.



MC_MoveRelative - Example of "Overlay motion 1"

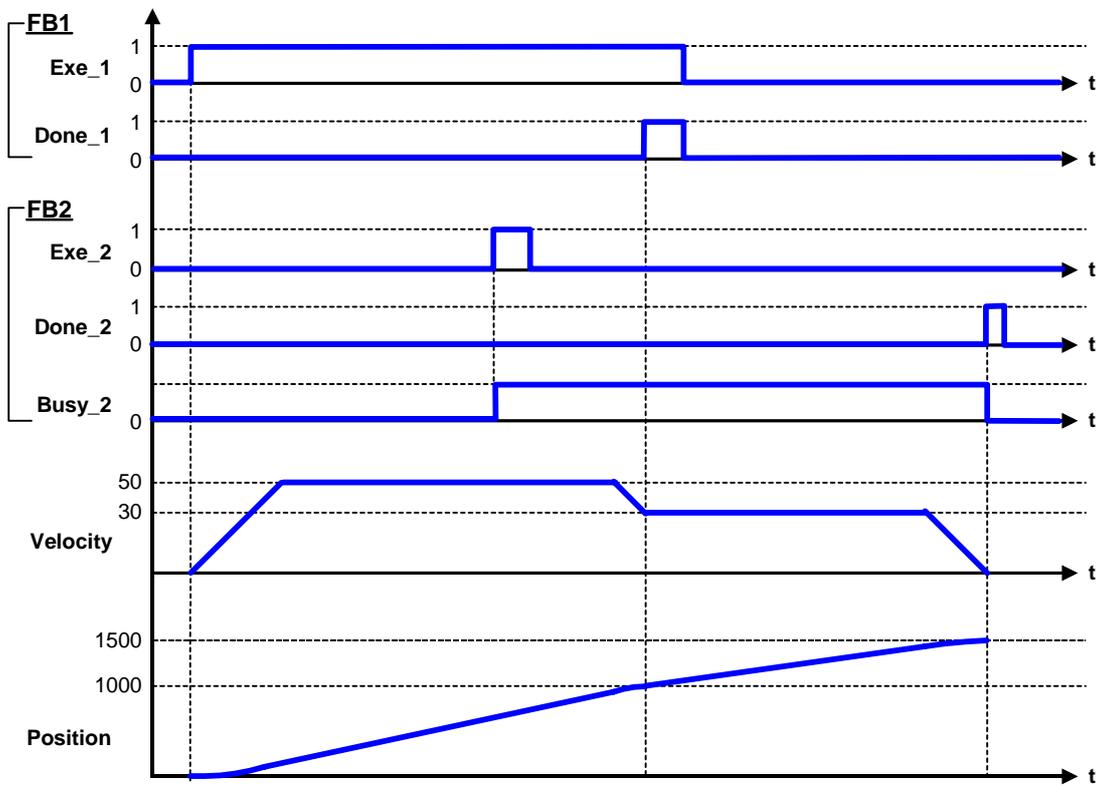
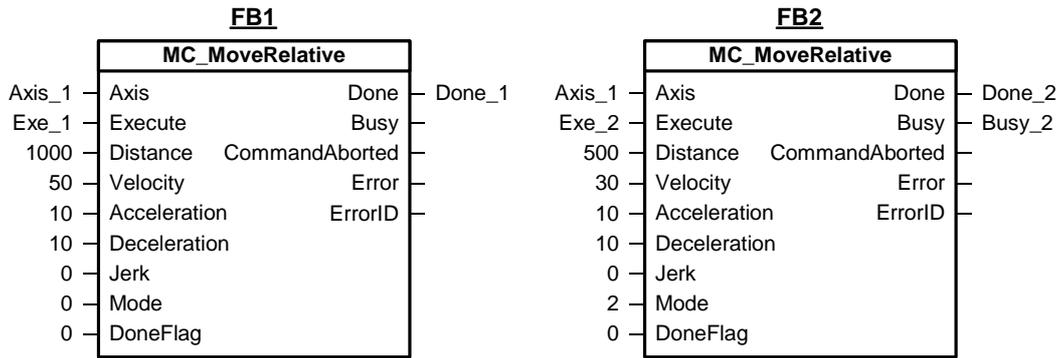
The signal profile shown below shows the "overlying" response of the technology function "MC_MoveRelative" (*Mode = 2*) in situations where the current speed exceeds the new speed.

Current speed > new speed

Relative positioning is started with a positive edge at input parameter *Execute* (*Exe_1*) of FB1. The axis (*Axis_1*) accelerates to its final speed *50* based on the set acceleration ramp (*Acceleration = 10*.) Before it has traversed the specified distance (*Distance = 1000*), a further MC_MoveRelative command is started (positive edge *Exe_2* at FB2.) *Busy_2* reports that the new command is busy.

The current positioning command is not canceled, but rather "overlaid" by setting *Mode = 2* at FB2. "MC_MoveRelative" decelerates the axis with *Deceleration = 10* in order to reach the final speed of *30* set by the overlying MC_MoveRelative command, after the axis has covered the distance *1000*. Completion of the command is reported with *Done_1* at FB1.

After it has covered the distance of *1000*, the axis (*Axis_1*) continues to move at a speed of *30*. The (*Axis_1*) moves by a distance of *500*, according to the set speed and deceleration values. *Done_2* is toggled to *TRUE* state, and *Busy_2* is toggled to *FALSE* state, if the axis has covered the distance *Distance = 500*.



MC_MoveRelative - Example of "Overlay motion 2"

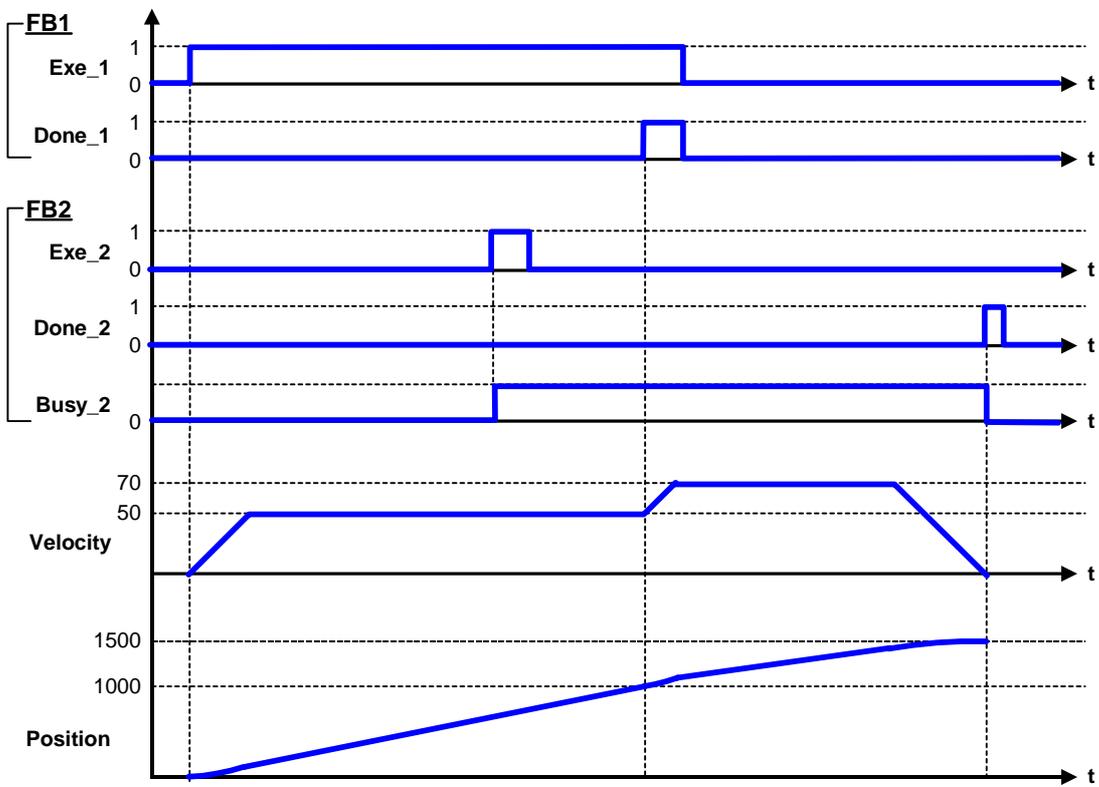
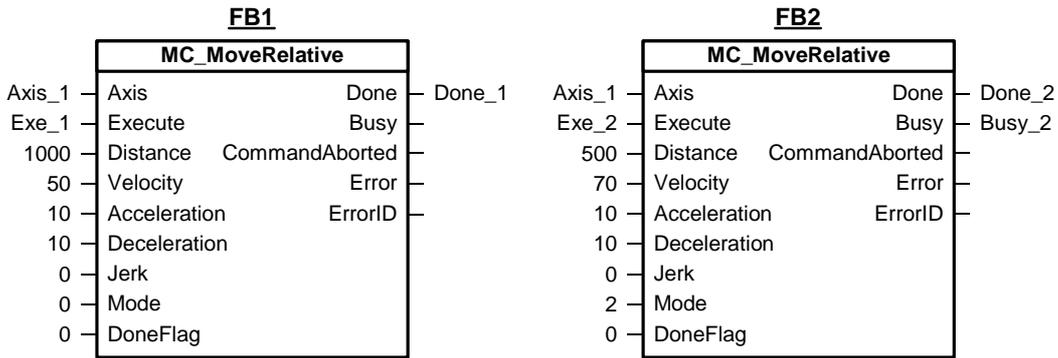
The signal profile shown below shows the "overlying" response of the technology function "MC_MoveRelative" (*Mode = 2*) in situations where the current speed is lower than the new speed.

Current speed new speed

Relative positioning is started with a positive edge at input parameter *Execute* (*Exe_1*) of FB1. The axis (*Axis_1*) accelerates to its final speed 50 based on the set acceleration ramp (*Acceleration = 10*.) Before it has traversed the specified distance (*Distance = 1000*), a further MC_MoveRelative command is started (positive edge *Exe_2* at FB2.) *Busy_2* reports that the new command is busy.

The current positioning command is not canceled, but rather "overlaid" by setting *Mode = 2* at FB2. "MC_MoveRelative" moves the axis along the distance to go at the final speed 50. *Done_1* reports completion of the command at FB1.

After it has covered the distance 1000, the axis accelerates (*Axis_1*) with *Acceleration = 10* to the final speed 70 set by the second command. The axis (*Axis_1*) covers the distance to go at the set speed and deceleration. *Done_2* is toggled to *TRUE*, and *Busy_2* is toggled to *FALSE state*, after the axis has covered the distance *Distance = 500*.



MC_MoveRelative - Example of "Overlay motion 3"

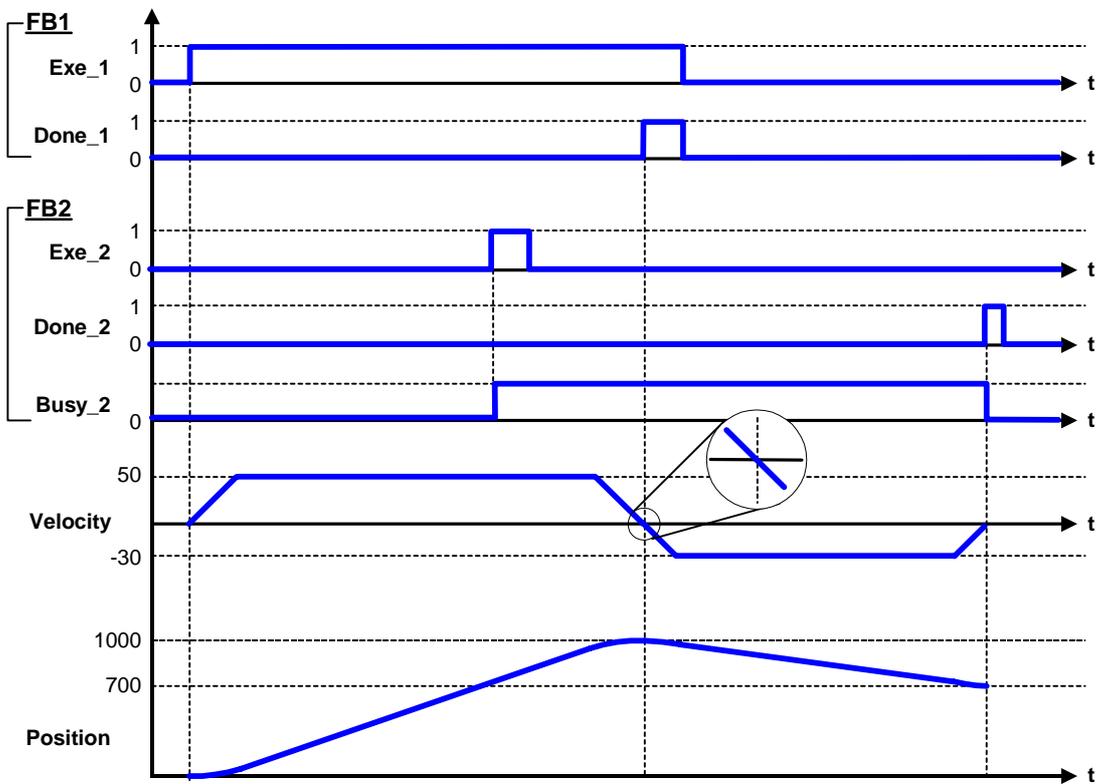
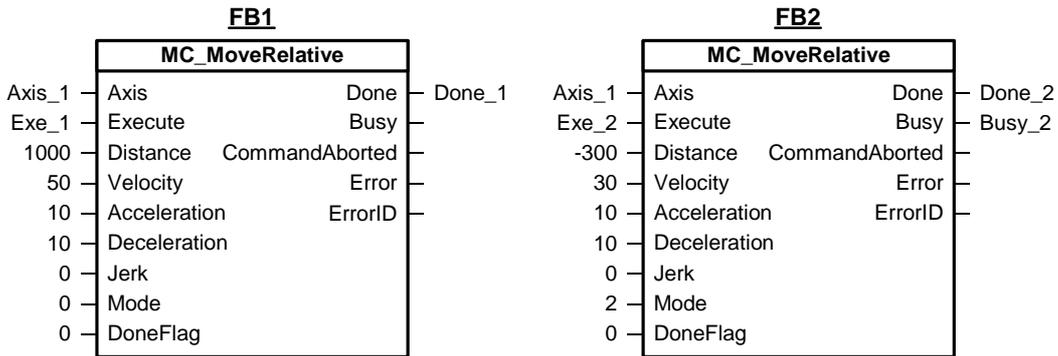
The signal profile below shows the "overlapping" reaction of the (*Mode = 2*) "MC_MoveRelative" technology function with reversal.

Reversal

Relative positioning is started with a positive edge at input parameter *Execute* (*Exe_1*) of FB1. The axis (*Axis_1*) accelerates to its final speed *50* based on the set acceleration ramp (*Acceleration = 10*.) Before it has traversed the specified distance (*Distance = 1000*), a further MC_MoveRelative command is started (positive edge *Exe_2* at FB2.) *Busy_2* reports that the new command is busy.

The current positioning command is not canceled, but rather "overlaid" by setting *Mode = 2* at FB2. The sense of direction is reversed, because a negative distance was set at FB2 (*Distance = -300*). "MC_MoveAbsolute" decelerates the axis with *Deceleration = 10* in order to reach *0* speed after the axis has covered the distance of *1000*. Completion of the command is reported with *Done_1* at FB1.

After it has covered the distance *1000*, the axis accelerates (*Axis_1*) with *Acceleration = 10* to a speed of *-30*. This is a bumpless transition, as the zoomed view shows. The axis (*Axis_1*) covers the distance to go at the set speed and deceleration. *Done_2* is toggled to *TRUE*, and *Busy_2* is toggled to *FALSE* state, after the axis has covered the distance *Distance -300*.



MC_MoveRelative - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing. Eliminate and acknowledge all queued errors and then enable the axis in the relevant mode (e.g. position-controlled).
8043	Illegal parameter value	Concerns the input parameters "Mode" and "DoneFlag."
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	An MC_Stop command is busy, for example.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)

ErrorID	Error message	Description / to correct or avoid error
8055	Saving motion not allowed in current state	A save command can not be accepted at the current axis state. Reasons: <ul style="list-style-type: none">• The axis is to be synchronized, or this synchronization process is currently busy.• Axis moves in synchronism.
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none">• A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>.• The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	Invalid floating-point format of at least one input parameter value. Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).

6.2.8 FB 412 MC_MoveAdditive - Additive positioning to current target position

Purpose

- The "MC_MoveAdditive" technology function starts an axis approach with user-definable dynamic values, towards a position which is relative to the destination position of the current positioning command. This method allows you to adjust the previously commanded target position by a defined distance.
- You define the dynamic characteristics of slave synchronization at the dynamic parameters *Velocity*, *Jerk*, *Acceleration*, *Deceleration*.
- The axis stops at the target position.
- A MC_MoveAdditive command overrides the current command.

Applicable to

- Positioning axes
- Synchronization axes

Requirements

- Axis has to be enabled for position control.
- Axis has to be homed if "Homing required" was selected at the configuration
 - and the axis is in motion
 - or "MC_MoveAdditive" overrides an active motion command (exception: "MC_MoveVelocity".)
- Axis does not have to be homed,
 - If the axis is not in motion
 - If a running MC_MoveVelocity command is overridden.
- No MC_Stop command is busy

Note

MC_MoveAdditive responds in the same way as MC_MoveRelative,

- when the axis is idle at the start of the motion command, or
 - when a **continuous function** is overridden, i.e. when the target position is not defined. The target position depends in this case on the override position, and is derived from the *distance* and the position at the start of the operation.
-

Restrictions for modulo axes

The application of this function to modulo axes is restricted and only possible for small distances (relative to the modulo length) which may not exceed the current modulo length:

(new target position = (old target position + distance) modulo length)

- *Distance* must be smaller than a modulo length.
- The distance to go must be smaller than a modulo length.
- *Distance* plus the distance to go for the overriding command must be smaller than a modulo length.

Overriding commands

MC_MoveAdditive
 MC_Power (*Enable = FALSE*)
 MC_Home (*Mode = 0, 1*)
 MC_Stop
 MC_Halt
 MC_MoveAbsolute (*Mode = 0*)
 MC_MoveRelative (*Mode=0*)
 MC_MoveToEndPos
 MC_MoveVelocity (*Mode=0*)
 MC_GearIn
 MC_CamIn



MC_MoveAdditive

MC_MoveAdditive



MC_MoveAdditive
 MC_MoveAbsolute
 MC_Home
 MC_Halt
 MC_MoveRelative
 MC_MoveSuperImposed
 MC_MoveVelocity
 MC_MoveToEndPos
 MC_GearIn
 MC_CamIn
 MC_Phasing
 MC_GearOut
 MC_CamOut
 MC_GearInSuperImposed
 MC_GearOutSuperimposed
 MC_CamInSuperimposed
 MC_CamOutSuperImposed
 MC_PhasingSuperimposed

(Cancellation relationships are shown in read direction)

A saved motion is canceled at the start of MC_MoveAdditive, and is not included in the new destination position.

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
Distance	REAL	0.0	Positioning distance (negative or positive)
Velocity	REAL	-1.0	Maximum velocity (is not always reached): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Acceleration	REAL	-1.0	Acceleration (increasing motor power): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Deceleration	REAL	-1.0	Deceleration (declining motor power): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk: Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

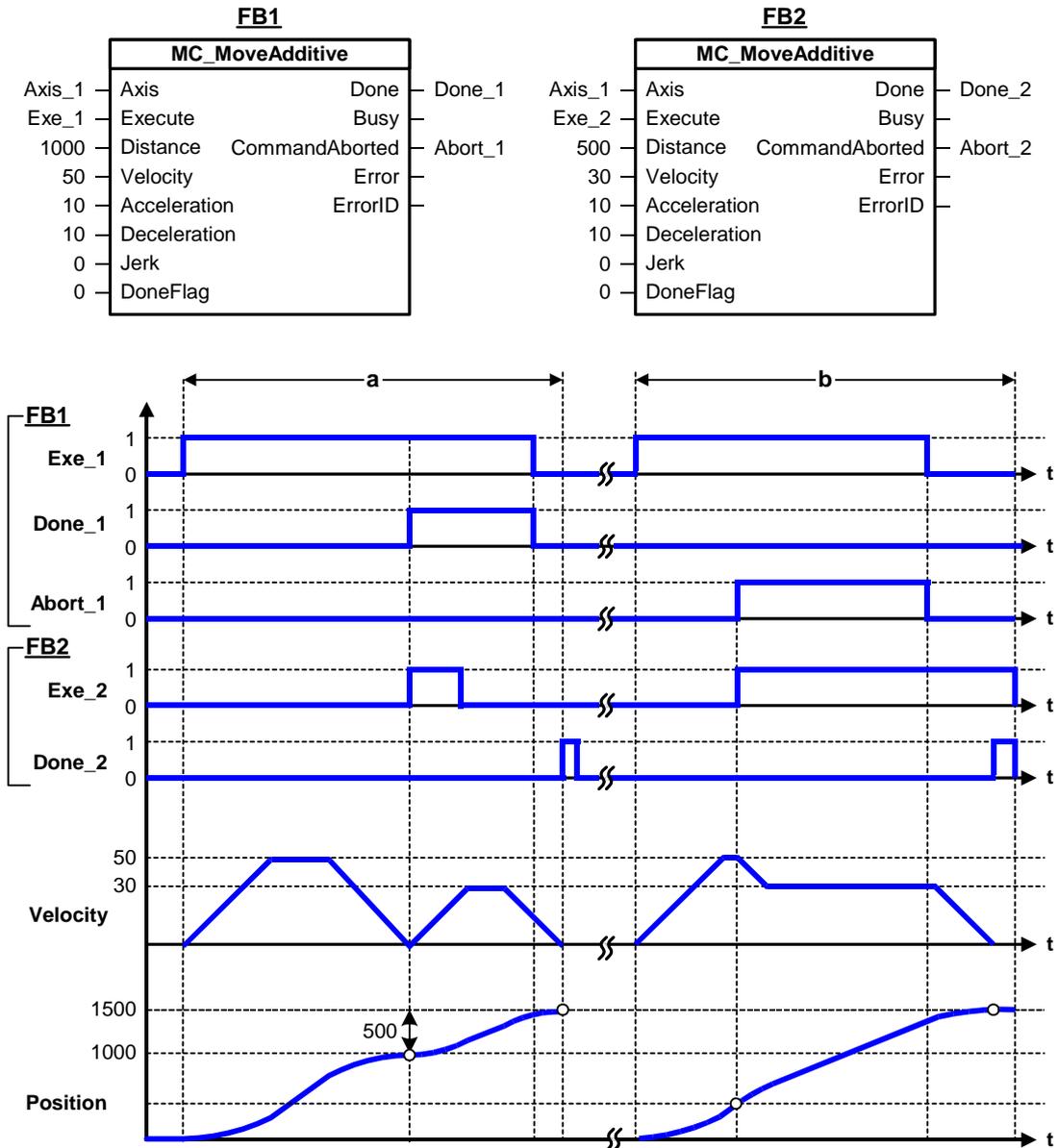
Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Destination position reached
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_MoveAdditive - Example

Signal profile

Case A: Two MC_MoveAdditive commands are started in succession.

Case B: The second MC_MoveAdditive command (FB2) is started before the first is completed. This will lead to an abortion of the first command (FB1). The target position results from the target position of the first command corrected by the distance of the second command.



MC_MoveRelative - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing. Eliminate and acknowledge all queued errors and then enable the axis in the relevant mode (e.g. position-controlled).
8043	Illegal parameter value	Concerns input parameter <i>DoneFlag</i> .
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	An MC_Stop command is busy.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)

ErrorID	Error message	Description / to correct or avoid error
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.2.9 FB 413 MC_MoveSuperImposed - Superimposed positioning

Purpose

- The "MC_Move SuperImposed" technology function allows superimposing positioning of an axis, for example, for impression mark adjustment.
- You define the dynamic characteristics of slave synchronization at the dynamic parameters *VelocityDiff*, *Jerk*, *Acceleration* and *Deceleration*.
- A current positioning or synchronization motion is not aborted.
- A new MC_MoveSuperImposed command overrides the active MC_MoveSuperImposed command. The distance-to-go value of the aborted MC_MoveSuperImposed is lost!

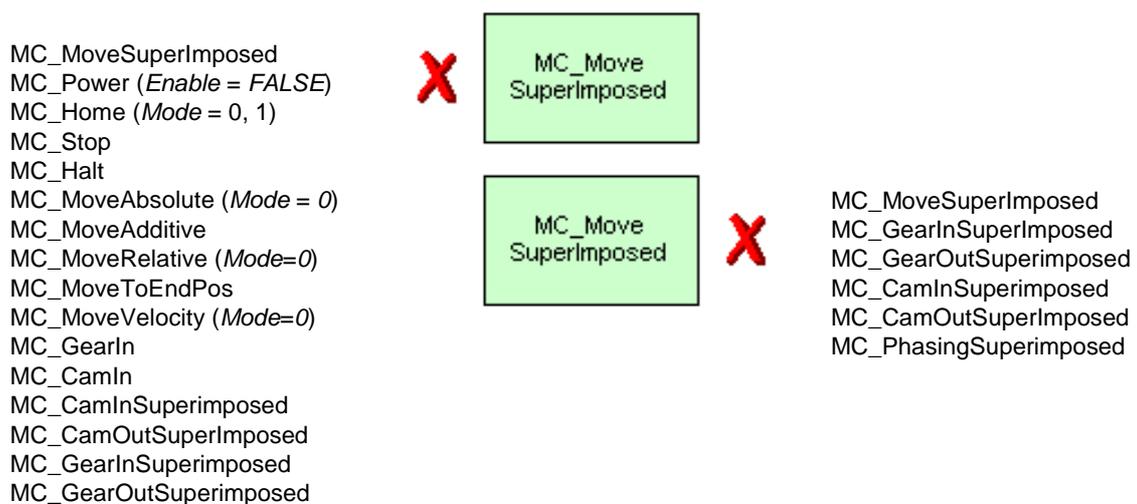
Applicable to

- Positioning axes
- Synchronization axes

Requirements

- The axis is enabled for position control
- No MC_Stop command busy
- For superimposing positioning, the axis velocity usually needs to be increased. This is why the basic velocity of the axis may not have reached the maximum when this positioning function is set.

Overriding commands



(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
Distance	REAL	0.0	Additional distance for superimposing positioning
VelocityDiff	REAL	-1.0	Maximum velocity deviation compared with current motion: Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Acceleration	REAL	-1.0	Acceleration (increasing motor power): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Deceleration	REAL	-1.0	Deceleration (declining motor power): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk: Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

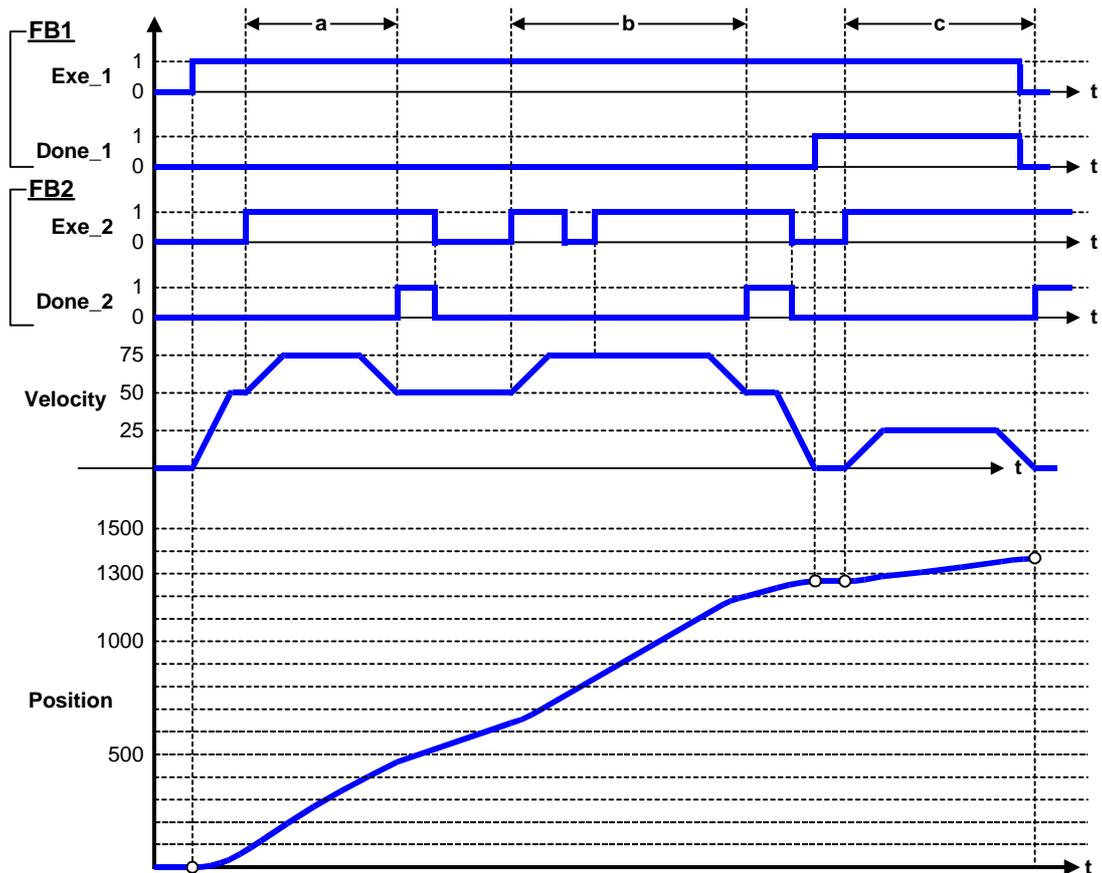
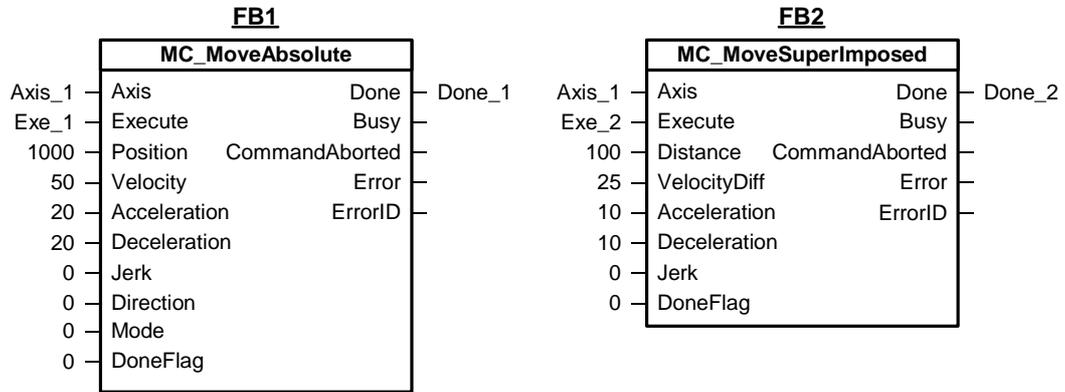
Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Superimposing positioning completed
Busy	BOOL	FALSE	TRUE: Superimposing positioning is active
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_MoveSuperImposed - Example of "Absolute positioning"

Signal profile: Effect of superimposing positioning

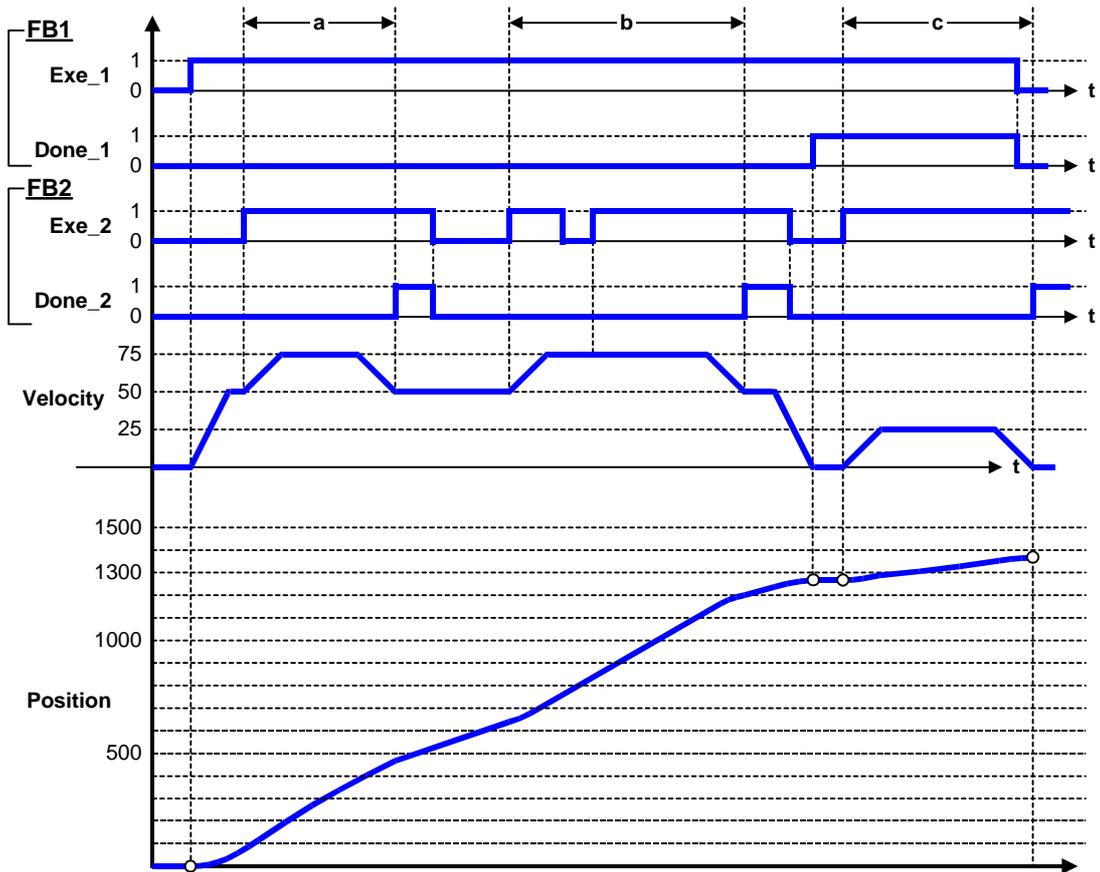
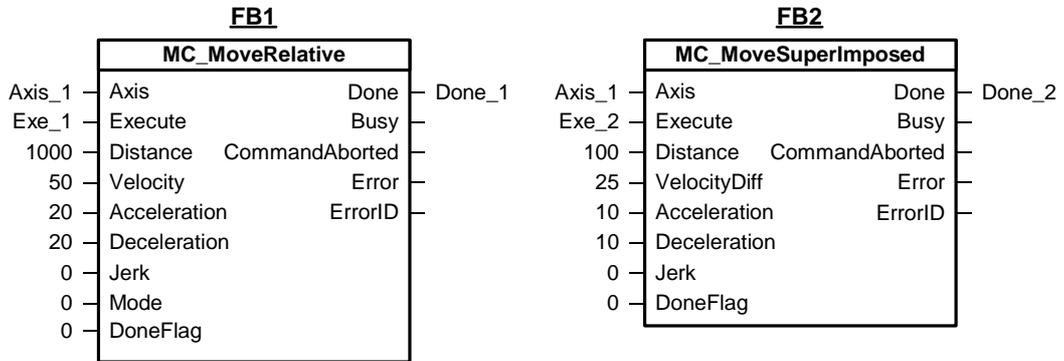
- (a) MC_MoveSuperImposed is started when absolute positioning is active.
- (b) "MC_MoveSuperImposed" is restarted before it has completed its cycle.
- (c) Start of MC_MoveSuperImposed when the axis is at a standstill.



MC_MoveSuperImposed - Example of "Relative positioning"

Signal profile: Effect of superimposing positioning

- (a) "MC_MoveSuperImposed" is started when relative positioning is active.
- (b) "MC_MoveSuperImposed" is restarted before it has completed its cycle.
- (c) Start of MC_MoveSuperImposed when the axis is at a standstill.



MC_MoveSuperImposed - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing. Eliminate and acknowledge all queued errors and then enable the axis in the relevant mode (e.g. position-controlled).
8043	Illegal parameter value	Concerns input parameter <i>DoneFlag</i> .
8044	Task not supported by the technology object	Send a command to a velocity axis, for example.
8045	Illegal command with current status	An MC_Stop command is busy.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)

ErrorID	Error message	Description / to correct or avoid error
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.2.10 FB 414 MC_MoveVelocity - Moving with speed preset

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_MoveVelocity" technology function initiates acceleration of the axis to its preset velocity.
- Use the input parameters *Velocity*, *Jerk*, *Acceleration*, *Deceleration* to define the dynamic response during axis movement.
- When a velocity-override function is active, allowances are made for this override in the calculation of the final velocity (output parameter *InVelocity*). make allowances for these characteristics in your user program.
- You can use input parameter *PositionControl* to set position or velocity control mode for position-controlled axes.
- At input parameter *Mode* you can specify whether to trigger an active motion, to override the current motion or to append the motion.

Applicable to

- Velocity axes
- Positioning axes
- Synchronization axes

Requirements

- The axis is enabled for velocity and position control
- No MC_Stop command busy
- Requirements for appended motions (*Mode = 1*):
 - An MC_CamIn or MC_GearIn has not been started
 - No synchronized operation.
 - "MC_MoveVelocity" can not be loaded in order to append it to an active "MC_MoveVelocity."

Overriding commands

MC_MoveAbsolute (Mode = 0)
 MC_Power (Enable = FALSE)
 MC_Home (Mode=0, 1)
 MC_Stop
 MC_Halt
 MC_MoveRelative (Mode = 0)
 MC_MoveVelocity (Mode = 0)
 MC_MoveToEndPos
 MC_GearIn
 MC_CamIn



MC_MoveVelocity
 Mode=0

MC_MoveVelocity
 Mode=0



MC_MoveAbsolute (Mode=0-2)
 MC_MoveRelative (Mode=0-2)
 MC_MoveVelocity (Mode=0, 1)
 MC_Home
 MC_Halt
 MC_MoveSuperImposed
 MC_MoveToEndPos
 MC_GearIn
 MC_CamIn
 MC_Phasing
 MC_GearOut
 MC_CamOut
 MC_GearInSuperImposed
 MC_GearOutSuperimposed
 MC_PhasingSuperimposed
 MC_GearOutSuperimposed
 MC_CamOutSuperImposed

MC_MoveAbsolute (Mode = 0)
 MC_MoveAbsolute (Mode=1,2)*
 MC_Power (Enable = FALSE)
 MC_Home (Mode=0, 1)
 MC_Stop
 MC_Halt
 MC_MoveRelative (Mode = 0)
 MC_MoveRelative (Mode=1,2)*
 MC_MoveVelocity (Mode = 0)
 MC_MoveVelocity (Mode=1)*
 MC_MoveToEndPos
 MC_GearIn
 MC_CamIn



MC_MoveVelocity
 Mode=1

MC_MoveVelocity
 Mode=1



MC_MoveAbsolute (Mode = 1,2)

*

* Cancellation is possible as long as the motion is not activated.

(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
Velocity	REAL	-1.0	Final velocity: Value < 0: Use preset value Value = 0: Permitted Value > 0: Final velocity
Acceleration	REAL	-1.0	Acceleration (increasing motor power): Value > 0: Use the specified value Value = 0: Only permitted if the axis does not have to be accelerated in order to reach its final velocity. Value < 0: Use preset value
Deceleration	REAL	-1.0	Deceleration (declining motor power): Value > 0: Use the specified value Value = 0: Only permitted if the axis does not have to be accelerated in order to reach its final velocity. Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk: Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
Direction	INT	0	Direction preset: Value = 0: default in S7T Config * Value = 1: Positive sense of direction Value = 2: - not permitted at "MC_MoveVelocity" - Value = 3: <i>Negative sense of direction</i> Value = 4: Current sense of direction (last used sense of direction)
CURRENT	BOOL	FALSE	Maintaining the current velocity: FALSE: "Maintain current velocity" disabled TRUE: the current velocity and direction are maintained. Used to terminate synchronous operation, for example. Input parameter <i>Velocity</i> is here ignored. As soon as the axis resumes its motion at the current velocity, output <i>InVelocity</i> returns the value <i>TRUE</i> .
PositionControl	BOOL	TRUE	Position-controlled mode (this parameter is neglected for velocity axes) This parameter allows you to set the position / velocity control mode for position-controlled axes. TRUE: Position-control mode FALSE: Velocity-control mode The axis must be enabled for position control in order to operated in master mode.

Parameter	Data type	Start value	Description
Mode	INT	0	Override mode: Value = 0: Override motion: The current motion is canceled Value = 1: Append motion: The motion command is written to the command buffer the axis is stopped at the motion transition
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB When the final velocity is reached, the DoneFlag value is inverted

- * Selection of the direction with "Determine based on sign of velocity setpoint" in the default setting of S7T Config is not useful, because negative velocity setpoint values can not be set at input parameter *Velocity*. The axis always moves in positive direction if the configuration in S7T Config is faulty.

Output parameters

Parameter	Data type	Start value	Description
InVelocity	BOOL	FALSE	TRUE: The velocity set at input parameter <i>Velocity</i> was reached, or is maintained.
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If <i>ErrorStatus</i> of the technology DB does not indicate an error, the command was canceled by a subsequent command. If <i>ErrorStatus</i> reports an error, an error at the TO occurred during command execution and has caused cancellation of the command. (see also the note below)
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the <i>ErrorID</i> . FALSE: Command initiation without error
ErrorID	WORD	0	<i>ErrorID</i> of the <i>Error</i> output parameter.

Note

Velocity setpoint **zero** (*Velocity = 0.0*): *InVelocity* is set when the axis has reached standstill, and remains set as long as *Execute = 1*. Command execution is completed when *InVelocity* is set, i.e. *Busy = FALSE*, and the technological function can neither report *CommandAborted*, nor an *Error*.

Velocity-controlled operation of a positioning axis

The transition "position-controlled motion" to "motion control with velocity preset" and vice versa can be set not only when the axis is in standstill, but also when it is in RUN.

You can use input parameters *PositionControl* to set either position or velocity control for position-controlled axes.

In velocity-controlled mode with velocity preset 0, the axes can be ramped down immediately, even if a greater following error has developed at the axis as a result of torque limiting, for example.

Software limit switch monitoring stays active.

Note

Velocity-controlled operation is maintained until one of the following positioning commands is started:

- MC_MoveAbsolute
- MC_MoveRelative
- MC_MoveAdditive
- MC_MoveVelocity (when *PositionControl* = TRUE)
- MC_MoveToEndPos
- MC_GearIn
- MC_CamIn

Restrictions with active velocity control:

- Homing not possible (MC_Home)
 - The axis must be enabled for position control in order to operated in master mode with setpoint coupling. When *PositionControl* = FALSE, the setpoint position of the axis is held constant.
-

Note

If the user program causes a velocity-controlled axis to overtravel a SW limit switch, you first need to disable this switch in order to release the axis.

If the user program does not support disabling of limit switches, you have to cycle power off and on in order to reset position control mode at the axis. You can then release the axis.

MC_MoveVelocity - Example of "Override motion"

The signal profile below shows the override reaction of the (*Mode = 0*) "MC_MoveVelocity" technology function.

Phase "a"

The first positive edge at input parameter *Execute (Exe_1)* of FB1 initiates movement of the axis (*Axis_1*) at a velocity of 50. *InVel_1* outputs a message when the final velocity is reached.

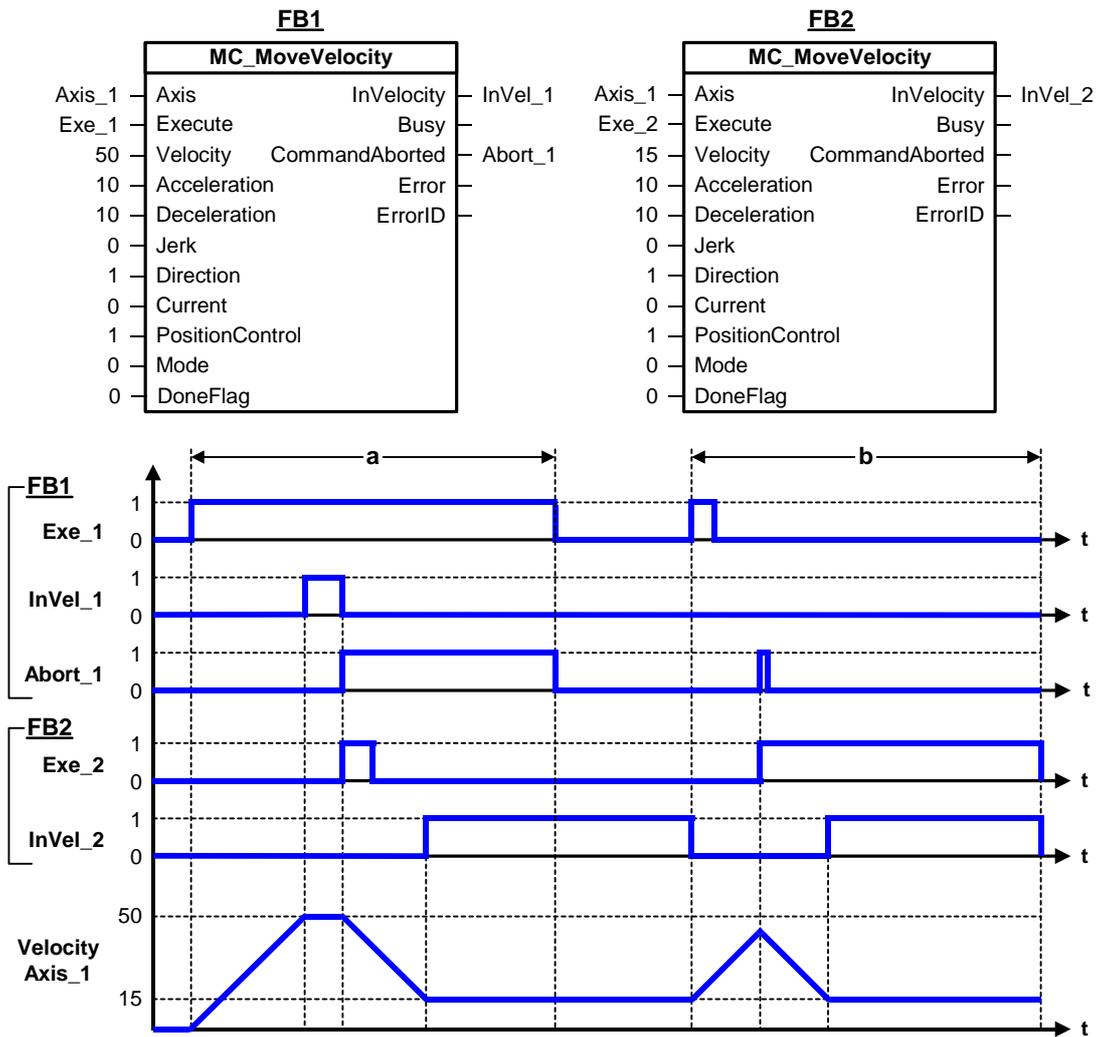
A positive edge at input parameter *Execute (Exe_2)* of FB2 overrides the current motion. *Abort_1* reports the override operation. *Abort_1* remains set as long as *Exe_1* is set at FB1. After the override, the axis continues to move (*Axis_1*) at velocity 15.

Phase "b"

A further positive edge at input parameter *Execute (Exe_1)* of FB1 overrides the current motion and resets the velocity to 50.

If the velocity of 50 is not reached yet, a further command at FB2 (positive edge at *Exe_2*) overrides the motion. After this override, the axis continues operation (*Axis_1*) at velocity 15. *InVel_2* outputs a message when this velocity is reached.

Exe_1 is only set briefly in phase "b"; *Abort_1* is therefore indicated only for the duration of one cycle.



MC_MoveVelocity - Example of "Append motion"

The signal profile below shows the "appending" reaction of the "MC_MoveVelocity" technology function (*Mode = 1*).

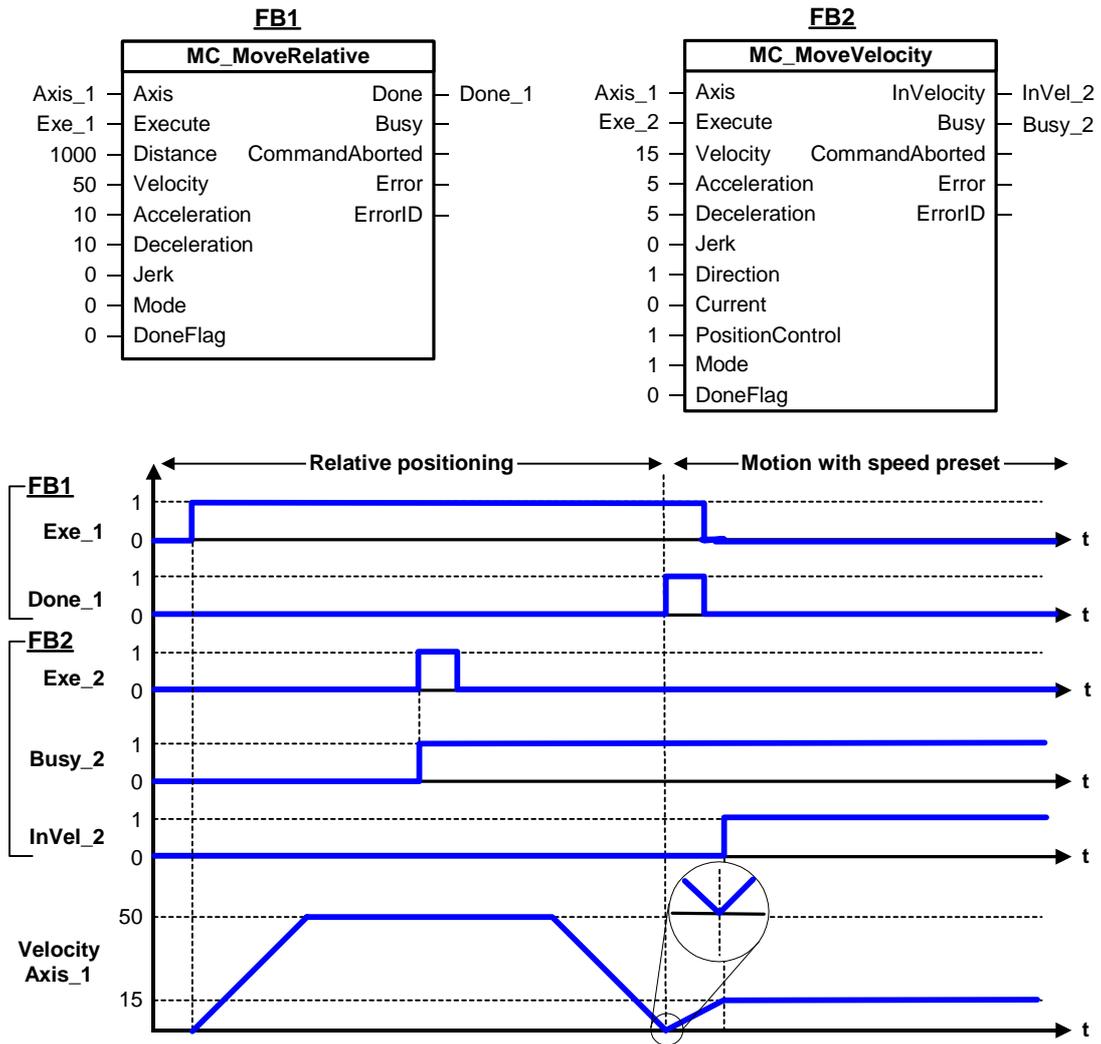
Phase - relative positioning

Relative positioning is started with a positive edge at input parameter *Execute* (*Exe_1*) of FB1. The axis (*Axis_1*) accelerates to its final speed along the specified acceleration ramp (*Acceleration = 10*)t. Before it reaches the destination position (*Distance = 1000*), the MC_MoveVelocity command is output (positive edge *Exe_2* at FB2).

The current positioning command is not canceled at "MC_MoveVelocity" if *Mode = 1* is set. "MC_MoveAbsolute" decelerates the axis with *Deceleration = 10*, and then approaches the destination position, according to the initiated command. Completion of the command is reported with *Done_1*.

Phase - Motion with speed preset

The MC_MoveVelocity motion is appended for immediate execution after the axis has reached the destination position set by the MC_MoveRelative command. *InVel_2* reports the final speed with a short delay. The axis (*Axis_1*) moves at the set speed 15.



MC_MoveVelocity - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing. Eliminate and acknowledge all queued errors and then enable the axis in the relevant mode (e.g. position-controlled).
8043	Illegal parameter value	Concerns the input parameters <i>Direction</i> , <i>mode</i> or <i>DoneFlag</i> .
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	An MC_Stop command is busy.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.

ErrorID	Error message	Description / to correct or avoid error
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8055	Saving motion not allowed in current state	A save command can not be accepted at the current axis state. Reasons: <ul style="list-style-type: none"> • The axis is to be synchronized, or this synchronization process is currently busy. • Axis moves in synchronism.
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	Invalid floating-point format of at least one input parameter value. Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).

6.2.11 FB 415 MC_MoveToEndPos - Move to mechanical end stop / clamping

Purpose

- The "MC_MoveToEndPos" technology function moves the axis into contact with an obstruction and holds it at this position, for example at the end of a traversing range.
- You define the dynamic characteristics of slave synchronization at the dynamic parameters *Velocity*, *Jerk*, *Acceleration*, *Deceleration*.
- The traversing motion and the criteria for detecting the end position can be defined in the axis configuration of S7T Config, e.g. the following error or torque.
- If it is possible to limit the drive's torque, torque limiting is also effective at the technology function when "Fixed end stop detection - with following error monitoring" is set (setting in S7T Config > Limits > "End stop" tab.)

Applicable to

- Positioning axes (physical axes only)
- Synchronization axes (physical axes only)

Requirements

- The axis is enabled for position control
- No MC_Stop command busy
- Fixed end stop detection must be enabled for the axis.
Configuration: Set the "Limits > End stop > Fixed end stop detection" parameter either to "following error out of limits" or to "torque out of limits".
- The relevant telegrams 101 to 105 are selected
- The drive supports the "MC_MoveToEndPos" technology function

Overriding commands

- Other motion commands can override the current command before the fixed end stop is reached.
- When the axis is clamped at the fixed end stop (*InClamping = TRUE*), the system only accepts commands for motions which release the axis from the fixed end stop. The MC_MoveToEndPos command remains active until the axis has moved out of the clamping tolerance window.
- MC_MoveToEndPos can only override an active MC_MoveToEndPos command if both are in the same effective direction.

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
Direction	INT	0	Direction preset: Value = 0: Default setting Value = 1: Positive sense of direction Value = 2: Shortest distance (module axes) Value = 3: Negative sense of direction Value = 4: Current sense of direction (last used sense of direction)
Torque	REAL	1.0	Drive torque limit in [N/m]. Comes into effect of the telegram supports torque limiting. Value >= 0: Use the specified value Value < 0: Not permitted
Velocity	REAL	0.0	Maximum velocity (is not always reached): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Acceleration	REAL	-1.0	Acceleration (increasing motor power): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Deceleration	REAL	-1.0	Deceleration (declining motor power): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk: Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

Parameter	Data type	Start value	Description
InClamping	BOOL	FALSE	TRUE: Axis has reached fixed end stop, and is positioned within the "Position tolerance after fixed end stop detection." (Position tolerance setting in S7T Config > Limits > "Fixed end stop" tab > Parameter "Position tolerance after fixed end stop detection".)
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

Note

When "Fixed end stop detection - with following error monitoring is set at " **S7T Config > Limits > "End stop" tab** in the axis configuration, following error monitoring is disabled when the technology function is used.

If the fixed end stop breaks, the following error is eliminated according to the limits configured at the drive. Neither the dynamic values defined at the input parameters, nor the limits set in the technology object influence this operation.

You should make sure that the following error is eliminated before you stop the axis with "MC_Stop" or "MC_Halt." Hence, you should preferably stop the axis without position control, i.e. by using the technology function MC_MoveVelocity with the settings *PositionControl = FALSE* and *Velocity = 0.0*.

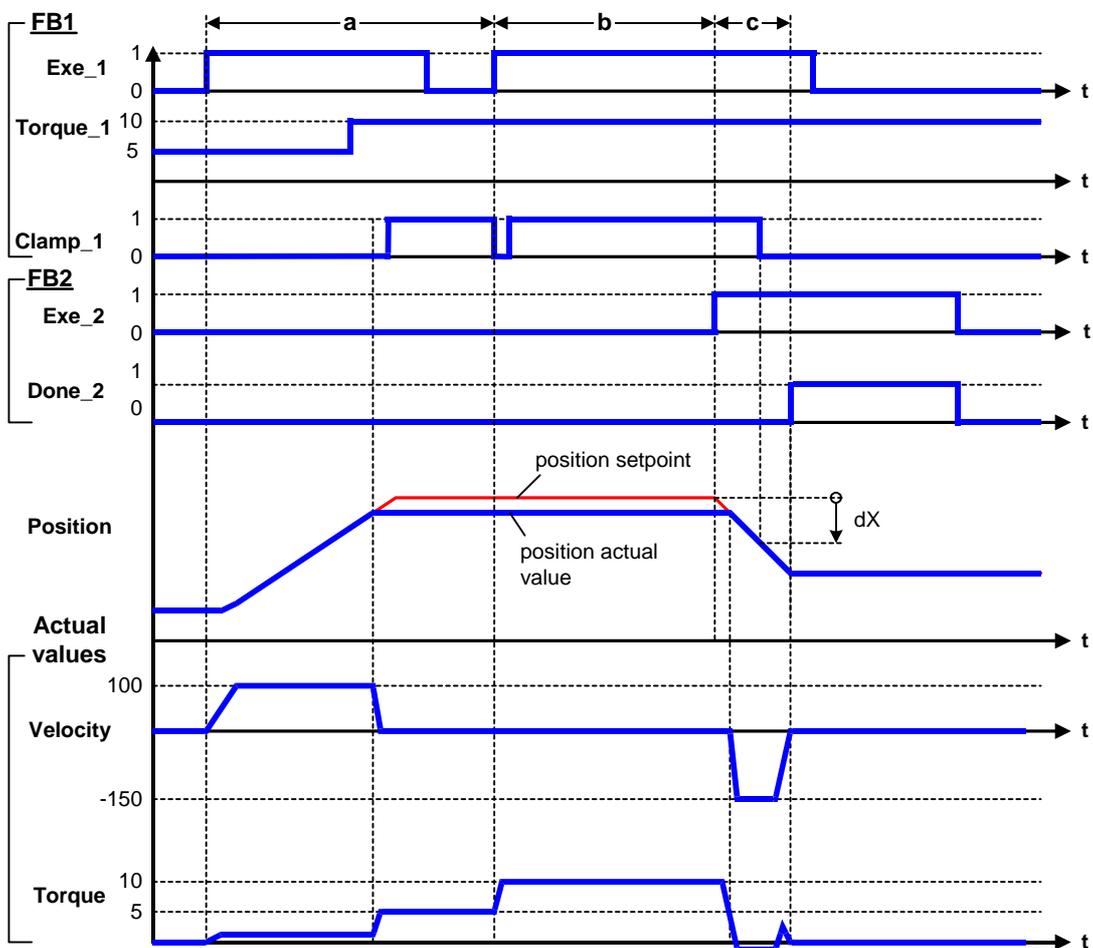
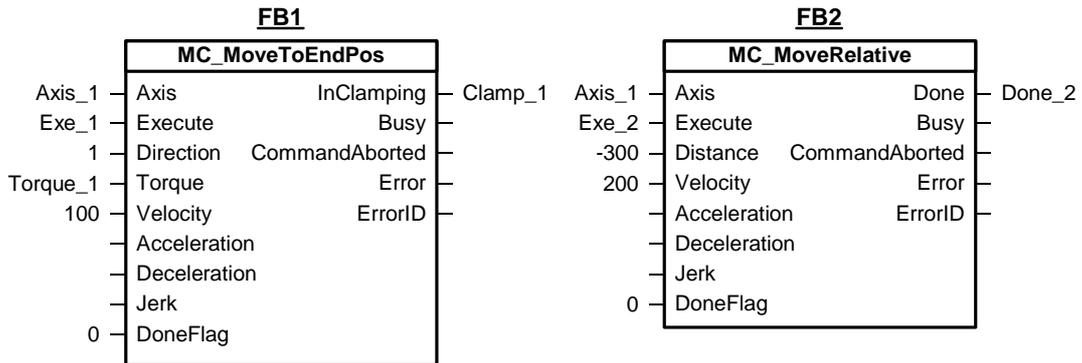
Dynamic parameter *Velocity*

Warning

The start value of the velocity ramp is set to *0.0* for reasons of safety. This value is not permitted in actual fact, and will lead to an error. Define a useful value.

MC_MoveToEndPos - Example

- a) An axis approaches the fixed end stop with reduced torque. To hold the drive at this torque, a following error is formed, based on position setpoint > actual position value.
- b) The clamping torque is doubled when a new command is received to move the axis in the same direction.
- c) To terminate clamping mode, an "MC_MoveRelative" command is output to start the drive in reversed direction. Clamping is terminated after the position setpoint is outside of clamping tolerance window.



MC_MoveToEndPos - ErrorIDs

ErrorID	Warning message	Description / to correct or avoid error
0000	No error	-
0029	MC_MoveToEndPos command in opposite direction was ignored	A new MC_MoveToEndPos command for reversing the direction of movement was started in order to override the busy MC_MoveToEndPos command. This is not permitted. For information on permissible commands and marginal conditions for terminating a current MC_MoveToEndPos command, refer to the MC_MoveToEndPos documentation.

ErrorID	Error message	Description / to correct or avoid error
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing. Eliminate and acknowledge all queued errors and then enable the axis in the relevant mode (e.g. position-controlled).
8043	Illegal parameter value	Concerns the input parameters <i>Direction</i> , <i>Velocity</i> or <i>DoneFlag</i> .
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	An MC_Stop command is busy.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.2.12 FB 437 MC_SetTorqueLimit - Enable / disable torque reduction

Purpose

- The "MC_SetTorqueLimit" technology function enables/disables torque limiting.
- Torque limiting is always disabled when the axis enable signal is reset.

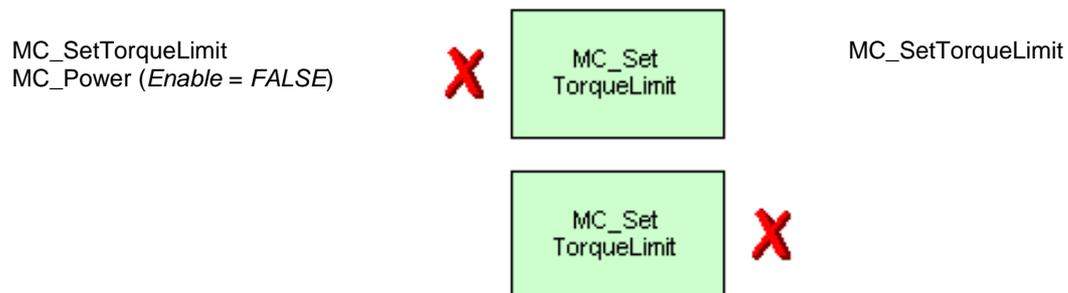
Applicable to

- Velocity axes
- Positioning axes
- Synchronization axes

Requirements

- No MC_Stop command busy
- The axis is enabled for velocity and position control
- The torque reference for the axis must be set correctly, in order to maintain the specified torque. The preset reference torque value is 3.2 N/m.
- The relevant telegrams 101 to 105 are selected
- The drive supports the "MC_MoveToEndPos" technology function

Overriding commands



(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
EnableLimit	BOOL	TRUE	Enable / disable limits
MaxTorque	REAL	100.0	Max. torque acting at the motor. * Define the torque in [N/m]. Value >= 0: Use the specified Value Value < 0: Not permitted

* Always set the "Max. drive torque" parameter in your axis configuration (in the Expert list: *TypeOfAxis.SetPointDriverInfo.DriveData.maxTorque*).

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: The command is completed
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

Note

Following error monitoring is disabled when the technology function is being used. Any accumulated following errors are eliminated based on the configured drive limits when torque is increased or countering torque is reduced. Neither the dynamic values defined at the input parameters, nor the limits set in the technology object influence this operation.

You should make sure that the following error is eliminated before you stop the axis with "MC_Stop" or "MC_Halt." Hence, you should preferably stop the axis without position control, i.e. by using the technology function MC_MoveVelocity with the settings *PositionControl = FALSE* and *Velocity = 0.0*.

MC_SetTorqueLimit - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	Concerns input parameter <i>MaxTorque</i> (value must be greater than or equal to zero.)
8044	Task not supported by the technology object	Send a command to a cam, for example.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.

ErrorID	Error message	Description / to correct or avoid error
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.3 Technology functions - Synchronism

6.3.1 FB 420 MC_GearIn - Start gear synchronization

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_GearIn" technology function starts basic gear synchronization between a leading axis and a following axis.
- Use the dynamic parameters *Velocity*, *Jerk*, *Acceleration*, *Deceleration* to define the dynamic response when synchronizing the following axis.
- The gear ratio is defined as the ratio between two integer numbers at the input parameter (nominator / denominator.)
- Synchronism can be defined relative to the start position (random position values upon reaching synchronism) or absolute.
- The gear ratio can be changed when the system is RUN by outputting a new MC_GearIn command. This operation does not require a stop of the master or following axis. Transitions are executed according to the specified acceleration or deceleration values.
- The function can be started when the leading axis is at a standstill, or when it is in motion.

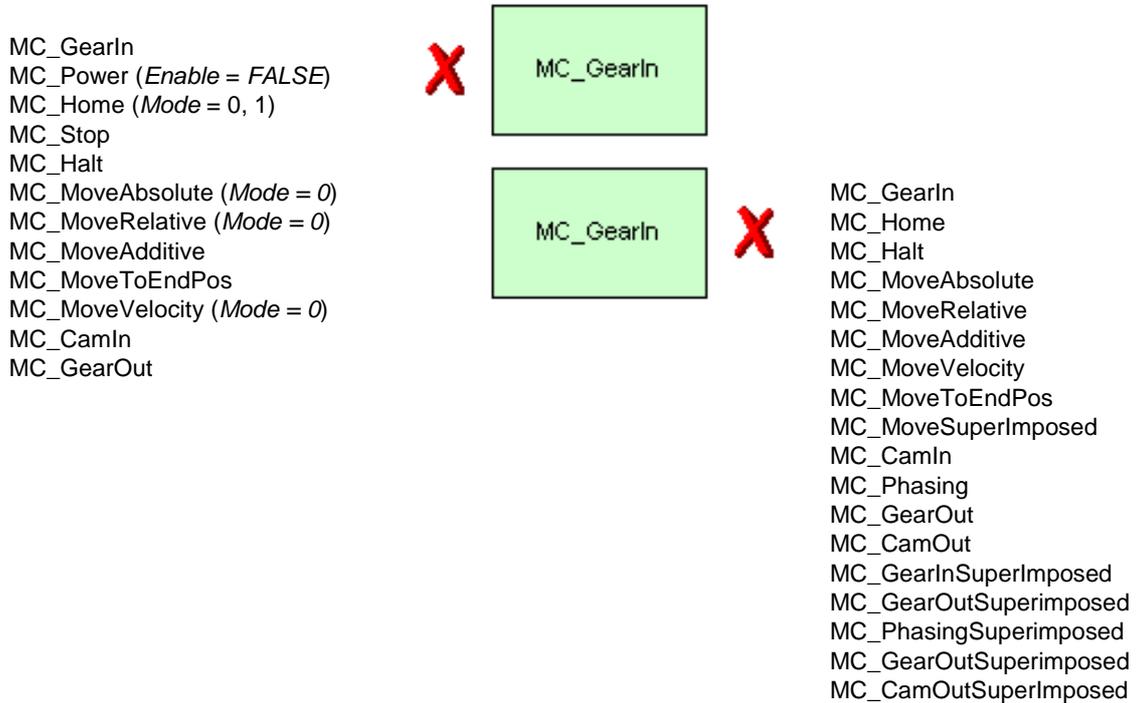
Applicable to

- Synchronization axes

Requirements

- The leading axis is configured for operation as external encoder, or as positioning or synchronization axis.
- The following axis is configured for operation as synchronized axis.
- The leading axis is set as available control value at the base synchronization object of the following axis.
- The following axis is enabled for position-controlled operation
- No MC_Stop command is busy at the following axis

Overriding commands (applies to following axis only)



(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Master	INT	0	Number of the leading axis technology DB
Slave	INT	0	Number of the following axis technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
RatioNumerator	DINT	1	Gear ratio numerator
RatioDenominator	DINT	1	Gear ratio denominator
Velocity	REAL	-1.0	Maximum velocity at the transition to gearing (only when Mode = 1): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Acceleration	REAL	-1.0	Acceleration at the transition to gearing (only when Mode = 1): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Deceleration	REAL	-1.0	Delay at the transition to gearing (only when Mode = 1): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value

Parameter	Data type	Start value	Description
Jerk	REAL	-1.0	Jerk at the transition to gearing (only when Mode = 1): Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
PhaseShift	REAL	0.0	Phase offset after reaching synchronism With <i>Absolute = TRUE</i> , the phase offset effect is absolute when synchronism is reached. With <i>Absolute = FALSE</i> , the specified phase offset is added to the phase offset determined by the relative relationship.
Absolute	BOOL	TRUE	TRUE: absolute, relative to the axis zero position, parameter output to <i>Jerk</i> is ignored, the system always uses the trapezoidal motion profile (unlimited jerk.) FALSE: relative to start position
Mode	INT	0	Synchronization mode / coupling mode: Value = 0: Use default of the corresponding synchronization object Value = 1: Start synchronization immediately according to dynamic parameters <i>Velocity, Jerk, Acceleration, Deceleration</i>
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB When gearing is reached, the DoneFlag value is inverted

Output parameters

Parameter	Data type	Start value	Description
InGear	BOOL	FALSE	TRUE: Base gearing reached
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If <i>ErrorStatus</i> of the technology DB does not indicate an error, the command was canceled by a subsequent command. If <i>ErrorStatus</i> reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the <i>ErrorID</i> . FALSE: Command initiation without error
ErrorID	WORD	0	<i>ErrorID</i> of the <i>Error</i> output parameter.

Parameter *Mode* = 1

In **relative** synchronization mode, synchronization (compensating operation) starts immediately. When synchronism is reached, a random offset is set between the leading and following axes.

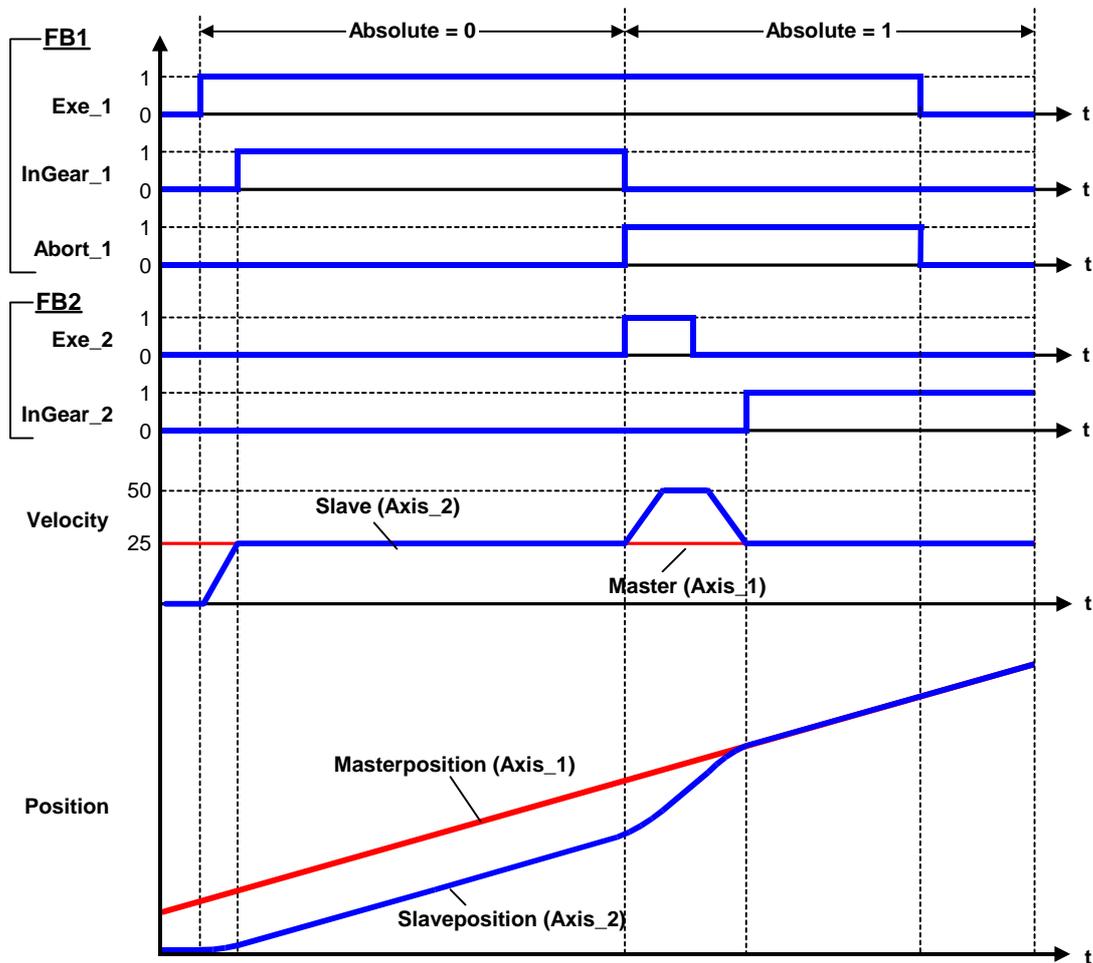
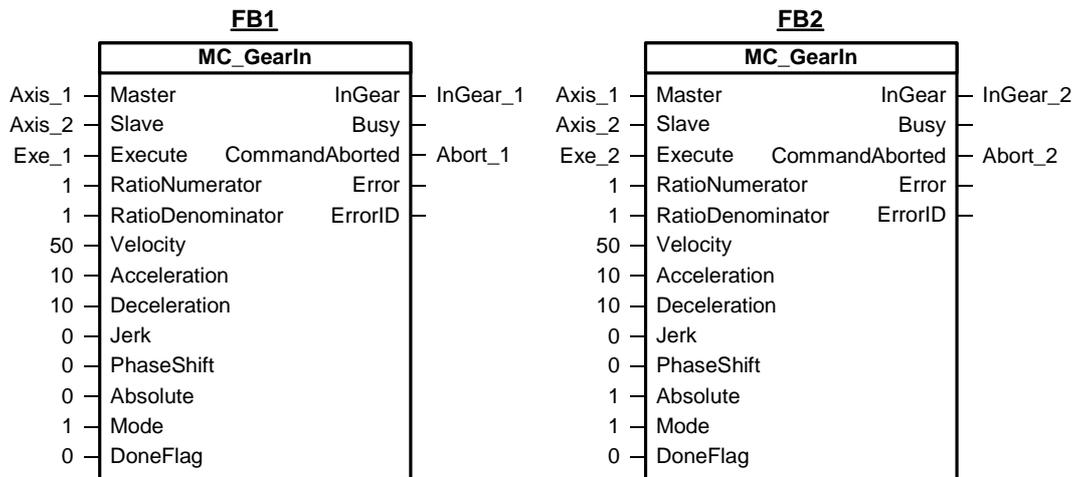
In **absolute** synchronization mode, the start of synchronization may be delayed. The actual position value of the leading and following axes is identical when synchronism is reached (phase shift = 0).

At a gear ratio of 1:1 and equal modulo length, or with infinite axes, the phase shift value stays at zero during synchronous operation.

MC_GearIn - Example of "Relative/absolute synchronism"

Absolute / relative base synchronism after synchronization based on preset dynamic parameters

First, Axis_2 is synchronized in relative synchronization mode with Axis_1 (*Absolute* = *FALSE*). A random offset develops between both axes. Next, the axes are once again synchronized with *Absolute* = *TRUE* in order to eliminate the offset between the axes.



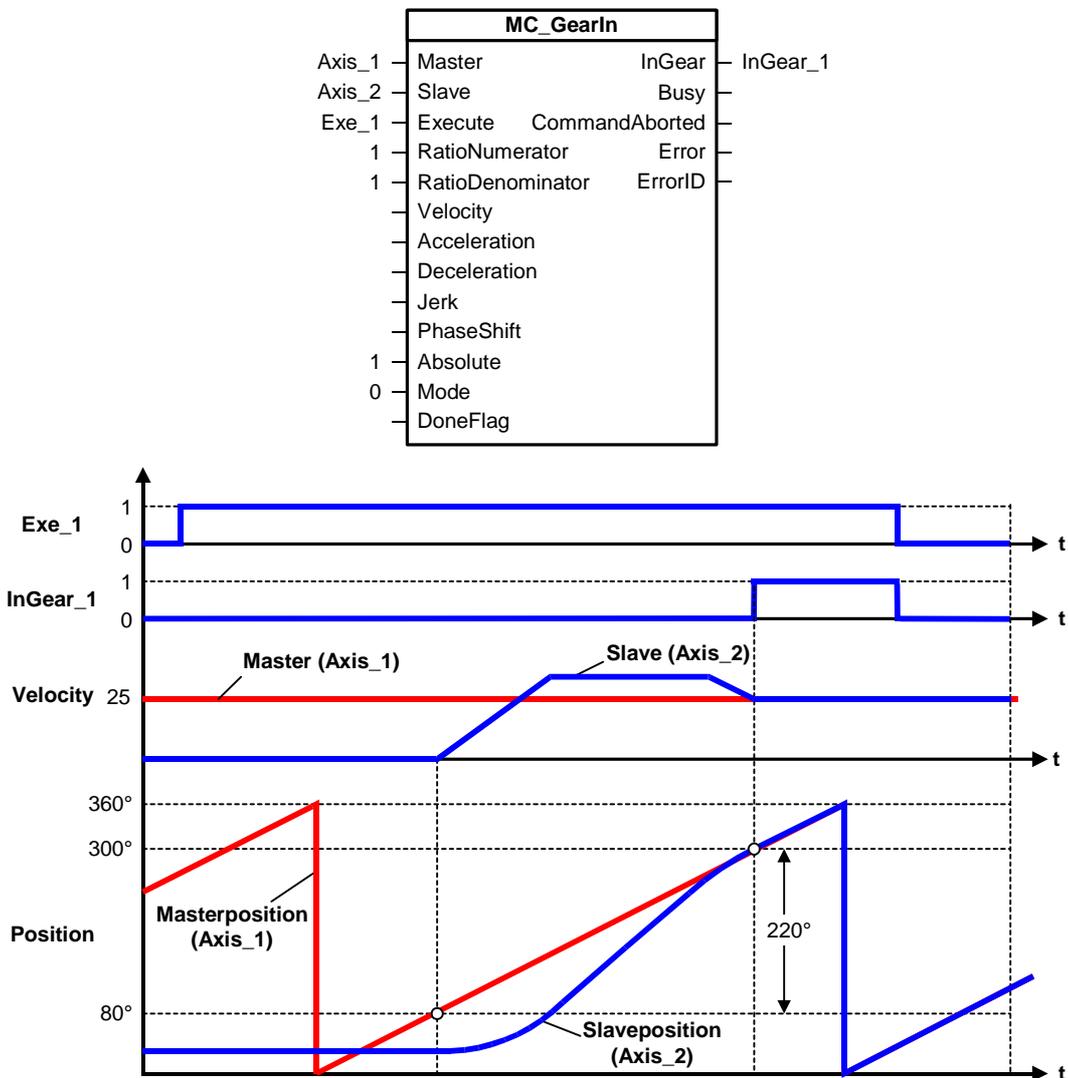
MC_GearIn - Example of "Synchronization according to configuration"

In *Mode = 0*, the axes are synchronized based on preset axis configuration data. In this example, we have configured:

Synchronization: "Preset synchronization position of the leading axis"
 Position reference: "Synchronize, starting at synchronization position"
 Sync. pos. master setpoint: 80.0
 Profile setting: "Leading axis-specific synchronization profile"
 Synchronization length: 220.0

Synchronization begins when the leading axis exceeds the synchronization position at 80°. The operation ends when the leading axis reaches 220°.

The dynamic parameters *Velocity*, *Acceleration*, *Deceleration* and *Jerk* are irrelevant.



MC_GearIn - Example of phase shift

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

Absolute synchronism without phase shift

Start positions at the start of the signal profile:

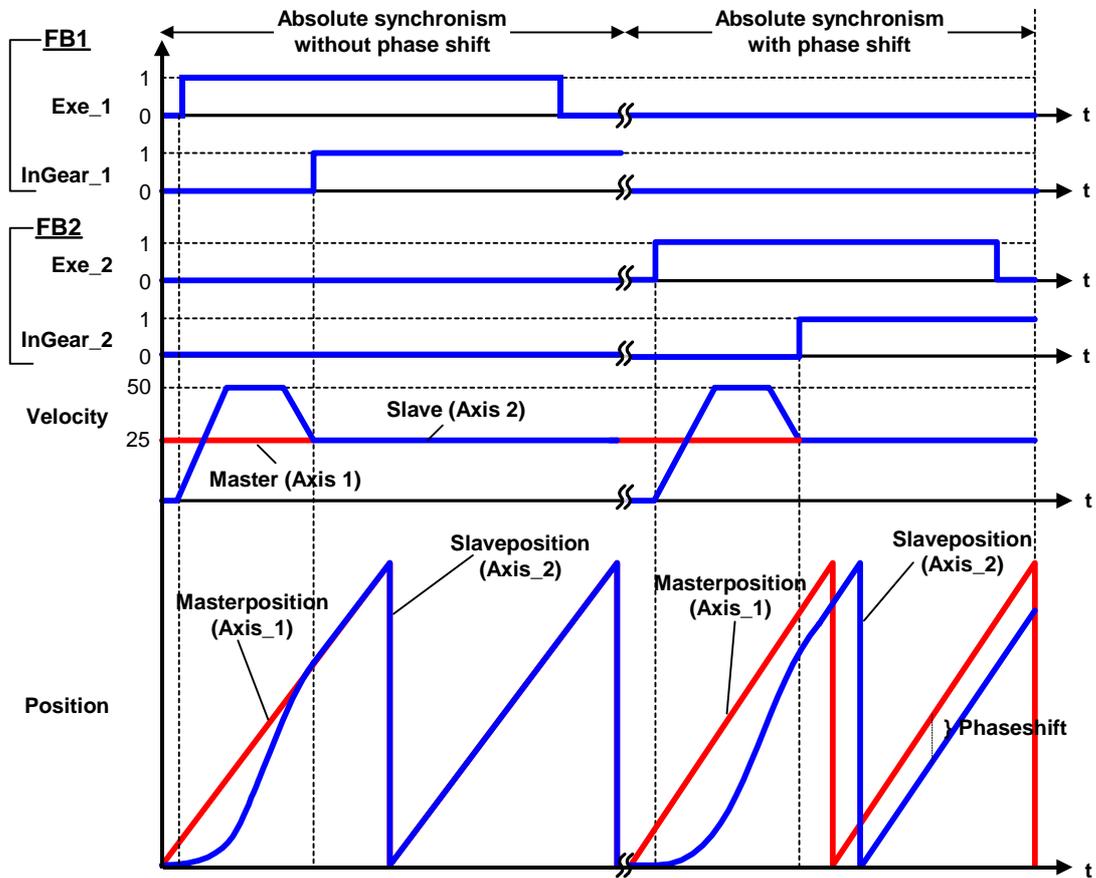
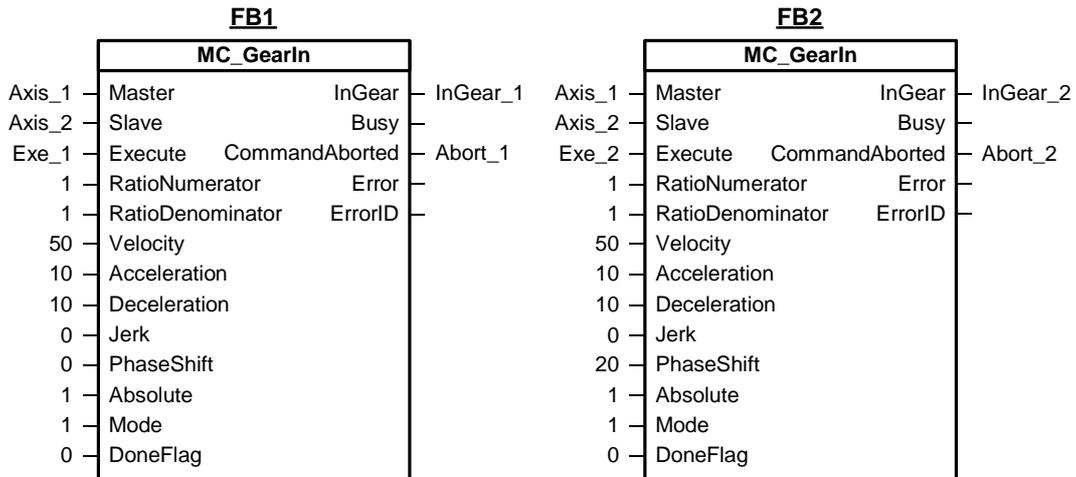
- Master position ($Axis_1$) = 0
- Slave position ($Axis_2$) = 0

A positive edge at Exe_1 starts absolute synchronism without phase shift. After a short delay, $InGear_1$ reports that absolute synchronism is reached. Absolute synchronism is established between the master position ($Axis_1$) and the slave position ($Axis_2$) (master position and slave position are identical.)

Absolute synchronism with phase shift

The signal profile applies to the start positions in analog to the signal profile without phase shift.

A positive edge at Exe_2 starts absolute synchronism with phase shift ($PhaseShift = 20$). After a short delay, $InGear_2$ reports that absolute synchronism is reached; the specified phase shift between the master position and the slave position is applied.



MC_GearIn - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The signal required for a command to enable the following axis is missing.
8043	Illegal parameter value or preset value	Concerns the input parameters <i>Mode</i> or <i>DoneFlag</i> . This may also be a configuration error in S7T Config (typically: a synchronization length of 0 is set).
8044	Task not supported by the technology object	This is not a synchronization axis.
8045	Illegal command with current status	An MC_Stop command is busy.
804A	The required object interconnection is missing	The selected master / slave combination is not configured.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.

ErrorID	Error message	Description / to correct or avoid error
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.3.2 FB 422 MC_GearOut - End gear synchronization

Purpose

- The "MC_GearOut" technology function terminates basic gearing. A s superimposing motion or superimposing synchronism is not affected by this operation.
- Synchronized operation is terminated according to the default setting of the synchronization object in S7T Config.
- The technology function is terminated when basic gearing of the following axis was terminated.
- **Recommendation:** Use the technology function if you want to stop the axis based on the position of the leading axis and / or the following axis. You can also remove the following axis from synchronized operation by means of the technology functions "MC_Halt", "MC_Stop", "MC_MoveRelative", "MC_MoveAdditive", "MC_MoveAbsolute", "MC_MoveVelocity" or "MC_MoveToEndPos".

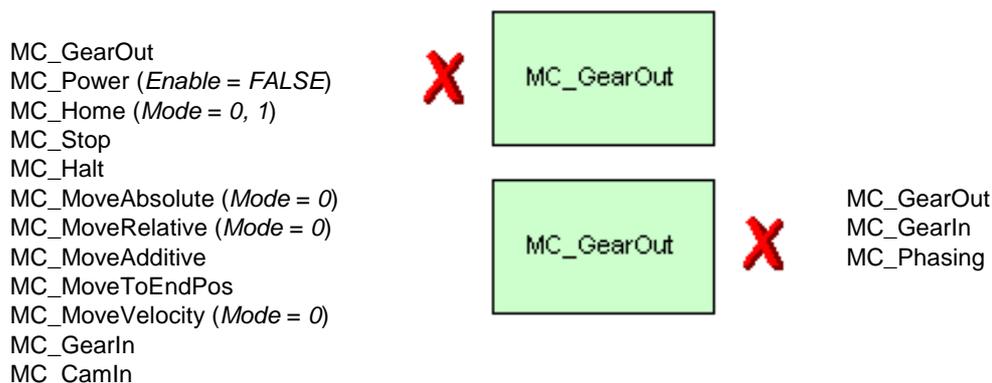
Applicable to

- Synchronization axes

Requirements

- The axis must be configured as slave for operation in an existing basic gear synchronization compound. When no basic gearing is active, the command is ignored and the technology function reports *Done = TRUE*.
- No active MC_Stop command at the following axis

Overriding commands



(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Slave	INT	0	Number of the following axis technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Basic gearing terminated; following axis has stopped Output parameter <i>Done</i> also signals <i>TRUE</i> if basic no gearing was active.
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_GearOut - Example

The "MC_GearOut" technology function (technology function) is used to terminate basic gearing and to stop the axis according to the configured mode. In this example we have a relative basic gearing with an offset between the leading and following axes which has developed during synchronization. The gear ratio is 1:1. The following axis is to be stopped at position 180°. Required settings:

Desynchronization: "Preset desynchronization position of the following axis"

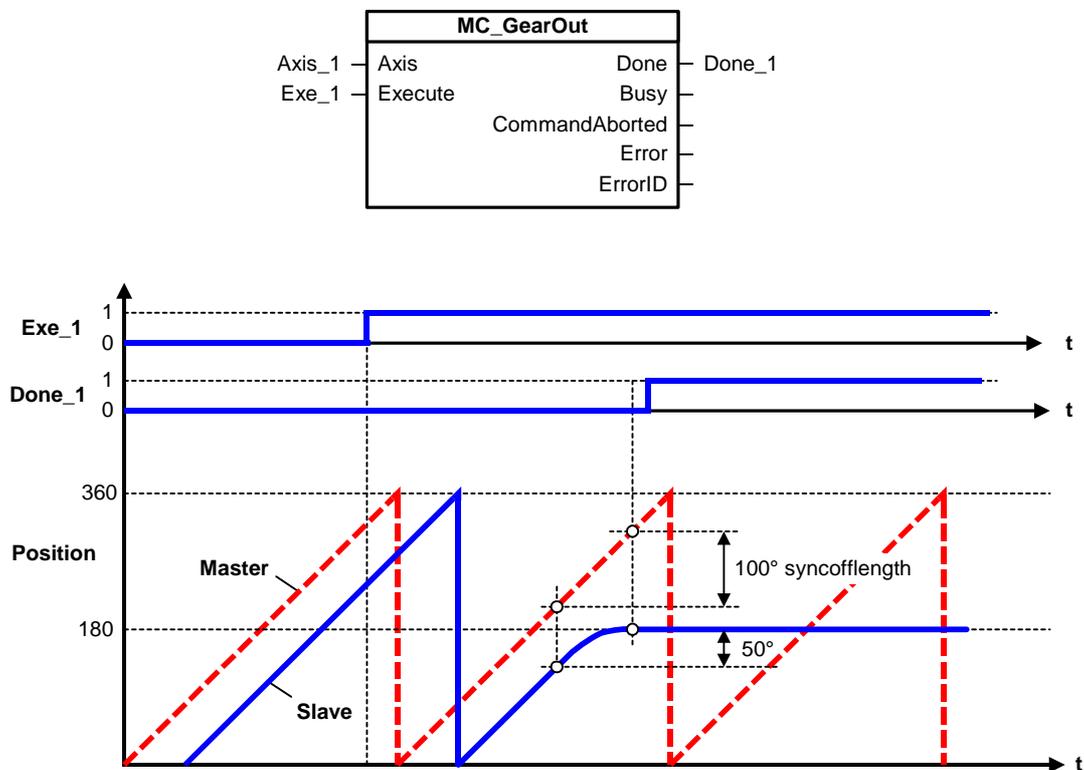
Position reference: "Stop before desynchronization position"

Desynchronization following axis: 180°

The axis is desynchronized based on the leading axis position. The following axis is desynchronized while the leading axis covers an angular distance of 100°. The following axis covers half the distance of the leading axis (50°).

Default profile setting: "Leading axis-specific synchronization profile"

Desynchronization length: 100°



MC_GearOut - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The signal required for a command to enable the following axis is missing.
8043	Illegal parameter value or preset value	This may also be a configuration error in S7T Config (typically: a sync off length of 0 is set).
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	An "MC_Stop" command is still busy, for example.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.

ErrorID	Error message	Description / to correct or avoid error
8084	Invalid technology DB	<ul style="list-style-type: none"><li>• A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>.<li>• The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.

6.3.3 FB 421 MC_CamIn - Start cam synchronization

Purpose

- The "MC_CamIn" technology function initiates cam synchronization between the leading and following axes.
- You define the dynamic characteristics of slave synchronization at the dynamic parameters *Velocity*, *Jerk* and *Acceleration*.
- The specified cam can be scaled and/or shifted.
- The specified cam disk can be executed once or cyclically.
- Synchronization may be relative or absolute.

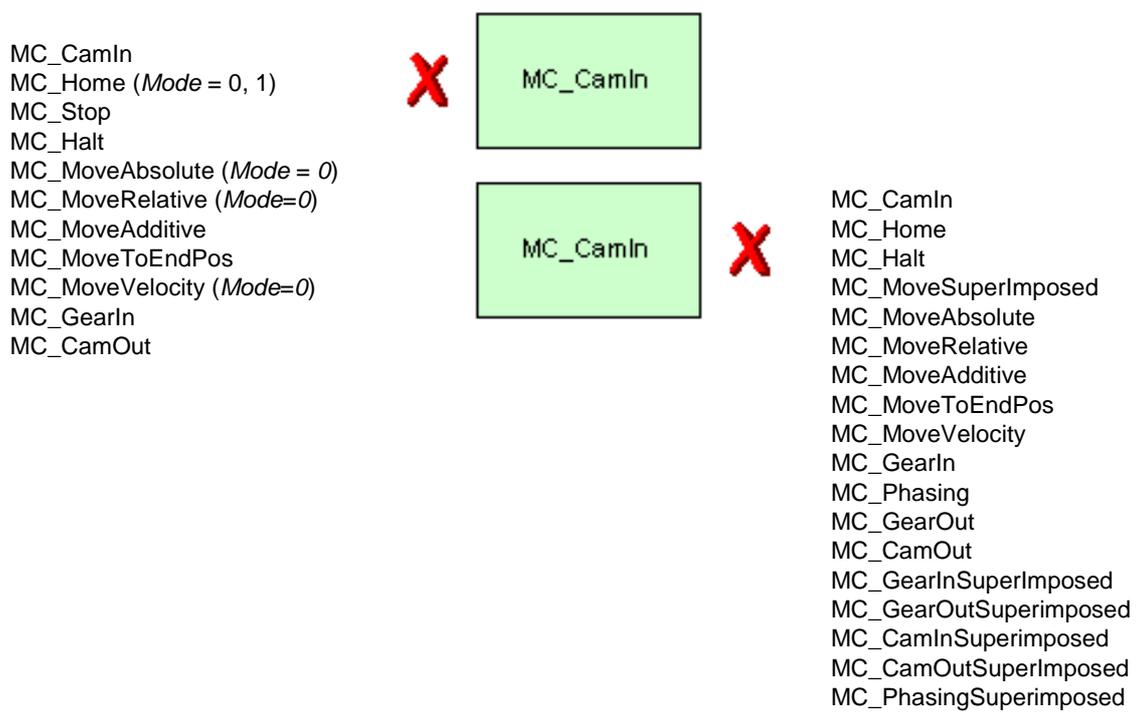
Applicable to

- Synchronization axes

Requirements

- The leading axis is configured for operation as external encoder, or as positioning or synchronization axis.
- The following axis is configured for operation as synchronized axis.
- In your configuration of the synchronization object of the following axis, you must have selected the required cam disk and leading axis.
- The axis is enabled for position control
- No active MC_Stop command at the following axis

Overriding commands (applies to following axis only)



(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Master	INT	0	Number of the leading axis technology DB
Slave	INT	0	Number of the following axis technology DB
CamTable	INT	0	Number of the cam disk technology DBs
Execute	BOOL	FALSE	Start of the command at the positive edge
Master offset	REAL	0.0	Shifting the cam along the coordinates of the leading axis
SlaveOffset	REAL	0.0	Shifting the cam along the coordinates of the following axis
MasterScaling	REAL	1.0	Scaling factor for the cam in the coordinates of the leading axis
SlaveScaling	REAL	1.0	Scaling factor for the cam in the coordinates of the following axis
MasterAbsolute	BOOL	TRUE	Interpret cam disk absolute or relative to the leading axis TRUE: absolute coordinates FALSE: relative coordinates
SlaveAbsolute	BOOL	TRUE	Interpret cam disk absolute or relative to the following axis TRUE: absolute coordinates FALSE: relative coordinates
CyclicMode	BOOL	TRUE	Cam disk processing TRUE: cyclic processing FALSE: no cyclic processing
Velocity	REAL	-1.0	Maximum coupling velocity (<i>Mode</i> = 1 only): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Acceleration	REAL	-1.0	Acceleration when coupling: (<i>Mode</i> = 1 only): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk when coupling the following axis (<i>Mode</i> = 1 only): Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
Mode	INT	0	Coupling mode: Value = 0: Use default setting of axis configuration Value: Use dynamic parameters <i>Velocity</i> , <i>Jerk</i> , <i>Acceleration</i> ; take effect instantaneously
DoneFlag	INT	1	DoneFlag generated in the MCDevice DB The value of DoneFlag is inverted when the command is completed (<i>InSync</i>)

Output parameters

Parameter	Data type	Start value	Description
InSync	BOOL	FALSE	TRUE: Base cam synchronism reached
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

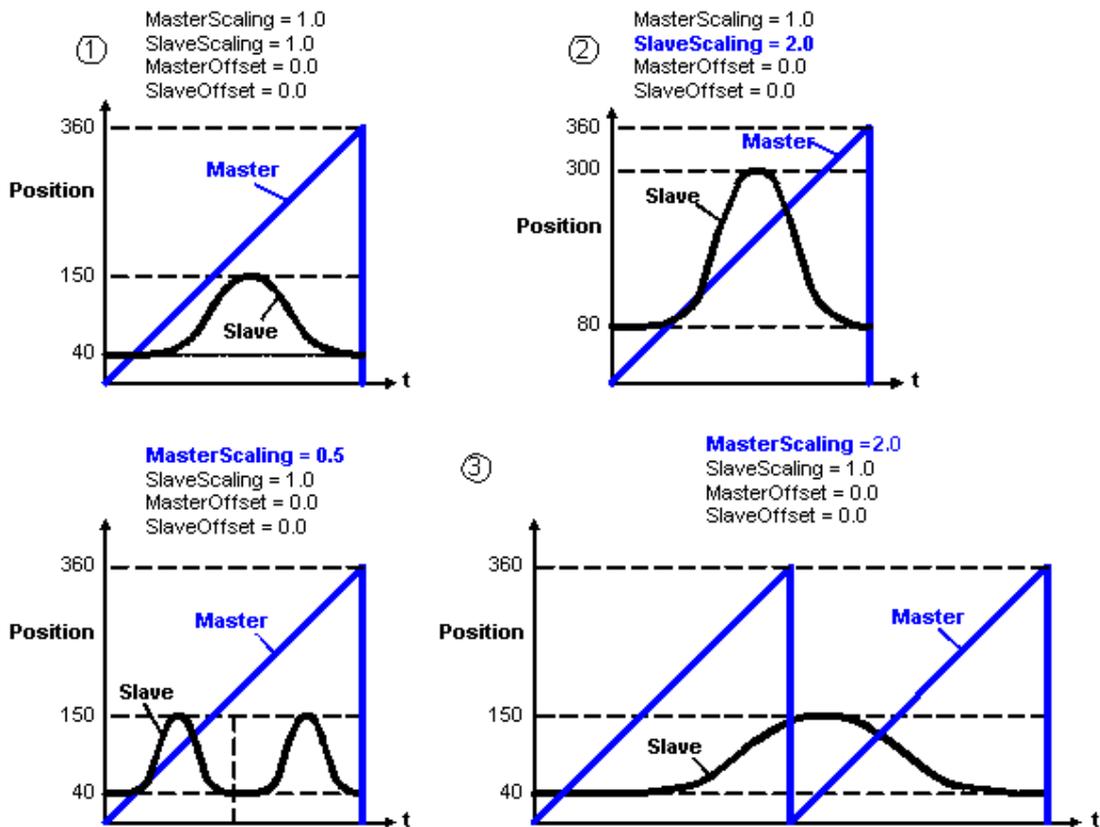
Recommendation for starting cam synchronism

1. Move the following axis to position X_s .
2. Move the leading axis to position X_m , whereby $X_s = \text{cam value } (X_m)$
3. Start the "MC_CamIn" technology function.

MC_CamIn - Example of "Effect of scaling factors and offset values"

Effect of scaling coefficients

- (1) shows the non-scaled output cams (scaling coefficients are 1.0).
- (2) At the *SlaveScaling* parameter, the cam can be expanded or compressed in Y direction. This means that the following axis travels a smaller or greater distance within a leading axis cycle.
- (3) At the *MasterScaling* parameter, the cam can be expanded or compressed in X direction.



Effect of offset values

- (4) The *SlaveOffset* parameter shifts the entire cam in Y direction.
- (5) The *MasterOffset* parameter shifts the cam in X direction, and thus generates a cam with phase shift.



MC_CamIn - Example of "Synchronization with leading axis position (cyclic relative synchronism)"

Synchronization mode:

Relative camming, cyclic mode

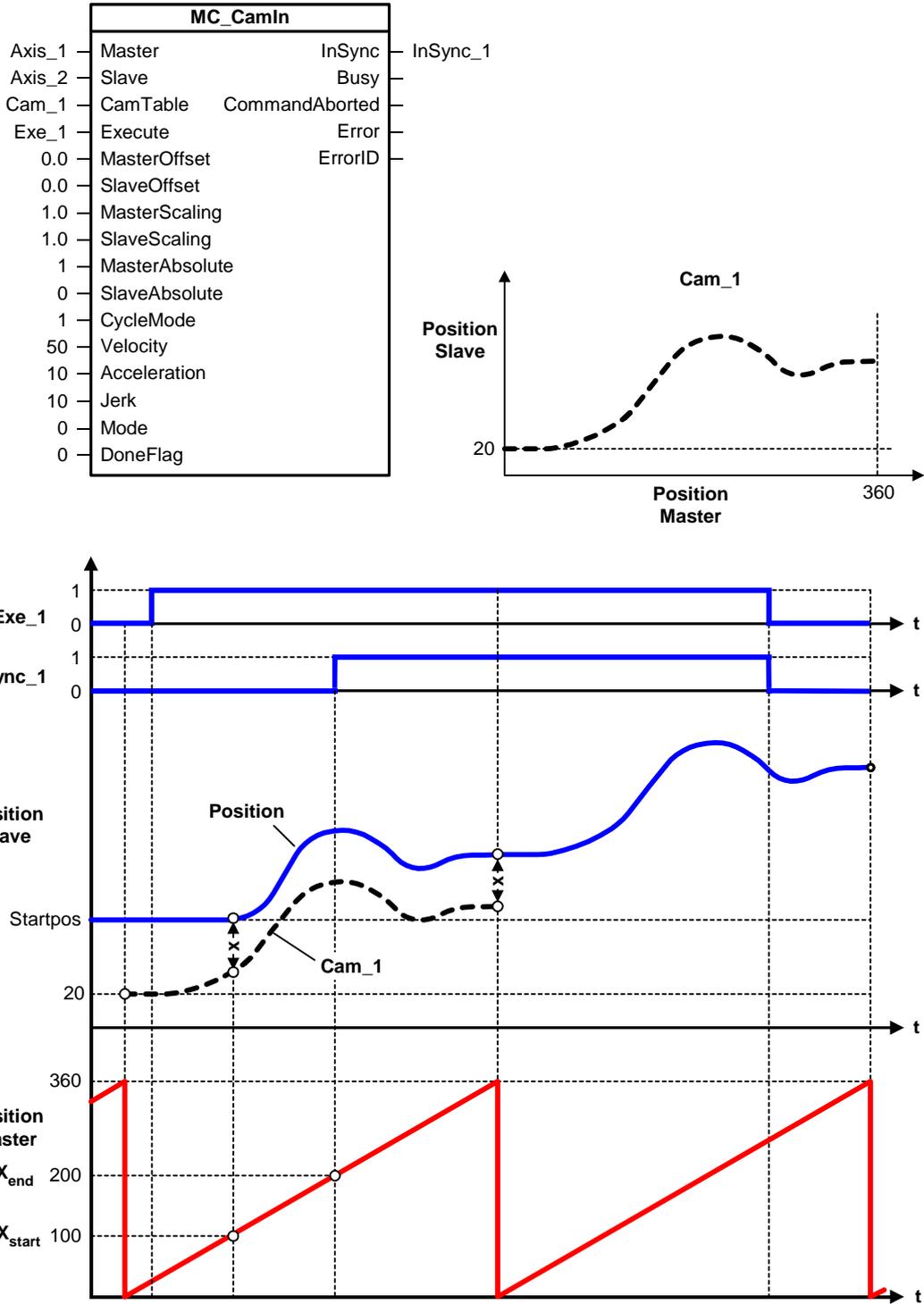
With relative camming, the Y coordinates of the cam start and end values may be identical. At the end of a current cam cycle, the cam is added to the current Y value.

Synchronization condition:

In *Mode = 0*, the synchronization condition is defined according to preset in the axis configuration, or by the data written to the corresponding parameters:

Synchronization:	"Preset synchronization position of the leading axis"
Position reference:	"Synchronize, starting at synchronization position"
Sync. pos. master setpoint:	100.0
Default profile setting:	"leading axis-specific synchronization profile"
Synchronization length:	100.0

Here, synchronization starts when the position of the leading axis exceeds 100°. The following axis is synchronized while the leading axis is moving within the angular range from 100° to 200° (100° = sync length).



MC_CamIn - Example of "Synchronization with leading axis position (cyclic absolute synchronism)"**Synchronization mode:**

Absolute camming, cyclic mode

The Y values and gradients at the cam start and end position are identical. This allows you to join the cams in a cyclic mode, without causing discontinuities.

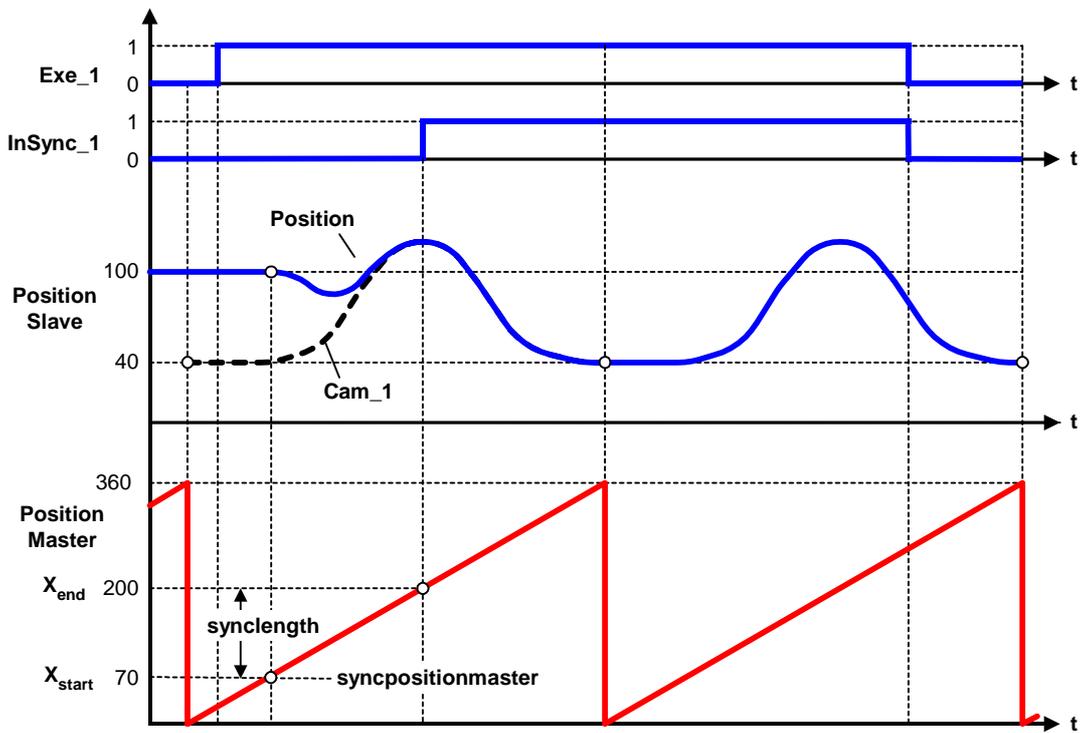
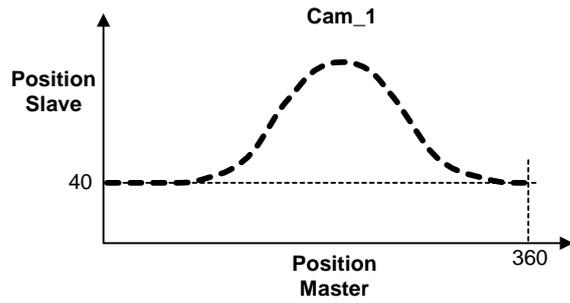
Synchronization condition:

In *Mode* = 0, the synchronization condition is defined according to preset in the axis configuration, or by the data written to the corresponding parameters:

Synchronization:	<i>"Preset synchronization position of the leading axis"</i>
Position reference:	<i>"Synchronize, starting at synchronization position"</i>
Sync. pos. control value:	70.0
Default profile setting:	<i>"leading axis-specific synchronization profile"</i>
Synchronization length:	130.0

Here, synchronization starts when the position of the leading axis exceeds 70°. The following axis is synchronized while the leading axis is moving within the angular range from 70° to 200° (130° = synchronization length).

MC_CamIn		
Axis_1	Master	InSync
Axis_2	Slave	Busy
Cam_1	CamTable	CommandAborted
Exe_1	Execute	Error
0.0	MasterOffset	ErrorID
0.0	SlaveOffset	
1.0	MasterScaling	
1.0	SlaveScaling	
1	MasterAbsolute	
1	SlaveAbsolute	
1	CycleMode	
50	Velocity	
10	Acceleration	
10	Jerk	
0	Mode	
0	DoneFlag	



MC_CamIn - Example of "Immediate synchronization"

Synchronization mode:

Relative camming, cyclic mode

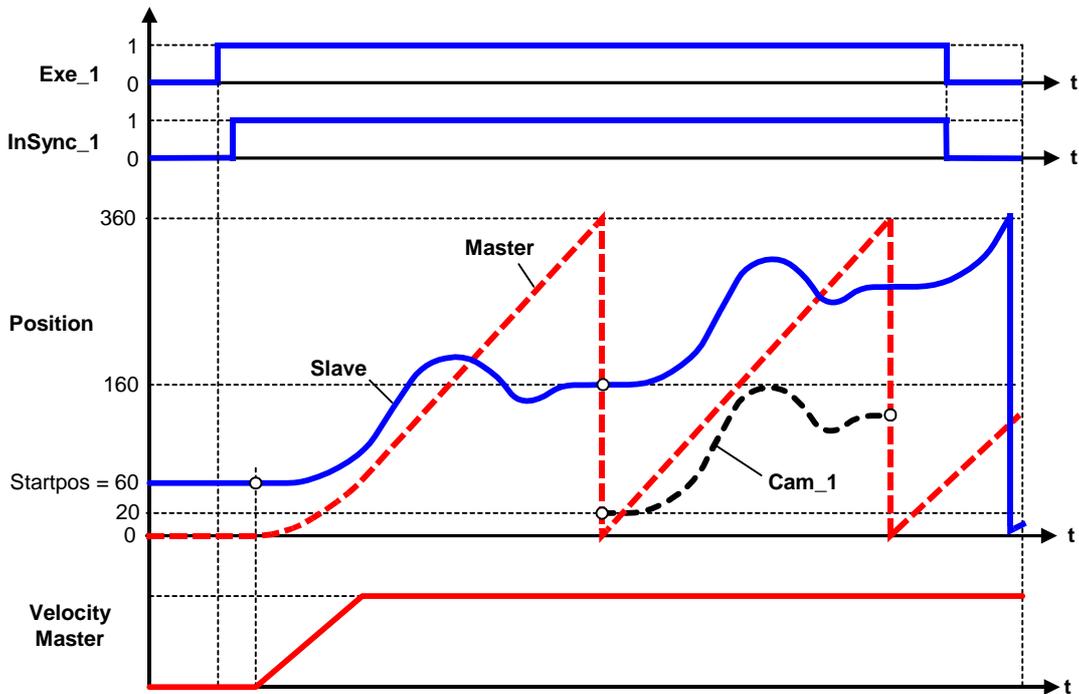
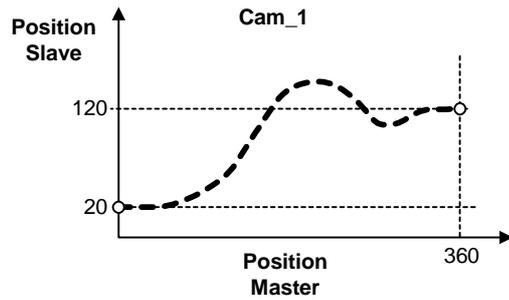
With relative synchronism, the Y coordinates of the cam start and end values may be identical. At the end of a current cam cycle, the cam is added to the current Y value.

Synchronization condition:

In *Mode* = 1, the cam is synchronized instantaneously, based on the dynamic parameters at FB MC_CamIn technology function.

In this example, the leading and following axes are initially moved to their initial positions by means of positioning commands. Next, the "MC_CamIn" function is started. Synchronism comes into effect instantaneously, because both axes are in standstill and relative synchronism is requested. (For absolute synchronism, the slave would first have to be moved to the absolute cam interpolation point that is assigned to the leading axis.)

MC_CamIn		
Axis_1	Master	InSync
Axis_2	Slave	Busy
Cam_1	CamTable	CommandAborted
Exe_1	Execute	Error
0.0	MasterOffset	ErrorID
0.0	SlaveOffset	
1.0	MasterScaling	
1.0	SlaveScaling	
1	MasterAbsolute	
0	SlaveAbsolute	
1	CyclicMode	
50	Velocity	
10	Acceleration	
10	Jerk	
1	Mode	
0	DoneFlag	



MC_CamIn - Example of "Cam changeover at the end of a cycle"

Synchronization mode:

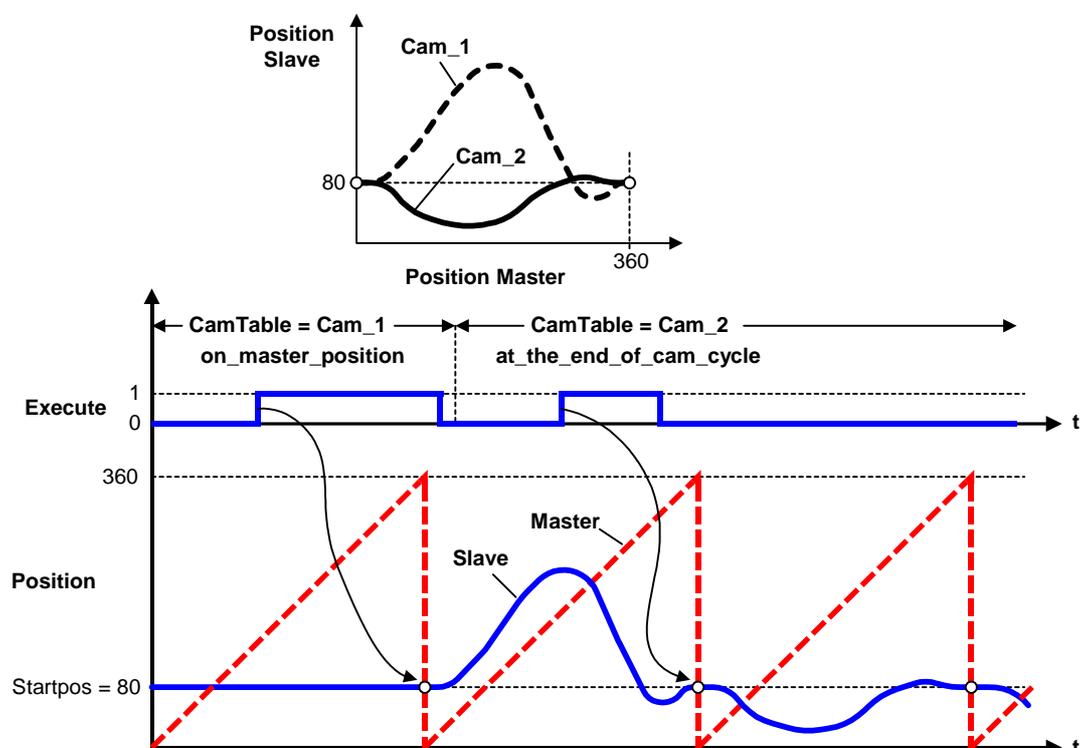
The following axis operates in absolute camming mode. The leading axis must operate in relative camming mode for synchronization "at the end of active cycle".

Synchronization condition:

Input parameter *Mode* = 0 sets the sync condition which is defined by the axis configuration or data written to the corresponding parameters. In this example, the synchronization condition is changed while the system is in RUN.

Sequence

- In S7T Config "Preset synchronization position of the leading axis" was selected as the synchronization mode when presetting the synchronization axis. The position reference was set to "Synchronize starting at the synchronization position" and the value 0.000000 was selected as the Sync. pos. master setpoint.
After *Execute* = 1, synchronization to Cam_1 starts at the value of 0.000000 of the leading axis.
- The synchronization condition is changed by calling FB MC_WriteParameter (parameter 4266 of the following axis is set to "AT_THE_END_OF_CAM_CYCLE".)
- Data are provided to the cam instance of Cam_2 cam at input parameter *CamTable*.
- After the next *Execute* = 1, synchronization to Cam_2 cam starts at the end of the active cams.



MC_CamIn - Example of "Synchronization condition AT_MASTER_AND_SLAVE_POSITION"

Synchronization mode:

The leading and following axes are operating in absolute camming mode.

Synchronization condition:

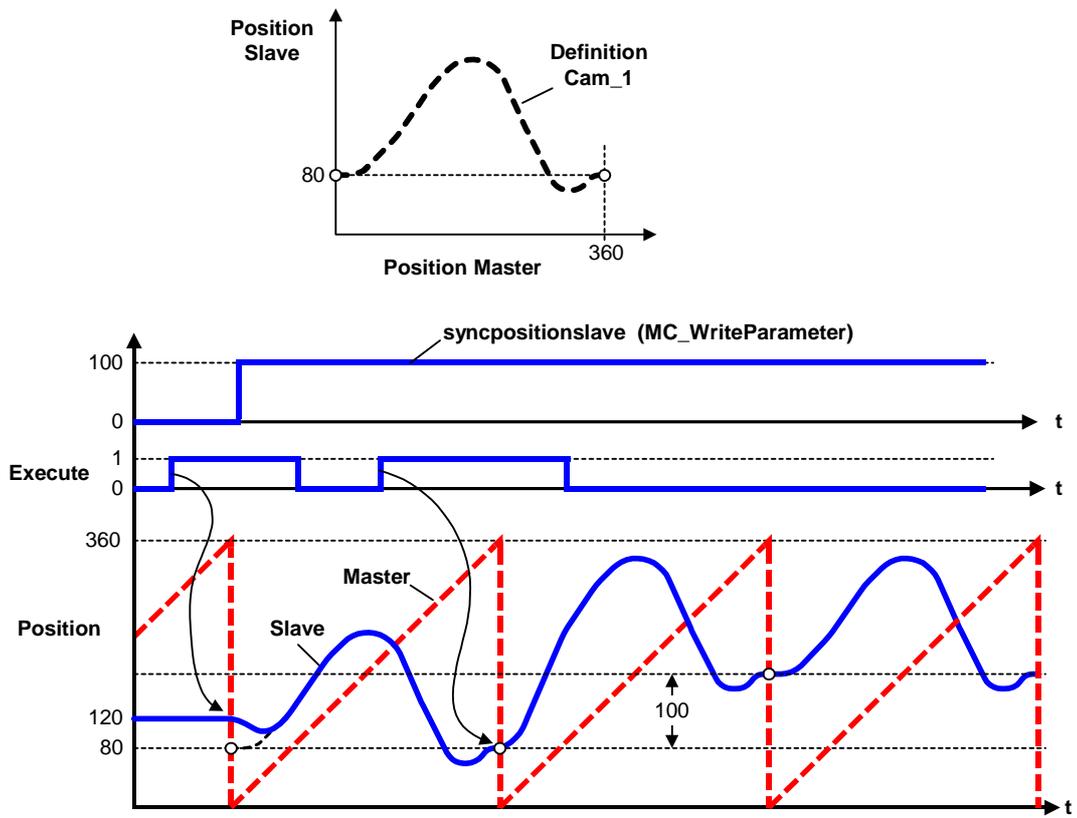
Input parameter *Mode* = 0 sets the synchronization condition which is defined by the axis configuration, or by the data written to the corresponding parameters. In this example, the synchronization position (parameter 4269) of the following axis is changed while the system is in RUN.

Sequence

- 1) Synchronization condition: *"Preset synchronization position of leading axis and following axis"*
Position reference: *"Synchronize starting at the synchronization position"*
Sync. pos. leading axis: 0.0
Sync. pos. following axis: 0.0

- 2) Changing the synchronization position at the MC_WriteParameter technology function (parameter 4269)

- 3) Synchronization condition: *"Preset synchronization position of leading axis and following axis"*
Position reference: *"Synchronize starting at the synchronization position"*
Sync. pos. leading axis: 0.0
Sync. pos. following axis: 100.0



MC_CamIn - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The signal required for a command to enable the following axis is missing.
8043	Illegal parameter value or preset value	Concerns the input parameters <i>Mode</i> or <i>DoneFlag</i> . This may also be a configuration error in S7T Config (typically: a synchronization length of 0 is set).
8044	Task not supported by the technology object	This is not a synchronization axis.
8045	Illegal command with current status	An MC_Stop command is busy.
804A	The required object interconnection is missing	The selected master / slave combination is not configured.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.

ErrorID	Error message	Description / to correct or avoid error
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.3.4 FB 423 MC_CamOut - End cam synchronism

Purpose

- "MC_CamOut" stops camming and the following axis. You can define the corresponding criteria in the axis configuration.
- **Recommendation:** Use the technology function if you want to stop the axis based on the position of the leading axis and / or the following axis. You can also remove the following axis from synchronized compound by means of the technology functions "MC_Halt", "MC_Stop", "MC_MoveRelative", "MC_MoveAdditive", "MC_MoveAbsolute", "MC_MoveVelocity" or "MC_MoveToEndPos".

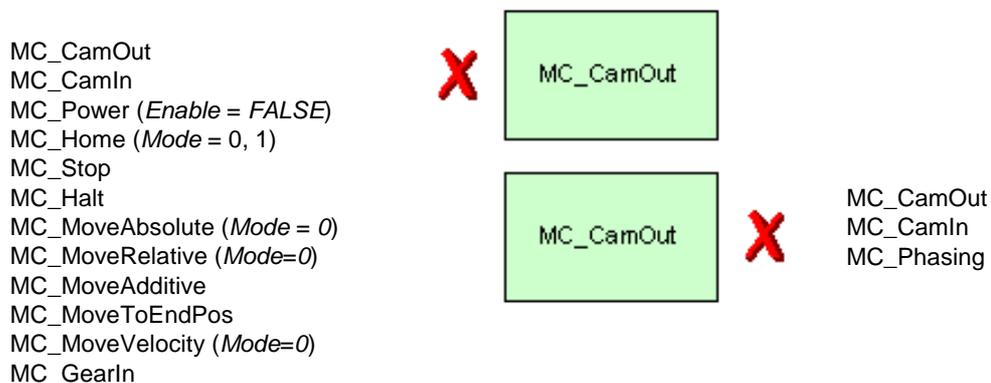
Applicable to

- Synchronization axes

Requirements

- The axis must be configured as slave for operation in an existing cam synchronization compound. If the cam is not operating in synchronized mode, the command is ignored and the technology function reports *Done = TRUE*.
- No MC_Stop command busy

Overriding commands



(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Slave	INT	0	Number of the following axis technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Camming terminated; following axis has stopped. Output parameter <i>Done</i> also signals <i>TRUE</i> if camming was not active.
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

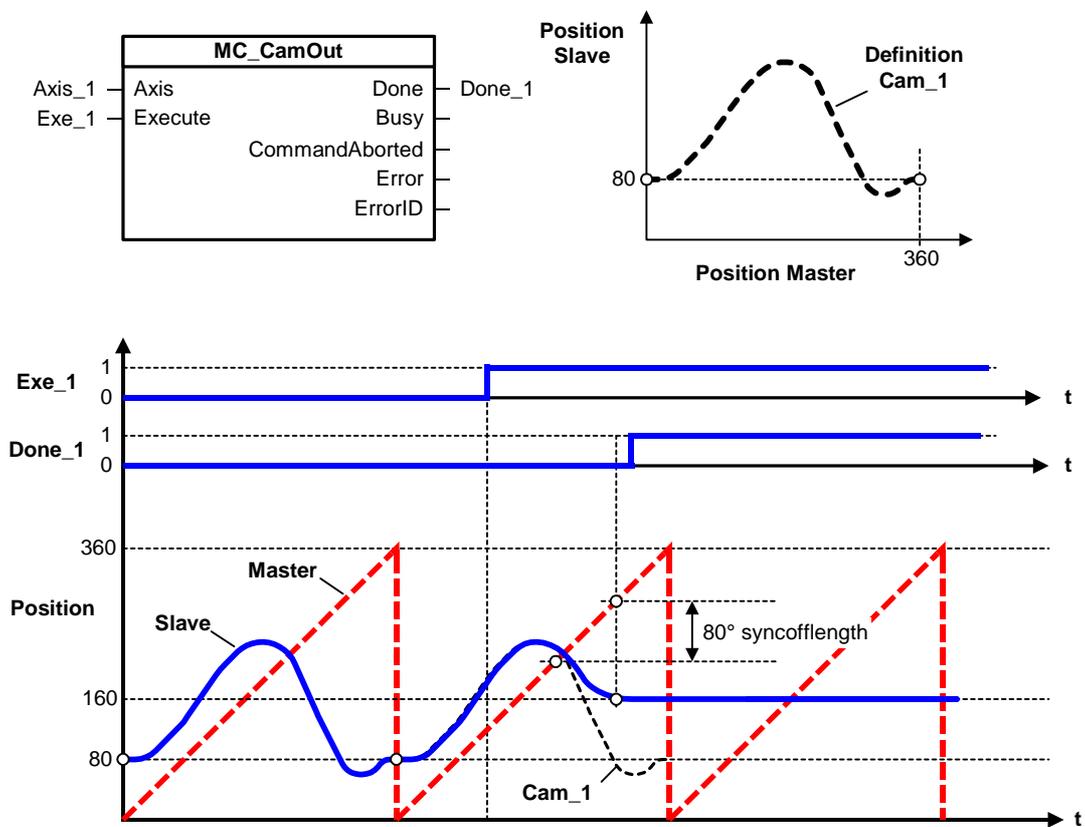
MC_CamOut - Example

The MC_CamOut technology function (technology function) is used to stop camming and to stop the axis according to the configured mode. In this example, the slave is to be stopped at 160°. Required settings:

Desynchronization "at the following axis position"
 Position reference: "Stop before desynchronization position"
 Desynchronization following axis: 160°

The axis is desynchronized based on the leading axis position. The following axis is desynchronized while the leading axis covers an angular distance of 80°. The start time of desynchronization is calculated internally.

Default profile setting: "Leading axis-specific synchronization profile"
 Desynchronization length: 80°



MC_CamOut - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the command interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The signal required for a command to enable the following axis is missing.
8043	Illegal parameter value or preset value	This may also be a configuration error in S7T Config (typically: a sync off length of 0 is set).
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	An "MC_Stop" command is still busy, for example.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.

ErrorID	Error message	Description / to correct or avoid error
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.

6.3.5 FB 424 MC_Phasing - Change phase shift between master and slave axes

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_Phasing" technology function sets a phase shift between the leading axis position and the following axis. This does not actually influence the position of the leading axis.
- The effect on the following axis in cam synchronism is the same as a horizontal cam shift.
- The phase can be referenced relative or absolute.
- The function can be started when the axis is at a standstill and also when it is moving.
- Use the dynamic parameters *Velocity*, *Jerk*, *Acceleration*, *Deceleration* to define the dynamic response during axis movement.

Applicable to

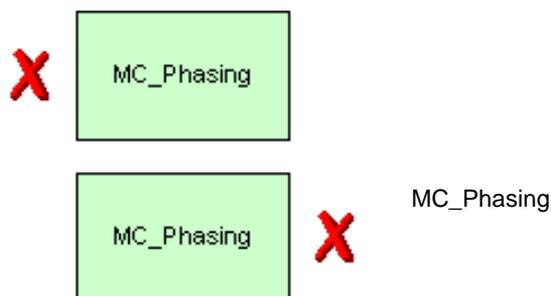
- Synchronization axes in camming or gearing mode

Requirements

- An MC_Stop command is not busy at the following axis
- The axis must be configured as slave for operation in an existing gearing or camming compound.

Overriding commands

MC_Phasing
 MC_Power (*Enable = FALSE*)
 MC_Home (*Mode = 0, 1*)
 MC_Stop
 MC_Halt
 MC_MoveAbsolute (*Mode = 0*)
 MC_MoveRelative (*Mode = 0*)
 MC_MoveAdditive
 MC_MoveToEndPos
 MC_MoveVelocity (*Mode = 0*)
 MC_GearIn
 MC_CamIn
 MC_GearOut
 MC_CamOut



(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Master	INT	0	Number of the leading axis technology DB
Slave	INT	0	Number of the following axis technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
PhaseShift	REAL	0.0	Phase shift
Velocity	REAL	-1.0	Maximum velocity for setting phase shift: Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Acceleration	REAL	-1.0	Acceleration for setting phase shift: Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Deceleration	REAL	-1.0	Deceleration for setting phase shift: Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk, for setting phase shift: Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
Absolute	BOOL	TRUE	Phase shift: Value = 0: relative to current phase Value = 1: absolute to current phase (cf. Example)
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Required phase position reached
Busy	BOOL	FALSE	TRUE: Command is busy
command Aborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was aborted by a successive command. When error at the integrated technology is indicated at ErrorStatus, the command was canceled by the next command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

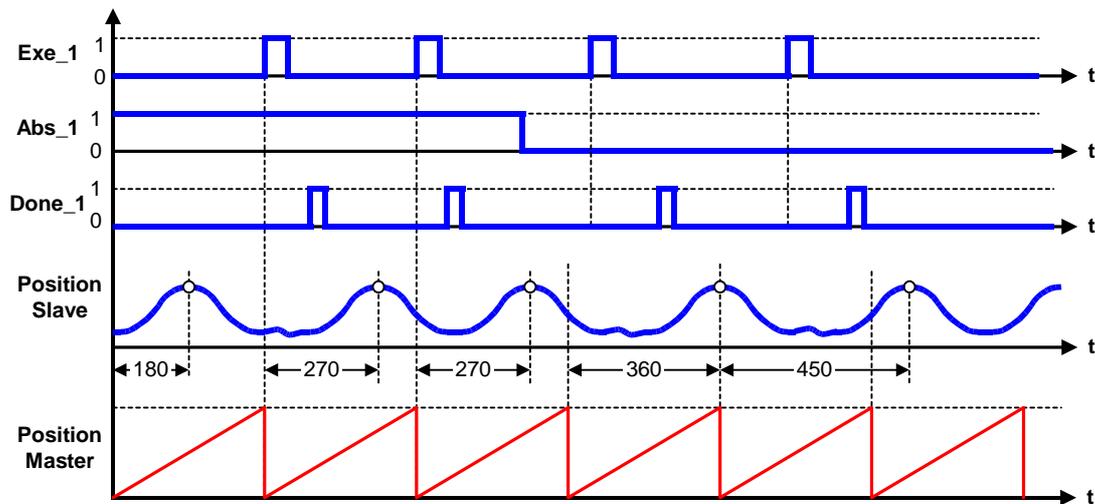
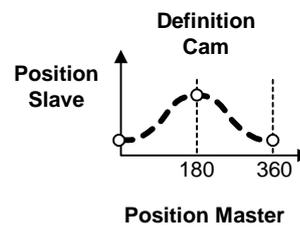
MC_Phasing - Example

Use the "MC_Phasing" technology function to shift the phase of a cam during camming.

When *Absolute* = 1, the phase shift of the cam compared with its defined position is defined by an absolute value. Repeated phasing with the same value of *PhaseShift* does not have any effect.

When *Absolute* = 0, the phase shift changes relative, i.e. the phase shifts with each command by the value set at *PhaseShift*.

MC_Phasing			
Axis_1	Master	Done	Done_1
Axis_2	Slave	Busy	
Exe_1	Execute	CommandAborted	
90	PhaseShift	Error	
	Velocity	ErrorID	
	Acceleration		
	Deceleration		
	Jerk		
Abs_1	Absolute		
0	DoneFlag		



MC_Phasing - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The signal required for a command to enable the following axis is missing.
8043	Illegal parameter value	Concerns input parameter <i>DoneFlag</i> .
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	No synchronous operation.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)

ErrorID	Error message	Description / to correct or avoid error
8079	No synchronous operation with specified master	The specified master and the slave are not in synchronism. Synchronize the relevant axes before you call the function.
8083	DB is not a technology DB	The DB specified at input parameter <i>Master</i> or <i>Slave</i> does not exist or is not a technology DB.
8084	Invalid technology DB	<ul style="list-style-type: none"> A technology object was not found in the system for the technology DB specified at the <i>Master</i> or <i>Slave</i> input parameters. Download the current technology to the PLC, or change the DB number at the <i>Master</i> or <i>Slave</i> input parameters. The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	Invalid floating-point format of at least one input parameter value. Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).

6.3.6 FB 441 MC_CamInSuperImposed - Start superimposing cam synchronism

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_CamInSuperImposed" technology function initiates superimposing camming between the leading and following axes.
- You define the dynamic characteristics of slave synchronization at the dynamic parameters *Velocity*, *Jerk*, *Acceleration* you define the dynamic characteristics of slave synchronization.
- The specified cam can be scaled and/or shifted.
- Synchronization may be relative or absolute.
- The specified cam disk can be executed once or cyclically.

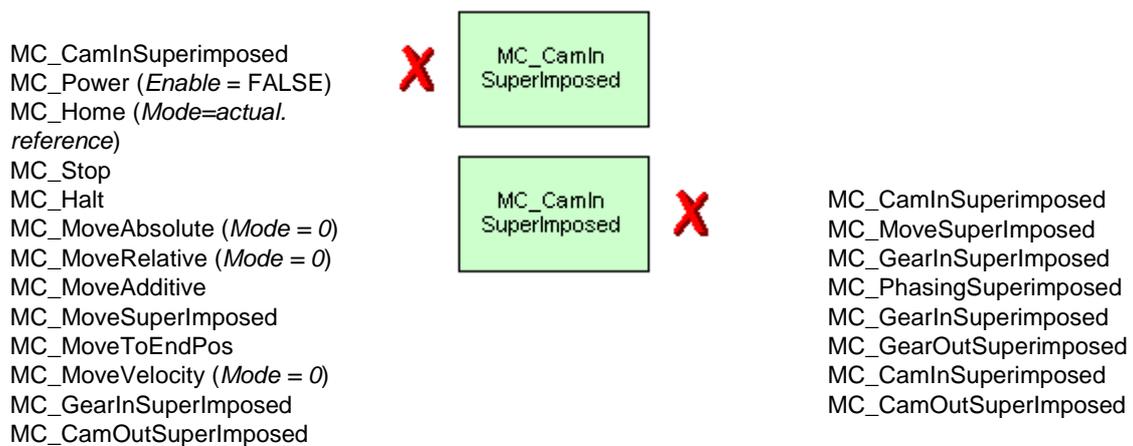
Applicable to

- Synchronization axes with superimposing synchronization object

Requirements

- The leading axis is configured for operation as external encoder, or as positioning or synchronization axis.
- The following axis is configured as synchronization axis with superimposing synchronization object.
- The leading axis is selected as available superimposing synchronization object of the following axis.
- The cam disk is marked available at the superimposing synchronization object.
- The following axis is enabled for position-controlled operation
- An MC_Stop command is not busy at the following axis

Overriding commands



(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Master	INT	0	Number of the leading axis technology DB
Slave	INT	0	Number of the following axis technology DB
CamTable	INT	0	Number of the cam disk technology DBs
Execute	BOOL	FALSE	Start of the command at the positive edge
Master offset	REAL	0.0	Shifting the cam along the coordinates of the leading axis
SlaveOffset	REAL	0.0	Shifting the cam along the coordinates of the following axis
MasterScaling	REAL	1.0	Scaling factor for the cam in the coordinates of the leading axis
SlaveScaling	REAL	1.0	Scaling factor for the cam in the coordinates of the following axis
MasterAbsolute	BOOL	TRUE	Interpret cam disk absolute or relative to the leading axis TRUE: absolute coordinates FALSE: relative coordinates
SlaveAbsolute	BOOL	TRUE	Interpret cam disk absolute or relative to the following axis TRUE: absolute coordinates FALSE: relative coordinates
CyclicMode	BOOL	TRUE	Cam disk processing TRUE: cyclic processing FALSE: no cyclic processing
Velocity	REAL	-1.0	Maximum velocity when coupling the slave (only <i>Mode</i> = 1) Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value

Parameter	Data type	Start value	Description
Acceleration	REAL	-1.0	Acceleration when coupling the slave (only when <i>Mode</i> = 1) Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk when coupling the slave (only when <i>Mode</i> = 1) Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
Mode	INT	0	Coupling mode Value = 0: according to default in S7T Config Value = 1: according to the dynamic parameters of the technology function
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB The value of DoneFlag is inverted when the command (<i>InSync</i>) is completed.

Output parameters

Parameter	Data type	Start value	Description
InSync	BOOL	FALSE	TRUE: superimposing cam synchronism reached
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_CamInSuperImposed - Example of "Superimposition"

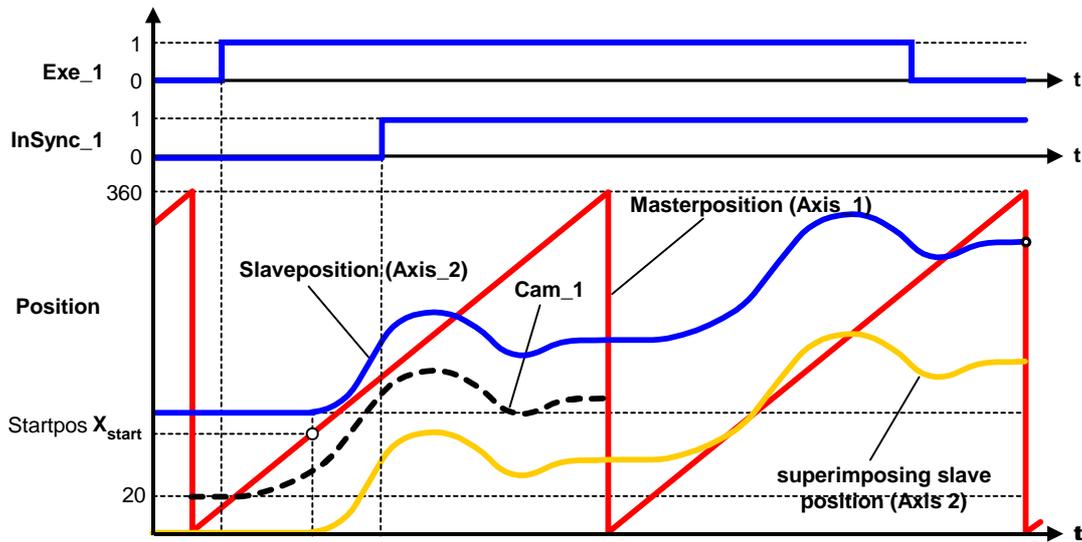
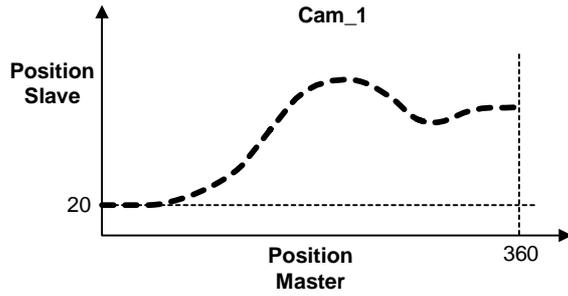
The example below shows the operating principle of a superimposing cam disk, based on its signal profile. In order to keep the example as simple as possible, we have excluded base synchronism from the signal profile shown.

At the start of the signal profile, both the leading axis (*Axis_1*) and the following axis (*Axis_2*) have a start position > 0 . The default superimposing position of the slave starts at 0 .

Exe_1 starts superimposing camming. Synchronization starts according to *Mode = 0* with the default settings in S7T Config (synchronization starting at leading axis position 100 with dynamic setpoints.) Synchronization starts when the leading axis has reached (*Axis_1*) position 100. After a short delay, *InSync_1* reports that cam synchronism is reached.

The signal flow highlighted in orange color indicates the superimposing slave position. The slave position follows according to its start position and with constant offset to the superimposing slave position.

MC_CamInSuperImposed			
Axis_1	Master	InSync	InSync_1
Axis_2	Slave	Busy	
Cam_1	CamTable	CommandAborted	
Exe_1	Execute	Error	
0.0	MasterOffset	ErrorID	
0.0	SlaveOffset		
1.0	MasterScaling		
1.0	SlaveScaling		
1	MasterAbsolute		
0	SlaveAbsolute		
1	CycleMode		
0	Velocity		
0	Acceleration		
0	Jerk		
0	Mode		
0	DoneFlag		



MC_CamInSuperImposed - Example "Base synchronism with superimposing camming"

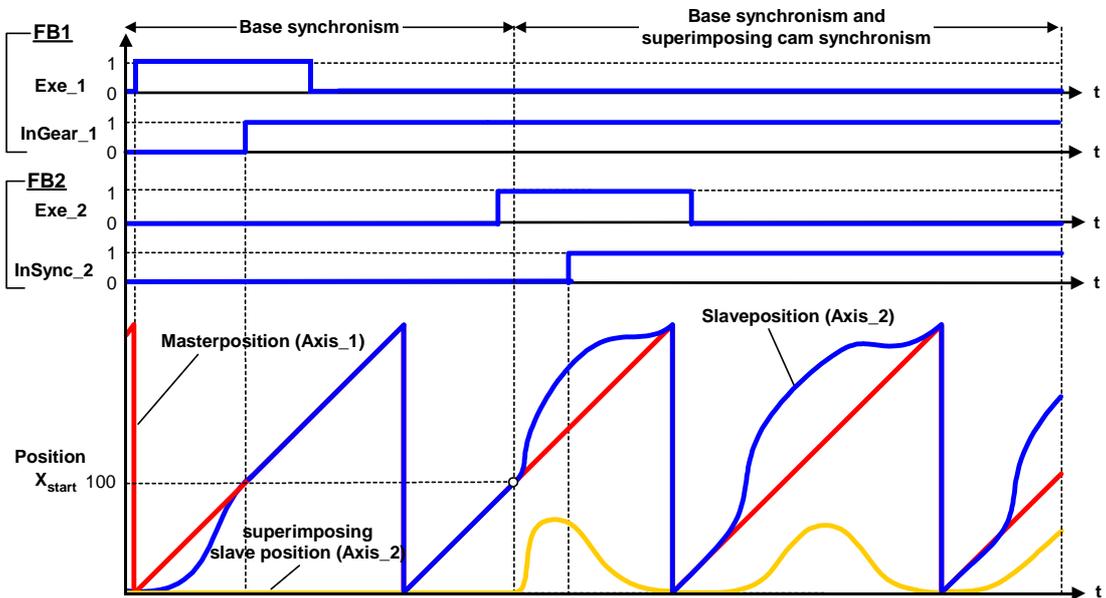
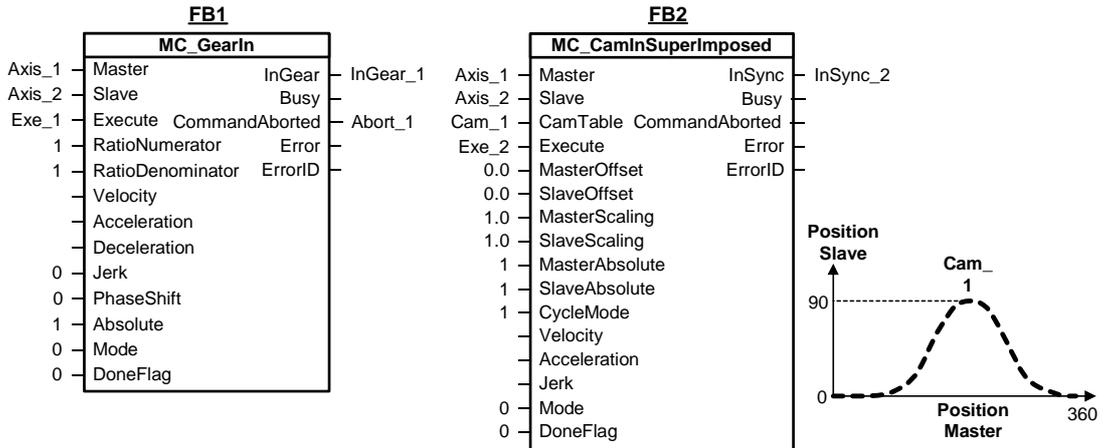
The signal profile of the example below demonstrates the effect of absolute base synchronism and superimposing camming.

Phase one - Base synchronism

Exe_1 starts absolute base synchronism. Synchronization starts according to *Mode = 0* at "MC_GearIn" with the default settings in S7T Config (synchronization starting at leading axis position 100 with dynamic setpoints.) Synchronization starts when the leading axis has reached (*Axis_1*) position 100. After a short delay, *InGear_1* reports that absolute base synchronism is reached.

Phase two - Base synchronism and superimposing camming

Exe_2 starts superimposing camming. The default start position of superimposing slave is 0. After a short delay, *InSync_2* indicates that superimposing cam synchronism is reached. The slave position is derived from the sum of the "Base slave position" (identical with master position (*Axis_1*)) + "superimposing slave position".



MC_CamInSuperImposed - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing. Eliminate and acknowledge all queued errors and then enable the axis in the relevant mode (e.g. position-controlled).
8043	Illegal parameter value	Concerns the input parameters Mode or DoneFlag. This may be caused by the configuration, because this error also appears when a faulty command parameter is found within the block that forms the default based on the configuration, for example, the synchronization length = 0. A further source of error in the configuration could be that the specified cam disk is not selected in the configuration of the synchronization object.
8044	Task not supported by the technology object	Send a command to a measuring sensor or cam.
8045	Illegal command with current status	Examples: <ul style="list-style-type: none"> An MC_Stop command is busy. The specified cam disk is currently performing a restart. Wait until "MC_Reset" (<i>Restart = TRUE</i>) was executed. Then, call "MC_CamInSuperImposed" once again.
804A	The required object interconnection is missing	The selected master / slave combination is not configured.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at the input parameters <i>Master</i> or <i>Slave</i> does not exist or is not a technology DB.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object was not found in the system for the technology DB specified at the <i>Master</i> or <i>Slave</i> input parameters. Download the current technology to the PLC, or change the DB number at the <i>Master</i> or <i>Slave</i> input parameters. • The user has written invalid data to the technology DB specified at input parameter <i>Master</i> or <i>Slave</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.3.7 FB 443 MC_CamOutSuperImposed- Terminate superimposing cam synchronism

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_CamOutSuperImposed" technology function stops superimposing camming. This does not affect basic motions or base synchronism.
- The command is completed when following axis synchronism is terminated according to the axis configuration or to the dynamic parameters of the technology function.

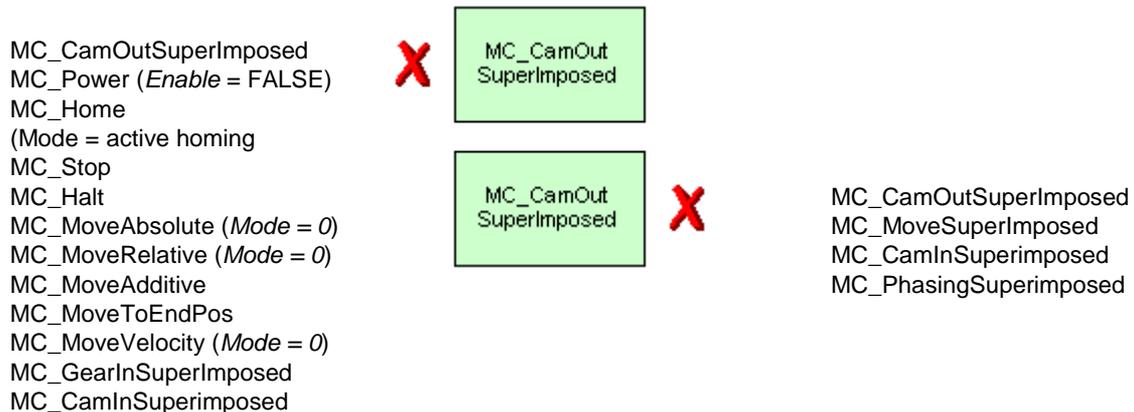
Applicable to

- Synchronization axes with superimposing synchronization object

Requirements

- The axis must be configured as slave for operation on the system with superimposing synchronization. If the axis is not operating in synchronous mode, the command is ignored and the technology function reports *Done = TRUE*.
- No MC_Stop command is busy

Overriding commands



(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Slave	INT	0	Number of the following axis technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
Deceleration	REAL	-1.0	Delay at the end of camming (only when <i>Mode</i> = 1): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk at the end of camming (only when <i>Mode</i> = 1): Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
Mode	INT	0	Decoupling mode Value = 0: Default Value = 1: according to dynamic preset
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB When the final velocity is reached, the DoneFlag value is inverted

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Camming stopped; following axis has stopped
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If <i>ErrorStatus</i> of the technology DB does not indicate an error, the command was canceled by a subsequent command. If <i>ErrorStatus</i> reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the <i>ErrorID</i> . FALSE: Command initiation without error
ErrorID	WORD	0	<i>ErrorID</i> of the <i>Error</i> output parameter.

MC_CamOutSuperImposed - ErrorIDs

Valid for firmware version V3.1.x of the integrated technology

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing. Eliminate and acknowledge all queued errors and then enable the axis in the relevant mode (e.g. position-controlled).
8043	Illegal parameter value	Concerns the input parameters <i>Mode</i> or <i>DoneFlag</i> . This could also be a faulty configuration in S7T Config.
8044	Task not supported by the technology object	Send a command to a measuring sensor or cam.
8045	Illegal command with current status	An MC_Stop command is busy, for example.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Slave</i> or the technology DB was not found or is not a technology DB.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Slave</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Slave</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Slave</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.3.8 FB 440 MC_GearInSuperImposed - Start superimposing gear synchronism

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_GearInSuperImposed" technology function starts superimposing gearing between a leading axis and a following axis.
- You define the dynamic characteristics of slave synchronization at the dynamic parameters *Velocity*, *Jerk*, *Acceleration*, *Deceleration* you define the dynamic characteristics of slave synchronization.
- The gear ratio is defined as the ratio between two integer numbers at the input parameter (nominator / denominator.)
- Synchronism can be defined relative to the start position (random position values upon reaching synchronism) or absolute.
- The gear ratio can be changed when the system is in RUN by outputting a new MC_GearInSuperImposed command. This operation does not require a stop of the leading or following axis. Transitions are executed according to the specified acceleration or deceleration values.
- The function can be started when the leading axis is at a standstill, or when it is in motion.

Applicable to

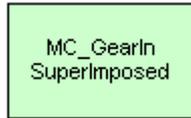
- Synchronization axes with superimposing synchronization object

Requirements

- The leading axis is configured for operation as external encoder, or as positioning or synchronization axis.
- The following axis is configured as synchronization axis with superimposing synchronization object.
- The leading axis is set as available superimposing synchronization object of the following axis.
- The following axis is enabled for position-controlled operation
- No MC_Stop command is busy at the following axis

Overriding commands

MC_GearInSuperImposed
 MC_Power (*Enable* = FALSE)
 MC_Home
 (Mode = active homing)
 MC_Stop
 MC_Halt
 MC_MoveAbsolute (*Mode* = 0)
 MC_MoveRelative (*Mode* = 0)
 MC_MoveAdditive
 MC_MoveVelocity (*Mode* = 0)
 MC_MoveSuperImposed
 MC_MoveToEndPos
 MC_GearIn
 MC_CamIn
 MC_CamInSuperimposed
 MC_GearOutSuperimposed



MC_GearInSuperImposed
 MC_MoveSuperImposed
 MC_CamInSuperimposed
 MC_PhasingSuperimposed
 MC_GearOutSuperimposed
 MC_CamOutSuperImposed

(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Master	INT	0	Number of the leading axis technology DB
Slave	INT	0	Number of the following axis technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
RatioNumerator	DINT	1	Gear ratio nominator
RatioDenominator	DINT	1	Gear ratio denominator
Velocity	REAL	-1.0	Maximum velocity at the transition to gearing (only when Mode = 1): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Acceleration	REAL	-1.0	Acceleration at the transition to gearing (only when Mode = 1): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Deceleration	REAL	-1.0	Delay at the transition to gearing (only when Mode = 1): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk at the transition to gearing (only when Mode = 1): Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value

Parameter	Data type	Start value	Description
PhaseShift	REAL	0.0	Phase offset after reaching synchronism With <i>Absolute</i> = <i>TRUE</i> , the phase offset effect is absolute when synchronism is reached. With <i>Absolute</i> = <i>FALSE</i> , the specified phase offset is added to the phase offset determined by the relative relationship.
Absolute	BOOL	TRUE	TRUE: Absolute superimposing gearing, absolute to the axis zero position, parameter output to <i>Jerk</i> is ignored, the system always uses the trapezoidal motion profile (unlimited jerk.) FALSE: Relative superimposing gearing, relative to start position
Mode	INT	0	Synchronization mode / coupling mode: Value = 0: Use default of the corresponding synchronization object Value = 1: Start synchronization immediately according to dynamic parameters <i>Velocity</i> , <i>Jerk</i> , <i>Acceleration</i> , <i>Deceleration</i>
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB When gear synchronism is reached, the DoneFlag value is inverted

Output parameters

Parameter	Data type	Start value	Description
InGear	BOOL	FALSE	TRUE: superimposing gear synchronism reached
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If <i>ErrorStatus</i> of the technology DB does not indicate an error, the command was canceled by a subsequent command. If <i>ErrorStatus</i> reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the <i>ErrorID</i> . FALSE: Command initiation without error
ErrorID	WORD	0	<i>ErrorID</i> of the <i>Error</i> output parameter.

MC_GearInSuperImposed - Example of "Superimposition"

The signal profile in the example below demonstrates the differences between absolute base synchronism and absolute superimposing synchronism.

Phase one - Base synchronism

Exe_1 starts absolute base synchronism. The following axis (*Axis_3*) changes to synchronized operation after a short delay time has expired, and the technology function reports *InGear_1*.

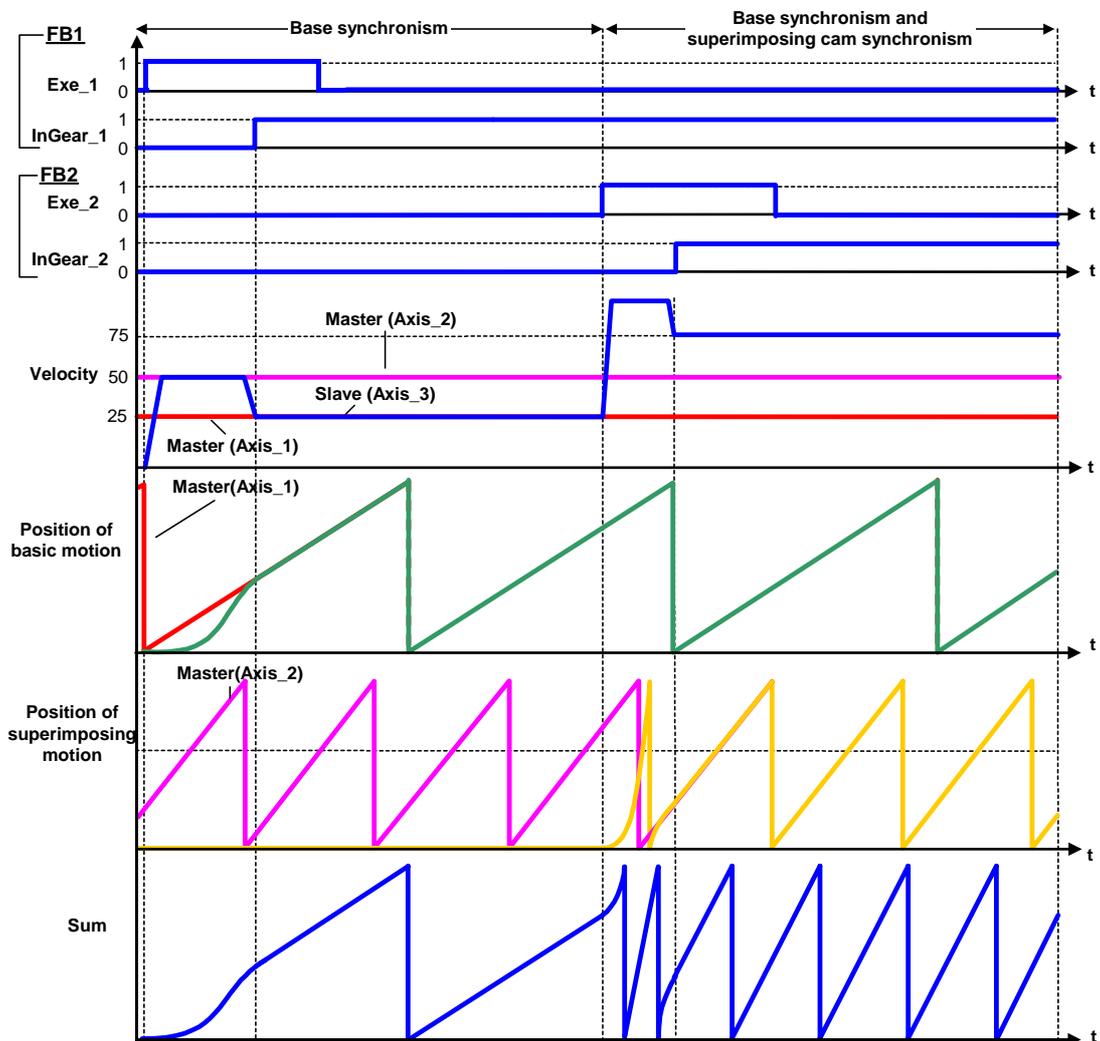
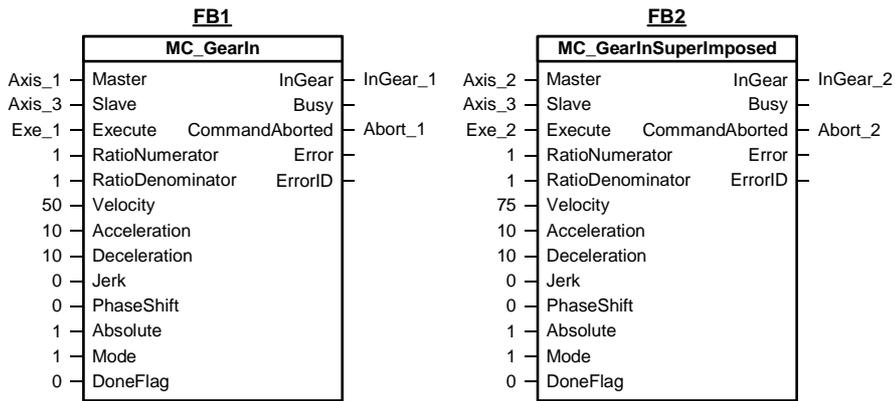
Within the basic synchronization phase, the position of the basic motion corresponds with the position of the additive motion, because the position of the superimposing motion starts at 0 by default.

An absolute reference is established between the master position (*Axis_1*) and the position of the basic motion (green signal profile.)

Phase two - Base synchronism and superimposing synchronism

Exe_2 starts absolute superimposing synchronism (orange-colored signal profile.) An absolute reference is established between the master position (*Axis_2*) and the superimposing motion of the following axis. The absolute reference between the master position (*Axis_1*) and the position of the basic motion (green signal profile) is retained.

The following axis position (*Axis_3*) is derived from the sum of the "position of basic motion" plus "position of superimposing motion" values. When superimposed synchronism is reached, the technology function reports *InGear_2*.



MC_GearInSuperImposed - Example of "Relative/absolute superimposing synchronism"

The signal profile in the example below demonstrates the differences between relative and absolute superimposing synchronism. In order to keep the example as simple as possible, we have excluded base synchronism from the signal profile shown.

Phase 1 - relative superimposing synchronism

At the start of the signal profile shown, the leading axis (*Axis_1*) and the following axis (*Axis_2*) have the same start position. A positive edge at *Exe_1* starts relative superimposing synchronism. After a short delay, *InGear_1* reports that relative superimposing synchronism is reached.

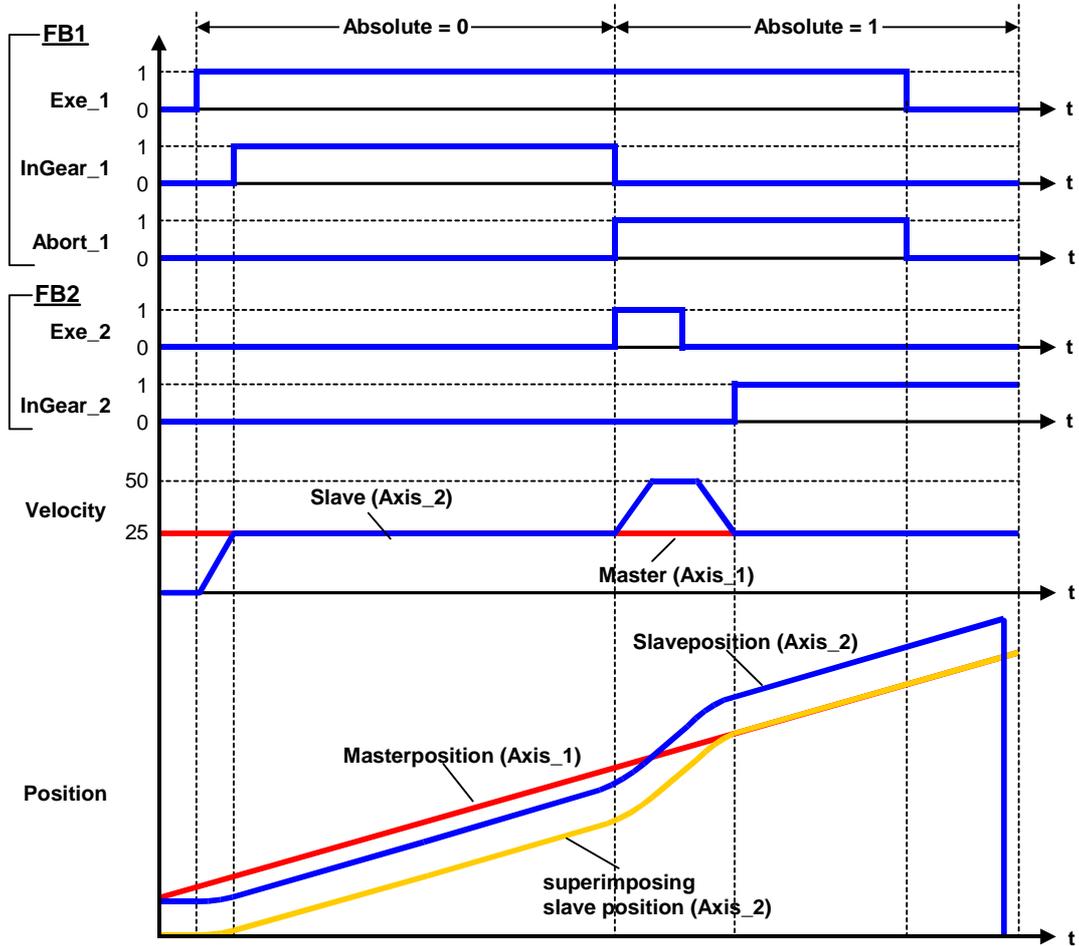
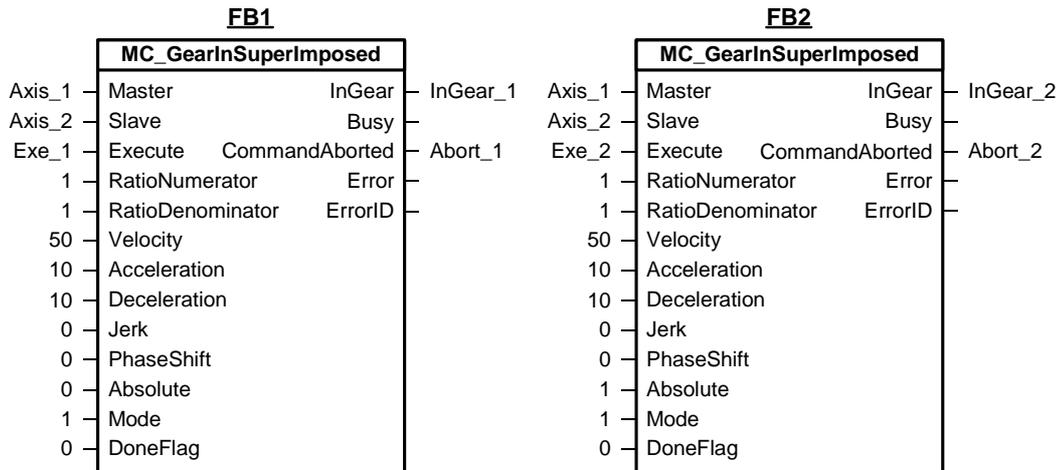
The signal profile highlighted in orange color (phase 1) shows the superimposing slave position (*Axis_2*). The default start position of the superimposing slave position is 0.

Relative synchronism is established between the master position (*Axis_1*) and the superimposing slave position (*Axis_2*).

Phase 2 - absolute superimposing synchronism

Exe_2 cancels current relative superimposing synchronism and starts absolute superimposing synchronism. After a short delay, *InGear_2* reports that absolute superimposing synchronism is reached.

The signal profile highlighted in orange color (phase 2) shows the superimposing slave position (*Axis_2*). Absolute synchronism is established between the master position (*Axis_1*) and the superimposing slave position (*Axis_2*). The reference to the original superimposing slave position is retained. Hence, the offset between the superimposing slave position and the slave position is also retained.



MC_GearInSuperImposed - Example of "Phase shift"

The signal profile in the example below shows the differences between absolute superimposing synchronism with and without phase shift. In order to keep the example as simple as possible, we have excluded base synchronism from the signal profile shown.

Absolute superimposing synchronism without phase shift

Start positions at the start of the signal profile:

- Master position (*Axis_1*) = 0
- Slave position (*Axis_2*) =
- superimposing slave position = 0

A positive edge at *Exe_1* starts absolute superimposing synchronism without phase shift. After a short delay, *InGear_1* reports that absolute superimposing synchronism is reached.

The signal flow highlighted in orange color indicates the superimposing slave position. The default start position of the superimposing slave position is 0.

Absolute synchronism is established between the master position (*Axis_1*) and the superimposing slave position (*Axis_2*).

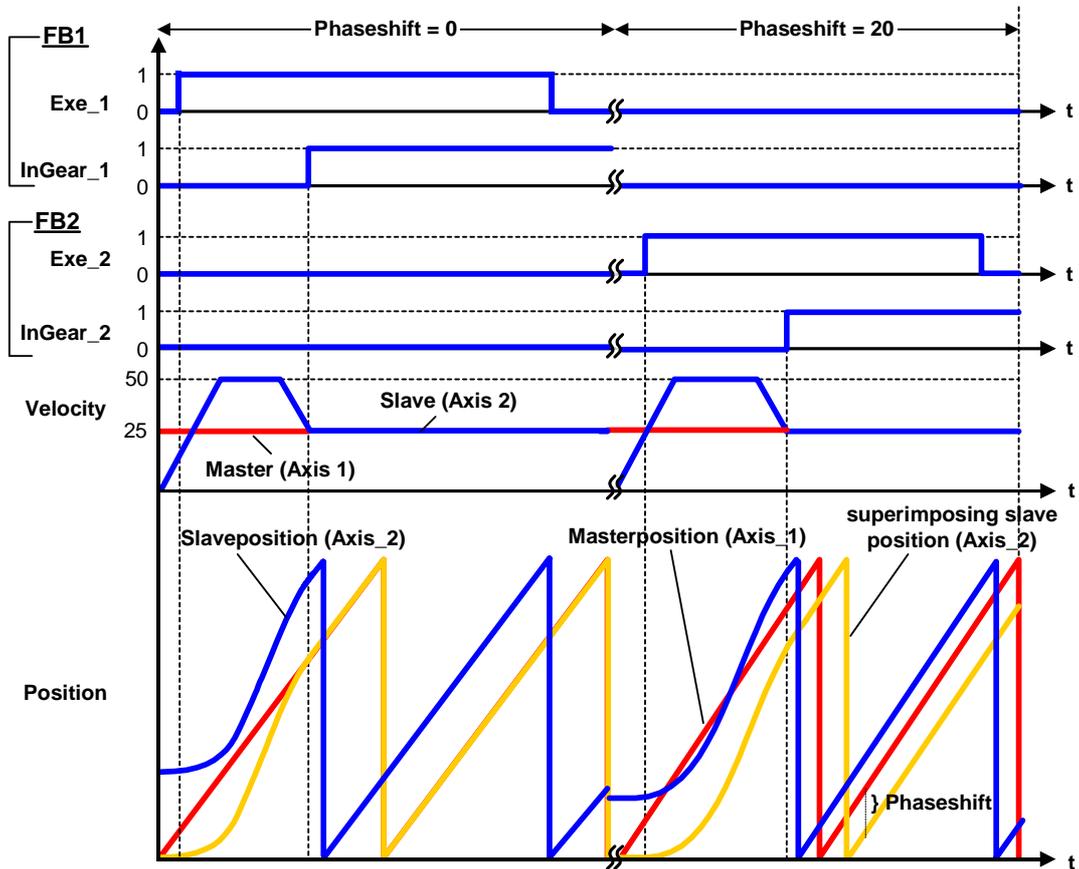
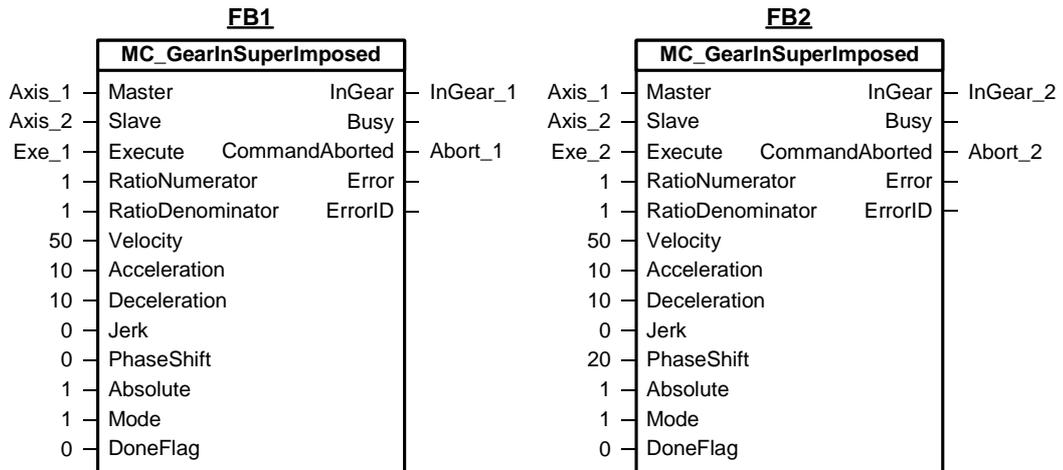
Absolute superimposing synchronism with phase shift

The signal profile applies to the start positions in analog to the signal profile without phase shift.

- Master position (*Axis_1*) = 0
- Slave position (*Axis_2*) =
- superimposing slave position = 0

A positive edge at *Exe_2* starts absolute superimposing synchronism with phase shift. After a short delay, *InGear_2* reports that absolute superimposing synchronism is reached.

This time, however, the orange-colored signal profile shows the superimposing slave position (*Axis_2*) with the specified phase shift. The default start position of the superimposing slave position is again 0.



MC_GearInSuperImposed - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing. Eliminate and acknowledge all queued errors and then enable the axis in the relevant mode (e.g. position-controlled).
8043	Illegal parameter value	Concerns the input parameters <i>Mode</i> or <i>DoneFlag</i> . This may be caused by the configuration, because this error also appears when a faulty command parameter is found within the block that forms the default based on the configuration, for example, the synchronization length = 0.
8044	Task not supported by the technology object	Send a command to a measuring sensor or cam.
8045	Illegal command with current status	An MC_Stop command is busy, for example.
804A	The required object interconnection is missing	The selected master / slave combination is not configured.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at the input parameters <i>Master</i> or <i>Slave</i> does not exist or is not a technology DB.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object was not found in the system for the technology DB specified at the <i>Master</i> or <i>Slave</i> input parameters. Download the current technology to the PLC, or change the DB number at the <i>Master</i> or <i>Slave</i> input parameters. • The user has written invalid data to the technology DB specified at input parameter <i>Master</i> or <i>Slave</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.3.9 FB 442 MC_GearOutSuperImposed - Terminate superimposing gear synchronism

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_CamOutSuperImposed" technology function terminates superimposing camming. This does not affect basic motions or base synchronism.
- Superimposing synchronism can be terminated immediately in *Mode = 1* by means of the input parameters *Deceleration* and *Jerk*. You can also terminate superimposing synchronism in *Mode = 0*, according to the default setting of the superimposing synchronization object in S7T Config.
- The technology function is terminated after superimposing synchronism of the following axis is terminated.

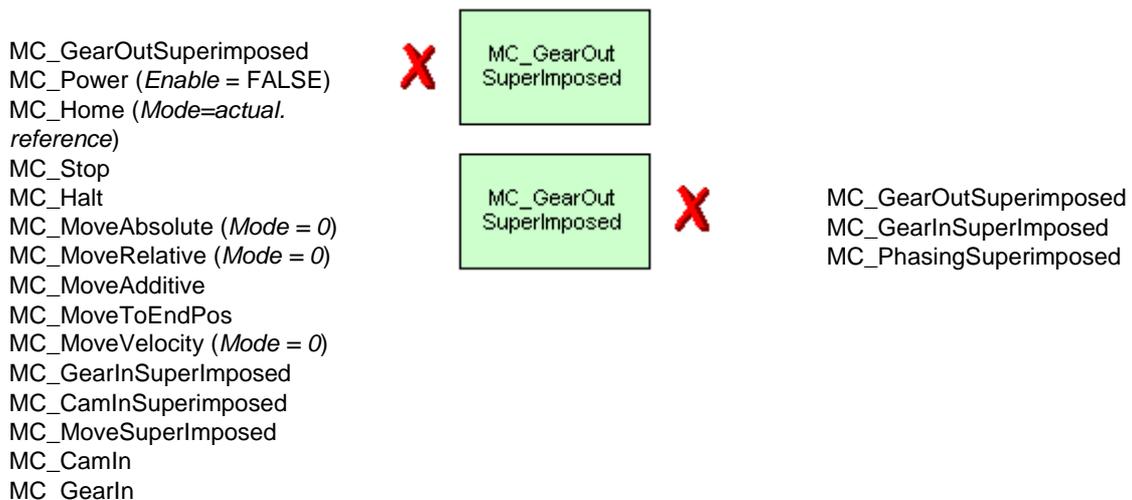
Applicable to

- Synchronization axes with superimposing synchronization object

Requirements

- The axis must be configured as slave for operation on a system with superimposing synchronization. If the axis is not operating with superimposing synchronism, the command is ignored and the technology function reports *Done = TRUE*.
- No MC_Stop command is busy

Overriding commands



(Cancellation relationships are shown in read direction)

Input parameters

Parameter	Data type	Start value	Description
Slave	INT	0	Number of the following axis technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
Deceleration	REAL	-1.0	Delay at the end of superimposing gearing(only when <i>Mode</i> = 1): Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Jerk	REAL	-1.0	Jerk at the end of superimposing gearing(only when <i>Mode</i> = 1): Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
Mode	INT	0	Synchronization termination mode: Value = 0: use the default setting of the corresponding synchronization object Value = 1: Immediate termination of synchronization according to input parameters <i>Deceleration</i> and <i>Jerk</i>
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Superimposing gearing stopped.
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If <i>ErrorStatus</i> of the technology DB does not indicate an error, the command was canceled by a subsequent command. If <i>ErrorStatus</i> reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the <i>ErrorID</i> . FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_GearOutSuperImposed - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing. Eliminate and acknowledge all queued errors and then enable the axis in the relevant mode (e.g. position-controlled).
8043	Illegal parameter value	Concerns the input parameters <i>Mode</i> or <i>DoneFlag</i> .
8044	Task not supported by the technology object	Send a command to a measuring sensor or cam.
8045	Illegal command with current status	An MC_Stop command is busy, for example.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)

ErrorID	Error message	Description / to correct or avoid error
8083	DB is not a technology DB	The DB specified at input parameter <i>Slave</i> or the technology DB was not found or is not a technology DB.
8084	Invalid technology DB	<ul style="list-style-type: none">• A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Slave</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Slave</i>.• The user has written invalid data to the technology DB specified at input parameter <i>Slave</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	Invalid floating-point format of at least one input parameter value. Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).

6.3.10 FB 444 MC_PhasingSuperImposed - Change superimposing phase shift

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The MC_PhasingSuperImposed technology function sets a superimposing phase shift between the leading axis and following axis positions. The phase shift value is based on the following axis requirements. Superimposing phase shift affect the following axis. The phase shift does not influence the position of the leading axis.
- The effect on the following axis in cam synchronism is the same as a horizontal cam shift.
- The phase can be referenced relative or absolute.
- The function can be started when the axis is at a standstill and also when it is moving.
- Use the dynamic parameters *Velocity*, *Jerk*, *Acceleration*, *Deceleration* to define the dynamic response during axis movement.

Applicable to

- Synchronization axes with superimposing synchronization object operating with camming and gearing

Requirements

- An MC_Stop command is not busy at the following axis
- The axis must be configured as slave for operation on the system with superimposing camming or gearing.

Overriding commands

MC_PhasingSuperimposed
 MC_Power (*Enable = FALSE*)
 MC_Home (*Mode=actual homing*)
 MC_Stop
 MC_Halt
 MC_MoveVelocity (*Mode = 0*)
 MC_MoveAbsolute (*Mode = 0*)
 MC_MoveRelative (*Mode = 0*)
 MC_MoveAdditive
 MC_MoveSuperImposed
 MC_MoveToEndPos
 MC_GearIn
 MC_GearInSuperImposed
 MC_GearOutSuperimposed
 MC_CamIn
 MC_CamInSuperimposed
 MC_CamOutSuperImposed



MC_Phasing
SuperImposed

MC_Phasing
SuperImposed



MC_PhasingSuperimposed

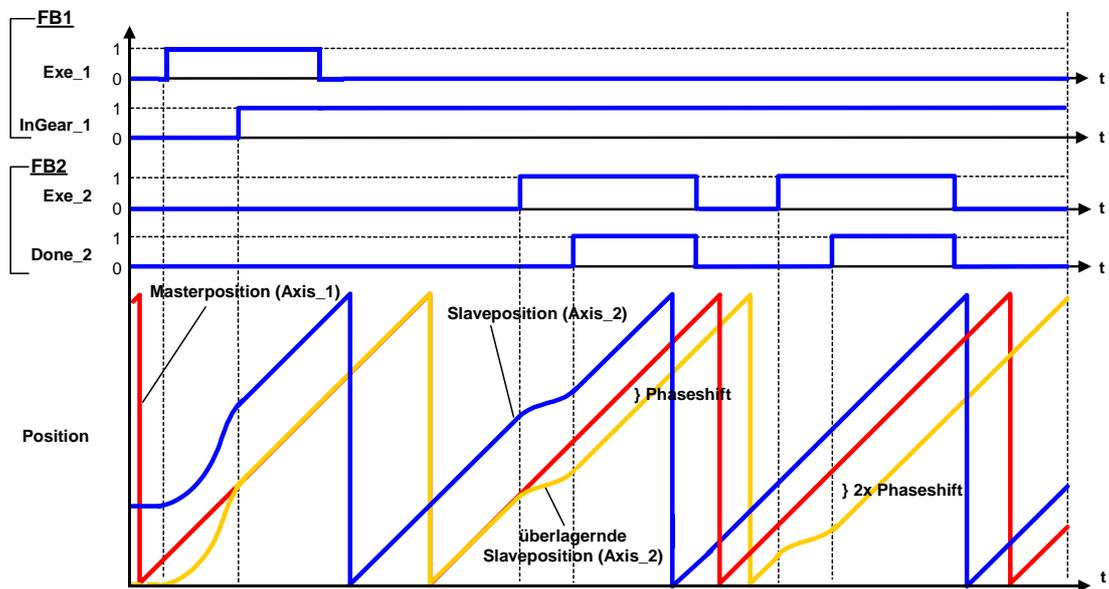
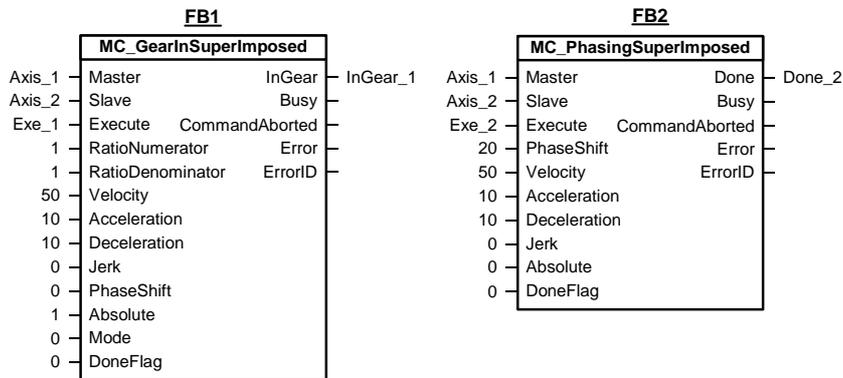
Input parameters

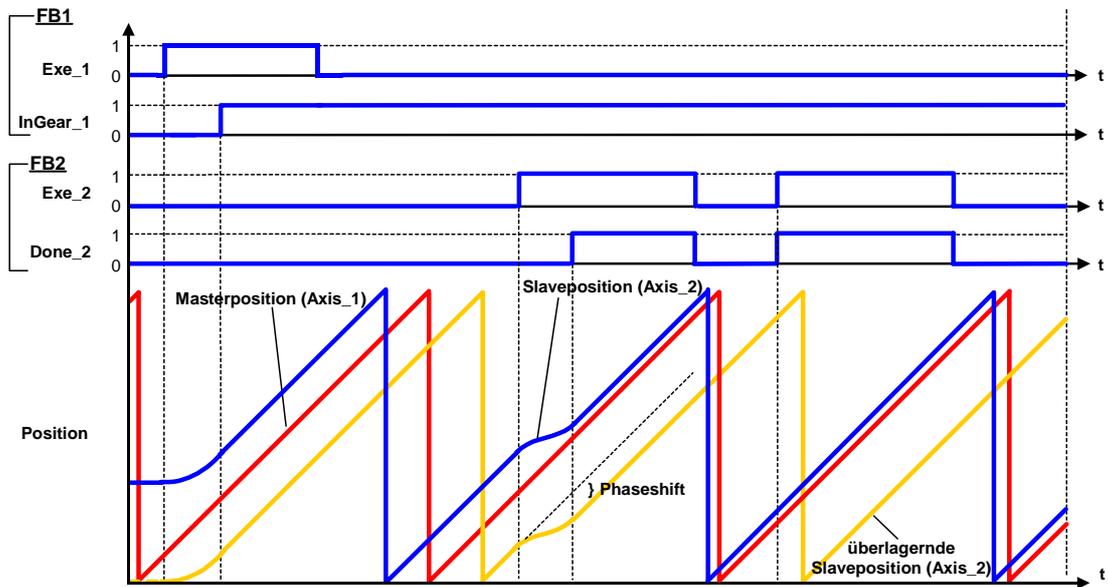
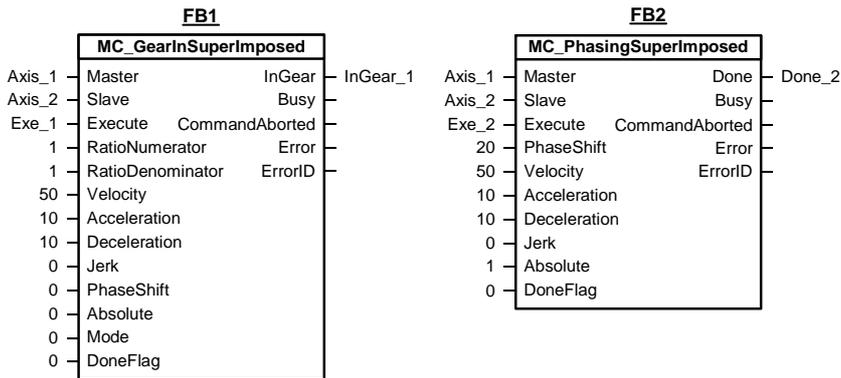
Parameter	Data type	Start value	Description
Master	INT	0	Number of the leading axis technology DB
Slave	INT	0	Number of the following axis technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
PhaseShift	REAL	0.0	Phase shift
Velocity	REAL	-1.0	Maximum velocity for setting phase shift: Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Acceleration	REAL	-1.0	Max. acceleration for setting phase shift: Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Deceleration	REAL	-1.0	Max. deceleration for setting phase shift: Value > 0: Use the specified value Value = 0: Not permitted Value < 0: Use preset value
Jerk	REAL	-1.0	Max. jerk for setting phase shift: Value > 0: Use the specified value Value = 0: Use trapezoidal motion profile Value < 0: Use preset value
Absolute	BOOL	TRUE	Phase shift Value = 0: relative Value = 1: absolute to current phase
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

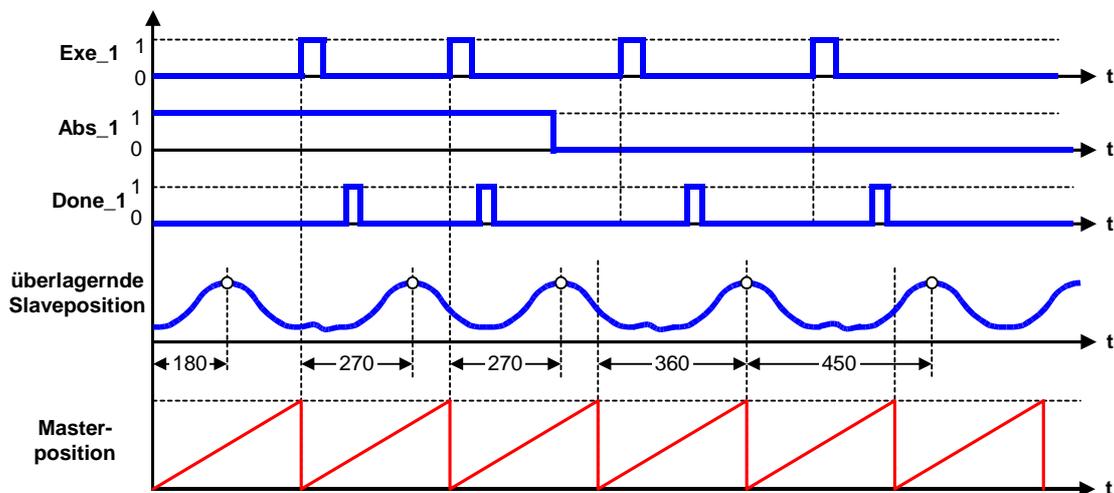
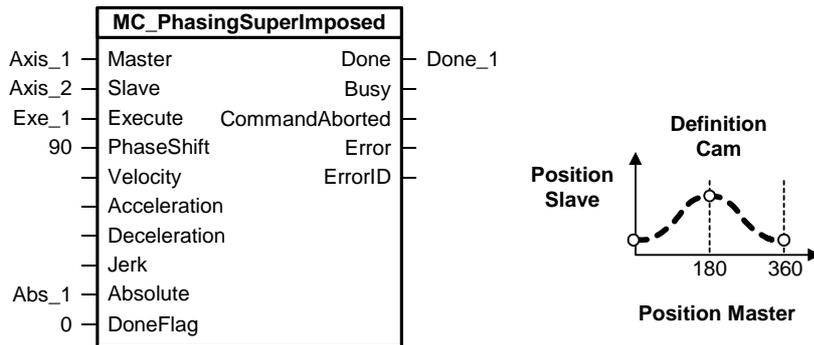
Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Required phase position reached
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_PhasingSuperImposed - Example







MC_PhasingSuperImposed - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing. Eliminate and acknowledge all queued errors and then enable the axis in the relevant mode (e.g. position-controlled).
8043	Illegal parameter value	Concerns input parameter <i>DoneFlag</i> .
8044	Task not supported by the technology object	Send a command to a measuring sensor or cam, for example.
8045	Illegal command with current status	An MC_Stop command is busy, for example.

ErrorID	Error message	Description / to correct or avoid error
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8079	No sync operation with specified master	The specified master and the slave are not in synchronism. Synchronize the relevant axes before you call the function.
8083	DB is not a technology DB	The DB specified at the input parameters <i>Master</i> or <i>Slave</i> does not exist or is not a technology DB.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object was not found in the system for the technology DB specified at the <i>Master</i> or <i>Slave</i> input parameters. Download the current technology to the PLC, or change the DB number at the <i>Master</i> or <i>Slave</i> input parameters. • The user has written invalid data to the technology DB specified at input parameter <i>Master</i> or <i>Slave</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	Invalid floating-point format of at least one input parameter value. Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).

6.4 Technology functions - Cam disks

6.4.1 FB 434 MC_CamClear - Deleting cams

Purpose

- The "MC_CamClear" technology function deletes all defined interpolation points or segments of a cam, and sets cam disk editing mode.
- The technological function "MC_CamSectorAdd" is used to create a new cam, and the technological function "MC_CamInterpolate" interpolates and re-enables this cam for camming.

Applicable to

- Cam disks

Requirements

- The cam disk may not be in use when you delete it.
- An MC_CamSectorAdd command may not be busy (restriction only applies to firmware V3.0.x of the integrated technology.)

Overriding commands

An MC_CamClear command can not be canceled by any other command.

An MC_CamClear command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
CamTable	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Starts deletion at the positive edge

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Cam segments were deleted
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of output parameter <i>Error</i> .

Warning

The deletion of cam disks with many interpolation points or polynomials may take a relatively long time. Other technology objects can not accept any new commands within this period of time. This also applies to MC_Stop commands ! Note that you can not cancel commands without defined termination ("MC_MoveVelocity", for example) within this time.

If the monitoring time for command execution is set too short in S7T Config, a deletion may lead to a time-out and, thus, to a STOP of the Technology CPU.

MC_CamClear - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	<ul style="list-style-type: none"> The cam is in use. An MC_CamSectorAdd is busy adding interpolation points to a cam disk. (the cause can only apply to firmware version V3.0.x of the integrated technology.)
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.

ErrorID	Error message	Description / to correct or avoid error
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8051	Read / write access denied.	Read / write access to the relevant technology object was not possible. This error may occur when a cam disk is tracked actively in a synchronous operation and MC_CamClear is started.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.

6.4.2 FB 435 MC_CamSectorAdd - Adding cam segments

Purpose

- The technology function "MC_CamSectorAdd" adds new interpolation points or polynomials to a cam disk.

Applicable to

- Cam disks

Requirements

- The cam is in editing mode
Editing mode is started by the technology function "MC_CamClear" and ends with the interpolation of the cam by the technology function "MC_CamInterpolate". This enables operation of the cam disk for camming.

Overriding commands

An MC_CamSectorAdd command can not be canceled by any other command.

An MC_CamSectorAdd command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
CamTable	INT	0	Number of the cam disk technology DB
Execute	BOOL	FALSE	Start at the positive edge
Data	ANY	--	Data area of the cam segments to be added (interpolation points interpolation points or polynomials). The data area has a maximum length of 240 bytes (equivalent to 30 interpolation points, or 4 polynomials.)
table	INT	0	Specification of the data area: Value = 0: Polynomials (arithmetical function) Value = 1: Position table

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Change of cam segment completed
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	FALSE	ErrorID of the <i>Error</i> output parameter.

Input *Data*: Polynomial preset (mathematical function)

Note

- To add cam segments, use only mathematical functions up to the 3rd order. Because of the resolution of floating-point values, any coefficients of a higher order may lead to inaccuracies.
- Segments defined as polynomials are recalculated in the Technology CPU. When read out afterwards in S7T Config it is thus possible that deviating coefficients are indicated. It is also possible that the Y-coordinates of the start and end points are swapped. However, the cam form is retained.

Mathematical functions are derived from the following formula:

$$Y = A_0 + A_1 \cdot X + A_2 \cdot X^2 + A_3 \cdot X^3 + A_4 \cdot X^4 + A_5 \cdot X^5 + A_6 \cdot X^6 + B_0 \cdot (\sin(B_1 \cdot X)) + B_2$$

Relative byte address	Data type	Variable	Function
0	INT	Type	Cam type (0 = polynomial)
2	INT	Reserve	-
4	REAL	X1	X coordinate of the start point
8	REAL	Y1	Y coordinate of the start point
12	REAL	X2	X coordinate of the end point
16	REAL	Y2	Y coordinate of the end point
20	REAL	0	Coefficient of the order 0
24	REAL	1	Coefficient of the order 1
28	REAL	A2	Coefficient of the order 2
32	REAL	A3	Coefficient of the order 3
36	REAL	4	Coefficient of the order 4
40	REAL	A5	Coefficient of the order 5
44	REAL	A6	Coefficient of the order 6
48	REAL	B0	Coefficient 0 of the trigonometrical portion
52	REAL	B1	Coefficient 1 of the trigonometrical portion
56	REAL	B2	Coefficient 2 of the trigonometrical portion

Example:

```
CALL "MC_CamSectorAdd" , DB435
CamTable:=
Execute :=
Data :=P#DB20.DBX 16.0 BYTE 60
Table :=0
Done :=
Error :=
ErrorID :=
```

In our example, the ANY pointer refers to a range of values starting at address 16 in DB20. The data structure of the polynomial is fixed and has a set length of 60 bytes.

Note

You can save yourself editing work by using UDT 20 from the "S7-Tech" library. UDT 20 contains the data structure of the polynomial. You can add up to 4 polynomials in one call by repeating this structure.

Input Data: Table of interpolation points

When cams are created by means of interpolation point tables, the X and Y values are fetched from a data area in the user program. The interpolation point table consists of at least one interpolation point (two REAL values). Up to 30 interpolation points can be passed with each call.

Example:

```
CALL "MC_CamSectorAdd" , DB435
CamTable:=
Execute :=
Data :=P#DB10.DBX 6.0 BYTE 64
Table :=1
Done :=
Busy :=
Error :=
ErrorID :=
```

In our example, the ANY pointer refers to a range of values of interpolation points that begins at address 6 in DB10 and consists of eight interpolation points (eight value pairs).

Relative byte address	Data type	Variable	Function
0	REAL	X1	X coordinate of the 1st interpolation point
4	REAL	Y1	Y coordinate of the 1st interpolation point
8	REAL	X2	X coordinate of the 2nd interpolation point
12	REAL	Y2	Y coordinate of the 2nd interpolation point
...
	REAL	Xn	X coordinate of the last interpolation point
	REAL	Yn	Y coordinate of the last interpolation point

Disadvantage: The creation of cams based on interpolation point tables takes a longer time, because a higher data volume is required for the cam description compared with polynomial definitions.

Note

Firmware V3.1.x of the integrated technology

This firmware version allows you to add all interpolation points and polynomials of an MC_CamSectorAdd command in a single command execution cycle. By starting several MC_CamSectorAdd commands, you can also add more than 30 interpolation points, or more than 4 polynomials to the cam disk.

Note

Firmware V3.0.x of the integrated technology

With this firmware version, the interpolation points and polynomials are distributed to several command execution cycles.

While a MC_CamSectorAdd command is busy, you may not start any further MC_CamSectorAdd, MC_CamClear or MC_CamInterpolate commands.

Effect of the coefficients of a cam segment

The coefficients A_0 to A_6 and B_0 to B_2 define the normalized cam profile of a cam segment. The range of the cam within the interval $0.0 = X = 1.0$ is transformed by interpolation to the image area defined by $\{X_1, Y_1\}$ and $\{X_2, Y_2\}$.

$$Y(X) = 1.0 + 2.0 \cdot \sin(2\pi \cdot X)$$

$$A_0 = 1.0$$

$$A_1 = A_2 = A_3 = A_4 = A_5 = A_6 = 0.0$$

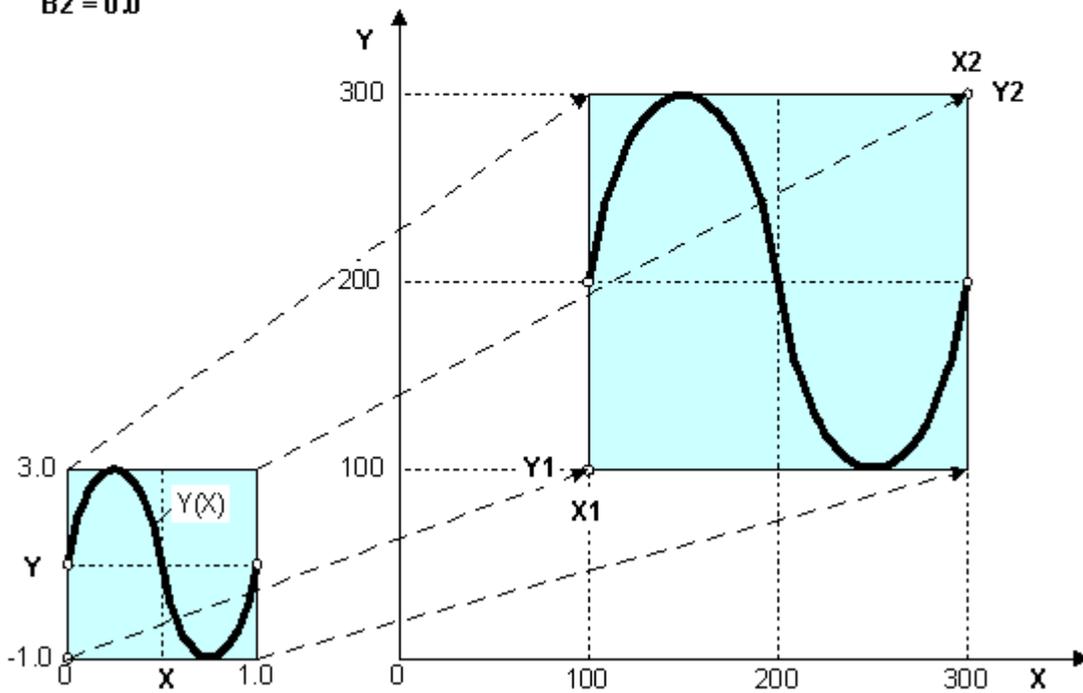
$$B_0 = 2.0$$

$$B_1 = 6.2831$$

$$B_2 = 0.0$$

$$X_1 = 100 \quad Y_1 = 100$$

$$X_2 = 300 \quad Y_2 = 300$$



MC_CamSectorAdd - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	Table = 167, for example.
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	An MC_CamSectorAdd is busy adding interpolation points to a cam disk. Wait for the Done bit of the other MC_CamSectorAdd, and then retrigger this command. (this error can only occur in firmware version V3.0.x of the integrated technology.)
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8051	Read / write access denied.	Read / write access to the relevant technology object was not possible. An error may occur if the cam disk is actively tracked in synchronous operation.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.

ErrorID	Error message	Description / to correct or avoid error
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8062	Access to interpolated cam disk not permitted	Then cam disk is interpolated already, which is why you can not add new interpolation points or polynomials to it. Remedy: Clear the content of the cam disk with MC_CamClear, and then recreate it.
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
8088	Invalid DB (ANY pointer)	The ANY pointer refers to an invalid data area. <ul style="list-style-type: none"> Data block not found Specified start address not found Data area too short
8089	Invalid data record length (ANY pointer)	For mathematical functions 60 bytes, for interpolation points a multiple of 8 bytes must be transferred. An interpolation point consists of X and Y values of the data type REAL (4 bytes)
808 A	The data block contains invalid REAL values	The DB transferred to the technology contains at least one value that does not correspond with a permissible REAL format specification. Check all DB values and adjust these as required.
808C	Pointer format is invalid or not supported	The ANY pointer contains illegal specifications. Accepted areas: I, O, M, DB, DI Accepted data types: BYTE, CHAR, WORD, INT, DWORD, DINT, REAL
808D	Data record length out of range	An attempt was made to transfer a data record with a length of more than 240 bytes. Reduce the length definition in the ANY pointer.

6.4.3 FB 436 MC_CamInterpolate - Interpolating cams

Purpose

- The "MC_CamInterpolate" technology function interpolates a cam disk. After its interpolation, the cam disk can be used for camming.
- Interpolation closes the gaps between the interpolation points and polynomials contained, according to the specified type of interpolation.

Applicable to

- Cam disks

Requirements

- The cam is in editing mode

Editing mode is started by the technology function "MC_CamClear" and ends with the interpolation of the cam by the technology function "MC_CamInterpolate". This enables operation of the cam disk for camming.

Marginal conditions

- Rule applied to interpolation points:
 - With superimposed interpolation points, the last created interpolation point takes priority
- Rule applied to segments:
 - The gaps between segments are filled with an interpolated cam.
 - The start point of a segment is relevant for overlapping segments; the previous segment is truncated, starting at this position.
- Rule applied to mixed mode cam disks (segments and interpolation points):
 - The start point takes priority as in a segmented cam.
- With the interpolation function, the attempt is made to perform a cyclically relative (constant velocity) interpolation of the cam disk. That is, the gradient is equalized, if possible, at the start and end positions.

Overriding commands

An MC_CamInterpolate command can not be canceled by any other command.

An MC_CamInterpolate command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
CamTable	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Starts at the positive edge
Mode	INT	0	Interpolation mode: Value = 0: Linear interpolation Value = 1: Cubic splines (cam path through the interpolation points) Value = 2: Bezier splines (cam path along the interpolation points)

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Cam disk is available for synchronous operation (TRUE is also indicated if an empty cam disk was interpolated)
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	FALSE	ErrorID of the <i>Error</i> output parameter.

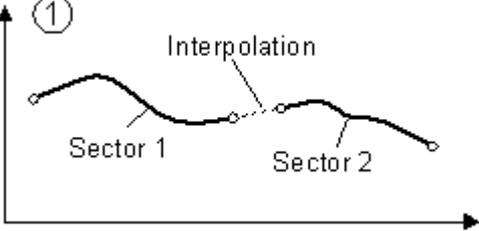
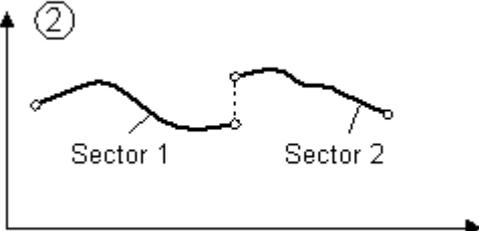
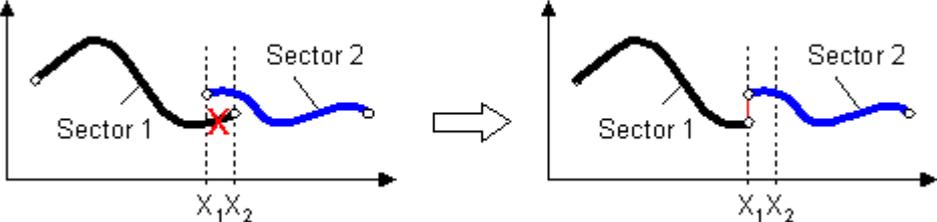
Warning

The interpolation of cam disks with many interpolation points or polynomials may take a relatively long time. Other technology objects can not accept any new commands within this period of time. This also applies to MC_Stop commands !
Note that you can not cancel commands without defined termination ("MC_MoveVelocity", for example) within this time.

If the monitoring time for command execution is set too short in S7T Config, the interpolation may lead to a time-out and, thus, to a STOP of the Technology CPU.

Interpolating two cam segments

At the segment borders of a cam consisting of several segments, various kinds of discontinuity may develop:

1.	<p>A gap between two segments is closed automatically by the interpolation. If the gap is smaller than a specific limit value, it is closed by joining the interpolation points.</p> <p>If the cam disk is created in S7T Config, the limit value of the gap can be specified in expert mode (CamEdit > "Interpolation" Tab, activate "Expert mode" check box).</p> <p>When the cam disk is created by means of the technology function MC_CamSectorAdd, the limit value of the gap is set fixed to 1E-04. Above this limit, the gap is closed by interpolation; below this limit, it is closed by joining the interpolation points.</p> 
2.	<p>When two successive segments have the same X coordinate, but different Y coordinates, this discontinuity persists irrespective of the interpolation.</p> 
3.	<p>Of two overlapping successive segments, the start position of the successive segment (sector 2) is used. The overlapping end position of the previous segment (sector 1) is truncated and therefore lost. Overlapping segments are particularly prone to discontinuity at the segment borders, because sector 1 is assigned a random Y value at the end of the segment ($Y(X_1)$).</p> 

MC_CamInterpolate - ErrorIDs

ErrorID	Warning	Description / to correct or avoid error
0000	No warning	-
0027	Interpolation property can not be maintained	A cam disk interpolation property could not be maintained at the interpolated cam disk. Example: A cam disk contains only a polynomial value with a different gradient at its start and end point.

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	<i>Mode</i> = 167, for example.
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	<ul style="list-style-type: none"> The cam is interpolated already. An MC_CamSectorAdd is busy adding interpolation points to a cam disk. (the cause can only apply to firmware version V3.0.x of the integrated technology.)
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8051	Read / write access denied.	Read / write access to the relevant technology object was not possible. This error may occur when a cam disk is tracked actively in a synchronous operation and MC_CamInterpolate is started.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8062	Error when interpolating the cam	The cam is in use or is interpolated already.
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.

6.4.4 FB 438 MC_GetCamPoint - Reading points from the cam disk

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_GetCamPoint" technology function can be used to determine the position of a following axis to the leading axis position, based on an existing cam disk.
- The "MC_GetCamPoint" technology function can be used to determine the position between a following axis and the leading axis, based on an existing cam disk.
 - The same following axis positions can be entered for different leading axis positions in the cam disk definition. Hence, the leading axis position must be defined in closer details. This can be done at input parameter *ApproachPosition*. At this input parameter, enter the assumed leading axis position as approximate value.
- When a cam disk was configured in S7T Config using CamEdit or CamTool, the scaling and shift defined with those tools are included when the positions are determined. Cam disk dynamically created in RUN are never scaled or shifted.
Any scaling or shift operations by the input parameters of the technology function MC_CamIn are ignored when the positions are determined.

Applicable to

- Cam disks

Requirements

- The cam disk was interpolated without error (status in technology DB 2 = interpolated.)

Overriding commands

An MC_GetCamPoint command can not be canceled by any other command.

An GetCamPoint command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
CamTable	INT	0	Number of the cam disk technology DBs
Execute	BOOL	FALSE	Start of the command at the positive edge
Mode	INT	0	Value = 0: The leading axis position is assigned the position of the following axis Value = 1: The following axis position is assigned the position of the leading axis Any scaling and shift configured in S7T Config is included in both modes.
Position	REAL	0.0	Master or following axis position for which the corresponding value is to be determined: <ul style="list-style-type: none"> • <i>Mode = 0</i>: Position of the leading axis • <i>Mode = 1</i>: Position of the following axis The valid range of values of the parameter is derived from the definition or range of values of the cam disk.
ApproachPosition	REAL	0.0	Assumed leading axis position Approximation in the definition range of the cam disk, used to determine the leading axis position (effective only when <i>Mode = 1</i>). <ul style="list-style-type: none"> • The function determines only the leading axis position nearest to the <i>ApproachPosition</i>. • When two leading axis positions have the same distance to the <i>ApproachPosition</i>, the leading axis position with the lower position value is determined.
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: The command is completed
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.

Parameter	Data type	Start value	Description
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.
Value	REAL	0.0	Fetches position value <i>Mode = 0</i> : Position of the following axis <i>Mode = 1</i> : Position of the leading axis

MC_GetCamPoint - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	Concerns the input parameters <i>Mode</i> or <i>DoneFlag</i> .
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	The cam disk is not interpolated.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8061	Cam point out of the definition range / range of values	<p>The leading/following axis positions defined at "MC_GetCamPoint" do not exist in the definition range/range of values of the cam disk</p> <p>Enter a valid position at "MC_GetCamPoint".</p>
8083	DB is not a technology DB	The DB specified at input parameter <i>CamTable</i> does not exist or is not a technology DB.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>CamTable</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>CamTable</i>. • The user has written invalid data to the technology DB specified at input parameter <i>CamTable</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.5 Technology functions - Cams, measuring sensors, external encoders

6.5.1 FB 430 MC_CamSwitch - Position-based cam

Purpose

- Using the "MC_CamSwitch" technology function you can enable / disable position-based cams or switching cams, and define their switching characteristics.
- In your cam configuration, you can define whether the switching positions are based on setpoints or actual values.
- Switching points can be advanced or retarded (derivative time and deactivation time). Here, the time unit set in S7T Config applies to the axis.
- The current switching state of the cam is stored in the technology DB.

Applicable to

- Position-based cam
- Switching cams

Overriding commands

An MC_CamSwitch command can only be canceled by a further MC_CamSwitch command to the same technology object. An MC_CamSwitch command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
CamSwitch	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Operating state transition at the positive edge
OnPosition	REAL	0.0	Switch-on position
OffPosition	REAL	0.0	OFF position (applies to position-based cams)
Hysteresis	REAL	0.0	Hysteresis
Delay	REAL	0.0	Time-based offset of the switching points (Derivative time) Value < 0: Advanced switching Value > 0: Delayed switching

Parameter	Data type	Start value	Description
Mode	INT	2	Operating mode: Value = 1: Cam locked (cam output permanently disabled, Technology DB: state = 0 (OFF)) Value = 2: Cam enabled (output not inverted) (cam output is set within the ON range) Value = 3: Cam enabled (output inverted) (cam output is set out of the ON range) Value = 4: Cam is always enabled (cam output permanently ON, technology DB: state = 1 (ON))
Direction	INT	1	Effective direction of the cam: Value = 1: Effective direction positive Value = 2: Effective direction positive and negative (i.e. effective direction is irrelevant) Value = 3: Effective direction negative Value = 4: Use last effective cam direction
DoneFlagPos	INT	0	DoneFlag generation at the MCDevice DB when the cam is switched on. When the cam overtravels the ON position, the DoneFlag value is inverted
DoneFlagNeg	INT	0	DoneFlag generation at the MCDevice DB when the cam is switched off. When the cam overtravels the OFF position, the DoneFlag value is inverted

Note

Drive failure does not influence the switching response of the assigned cams.

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Changes were accepted
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	BOOL	0	ErrorID of the <i>Error</i> output parameter.

Input parameter *OffPosition*

An OFF position is not defined for the switching cam. The *OffPosition* does not take effect. The switching cam can be reset by the user program, for example, with another call of the "MC_CamSwitch" technology function.

MC_CamSwitch - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	Concerns the input parameters <i>Mode</i> , <i>Direction</i> , <i>Hysteresis DoneFlagPos</i> or <i>DoneFlagNeg</i> . Valid for input parameter <i>Hysteresis</i> : <ul style="list-style-type: none"> Infinite axis - Value > ¼ of the working range (the working range is defined by the position of the SW limit switches.) Modulo axes - value > ¼ of the modulo length
8044	Task not supported by the technology object	<ul style="list-style-type: none"> The command was sent to a measuring sensor, for example. The command was sent to a time-based cam, for example.
8045	Illegal command with current status	For example, in case of a hardware failure of a cam output at an ET 200M.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.5.2 FB 431 MC_CamSwitchTime - Time-based cam

Purpose

- At the "MC_CamSwitchTime" technology function, you enable / disable time-based or switching cams, and define their switching characteristics. The time-based cams are set when the ON position is reached, and are reset when the pulse period has expired.
- In your cam configuration, you can define whether the switching positions are based on setpoint or actual values.
- All specified times refer to the timebase configured in S7T Config.
- The current switching state of the cam is stored in the technology DB.

Applicable to

- Time-based cam

Overriding commands

An MC_CamSwitchTIME command can only be canceled by a further MC_CamSwitchTime command to the same technology object. An MC_CamSwitchTime command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
CamSwitch	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Operating state transition at the positive edge
OnPosition	REAL	0.0	Switch-on position
Duration	REAL	0.0	Pulse width (physical unit according to the "Time" unit set at the corresponding axis)
Hysteresis	REAL	0.0	Hysteresis
Delay	REAL	0.0	Time-based offset of the switching points (Derivative time) Value 0: Advanced switching Value 0: Delayed switching
Mode	INT	2	Operating mode: Value = 1: Cam locked Value = 2: Cam enabled (output not inverted) Value = 3: Cam enabled (output inverted) Value = 4: Cam permanently enabled
Direction	INT	1	Effective direction of the cam: Value = 1: Effective direction positive Value = 2: Effective direction positive and negative (i.e. effective direction is irrelevant) Value = 3: Effective direction negative Value = 4: Use last effective cam direction

Parameter	Data type	Start value	Description
DoneFlagPos	INT	0	DoneFlag generation at the MCDevice DB when the cam is switched on. When the cam overtravels the ON position, the DoneFlag value is inverted
DoneFlagNeg	INT	0	DoneFlag generation at the MCDevice DB when the cam is switched off. When the cam overtravels the OFF position, the DoneFlag value is inverted

Note

Drive failure does not influence the switching response of the assigned cams.

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Changes were accepted
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	BOOL	0	ErrorID of output parameter <i>Error</i> .

MC_CamSwitchTime - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	Concerns the input parameters <i>Mode</i> , <i>Direction</i> , <i>Duration</i> , <i>Delay</i> , <i>Hysteresis</i> , <i>DoneFlagPos</i> or <i>DoneFlagNeg</i> . Valid for input parameter <i>Hysteresis</i> : <ul style="list-style-type: none"> Infinite axis - Value > ¼ of the working range (the working range is defined by the position of the SW limit switches.) Modulo axes - value > ¼ of the modulo length
8044	Command not supported by the technology object.	<ul style="list-style-type: none"> The command was sent to a measuring sensor, for example. The command was sent to a position-based cam or switching cam, for example.

ErrorID	Error message	Description / to correct or avoid error
8045	Illegal command with current status	For example, in case of a hardware failure of a cam output at an ET 200M.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	Invalid floating-point format of at least one input parameter value. Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).

6.5.3 FB 433 MC_MeasuringInput - Measuring sensor

Purpose

- The "MC_MeasuringInput" technology function is used to enable recording of **one** measurement by means of measuring sensor.
- A measuring sensor records the length of a configured axis or of an external encoder, based on the trigger by an external event such as an impression mark or BERO.
- The measurement range can be limited. The first value measured within the range of the *StartPosition* and *EndPosition* is accepted.
- *StartPosition = EndPosition* is neglected for measurement.
- The function is terminated after the measured value has been recorded and output, or if the measurement was canceled, for example, by another command.
- Several operating modes can be selected at input *Mode*, based on the drive and measuring components used.

Applicable to

- Measuring input

Requirements

- The axis is enabled for position control
- The connected drive or measuring component supports the selected mode. Refer to the relevant drive documentation!

Note

Make allowances for the drive reaction times. Further information is provided in the documentation of the drive used (for example on the "S7-Technology" CD).

Overriding commands

An MC_MeasuringInput command can only be canceled by a further MC_MeasuringInput command to the same technology object. An MC_MeasuringInput command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
MeasureInput	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Start of the operating mode at the positive edge
Mode	INT	1	Operating mode: Value = 1: Measurement at positive edge Value = 2: Measurement at negative edge Value = 3: Measurement at both edges, starting at the positive edge (two separate measured values) Value = 4: Measurement at both edges, starting the negative edge (two separate measured values) Value = 5: Cancel current measurement
StartPosition	REAL	0.0	Start position of the measurement range
EndPosition	REAL	0.0	End position of the measurement range
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB The DoneFlags value is inverted when a new measured value has been returned

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Measurement completed, measured value is valid
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: Measurement command canceled (no edge signal in measuring range)
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.
MeasuringValue1	REAL	0.0	Measured value 1
MeasuringValue2	REAL	0.0	Measured value 2 (only with measurement trigger at both edges)

MC_MeasuringInput - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8034	Could not record a measured value in the measuring range	
8043	Illegal parameter value	Violation of the range limits at input parameter <i>Mode</i> or <i>DoneFlag</i> .
8044	Task not supported by the technology object	Send a command to a cam, for example.
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.

ErrorID	Error message	Description / to correct or avoid error
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.5.4 FB 432 MC_ExternalEncoder - External encoder

Purpose

- The "MC_ExternalEncoder" technology function controls an external encoder that can be used, for example, as physical leading axis (master) for synchronous operation.
- The external encoder can be enabled / disabled.
- Absolute value encoder adjustment is possible
- Synchronization: The actual position value of an incremental encoder can be set or influenced with the passive homing function.

Applicable to

- External encoders

Requirements

- The actual position value of an external encoder can only be influenced when the encoder is enabled.

Overriding commands

An MC_ExternalEncoder command can only be canceled by a further MC_ExternalEncoder command to the same technology object. An MC_ExternalEncoder command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Start at the positive edge
Position	REAL	0.0	Position setpoint

Parameter	Data type	Start value	Description
Mode	INT	1	<p>Operating mode:</p> <p>Value = 0: Disable external encoder (actual position value is frozen)</p> <p>Value = 1: Enable external encoder</p> <p>Value = 2: Direct homing: The current position is assigned the value of input parameter <i>Position</i>.</p> <p>Value = 3: Passive homing with "zero mark" or "BERO", or "BERO and zero mark" (default setting is zero mark): The homing position is assigned the current position at input parameter <i>Position</i>.</p> <p>Value = 4: Direct homing: The current position is assigned reference position set under defaults in S7T.</p> <p>Value = 5: Passive homing with "zero mark" or BERO or BERO with zero mark (default setting is zero mark): The homing position is assigned the current position defined in S7T Config under the default configuration of the reference position.</p> <p>Value = 6: Absolute value encoder adjustment: The current position is assigned the value of input parameter <i>Position</i>. The position offset set by the absolute value adjustment is retained after power failure. Precise adjustment requires axis standstill.</p> <p>Please note that any position adjustments (<i>Mode</i> = 2 or 4) are superimposed on the absolute value encoder adjustment. After POWER OFF or restart (MC_Reset, Restart = TRUE), only the absolute value encoder adjustment comes into effect.</p>
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Command completed
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_ExternalEncoder - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	. <i>Mode</i> = 167, for example.
8044	Task not supported by the technology object	Send a command to a cam, for example.
8045	Illegal command with current status	For example, the encoder value is not valid at the moment when the command is started (for example, hardware deactivated).
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.6 Technology functions - Basic functions

6.6.1 FB 402 MC_Reset - Error acknowledgement

Valid for firmware version V3.1.x of the integrated technology

Purpose

- Use the technology function "MC_Reset" to acknowledge all errors accepting acknowledgment in the user program. Acknowledgment of fatal errors is only possible either by cycling power, or by downloading the project data to the module again. The acknowledgment also clears the entries at the *ErrorID* and *ErrorBuffer* parameters, and resets the *ErrorStatus* bits in the technology DB.
- Use the technology function "MC_Reset" *Restart = TRUE* to start the re-initialization (restart) of axes, cams, cam disks, external encoders and measuring sensors. After initialization, the status of an axis with incremental encoder is "Not homed." The cam originally configured in S7T Config is restored at the cam disks.
- When executing the "MC_Reset" technology function at the MCDevice technology DB (*Axis = DB no. MCDevice DB*), the maximum command execution time is reset to "0" (*MaxLoopDuration* at the MCDevice DB.)
- The system continues command processing during a restart. However, the TO performing the restart can not accept any commands for the duration of the restart.

Applicable to

- Velocity axes
- Positioning axes
- Synchronization axes
- Output cam
- Measuring input
- Cam disks
- External encoders
- MCDevice DB

Requirements for restart

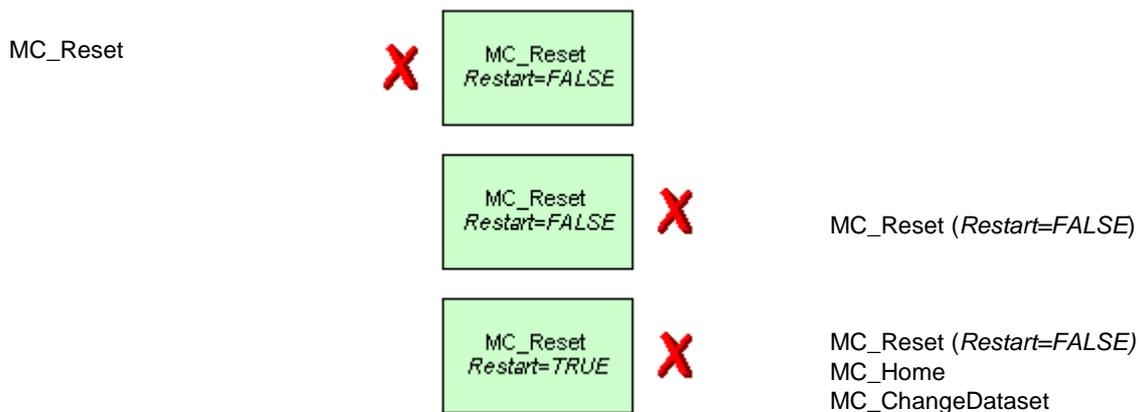
- A restart is only possible when the relevant technology object is disabled, or not busy, or not in use by another application.

Warning

Set *Restart = FALSE* if you only want to clear the errors at a technology object.

Re-initialization of a technology object (*Restart = TRUE*) may take several 100 milliseconds. The technology object is not available for the duration of this process.

Overriding commands



(Cancellation relationships are shown in read direction)

An MC_Reset with *Restart = TRUE* can not be canceled

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Start of the command at the positive edge
Restart	BOOL	FALSE	FALSE: Acknowledge error TRUE: Restart - Re-initialization and application of modified configuration parameters

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Error was acknowledged, or a restart was executed.
Busy	BOOL	FALSE	TRUE: Command is busy
CommandAborted	BOOL	FALSE	TRUE: The command was aborted by another command or by an error during command execution. If ErrorStatus of the technology DB does not indicate an error, the command was canceled by a subsequent command. If ErrorStatus reports an error, an error at the TO occurred during command execution and has caused cancellation of the command.
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorIDs of the Error output parameter.

MC_Reset - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8045	Illegal in current status	An "MC_Reset" (<i>Restart = TRUE</i>) is already active. The command is canceled
8047	Can not acknowledge this error	It is not possible to acknowledge the error by means of the technology function "MC_Reset." Examples: <ul style="list-style-type: none"> An axis has been brought to standstill, and the error causing this can not be acknowledged. Further errors occur in the acknowledgment or restart phase. Eliminate all causes of error and retry to acknowledge. Please note that you must acknowledge particular errors by cycling power.
8048	Unable to restart	<ul style="list-style-type: none"> Restart only permitted when the axis is locked The cam disk is in use by another application and can thus not be reset.

ErrorID	Error message	Description / to correct or avoid error
804C	Command output rate too high	<p>The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first.</p> <p>For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.</p>
8050	Technology not ready	<p>During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.</p>
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	<p>Faulty instance DB of the technology function (wrong length, for example.)</p>
8083	DB is not a technology DB	<p>The DB specified at input parameter <i>Axis</i> or the technology DB were not found.</p>
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.

6.6.2 FB 406 MC_ReadSysParameter - Reading parameters

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The technology function "MC_ReadSysParameter" returns selected parameters of a technology object, for example, of an axis or cam.
- The valid actual value is indicated at the restart parameters.
- The result is output at the relevant output parameter, depending on the parameter type. In this case the other outputs return the a 0 value.
- At input parameter *Index* you can define which of the multiple parameters of the project you want to access. Multiple parameters exist in these areas:
 - Data records (Dataset_1 to Dataset_16)
 - Encoders (Encoder_1 to Encoder_8)
 - Synchronization objects (1 for synchronization object, 2 for superimposing synchronization object)

Applicable to

- The parameter defined by the parameter number and the index must be available in the system.

Overriding commands

An MC_ReadSysParameter command can not be canceled by any other command.

An MC_ReadSysParameter command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Command parameter value at the positive edge
ParameterNumber	INT	0	Number of the parameter to be read
Index	INT	0	Parameter field number (2 for data_set_2, for example)

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: The required parameter value is available at the <i>Value</i> output, depending on the parameter type, <i>ValueDInt</i> , <i>ValueDword1</i> , <i>ValueDword2</i> or <i>ValueBool</i>
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.
Value	REAL	0.0	Value of the specified parameter, if it is of the REAL type (otherwise 0.0.)
ValueDInt	DINT	0	Value of the specified parameter, if it is of the DINT type (otherwise 0.) (the ENUM values are also output here)
ValueDword1	DWORD	0	Value of the specified parameter, if it is of the DWORD type and has a length of 1 DWORD (otherwise 0.)
ValueDword2	DWORD	0	Value of the specified parameter, if it is of the DWORD type and has a length of 2 DWORDs (otherwise 0.)
ValueBool	BOOL	FALSE	Value of the specified parameter, if it is of the BOOL type (otherwise <i>FALSE</i> .)

MC_ReadSysParameter - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8044	Task not supported by the technology object	Send command to MCDevice DB, for example
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8080	Invalid parameter number or parameter index	The technology object does not support this parameter or parameter index.
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
8086	Parameter not available	<p>Example:</p> <ul style="list-style-type: none"> • Access to incremental encoder parameters in a system with absolute value encoders • The technology object is currently performing a restart. It is therefore not possible to read the parameter.

6.6.3 FB 407 MC_WriteParameter - Changing parameters

Valid for firmware version V3.1.x of the integrated technology

Purpose

- You can use the "MC_WriteParameter" technology function to edit the parameters of technology objects while the Technology CPU is in RUN. These changes apply until the next POWER OFF / POWER ON or CPU memory reset operation was carried out (exception: the value set during absolute value adjustment is retained even under those conditions.)
- Of the input parameters *Value*, *ValueDInt*, *ValueDword1*, *ValueDword2* and *ValueBool*, the system evaluates only those which conform to the relevant technology parameter (for details, refer to the List of technology parameters).
- The technology function can only modify parameters identified in the List of technology parameters with access type "W", i.e. "Write" access.
- Input parameter *Index* can be used for direct access to multi-parameters (the value at input parameter *Index* is not evaluated for single parameters):
 - Data records (Dataset_1 to Dataset_16)
 - Encoders (Encoder_1 to Encoder_8)
 - Synchronization objects (1 for synchronization object, 2 for superimposing synchronization object)



Caution

The use of this technology function is intended for experienced users. Wrong input may result in uncontrolled response of the drive!

The system does not check the plausibility of your entries.

Wrong input may lead to inconsistency of the technology object.

Applicable to

- Parameters of the technology objects you configured in S7T Config. Note that some parameter changes require a system restart (for information, refer to the List of technology parameters "Activation" column.)

Requirements

- The parameter defined by the parameter number and index must be available and assigned the write attribute.

Overriding commands

An MC_WriteParameter command can not be canceled by any other command.

An MC_WriteParameter command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
Axis	INT	0	Number of the technology DB
Execute	BOOL	FALSE	Write parameter with a positive edge at Execute
ParameterNumber	INT	0	Number of the technology parameter
Index	INT	1	Parameter field number (2 for data_set_2, for example)
Value	REAL	0.0	New value of the specified parameter, if it is of the type REAL (the value is ignored otherwise.)
ValueDInt	DINT	0	New value of the specified parameter, if it is of the type DINT (the value is ignored otherwise.)
ValueDword1	DWORD	0	New value of the specified parameter, if it is of the type DWORD and has a length of 1 DWORD (the value is ignored otherwise.)
ValueDword2	DWORD	0	New value of the specified parameter, if it is of the type DWORD and has a length of 2 DWORDs (the value is ignored otherwise.)
ValueBool	BOOL	0	New value of the specified parameter, if it is of the type BOOL (the value is ignored otherwise.)

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Change of technology parameter completed
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

Warning

Observe the range limits applying to the parameters. The valid range limits are found in the "List of technology parameters".

When editing data record parameters, note that some of the parameters must be identical in the data records:

- parameters changing the structure (different controller types such as PV or PID controllers, for example)
- important activating parameters (following monitoring on/off, DSC on/off, for example)

The system reports a configuration error if you assign illegal values to data record parameter in runtime by means of the technology function "MC_WriteParameter." You should therefore edit only the data record parameters you can compile as consistent project when you configure these in S7T Config.

Note

To change several parameters which do not require a restart and come into effect immediately in one pass, group all parameter deltas, and then enable these.

Procedure:

1. Use MC_WriteParameter to set the technology parameter *activationmodechangedconfigdata* (*ParameterNumber* = 4001) to COLLECT_CHANGED_CONFIG_DATA (82).

This forms a collection of all subsequent changes at the relevant technology object.

2. Use MC_WriteParameter to change the relevant technology parameters.
3. Set ACTIVATE_CHANGED_CONFIG_DATA (81) at MC_WriteParameter *activationmodechangedconfigdata* to apply all changes.

This procedure is called for when editing technology parameters requiring identical values in all data records.

MC_WriteParameter - Example of "Override"

Example of changing parameters with "Override"

Factors can be superimposed online on the current traversing velocity or acceleration / deceleration ramp. Speed override affects the velocity, acceleration override affects acceleration and deceleration.

Set the following input parameter values, in order to set **velocity** override:

ParameterNumber = 4142

Value = 0 to 200 (in [%])

Set the following input parameter values, in order to set **acceleration** override:

ParameterNumber = 4141

Value = 1 to 1000 (in [%])

MC_WriteParameter - Example of "Drive control word"

Drives coupled via PROFIBUS communicate by means of the standard telegrams. These telegrams contain up to two control words for the drives. The content of those words is specified in the PROFIdrive standard.

Structure of control word CW1			Structure of control word CW2		
Bit	reserved for Technology object	PROFIdrive V3.1 definition	Bit	reserved for Technology object	PROFIdrive V3.1 definition
0	X	Drive ON (not OFF1)	0		free
1	X	Operating condition (not OFF2)	1		free
2	X	Operating condition (not OFF3)	2		free
3	X	Rectifier enable	3		free
4	X	Startup encoder enable	4		free
5	X	Start startup encoder	5		free
6	X	Setpoint enable	6		free
7	X	Reset error memory	7		free
8		Step distance 1 (optional)	8		free
9		Step distance 2 (optional)	9		free
10	X	Control required	10		free
11		free	11		free
12		free	12	X	Master life sign
13		free	13	X	Master life sign
14		free	14	X	Master life sign
15		free	15	X	Master life sign

Drive control words can be written with parameter number 4500 at "MC_WriteParameter", or read with "MC_ReadSysParameter." Both control words are available for reading at output parameter *ValueDword1* (unmasked.)

The control word is written by means of the corresponding value and a mask. The mask defines which bits of the control word can be accessed by the write operation. This mask can be used to manipulate single or several bits. Unmasked bits (value 0) retain their current state. Criterion for selecting the mask is, that the bits reserved for the technology object remain unchanged.

The values of control words CW1 and CW2 are defined at input parameter *ValueDword1*. Their corresponding mask values are set at input parameter *ValueDword2*.

Example of *ValueDword1*

<i>DW#16#</i>	0001	0300
	CW2	CW1

Example of *ValueDword2*

<i>DW#16#</i>	0FFF	FB00
	Mask CW2	Mask CW1

Set mask value *FB00* for control word CW1 to overwrite all free bits of the control word. meaning of the hexadecimal characters:

F = 1111 / bits 12 to 15 are written
B = 1011 / bits 8, 9 and 11 are written; bit 10 is protected
0 = 0000 / bits 4 to 7 are protected
0 = 0000 / bits 0 to 3 are protected

Set mask value *0FFF* for control word CW1 to overwrite all free bits of the control word. meaning of the hexadecimal characters:

0 = 0000 / bits 12 to 15 are protected
F = 1111 / bits 8 to 11 are written
F = 1111 / bits 4 to 7 are written
F = 1111 / bits 0 to 3 are written

MC_WriteParameter - Example: "Save absolute value encoder adjustment"

Editing parameters, based on the example "Saving absolute value encoder adjustment"

The data of the absolute value encoder adjustment are saved to nonvolatile memory of the Technology CPU. Hence, these data will be lost when you replace the CPU.

The "MC_ReadSysParameter" and "MC_WriteParameter" technology functions can be used to backup the data of your absolute value encoder adjustment to Micro Memory Card, and to restore these to the nonvolatile memory of your Technology CPU. Prerequisite is that you have set the "absolute value encoder" type in your S7T Config configuration.

After you adjusted the absolute value encoder using the "MC_Home" technology function, proceed as described below:

Create a backup copy of the data of your absolute value encoder adjustment

Step	Description
1.	Read the current value of the absolute value encoder adjustment by means of the "MC_ReadSysParameter" technology function, using the input parameters described below, for example: <ul style="list-style-type: none"> • <i>Axis</i> = Technology DB of the relevant axis • <i>Execute</i> = positive edge to start the read operation • <i>ParameterNumber</i> = 4010 Parameter number of the absolute value encoder adjustment • <i>ValueDword1</i> = DB1.DBD0 (temporary memory) • <i>ValueDword2</i> = DB1.DBD4 (temporary memory)
2.	Use SFC 82 "CREA_DBL" to generate a DB in the load memory of the Technology CPU. The DB is also generated in the RAM when you reset bit 0 of input parameter <i>ATTRIB</i> .
3.	Call SFC 84 "WRIT_DBL" to write the previously backed up data of the absolute value encoder adjustment to the new DB.

Replacing the CPU and restoring the data of your absolute value encoder adjustment

Step	Description
1.	Replace the Technology CPU and inset your configuration MMC.
2.	The backup DB for the data of your absolute value encoder adjustment is stored to working memory after the startup of your Technology CPU.
3.	Call the "MC_WriteParameter" technology function to restore the values of the absolute value encoder adjustment to the nonvolatile memory of your Technology CPU. Use these input parameters: <ul style="list-style-type: none"> • <i>Axis</i> = Technology DB of the relevant axis • <i>Execute</i> = positive edge to start the write operation • <i>ParameterNumber</i> = 4010 Parameter number of the absolute value encoder adjustment • <i>ValueDword1</i> = DBx.DBD0 (x = number of the DB generated with SFC 82) • <i>ValueDword2</i> = DBx.DBD4 (x = number of the DB generated with SFC 82)

MC_WriteParameter - ErrorIDs

ErrorID	Warning	Description / to correct or avoid error
0000	No error	-
0020	Restart to apply parameter changes	<p>A parameter which is normally required to restart the technology object was modified. The restart is not required if the new parameter value corresponds to the old parameter value (for example, the parameter value "5" is modified to "5").</p> <p>The information whether a restart is required is contained in the technology data block.</p> <ul style="list-style-type: none"> For axes and external encoders, the <i>RequestRestart</i> bit is set in the status word. In the case of cams and measuring sensors the restart requirement is indicated by means of the ErrorID <i>0020</i> of the technology data block.

ErrorID	Error message	Description / to correct or avoid error
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	<p>Due to an internal problem in the S7 system, commands can not be accepted.</p> <p>Check the consistency of your project data, then download all system data to the module again.</p>
8043	Illegal parameter value	<p>Concerns the input parameters <i>Value</i>, <i>ValueDInt</i>, <i>ValueDword1</i>, <i>ValueDword2</i> and <i>ValueBool</i>.</p> <p>Invalid values for the selected <i>ENUM</i>, for example.</p>
8044	Task not supported by the technology object	Send command to MCDevice DB, for example
804C	Command output rate too high	<p>The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first.</p> <p>For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.</p>
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8080	Invalid parameter number or parameter index	The technology object does not support this parameter or parameter index.
8081	Parameter is read-only	<p>The selected parameter is read-only.</p> <p>Check the selected parameter number and the ID of the technology object.</p>
8083	DB is not a technology DB	The DB specified at input parameter <i>Axis</i> or the technology DB were not found.
8084	Invalid technology DB	<ul style="list-style-type: none"> • A technology object does not exist in the PLC for the technology DB specified at input parameter <i>Axis</i>. Download the current technology to the PLC, or change the DB number at input parameter <i>Axis</i>. • The user has written invalid data to the technology DB specified at input parameter <i>Axis</i>. In "Technology Objects Management", delete and then recreate the technology DB.
8086	Parameter not available	Attempt to access incremental encoder parameters in a system with absolute value encoders, for example.
808B	Parameter value of invalid REAL format	<p>Invalid floating-point format of at least one input parameter value.</p> <p>Check the input parameter values or the instance DB data. Invalid values can not be indicated in floating-point format. They are shown on hexadecimal format (DW16# ...).</p>

6.6.4 FB 450 MC_ReadPeriphery - Reading technology I/O

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_ReadPeriphery" technology function can be used to read the I/O image (DP(DRIVE)) of the integrated technology. For information on time-based updates, refer to the Example

Applicable to

- DP I/O on DP(DRIVE)
- Integrated I/O of the Technology CPU

Requirements

- The addressed I/O must exist in the I/O image DP(DRIVE) of the integrated technology.

Overriding commands

An MC_ReadPeriphery command can not be canceled by any other command.

An MC_ReadPeriphery command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
Enable	BOOL	FALSE	The system continues reading the I/O as long as <i>Enable</i> = <i>TRUE</i> . Changes at the input parameters <i>InputOutput</i> , <i>ByteAddress</i> and <i>Data</i> are only applied with a positive edge at <i>Enable</i> .
InputOutput	BOOL	FALSE	Definition of the I/O area to be read: FALSE: I/O image of inputs TRUE: I/O image of outputs
ByteAddress	INT	0	Byte start address for reading (possible values: 0 to 63).
Data	ANY	--	Destination for read data. The maximum length of data to be read is defined by the data type and the repetition coefficient at the ANY pointer. The maximum length is 64 bytes.

Output parameters

Parameter	Data type	Start value	Description
DataValid	BOOL	FALSE	TRUE: Valid data available for reading (set at the first successful read operation)
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

Note

The runtime of command execution in the integrated technology plus the runtime of the OBx cycle in which MC_ReadPeriphery is called may lead to a considerable length of reaction times. You should therefore connect the I/O requiring a quick reaction to the MPI/DP interface of your Technology CPU.

MC_ReadPeriphery - Example

The example shown in the diagram shows the time-based relationship when reading or loading the I/O image DP(DRIVE).

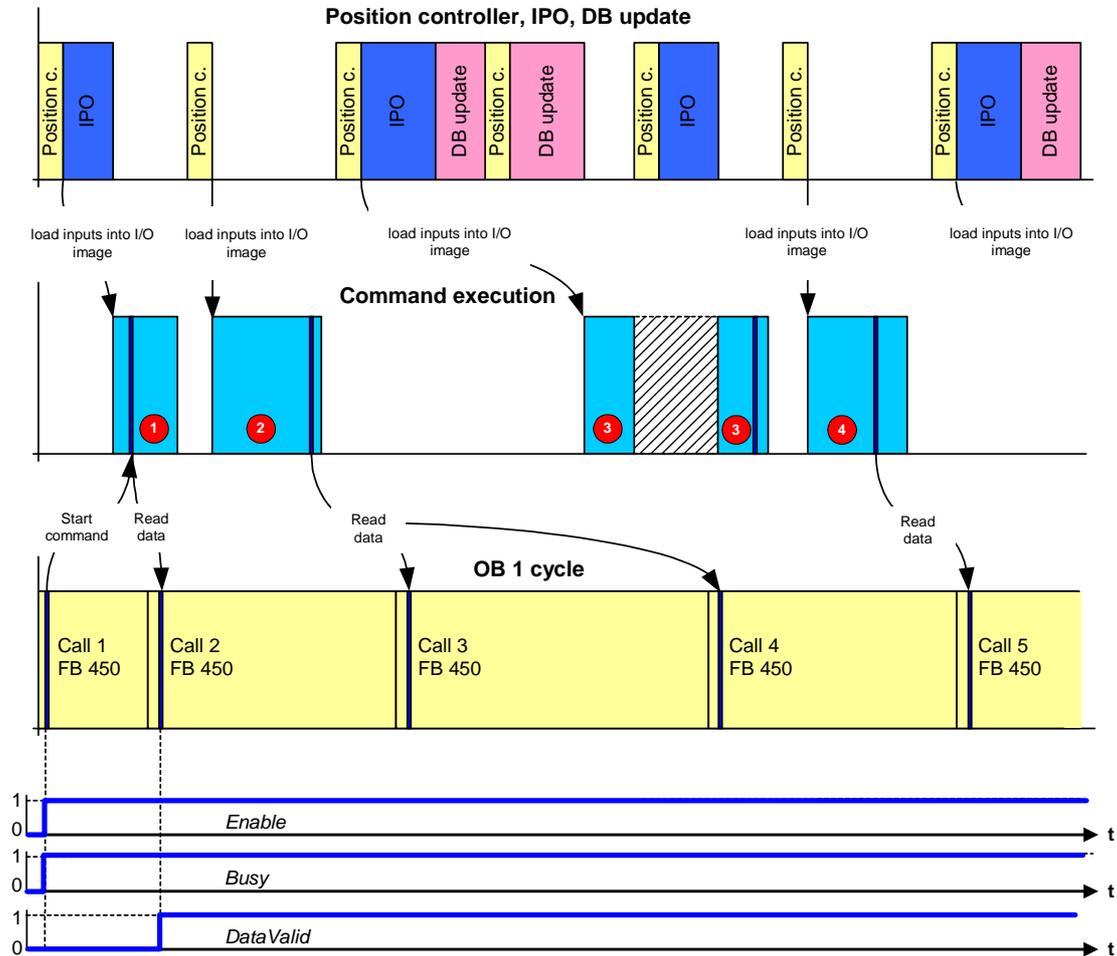
At the start of each command execution cycle, the signal status of inputs is loaded from the position controller and written to the I/O image of inputs. This load operation is independent of the "MC_ReadPeriphery" technology function. The "MC_ReadPeriphery" technology function accesses this I/O image and provides these data to the user program.

The I/O image is read to the controller, initiated by the first call of MC_ReadPeriphery with *Enable = TRUE*. Output parameter *Busy* is set *TRUE* in time with this operation. The MC_ReadPeriphery command is processed as new command within the first command execution cycle (new commands are processed at the start of the command execution.) The I/O image of inputs is written to the PLC inputs with the next call of MC_ReadPeriphery, and output parameter *DataValid* reports a *TRUE* status.

The current MC_ReadPeriphery command is tracked, starting at the second command execution cycle (current commands are processed at the end of command execution, whereby the most recent command is processed last.) With the third call of MC_ReadPeriphery, the I/O image of inputs of the second command execution cycle is transferred to the PLC.

The DB update is triggered by the subsequent IPO cycle. This is not concluded until the next position controller cycle is completed and is interrupted by the position controller. The time slice for the third command execution is available after the DB update. Due to the delayed start of command execution, this is interrupted by the next position controlled and by the subsequent IPO. An updated I/O image is therefore not available at the time of the fourth call of MC_ReadPeriphery. Hence, the I/O image of call 3 is transferred to the PLC.

The I/O image of the fourth call is available at the fifth call of MC_ReadPeriphery, and transferred to the PLC (the PLC does not read the I/O image of the third command execution cycle.)



MC_ReadPeriphery - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	Concerns input parameter <i>ByteAddress</i> .
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8088	Invalid DB (ANY pointer)	The ANY pointer refers to an invalid data area. <ul style="list-style-type: none"> • Data block not found • Specified start address not found • Data area too short
8089	Invalid data length (ANY pointer)	Specified data length is invalid. Possible causes are: <ul style="list-style-type: none"> • The length exceeds 64 bytes • The specified length plus the start address defines an address outside of the I/O image DP(DRIVE).

ErrorID	Error message	Description / to correct or avoid error
808C	Pointer format is invalid or not supported	The ANY pointer contains illegal specifications. Accepted areas: I, O, M, DB, DI Accepted data types: BYTE, CHAR, WORD, INT, DWORD, DINT, REAL
808D	Data record length out of range	An attempt was made to transfer a data record with a length of more than 240 bytes. Reduce the length definition in the ANY pointer.

6.6.5 FB 451 MC_WritePeriphery - Writing technology I/O

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_WritePeriphery" technology function can be used to write the I/O image DP(DRIVE) of the integrated technology. For information on time-based updates, refer to the Example

Applicable to

- DP I/O on DP(DRIVE)
- Integrated I/O of the Technology CPU

Requirements

- The addressed I/O must exist in the I/O image DP(DRIVE) of the integrated technology.

Overriding commands

An MC_WritePeriphery command can not be canceled by any other command.

An MC_WritePeriphery command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
Execute	BOOL	FALSE	Start of the command at the positive edge
ByteAddress	INT	0	Byte start address for writing (possible values: 0 to 63).
Data	ANY	--	Source are of data to be written. The maximum length of data to be written is defined by the data type and the repetition coefficient at the ANY pointer. The maximum length is 64 bytes.
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Command completed.
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: Command initiation with error. The command is not executed; the cause is found in the ErrorID. FALSE: Command initiation without error
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

Note

The runtime of command execution in the integrated technology plus the runtime of the OBx cycle in which MC_WritePeriphery is called may lead to a considerable length of reaction times. You should therefore connect the I/O requiring a quick write access to the MPI/DP interface of your Technology CPU.

MC_WritePeriphery - Example

The example shown in the diagram shows the time-based relationship when writing the I/O image DP(DRIVE).

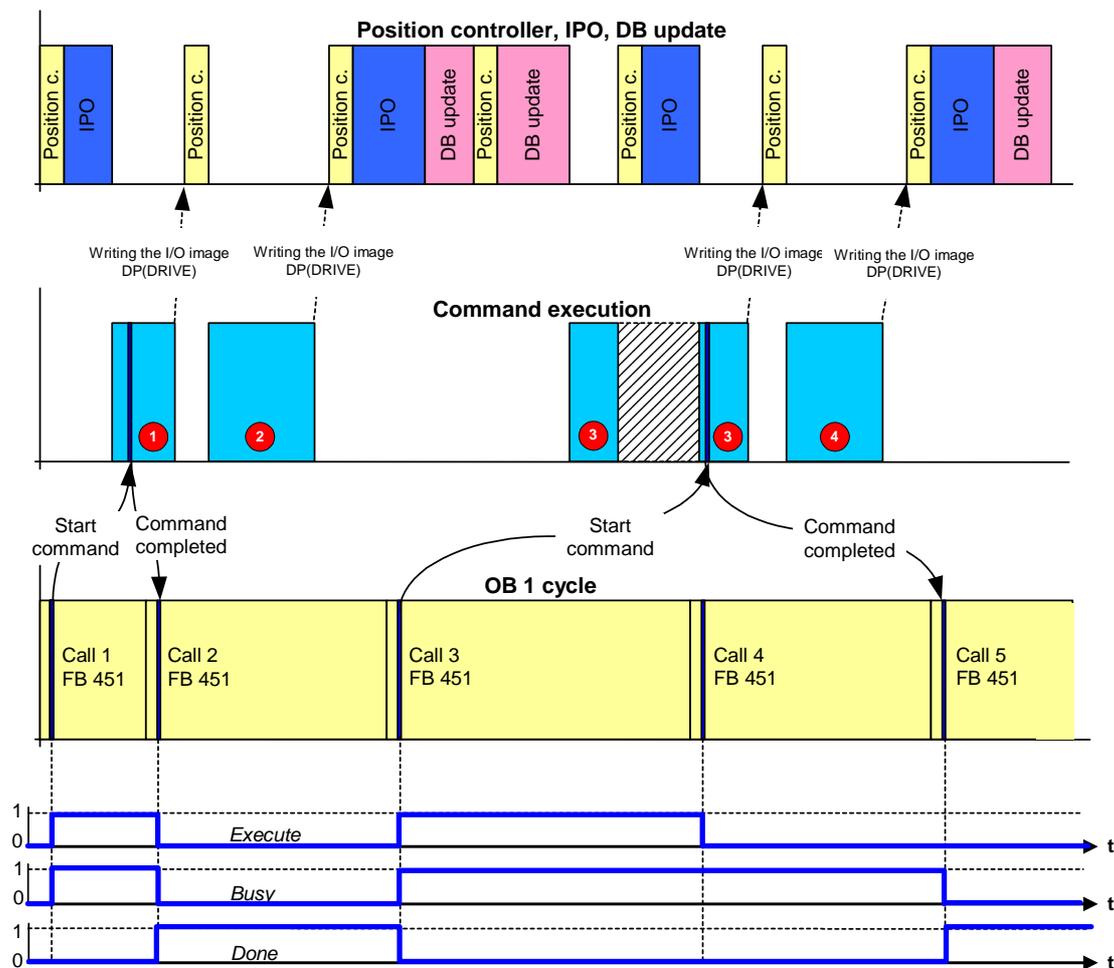
The I/O image of outputs is written to the I/O via the position controller at the end of each time slice for command execution. This write operation is carried out, regardless whether the technology function "MC_WritePeriphery" is started or not. "MC_WritePeriphery" is used to write the PLC data specified at input parameter *Data* to the I/O image of outputs.

Write access to the I/O image of outputs is triggered by the positive edge at input parameter *Execute*. Output parameter *Busy* is set *TRUE* in time with this operation. The MC_WritePeriphery command is added as new command to the time slice of the first command execution cycle. Command execution is started within this time slice. The second MC_WritePeriphery call reports completion of this command (*Busy* is toggled to *FALSE* and *Done* is set *TRUE*).

At the end of the second command execution time slice, the most recently written I/O image of outputs is written once again to the I/O via the position controller.

The DB update is triggered at the subsequent position controller cycle. The DB update is interrupted within the time slice of the position controller, but is resumed after this time slice has expired. The start of command execution is delayed due to missing time gaps. The delayed command execution cycle is interrupted by the next position controller time slice and by the subsequent IPO time slice.

The third call of MC_WritePeriphery plus positive edge at input parameter *Execute* starts a new write command. Because of the fact that further new commands were started, this new write command is queued in the second half of the command execution time slice. This is why completion of the command is not reported right away at the fourth, but rather with the fifth of MC_WritePeriphery (*Busy* is now toggled to *FALSE* state, and *Done* is set *TRUE*.)



MC_WritePeriphery - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	Concerns the input parameters <i>ByteAddress</i> or <i>DoneFlag</i> .
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.
8052	Block call at different run levels	This block was called at different run levels using the same instance DB. Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls. Error reactions to be expected: <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8088	Invalid DB (ANY pointer)	The ANY pointer refers to an invalid data area. <ul style="list-style-type: none"> • Data block not found • Specified start address not found • Data area too short

ErrorID	Error message	Description / to correct or avoid error
8089	Invalid data length (ANY pointer)	Specified data length is invalid. Possible causes are: <ul style="list-style-type: none">• The length exceeds 64 bytes• The specified length plus the start address defines an address outside of the I/O image DP(DRIVE).
808C	Pointer format is invalid or not supported	The ANY pointer contains illegal specifications. Accepted areas: I, O, M, DB, DI Accepted data types: BYTE, CHAR, WORD, INT, DWORD, DINT, REAL
808D	Data record length out of range	An attempt was made to transfer a data record with a length of more than 240 bytes. Reduce the length definition in the ANY pointer.

6.6.6 FB 453 MC_ReadRecord - Reading data record

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_ReadRecord" technology function can be used to read a data record from an I/O on DP(DRIVE).
- The technology function can be compared with the system function SFC 59 "RD_REC" which is used to read data records at the DP interface of an S7 CPU.

Applicable to

- DP I/O on DP(DRIVE)

Requirements

- The I/O must support data record communication.
- The I/O must support the relevant data record.

Overriding commands

An MC_ReadRecord command can not be canceled by any other command.

An MC_ReadRecord command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
Execute	BOOL	FALSE	Start of the command at the positive edge
InOut	BOOL	FALSE	I/O assignment of the logical base address of the I/O module FALSE: input address TRUE: output address
Address	INT	0	Logical base address of the I/O module
RecordNumber	INT	0	Number of the data record of the I/O module (possible values: 0 to 255)
Data	ANY	-	Destination for read data. The maximum length of data to be read is defined by the data type and the repetition coefficient at the ANY pointer.
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Command completed.
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: During command execution, one error has occurred. The command was not completed; the cause is found in the <i>ErrorID</i> . TRUE: During command execution, no errors occurred.
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.
DataLength	INT	0	Length of read data record information in bytes

MC_ReadRecord - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	Concerns the input parameters <i>RecordNumber</i> or <i>DoneFlag</i> .
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8088	Invalid DB (ANY pointer)	<p>The ANY pointer refers to an invalid data area.</p> <ul style="list-style-type: none"> • Data block not found • Specified start address not found • Data area too short
8089	Invalid data length (ANY pointer)	The data length specified at the ANY pointer is shorter than the data record length.
808C	Pointer format is invalid or not supported	<p>The ANY pointer contains illegal specifications. Accepted areas: I, O, M, DB, DI</p> <p>Accepted data types: BYTE, CHAR, WORD, INT, DWORD, DINT, REAL</p>
808D	Data record length out of range	An attempt was made to transfer a data record with a length of more than 240 bytes. Reduce the length definition in the ANY pointer.
8090	invalid logical base address	Error in data record transfer, command canceled. The specified base address is invalid: no assignment in SDB1/SDB2x, or this is not a base address.
8091	Logical base address is not available	<p>Error in data record transfer, command canceled. The function can not access the specified logical base address.</p> <p>The error occurs when an attempt is made to establish a data record communication with the integrated I/O of the Technology CPU.</p>
8092	Faulty response ID	Error in data record transfer, command canceled. Faulty response ID
80A2	DP protocol error in layer 2	<p>Error in data record transfer, repetition in next program cycle possible. PROFIBUS DP error in layer 2:</p> <ul style="list-style-type: none"> • Station failure • Time-out • Protocol error
80A3	DP protocol error in user interface	Error in data record transfer, command canceled. PROFIBUS DP protocol error in user interface/user.

ErrorID	Error message	Description / to correct or avoid error
80B0	Data set not supported	Error in data record transfer, command canceled. <ul style="list-style-type: none"> System function not available for module type Module does not know the data record Data set number out of the range of 0 to 255
80B1	Faulty length definition	Error in data record transfer, command was canceled. Wrong length definition at input parameter Data. Examples: <ul style="list-style-type: none"> The data record read 240 bytes, but the ANY pointer only points to a field with a length of 80 bytes. The length definition in the ANY pointer is not supported, for example, 260 bytes.
80C0	No read data	Error in data record transfer, repetition in next program cycle possible. The module maintains the data record, but read data do not exist yet.
80C2	Maximum number of commands reached	Error in data record transfer, the command can be repeated immediately. The module is currently processing the maximum number of commands the CPU can handle.
80C3	Module at capacity limits	Error in data record transfer, the command can be repeated immediately. Required resources are currently in use by other applications: <ul style="list-style-type: none"> In the module
80C4	Communication error	Error in data record transfer, the command can be repeated immediately. Communication error <ul style="list-style-type: none"> Parity error SW ready not set Error in block length forwarding Checksum error at CPU Checksum error at module
80C5	Access to distributed I/O failed	Error in data record transfer, repetition in next program cycle possible. Distributed I/O currently unavailable.
80C6	Priority class error	Error in data record transfer, repetition in next program cycle possible. Data set transfer canceled because of priority class cancellation (restart or background.)

Note

In accordance with PROFIBUS DP V1, a DP slave can report the errors *A0* to *CF*. The errors *A0* to *CF* are mapped to the *ErrorID* of the technology function as error *80A0* to *80CF*.

When output parameter *ErrorID* reports an error in the range from *80A0* to *80CF* which are not listed in the list shown earlier, consult your DP slave documentation.

6.6.7 FB 454 MC_WriteRecord - Writing data record

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_WriteRecord" technology function can be used to write a data record to an I/O on DP(DRIVE).
- The technology function can be compared with the system function SFC 58 "WR_REC" which is used to write data records at the DP interface of an S7 CPU.

Applicable to

- DP I/O on DP(DRIVE)

Requirements

- The I/O must support data record communication.
- The I/O must support the relevant data record.

Overriding commands

An MC_WriteRecord command can not be canceled by any other command.

An MC_WriteRecord command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
Execute	BOOL	FALSE	Start of the command at the positive edge
InOut	BOOL	FALSE	I/O assignment of the logical base address of the I/O module FALSE: input address TRUE: output address
Address	INT	0	Logical base address of the I/O module
RecordNumber	INT	0	Number of the data record of the I/O module (possible values: 0 to 255)
Data	ANY	-	Source are of data to be written. The maximum length of data to be written is defined by the data type and the repetition coefficient at the ANY pointer.
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Command completed.
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: During command execution, one error has occurred. The command was not completed; the cause is found in the <i>ErrorID</i> . TRUE: During command execution, no errors occurred.
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_WriteRecord - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	Concerns the input parameters <i>RecordNumber</i> or <i>DoneFlag</i> .
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8088	Invalid DB (ANY pointer)	<p>The ANY pointer refers to an invalid data area.</p> <ul style="list-style-type: none"> • Data block not found • Specified start address not found • Data area too short
8089	Invalid data length (ANY pointer)	The data length specified at the ANY pointer is shorter than the data record length.
808C	Pointer format is invalid or not supported	<p>The ANY pointer contains illegal specifications. Accepted areas:</p> <p>I, O, M, DB, DI</p> <p>Accepted data types:</p> <p>BYTE, CHAR, WORD, INT, DWORD, DINT, REAL</p>
808D	Data record length out of range	An attempt was made to transfer a data record with a length of more than 240 bytes. Correct the length definition in the ANY pointer.
8090	invalid logical base address	Error in data record transfer, command canceled. The specified base address is invalid: no assignment in SDB1/SDB2x, or this is not a base address.
8091	Logical base address is not available	<p>Error in data record transfer, command canceled.</p> <p>The function can not access the specified logical base address.</p> <p>The error occurs when an attempt is made to establish a data record communication with the integrated I/O of the Technology CPU.</p>
80A0	Error when writing to module	<p>Error in data record transfer, command canceled.</p> <p>Negative acknowledgment when writing to module:</p> <ul style="list-style-type: none"> • Module was removed at the time the write operation was carried out • Defective module

ErrorID	Error message	Description / to correct or avoid error
80A2	DP protocol error in layer 2	Error in data record transfer, command canceled. PROFIBUS DP protocol error in layer 2: <ul style="list-style-type: none"> • Station failure • Time-out • Protocol error
80A3	DP protocol error in user interface	Error in data record transfer, command canceled. PROFIBUS DP protocol error in user interface/user.
80B0	Data set not supported	Error in data record transfer, command canceled. <ul style="list-style-type: none"> • System function not available for module type • Module does not know the data record • Data set number out of the range of 0 to 255
80B1	Faulty length definition	Error in data record transfer, command canceled. Wrong length definition at input parameter <i>Data</i> . <ul style="list-style-type: none"> • The data record read 240 bytes, but the ANY pointer only points to a field with a length of 80 bytes. • The length definition in the ANY pointer is not supported, for example, 260 bytes.
80C0	Previous write command is still busy	Error in data record transfer, the command can be repeated immediately. The module has not yet processed the previous write command for the same data record.
80C2	Maximum number of commands reached	Error in data record transfer, the command can be repeated immediately. The module is currently processing the maximum number of commands the CPU can handle.
80C3	Module at capacity limits	Error in data record transfer, the command can be repeated immediately. Required resources are currently in use by other applications: <ul style="list-style-type: none"> • In the module
80C4	Communication error	Error in data record transfer, the command can be repeated immediately. Communication error <ul style="list-style-type: none"> • Parity error • SW ready not set • Error in block length forwarding • Checksum error at CPU • Checksum error at module
80C5	Access to distributed I/O failed	Error in data record transfer, repetition in next program cycle possible. Distributed I/O currently unavailable.
80C6	Priority class error	Error in data record transfer, repetition in next program cycle possible. Data set transfer canceled because of priority class cancellation (restart or background.)

Note

In accordance with PROFIBUS DP V1, a DP slave can report the errors *A0* to *CF*. The errors *A0* to *CF* are mapped to the *ErrorID* of the technology function as error *80A0* to *80CF*.

When output parameter *ErrorID* reports an error in the range from *80A0* to *80CF* which are not listed in the list shown earlier, consult your DP slave documentation.

6.6.8 FB 455 MC_ReadDriveParameter - Reading drive parameters

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_ReadDriveParameter" technology function allows the user program to read the parameters of a drive connected to DP(DRIVE).

Applicable to

- Profidrive-compliant drives on DP(DRIVE)

Requirements

- The drive is configured for operation on DP(DRIVE).
- The drive must support data record communication.
- The drive must support the parameter number and the index.

Overriding commands

An MC_ReadDriveParameter command can not be canceled by any other command.

An MC_ReadDriveParameter command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
Execute	BOOL	FALSE	Start of the command at the positive edge
InOut	BOOL	FALSE	I/O assignment of the logical base address of the drive FALSE: input address TRUE: output address
Address	INT	0	Definition of the logical base address of the module
ParameterNumber	DINT	0	Specification of the parameter number, from where the data should be read - Range of values: 0 to 65535
SubIndex	DINT	0	Definition of the parameter index used to address the first array element of an array parameter (only when <i>NumberOfElements</i> > 0, otherwise the value is set internally to zero) - Range of values: 0 to 65535
NumberOfElements	DINT	0	Number of sub-parameters to be read: Value > 0: Parameter with subindex, range of values 0 to 234 (according to the max. length of the data area at input parameter <i>Data</i>) Value = 0: Parameter without subindex Value < 0: Not permitted

Parameter	Data type	Start value	Description
Data	ANY	--	Destination data area to which the parameter values should be saved. The maximum length of data to be read or transferred is defined by the data type and the repetition coefficient at the ANY pointer. The data area has a maximum size of 234 bytes.
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Command execution completed
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: During command execution, one error has occurred. The command was not completed; the cause is found in the <i>ErrorID</i> . TRUE: During command execution, no errors occurred.
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.
DataLength	INT	0	Length of read data record information in bytes

MC_ReadDriveParameter - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	Affects the input parameters <i>ParameterNumber</i> , <i>SubIndex</i> , <i>NumberOfElements</i> or <i>DoneFlag</i> .
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example: FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning: Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8088	Invalid DB (ANY pointer)	<p>The ANY pointer refers to an invalid data area.</p> <ul style="list-style-type: none"> • Data block not found • Specified start address not found • Data area too short
8089	Invalid data length (ANY pointer)	<p>The data length specified at the ANY pointer is shorter than the data record length.</p> <p>The length of the data record is determined by the number and type of parameter values to be read.</p>
808C	Pointer format is invalid or not supported	<p>The ANY pointer contains illegal specifications. Accepted areas: I, O, M, DB, DI</p> <p>Accepted data types: BYTE, CHAR, WORD, INT, DWORD, DINT, REAL</p>
808D	Data record length out of range	An attempt was made to transfer a data record with a length of more than 234 bytes. Reduce the length definition in the ANY pointer.
8090	invalid logical base address	Error in data record transfer, command canceled. The specified base address is invalid: no assignment in SDB1/SDB2x, or this is not a base address.
8091	Logical base address is not available	<p>Error in data record transfer, command canceled.</p> <p>The function can not access the specified logical base address.</p> <p>The error occurs when an attempt is made to establish a data record communication with the integrated I/O of the Technology CPU.</p>
8092	Faulty response ID	Error in data record transfer, command canceled. Faulty response ID
80A2	DP protocol error in layer 2	<p>Error in data record transfer, repetition in next program cycle possible.</p> <p>PROFIBUS DP error in layer 2:</p> <ul style="list-style-type: none"> • Station failure • Time-out • Protocol error

ErrorID	Error message	Description / to correct or avoid error
80B0	Data set not supported	Error in data record transfer, command canceled. <ul style="list-style-type: none"> System function not available for module type Module does not know the data record Data set number out of the range of 0 to 255
80B5	System function can not be executed	Error in data record transfer, repetition in next program cycle possible. The system function can not be executed due to the internal processing state of the drive.
80B7	Faulty command	Error in data record transfer, PROFIBUS DP error, command canceled. The faulty command could not be output.
80C3	Module at capacity limits	Error in data record transfer, repetition in next program cycle possible. Required resources currently in use by other applications: <ul style="list-style-type: none"> In the technology function "MC_ReadDriveParameter" In the module
80C5	Access to distributed I/O failed	Error in data record transfer, repetition in next program cycle possible. Distributed I/O currently unavailable.
80C7	A command has already been output to the drive	Error in data record transfer, repetition in next program cycle possible. Another command has already been output to the drive
8100	Parameter not found	Parameter error, command canceled. Attempt to access a non-existing parameter.
8103	Subindex not found	Parameter error, command canceled. Attempt to access a non-existing subindex.
8104	Parameter not indexed	Parameter error, command canceled. Attempt to access a non-indexed parameter using the subindex.
8111	Access denied in current state	Parameter error, command canceled. Command can not be executed in current operating state.
8116	Value is invalid or not supported	Parameter error, command canceled. Invalid or unsupported value for attribute, number of elements, parameter number, or subindex, or of a combination.
8119	Axis does not exist	Parameter error, command canceled. Attempt to access to a non-existing axis.
8120 - 8164	Reserve	Reserved error codes to PROFIdrive
8165 - 81FF	Manufacturer-specific error	Manufacturer-specific error codes to PROFIdrive Errors are formed by the drive.

Note

In accordance with PROFIBUS DP V1, a DP slave can report the errors *A0* to *CF*. The errors *A0* to *CF* are mapped to the *ErrorID* of the technology function as error *80A0* to *80CF*.

When output parameter *ErrorID* reports an error in the range from *80A0* to *80CF* which are not listed in the list shown earlier, consult your DP slave documentation.

6.6.9 FB 456 MC_WriteDriveParameter - Writing drive parameters

Valid for firmware version V3.1.x of the integrated technology

Purpose

- The "MC_WriteDriveParameter" technology function allows the user program to write parameters of a drive connected to DP(DRIVE).

Applicable to

- Profidrive-compliant drives on DP(DRIVE)

Requirements

- The drive is configured for operation on DP(DRIVE).
- The drive must support data record communication.
- The drive supports the parameter number and the index.

Overriding commands

An MC_WriteDriveParameter command can not be canceled by any other command.

An MC_WriteDriveParameter command does not cancel any other commands.

Input parameters

Parameter	Data type	Start value	Description
Execute	BOOL	FALSE	Start of the command at the positive edge
InOut	BOOL	0	I/O assignment of the logical base address of the drive FALSE: input address TRUE: output address
Address	INT	0	Definition of the logical base address of the module
ParameterNumber	DINT	0	Definition of the parameter number from which the data are to be read. Range of values: 0 to 65535
SubIndex	DINT	0	Definition of the parameter index used to address the first array element of an array parameter. (only when <i>NumberOfElements</i> > 0, otherwise the value is set internally to zero.) Range of values: 0 to 65535
NumberOfElements	DINT	0	Number of sub-parameters to be read. Value > 0: Parameter with subindex, range of values 1 to 228 (according to the max. length of the data area at input parameter <i>Data</i>) Value = 0: Parameter without subindex Value < 0: Not permitted

Parameter	Data type	Start value	Description
Data	ANY	--	Data area containing the parameter values. The data length is determined by the parameter data type and the number of parameters to be written. The combination consisting of the data type and repetition coefficient of the ANY must result in the same data length. The data area has a maximum size of 228 bytes.
DoneFlag	INT	0	DoneFlag generated in the MCDevice DB

Output parameters

Parameter	Data type	Start value	Description
Done	BOOL	FALSE	TRUE: Command execution completed
Busy	BOOL	FALSE	TRUE: Command is busy
Error	BOOL	FALSE	TRUE: During command execution, one error has occurred. The command was not completed; the cause is found in the <i>ErrorID</i> . TRUE: During command execution, no errors occurred.
ErrorID	WORD	0	ErrorID of the <i>Error</i> output parameter.

MC_WriteDriveParameter - ErrorIDs

ErrorID	Error message	Description / to correct or avoid error
0000	No error	-
8001	Internal fault	Faulty or inconsistent project / software.
8005	Command canceled because of input buffer overflow	The rate at which the user program outputs commands to the technology is too high.
8007	An internal error has occurred at the job interface	Due to an internal problem in the S7 system, commands can not be accepted. Check the consistency of your project data, then download all system data to the module again.
8043	Illegal parameter value	Affects the input parameters <i>ParameterNumber</i> , <i>SubIndex</i> , <i>NumberOfElements</i> or <i>DoneFlag</i> .
804C	Command output rate too high	The command output rate with the same instance DB was higher than the command interface was able to accept. The second command is rejected in order not to violate consistency the first. For high command output rates, always use a separate instance DB, or send the command again. Please note, that although the first accepted command may be busy, you may not be able to monitor it at the status outputs.
8050	Technology not ready	During testing with breakpoints (CPU in HOLD), the technology function has output a new command to the technology. The command is rejected.

ErrorID	Error message	Description / to correct or avoid error
8052	Block call at different run levels	<p>This block was called at different run levels using the same instance DB.</p> <p>Example:</p> <p>FBx is called in the instance DBx, in OB1, and in OB35. Execution of the FB started in OB1, and was interrupted by its call in OB35. Based on the shared use of the instance DB, the error is indicated at output parameter <i>ErrorID</i> of both FB calls.</p> <p>Error reactions to be expected:</p> <ul style="list-style-type: none"> • The new command (positive or negative edge at parameter input Execute/Enable) is not transferred to the integrated technology. • The first command started can not be traced at the output parameter of the technology function. However, the command may still be active in the integrated technology. <p>Warning:</p> <p>Use different instance DBs at different run levels, or interlock the call of the technology function.</p>
8053	Invalid instance DB	Faulty instance DB of the technology function (wrong length, for example.)
8088	Invalid DB (ANY pointer)	<p>The ANY pointer refers to an invalid data area.</p> <ul style="list-style-type: none"> • Data block not found • Specified start address not found • Data area too short
8089	Invalid data length (ANY pointer)	<p>The data length specified at the ANY pointer is shorter than the data record length.</p> <p>The length of the data record is determined by the number and type of parameter values to be written.</p>
808C	Pointer format is invalid or not supported	<p>The ANY pointer contains illegal specifications. Accepted areas:</p> <p>I, O, M, DB, DI</p> <p>Accepted data types:</p> <p>BYTE, CHAR, WORD, INT, DWORD, DINT, REAL</p>
808D	Data record length out of range	An attempt was made to transfer a data record with a length of more than 228 bytes. Reduce the length definition in the ANY pointer.
808E	Invalid data format	Error in data record transfer, command canceled. A valid data format was not found.
8090	invalid logical base address	Error in data record transfer, command canceled. The specified base address is invalid: no assignment in SDB1/SDB2x, or this is not a base address.
8091	Logical base address is not available	<p>Error in data record transfer, command canceled.</p> <p>The function can not access the specified logical base address.</p> <p>The error occurs when an attempt is made to establish a data record communication with the integrated I/O of the Technology CPU.</p>
8092	Faulty response ID	Error in data record transfer, command canceled. Faulty response ID

ErrorID	Error message	Description / to correct or avoid error
80A2	DP protocol error in layer 2	Error in data record transfer, repetition in next program cycle possible. PROFIBUS DP error in layer 2: <ul style="list-style-type: none"> • Station failure • Time-out • Protocol error
80B0	Data set not supported	Error in data record transfer, command canceled. <ul style="list-style-type: none"> • System function not available for module type • Module does not know the data record • Data set number out of the range of 0 to 255
80B5	System function can not be executed	Error in data record transfer, repetition in next program cycle possible. The system function can not be executed due to the internal processing state of the drive.
80B7	Faulty command	PROFIBUS DP error, command aborted. The faulty command could not be output.
80C3	Module at capacity limits	Error in data record transfer, repetition in next program cycle possible. Required resources currently in use by other applications: <ul style="list-style-type: none"> • In the technology function "MC_WriteDriveParameter" • In the module
80C5	Access to distributed I/O failed	Error in data record transfer, repetition in next program cycle possible. Distributed I/O currently unavailable.
80C7	A command has already been output to the drive	Error in data record transfer, repetition in next program cycle possible. Another command has already been output to the drive
8100	Parameter not found	Parameter error, command canceled. Attempt to access a non-existing parameter.
8101	Parameter is read-only	Parameter error, command canceled. Attempt to modify a read only parameter.
8102	Parameter limits violated	Parameter error, command canceled. Attempt to write values which are out of value limits.
8103	Subindex not found	Parameter error, command canceled. Attempt to access a non-existing subindex.
8104	Parameter not indexed	Parameter error, command canceled. Attempt to access a non-indexed parameter using the subindex.
8105	Invalid data type	Parameter error, command canceled. Attempt to modify a value to a value not supported by the data type of the parameter.
8106	Parameter value not equal to 0	Parameter error, command canceled. Attempt to modify with value not equal to 0.
810B	No exclusive access	Parameter error, command canceled. Attempt to modify without exclusive access privileges.
8111	Access denied in current state	Parameter error, command canceled. Command can not be executed in current operating state.
8114	Illegal parameter value	Parameter error, command canceled. Attempt to modify with value which may not violate value limits, but is still not permissible for reasons of permanent compatibility (existing parameters with defined single values.)

ErrorID	Error message	Description / to correct or avoid error
8116	Value is invalid or not supported	Parameter error, command canceled. Invalid or unsupported value for attribute, number of elements, parameter number, or subindex, or of a combination.
8117	Illegal format	Parameter error, command canceled. Illegal format
8118	Invalid number of parameter data	Parameter error, command canceled. The number of values in parameter data does not match the number of addresses in the parameter address.
8119	Axis does not exist	Parameter error, command canceled. Attempt to access to a non-existing axis.
8120 - 8164	Reserve	Reserved error codes to PROFIdrive
8165 - 81FF	Manufacturer-specific error	Manufacturer-specific error codes to PROFIdrive Errors are formed by the drive.

Note

In accordance with PROFIBUS DP V1, a DP slave can report the errors *A0* to *CF*. The errors *A0* to *CF* are mapped to the *ErrorID* of the technology function as error *80A0* to *80CF*.

When output parameter *ErrorID* reports an error in the range from *80A0* to *80CF* which are not listed in the list shown earlier, consult your DP slave documentation.

6.7 Information about parameters

6.7.1 Reaction of the technology function after POWER OFF and restart

The technology function is reinitialized after POWER OFF (POWER OFF -> POWER ON) and restart (RUN-STOP -> STOP-RUN).

Note

If the value *Execute=TRUE* is set at the input parameter after POWER OFF or restart, a signal edge is detected, and the command is started.

In order to prevent an unwanted start of the command, set the "non-retain" check box at the block properties in SIMATIC Manager. The relevant block is initialized again after POWER On or restart if "non-retain" is set.

6.7.2 DoneFlag generation

The *DoneFlag* can be used to indicate and evaluate the completion of technology object commands in the local MCDevice DB.

At the input parameter *DoneFlag* of the technology function, you define which *DoneFlag* or which *DoneFlag* in the MCDevice DB is to be generated.

Parameter value	Meaning
0	<i>DoneFlag</i> is not generated in the MCDevice DB
1	<i>DoneFlag[1]</i> is generated in the MCDevice DB
...	
32	<i>DoneFlag[32]</i> is generated in the MCDevice DB

Each time the technology function completes a task, the value in *DoneFlag* is inverted in the MCDevice DB (*FALSE* is set *TRUE* or *TRUE* is set *FALSE*.) The *DoneFlag* is only set as long as the initiated command can be tracked. The command can no longer be tracked if a subsequent command uses the same instance.

6.7.3 Range of values

Range of REAL values

The following applies to all REAL values at the input parameters of the technology functions:

$$-1E+12 < \text{REAL value} < +1E+12$$

The restrictions specified in the descriptions of the input parameters also apply.

These values are verified in the integrated technology at the start of motion control commands. If these values ranges are exceeded, an error message is output at the technology DB and at the technology function.

Range of values for dynamic parameters at the technology functions

You define the limit values of dynamic motion characteristics at the input parameters *Velocity*, *Acceleration*, *Deceleration* and *Jerk*.

When the dynamic value of a motion lies within the limits preset in the axis configuration, the axis responds as follows:

Dynamic parameters	Response when < 0	Response when = 0	Response when > 0
Velocity	Use velocity preset of axis configuration	Error: Command is ignored Exception: MC_MoveVelocity	Use Velocity
Acceleration	Use acceleration preset of axis configuration	Error: Command is ignored (not permitted)	Use acceleration
Deceleration	Use deceleration preset of axis configuration	Error: Command is ignored	Use deceleration
Jerk	Use jerk value preset of axis configuration	Use trapezoidal profile	Use jerk

A warning is output at the technology DB if the dynamic value of a motion is outside the limits preset in the axis configuration.

Note

The preset limits of the axis configuration can be by means of FB "MC_WriteParameter".

Note

Initially, the dynamic values in the technology function are not verified when the motion control command starts. The command is output to the system, where the dynamic values are verified. The system reports any errors at the corresponding technology DB. Output parameter *CommandAborted* is then set at the technology function.

6.7.4 Absolute positioning of modulo axes

The technology transforms all absolute positioning parameters into the modulo axis cycle.

Example with modulo start value 0° and modulo length 360° :

1. An absolute positioning command to the position 400° carries out positioning to 40° ($400^\circ \bmod 360^\circ = 40^\circ$).
2. When a homing position of -20° is specified for homing, the effect is the same as a homing position 340° .
3. The ON position of a cam is set to 730° . The cam ON position is 10° ($730^\circ \bmod 360^\circ = 10^\circ$).

7 Technology DBs

7.1 "Velocity-controlled axis" - Technology DB

Valid for firmware version V3.1.x of the integrated technology

The DB is described in the integrated technology section and is read-only in the STEP 7 user program.

The DB is non-retentive, irrespective of the retentivity setting of the CPU.

Variable *UpdateFlag/UpdateCounter*

See: Technology DB updates

Variable *ErrorID*

Shows the ErrorID of the last error or warning detected of the velocity-controlled axis.

An error message can be acknowledged by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *ErrorBuffer[0..2]*

Buffer for the first three errors and warnings. The first error is written to ARRAY element *0*, the second to ARRAY element *1*, etc.

This content of the buffer can be cleared by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *Reserve34*

The variable is reserved for internal functions. It does not contain user-relevant information.

Variable *ErrorStatus.xxx*

The bits in variable *ErrorStatus.xxx* return information on various axis errors.

Bit No.	Variable	Meaning of the status <i>TRUE</i>
0	ErrorStatus.SystemFault	Internal system error
1	ErrorStatus.ConfigFault	Faulty TO configuration
2	ErrorStatus.UserFault	The user program has caused an error by outputting an illegal command
3	ErrorStatus.FaultDrive	A drive or TO reports an error
4	ErrorStatus.Reserve4	Not used
5	ErrorStatus.FollowingWarning	Not used
6	ErrorStatus.FollowingError	Not used
7	ErrorStatus.StandstillFault	The axis has moved out the standstill window, or could not reach the standstill window in the specified time.
8	ErrorStatus.PositioningError	Not used
9	ErrorStatus.SynchronOpError	Not used
10	ErrorStatus.DynamicError	Dynamic limits were exceeded
11	ErrorStatus.ClampingError	Not used
12	ErrorStatus.SoftwareLimitPos	Not used
13	ErrorStatus.SoftwareLimitNeg	Not used
14	ErrorStatus.LimitSwitchActive	A hardware limit switch is actuated
15	ErrorStatus.SensorFreqViolation	The encoder frequency is out of limits.
16	ErrorStatus.ReferenceNotFound	Not used
17	ErrorStatus.ZeroMonitoring	Zero pulse monitoring has detected an error (not a homing error)
18	ErrorStatus.Overspeed	Not used
19	ErrorStatus.FollowObjectError	Not used
20	ErrorStatus.SupImpFollowObjectError	Not used

Variable *Statusword.xxx*

The *Statusword* variable indicates the current status of the velocity-controlled axis.

Bit No.	Variable	Meaning of the status <i>TRUE</i>
0	Statusword.DriveEnabled	Drive pulse enabled (not the axis!). At virtual axes, this value is always <i>TRUE</i> . Pulse enabled is not active in following mode ("MC_Power" with <i>Mode</i> = 3.)
1	Statusword.HomingDone	Irrelevant for velocity-controlled drives.
2	Statusword.Done	No motion command is being processed (MC_Power does not represent a motion command in this case).
3	Statusword.SuperImposedCommand	Irrelevant for velocity-controlled drives.
4	Statusword.Error	At least one error has occurred (<i>ErrorID</i> = 8xxx). Warning do not change the <i>Error</i> = <i>FALSE</i> status.
5	Statusword.Errorstop	The axis is being stopped / was stopped due to an error; the technology object may be locked. Eliminate the cause and acknowledge the error.
6	Statusword.Stopping	An MC_Stop command is busy at the axis. New motion commands are rejected.
7	Statusword.Standstill	The axis velocity (absolute value) is lower than the set standstill limit.
8	Statusword.PositioningCommand	Irrelevant for velocity-controlled drives.
9	Statusword.SpeedCommand	A speed command is busy at the axis. Examples: <ul style="list-style-type: none"> • MC_MoveVelocity • "MC_MoveToEndPos" (before the fixed end stop is detected)
10	Statusword.SynchrCommand	Irrelevant for velocity-controlled drives.
11	Statusword.Homing	Irrelevant for velocity-controlled drives.
12	Statusword.FollowUpControl	Remains set as long as following mode is enabled. This is not the case if the axis is shut down with "MC_Power" or switched on with <i>Mode</i> = 3.
13	Statusword.ConstantVelocity	Is set as long as the velocity setpoint remains constant.
14	Statusword.Accelerating	Axis is accelerating (increasing drive power).
15	Statusword.Decelerating	Axis is decelerating (declining drive power).
16	Statusword.RequestRestart	Axis parameters were changed and do not take effect until after the next restart (MC_Reset with <i>Restart</i> = <i>TRUE</i>).
17	Statusword.Simulation	Axis in simulation mode. You achieve this with MC_Power by setting <i>Mode</i> = 4.
18	Statusword.CyclicInterface	Cyclic communication between the integrated technology and the drive is active. At a virtual axis, this value is always <i>TRUE</i> .
19	Statusword.EncoderValid	Irrelevant for velocity-controlled drives.
20	Statusword.SpeedMode	Always <i>TRUE</i> at the velocity-controlled axis.
21	Statusword.TorqueLimiting	The torque of the axis was limited by an "MC_SetTorqueLimit" or "MC_MoveToEndPos" command, and the drive is operating at this limit. The drive must support torque limiting in this case (telegram 10x).
22	Statusword.SupImpSynchrCommand	Irrelevant for velocity-controlled drives.

Variable *CommandVelocity*

Shows the current velocity setpoint for the axis (allowance is made for *SpeedOverride*.)

Variable *CommandAcceleration*

Shows the current acceleration setpoint for the axis (allowance is made for *AccelerationOverride*.)

Variable *ActualVelocity*

Shows the current axis velocity.

If the velocity-controlled axis does not have an encoder, this value is always 0.

Variable *ActualAcceleration*

Shows the current axis acceleration.

If the velocity-controlled axis does not have an encoder, this value is always 0.

Variable *SpeedOverride*

Shows the percentage of the currently effective *SpeedOverride*. The percentage is reciprocal to the velocity setpoint of the axis, and is set to 100% by default.

The *SpeedOverride* can be set at the technology function FB 407 "MC_WriteParameter" from 0% to 200%.

Variable *AccelerationOverride*

Shows the percentage of the currently effective *AccelerationOverride*. The percentage is reciprocal to the acceleration setpoint of the axis, and is set to 100% by default.

The *AccelerationOverride* can be set at the technology function FB 407 "MC_WriteParameter" from 1% to 1000%.

7.2 "Positioning axis" - Technology DB

Valid for firmware version V3.1.x of the integrated technology

The DB is described in the integrated technology section and is read-only in the STEP 7 user program.

The DB is non-retentive, irrespective of the retentivity setting of the CPU.

Variable *UpdateFlag/UpdateCounter*

See: Technology DB updates

Variable *ErrorID*

Shows the ErrorID of the last error or warning detected at the positioning axis.

An error message can be acknowledged by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *ErrorBuffer[0..2]*

Buffer for the first three errors and warnings. The first error is written to ARRAY element 0, the second to ARRAY element 1, etc.

This content of the buffer can be cleared by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *Reserve34*

The variable is reserved for internal functions. It does not contain user-relevant information.

Variable *ErrorStatus.xxx*

The bits in variable *ErrorStatus.xxx* return information on various positioning axis errors.

Bit No.	Variable	Meaning of the status <i>TRUE</i>
0	ErrorStatus.SystemFault	Internal system error
1	ErrorStatus.ConfigFault	Faulty TO configuration
2	ErrorStatus.UserFault	The user program has caused an error by outputting an illegal command
3	ErrorStatus.FaultDrive	A drive or TO reports an error
4	ErrorStatus.Reserve4	Not used
5	ErrorStatus.FollowingWarning	Dynamic following error monitoring function reports violation of warning limits
6	ErrorStatus.FollowingError	Dynamic following error monitoring function reports violation of window limits
7	ErrorStatus.StandstillFault	The axis has moved out the standstill window, or could not reach the standstill window in the specified time.
8	ErrorStatus.PositioningError	The axis could not reach the positioning window within the specified time.
9	ErrorStatus.SynchronOpError	Synchronization tolerance out of limits
10	ErrorStatus.DynamicError	Dynamic limits were exceeded
11	ErrorStatus.ClampingError	Clamping error. The axis has overrun the "Position tolerance after fixed end stop detection" without having received a new motion command. (Position tolerance setting in S7T Config > Limits > "Fixed end stop" tab > Parameter "Position tolerance after fixed end stop detection".)
12	ErrorStatus.SoftwareLimitPos	Upper software limit switch reached or passed
13	ErrorStatus.SoftwareLimitNeg	Lower software limit switch reached or passed
14	ErrorStatus.LimitSwitchActive	A hardware limit switch is actuated
15	ErrorStatus.SensorFreqViolation	The encoder frequency is out of limits.
16	ErrorStatus.ReferenceNotFound	Reference cam or zero pulse not found when homing
17	ErrorStatus.ZeroMonitoring	Zero pulse monitoring has detected an error (not a homing error)
18	ErrorStatus.Overspeed	Not used
19	ErrorStatus.FollowObjectError	Not used
20	ErrorStatus. SupImpFollowObjectError	Not used

Variable *Statusword.xxx*

The *Statusword* variable indicates the current status of the velocity-controlled axis.

Bit No.	Variable	Meaning of the status <i>TRUE</i>
0	Statusword.DriveEnabled	Drive pulse enabled (not the axis!). At virtual axes, this value is always <i>TRUE</i> . Pulse enabled is not active in following mode ("MC_Power" with <i>Mode</i> = 3.)
1	Statusword.HomingDone	Axis is homed, i.e. "MC_Home" was executed without error
2	Statusword.Done	No motion command is being processed (MC_Power does not represent a motion command in this case).
3	Statusword.SuperImposedCommand	A superimposing motion is active (e.g. "MC_MoveSuperImposed").
4	Statusword.Error	At least one error has occurred (<i>ErrorID</i> = 8xxx). Warning do not change the <i>Error</i> = <i>FALSE</i> status.
5	Statusword.Errorstop	The axis is being stopped / was stopped due to an error; the technology object may be locked. Eliminate the cause and acknowledge the error.
6	Statusword.Stopping	An MC_Stop command is busy at the axis. New motion commands are rejected.
7	Statusword.Standstill	The axis velocity (absolute value) is lower than the set standstill limit.
8	Statusword.PositioningCommand	A positioning command is active at the axis (may also be superimposing.)
9	Statusword.SpeedCommand	A speed command is busy at the axis. Examples: <ul style="list-style-type: none"> • MC_MoveVelocity • "MC_MoveToEndPos" (before the fixed end stop is detected)
10	Statusword.SynchrCommand	Irrelevant to the positioning axis.
11	Statusword.Homing	The bit is set at the start, and reset at the end of MC_Home.
12	Statusword.FollowUpControl	Remains set as long as following mode is enabled. This is not the case if the axis is shut down with "MC_Power" or switched on with <i>Mode</i> = 3.
13	Statusword.ConstantVelocity	Is set as long as the velocity setpoint remains constant.
14	Statusword.Accelerating	Axis is accelerating (increasing drive power).
15	Statusword.Decelerating	Axis is decelerating (declining drive power).
16	Statusword.RequestRestart	Axis parameters were changed and do not take effect until after the next restart (MC_Reset with <i>Restart</i> = <i>TRUE</i>).
17	Statusword.Simulation	Axis in simulation mode. You achieve this with MC_Power by setting <i>Mode</i> = 4.
18	Statusword.CyclicInterface	Cyclic communication between the integrated technology and the drive is active. At a virtual axis, this value is always <i>TRUE</i> .
19	Statusword.EncoderValid	The actual position of the encoder that is relevant to the axis is valid (of particular importance in the startup phase of absolute value encoders).
20	Statusword.SpeedMode	The axis motion is velocity-controlled by "MC_MoveVelocity" (<i>PositionControl</i> = <i>FALSE</i>).

Bit No.	Variable	Meaning of the status <i>TRUE</i>
21	Statusword.TorqueLimiting	The torque of the axis was limited by an "MC_SetTorqueLimit" or "MC_MoveToEndPos" command, and the drive is operating at this limit. The drive must support torque limiting in this case (telegram 10x).
22	Statusword.SuplmpSynchrCommand	Irrelevant to the positioning axis.

Variable *CommandVelocity*

Shows the current velocity setpoint for the axis (allowance is made for *SpeedOverride*.)

Variable *CommandAcceleration*

Shows the current acceleration setpoint for the axis (allowance is made for *AccelerationOverride*.)

Variable *ActualVelocity*

Shows the current axis velocity.

Variable *ActualAcceleration*

Shows the current axis acceleration.

Variable *SpeedOverride*

Shows the percentage of the currently effective *SpeedOverride*. The percentage is reciprocal to the velocity setpoint of the axis, and is set to *100%* by default.

SpeedOverride can be set at the technology function FB 407 "MC_WriteParameter" from *0%* to *200%*.

Variable *AccelerationOverride*

Shows the percentage of the currently effective *AccelerationOverride*. The percentage is reciprocal to the acceleration setpoint of the axis, and is set to *100%* by default.

The *AccelerationOverride* can be set at the technology function FB 407 "MC_WriteParameter" from *1%* to *1000%*.

Variable *ActualPosition*

Shows the current axis position.

Variable *CommandPosition*

Indicates the current target position for positioning operations.

Variable *TargetPosition*

indicates the target position for the current command. Only valid for a single positioning command.

Variable *Distance*

Shows the current distance of relative / superimposing positioning. Only valid for a single positioning command.

Variable *DecelerationDistance*

Indicates the current stop distance of the axis. Only valid for a single positioning command.

Variable *FollowingError*

Indicates the current following error value of the axis. Only valid for a single positioning command.

7.3 "Synchronization axis" - Technology DB

Valid for firmware version V3.1.x of the integrated technology

The DB is described in the integrated technology section and is read-only in the STEP 7 user program.

The DB is non-retentive, irrespective of the retentivity setting of the CPU.

Variable *UpdateFlag/UpdateCounter*

See: Technology DB updates

Variable *ErrorID*

Shows the ErrorID of the last error or warning detected of the synchronous axis.

An error message can be acknowledged by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *ErrorBuffer[0..2]*

Buffer for the first three errors and warnings. The first error is written to ARRAY element 0, the second to ARRAY element 1, etc.

This content of the buffer can be cleared by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *Reserve34*

The variable is reserved for internal functions. It does not contain user-relevant information.

Variable *ErrorStatus.xxx*

The bits in variable *ErrorStatus.xxx* return information on various axis errors.

Bit No.	Variable	Meaning of the status <i>TRUE</i>
0	ErrorStatus.SystemFault	Internal system error
1	ErrorStatus.ConfigFault	Faulty TO configuration
2	ErrorStatus.UserFault	The user program has caused an error by outputting an illegal command
3	ErrorStatus.FaultDrive	A drive or TO reports an error
4	ErrorStatus.Reserve4	Not used
5	ErrorStatus.FollowingWarning	Dynamic following error monitoring function reports violation of warning limits
6	ErrorStatus.FollowingError	Dynamic following error monitoring function reports violation of window limits
7	ErrorStatus.StandstillFault	The axis has moved out the standstill window, or could not reach the standstill window in the specified time.
8	ErrorStatus.PositioningError	The axis could not reach the positioning window within the specified time.
9	ErrorStatus.SynchronOpError	Synchronization tolerance out of limits
10	ErrorStatus.DynamicError	Dynamic limits were exceeded
11	ErrorStatus.ClampingError	Clamping error. The axis has overrun the "Position tolerance after fixed end stop detection" without having received a new motion command. (Position tolerance setting in S7T Config > Limits > "Fixed end stop" tab > Parameter "Position tolerance after fixed end stop detection".)
12	ErrorStatus.SoftwareLimitPos	Upper software limit switch reached or passed
13	ErrorStatus.SoftwareLimitNeg	Lower software limit switch reached or passed
14	ErrorStatus.LimitSwitchActive	A hardware limit switch is actuated
15	ErrorStatus.SensorFreqViolation	The encoder frequency is out of limits.
16	ErrorStatus.ReferenceNotFound	Reference cam or zero pulse not found when homing
17	ErrorStatus.ZeroMonitoring	Zero pulse monitoring has detected an error (not a homing error)
18	ErrorStatus.Overspeed	Not used
19	ErrorStatus.FollowObjectError	Error at the synchronization object.
20	ErrorStatus.SupImpFollowObjectError	Error at the superimposing synchronization object.

Variable Statusword.xxx

The status word variable indicates the current status of the synchronous axis.

Bit No.	Variable	Meaning of the status <i>TRUE</i>
0	Statusword.DriveEnabled	Drive pulse enabled (not the axis!). At virtual axes, this value is always <i>TRUE</i> . Pulse enabled is not active in following mode ("MC_Power" with <i>Mode</i> = 3.)
1	Statusword.HomingDone	Axis is homed, i.e. "MC_Home" was executed without error
2	Statusword.Done	No motion command is being processed (MC_Power does not represent a motion command in this case).
3	Statusword.SuperImposedCommand	A superimposing motion is active (e.g. "MC_MoveSuperImposed").
4	Statusword.Error	At least one error has occurred (<i>ErrorID</i> = 8xxx). Warning do not change the <i>Error</i> = <i>FALSE</i> status.
5	Statusword.Errorstop	The axis is being stopped / was stopped due to an error; the technology object may be locked. Eliminate the cause and acknowledge the error.
6	Statusword.Stopping	An MC_Stop command is busy at the axis. New motion commands are rejected.
7	Statusword.Standstill	The axis velocity (absolute value) is lower than the set standstill limit.
8	Statusword.PositioningCommand	A positioning command is active at the axis (may also be superimposing.)
9	Statusword.SpeedCommand	A speed command is busy at the axis. Examples: <ul style="list-style-type: none"> • MC_MoveVelocity • "MC_MoveToEndPos" (before the fixed end stop is detected)
10	Statusword.SynchrCommand	Axis in synchronism (active MC_GearIn or MC_CamIn)
11	Statusword.Homing	The bit is set at the start, and reset at the end of MC_Home.
12	Statusword.FollowUpControl	Remains set as long as following mode is enabled. This is not the case if the axis is shut down with "MC_Power" or switched on with <i>Mode</i> = 3.
13	Statusword.ConstantVelocity	Is set as long as the velocity setpoint remains constant.
14	Statusword.Accelerating	Axis is accelerating (increasing drive power).
15	Statusword.Decelerating	Axis is decelerating (declining drive power).
16	Statusword.RequestRestart	Axis parameters were changed and do not take effect until after the next restart (MC_Reset with <i>Restart</i> = <i>TRUE</i>).
17	Statusword.Simulation	Axis in simulation mode. You achieve this with MC_Power by setting <i>Mode</i> = 4.
18	Statusword.CyclicInterface	Cyclic communication between the integrated technology and the drive is active. At a virtual axis, this value is always <i>TRUE</i> .
19	Statusword.EncoderValid	The actual position of the encoder that is relevant to the axis is valid (of particular importance in the startup phase of absolute value encoders).
20	Statusword.SpeedMode	The axis motion is velocity-controlled by "MC_MoveVelocity" (<i>PositionControl</i> = <i>FALSE</i>).

Bit No.	Variable	Meaning of the status <i>TRUE</i>
21	Statusword.TorqueLimiting	The torque of the axis was limited by an "MC_SetTorqueLimit" or "MC_MoveToEndPos" command, and the drive is operating at this limit. The drive must support torque limiting in this case (telegram 10x).
22	Statusword.SupImpSynchrCommand	Axis in superimposing synchronism (active MC_GearInSuperImposed or MC_GearInSuperImposed)

Variable *CommandVelocity*

Shows the current velocity setpoint for the axis (allowance is made for *SpeedOverride*.)

Variable *CommandAcceleration*

Shows the current acceleration setpoint for the axis (allowance is made for *AccelerationOverride*.)

Variable *ActualVelocity*

Shows the current axis velocity.

Variable *ActualAcceleration*

Shows the current axis acceleration.

Variable *SpeedOverride*

Shows the percentage of the currently effective *SpeedOverride*. The percentage is reciprocal to the velocity setpoint of the axis, and is set to *100%* by default.

SpeedOverride can be set at the technology function FB 407 "MC_WriteParameter" from *0%* to *200%*.

Variable *AccelerationOverride*

Shows the percentage of the currently effective *AccelerationOverride*. The percentage is reciprocal to the acceleration setpoint of the axis, and is set to *100%* by default.

The *AccelerationOverride* can be set at the technology function FB 407 "MC_WriteParameter" from *1%* to *1000%*.

Variable *ActualPosition*

Shows the current axis position.

Variable *CommandPosition*

Indicates the current target position for positioning operations.

Variable *TargetPosition*

indicates the target position for the current command. Only valid for a single positioning command.

Variable *Distance*

Shows the current distance of relative / superimposing positioning. Only valid for a single positioning command.

Variable *DecelerationDistance*

Indicates the current stop distance of the axis. The indicated value applies only to the current positioning command.

Variable *FollowingError*

Indicates the current following error value of the axis. This value applies only to the execution of a positioning command or to synchronous operation.

Variable *SyncStatus*

Value	Function	Comments
0	No synchronism	Active synchronization mode is "No synchronism".
1	Gearing	Active synchronization mode is "Gearing".
2	Camming	Active synchronization mode is "Camming".

Variable *Reserve94*

The variable is reserved for internal functions. It does not contain user-relevant information.

Variable *NumGear/DenomGear*

The variables indicate the gear ratio for base synchronism. The *NumGear* variable indicates the leading axis coefficient, and the *DenomGear* variable the following axis coefficient (in the context of base synchronism.) The indicated values apply only to base synchronous operation.

Example:

With a transmission ratio of 17:25 between the leading and following axes, the *NumGear* variable outputs the value 17 and the *DenomGear* variable has the value 25.

Variable *PhaseShift*

Shows the phase offset between the reference positions of the leading axis and following axis. The value indicated is only valid during base synchronism.

SupImpSyncStatus variable

Value	Function	Comments
0	No synchronism	Active mode of the superimposing synchronization object is "No synchronism."
1	Gearing	Active mode of the superimposing synchronization object is "Gearing."
2	Camming	Active mode of the superimposing synchronization object is "Camming."

Reserve110 variable

The variable is reserved for internal functions. It does not contain user-relevant information.

SupImpNumGear/SupImpDenomGear variable

These variables indicate the gear ratio for base synchronism. The *SupImpNumGear* shows the coefficient of the leading axis, and the *SupImpDenomGear* shows the coefficient of the following axis (referenced to the superimposing coordinate system of the following axis.). The indicated values apply to superimposing synchronism.

SupImpPhaseShift variable

Indicates the phase shift between the reference position of the leading axis and the reference position in the superimposing coordinate system of the following axis. This value is only valid for superimposed synchronism.

7.4 "External encoder" - Technology DB

Valid for firmware version V3.1.x of the integrated technology

The DB is described in the integrated technology section and is read-only in the STEP 7 user program.

The DB is non-retentive, irrespective of the retentivity setting of the CPU.

Variable *UpdateFlag/UpdateCounter*

See: Technology DB updates

Variable *ErrorID*

Shows the ErrorID of the last error or warning detected of the external encoder.

An error message can be acknowledged by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *ErrorBuffer[0..2]*

Buffer for the first three errors and warnings. The first error is written to ARRAY element 0, the second to ARRAY element 1, etc.

This content of the buffer can be cleared by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *Reserve34*

The variable is reserved for internal functions. It does not contain user-relevant information.

Variable *ErrorStatus.xxx*

The bits in variable *ErrorStatus.xxx* return information on various errors at the external encoder.

Bit No.	Variable	Meaning of the status <i>TRUE</i>
0	ErrorStatus.SystemFault	Internal system error
1	ErrorStatus.ConfigFault	Faulty TO configuration
2	ErrorStatus.UserFault	The user program has caused an error by outputting an illegal command
3	ErrorStatus.FaultDrive	The external encoder or technology object reports an error
4	ErrorStatus.Reserve4	Not used
5	ErrorStatus.FollowingWarning	Dynamic following error monitoring function reports violation of warning limits
6	ErrorStatus.FollowingError	Dynamic following error monitoring function reports violation of window limits
7	ErrorStatus.StandstillFault	The external encoder has moved out the standstill window, or could not reach the standstill window in the specified time.
8	ErrorStatus.PositioningError	The axis could not reach the positioning window within the specified time.
9	ErrorStatus.SynchronOpError	Not used
10	ErrorStatus.DynamicError	Dynamic limits were exceeded
11	ErrorStatus.ClampingError	Clamping error. The axis has overrun the "Position tolerance after fixed end stop detection" without having received a new motion command. (Position tolerance setting in S7T Config > Limits > "Fixed end stop" tab > Parameter "Position tolerance after fixed end stop detection".)
12	ErrorStatus.SoftwareLimitPos	Not used
13	ErrorStatus.SoftwareLimitNeg	Not used
14	ErrorStatus.LimitSwitchActive	Not used
15	ErrorStatus.SensorFreqViolation	The encoder frequency is out of limits.
16	ErrorStatus.ReferenceNotFound	Reference cam or zero pulse not found when homing
17	ErrorStatus.ZeroMonitoring	Zero pulse monitoring has detected an error (not a homing error)
18	ErrorStatus.Overspeed	Not used
19	ErrorStatus.FollowObjectError	Not used
20	ErrorStatus. SupImpFollowObjectError	Not used

Variable *Statusword.xxx*

The *Statusword* indicates the current status of the external encoder.

These values are no longer updated when the external encoder is disabled. The values shown correspond with the last status registered at the time the enable signal was reset.

Bit No.	Variable	Meaning of the status <i>TRUE</i>
0	Statusword.DriveEnabled	The external encoder is enabled (<i>Mode</i> = 1 at the input parameter of "MC_ExternalEncoder")
1	Statusword.HomingDone	The axis is homed, i.e. "MC_ExternalEncoder" was successfully completed in <i>Mode</i> = 2 to 6
2	Statusword.Done	No command currently executed
3	Statusword.SuperImposedCommand	Irrelevant for the external encoder.
4	Statusword.Error	At least one error has occurred (<i>ErrorID</i> = 8xxx). Warning do not change the <i>Error</i> = <i>FALSE</i> status.
5	Statusword.Errorstop	The external encoder will be/was locked due to an error. Eliminate the cause and acknowledge the error.
6	Statusword.Stopping	Irrelevant for the external encoder.
7	Statusword.Standstill	The velocity of the external encoder (absolute value) is lower than the set standstill limit.
8	Statusword.PositioningCommand	Irrelevant for the external encoder.
9	Statusword.SpeedCommand	Irrelevant for the external encoder.
10	Statusword.SynchrCommand	Irrelevant for the external encoder.
11	Statusword.Homing	The bit is set at the start and reset at the end of homing ("MC_ExternalEncoder" <i>Mode</i> = 2 to 6)
12	Statusword.FollowUpControl	Irrelevant for the external encoder.
13	Statusword.ConstantVelocity	Irrelevant for the external encoder.
14	Statusword.Accelerating	Irrelevant for the external encoder.
15	Statusword.Decelerating	Irrelevant for the external encoder.
16	Statusword.RequestRestart	Parameters of the external encoder were changed and do not take effect until after the next restart (MC_Reset with <i>Restart</i> = <i>TRUE</i>).
17	Statusword.Simulation	Irrelevant for the external encoder.
18	Statusword.CyclicInterface	Irrelevant for the external encoder.
19	Statusword.EncoderValid	The actual position values of the external encoder is valid (of particular importance due to the startup phase of absolute value encoder.)
20	Statusword.SpeedMode	Always <i>FALSE</i> for the external encoder.
21	Statusword.TorqueLimiting	Irrelevant for the external encoder.
22	Statusword.SupImpSynchrCommand	Irrelevant for the external encoder.

Variable *ActualPosition*

Shows the current position of the external encoder.

The position is no longer updated when the external encoder is disabled. The indicated position corresponds with the last position before the enable signal was reset.

Variable *ActualVelocity*

Shows the current acceleration of the external encoder.

The acceleration value is no longer updated when the external encoder is disabled. The indicated acceleration value corresponds with the last acceleration value before the enable signal was reset.

7.5 "Cam disk" - Technology DB

The DB is described in the integrated technology section and is read-only in the STEP 7 user program.

The DB is non-retentive, irrespective of the retentivity setting of the CPU.

Variable *ErrorID*

Shows the ErrorID of the last error or warning detected at the cam disk.

An error message can be acknowledged by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *ErrorBuffer[0..2]*

Buffer for the first three errors and warnings. The first error is written to ARRAY element 0, the second to ARRAY element 1, etc.

This content of the buffer can be cleared by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *Status*

Value	Function	Comments
0	Cleared	The cam does not have interpolation points or segments.
1	Added interpolation points / segments	The cam contains interpolation points / segments.
2	Interpolated	The cam is interpolated (i.e. it is suitable for synchronous operation.)
3	Error	An error has occurred

Variable *UserCount*

Indicates how many technology objects are currently using the cam.

7.6 "Measuring sensor" - Technology DB

The "Measuring sensor" technology DB contains information on the "Measuring sensor" TO and command processing. The DB is described in the integrated technology section and is read-only in the STEP 7 user program.

The DB is non-retentive, irrespective of the retentivity setting of the CPU.

Variable *UpdateFlag/UpdateCounter*

See: Technology DB updates

Variable *ErrorID*

Shows the ErrorID of the last error or warning detected of the measuring sensor.

An error message can be acknowledged by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *ErrorBuffer[0..2]*

Buffer for the first three errors and warnings. The first error is written to ARRAY element 0, the second to ARRAY element 1, etc.

This content of the buffer can be cleared by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *Status*

Indicates the operational state of the measuring sensor. The following operating states can be shown:

Value	Function	Comments
0	INIT	Measuring sensor is idle
1	WaitForTrigger	Waiting for edge(s) at the measuring input (measured value(s) not recorded yet)
2	DataValid	Measurement completed, value(s) logged and valid
3	Error	Error detected; value(s) invalid

Variable *MeasureValue1*

Indicates measured value 1 of the measuring sensor. This value is valid in status (operating state) 2.

Variable *MeasureValue2*

Indicates measured value 2 of the measuring sensor. This value is valid in status (operating state) 2.

The measured value 2 is logged only in (*Mode*) 3 and 4 of FB 433.

Variable *MeasureStart/MeasureEnd*

The *MeasureStart* variable indicates the lo limit, the *MeasureEnd* variable the hi limit of the measuring hysteresis. Only the measured values within this hysteresis are logged. When the *MeasureStart* and *MeasureEnd* values are equal, the hysteresis has no effect.

The *MeasureStart/MeasureEnd* variables shown at the DB correspond with the values of the input parameters of the relevant FB 433 "MC_MeasuringInput."

7.7 "Cam" - Technology DB

Valid for firmware version V3.1.x of the integrated technology

The DB is described in the integrated technology section and is read-only in the STEP 7 user program.

The DB is non-retentive, irrespective of the retentivity setting of the CPU.

Variable *ErrorID*

Shows the ErrorID of the last error or warning detected at the cam.

An error message can be acknowledged by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *ErrorBuffer[0..2]*

Buffer for the first three errors and warnings. The first error is written to ARRAY element 0, the second to ARRAY element 1, etc.

This content of the buffer can be cleared by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *State*

Value	Function	Comments
0	OFF	The current switching state of the cam is "OFF".
1	ON	The current switching state of the cam is "ON".

Variable *CamType*

Value	Function	Comments
0	Positioning cam	The cam operates position-based.
1	Time-based cam	The cam operates time-based.
2	Switching cam	The cam operates in switching mode.

Variable *Mode*

Value	Function	Comments
1	locked	The current cam operating state is "Cam disabled".
2	normal	The current cam operating state is "Cam enabled (output not inverted)".
3	inverse	The current cam operating state is "Cam enabled (output inverted)".
4	always ON	The current cam operating state is "Cam is permanently ON".

Direction variable

Shows the effective cam direction of the most recent MC_CamSwitch or MC_CamSwitchTime command. The variable is not changed in the following "MC_CamSwitch" and "MC_CamSwitchTime" modes:

- Value = 1 (cam locked)
- Value = 4 (cam permanently enabled)

Value	Function
1	Positive direction of action
2	Positive and negative (i.e. the effective direction is irrelevant)
3	Negative direction of action
4	The current sense of direction of the axis is the effective direction

OnPosition variable

This variable indicates the current ON position.

OffPosition variable

Indicates the current OFF position of a position-controlled axis.

Duration variable

Indicates the pulse duration of a time-based cam. The physical unit corresponds with the physical unit of the "time" at the corresponding axis.

Delay variable

Indicates the current offset (derivative action time) of the ON/OFF times.

Value < 0: Advanced switching

Value > 0: Delayed switching

Hysteresis variable

Indicates the current values of the hysteresis.

7.8 "Trace" - Technology DB

You can use the TraceTool in S7T Config to record variables of the integrated technology graphically in realtime. The "Trace" DB forms the interface between TraceTool and the user program.

For tracing, you can write two values of the data type DINT, two values of the data type DWORD and four values of the data type REAL to the relevant variables of the Trace DB. The *ErrorID* variable may not be overwritten by the user program.

The DB data are fetched from the integrated technology within the technology DB update cycle. The technology DB update cycle can be set in S7T Config by selecting the **Target System > Set system clocks** command.

The DB is non-retentive, irrespective of the retentivity setting of the CPU.

Variable *ErrorID*

Indicates the ErrorID of the most recently detected error. The error must be eliminated and can not be acknowledged.

Variable *S7_TraceDINT[0..1]*

The *S7_TraceDINT* variable is an ARRAY consisting of two elements of the data type DINT.

These values can be selected for tracing *Technology > userdata1 > user1* and *user2* when you select the signal source in the TraceTool of S7T Config.

Variable *S7_TraceDWORD[0..1]*

The *S7_TraceDWORD* variable is an ARRAY consisting of two elements of the data type DWORD. Use these variables to trace bit information, such as the status word / error word, in the TraceTool of S7T Config. In the TraceTool, you can select the bit information as you are used to in the SIMATIC numbering system.

These values can be selected for tracing *Technology > userdata1 > user3* and *user4* when you select the signal source in the TraceTool of S7T Config.

Variable *S7_TraceREAL[0..3]*

The *S7_TraceREAL* variable is an ARRAY consisting of four elements of the data type REAL.

These values can be selected for tracing *Technology > userdata1 > user5*, *user6*, *user7* and *user8* when you select the signal source in the TraceTool of S7T Config.

7.9 "MCDevice" - Technology DB

Valid for firmware version V3.1.x of the integrated technology

The technology DB "MCDevice" contains general information on the integrated technology. Information on the various TOs is found in the corresponding DBs.

The DB is described in the integrated technology section and is read-only in the STEP 7 user program.

The DB is non-retentive, irrespective of the retentivity setting of the CPU.

Variable *UpdateFlag/UpdateCounter*

See: Technology DB updates

Variable *ErrorID*

Indicates the ErrorID of the most recently detected error. The error must be eliminated and can not be acknowledged.

Variable *ErrorBuffer[0..2]*

Buffer for the first three errors and warnings. The first error is written to ARRAY element 0, the second to ARRAY element 1, etc.

This content of the buffer can be cleared by calling FB 402 "MC_RESET" (with *Axis* = number of the technology DB).

Variable *Reserve34*

The variable is reserved for internal functions. It does not contain user-relevant information.

Variable *MaxLoopDuration*

Shows the maximum command execution time of the integrated technology.

The entry is deleted by calling FB 402 "MC_RESET" (with *Axis* = *MCDevice DB*).

Variable *CmdLoopDuration*

Indicates the command execution cycle of the integrated technology, averaged over the seconds.

The entry is deleted by calling FB 402 "MC_RESET" (with *Axis* = *MCDevice DB*).

Variable *StationLifeList[0..127]*

The ARRAY of this variable lists all available partner stations on PROFIBUS DP(DRIVE). The index of the ARRAY element corresponds with the PROFIBUS address. A value 1 in an element indicates that the partner station can be reached, while the value 0 indicates that the station can not be reached.

Variable *DoneFlag*[1..32]

The ARRAY elements 1 to 32 can be assigned to the *DoneFlag* input parameter of the function blocks.

Value of the <i>DoneFlag</i> at the FB	used ARRAY element	
0		A <i>DoneFlag</i> is not generated
1	1	<i>DoneFlag</i> [1] is generated
...	...	
32	32	<i>DoneFlag</i> [32] is generated

Each time the technology function completes a task, the value in *DoneFlag* is inverted (*FALSE* is set *TRUE* or *TRUE* is set *FALSE*). The *DoneFlag* is only set as long as the initiated command can be tracked. The command can no longer be tracked if a subsequent command uses the same instance.

Variable *DIStatus*[0..3]

The ARRAY elements indicate the status at the integrated digital outputs of the Technology CPU.

Variable *DOStatus*[0..7]

The ARRAY elements 0 to 7 indicate the status at the integrated digital outputs of the Technology CPU. The outputs of the integrated technology can be assigned to individual cams in S7T Config, for example.

7.10 Update of technology DBs

Valid for firmware version V3.1.x of the integrated technology

The integrated technology updates the technology DB, asynchronously to the cyclic user program. The Trace DB forms an exception, because this is updated only by the user.

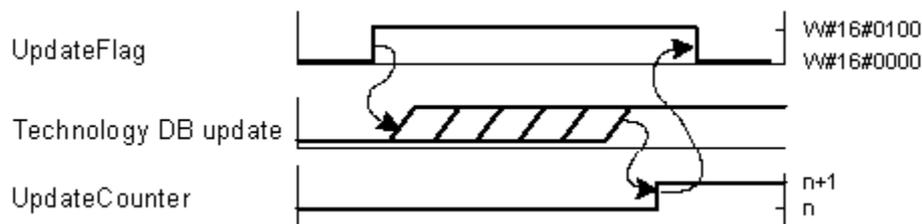
The technology DB update cycle can be set in S7T Config by selecting **PLC > Set system clocks** command.

We recommend using the technology synchronization interrupt OB65 for consistent evaluation of the technology DBs.

Consistent evaluation of the technology DBs with technology synchronization interrupt OB65

Technology synchronization interrupt OB65 is called by the integrated technology after each update of the technology DBs. This function allows you to evaluate the technology DBs synchronously to the integrated technology. For details on local data (start info in OB65), refer to the STEP 7 Online Help. OB65 can be copied from the "Organization Blocks" folder of the "Standard Library" to the project.

Use "UpdateCounter" and the "UpdateFlag" of the technology DBs to verify consistent evaluation of the DBs. The response of the "UpdateFlag" and of the "UpdateCounter" is shown in the figure below:



1. At the start of a DB update, the "UpdateFlag" is set from $W\#16\#0000$ to $W\#16\#0100$.
2. The integrated technology describes the complete DB.
3. The "UpdateCounter" increments its value by the count of "1".
4. The value at the "UpdateFlag" changes from $W\#16\#0100$ to $W\#16\#0000$.

How to verify consistent evaluation of the technology DBs

Based on the procedure described below, check whether a new technology DB update cycle has been triggered while an operation which is relevant to consistency is active at OB65. Technology DB updates start at the "MCDevice" DB. However, in order to ensure consistency, the "UpdateCounter" and "UpdateFlag" of each technology DB to be evaluated must be verified. Procedure:

1. At the start of OB 65, save the value of the various "UpdateCounter" of the technology DBs to be evaluated.
2. Evaluate the consistent data, or transfer the technology DBs to be evaluated to another working area.
3. Verify the "UpdateFlag". If its value is *W#16#0100*, consistent evaluation of this technology DB is no longer ensured.
4. Compare "UpdateCounter" with the previously saved value. If the "UpdateCounter" was incremented by the count of *1*, consistent evaluation of the technology DB is no longer.
5. Repeat steps 3 and 4 for all technology DBs to be evaluated.

Identical "UpdateCounter" values in the technology DBs originate from the same update cycle.

Counter any consistency problems by taking the following measures:

- Increase the technology DB update cycle
- Evaluate the technology DBs at the start of OB65
- Reduce the number of instructions to be evaluated

Note

The *ErrorID*, *ErrorStatus* and *ErrorBuffer* entries are updated asynchronously, i.e. independently of the "UpdateFlag."

7.11 ErrorID - Technology DBs

7.11.1 ErrorIDs - Axis technology DBs

Valid for firmware version V3.1.x of the integrated technology

Warnings

ErrorID	Warning message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
0020	Restart to apply parameter changes	You have changed a parameter which is not applied directly	To apply the parameter changes, you need to lock and reinitialize the object (MC_Reset with <i>Restart = TRUE</i>)	20010
0021	Dynamic values are being limited	The dynamic values of the command (velocity, acceleration, delay or starting torque) are being limited, because they are out of configured limits.	Check why the setpoint values are too high: configured max. values; mean velocity setpoint interface; encoder connection; mechanical installation.	40002, 40003, 40004, 50003, 50005
0022	Internal warning	Temporary internal problem	For detailed information, refer to the alarm view in S7T Config	20009, 40109, 50010
0023	Stop time is limited by max. acceleration value	The specified stop time can not be maintained. The stop time of the drive is extended, because its value can not be reached due to the currently effective max. acceleration.	In your configuration, increase the stop time or the max. acceleration.	40013
0026	Position is limited to software limit switches	The target position of a positioning command is out of range of the software limit switches	Check the calculated target position	40105

* Interrupts in S7T Config, which may be associated with the indicated warning.

Error

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8001	Fatal internal error	Faulty / inconsistent project / software; can not be influenced by the user.	Check consistency in your project data. Compile the data again, then download all data to the module. Evaluate the error code in the alarm view of S7T Config and inform the Siemens Hotline.	20001, 50015
8002	Internal fault	<ul style="list-style-type: none"> • Version conflict • Firmware error • Inconsistent software 	Check consistency in your project data. Compile the data again, then download all data to the module. Evaluate the alarm view of S7T Config and inform the Siemens Hotline.	30004, 30005, 30010, 30011, 30015
8003	Fatal configuration error	Faulty axis configuration data. A hardware driver, or the device it addresses, may not be available	<ul style="list-style-type: none"> • Check the plausibility of changed parameters. (Example: Spindle pitch is 0; Homing with absolute value encoder above zero mark is not possible). • Check the connected devices and their configuration in HW Config. • Verify that the telegram used is compatible with the object. • Reload the technology to the PLC. 	20004, 20006
8004	Configuration error	The configuration of a technological object is incomplete or faulty.	Check the plausibility of changed parameters. Evaluate the detailed information in the alarm view of S7T Config.	20003, 20011
8005	Stack overflow	<p>The command can not be executed, because all input buffer stacks are in use. Possible causes:</p> <ul style="list-style-type: none"> • The current commands are not executed in cyclic mode. This has the effect that stack memory is not reclaimed after the task is done. • The S7 program transmits too many commands within a short period. • An internal error has occurred in command execution 	Call the FBs in the cycle until one of the output parameters <i>Done</i> , <i>CommandAborted</i> or <i>Error</i> is <i>TRUE</i> . Verify that the program does not contain unnecessary (redundant) commands.	30003
8006	Insufficient memory	Integrated technology is out of memory.	Reduce the number of technology objects or the number of interpolation points or polynomials in the cam disks.	20002
8008	Invalid technology DB (unknown GuID or InstanzID)	The technology does not recognize this DB, because it has an invalid internal ID. Perhaps the DB was generated in a copy operation.	Recreate the DB in the "Technology Objects Management" dialog box, and download the configuration data again, i.e. establish online / offline consistency.	

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8009	The technology DB is disabled because it was substituted with a new instance	The DB is no longer assigned to the technology object, because a newer instance with a different DB number has been downloaded.	Delete the DB	
800A	HW driver not available	The driver of a physical device is not available or is being used by another TO.	Check whether the logical device was available at the time the command was output, or whether it was being used by another technology object (TO). Connect a suitable device and check its functions, connections and terminals. Check the topology in HW Config. Compare the configuration in HW Config and of the TO.	20014
8010	Drive failure	The drive or an external device has failed, or communication is disrupted as a result of faulty configuration or parameter data.	Check the device functions, connections and terminals. Check the configuration in HW Config, based on the current telegram settings.	20005, 50001
8012	Homing error	The required homing mode is not possible. Examples: Homing with absolute value encoder; homing velocity = 0;	Check the settings for axis homing with respect to inconsistency and illegal values.	40103
8013	A hardware limit switch is actuated	<ul style="list-style-type: none"> The hardware limit switch is actuated. The polarity of the switch is reversed. Wrong direction of the release motion 	Return the drive to its operational range. Check the limit switch terminals.	50007
8014	Approached a software limit switch	A motion was stopped when the software limit switch was reached	Check the motion program.	40106, 40111
8015	Software limit switch overtravelled	Axis overtravelled the software limit switch.	Check the motion program.	40107, 40112
8016	Following error limits exceeded	The offset between the position setpoint and actual value of the axis has exceeded the configured limit.	Check the sense of direction of the encoder, the settings of the position control circuit and offset error monitoring.	50102
8017	Following error has exceeded the warning limit	The offset between the position setpoint and actual value of the axis has exceeded the configured warning limit.	Check the sense of direction of the encoder, the settings of the position control circuit and offset error monitoring.	50103
8018	Standstill monitoring error	The axis has left the standstill window, or could not reach the standstill window in the specified time.	Check the functions of the velocity and position control loop, and the settings of the standstill monitoring circuit.	50107, 50008
8019	Positioning monitoring time-out	The axis could not reach the positioning window within the specified time.	Check the functions of the velocity and position controllers and the settings of the position monitoring circuit.	50106

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
801A	Synchronization monitoring error	The following axis of a synchronization compound can not adhere to the configured tolerance limit, i.e. the offset between the position setpoint and actual value is too high.	Check the synchronization and desynchronization parameters, the gear ratio and the configured units. Increase the set tolerance.	40110, 40201
801B	Clamping monitoring error	Clamping error. The axis has overrun the "position tolerance after fixed end stop detection" without having received a new motion command. (Position tolerance setting in S7T Config > Limits > "Fixed end stop" tab > Parameter "Position tolerance after fixed end stop detection".)	Check: <ul style="list-style-type: none"> the fixed end stop the function of the position control loop the clamping monitoring settings in S7T Config 	50108
801C	Dynamic limits are exceeded	The internal monitoring system has intervened in the dynamic process, because user specifications would violate limit values, or lead to impermissible reversal or overshoot of the axis.	Particularly when setting the values of release motions, make sure you do not set these too low with respect to acceleration, deceleration and jerk. For superimposing motions, always make allowances for superimposing values at the dynamic parameters.	40012
801D	Reference cam or zero mark not found	<ul style="list-style-type: none"> The reference cam is out of the permissible range. An end position monitoring function has responded. The velocity was out of limits. 	Check the permissible ranges (e.g. max. distance between BERO and zero mark), the end position monitoring system and reduce the cutoff velocity.	40101, 40102
801F	Dynamic control circuit out of range	<ul style="list-style-type: none"> The position or velocity controllers are not tuned Wrong sense of direction of the encoder Following monitoring too sensitive Offset between velocity setpoint and actual values too high 	<ul style="list-style-type: none"> Check the sense of direction of the encoder. Check the control loop parameters. Modify the following error monitoring parameters. 	50101
8030	The frequency of the measuring system is out of range	The pulse frequency of the encoder signals is too high.	Check the electrical connection of the encoder. Check whether the configured max. velocity is too low.	50002
8031	Actual value monitoring error	<ul style="list-style-type: none"> An incremental encoder is out of range The motion in each position controller cycle exceeds the modulo length of the axis 	Check and adjust the configuration data for the adaptation of the actual value to mechanical requirements	50001, 50013
8032	Can not shift the coordinate system	The programmed phase shift of the coordinate system (set or correct the actual position value) leads to a violation of the internal traversing range. The coordinate system is not shifted.	Check the programmed shift of the coordinate system.	30014

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8033	Zero mark monitoring triggered	Wrong number of increments between two zero marks of the encoder.	Check the wiring and the set encoder resolution.	50006
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing.	Eliminate and acknowledge all queued errors, and then enable the relevant operating mode of the axis (e.g. position-controlled).	40005
8041	Axis not homed	An active motion command requires a homed axis.	Home the axis (MC_Home). If this command is to be executed at an axis which is not homed, then set axis homing to "Homing required = no"	40108
8042	Illegal change of axis status	The command for changing the axis status was rejected, because: <ul style="list-style-type: none"> The current operating phase is not completed yet. A mode transition is not possible. 	Repeat the command Reset first.	40001
8043	Illegal command parameter value or preset value	One or several values at the input parameters of the FB for the command, or the preset values in relevant parameters are illegal.	Check the command and adjust illegal parameters. Note the current preset values.	30001
8045	Illegal command for current status	<ul style="list-style-type: none"> A command of higher priority is busy (e.g. MC_Stop). The technology object is disabled or not ready. Received measurement command when homing 	Acknowledge all queued errors of the technology object. Wait for the initialization of the technology object (after restart). Enable the technology object. Disable MC_Stop. Do not start any measuring commands during homing.	30006, 30009
8046	The drive does not support this command	The connected drive does not support this type of command, for example, a certain homing mode.	Check and adjust the drive configuration data and the drive settings.	50012
8047	Can not acknowledge this error	It is not possible to reset the error with FB MC_Reset. Examples: <ul style="list-style-type: none"> An axis has been brought to standstill, and the error causing this can not be acknowledged. Further errors occur in the acknowledgment or restart phase. 	Eliminate all causes of error and retry to acknowledge. Please note that you must acknowledge particular errors by cycling power OFF / ON.	30007
8048	Unable to restart	The object is busy or a queued error prevents restart.	Eliminate and acknowledge all queued errors and disable the object.	20012

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8049	Illegal object combination	Faulty combination of technology objects. Examples: <ul style="list-style-type: none"> Axis_2 was set as leading synchronization axis for Axis_1, and Axis_1 was set as leading axis for Axis_2. All synchronized drives are processed at different run levels. 	<ul style="list-style-type: none"> Set a definite leading / following axis combination. Assign the leading / following axes to the same run level (usually the interpolator cycle). 	20007
804A	The required object interconnection is missing	No allowances have been made in the application program for relevant combinations of leading / following axes and cam disks.	Set the required leading axes and cam disks in the "Configuration" section of the synchronization object of the following axis.	30008
804B	Limit switch actuated; illegal command	A hardware limit switch is actuated. Permitted are only motion commands in direction of the operating range.	Check the mechanical configuration and the wiring. Correct any programming errors or use the software limit switches.	50009
8082	Illegal Zero value in parameter	A command was passed alongside with a Zero parameter. This value must always be unequal to Zero.	Check the transferred parameters, preset values and, in particular, the dynamic and limit values. (e.g. max. velocity or acceleration for positioning)	40006, 40007, 40008, 40009, 40010, 40011
8085	Illegal limit switch parameters	Implausible position values for the SW limit switch. One of the values violates the range, or the start value is higher than the end value. The latter may occur if the order is neglected when the parameters are changed.	Adjust the setting of the SW limit switch. After the first change of the position, the position value of the positive switch must be higher than that of the negative switch.	40104
8090	Illegal Zero parameter	Reserved error		40122, 40123
8091	Error in pressure control	Reserved error		50014
8092	Error in force limit monitoring	Reserved error		50109, 50110

* Interrupts in S7T Config, which may be associated with the indicated error.

7.11.2 ErrorIDs - Synchronization technology DB

Valid for firmware version V3.1.x of the integrated technology

Warnings

ErrorID	Warning message	Possible causes	To correct or avoid errors	Interrupts in S7T Config* Synchroni- zation object	Interrupts in S7T Config* Synchroni- zation axis
0020	Restart to apply parameter changes	You have changed a parameter which is not applied directly	To apply the parameter changes, you need to lock and reinitialize the object (MC_Reset with <i>Restart = TRUE</i>)	20010	20010
0021	Dynamic values are being limited	The dynamic values of the command (velocity, acceleration, delay or starting torque) are being limited, because they are out of configured limits.	Check why the setpoint values are too high: configured max. values; mean velocity setpoint interface; encoder connection; mechanical installation.	40002, 40003, 40004	40002, 40003, 40004, 50003, 50005
0022	Internal warning	Temporary internal problem	For detailed information, refer to the alarm view in S7T Config	50103, 50104, 50105, 50106, 50108, 50109	20009, 40109, 50010
0023	Stop time is limited by max. acceleration value	The specified stop time can not be maintained. The stop time of the drive is extended, because its value can not be reached due to the currently effective max. acceleration.	In your configuration, increase the stop time or the max. acceleration.	40013	0023
0024	Long-term instability of gear synchronism	The nominator and denominator values of the gear ratio are too high. This may result in mathematical rounding errors in long-term operation.	Adjust the gear ratio, or correct any inaccuracies caused by repeated synchronization	50008	
0026	The position is limited to the SW limit switches	The target position of a positioning command is out of range of the software limit switches	Check the calculated target position		40105

* Interrupts in S7T Config, which may be associated with the indicated warning.

Error

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config* Synchroni- zation object	Interrupts in S7T Config* Synchroni- zation axis
8001	Fatal internal error	Faulty / inconsistent project / software; can not be influenced by the user.	Check the consistency of your project data. Compile the data again, then download all data to the module. Evaluate the error code in the alarm view of S7T Config and inform the Siemens Hotline.	20001	20001, 50015
8002	Internal fault	<ul style="list-style-type: none"> • Version conflict • Firmware error • Inconsistent software 	Check consistency of your project data. Compile the data again, then download all data to the module. Evaluate the alarm view of S7T Config and inform the Siemens Hotline.	30004, 30005, 30010, 30011, 30015	30004, 30005, 30010, 30011, 30015
8003	Fatal configuration error	Faulty axis configuration data. A hardware driver, or the device it addresses, may not be available	<ul style="list-style-type: none"> • Check the plausibility of changed parameters. (Example: Spindle pitch is 0; Homing with absolute value encoder above zero mark is not possible). • Check the connected devices and their configuration in HW Config. • Verify that the telegram used is compatible with the object. • Reload the technology to the PLC. 	20004, 20006	20004, 20006
8004	Configuration error	The configuration of a technological object is incomplete or faulty.	Check the plausibility of changed parameters. Evaluate the detailed information in the alarm view of S7T Config.	20003, 20011	20003, 20011
8005	Stack overflow	<p>The command can not be executed, because all input buffer stacks are in use. Possible causes:</p> <ul style="list-style-type: none"> • The current commands are not executed in cyclic mode. This has the effect that stack memory is not reclaimed after the task is done. • The S7 program transmits too many commands within a short period. • An internal error has occurred in command execution 	Call the FBs in the cycle until one of the output parameters <i>Done</i> , <i>CommandAborted</i> or <i>Error</i> is <i>TRUE</i> . Verify that the program does not contain unnecessary (redundant) commands.	30003	30003

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config* Synchroni- zation object	Interrupts in S7T Config* Synchroni- zation axis
8006	Insufficient memory	Integrated technology is out of memory.	Reduce the number of technology objects or the number of interpolation points or polynomials in the cam disks.	20002	20002
8008	Invalid technology DB (unknown GuID or InstanzID)	The technology does not recognize this DB, because it has an invalid internal ID. Perhaps the DB was generated in a copy operation.	Recreate the DB in the "Technology Objects Management" dialog box, and download the configuration data again, i.e. establish online / offline consistency.		
8009	The technology DB is disabled because it was substituted with a new instance	The DB is no longer assigned to the technology object, because a newer instance with a different DB number has been downloaded.	Delete the DB		
800A	HW driver not available	The driver of a physical device is not available or is being used by another TO.	Check whether the logical device was available at the time the command was output, or whether it was in use by another technology object (TO). Connect a suitable device and check its functions, connections and terminals. Check the topology in HW Config. Compare the configuration in HW Config and of the TO.	20014	20014
8010	Drive failure	The drive or an external device has failed, or communication is disrupted as a result of faulty configuration or parameter data.	Check the device functions, connections and terminals. Check the configuration in HW Config, based on the current telegram settings.	20005	20005, 50001
8012	Homing error	The required homing mode is not possible. Examples: Homing with absolute value encoder; homing velocity = 0.;	Check the settings for axis homing with respect to inconsistency and invalid values.		40103
8013	Hardware limit switch is actuated	<ul style="list-style-type: none"> The hardware limit switch is actuated. The polarity of the switch is reversed. Wrong direction of the release motion 	Return the drive to its operational range. Check the limit switch terminals.		50007
8014	Approached a software limit switch	A motion was stopped when the software limit switch was reached	Check the motion program.		40106, 40111

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config* Synchroni- zation object	Interrupts in S7T Config* Synchroni- zation axis
8015	Software limit switch overtravelled	An axis has overtravelled the software limit switch.	Check the motion program.		40107, 40112
8016	Following error out of limits	The offset between the position setpoint and actual value of the axis has exceeded the configured limit.	Check the sense of direction of the encoder, the settings of the position control circuit and following error monitoring.		50102
8017	Following error has exceeded the warning limit	The offset between the position setpoint and actual value of the axis has exceeded the configured warning limit.	Check the sense of direction of the encoder, the settings of the position control circuit and following error monitoring.		50103
8018	Standstill monitoring error	The axis has left or failed to reach the standstill window within the specified time.	Check the functions of the velocity and position control loop, and the settings of standstill monitoring.		50107, 50008
8019	Positioning monitoring error	The axis could not reach the positioning window within the specified time.	Check the functions of the velocity and position control loop, and the settings of positioning monitoring.		50106
801A	Synchronization monitoring has responded	The following axis of a synchronization compound can not operate within the configured tolerance limit, i.e. the offset between the position setpoint and actual value is too high.	Check the synchronization and de synchronization parameters, the gear ratio and the configured units. Increase the set tolerance.		40110, 40201
801B	Clamping monitoring has responded	Clamping error. The axis has overrun the "Position tolerance after fixed end stop detection" without having received a new motion command. (Position tolerance setting in S7T Config > Limits > "Fixed end stop" tab > Parameter "Position tolerance after fixed end stop detection".)	Check: <ul style="list-style-type: none"> the fixed end stop the function of the position control loop the clamping monitoring settings in S7T Config 		50108
801C	Dynamic limits are exceeded	The internal monitoring system has intervened in the dynamic process, because user input would violate limit values, or lead to impermissible reversal or overshoot of the axis.	Particularly when setting the values of release motions, make sure you do not set these too low with respect to acceleration, deceleration and starting torque. With superimposing motions, always make allowances for superimposing values at the dynamic parameters.		40012

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config* Synchroni- zation object	Interrupts in S7T Config* Synchroni- zation axis
801D	Reference cam or zero mark not found	<ul style="list-style-type: none"> The reference cam is out of the permissible range. An end position monitoring has responded. The velocity was too high. 	Check the permissible ranges (e.g. max. distance between BERO and zero mark), the end position monitoring system and reduce the cutoff velocity.		40101, 40102
801F	Dynamic control circuit out of range	<ul style="list-style-type: none"> The position or velocity controllers are not tuned Wrong sense of direction of the encoder Following error monitoring too sensitive Offset between velocity setpoint and actual value too high 	<ul style="list-style-type: none"> Check the sense of direction of the encoder. Check the control loop parameters. Modify the following error monitoring parameters. 		50101
8030	The frequency of the measuring system is out of range	The pulse frequency of the encoder signals is too high.	Check the electrical connection of the encoder. Check whether the configured max. velocity is too low.		50002
8031	Actual value acquisition error	<ul style="list-style-type: none"> An incremental encoder is out of range The movement per position controller cycle exceeds the modulo length of the axis 	Check and adjust the configuration data for the adaptation of the actual value to mechanical requirements		50001, 50013
8032	Can not shift the coordinate system	The programmed shift of the coordinate system (set or correct the actual position value) leads to a violation of the internal traversing range. The coordinate system is not shifted.	Check the programmed shift of the coordinate system.		30014
8033	Zero mark monitoring has responded	Wrong number of increments between two zero marks of the encoder.	Check the wiring and the set encoder resolution.		50006
8040	The axis / external encoder is not enabled, or the wrong mode is set	The enable signal required for a motion command is missing.	Eliminate and acknowledge all queued errors and then enable axis operation in the relevant mode (e.g. position-controlled).		40005
8041	Axis not homed	A motion command is active and requires a homed axis.	Home the axis (MC_Home). If this command is to be executed at an axis which is not homed, then set axis homing to "Homing required = no"		40108

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config* Synchroni- zation object	Interrupts in S7T Config* Synchroni- zation axis
8042	Illegal change of axis status	The command for changing the axis status was rejected, because: <ul style="list-style-type: none"> The current phase in operation is not completed yet. A mode transition is not possible. 	Repeat the command Reset first.		40001
8043	Invalid command parameter or preset value	One or several values at the input parameters of the FB for the command, or preset values in relevant parameters are illegal.	Check the command and adjust illegal parameters. Note the current preset values.	30001, 50107	30001
8045	Illegal command with current status	<ul style="list-style-type: none"> A command of higher priority is busy (e.g. MC_Stop). The technology object is disabled or not ready. Received measurement command when homing 	<p>Acknowledge all queued errors of the technology object.</p> <p>Wait for the initialization of the technology object (after restart).</p> <p>Enable the technology object.</p> <p>Disable MC_Stop.</p> <p>Do not start any measuring commands during homing.</p>	30006	30006, 30009
8046	The drive does not support this command	The connected drive does not support this type of command, for example, a certain homing mode.	Check and adjust the drive configuration data and settings.		50012
8047	Can not acknowledge this error	It is not possible to reset the error with FB MC_Reset. Examples: <ul style="list-style-type: none"> An axis has been brought to standstill, and the error causing this can not be acknowledged. Further errors occur in the acknowledgment or restart phase. 	Eliminate all causes of error and retry to acknowledge. Please note that you must acknowledge particular errors by cycling power.	30007	30007
8048	Unable to restart	The object is busy or a queued error prevents restart.	Eliminate and acknowledge all queued errors and disable the object.	20012	20012

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config* Synchroni- zation object	Interrupts in S7T Config* Synchroni- zation axis
8049	Illegal object combination	Faulty combination of technology objects. Examples: <ul style="list-style-type: none"> Axis_2 was set as leading synchronization axis for Axis_1, while Axis_1 is set as leading axis for Axis_2. All synchronized axes are processed at different run levels. 	<ul style="list-style-type: none"> Set a definite leading / following axis combination. Assign the leading / following axes to the same run level (usually the interpolator cycle). 	20007	20007
804A	The required object interconnection is missing	No allowances have been made in the application program for relevant combinations of leading / following axes and cam disks.	Set the required leading axes and cam disks in the "Configuration" section of the synchronization object of the following axis.	30008	30008
804B	Limit switch actuated; illegal command	A hardware limit switch is actuated. Permitted are only motion commands in direction of the operating range.	Check the mechanical installation and the wiring. Correct any programming errors or use the software limit switches.		50009
8063	Cam is not interpolated	At the start of camming, it was detected that the cam was not interpolated yet.	Check the current cam status at the technology DB. Add the missing points or segments, then interpolate the cam.	50002	
8064	Failed to access the cam	<ul style="list-style-type: none"> Can not find the specified cam disk. The cam disk is not interconnected with synchronous operation. The cam disk is busy. 	Check the cam disk and all possible interconnections with the axes (configuration of synchronism).	50001, 50004	
8065	Range violation at the cam	A specified cam interpolation point violates the defined cam range.	Check the start and end positions of cam synchronization and desynchronization.	50003	
8072	Can not enable / disable synchronism	This error is caused by an illegal status of the leading axis during synchronization and desynchronization. Example: The leading axis reverses during position-related synchronization.	Check the motion of the leading axis, or select a different synchronization strategy.	50007	
8073	Violation of dynamic values at the master during synchronous operation	The dynamic values at the leading axis are too high during synchronization and desynchronization (e.g. acceleration values too high)	Check the motion of the leading axis, or select a different synchronization strategy.	50009	

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config* Synchroni- zation object	Interrupts in S7T Config* Synchroni- zation axis
8074	The leading axis is not configured for synchronous operation	<ul style="list-style-type: none"> In the configuration of the following axis, the axis connected at the "Master" terminal was not defined as leading axis. The leading axis is not enabled (applies only for the external encoder). The leading axis is operated with velocity control. 	Adjust the configuration of the following axis or use the configured leading axes. Operate the leading axis in position-controlled mode or enable it.	50101, 50102	
8077	Deactivation of synchronous operation aborted	Deactivation of synchronous operation was rejected, because the current synchronous operation type (gear/cam gear) does not agree with the deactivation type.	Deactivate camming with MC_CamOut and gearing with MC_GearOut, or use global instructions (MC_Halt, MC_Stop, ...)	50005	
8078	Superimposing synchronism is not possible	Superimposing synchronism was set for the axis in the experts list.	Adjust the settings in the experts list		
8082	Illegal Zero value in parameter	A command was passed alongside with a Zero parameter. This value must always be unequal to Zero.	Check the transferred parameters, preset values and, in particular, the dynamic and limit values. (e.g. max. velocity, or acceleration for positioning)	40006, 40007, 40008, 40009, 40010, 40011	40006, 40007, 40008, 40009, 40010, 40011
8085	Illegal limit switch parameters	Implausible position values for the SW limit switch. One of the values violates the range, or the start value exceeds the end value. The latter may occur if the order is neglected when the parameters are changed.	Adjust the setting of the SW limit switch. After the first change of the position, the position value of the positive switch must be higher than that of the negative switch.		40104
8090	Illegal Zero parameter	Reserved error			40122, 40123
8091	Error in pressure control	Reserved error			50014
8092	Error in force limit monitoring	Reserved error			50109, 50110

* Interrupts in S7T Config, which may be associated with the indicated error.

7.11.3 ErrorIDs - External encoders technology DB

Valid for firmware version V3.1.x of the integrated technology

Warnings

ErrorID	Warning message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
0020	Restart to apply parameter changes	You have changed a parameter which is not applied directly	To apply the parameter changes, you need to lock and reinitialize the object (MC_Reset with <i>Restart = TRUE</i>)	20010
0021	Dynamic values are being limited	The dynamic values of the command (velocity, acceleration, delay or starting torque) are being limited, because they are out of configured limits.	Check why the setpoint values are too high: configured max. values; mean velocity setpoint interface; encoder connection; mechanical configuration.	50003, 50005

* Interrupts in S7T Config, which may be associated with the indicated warning.

Error

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8001	Fatal internal error	Faulty / inconsistent project / software; can not be influenced by the user.	Check the consistency of your project data. Compile the data again, then download all data to the module. Evaluate the error code in the alarm view of S7T Config and inform the Siemens Hotline.	20001, 50015
8002	Internal fault	<ul style="list-style-type: none"> Version conflict Firmware error Inconsistent software 	Check consistency of your project data. Compile the data again, then download all data to the module. Evaluate the alarm view of S7T Config and inform the Siemens Hotline.	30004, 30005, 30010, 30011, 30015
8003	Fatal configuration error	Faulty axis configuration data. A hardware driver, or the device it addresses, may not be available	<ul style="list-style-type: none"> Check the plausibility of changed parameters. (Example: Spindle pitch is 0; Homing with absolute value encoder above zero mark is not possible). Check the connected devices and their configuration in HW Config. Verify that the telegram used is compatible with the object. Reload the technology to the PLC. 	20004, 20006
8004	Configuration error	The configuration of a technological object is incomplete or faulty.	Check the plausibility of changed parameters. Evaluate the detailed information in the alarm view of S7T Config.	20003, 20011

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8005	Stack overflow	The command can not be executed, because all input buffer stacks are in use. Possible causes: <ul style="list-style-type: none"> The current commands are not executed in cyclic mode. This has the effect that stack memory is not reclaimed after the task is done. The S7 program transmits too many commands within a short period. An internal error has occurred in command execution 	Call the FBs in the cycle until one of the output parameters <i>Done</i> , <i>CommandAborted</i> or <i>Error</i> is <i>TRUE</i> . Verify that the program does not contain unnecessary (redundant) commands.	30003
8006	Insufficient memory	Integrated technology is out of memory.	Reduce the number of technology objects or the number of interpolation points or polynomials in the cam disks.	20002
8008	Invalid technology DB (unknown GuID or InstanzID)	The technology does not recognize this DB, because it has an invalid internal ID. Perhaps the DB was generated in a copy operation.	Recreate the DB in the "Technology Objects Management" dialog box, and download the configuration data again, i.e. establish online / offline consistency.	
8009	The technology DB is disabled because it was substituted with a new instance	The DB is no longer assigned to the technology object, because a newer instance with a different DB number has been downloaded.	Delete the DB	
800A	HW driver not available	The driver of a physical device is not available or is in use by another TO.	Check whether the logical device was available at the time the command was output, or whether it is in use by another technology object (TO). Connect a suitable device and check its functions, connections and terminals. Check the topology in HW Config. Compare the configuration in HW Config and of the TO.	20014
8010	Drive failure	The drive or an external device has failed, or communication is disrupted as a result of faulty configuration or parameter data.	Check the device functions, connections and terminals. Check the configuration in HW Config, based on the current telegram settings.	20005, 50001
8012	Homing error	The required homing mode is not possible. Examples: Homing with absolute value encoder; homing velocity = 0.	Check the settings for axis homing with respect to inconsistencies and invalid values.	40103

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8013	A hardware limit switch is actuated	<ul style="list-style-type: none"> The hardware limit switch is actuated. The polarity of the switch is reversed. Wrong direction of the release motion 	Return the drive to its operational range. Check the limit switch terminals.	50007
8016	Following error out of limits	The offset between the position setpoint and actual value of the axis has exceeded the configured limit.	Check the sense of direction of the encoder, the settings of the position control circuit and following error monitoring.	50102
8017	Following error has exceeded the warning limit	The offset between the position setpoint and actual value of the axis has exceeded the configured warning limit.	Check the sense of direction of the encoder, the settings of the position control circuit and following error monitoring.	50103
8018	Standstill monitoring error	The axis has left the standstill window, or could not reach the standstill window in the specified time.	Check the functions of the velocity and position control loops, and the settings of standstill monitoring.	50107, 50008
8019	Positioning monitoring error	The axis could not reach the positioning window within the specified time.	Check the functions of the velocity and position controllers, and the settings of positioning monitoring.	50106
801B	Clamping monitoring error	<p>Clamping error.</p> <p>The axis has overrun the "Position tolerance after fixed end stop detection" without having received a new motion command.</p> <p>(Position tolerance setting in S7T Config > Limits > "Fixed end stop" tab > Parameter "Position tolerance after fixed end stop detection".)</p>	<p>Check:</p> <ul style="list-style-type: none"> the fixed end stop the function of the position control loop the clamping monitoring settings in S7T Config 	50108
801D	Reference cam or zero mark not found	<ul style="list-style-type: none"> The reference cam is out of the permissible range. An end position monitoring function has responded. The velocity was too high. 	Check the permissible ranges (e.g. max. distance between BERO and zero mark), the end position monitoring system and reduce the cutoff velocity.	40102
801F	Dynamic control circuit out of range	<ul style="list-style-type: none"> The position or velocity controllers are not tuned Wrong sense of direction of the encoder Following monitoring too sensitive Offset between velocity setpoint and actual values too high 	<ul style="list-style-type: none"> Check the sense of direction of the encoder. Check the control loop parameters. Modify the following error monitoring parameters. 	50101
8030	The frequency of the measuring system is out of limits	The pulse frequency of the encoder signals is too high.	Check the electrical connection of the encoder. Check whether the configured max. velocity is too low.	50002
8031	Process value monitoring error	<ul style="list-style-type: none"> An incremental encoder is out of range The movement per pulse of the position controller exceeds the modulo length of the axis 	Check and adjust the configuration data for the adaptation of the actual value to mechanical requirements	50001, 50013

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8032	Can not shift the coordinate system	The programmed shift of the coordinate system (set or correct the actual position value) leads to a violation of the internal traversing range. The coordinate system is not shifted.	Check the programmed shift of the coordinate system.	30014
8033	Zero mark monitoring triggered	Wrong number of increments between two zero marks of the encoder.	Check the wiring and the set encoder resolution.	50006
8040	The axis / external encoder is not enabled, or the wrong mode is set	The required command enable signal is missing.	Eliminate and acknowledge all queued errors and then enable the axis for the relevant mode.	40005
8043	Illegal command parameter value or preset value	One or several values at the input parameters of the FB for the command, or the preset values in relevant parameters are illegal.	Check the command and adjust illegal parameters. Note the current preset values.	30001
8045	Illegal command with current status	<ul style="list-style-type: none"> A command of higher priority is busy (e.g. MC_Stop). The technology object is disabled or not ready. Received measurement command when homing 	<p>Acknowledge all queued errors of the technology object.</p> <p>Wait for the initialization of the technology object (after restart).</p> <p>Enable the technology object.</p> <p>Disable MC_Stop.</p> <p>Do not start any measuring commands in the homing phase.</p>	30006, 30009
8046	The drive does not support this command	The connected drive does not support this type of command, for example, a certain homing mode.	Check and adjust the drive configuration data and settings.	50012
8047	Can not acknowledge this error	<p>It is not possible to reset the error with FB MC_Reset.</p> <p>Examples:</p> <ul style="list-style-type: none"> An axis has been brought to standstill, and the error causing this can not be acknowledged. Further errors occur in the acknowledgment or restart phase. 	Eliminate all causes of error and retry to acknowledge. Please note that you must acknowledge particular errors by cycling power.	30007
8048	Unable to restart	The object is busy or a queued error prevents restart.	Eliminate and acknowledge all queued errors and disable the object.	20012

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8049	Illegal object combination	Faulty combination of technology objects. Examples: <ul style="list-style-type: none"> Axis_2 was set as leading synchronization axis for Axis_1, and Axis_1 was set as leading axis for Axis_2. All synchronized drives are processed at different run levels. 	<ul style="list-style-type: none"> Set a definite leading / following axis combination. Assign the leading / following axes to the same run level (usually the interpolator cycle). 	20007
804A	The required object interconnection is missing	No allowances have been made in the application program for relevant combinations of leading / following axes and cam disks.	Set the required leading axes and cam disks in the "Configuration" section of the synchronization object of the following axis.	30008
804B	Limit switch actuated; illegal command	A hardware limit switch is actuated. Permitted are only motion commands in direction of the operating range.	Check the mechanical installation and the wiring. Correct any programming errors or use the software limit switches.	50009
8091	Error in pressure control	Reserved error		50014, 50111
8092	Error in force limit monitoring	Reserved error		50109, 50110

* Interrupts in S7T Config, which may be associated with the indicated error.

7.11.4 ErrorIDs - Output cam technology DB

Valid for firmware version V3.1.x of the integrated technology

Warnings

ErrorID	Warning message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
0020	Restart to apply parameter changes	You have changed a parameter which is not applied directly	To apply the parameter changes, you need to lock and reinitialize the object (MC_Reset with <i>Restart = TRUE</i>)	20010

* Interrupts in S7T Config, which may be associated with the indicated warning.

Error

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8001	Fatal internal error	Faulty / inconsistent project / software; can not be influenced by the user.	Check consistency of your project data. Compile the data again, then download all data to the module. Evaluate the error code in the alarm view of S7T Config and inform the Siemens Hotline.	20001
8002	Internal fault	Version conflict, firmware error, inconsistent software	Check consistency of your project data. Compile the data again, then download all data to the module. Evaluate the alarm view of S7T Config and inform the Siemens Hotline.	30004, 30005, 30010, 30011, 30015
8003	Fatal configuration error	Faulty axis configuration data. A hardware driver, or the device it addresses, may not be available	<ul style="list-style-type: none"> • Check the plausibility of changed parameters. (Example: Spindle pitch is 0; Homing with absolute value encoder above zero mark is not possible). • Check the connected devices and their configuration in HW Config. • Verify that the telegram used is compatible with the object. • Reload the technology to the PLC. 	20004, 20006
8004	Configuration error	The configuration of a technological object is incomplete or faulty.	Check the plausibility of changed parameters. Evaluate the detailed information in the alarm view of S7T Config.	20003, 20011

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8005	Stack overflow	The command can not be executed, because all input buffer stacks are in use. Possible causes: <ul style="list-style-type: none"> The current commands are not executed in cyclic mode. This has the effect that stack memory is not reclaimed after the task is done. The S7 program transmits too many commands within a short period. An internal error has occurred in command execution 	Call the FBs in the cycle until one of the output parameters <i>Done</i> , <i>CommandAborted</i> or <i>Error</i> is <i>TRUE</i> . Verify that the program does not contain unnecessary (redundant) commands.	30003
8006	Insufficient memory	Integrated technology is out of memory.	Reduce the number of technology objects or the number of interpolation points or polynomials in the cam disks.	20002
8008	Invalid technology DB (unknown GuID or InstanzID)	The technology does not recognize this DB, because it has an invalid internal ID. Perhaps the DB was generated in a copy operation.	Recreate the DB in the "Technology Objects Management" dialog box, and download the configuration data again, i.e. establish online / offline consistency.	
8009	The technology DB is disabled because it was substituted with a new instance	The DB is no longer assigned to the technology object, because a newer instance with a different DB number has been downloaded.	Delete the DB	
800A	HW driver not available	The driver of a physical device is not available or is being used by another TO.	Check whether the logical device was available at the time the command was output, or whether it was being used by another technology object (TO). Connect a suitable device and check its functions, connections and terminals. Check the topology in HW Config. Compare the configuration in HW Config and of the TO.	20014
8010	Drive failure	The drive or an external device has failed, or communication is disrupted as a result of faulty configuration or parameter data.	Check the device functions, connections and terminals. Check the configuration in HW Config, based on the current telegram settings.	20005
8043	Illegal command parameter value or preset value	One or several values at the input parameters of the FB for the command, or the preset values in relevant parameters are illegal. Example: <ul style="list-style-type: none"> The switching position of a cam is outside the operating range of the axis. 	Check the command and adjust illegal parameters. Note the current preset values.	30001, 40003

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8045	Illegal command with current status	<ul style="list-style-type: none"> A command of higher priority is busy (e.g. MC_Stop). The technology object is disabled or not ready. Received measurement command when homing 	<p>Acknowledge all queued errors of the technology object.</p> <p>Wait for the initialization of the technology object (after restart).</p> <p>Enable the technology object.</p> <p>Disable MC_Stop.</p> <p>Do not start any measuring commands in the homing phase.</p>	30006, 30009
8047	Can not acknowledge this error	<p>It is not possible to reset the error with FB MC_Reset.</p> <p>Examples:</p> <ul style="list-style-type: none"> An axis has been brought to standstill, and the error causing this can not be acknowledged. Further errors occur in the acknowledgment or restart phase. 	Eliminate all causes of error and retry to acknowledge. Please note that you must acknowledge particular errors by cycling power.	30007
8048	Unable to restart	The object is busy or a queued error prevents restart.	Eliminate and acknowledge all queued errors and disable the object.	20012
8049	Illegal object combination	<p>Faulty combination of technology objects. Examples:</p> <ul style="list-style-type: none"> Axis_2 was set as leading synchronization axis for Axis_1, and Axis_1 was set as leading axis for Axis_2. All synchronized drives are processed at different run levels. 	<ul style="list-style-type: none"> Set a definite leading / following axis combination. Assign the leading / following axes to the same run level (usually the interpolator cycle). 	20007
804A	The required object interconnection is missing	No allowances have been made in the application program for relevant combinations of leading / following axes and cam disks.	Set the required leading axes and cam disks in the "Configuration" section of the synchronization object of the following axis.	30008
8087	Illegal cam position	At least one output cam position is invalid. The output cam was moved beyond the limits of the operating range.	Check the output cam positions. Reduce the current delay / derivative time.	40001

* Interrupts in S7T Config, which may be associated with the indicated error.

7.11.5 ErrorIDs - Measuring sensor technology DB

Valid for firmware version V3.1.x of the integrated technology

Warnings

ErrorID	Warning message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
0020	Restart to apply parameter changes	Changes to a parameter are not applied directly	To apply the parameter changes, you need to lock and reinitialize the object (MC_Reset with <i>Restart = TRUE</i>)	20010

* Interrupts in S7T Config, which may be associated with the indicated warning.

Error

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8001	Fatal internal error	Faulty / inconsistent project / software; can not be influenced by the user.	Check consistency of your project data. Compile the data again, then download all data to the module. Evaluate the error code in the alarm view of S7T Config and inform the Siemens Hotline.	20001
8002	Internal fault	Version conflict, firmware error, inconsistent software	Check consistency of your project data. Compile the data again, then download all data to the module. Evaluate the alarm view of S7T Config and inform the Siemens Hotline.	30004, 30005, 30010, 30011, 30015
8003	Fatal configuration error	Faulty axis configuration data. A hardware driver, or the device it addresses, may not be available	<ul style="list-style-type: none"> • Check the plausibility of changed parameters. (Example: Spindle pitch is 0; Homing with absolute value encoder above zero mark is not possible). • Check the connected devices and their configuration in HW Config. • Verify that the telegram used is compatible with the object. • Reload the technology to the PLC. 	20004, 20006, 40006
8004	Configuration error	The configuration of a technological object is incomplete or faulty.	Check the plausibility of changed parameters. Evaluate the detailed information in the alarm view of S7T Config.	20003, 20011

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8005	Stack overflow	The command can not be executed, because all input buffer stacks are in use. Possible causes: <ul style="list-style-type: none"> The current commands are not executed in cyclic mode. This has the effect that stack memory is not reclaimed after the task is done. The S7 program transmits too many commands within a short period. An internal error has occurred in command execution 	Call the FBs in the cycle until one of the output parameters <i>Done</i> , <i>CommandAborted</i> or <i>Error</i> is <i>TRUE</i> . Verify that the program does not contain unnecessary (redundant) commands.	30003
8006	Insufficient memory	Integrated technology is out of memory.	Reduce the number of technology objects or the number of interpolation points or polynomials in the cam disks.	20002
8008	Invalid technology DB (unknown GuID or InstanzID)	The technology does not recognize this DB, because it has an invalid internal ID. Perhaps the DB was generated in a copy operation.	Recreate the DB in the "Technology Objects Management" dialog box, and download the configuration data again, i.e. establish online / offline consistency.	
8009	The technology DB is disabled because it was substituted with a new instance	The DB is no longer assigned to the technology object, because a newer instance with a different DB number has been downloaded.	Delete the DB	
800A	HW driver not available	The driver of a physical device is not available or is being used by another TO.	Check whether the logical device was available at the time the command was output, or whether it was being used by another technology object (TO). Connect a suitable device and check its functions, connections and terminals. Check the topology in HW Config. Compare the configuration in HW Config and of the TO.	20014
8010	Drive failure	The drive or an external device has failed, or communication is disrupted as a result of faulty configuration or parameter data.	Check the device functions, connections and terminals. Check the configuration in HW Config, based on the current telegram settings.	20005
8034	Could not record a process value in this range	The expected edge signal of the measuring sensor was not detected in the specified measuring range.	Check the measuring range and the electrical function of the measuring sensor.	40003, 40004
8035	Measuring command canceled	Cause: <ul style="list-style-type: none"> Drive or encoder error Operation aborted by the recording device Multiple measuring sensors access the same encoder 	Eliminate the drive or encoder error. Do not access one encoder simultaneously with several measuring inputs.	40005, 40007, 40008

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8043	Illegal command parameter value or preset value	One or several values at the input parameters of the FB for the command, or the preset values in relevant parameters are illegal.	Check the command and adjust illegal parameters. Note the current preset values.	30001
8044	Command not supported by the technology object	The technology DB specified at the FB belongs to an object that does not support this type of command. Example: A velocity axis DB is defined at the axis connection of FB MC_MoveAbsolute, but the velocity axes can not position.	Use the correct object type. Adjust the axis configuration.	40001
8045	Illegal command with current status	<ul style="list-style-type: none"> A command of higher priority is busy (e.g. MC_Stop). The technology object is disabled or not ready. Received measurement command when homing 	<p>Acknowledge all queued errors of the technology object.</p> <p>Wait for the initialization of the technology object (after restart).</p> <p>Enable the technology object.</p> <p>Disable MC_Stop.</p> <p>Do not start any measuring commands in the homing phase.</p>	30006, 30009, 40002
8047	Can not acknowledge this error	It is not possible to reset the error with FB MC_Reset. Examples: <ul style="list-style-type: none"> An axis has been brought to standstill, and the error causing this can not be acknowledged. Further errors occur in the acknowledgment or restart phase. 	Eliminate all causes of error and retry to acknowledge. Please note that you must acknowledge particular errors by cycling power.	30007
8048	Unable to restart	The object is busy or a queued error prevents restart.	Eliminate and acknowledge all queued errors and disable the object.	20012
8049	Illegal object combination	Faulty combination of technology objects. Examples: <ul style="list-style-type: none"> Axis_2 was set as leading synchronization axis for Axis_1, while Axis_1 is set as leading axis for Axis_2. All synchronized drives are processed at different run levels. 	<ul style="list-style-type: none"> Set a definite leading / following axis combination. Assign the leading / following axes to the same run level (usually the interpolator cycle). 	20007
804A	The required object interconnection is missing	No allowances have been made in the application program for relevant combinations of leading / following axes and cam disks.	Set the required leading axes and cam disks in the "Configuration" section of the synchronization object of the following axis.	30008

* Interrupts in S7T Config, which may be associated with the indicated error.

7.11.6 ErrorIDs - Cam technology DBs

Valid for firmware version V3.1.x of the integrated technology

Warnings

ErrorID	Warning message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
0020	Restart to apply parameter changes	You have changed a parameter which is not applied directly	To apply the parameter changes, you need to lock and reinitialize the object (MC_Reset with <i>Restart = TRUE</i>)	20010
0022	Internal warning	Temporary internal problem	For detailed information, refer to the alarm view in S7T Config	40003
0027	Could not adhere to interpolation properties	Discontinuity of the position or gradient was detected at the transition between cam segments	Move the interpolation limits. Check the cam disk profile. Change the criteria for the interpolation of segments.	40008

* Interrupts in S7T Config, which may be associated with the indicated warning.

Error

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8001	Fatal internal error	Faulty / inconsistent project / software; can not be influenced by the user.	Check the consistency of your project data. Compile the data again, then download all data to the module. Evaluate the error code in the alarm view of S7T Config and inform the Siemens Hotline.	20001
8002	Internal fault	<ul style="list-style-type: none"> Version conflict Firmware error Inconsistent software 	Check the consistency of your project data. Compile the data again, then download all data to the module. Evaluate the alarm view of S7T Config and inform the Siemens Hotline.	30004, 30005, 30010, 30011, 30015
8003	Fatal configuration error	Faulty axis configuration data. A hardware driver, or the device it addresses, may not be available	<ul style="list-style-type: none"> Check the plausibility of changed parameters. (Example: Spindle pitch is 0; Homing with absolute value encoder above zero mark is not possible). Check the connected devices and their configuration in HW Config. Verify that the telegram used is compatible with the object. Reload the technology to the PLC. 	20004, 20006
8004	Configuration error	The configuration of a technological object is incomplete or faulty.	Check the plausibility of changed parameters. Evaluate the detailed information in the alarm view of S7T Config.	20003, 20011

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8005	Stack overflow	The command can not be executed, because all input buffer stacks are in use. Possible causes: <ul style="list-style-type: none"> The current commands are not executed in cyclic mode. This has the effect that stack memory is not reclaimed after the task is done. The S7 program transmits too many commands within a short period. An internal error has occurred in command execution 	Call the FBs in the cycle until one of the output parameters <i>Done</i> , <i>CommandAborted</i> or <i>Error</i> is <i>TRUE</i> . Verify that the program does not contain unnecessary (redundant) commands.	30003
8006	Insufficient memory	Integrated technology is out of memory.	Reduce the number of technology objects or the number of interpolation points or polynomials in the cam disks.	20002
8008	Invalid technology DB (unknown GuID or InstanzID)	The technology does not recognize this DB, because it has an invalid internal ID. Perhaps the DB was generated in a copy operation.	Recreate the DB in the "Technology Objects Management" dialog box, and download the configuration data again, i.e. establish online / offline consistency.	
8009	The technology DB is disabled because it was substituted with a new instance	The DB is no longer assigned to the technology object, because a newer instance with a different DB number has been downloaded.	Delete the DB	
800A	HW driver not available	The driver of a physical device is not available or is in use by another TO.	Check whether the logical device was available at the time the command was output, or whether it was in use by another technology object (TO). Connect a suitable device and check its functions, connections and terminals. Check the topology in HW Config. Compare the configuration in HW Config and of the TO.	20014
8010	Drive failure	The drive or an external device has failed, or communication is disrupted as a result of faulty configuration or parameter data.	Check the device functions, connections and terminals. Check the configuration in HW Config, based on the current telegram settings.	20005
8043	Illegal command parameter value or preset value	One or several values at the input parameters of the FB for the command, or the preset values in relevant parameters are illegal.	Check the command and adjust illegal parameters. Note the current preset values.	30001

ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8045	Illegal command with current status	<ul style="list-style-type: none"> A command of higher priority is busy (e.g. MC_Stop). The technology object is disabled or not ready. Received measurement command when homing 	<p>Acknowledge all queued errors of the technology object.</p> <p>Wait for the initialization of the technology object (after restart).</p> <p>Enable the technology object.</p> <p>Disable MC_Stop.</p> <p>Do not start any measuring commands during homing.</p>	30006, 30009
8047	Can not acknowledge this error	<p>It is not possible to reset the error with FB MC_Reset.</p> <p>Examples:</p> <ul style="list-style-type: none"> An axis has been brought to standstill, and the error causing this can not be acknowledged. Further errors occur in the acknowledgment or restart phase. 	Eliminate all causes of error and retry to acknowledge. Please note that you must acknowledge particular errors by cycling power.	30007
8048	Unable to restart	The object is busy or a queued error prevents restart.	Eliminate and acknowledge all queued errors and disable the object.	20012
8049	Illegal object combination	<p>Faulty combination of technology objects. Examples:</p> <ul style="list-style-type: none"> Axis_2 was set as leading synchronization axis for Axis_1, while Axis_1 is set as leading axis for Axis_2. All synchronized drives are processed at different run levels. 	<ul style="list-style-type: none"> Set a definite leading / following axis combination. Assign the leading / following axes to the same run level (usually the interpolator cycle). 	20007
804A	The required object interconnection is missing	No allowances have been made in the application program for relevant combinations of leading / following axes and cam disks.	Set the required leading axes and cam disks in the "Configuration" section of the synchronization object of the following axis.	30008
8051	Read / write access denied.	An attempt was made to delete a cam, or to adjust it while it was in use.	Necessary procedure: Terminate synchronous operation of the cam, then edit it.	40001, 40002
8060	Error when adding a cam segment	The new cam segment is faulty, e.g. its start and end points are identical.	Check the values defining the new cam segment.	40004
8061	Cam position out of the definition range/ range of values	The master/following axes defined at "MC_GetCamPoint" do not exist in the definition range/ range of values of the cam disk.	Enter a valid position at "MC_GetCamPoint".	40005, 40006
8062	Access to an interpolated cam denied	<p>An illegal command was output to an already interpolated cam.</p> <p>Example: MC_CamSectorAdd</p>	You can not adjust a cam while it is in use. Before you do so, delete it with MC_CamClear.	40007

* Interrupts in S7T Config, which may be associated with the indicated error.

7.11.7 ErrorIDs - MCDevice / Trace technology DB

Valid for firmware version V3.1.x of the integrated technology

Error

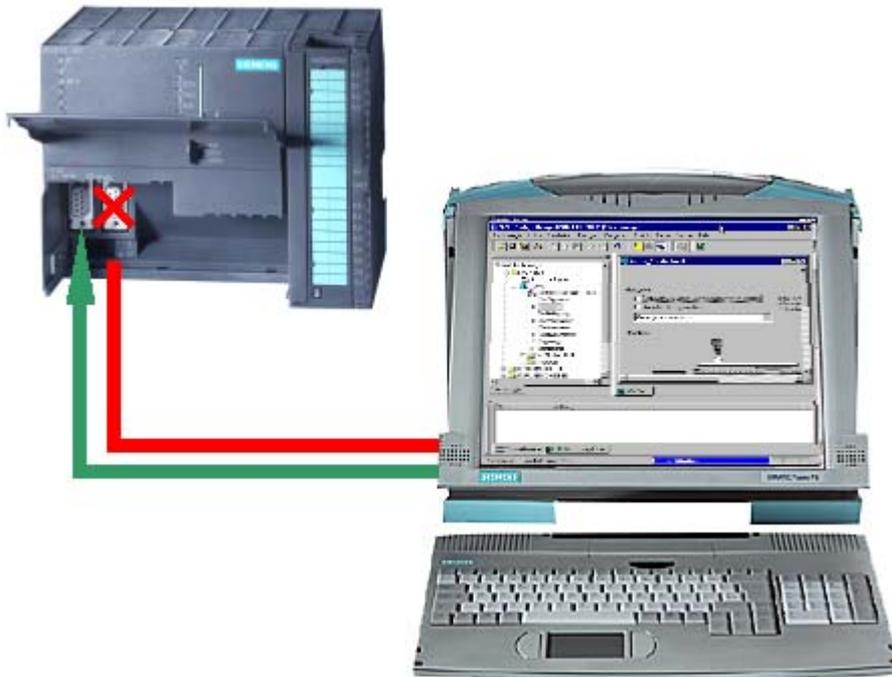
ErrorID	Error message	Possible causes	To correct or avoid errors	Interrupts in S7T Config*
8008	Invalid technology DB (unknown Guld or InstanzID)	The technology does not recognize this DB, because it has an invalid internal ID. The DB may have been generated in a copy operation.	Recreate the DB in the "Technology Objects Management" dialog box, and download the configuration data again, i.e. establish online / offline consistency.	
8009	The technology DB is disabled because it was substituted with a new instance	The DB is no longer assigned to the technology object, because a newer instance with a different DB number has been downloaded.	Delete the DB	

* Interrupts in S7T Config, which may be associated with the indicated error.

8 Download, testing and diagnostics

8.1 Connecting the PG / PC

All configuration and programming work is PG- / PC-based.



Always use the online cable to interconnect the PG / PC with the "X1" interface of the Technology CPU.

Programming devices such as text-based displays and Operator Panels may not be connected to the "X3" interface (DP(DRIVE).) Any operation of these devices will disrupt cyclic synchronous operation at the DP(DRIVE).

As an option, you may want to connect the programming device to a CP in your system. Please note, that download times may be prolonged in this case.

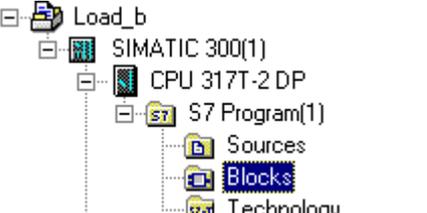
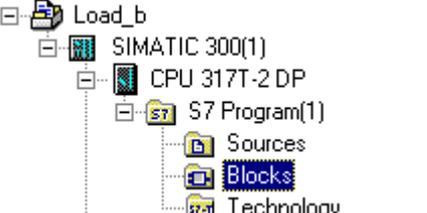
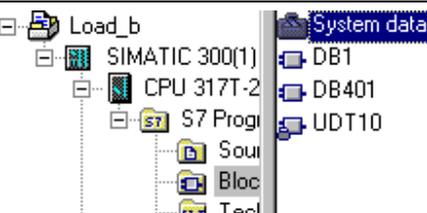
8.2 Downloading - user program, configuration data, firmware

Regardless whether you are working in SIMATIC Manager, HW Config or in S7T Config, you can always download your configuration data to the PLC (your Technology CPU). Objects you can download:

User program (OB, FC, FB, DB)	Program blocks and DBs from the blocks folder of your project.
System data	The system data contain the permanent and configured technical data of the CPU, i.e. the HW Configuration and all configuration information of the integrated technology.
Hardware Configuration	The hardware configuration data are created in HW Config and reflect the HW structure of the station.
Technology	These data include the configuration data of the integrated technology and of technology objects.
Firmware of the integrated technology	<p>The current firmware of the integrated technology is packed to SDBs and saved to the MMC of your Technology CPU. The firmware download is based on the conditions listed below:</p> <ul style="list-style-type: none"> • The "Generate technology data" check box was set at the time "Save and compile" was executed. You will find this check box in the properties dialog box of the technology > "Technology system data" tab in HW Config. If the technology system data were not generated when "Save and compile" was executed (check box was reset), any existing firmware data are deleted from the MMC. • The current firmware of the integrated technology is not stored on the MMC yet. If it is, the download is canceled.
Drive configuration	In S7T Config, you can configure the MICROMASTER and SINAMICS drives with integrated STARTER.

Below you will find a listing of objects you can download with the various tools:

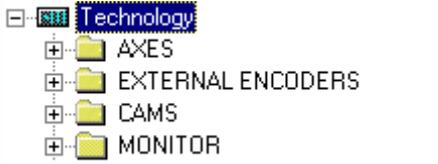
Download in "SIMATIC Manager"

Selection	Menu command	What is downloaded
	PLC > Download	<ul style="list-style-type: none"> • User program • Hardware Configuration • Technology • Firmware of the integrated technology
Selection has no effect	PLC > Upload Station to PG	<ul style="list-style-type: none"> • User program • Hardware Configuration • Technology (backup copy only; can not be edited in S7T Config) • Firmware of the integrated technology
	PLC > Download	<ul style="list-style-type: none"> • User program • Hardware Configuration • Technology • Firmware of the integrated technology
	PLC > Download user program to memory card	<ul style="list-style-type: none"> • User program • Hardware Configuration • Technology • Firmware of the integrated technology <p>The MMC is erased before the start of the download.</p>
	PLC > Download	<ul style="list-style-type: none"> • Hardware Configuration • Technology • Firmware of the integrated technology
	No download	The block folder and the "technology objects" icon are only representative objects used for configuring the technology.

Download "HW Config"

Selection	Menu command	What is downloaded
No selection required / possible	PLC > Download	<ul style="list-style-type: none"> • Hardware Configuration • Technology • Firmware of the integrated technology

Download in "S7T Config"

Selection	Menu command	What is downloaded
	Target system > Download > Project to PLC	<ul style="list-style-type: none"> • Technology This download to the MMC includes only the delta configuration data created in S7T Config. • Drive configuration If the "Drives" check box is set on the "Download" tab in Options > Settings in S7T Config.

All downloads described can also be directed to the MMC in the MMC interface of the PG / PC. This reduces download times.

8.3 Tuning technology system cycles

The integrated technology executes its tasks in single processing cycles (see also "Time slices"). Based on the task, you can adjust the technology system cycles to meet your requirements and to enhance performance of the Motion Control application.

Select the technology in S7T Config, then select **Target system > Set system cycle clocks**.

System Cycle Clocks

Cycle clock ratios

DP cycle: 3 ms

Position control cycle clock (master application cycle): 1

Interpolator cycle clocks (position ramp-up generator cycle clocks): lpo 3 9 ms

lpo_2 2 18 ms

Job monitoring time (1 - 5,000 ms): 540 ms

Technology DB update (n * IPD): 18.00 ms

Maximum shutdown time (1,000 - 60,000 ms): 15300 ms

Number of tolerated IPD overflows: 0

Network settings PROFIBUS(1)

Isochronous bus cycle activated:

Isochronous DP cycle: 3.000 ms

OK Cancel Help

DP cycle

The clock-synchronized DP cycle of the DP(DRIVE) interface forms the basic clock of the technology system cycles. The value of the DP cycle is set in HW Config. In this dialog box it is only displayed.

Note

The DP cycle time must be an integer multiple of 0.5 ms. Change the value in HW Config if this is not so.

Position controller cycle

The position control of the axes is calculated in this cycle, for example. The position controller cycle must be an integer multiple of the DP cycle. The Technology CPU supports the values 1 and 2. Select a multiplication factor from the drop-down list in order to set the required position controller cycle.

You should usually enter the value 1. Although you reduce the dynamic performance of the controller by setting a value of "2", you provide more computing time for the execution of other commands. The maximum and average task execution time can be read from the *MaxLoopDuration* and *CmdLoopDuration* variables of the technology DB MCDevice.

Note

The reduction ratio between the DP cycle and position control cycle is also set at the drive as "Master application cycle" in order to enable interactive life-sign monitoring. For further information, refer to the drive documentation..

Interpolator cycle (ipo)

The axis motion control is always calculated in the "IPO cycle". Based on the value of the IPO cycle, you determine the time frame for calculating the drive setpoint values. Select a multiplication factor from the drop-down list in order to set the required position control cycle.

Interpolator cycle 2 (ipo2)

"Interpolator cycle2" is used to control the motion of low-priority axes. Based on the value of the IPO cycle, you determine the time frame for calculating the setpoint values of the low-priority drive. Select a multiplication factor from the drop-down list in order to set the required interpolation cycle 2.

Job monitoring time

The motion control commands requested in the STEP 7 user program are executed within the remaining time slices by the integrated technology. The function monitors the execution time of all busy motion control commands.

If the job monitoring time reports a time-out, the Technology CPU changes to the safety state STOP, and an error message is written to the diagnostic buffer.

Technology DB update

Select an entry from the drop-down list to set the technology DB update interval for the integrated technology.

Shorter intervals between updates prolong motion control execution times. Do not set any cycles below the evaluating capacity of your program.

Maximal shutdown delay

Here you enter the time for monitoring shutdown of the integrated technology. If the integrated technology is not shut down after this time has expired, the Technology CPU changes to STOP mode.

Number of tolerated IPO overflow events

An "IPO overflow" event occurs whenever the execution of the interpolator takes longer than the configured interpolator cycle. In this case, the next interpolator is ignored and thus not started within the selected cycle. It is started as usual if the interpolator is executed within the current cycle.

Each ignored interpolator is counted as "IPO overflow". From the drop-down list, select the number of tolerated successive "IPO overflows" after which the Technology CPU goes into STOP.

8.4 Assigning technology system cycles

Best practice in tuning power resources of the integrated technology is to set priorities for your Motion Control tasks (technology objects), and assign these directly to the technology system cycles. By defining tasks to low priority classes, you release performance resources for higher-priority tasks.

Change the default settings,

- if the time to a command execution is too long
- if load on the technology is too high (the processing times are available in the technology DB MCDevice.)

Assign the technology objects "axis" and "external encoder" with low-priority tasks to "interpolator cycle2", the technology objects "output cam" and "measuring sensor" to "interpolator cycle" or "interpolator cycle2". Assign the technology objects "cam" and "measuring sensor" with tasks of a higher priority class to the "interpolator cycle" or to the "position control cycle".

The technology objects can be assigned the cycles listed below:

Motion Control command	high priority	...	low priority
Technology object	Position controller cycle	Interpolator cycle	Interpolator cycle 2
Velocity-controlled axis	-	Default	X
Positioning axis	-	Default	X
Synchronization axis	-	Default	X
External encoder	-	Default	X
Output cam	X	X	X
Measuring input	X	X	X

Assignment of system clocks

- The technology system cycles of cams and measuring sensors are set in the **Configuration** dialog box of S7T Config.
- For the axes and external encoders these are set at the *Execution.ExecutionLevel* variable in the expert list of S7T Config.

Warning

The technology objects listed below must be clocked at the same frequency:

- Synchronized leading / following axes
 - Measuring sensors and cams at the axis
-

8.5 Checking the load on integrated technology

Typical memory requirements of technology objects and cam disk interpolation points are described in the "CPU Data" documentation of your Technology CPU. Determine the approximate percentile value of memory utilization based on the values described in this documentation. This approximate value should not exceed 90%.

You can check the current memory load in S7T Config.

Checking the load on integrated technology

How to check load on integrated technology.

1. Download all technology objects required to the Technology CPU.
Verify that the cam disks contain all interpolation points required. When changing cam disks dynamically in runtime using the "MC_CamClear", "MC_CamSectorAdd" and "MC_CamInterpolate" technology functions, use these functions to create the interpolation points.
2. Change to "Online" mode in S7T Config.
3. In S7T Config, select the **Target system > Device diagnostics** command.
The "Device diagnostics" dialog box opens.
4. Select the "System load" tab.

This tab shows the current memory load and the "CPU load due to system tasks" in the integrated technology. The output value should not exceed 90%.

"CPU load due to system tasks" shows the load on integrated technology caused by the position control and the interpolator cycles (ipo and ipo2) as a percentage (for example, 40%.) The remaining time slice (60%, for example) is available for technology DB updates and command processing.

You can modify CPU load by adjusting the system cycles:

- Shorter system cycles allow faster control, but reduce the time slice for command processing. Technology DB updates may require a longer cycle.
- Longer system cycles, on the other hand, provide more computing time for command processing and technology DB updates. This reduces control performance.

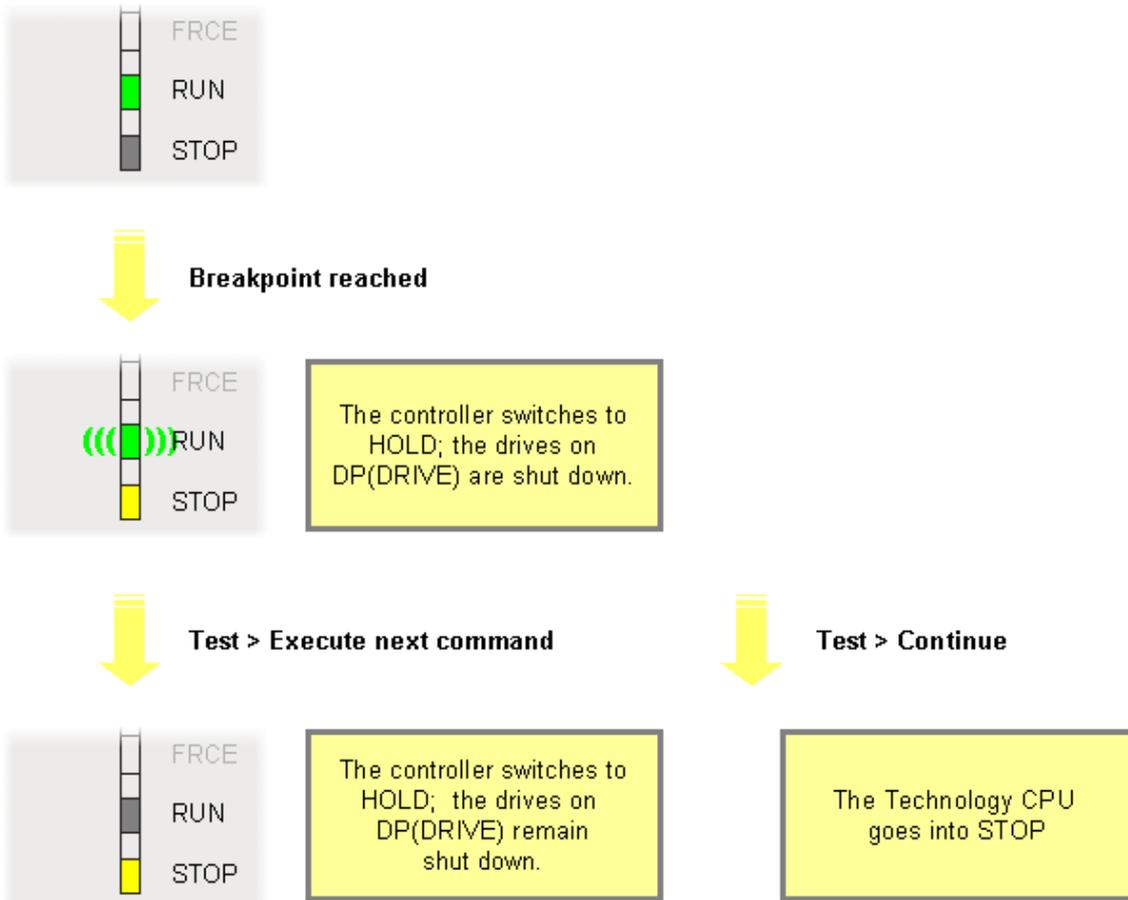
The value of "CPU load due to system tasks" should normally lie between 40% and 60%.

8.6 Testing with breakpoints

You can test your user program with breakpoints, same as in STEP 7 (for further information, refer to the STEP 7 documentation).

The Technology CPU has some special features with respect to safety requirements. See the figure below: Menu command

RUN state



Breakpoint reached

After the breakpoint is reached, the PLC changes as usual to "HOLD"; the "RUN" LED flashes at 0.5 Hz, the "STOP" LED is lit permanently. In "HOLD" mode, the outputs of the PLC and of its integrated technology are shut down.

The **Test > Execute Next Statement** command

After the breakpoint is reached, you can continue to test your user program by selecting the **Test > Execute next instruction**.

The **Test > Resume** command

After you execute **Test > Resume**, the Technology CPU changes to "STOP". "Restart" the Technology CPU in order to set it to "RUN" mode again.

8.7 Monitoring system variables with the Watch table

Use the "Watch table" of S7T Config to monitor the system variables of technology objects. The "Watch table" in S7T Config can be compared with the variable table of STEP 7.

You can group different variables in watch tables in order to monitor the entire group, for example, the system variables of several technology objects and the user variables of several programs.

Note

An online connection is required to monitor variables in the watch table.

How to create a watch table:

1. Select the MONITOR element in the project navigator.
2. Select the **Insert > Watch table** command.
3. Type in the name of the watch table.
4. Click OK to confirm.

To add a variable to the watch table:

1. In the project navigator, select the element containing the variable you want to add to the watch table (the variable table is shown in the symbol browser).
2. In the symbol browser, select the rows with the variables to be included in the watch table.
3. Select **Move in watch table** from the shortcut menu.
4. Repeat steps 1 to 3 as required.

8.8 Testing with TraceTool

8.8.1 Introduction - TraceTool

Using the TraceTool of S7T Config, you can trace and save the signals and values of variables. The recorded data are helpful, for example, in the diagnosis of motion sequences of machines and troubleshooting in user programs. For better diagnosis, you can also assign defined setpoint values to variables by means of the function generator, while recording the values of other variables at the same time. You can display and edit recorded measurements in a diagram.

Overview of recordable variables and of the corresponding tools:

Object	Tool	Which variables can be logged?
Integrated technology	TraceTool S7T Config	<ul style="list-style-type: none"> internal system variables Variables of technology objects; Actual/setpoint values, actual velocity and position values of the axes Variables of the user program The data are recorded according to the position controller cycle.
SINAMICS drives	TraceTool S7T Config	internal variables of the drive such as current, torque etc. Logging according to the internal drive cycle.
SIMODRIVE drives *	Trace function (SimoComU)	internal variables of the drive such as current, torque etc. Logging according to the internal drive cycle.
MASTERDRIVES drives *	Trace function (DriveMonitor)	internal variables of the drive such as current, torque etc. Logging according to the internal drive cycle.

* Refer to the description of the functionality in the relevant Online Help.

8.8.2 Trace for SINAMICS drives

In the "Trace" tab, define the recording and trigger conditions, and configure the signals to be recorded. You can record the values for parameters of the selected SINAMICS drive device. Only individual element variables can be recorded for arrays and structures.

You can use the recording results to locate configuration errors, for example. To check the input, incorrect parameters are colored red. You must change these parameters before you download the settings to the PLC. Certain parameters are grayed out or not shown at all, depending on the configuration.

This Trace functionality closely resembles that of the standard Trace for S7T Config. The layout of the various fields and buttons is slightly different. Where appropriate, any differences are mentioned in the sections below.

8.8.3 Starting TraceTool

Make sure the following conditions are satisfied:

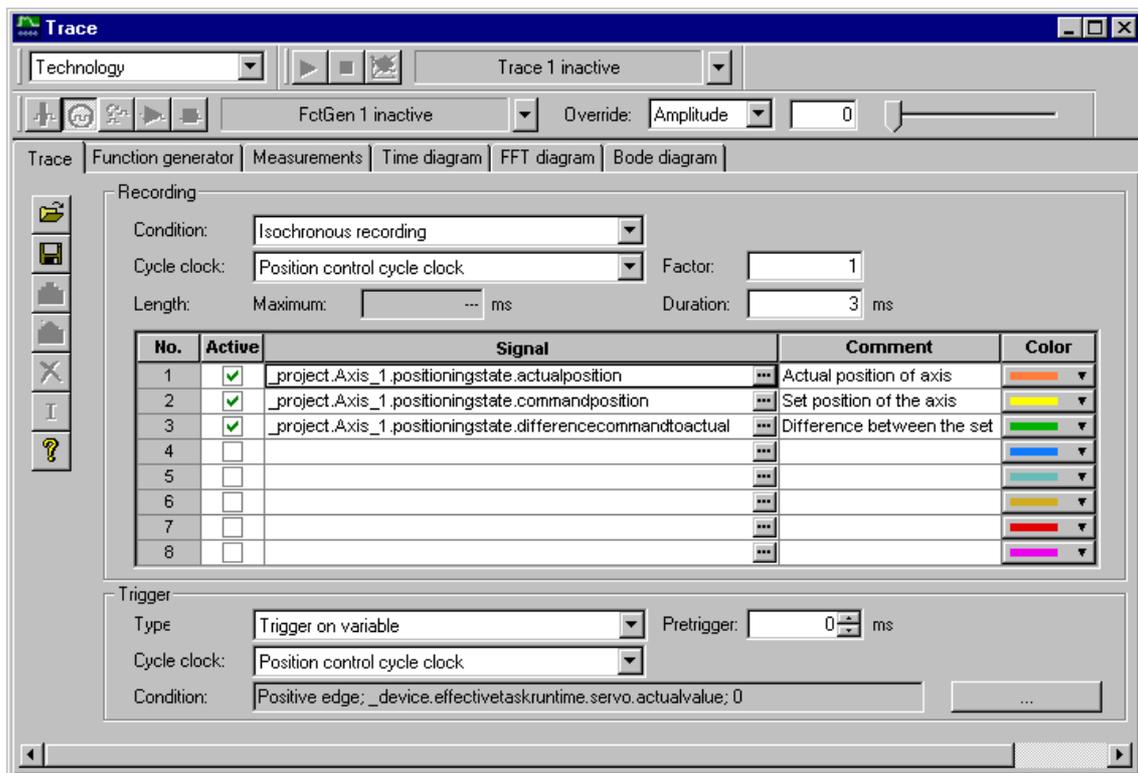
1. S7T Config is in online mode.
2. The technology was downloaded to the PLC.

Note

Although you can configure the TraceTool offline mode, you can not record any values.

In Navigator, select the technology, then select **Target system > Trace** to start TraceTool.

The "Trace" dialog box opens on the working area, showing the "Trace", "Functions generator", "Measurements", "Timer diagram", "FFT diagram" and "Bode diagram" tabs.



TraceTool with the "Trace" tab

8.8.4 General functions of TraceTool

Basic functionality available for Trace:

Function	Description
Recording signal	<ul style="list-style-type: none"> System variables of the Technology CPU and technology objects. Internal variables of SINAMICS drives Variables of the user program at the "Trace" technology DB.
Recording conditions	<ul style="list-style-type: none"> Recording in synchronism with a selected system clock. Infinite trace or certain logging period (not possible when tracing SINAMICS drives).
Trigger	<p>This specifies when the system starts with the recording. This can be:</p> <ul style="list-style-type: none"> Specific value or the value range of a variable <p>Invoked by:</p> <ul style="list-style-type: none"> Sets a system variable Function generator
Function generator	<ul style="list-style-type: none"> Input of defined signal shapes Coupling of the two function generators
Display measurements in table format	<ul style="list-style-type: none"> Measurements are shown in a table in the "Measurements" tab. Details about the various trends are found in the "Trace detail" tab of the detail view. Measurement repeats with identical trace configuration
Display and edit measuring trends	<ul style="list-style-type: none"> Indication of logged measurements by means of trends in the "Time diagram", "FFT diagram" and "Bode diagram" trends. 2 measuring cursors per coordinate axis Scaling and zoom functions Hiding measurements Memo function
Bit trace	Representation of individual bit values of recorded measurements
Save trace measurements and parameters	<ul style="list-style-type: none"> Store and archive trace parameter settings and recorded measurements. Catalog functions for the reuse of common trace parameter settings

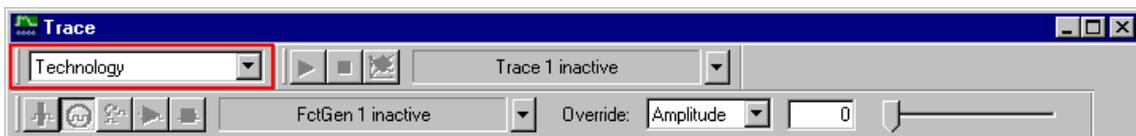
8.8.5 Basic procedure for handling the TraceTool

1. Define the recording and trigger conditions for the trace.
2. Optionally configure the function generator. Save the trace and function generator parameter data to the catalog if you want to reuse these configuration data.
3. In S7T Config, log on to the online PLC.
4. Download the Trace and function generator configuration to the PLC by clicking "Download configuration".
5. Start the trace and function generator (if applicable). The measurements are now recorded and displayed on the "Measurements" and "Diagram" tabs.
6. Stop Trace and save the recorded data by clicking **Trace > Save measurements**.

8.8.6 The TraceTool toolbars

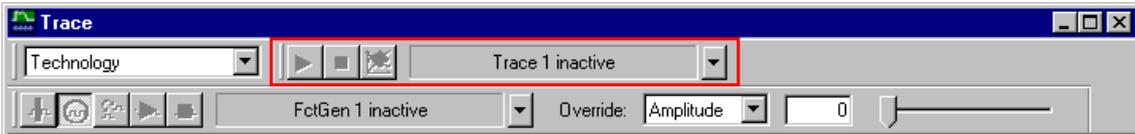
Select the command **Trace > Toolbars**, in order to enable the various toolbars of TraceTool.

"Standard" toolbar



Select the technology or the SINAMICS drive of which you want to log the variables from the drop-down list.

"Trace" toolbar



The "Trace" toolbar contains the functions for logging the trace.

Function	Control element	Meaning/description
Start Trace		Click this button to start tracing (corresponds with the Trace > Trace > Start) menu command.
Stop Trace		Click this button to stop tracing (corresponds with the Trace > Trace > Stop) menu command.
Load values		Click this button to upload the recorded trace trends from the PLC to S7T Config (corresponds with the Trace > Trace > Upload trace) menu command You can use this function, for example, if a trace recording has been started by a user program in the PLC and errors have occurred. If required, you can upload these trends to the TraceTool. During this trace operation, S7T Config does not need to be online to the PLC.
Trace block selection	Drop-down list	You can choose between 4 different configurable blocks by selecting "Trace block". You can monitor and record 8 channels (signal sources) together per trace block. "Trace inactive" indicates the stop status of the trace. A SINAMICS drive has two trace blocks, each with four channels.

"Function generator" toolbar



The "Functions generator" toolbar is used to control the functions generator.

Function	Control element	Meaning/description
FctGen On		Click this button to enable the function generator. S7T Config must be in online mode, and the function generator must be configured.
FctGen Off		Click this button to disable the function generator.
Start of functions generator coupling		Click this button to couple the start of the two configured function generators. The two function generators will then be started at the same time.
Start FctGen		Click this button to start the function generator.
Stop FctGen		Click this button to stop the function generator.
Select FctGen	Drop-down list	Select the function generator you want to configure from the drop-down list. The list contains two function generators which you can configure with different values. If the trace is in the Stop state, FctGen inactive is displayed.
Override	Drop-down list	In the next drop-down list and input box, set the
Amplitude / offset	Drop-down list	From the drop-down list, select whether the override must apply to the amplitude or the offset.
Amplitude / offset	Input field	At the input box, set the override value for the amplitude or offset. Allowed are values from 0% to 1000%.
Amplitude / offset	Slider	You can also use the slider to enter the override value.

8.8.7 "Trace" menu

The Trace menu command contains the functions listed in the table below.

Function	Meaning/description
Open measurements	You can use "Open measurements" to view the logged curves (*.TRC) in the diagram.
Save measurements	Select "Save measurements" to save the recorded curves to a file. This file is saved per default as a TRC file.
Export measurements	Select "Export measurements" to export the recorded signals in a file. The recorded measured values are stored in the file during the export. You can export individual measurements or all measurements. You can export files of the type: <ul style="list-style-type: none"> • TXT (ASCII format): The values are delimited. • XLS (MS EXCEL 5.0 format): The data can be imported into MS EXCEL and displayed as a diagram. • EMF (image file of the Diagram tab): All displayed curves are exported as a vector graph. This file can be opened and edited in a picture processing program. • CSV (Comma-Separated Value files): The values are separated with semicolons. This format can be copied to a spreadsheet program.
Toolbars	Use the menu command to show the "Standard", "Functions generator" and/or "Trace" toolbars.
Timing diagram	The "Diagram" menu command can be select further menu commands. The following auxiliary functions can be displayed: <ul style="list-style-type: none"> • Auxiliary lines • Zoom • Repeated measurement • Select several measurements
FFT diagram	The "FFT Diagram" menu command can be used to select further menu commands. The following auxiliary functions can be displayed: <ul style="list-style-type: none"> • Auxiliary lines • Zoom

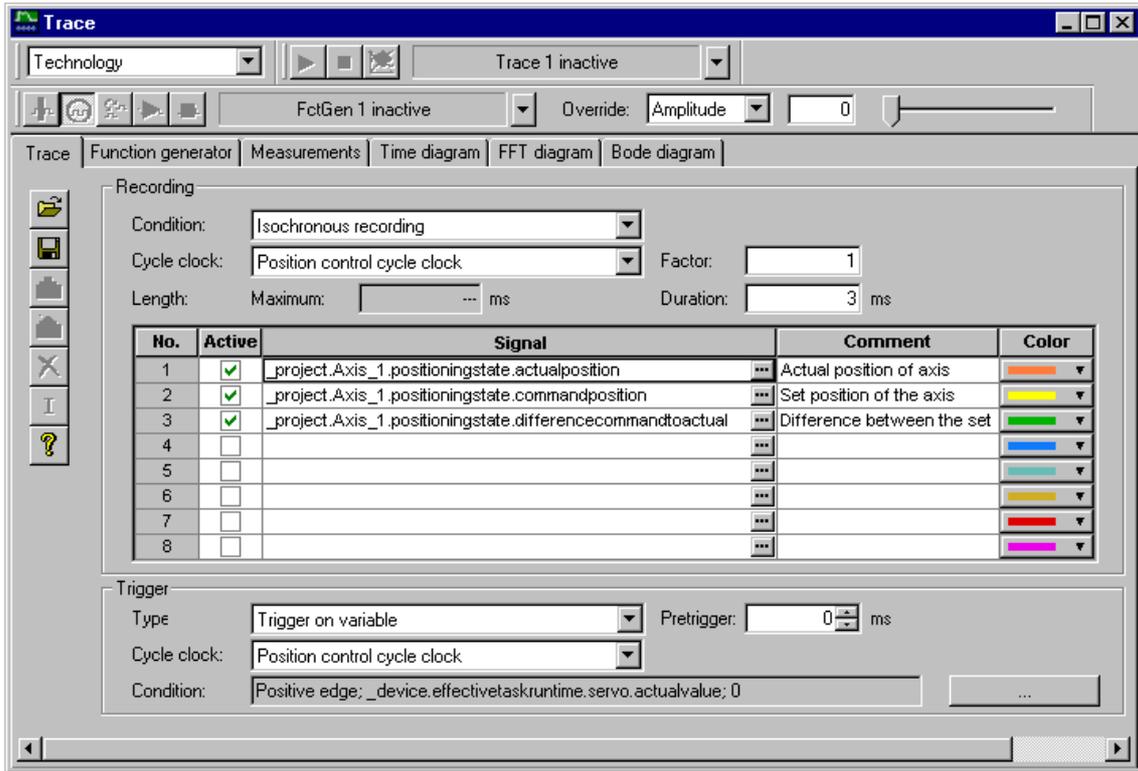
Function	Meaning/description
Properties	<p>Opens the "Diagram properties" dialog box Set the properties listed below in the tabs:</p> <ul style="list-style-type: none"> • "Print quality" tab Color / grayscale printing, line types and widths for printing • "Colors" tab The color representation of the diagram • "Cache" tab Set the cache drive and path for logging • "Logging" tab Logging options such as "Superimpose measurements" and "Measurement repetition" • "Grid" tab If you have not set the "Fixed Grid" check box, the system automatically sets the grid pattern. Set the check box to enable user-specific settings. In the next fields, you can define the number of lines for the x and y coordinates. • "Default values" tab Save the current settings as default, accept the default values and reset these to factory state
Function generator	<p>The submenu of the "Function generator" menu contains the executable commands shown below:</p> <ul style="list-style-type: none"> • Enable (not for SINAMICS) • FktGen coupled (not for SINAMICS) • Start • STOP • Download configuration • Upload configuration • Reset configuration
Trace	<p>The submenu of the "Trace" menu contains the executable commands shown below:</p> <ul style="list-style-type: none"> • Start • STOP • Download configuration • Upload configuration • Upload curve • Reset configuration
Close	Closes the TraceTool.

8.8.8 "Trace" tab

In the "Trace" tab, define the recording and trigger conditions, and configure the signals to be recorded.

Use the "Function generator" and "Trace" toolbar buttons to control the Download of your configuration to the PLC.

You can use the logs to locate errors and logic problems in the user programs, for example.



TraceTool tab "Trace"

Trace configuration (recording / trigger conditions)

Field / button	Description
Condition (not SINAMICS Trace)	Select here when the values of the variables are to be recorded. Isochronous recording The variable value is recorded in synchronism with the selected clock. 1st Select the "Cycle clock." 2nd Enter a number as "coefficient" in order to log the values in each n-th cycle.
Length Maximum (ms/number) SINAMICS Trace: Max. duration	This indicates the maximum logging time in ms in one cycle. The maximum recording length depends on the size of memory in the Technology CPU and on the recording cycle. This period is calculated automatically and displayed in ONLINE mode. In OFFLINE mode, a minimum value is defined as a base value for the recording. Note: The maximum available memory is shared between the various trace blocks. If you have already set the duration of trace 1 to maximum, you will not be able to log any values at the other trace blocks.
Length Time (ms/number) SINAMICS Trace: Recording duration	Here you enter the logging time in ms. It can only be a multiple of the maximum duration. The system will modify your input appropriately. In ONLINE mode, you can transfer the maximum duration as recording duration in the SINAMICS trace. Click "Start".
Length Endless trace (not SINAMICS Trace)	The endless trace option is available only for trigger types "Immediate recording" and "At start of a function generator." When you enable endless trace, the recording is not limited in time. The recorded data are written alternately to two ring buffers in the PLC. If one of the buffers can not backup anymore data, its data are transferred to S7T Config, and the new data are written to the second ring buffer. The infinite trace function continues recording until the available memory space (hard disk drive of the PG / PC) is used up. 3rd Set the "Endless trace" check box as required. 4th Click "Options" to configure the ring buffers (number of measured values per channel) and the display range for measured data. If the endless trace is written to a highly fragmented hard disk, it is possible that gaps occur in long trace recordings that exhaust the hard disk capacity. This behavior occurs in particular on lowperformance PC systems. Remedy: <ul style="list-style-type: none"> • Release sufficient hard disk space for the recording • If necessary, use the ring buffer function of the endless trace

Field / button	Description
Table	<ul style="list-style-type: none"> • "No.:" Shows the channel number. • The "Enabled:" check box Set this check box to record the channel. You can enable all 8 channels. (Only 4 channels can be enabled in SINAMICS Trace.) • "Signal:" Name of the variable that is to be recorded. You can enter this directly, or select it in the "Signal Selection" view. To do so, click " ..." at the end of the field in the "Signal" column. This view shows all available variables (system variables, I/O variables, global device variables, unit variables, local variables of the programs in the runtime system, etc.). Syntax for entering the signal name: <name of drive object>.<parameter name / number> • Comment: You can give the channel a name of your choice. If you do not enter a new name, the program automatically uses the standard name of the parameter. • color : Set the color of the recorded curve

SINAMICS Trace: Further fields

Field / button	Description
Device cycle	Cycle clock of the drive in ms This cycle is the minimum trace clock in which the signal can be recorded.
Factor	Enter a number n as the reduction factor if you want to start logging at each n-th cycle.
Trace cycle	Trace cycle in ms. This is the cycle used to record every value of the signal. The trace cycle is a multiple of the device cycle.

Trigger

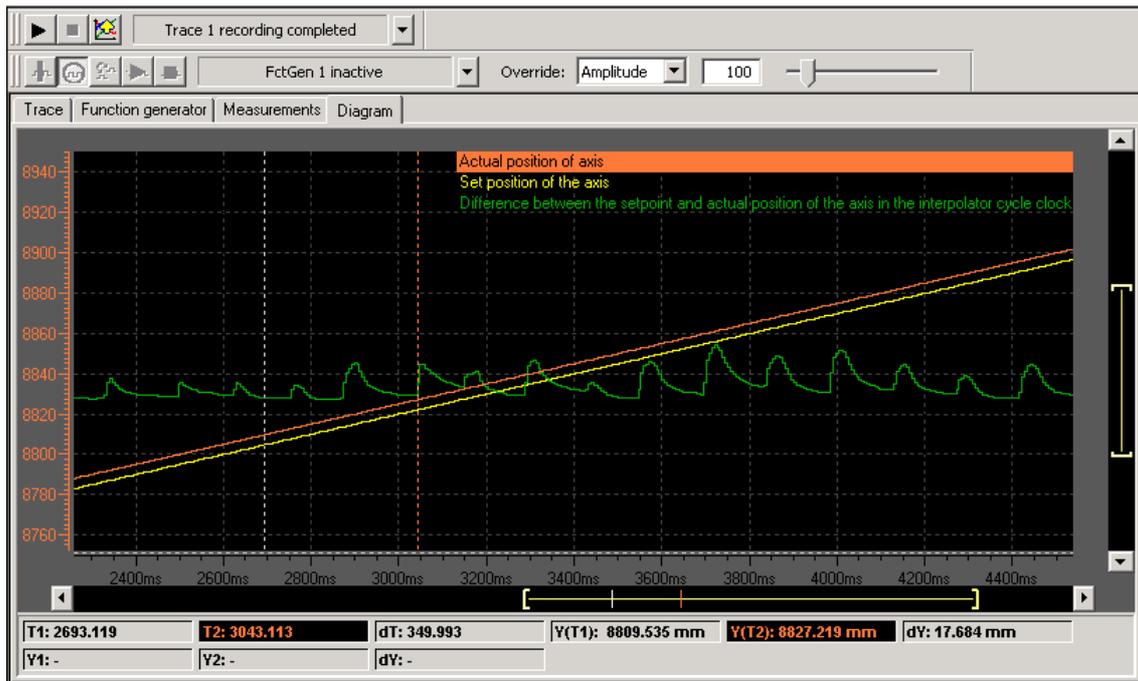
Field / button	Description
Type (not SINAMICS Trace)	<p>At "Type", select the condition for starting signal recording in Trace.</p> <p>Immediate recording Recording begins when the trace is started.</p> <p>Trigger on variable The recording is triggered by a system variable:</p> <p>5th Select the "cycle clock" in which the condition (below) is checked.</p> <p>6th Enter the condition. To do so, click "...". Select the trigger type, the variable etc.</p> <p>7th Enter a value in the "Pre-trigger" box if you want recording to start before the trigger condition is fulfilled.</p> <p>Trigger at the start of a Function generator The recording is triggered at the start of a function generator. This can be used, for example, to record the step response of the system to a step you have defined in the function generator.</p> <ul style="list-style-type: none"> • Select the function generator in "FctGen."
Trigger type SINAMICS Trace: Type	<p>Set the condition for starting signal recording in Trace.</p> <ul style="list-style-type: none"> • Immediate trigger: Recording begins at the start of Trace. • "Positive edge:" The recording starts when the entered trigger threshold is exceeded. Enter the trigger threshold at "Threshold". • "Negative edge:" The recording starts when the specified low limit of the trigger threshold is violated. Enter the trigger threshold at "Threshold". • "Within a tolerance band:" The signal recording is started when the parameter value lies within the tolerance band. To start the measurement, the parameter value must lie within the hi and lo threshold value. If the hi and the lo threshold values are identical, a test is made whether the parameter value equals the threshold values. • "Outside a tolerance band:" The signal recording is started when the parameter value lies outside the tolerance band. To start the measurement, the parameter value must lie within the hi and lo threshold values. If the upper and the lower threshold values are identical, a test is made whether the parameter value equals the threshold values. • "Bit pattern:" If the value of the parameter has the same bit pattern as the comparison pattern, the signal recording will be started. You must enter the bit mask and the bit pattern. • "Status change (ENUM):" If the value of the parameter matches the set state, the signal recording will be started. Enter the ENUM variable whose values are used for triggering. Also specify whether the state is to be equal to, less than or greater than the value of the ENUM variable. (not available in the SINAMICS Trace)

Buttons on the "Trace" tab

Name	Control element	Meaning/description
Open configuration (catalog)		Click this button to open the catalog of preset parameters. Select a setting from the parameter list and confirm with "OK."
Save configuration (catalog)		Click this button to save the current Trace settings to the catalog. You can use this catalog to store typical trace settings so that you can reload them in future if necessary. In other words, you need only configure and save the trace once for repeat measurements. Type in a name for the current Trace setting and confirm with "OK". The current settings will be saved.
Download configuration		Click this button to download the current Trace settings to the PLC (Technology CPU). When you select this setting, signals are recorded when the trace starts. Corresponds with the Trace > Trace > Download command.
Upload Trace configuration		Click this button to upload the current Trace settings from the PLC to the PG. Corresponds with the Trace > Trace > Upload command.
Deletion of configuration during RT		Click this button to delete the current Trace settings from the PLC. Corresponds with the Trace > Trace > Reset configuration command.
Memory blocks		Click this button to view the allocation of memory among the Trace blocks.
Help		Opens the online help

8.8.9 "Time diagram", "FFT diagram", "Bode diagram" tab

The logged measured signal values are shown in the "Time diagram" tab in the form of graphic trends.



"Time Diagram" tab with measuring cursor

The traces to be shown and the scaling are defined in the "Trace time diagram" tab of the detail view.

The system automatically scales the yaxis for all displayed curves. You can adjust these settings. The tab also contains a description of auxiliaries such as the measuring cursor.

FFT and Bode diagrams

The FFT and Bode diagrams are available for mathematically processed traces. To view the Fourier transformation or the Bode diagram of the logged signals, these must have been processed mathematically in the function generator.

8.8.10 Tracing values of the user program in the CPU

The "Trace" technology DB forms the interface between TraceTool and the user program. For tracing, you can write two values of the data type DINT, two values of the data type DWORD and four values of the data type REAL to the relevant variables of the Trace DB. The *ErrorID* variable may not be overwritten by the user program.

The DB data are fetched from the integrated technology within the technology DB update cycle. The technology DB update cycle can be set in S7T Config by selecting **Target system > Set system cycle clocks...**

The DB is non-retentive, irrespective of the retentivity setting of the CPU.

Variable **S7_TraceDINT[0..1]**

The *S7_TraceDINT* variable is an ARRAY consisting of two elements of the data type DINT.

These values can be selected for tracing *Technology > userdata1 > user1* and *user2* when you select the signal source in the TraceTool of S7T Config.

Variable **S7_TraceDWORD[0..1]**

The *S7_TraceDWORD* variable is an ARRAY consisting of two elements of the data type DWORD. Use these variables to trace bit information, such as the status word / error word, in the TraceTool of S7T Config. In the TraceTool, you can select the bit information as you are used to in the SIMATIC numbering system.

These values can be selected for tracing *Technology > userdata1 > user3* and *user4* when you select the signal source in the TraceTool of S7T Config.

Variable **S7_TraceREAL[0..3]**

The *S7_TraceREAL* variable is an ARRAY consisting of four elements of the data type REAL.

These values can be selected for tracing *Technology > userdata1 > user5, user6, user7* and *user8* when you select the signal source in the TraceTool of S7T Config.

8.8.11 "Function generator" tab

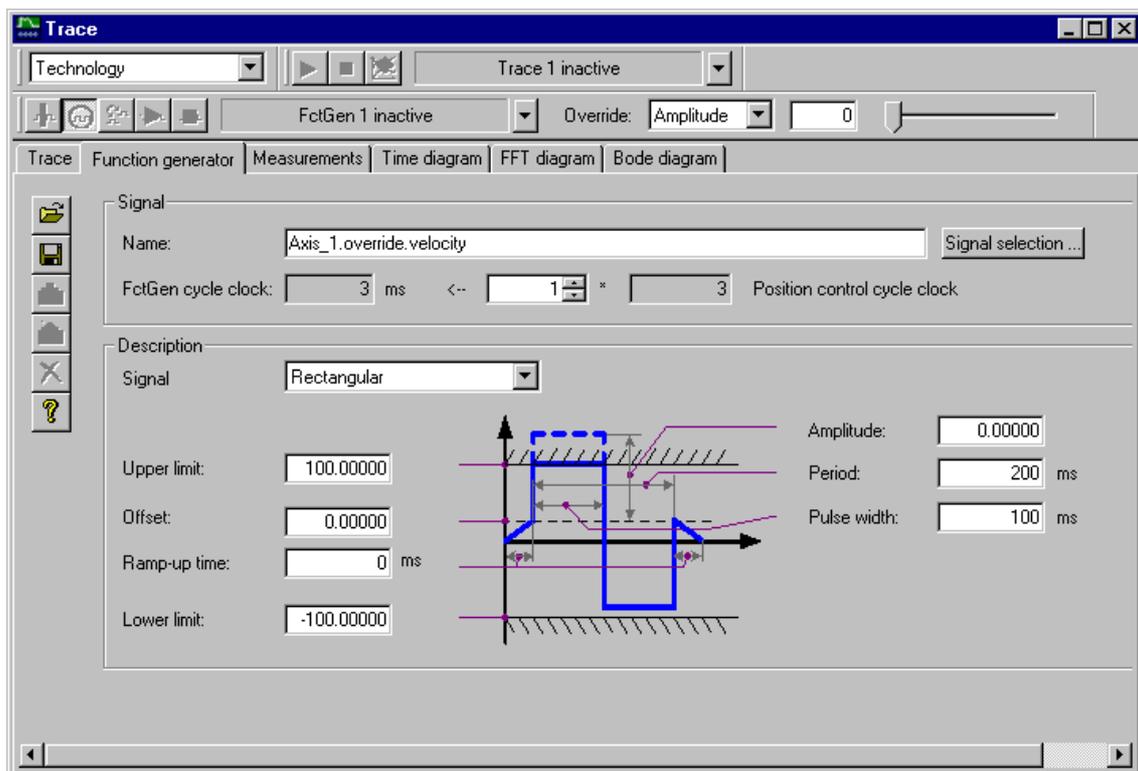
You can use the "Function generator" tab, to dynamically generate setpoint values of a defined shape (e.g. rectangular, sine) for a variety of system variables for test purposes. By using the trace, you can then record the system response in order, for example, to tune the controllers.

Two function generators are provided which you can start either separately or in synchronism. The Trace of a SINAMIC drive provides only one function generator.

In the drop-down list of the "Function generator" toolbar select the function generator. The toolbar buttons are used to enable and disable the function generator, and to couple, start and stop it. Carry out the menu command **Trace > Toolbars > Function generator** in order to display the toolbar.

In the "Function generator" tab, select the system variable to be assigned the signal of the function generator, the signal type and its parameter (e.g. amplitude, period, rampup time).

Use the "Function generator" and "Trace" toolbar buttons to control the Download of your configuration to the PLC.



"Function generator" tab

Function generator parameter settings

Field	Description
<p>Name SINAMICS Trace: Parameters</p>	<p>Parameter name of the variable for which the function generator returns the value. You can enter this directly, or select it in the "Function generator signal selection" view. To do so, click "Signal selection" at the end of the field. This view shows all system variables available for the technology objects. Syntax for entering the signal name: <name of drive object>.<parameter number> You must have created at least one technology object in the project. You can also output the signals of both function generators to one system variable. The signals are then superimposed (not with SINAMICS Trace).</p>
<p>FctGen Cycle (not SINAMICS Trace)</p>	<p>The selected system variable is updated with the function generator signal in the function generator cycle. Specify the cycle as a multiple of the position controller cycle. Note: To generate a precise reconstruction of the trace shape selected under "Signal type" by means of the function generator, the function generator cycle must be significantly shorter than the signal period.</p>
<p>Signal type</p>	<p>Here you select cyclic or acyclic signals with a different trace profile, which you want to generate by means of the function generator.</p> <ul style="list-style-type: none"> • Enter the required signal parameters. Which parameters are available depends on the selected signal type. <p>Individual trace parameters displayed in red print indicate that the values you have entered are not valid.</p>

Buttons of the "Function generator" tab

Name	Control element	Meaning/description
Open configuration (catalog)		Click this button to open the catalog of preset parameters. Select a setting from the parameter list and confirm with "OK."
Save configuration (catalog)		Click this button to save the current settings to the catalog. You can save the typical function generator settings to this catalog for reuse. In other words, you need only configure and save the function generator once for repetitive measurements. Enter a name for the current setting and confirm with OK. The current settings will be saved.
Download the FktGen configuration		Click this button to download configuration data of the function generator to the Target system. S7T Config must be in online mode. Corresponds with the Trace > Function generator > Download command.
Upload configuration FktGen configuration		Click this button to upload configuration data of the function from the Target system to TraceTool. Corresponds with the Trace > Function generator > Upload command.
Deletion of configuration during RT		Click this button to delete the current function generator settings from the Target system. Corresponds with the Trace > Function generator > Reset configuration command.
Help		Open the online help

"Function generator" toolbar

Field / button	Control element	Meaning/description
Switch on function generator*		Click this button to enable the function generator. S7T Config must be in online mode, and the function generator must be configured. Corresponds with the Trace > Function generator > Enable command.
Switch off function generator*		Click this button to disable the function generator.
Synchronized start of function generators*		Click this button to couple the start of the two configured function generators. The two function generators will then be started at the same time. Corresponds with the Trace > Function generator > FctGen coupled command.
Start FctGen		Click this button to start the function generator. S7T Config must be in online mode, and the configuration data function must have been downloaded to the Target system. Corresponds with the Trace > Function generator > Start command.
Stop FctGen		Click this button to stop the function generator. Corresponds with the Trace > Function generator > Stop command.
Select FctGen	Selection list	Select here the function generator that you want to configure. The list contains two function generators which you can configure with different values. If the trace is in the Stop state, FctGen inactive is displayed. The Trace of a SINAMIC drive provides only one function generator.
Override*	Input field Slider	Select "Override" in online mode to increase the amplitude and offset values by a percentage. Select first whether the override must apply to the amplitude or the offset. You can vary the override between 0% and 1000% using the slider. Alternatively, you can enter an override value directly in the input field.

* The fields and command buttons with an asterisk are not available in the Trace of a SINAMIC drive.

8.8.12 "Measurements" tab

The "Measurements" tab shows a table of all measured values and their trend profiles. By setting the "Selection" check box, you can choose which measurement and which of its traces you want to display. You can select up to 8 traces simultaneously. You can also edit their display colors.

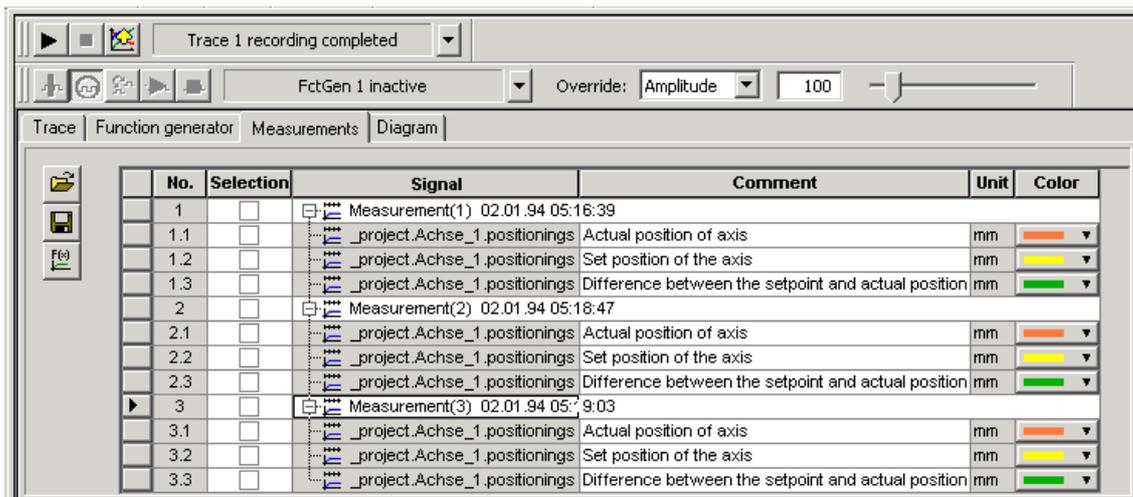
Button in the "Measurements" tab

Name	Control element	Meaning/description
Open measurements		You can use "Open measurements" to view the logged traces (*.TRC) in the diagram.
Save measurements		Use "Save Measurements" to save the logged traces to a file. This file is saved per default as a TRC file. As an alternative, you can save the data in ASCII or another compatible format.
Mathematical functions		Opens the "Mathematical processing" window. There you can configure the mathematical cams (computer channels) for the trace. Mathematical processing is here based on the pre-configured signals for trace logging.

Note

Make the final selection of the traces to be displayed in the "Trace detail" tab of the detail view.

The "Trace detail" tab shows further information about the selected measurement.



No.	Selection	Signal	Comment	Unit	Color
1	<input type="checkbox"/>	Measurement(1) 02.01.94 05:16:39			
1.1	<input type="checkbox"/>	_project.Achse_1.positionings	Actual position of axis	mm	
1.2	<input type="checkbox"/>	_project.Achse_1.positionings	Set position of the axis	mm	
1.3	<input type="checkbox"/>	_project.Achse_1.positionings	Difference between the setpoint and actual position	mm	
2	<input type="checkbox"/>	Measurement(2) 02.01.94 05:18:47			
2.1	<input type="checkbox"/>	_project.Achse_1.positionings	Actual position of axis	mm	
2.2	<input type="checkbox"/>	_project.Achse_1.positionings	Set position of the axis	mm	
2.3	<input type="checkbox"/>	_project.Achse_1.positionings	Difference between the setpoint and actual position	mm	
3	<input type="checkbox"/>	Measurement(3) 02.01.94 05:19:03			
3.1	<input type="checkbox"/>	_project.Achse_1.positionings	Actual position of axis	mm	
3.2	<input type="checkbox"/>	_project.Achse_1.positionings	Set position of the axis	mm	
3.3	<input type="checkbox"/>	_project.Achse_1.positionings	Difference between the setpoint and actual position	mm	

"Measurements" tab

At the zero time (trigger time) of measurement, the measurements are assigned a time stamp based on the system time of the Technology CPU.

The default setting allows the display of only one measurement and its traces.

To use various measurements in order to repeat or compare measurements, for example:

1. Select the **Trace > Properties** command, then select the "Recording" tab.
2. To visualize several traces (to determine value deviations, for example), set the "Superimpose measurements" check box. The "Diagram" tab supports visualization of up to eight superimposed traces.
3. To use the settings of another measurement for your current measurement, set the "Repeated measurement" check box. Settings for previous measurements are then applied to the selected measurement, provided that you do not change the trace parameter settings.

You can delete a group of measurements or individual traces. To do so, select the relevant line, then select the corresponding command from the shortcut menu.

Note

Open the shortcut menu for the individual rows (measurements/trace):

Place the cursor in the **first** column in front of the line, then press the right mouse button.

Shortcut menu in the "Measurements" tab

Function	Meaning/description
Close measurement/trace	Closes the selected measurement or trace.
Close all measurements/traces	Closes all listed measurements.
Expand (show all traces)	Opens and lists all traces for the measurement.
Reduce (show measurements only)	Shows only the measurements, but not the traces.
In ascending order	Sorts the measurements in ascending order of the measurement name or measuring time.
In descending order	Sorts the measurements in descending order of the measurement name or measuring time.
Maths functions	Opens the "Mathematical processing" window. There you can configure the mathematical cams (computer channels) for the trace.
Properties	Indicates the properties of the marked measurement. You can enter a comment for the measurement.

8.8.13 "Trace time diagram" tab in the detail view

Traces shown in the "Time Diagram" tab are configured in the "Trace time diagram" tab.

Scale	Display	Signal	Comment	Unit	Y(T1)	Y(T2)	deltaY	Color
<input checked="" type="checkbox"/> 8.1	<input checked="" type="checkbox"/>	***_project.Achse_1.positioningstate.a	Actual position of axis	mm	8815.837	8827.219	11.382	Orange
<input type="checkbox"/> 8.2	<input checked="" type="checkbox"/>	***_project.Achse_1.positioningstate.c	Set position of the axis	mm	8816.437	8827.837	11.400	Yellow
<input type="checkbox"/> 8.3	<input checked="" type="checkbox"/>	***_project.Achse_1.positioningstate.di	Difference between the setp	mm	0.299	0.317	0.018	Green

Alarms Trace detail Symbol browser Error in configuration data Target system output Trace info

"Trace time diagram" tab in the detail view

Set the "Show" check box to view the trace in the "Time Diagram" tab. Disable the check box to hide the trace.

When a trace is shown, you can set the "Scale" check box. The scale for this trace is then shown.

When the measuring cursors are shown, the system also indicates the function values of the active trace $Y(X1/2)$ at the measuring cursor positions $X1/2$, including the relevant delta-Y and delta-X or delta-t differences.

Note

Open the shortcut menu for the individual rows/curves:

Place the cursor in the **first** column in front of the line, then press the right mouse button.

8.8.14 Further tools in the "Time diagram", "FFT diagram", "Bode diagram" tab

The "Time diagram", "FFT diagram" and "Bode diagram" tab provide further tools that you can use to analyze recorded measurement traces.

You can zoom an area of the display:

1. Mark with pressed left mouse button on the area to be expanded.
2. The zoom area selected is magnified to the size of the whole display area. You can use the scrolling function to move the diagram to another view.

Open the shortcut menu:

3. Place the cursor in the display area.
4. Click with the right mouse button.

Many of these functions can also be called in the shortcut menu of the "Trace time diagram" tab of the detail view.

Tools for analyzing measurement traces in the shortcut menu

Tool	Description
Zoom -	Use the Zoom function to reduce the trace view in the diagram.
Undo zoom completely	Restores the diagram view to its standard zoom ratio.
Measuring cursor	In this menu you can view and modify the measuring cursor of the relevant diagram axes. Move the measuring cursor in the view area by keeping the left button pressed. The measuring cursors can be moved freely in the diagram. The active measuring cursor is indicated in red color. The coordinates of the measuring cursors are indicated below the diagram. The coordinates of the active cursor are shown on a colored background.
T measuring cursor	"T measuring cursor" is used to show the measuring cursor for the x coordinate. The function indicates the relevant value T and the corresponding function value Y(T).
Y measuring cursor	"Y measuring cursor" is used to show the measuring cursor for the y coordinate. The function indicates the relevant y value of the measuring cursor.
T and Y measuring cursor	"T and Y measuring cursor" is used to show the measuring cursor for both coordinate axes. The function shows two measuring cursors per coordinate axis.
X measuring cursor (FFT/Bode)	"X measuring cursor" is used to show the measuring cursor for the x-axis of the amplitude spectrum. The function indicates the relevant value X and the corresponding function value Y(X).
Y measuring cursor (FFT/Bode)	"Y measuring cursor" is used to show the measuring cursor for the y-axis of the amplitude spectrum. The function indicates the relevant y value.
X and Y measuring cursor (Bode)	Use this menu command to output both the X and Y measuring cursor in the Bode diagram.
Use measuring cursor position as 100%	Sets the current position of the active measuring cursor to 0%, and that of the second measuring cursor to 100%. When you move the measuring cursors, the relevant current position is indicated as a percentage of the home position. The percentile distance between both measuring cursors is indicated under dT or dY. This menu is only available when the measuring cursors are located within the range of the diagram.
Use measuring cursor position as 360%	Sets the current position of the active measuring cursor to 0%, and that of the second measuring cursor to 360%. When you move the measuring cursors, the relevant current position is indicated with reference to the home position. The distance in degrees between both measuring cursors is indicated under dT. This menu command is only available if the measuring cursors are located within the range of the diagram.
Measuring cursor position dT in [Hz]	Select this menu item to show the measuring cursor position dT in [Hz].
Center measuring cursor	Select "Align measuring cursors to center" to realign the measuring cursor to the screen center, if you scaled or zoomed the diagram so that the measuring cursors are no longer visible.
Measuring cursor tool tip	A tooltip can be used for the measuring cursors of the x axis to indicate the trace value at the current cursor position. Using the tooltip: <ol style="list-style-type: none"> 1. Open the shortcut menu 2. From the menu, select the entry "Enable measuring cursor tooltip and measuring cursor." 3. Drag an x axis measuring cursor out of the left area of the diagram. When you move the cursor, the y value of the trace is output at the current position of the measuring cursor on a yellow background. The Tooltip function indicates the y value of the currently active trace. Select the active trace from the shortcut menu of the "Active trace" diagram.

Tool	Description
Auxiliary line grid	Select "Grid" to show or hide the grid in the diagram.
Phase -270° - 90° (Bode diagram only)	This menu command changes the view of the phase in the Bode diagram from -180° to +180° to -270° to +90° um. This range gives you a more precise view of the 3 dB decay.
Memo function active	You may attach notes at any trace position within the diagram. Using the notepad function: <ol style="list-style-type: none"> 1. Open the shortcut menu 2. Select "Notepad function" from the shortcut menu. 3. To insert a note, double-click the relevant position in the diagram. The "Enter note" window opens. 4. type a comment under "Text" and confirm with OK. The diagram shows the note and its text on a yellow background. 5. Double-click the note to delete it again.
Display trigger line	Set "Show trigger line" to indicate the trigger position of the recorded trace in the diagram. The trigger position is marked with a red triangle.
Active trace	Select the scale of which you want to view the scale in the diagram of the y axis.
Auto-scale	Select "Auto-scale" to automatically scale the Y coordinate based on the currently active trace. The diagram shows the full range of the active trace.
Scaling	Select "Scaling" to scale the y coordinate of the diagram. In this dialog box, you can enter new values for the y coordinate.
Arrange traces in tracks	Select this menu command to output several superimposing traces in the diagram. The various traces are output at the y coordinate at an offset and overlaying each other.
Bit tracks	You can configure bit tracing for recorded measurements. This allows you to explicitly visualize certain bits in the diagram, based on the logged values of a variable. The function shows a trace for the selected bit in this case. You can also use this function to monitor the time-based profile of a specific bit of a variable.
Time / FFT diagram	Select this menu command to show the time and FFT diagrams in one tab, one underneath the other. Both diagrams are shown in the time diagram tab, one underneath the other. Select the entry again to disable it.
Repeated measurement	Enable "Repetitive measurement" if you want to reuse an existing signal configuration for your recording (trace color, scaling, for example.)
Superimpose measurements	Select "Superimpose measurement" to view several traces of different measurements in the diagram. The function supports visualization of up to eight traces of different measurements.
Copying a graphic object to the clipboard	You can copy the current view in the diagram to the clipboard as graphic object. You can paste this graphic object into a graphics editor and save it.
Properties	Click "Properties" to open the "Diagram properties" dialog box. On this dialog box, define the line layout for printing the traces, the cache memory for the recording, the color layout of the diagram and the recording options.

8.9 Testing with the control panel

8.9.1 Introduction - Control panel

The control panel is used to control and monitor individual axes and drives. You can use it to move drives or axes. It allows the commissioning engineer to

- test each part of the installation individually before he initiates programdriven, coordinated axis motions
- test under error conditions whether individual axes can be operated at all from the control panel, or whether this function is affected by the error
- "Release run": Move the axis quickly and independently of the program to another position.
- traverse axes for controller optimization purposes
- perform active homing
- position relative / absolute
- set and remove the axis enable
- initiate an axis reset
- adjust the absolute value encoder by adding the absolute value encoder offset ("Homing" dialog box)

Note

While the control panel is active and S7T Config has control priority, only configuration data that become immediately active can be changed.

If configuration data that require a RESTART are changed, control priority must be returned beforehand. The control priority must be requested again after the RESTART



Warning

Use the axis control panel only in the commissioning or testing phases.

8.9.2 Starting the axis control panel

Make sure the following conditions are satisfied:

1. The axis is configured.
2. S7T Config is in online mode.
3. The technology was downloaded to the target system.

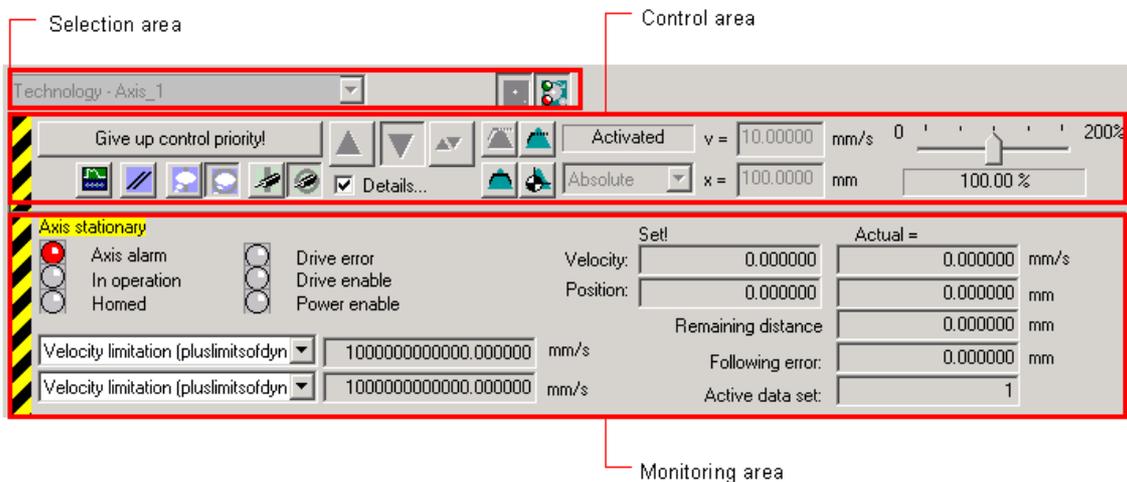
To start the axis control panel, proceed as follows:

1. In the project navigator, open the "AXES" folder.
2. Select an axis.
3. Select **Edit > Open object**.
4. Select **Axis > Control panel**.

The "Control panel" tab appears in the detail view. The control panel is in monitoring mode.

8.9.3 Layout of the axis control panel

The axis control panel is divided into several different areas:



Axis control panel (the control panel is in control mode)

- **Selection area**

Click the relevant buttons to show or hide specific areas.

In monitoring mode, you can select the axis. All axes configured in the technology are available for selection.

- **Control area** (hide or show by means of the button )

In this area, you can assume control priority over the selected axis and send motions commands to it.

In monitoring mode, only the "Trace Editor" button is enabled.

- **Monitoring area** (hide or show by means of the button )

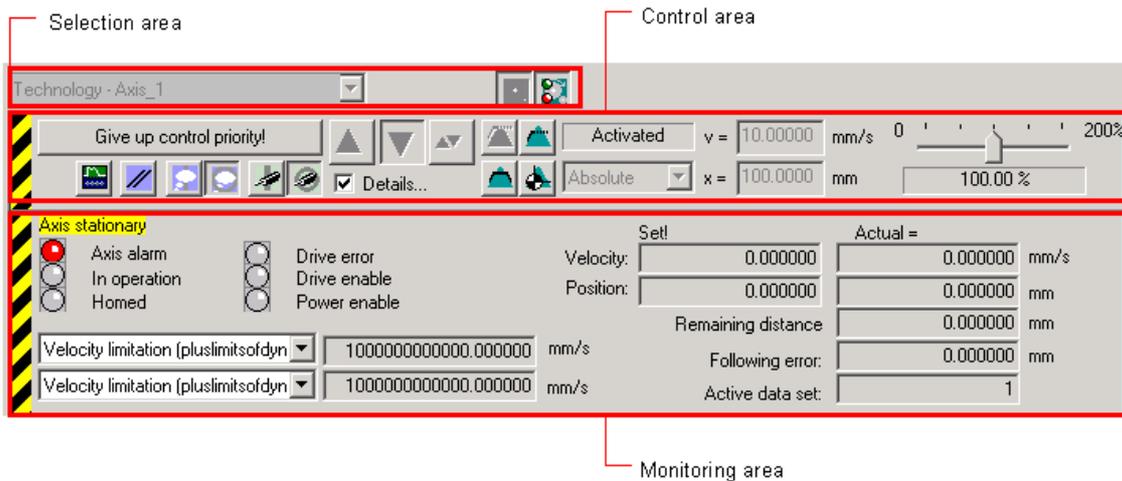
You can monitor the data for the axis you have selected in this area:

- in monitoring mode:
You can test motions initiated in the user program.
- in control mode:
You can test motions which have been triggered by commands to the axis.

8.9.4 Using the control panel to monitor axis values

You can use this area in the monitoring mode and control mode to monitor values of the selected axis:

- In monitoring mode (e.g. directly after the control panel is started):
You can, for example, test the traversing motions initiated by a program.
- In control mode (after control priority has been assigned to panel):
You can test traversing motions sent to the axis as motion commands.



Monitoring area of the control panel

The display is determined by the technology of the selected axis (velocity-controlled, positioning axis or synchronized axis):

- Velocity setpoint and actual value,
- Position setpoint and actual value,
- Distance to go,
- Offset error,
- Two further variables you can select from the drop-down list.

The motion status of the axis will be displayed in a colored text field, e.g. axis stationary, axis accelerating, etc.

Color "LEDs" keep you informed of:

- Alarms and axis enabling signals:
 - Active technological alarm (red). Select the "Alarms" tab in the detail view for more information.
 - In operation (green). This "LED" shows whether following mode is canceled; axis commands can be executed only in this state.
 - Axis is homed (green).
- Monitoring functions and enabling signals of drive:
 - Drive error (rot)
 - Drive enabled (green)

- Power unit enabled (pulse enable - green)

8.9.5 Assume control priority

Make sure the following condition is satisfied:

- The Technology CPU is in STOP.
- In a STEP 7 variable list, set **Variable > Enable Peripheral Outputs**.



Warning

You must observe the appropriate safety regulations.

Use the axis control panel in control mode only with the PG / CPU lifesign monitoring function activated with a suitably short monitoring time!

Otherwise, if problems occur in the communication between the programming device and the technology CPU, the axis may start moving in an uncontrollable manner.

Procedure:

1. In the control area, click "Assume control priority !".
A warning box appears.
2. Read the warning message in S7T Config!
3. Do not make any changes to the defaults for lifesign monitoring.

Changes should only be made in special circumstances and in observance of all danger warnings.

4. Check and change the emergency stop setting as required
 - To do so, click "Expand>>".
 - For reasons of safety, you should always set the "Emergency-Stop when changing to another Windows application" check box. The monitoring function is here irrelevant.
 - Set the key that triggers the emergency-stop signal.
<Spacebar>
<ESC>

The control panel is in control mode after receiving the control priority. The previously grayedout buttons and fields in the control area are now active.

Warning

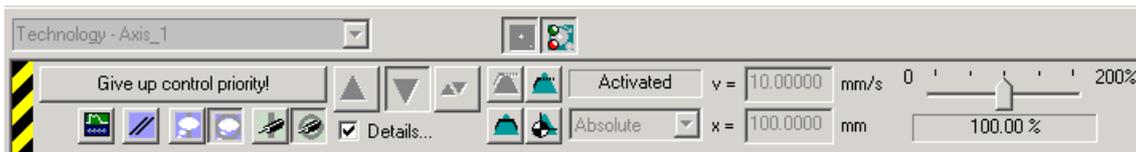
When the control panel is in control mode, a space bar signal will be interpreted as a control signal to stop the axis. This also affects other applications running on the programming device (word processors, for example). If you assign the space bar to the emergency-stop function, it is no longer available for word processors.

8.9.6 Controlling the axis

Make sure the following conditions are satisfied:

- The axis control panel is in control mode.
- The control panel takes control priority.

The buttons in the control area are active.



Control area of the axis control panel

Control elements in the control area of the axis control panel:

Command	Control element	Description
Set / reset enable signals		This command switches the enabling signals on the axis. The states: <ul style="list-style-type: none"> • Drive enabled • pulses (power section enabled) enabled are indicated by the corresponding "LEDs" in the monitoring area. To permit the motion commands to be processed at the axis, all enable signals must be assigned and the followup mode canceled. Position controller enable is ignored in the case of velocity-controlled axes.
Details	check box	When this box is set, some of the commands open a separate parameter input box. When this check box is reset, you can enter selected parameters in the adjacent input boxes.
Velocity-controlled axis motion		This command specifies that the axis must start in velocity-controlled mode. A velocity setpoint is preset to which the axis can accelerate along a set velocity ramp. The command can be issued for all axis types. Positioning and synchronization axes are operated in velocity-controlled mode. You start the axis starts by clicking "Start" or "Jog".
Position-controlled axis motion		This command specifies that the axis must start in position-control mode. A velocity setpoint is preset at which the axis can accelerate along a set velocity ramp. The command can be issued for all positioning and synchronization axes. Start the axis starts by clicking "Start" or "Jog".
Relative / absolute positioning		The command positions the axis (positioning or synchronized axis). You can enter an absolute or relative position value. Modulo axes can also be positioned along the "shortest path". You start the axis by clicking "Start".

Command	Control element	Description
Axis homing		If you are using an absolute measuring system, you need only home the axis once during commissioning. Once you have done this, the position value is available when you switch on the machine. If an incremental measuring system is installed, you will need to home the machine every time it is switched on. You start the axis by clicking "Start".
-	Input boxes	Input boxes for entering the position and velocity setpoint values, when the "Details" check box is reset
Speed override	Slider	The specified velocity is multiplied by the set override factor (0 - 200 %). After the control panel is started, the value is set to 100 for reasons of safety. The value is used for all subsequent commands.
Simulation On		This command switches the axis into simulation mode. Setpoint output is suppressed.
Simulation Off		This command switches the axis from simulation mode into normal operation. The setpoint last valid in the simulation is activated for output. Warning: The drive is disabled while you are running a simulation. Hence, the axis may perform an adjusting movement when you close simulation mode. You can avoid these adjusting motions by running the axis to its initial position while you are still in simulation mode.
Reset axis		The axis is switched to its initial state. You should use this command if the axis has reached an undefined state as a result of a configuration error.
Start motion		The motion command last configured (Velocity preset, Start axis positioncontrolled, Position axis or Home axis) is started.
Stop motion		The motion last started is stopped again.
Jog mode		The motion commands Velocity preset and Start axis position-controlled can also be executed in jog mode. The motion continues as long as you keep the right button pressed and the cursor positioned on the button.
Execute trace recording		Starts the TraceTool.

Warning

Please take all the specified safety measures before starting up the axis!

To move an axis using the axis control panel:

1. Click "Details".
2. Click "Enable axis".

Check that all enabling signals have been set and followup mode canceled in the displayed window. Confirm with "OK".

3. Click the button of a motion command (Velocity preset, Start axis position-controlled, Position axis or Home axis).

In the next dialog box, enter the parameters. Confirm with "OK".

4. Set override at the "Speed Override" shift register to an acceptable value.
5. Click "Start".

The axis starts to move.

While the axis is moving, you can alter the velocity override factor.

6. To stop the motion, click "Stop" or press the space bar.

You can continue the movement by clicking "Start."

7. Repeat steps 3 to 6 as required.

Note

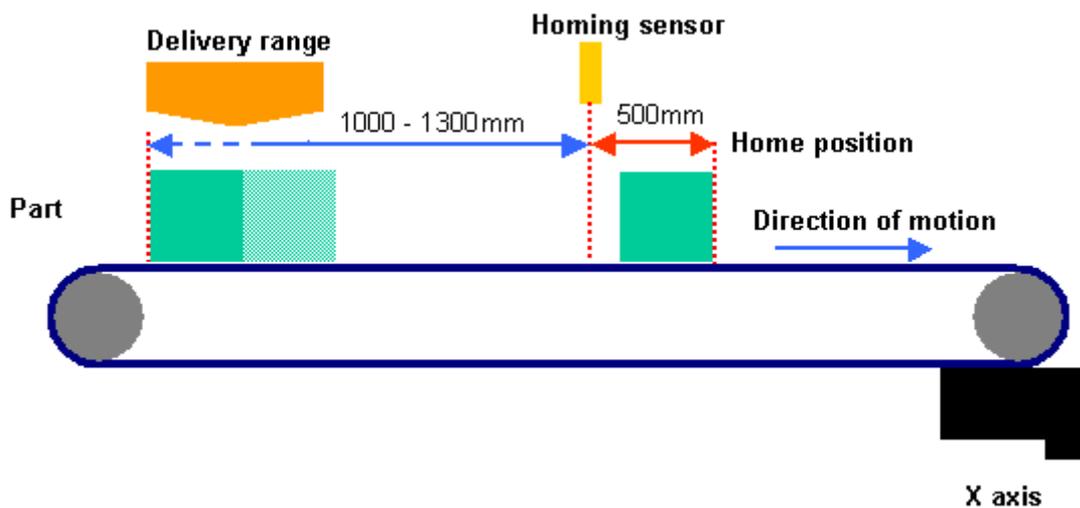
When using the "Velocity preset" and "Start axis positioncontrolled" commands, you can also start the motion by clicking "Jog." Keep the left mouse button pressed while the motion is to continue. The motion stops when the mouse button is released.

You can also stop the axis by pressing the space bar.

A Appendix

A.1 Application samples

A.1.1 Example of "Positioning with target sensor"



The example shows a typical application for positioning objects on a conveyor.

A part is transported on the conveyor and positioned at an explicit end position. The delivery range is variable, so that the current position of the part is not definite at the start.

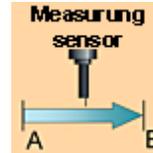
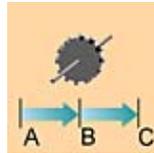
To help approach the target position with sufficient accuracy, a target sensor is installed 500 mm away from the end position. The digital input of the target sensor signal is located on the drive. At the time of detection, the current position value of the conveyor is set to 500 mm. The integrated technology of the Technology CPU ensures, that the position of the part is saved via the measuring sensor input virtually without any delay. The current position is thus precisely defined, and positioning can be completed with a high degree of accuracy.

Technology objects

In S7T Config, you configure the technology objects used to control the conveyor drive and the target sensor. Technology objects used in this example:

Technology objects

- Positioning axis (conveyor)
- Measuring sensor (target sensor)

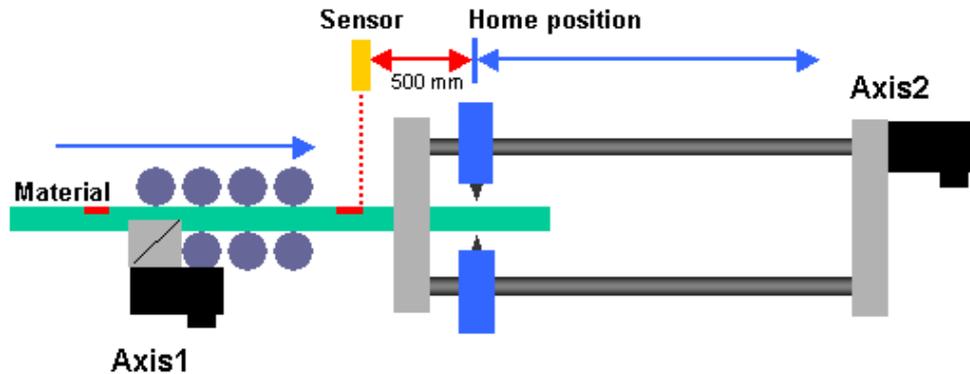


Technology functions

The task is solved in the user program by calling the following technology functions at the FBs:

	Technology function	Task / description
1.	MC_Power	Enable axis
2.	MC_MeasuringInput	Enabling and configuring the measuring sensor (target sensor)
3.	MC_MoveVelocity	Moving the axis at a preset velocity
4.	MC_Home	After the target sensor is detected, the position value is corrected (actual position value - position of the target sensor). This assigns the position a zero value at the time the target sensor is detected.
5.	MC_MoveAbsolute	Moving the axis to the absolute position of 500 mm.

A.1.2 Example of "Flying shears"



The example shows a typical application for cutting the continuously produced material to length.

The incoming material is conveyed by the feed axis (Axis 1) in a continuous motion, and cut to length "on the fly" by the severing axis (Axis 2).

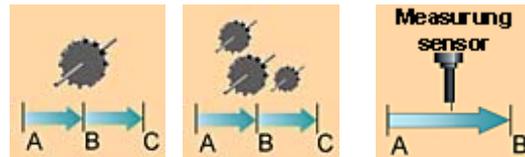
The marks on the surface of the material identify the severing points. A sensor detects the mark, and sets the process value of the feed axis (Axis 1) to -500 mm. This sensor signal also triggers synchronization of the shearing axis. During axis synchronization, the shearing blade approaches the mark. The material is cut after the shearing axis is synchronized. Finally, the flying shears are returned to home position, waiting for the next mark.

Technology objects

You configure the technology objects in S7T Config. Technology objects used in this example:

Technology objects

- Positioning axis (feed axis)
- Synchronization axis (severing axis)
- Measuring sensor (sensor)

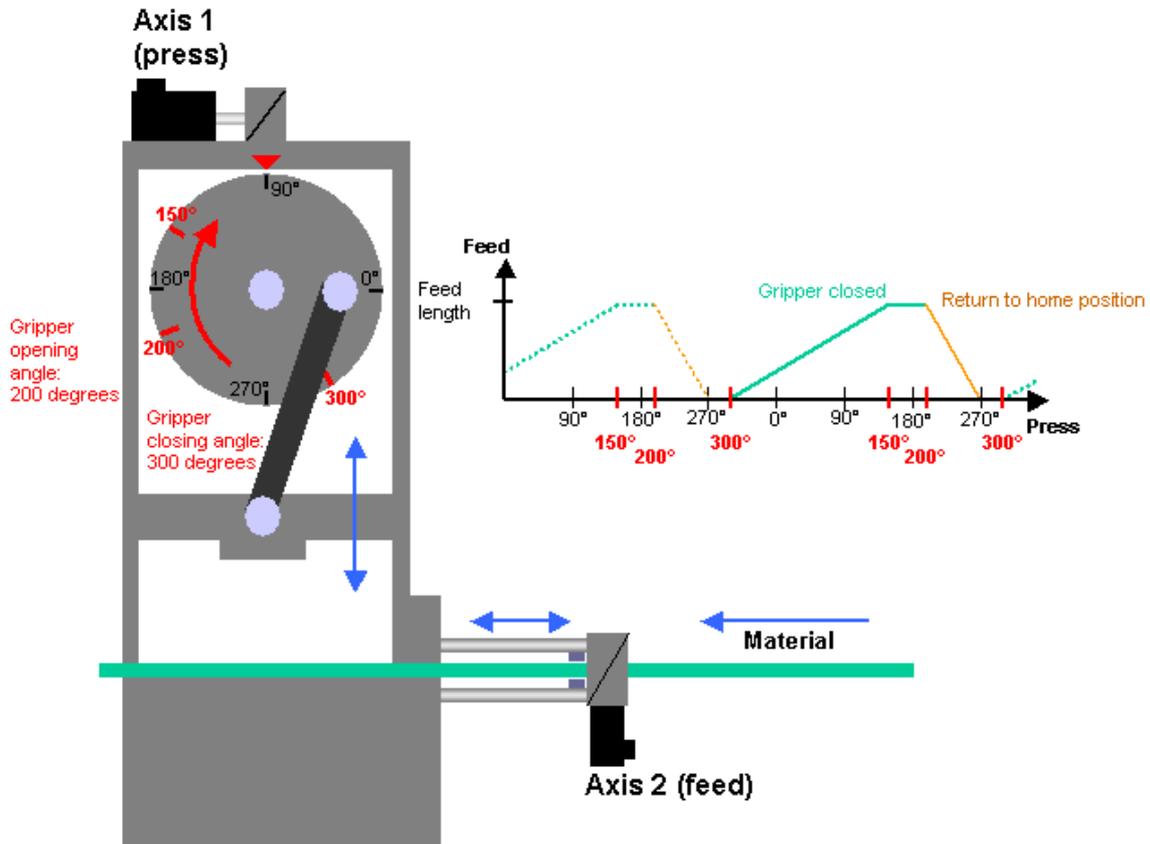


Technology functions

The task is solved in the user program by calling the following technology functions at the FBs:

	Technology function	Task / description
1.	MC_Power	Enable feed axis
2.	MC_Power	Enable shearing axis
4.	MC_Home	Homing of the shearing axis to the basic position at 0 mm
5.	MC_MeasuringInput	Enabling and configuring of the measuring sensor (sensor)
6.	MC_MoveVelocity	Moving the feed axis at a preset velocity
7.	MC_Home	When the sensor detects the mark, the position value of the feed axis is set to -500 mm. MC_Home in Mode 4 (position adjustment): $X_{actual} = X_{actual} - \text{"measuring sensor position"} - 500 \text{ mm}$
8.	MC_GearIn	The sensor detects the indentation mark and initiates synchronization of the severing axis
9.	MC_GearIn	When the "InGear" (gears in synchronism) return value is received, the material is severed off
10.	MC_MoveAbsolute	The shearing axis returns to home position
		Further cyclic execution at steps 5 to 10

A.1.3 Example of "Gripper feed"



The example shows a press to which the material is fed by means of a gripper feed mechanism.

At the angular position of 300°, the gripper closes and moves the material up to the angular position 150°.

The gripper remains closed during the press operation and opens again at 200°.

The gripper feed returns to its home position, starting at angular position 200°, up to angular position 270°.

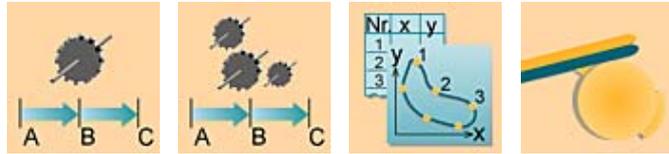
The motion of the feed axis is directly proportional to the rotary movement of the die axis. Because of this, the feed axis is coupled to the die axis by means of a cam disk technology. The opening (at 200°) and closing (at 300°) movement of the gripper tool is controlled with the help of a cam switching function.

Technology objects

You configure the technology objects in S7T Config. Technology objects used in this example:

Technology objects

- Positioning axis (die axis)
- Synchronization axis (feed axis)
- Cam disk (for coupling the feed axis to the die axis)
- Cam (for controlling the gripper function)



Technology functions

The task is solved in the user program by calling the following technology functions at the FBs:

	Technology function	Task / description
1.	MC_Power	Enable feed axis
2.	MC_Power	Enable die axis
3.	MC_Home	Homing the die axis in angular position 0°
4.	MC_Home	Homing the feed axis in basic position
5.	MC_CamIn	Couples the feed axis to the die axis via cam disk
6.	MC_CamSwitch	Setting up a positioning cam for controlling the gripper function
7.	MC_MoveVelocity	Moving the die axis at a preset velocity
		Current production process
		Press shutdown:
a.	MC_MoveAbsolute	Running the die axis to angular position 0°
b.	MC_Halt	"Normal stop" feed axis
c.	MC_Halt	"Normal stop" die axis

A.2 FAQs, Tips & Tricks

A.2.1 How to use the new performance features for older Technology CPUs

Query:

How to use the performance features described is found in "What's new in S7-Technology V2.0."

Answer:

Measures to be taken in order to allow the use of the new performance features in older Technology CPUs:

- Upgrade of the Technology CPU firmware at least to V2.3.
- Upgrade of the firmware of the integrated technology at least to V3.1.
- Convert the technology.
- Create new technology DBs.
- Download the new user program, HW configuration, technology and the firmware of the integrated technology to the Technology CPU.

Note the different HW versions of CPU 317T. The HW versions differ in the memory configuration of the integrated technology. For further information, refer to the CPU Data:CPU 317T-2 DP manual, chapter 6.6 "Memory in the integrated technology of the CPU".

Caution

Create a backup copy of your project data before you start the upgrade.

Carry out the checks and tasks described below, according to the given step sequence.

Upgrading the Technology CPU firmware

Upgrade the firmware of the Technology CPU if the current version is V2.3 or older. You should therefore verify the current firmware version.

You update the Technology CPU firmware from a Micro Memory Card.

Components required:

- A programming device / PC with STEP 7 Basis and Micro Memory Card adapter.
- A Micro Memory Card with a minimum capacity of 8 MB.

You can download the current firmware update from our Internet Service & Support pages:

<http://www.siemens.com/automation/service&support>

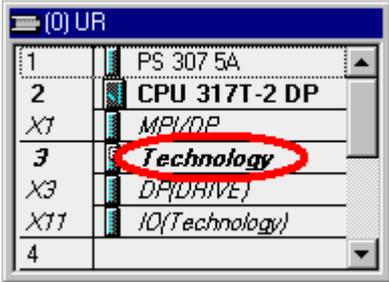
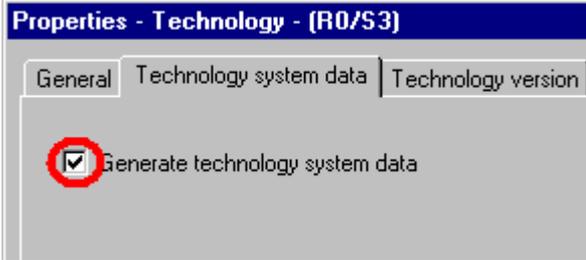
In SIMATIC Manager, select **PLC > Update Operating System**. For details on procedures, refer to the STEP 7 Online Help.

Upgrade the firmware of the integrated technology

Upgrade the firmware of the integrated technology, if the current version is V3.1 or older. Start by verifying the current firmware version.

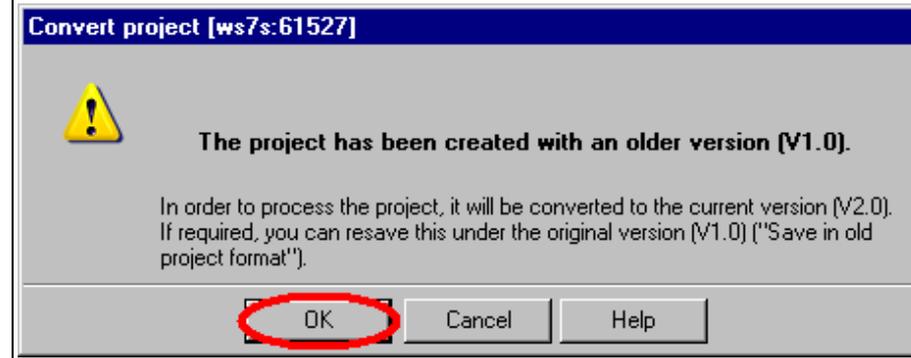
To upgrade the firmware:

1.	Open HW Config.
2.	From the hardware catalog, select the "SIMATIC Technology CPU" profile.
3.	Open the folder as shown in the figure below, or drag-and-drop the component "V2.3/3.1" to the CPU.
4.	Click "Yes" on the dialog box to confirm replacement of the component.

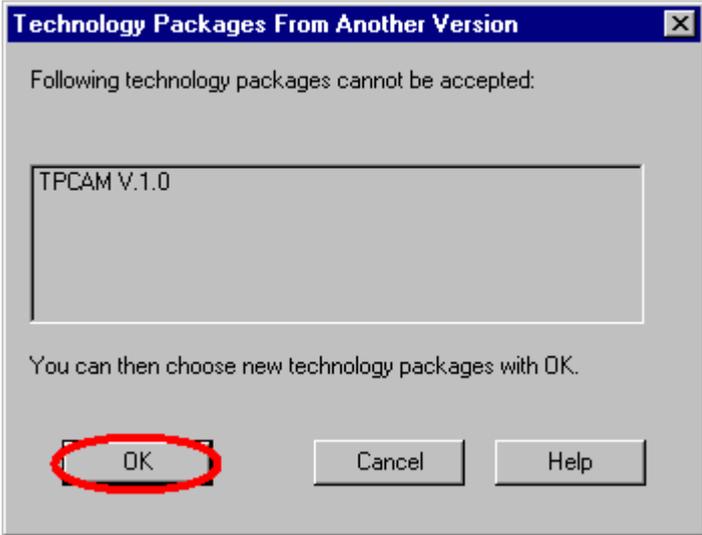
5.	<p>Double-click "Technology" of the Technology CPU.</p> 
6.	<p>The "Properties - Technology" dialog box opens. On the "Technology system data" tab, set the "Generate technology system data" check box.</p> 
7.	<p>Click "OK" to close the "Properties - Technology" dialog box.</p>
8.	<p>Select Station > Save.</p>
9.	<p>Close HW Config.</p>

Converting the technology

To convert the technology:

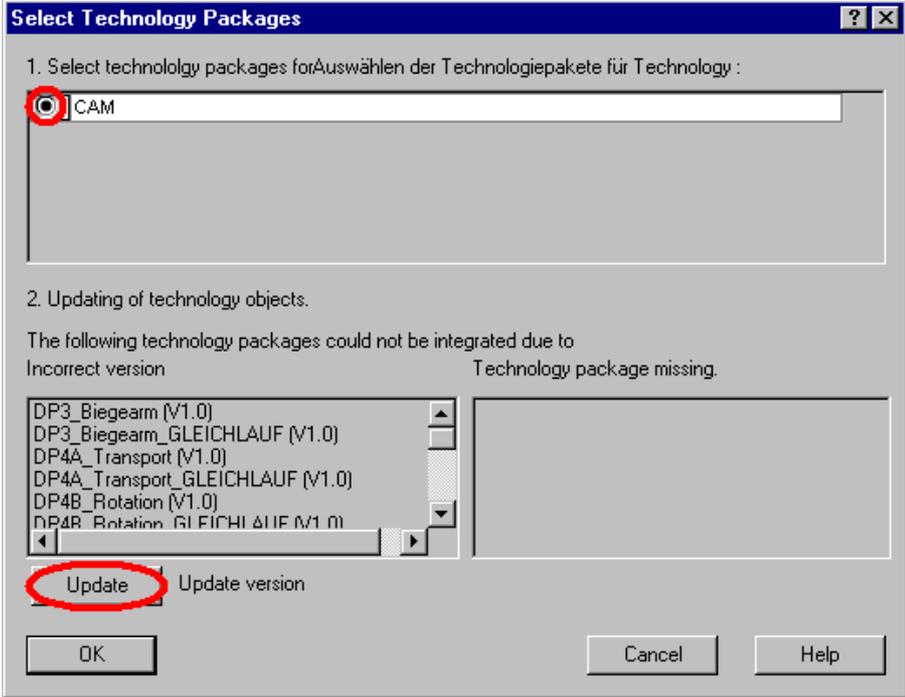
1.	<p>In SIMATIC Manager, select "Technology objects", then select Options > Configure technology</p>
2.	<p>S7T Config opens in a message window.</p>  <p>Confirm the message with "OK." The project is now converted. Next, the system automatically saves and compiles the project. Warning and error messages may be generated because of the incomplete upgrade operation. Ignore such warnings and errors and confirm the message box with "OK."</p>
3.	<p>Select the technology from the Navigator, then select Edit > Select technology packages.</p>

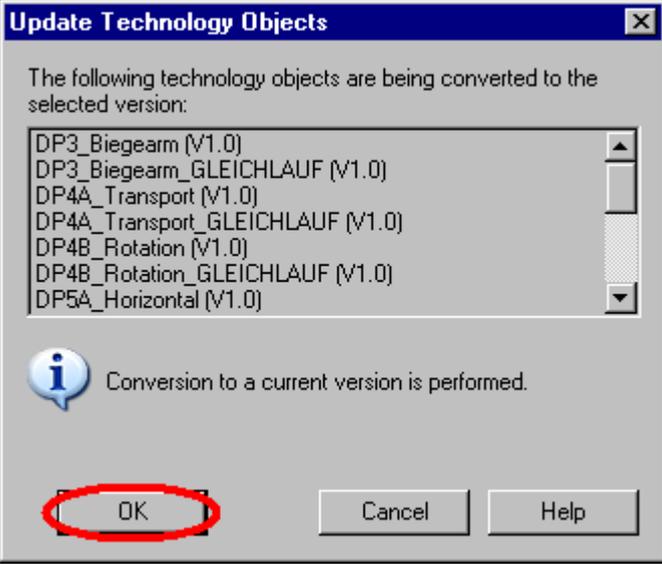
4. Confirm the message box with "OK."

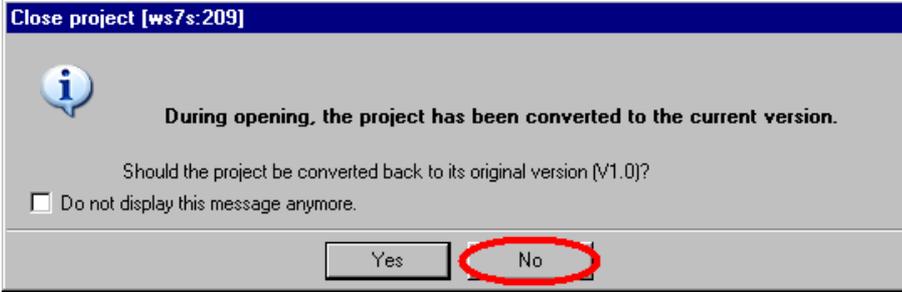


The "Select technology packages" dialog box opens.

5. Select the "CAM" technology package, and confirm by clicking "Update."

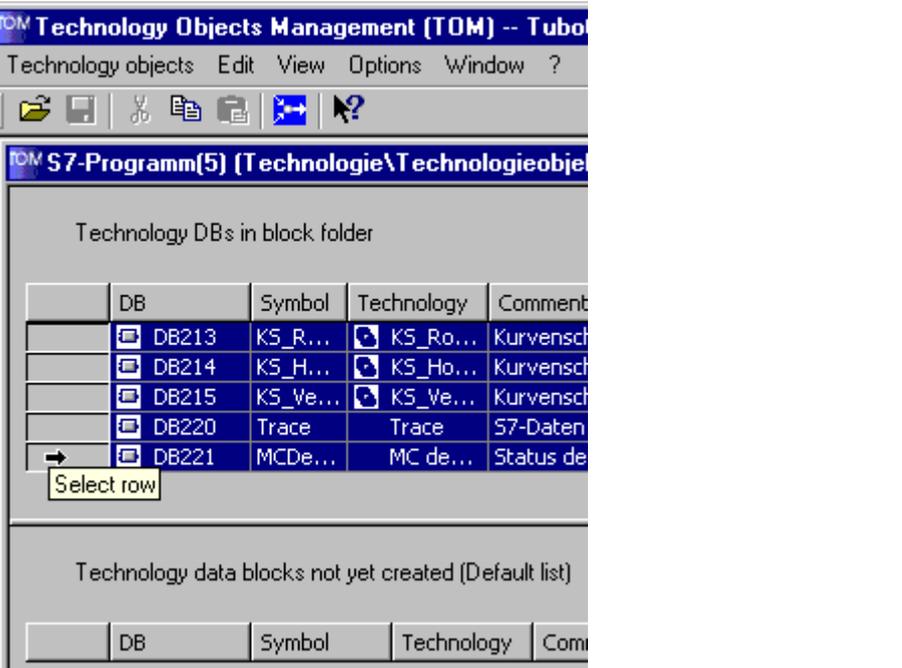


6.	<p>Confirm the message box with "OK."</p> 
7.	<p>Confirm the next message with "Yes." The system updates the technology packages.</p> <p>Note</p> <p>The conversion changes the units at some of the system variables. For this reason, the detail view of S7T Config outputs warnings during conversion, indicating that some of the system variables ("<i>userdefaultqfaxis.maxderivative.foutput</i>", for example) could not be set.</p> <p>You may ignore these warnings, because the Technology CPU does not use these system variables</p>
8.	<p>Confirm the "Update of technology objects completed" message with "OK".</p>
9.	<p>Close the "Select technology packages" dialog box with "OK."</p>
10.	<p>Select Project > Save and compile all.</p>
10a.	<p>Continue with step 10b if errors are indicated.</p> <p>Continue with step 21 if no errors are indicated.</p>
10b.	<p>Select Project > Check consistency to localize the errors.</p> <p>Note</p> <p>Possible causes of the error messages:</p> <ul style="list-style-type: none"> • The value of the <i>TypeOfAxis.NumberOfEncoders.Encoder1.DriverInfo.EncoderNumberOnDevice</i> configuration parameter is not 0 for axes and external encoders. <p>Exception: an external encoder returns an additional actual value for the axis. The condition is here the use of standard telegrams 4 or 6, or 103, 104, or 106.</p> <p>To correct or avoid errors: Set the configuration parameter value "0".</p> <ul style="list-style-type: none"> • At speed-controlled axes, the value at configuration parameter <i>TypeOfAxis.NumberOfDataSets.DataSet_1.EncoderNumber.EncoderNumber</i> is not "0". <p>To correct or avoid errors: Set the configuration parameter value "0".</p>

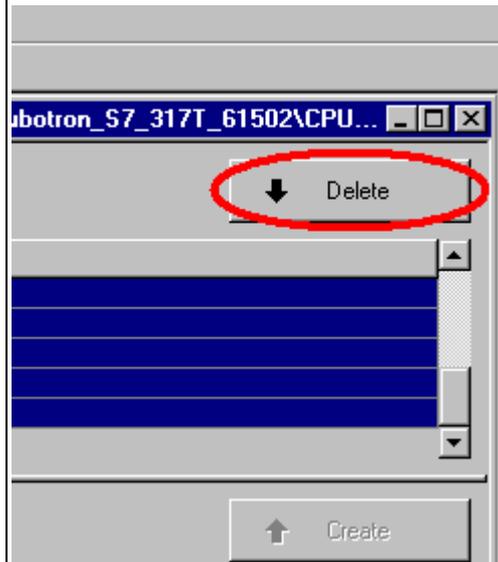
10c.	Eliminate the causes of error, and continue with step 10. You can also save the project with Project > Save , and the continue with step 11 to eliminate the causes of error at a later time.
11.	Close S7T Config.
12.	<p>A dialog box appears when you close S7T Config.</p>  <p>Confirm it with "No."</p>

Creating new technology DBs

To create new technology DBs:

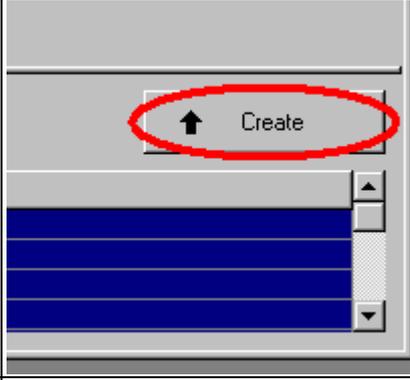
1.	Run Technology Objects Management.
2.	<p>Select all existing technology DBs.</p> 

3. Next, click "Delete."



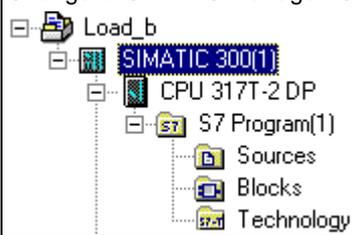
After this deletion, all technology DBs are selected in the area of the technology DBs which are not generated yet.



4.	<p>Click "Generate" in order to generate the technology DBs with a new structure.</p> 
5.	<p>Close Technology Object Management.</p>

Download all configuration data to the Technology CPU

The conversion is finalized by downloading the user program, HW configuration, technology and the firmware of the integrated technology to the Technology CPU.
 Procedure:

1.	<p>Change to SIMATIC Manager. Select the relevant SIMATIC station in your project.</p> 
2.	<p>Select PLC > Download.</p> <p>The Technology CPU automatically resets memory after the download.</p>
	<p>The new performance features are available after you completed the download.</p>

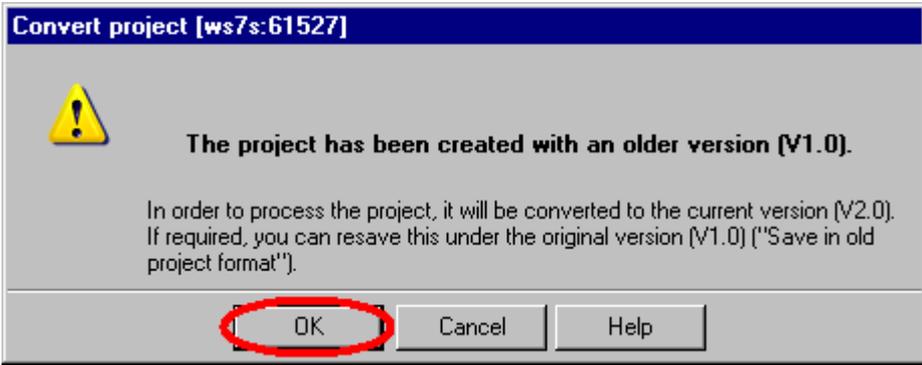
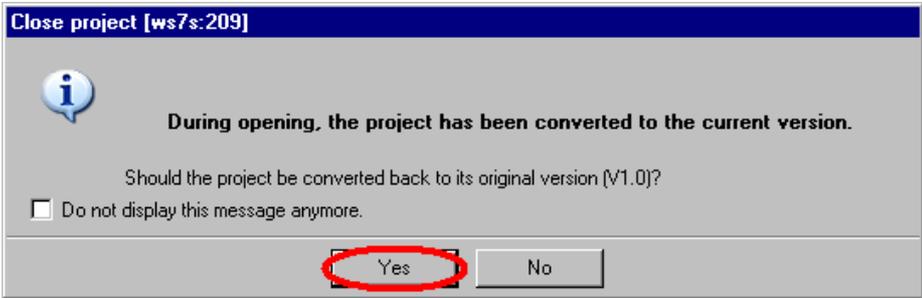
A.2.2 How to edit a V1.0 project with S7-Technology V2.0

Query:

My current project was created with SIMATIC S7-Technology V1.0. Can I maintain compatibility with S7-Technology V1.0 when I edit the project in S7-Technology V2.0?

Answer:

Yes, you can edit the project and maintain compatibility with S7-Technology V1.0 as shown below. Procedure:

1.	In SIMATIC Manager, select "Technology objects", then select Options > Configure technology
2.	This dialog box appears when S7T Config opens: 
3.	Confirm the message with "OK." (You can reconvert the project after you close S7T Config.)
4.	Make your relevant changes.
5.	Select Project > Save and compile all.
5a.	Open Technology Objects Management (double-click "Technology objects" in SIMATIC Manager) if you have added or deleted technology objects. Continue with step 6 if you have not added or deleted any technology objects.
5b.	Create or delete the corresponding technology DBs as described in "Creating and managing technology DBs".
5c.	Close Technology Objects Management.
6.	Close S7T Config.
7.	The dialog box shown below opens when you close S7T Config: 
8.	Confirm with "Yes" to allow further editing of the project in S7-Technology V1.0.

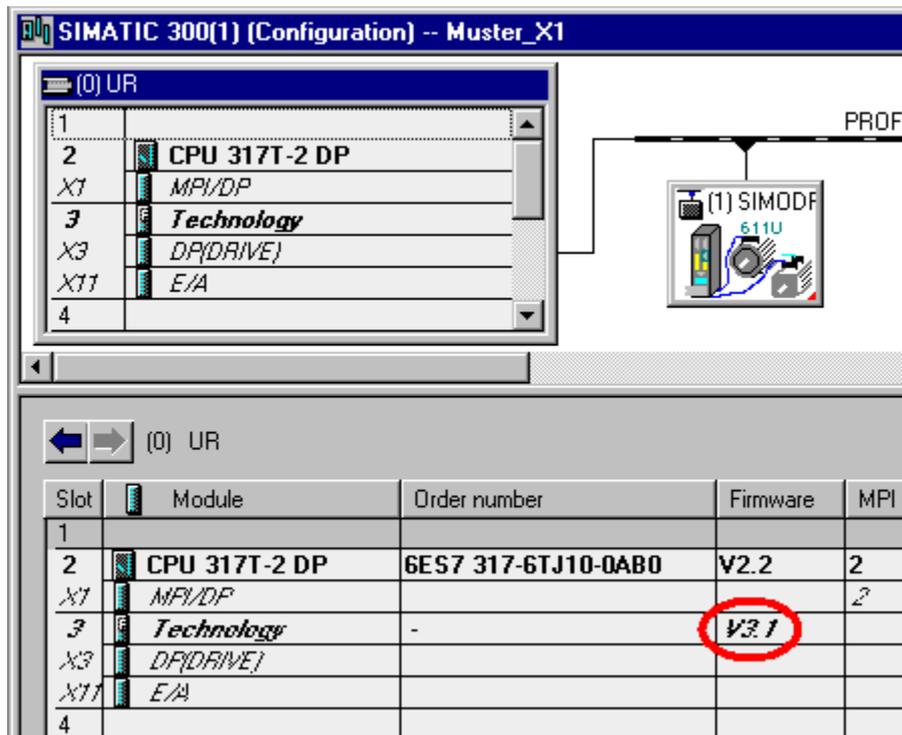
A.2.3 How to recognize the firmware version of the integrated technology

Query:

In many sections of this documentation your attention was drawn to the fact that the functions apply only to a specific firmware version of the integrated technology. How to recognize the current firmware version of the integrated technology of the system

Answer:

Open HW Config. The "Technology" entry shows you the current firmware version of the integrated technology.



Open HW Config in Online mode if you are uncertain of the consistency between project data and online data.

A.2.4 Why do some system DBs have a different online / offline time stamp?

Query:

Some of the SDBs in the project have a different time stamp than the SDBs in the technology CPU.

Does this time stamp difference represent a problem?

Answer:

When you download the technology in S7T Config to the Technology CPU with **Target system > Download > Technology to target system**, the downloaded SDBs of the type 3311 are assigned the time stamp of the integrate real-time clock of the CPU. A different time stamp as such does not present a problem at the moment.

The SDBs of the type 3311 are assigned the time stamp of the integrate real-time clock of the CPU at the time of their download. Hence, it may well be the online / offline SDBs have a different time stamp, but are not different by contents. If the online view of S7T Config marks all drives "green", you can presume that your technology configuration is consistent.

Note

When "Automatic summertime/wintertime" is set in Windows, the time stamp of the system data shows an additional hour in the summertime.

A.2.5 Why does the number of system DBs differ in the online and offline view?

Query:

The online view of the Technology CPU shows more system DBs of the type 3311 than the project view. Does this difference represent a problem?

Answer:

When you download the technology in S7T Config to the CPU, the system generates additional SDBs of the type 3311 and assigns these a different time stamp.

You can use S7T Config to compare the online and offline data. If all objects appear in green color, these are identical.

When you download system data with STEP 7 or HW Config, the online / offline comparison does not return any differences.

A.2.6 STEP 7 reports "Out of memory space"

Query:

During the download of blocks to the Technology CPU, STEP 7 outputs the message "The memory space in the module is not sufficient. Do you want to compress the load memory?". The message persists after you compressed the data and sufficient work memory is available.

Answer:

The cause of this message may be:

- The Technology CPU contains "orphan" technology DBs which are not listed in your project. You can identify technology DBs based on the creation language "TechObj".

To perform a corresponding check, open SIMATIC Manager and select **View > Details**.

Delete all obsolete technology DBs from the Technology CPU.

A.2.7 The CPU goes into STOP sporadically as a result of time-out

Query:

You have tuned the system cycles; when operating in continuous mode, however, the CPU sporadically goes into STOP because of a time-out at the integrated technology.

Answer:

The system load on the integrated technology fluctuates, based on the command volume and possibly occurring errors. Short system cycles may lead to time-out at the integrated technology and, thus, to CPU STOP.

If this happens, extend the system cycles, so that the system does no longer respond with time-out errors over a longer period of time.

A.2.8 Errors occur when the "Save and compile all" function is executed for the technology data

Query:

Errors occur when the "Save and compile all" function is executed for the technology data in S7T Config But I have only applied the default parameter values?

Answer:

For reasons of safety, all safety- and function-relevant parameters or addresses are assigned default values in S7T Config, so that the "Save and compile all" function can not be executed.

This is why you should always exercise due care when setting safety- and function-relevant parameters, and then verify their values and logical context.

A.3 Expert list in S7T Config

A.3.1 Using the Expert list

We assume you are familiar in handling the Expert list in S7T Config before you work through the settings described in the chapters below. The Expert list in S7T Config provides read / write access to all configuration data and system variables of a technology object. These also include those data that can not be set in the wizards and in the parameter assignment windows.

Expert lists are available for all configured technology objects.



Caution

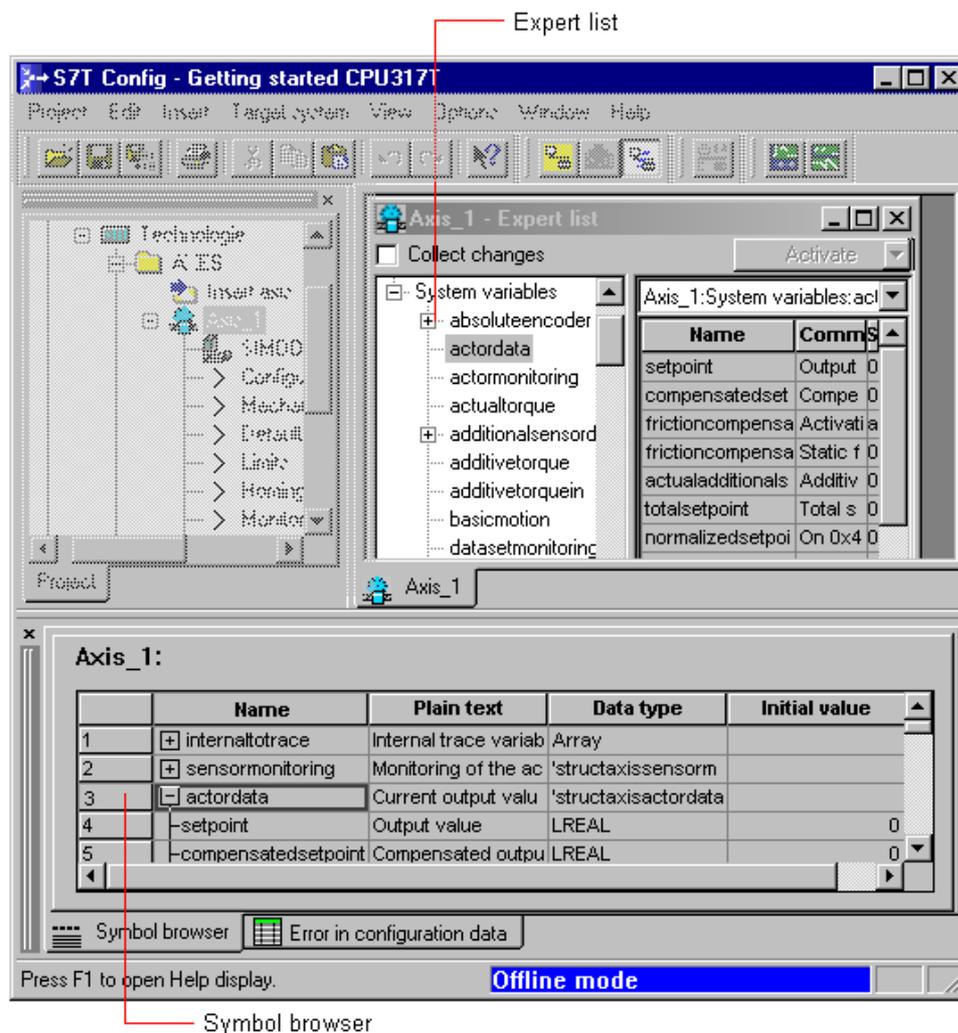
The expert mode is intended for the experienced user. Wrong input may result in uncontrolled response of the drive!

The system does not check the plausibility of your entries.
Wrong input may lead to inconsistency of the technology object.

Calling the expert list:

1. In the navigator, select the technology object (axis, for example) of which you want to view or edit configuration data or system variables.
2. Select **Expert > Expert list** from the shortcut menu.

The Expert list opens in the working area.



The left pane of the Expert list shows the tree structure of the system variables and configuration data. The right pane shows a table of system variables and configuration data.

Mark an element in the tree structure to show the associated parameter values in this table.

Values requiring a restart, and all subsequently changed configuration data, are indicated in brown color until you have performed the restart.

Click the value you want to edit. Type in a new value or select a symbolic name (grayed out values can not be edited.) Save your changes with ENTER. Set the "Collect changes" check box to change a group of values. Make your changes, then confirm your entries by clicking "Activate". All your changes will be saved.

Effect of ONLINE changes

- Modified system variables come into effect instantaneously.
- Changes in configuration data come into effect according to the setting in the "Effectiveness" column.
 - "instantaneous"
Values are confirmed and are applied by pressing RETURN or clicking "enable."
 - "restart"
Values do not come into effect until the next restart of the technological object with the technology function "MC_Reset."
 - "download"
Values can not be changed in online mode. Change to OFFLINE mode, make your changes and then download the technology delta to the PLC.
- Changes to system variables and configuration data are retained when the Technology CPU changes from STOP to RUN.
- Changes to system variables and configuration data are non-retentive, i.e. they are lost after power has been cycled.

In the Navigator, select the technology, then select **Target device > Copy current data to ROM** to save your changes in configuration data to retentive memory.

To store the values permanently in your project data, you need to apply your changes in OFFLINE mode, save and compile the technology data and download these to the destination device. You can also upload the deltas to the project data of the technology by executing the **PLC > Upload > Configuration data to PG**. Next, select **Technology > Save and compile all** to save and compile the technology.

Effect of OFFLINE changes

- OFFLINE changes affect only the technology project data. To apply these changes to the Technology CPU, select **Technology > Save and compile all** to save and compile the data, then select **PLC > Download > Technology to PLC** to download these data to the PLC.

A.3.2 Axis settings

A.3.2.1 Commissioning the position controllers of positioning axes

The position controller should be tuned in order to avoid overshoot of the positioning axis during positioning. Procedure:

Requirements

- The axis is configured, except for the acceleration limits and the controller settings.
- Commissioning guidelines for tuning without overshoot are provided.
- The cascaded control loops are commissioned, and the velocity control loop is overshoot-free by means of feed-forward control.

Commissioning the P-controller with feed-forward control

1. Apply step velocity changes in the position controller (about 10 % of v_{max}). Observe the current. It must not reach the limit. Remedy: Reduce the step amplitude.
2. Change the K_v coefficient in the axis screen form for position control until the actual velocity value no longer overshoots at the point of transition, and then **note** this setting.
3. Set the following tuning values: K_v to **0.00 ... 1**, enable velocity pre-control and set the rating to 100%.
4. Apply the velocity step changes to the position controller once again; see item 1.
5. Compare the setpoint and process values, based on the Trace recording:
The setpoint is found in **Technology > Technology object > [Axis name] > servodata.symmetricServoCommandVelocity**
The actual value is found in **Technology > Technology object > [Axis name] > sensordata...[1].velocity**.
6. Align the qualitative profile of both curve profiles by changing the velocity controller time constants when you configure the axis
(see the Experts list:
TypeOfAxis.NumberOfDataSets.DataSet_x.DynamicData.velocityTimeConstant or position control > Expert mode > Dynamic controller data).
Note: Dead-time in the position control cycle or an offset in the display is runtime-relevant and does not have to be compensated for.
7. Reset K_v to the **previously determined** value at which the transition process no longer overshoots.

Note:

The following error can not reach zero with dimensioning without overshoot in the constant travel phase.

The balancing filter which is configured based on the velocity controller time constant can only be set correctly for time constants greater than the position controller cycle.

The following **substitution strategy** for displaying the drive model applies to **high-speed drives**:

- **Substitution velocity controller > position controller cycle/2**

The balancing filter is represented by the dead-time element of a position controller cycle.

- **Substitution velocity controller position controller cycle/2**

Velocity controller timebase = 0; the balancing filter has no effect. A feed-forward strategy with no balancing filter is implemented.

A.3.2.2 Assigning interpolator cycle 2

Axes and external encoders are always processed within the interpolator cycle. Lower-priority axes and external encoders can also be assigned interpolator cycle 2. Operation of all interconnected technology objects must be based on the same cycle.

Note

The interpolator cycle may not be assigned online!

"Save and compile all" the technology and download the system data to the technology CPU in the SIMATIC Manager.

1. In the S7T Config Navigator, select the corresponding axis or external encoder
2. Select **Expert > Experts list** from the shortcut menu
3. In the *Execution.executionlevel* configuration data, you can select interpolator cycle 2 ("IPO_2").

A.3.2.3 Torque settings

The FBs MC_SetTorqueLimit and MC_MoveToEndPos (not with detection based on following error) can be used to reduce the torque of the drive motor. The torque is specified in N/m. The reference torque of the motor is set in the "TypeOfAxis.SetPointDriverInfo.DriveData.maxTorque" configuration data.

Percentage of reduction

To override the absolute value with a torque reduction percentage, set the reference torque to 100.0 N/m:

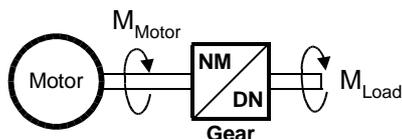
Configuration data: *TypeOfAxis.SetPointDriverInfo.DriveData.maxTorque = 100.0* N/m

When you set the parameter *MaxTorque = 25.0* at the call of MC_SetTorqueLimit, the maximum torque of the motor is reduced to 25 %.

Load conversion

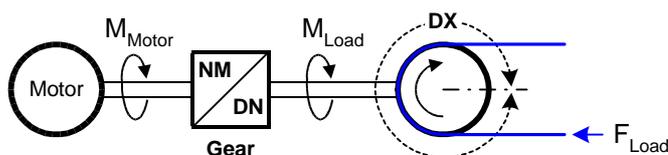
The motor torque can be converted into a load torque value, while making allowances for the gear load and spindle gradients. There is no allowance made for frictional losses in the following.

Rotary axes:



$$M_{Load} = M_{Motor} \cdot \frac{NM}{DN}$$

Linear axes (here, the force is calculated):



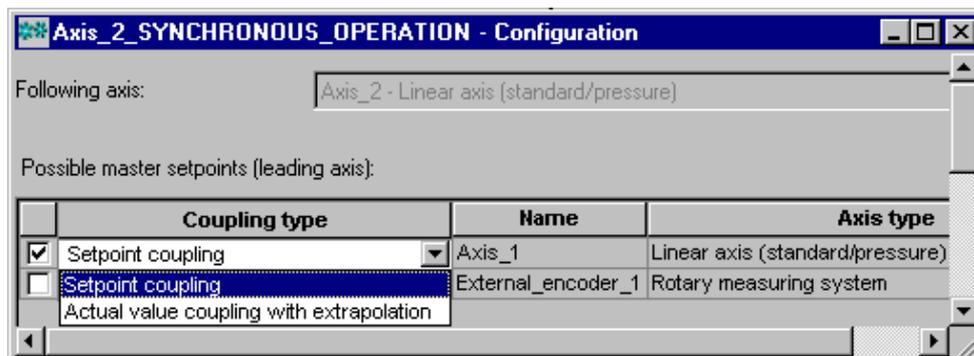
$$F_{Load} = M_{Motor} \cdot \frac{NM}{DN} \cdot \frac{2\pi}{DX}$$

M_{Motor}	Drive motor torque in [N/m]
M_{Load}	Torque at the load side of the gears in [N/m]
F_{Load}	Load force in [N]
NM	Motor rotations
DN	Number of load rotations
DX	Load feed per rotation (e.g. spindle pitch) in [m]

A.3.2.4 Setting actual value coupling at the synchronization object

In the configuration of the synchronization object, it is determined whether to use the setpoint or actual values of the leading axis object.

- physical axes - reference value/actual value coupling
- virtual axes - reference value coupling only
- external encoder - actual value coupling only



Extrapolation

The reference value for actual value coupling can be extrapolated for the compensation of dead time.

The extrapolation is set and configured for the leading axis in the S7T Config Experts list by means of *extrapolation.extrapolationTime*.

Filtering

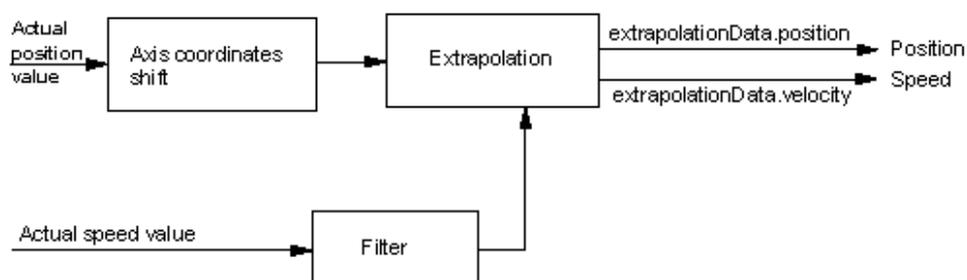
Extrapolation of the position is based on the filtered or averaged velocity value.

- *timeConstant*: Timebase used to calculate the mean value, or time constant for filtering
- *extrapolationTime*: Specified time for extrapolation

Extrapolation is not performed if 0.0 is specified.

The extrapolated position and velocity value are indicated in the system variable *extrapolationData*.

The extrapolation compensates for the local delays that result from use of the actual value instead of the setpoint.



Extrapolation and filtering with actual value coupling

Creating axes with setpoint / actual value coupling

Setpoint or actual value coupling is set when the control value is configured at the synchronization object.

Possible settings based on the source of the manipulated value:

- A physical axis: Setpoint coupling (default) /actual value coupling with extrapolation
- A virtual axis: Setpoint coupling (default) / actual value coupling with extrapolation (an extrapolated setpoint can be set here, because the actual value for a virtual axis is set to be equal to the setpoint value)
- External encoder: Actual value coupling (default) /actual value coupling with extrapolation

Coupling with external encoder

Two coupling modes are available for external encoders:

- Coupling without extrapolation
- Coupling with extrapolation

Display

The extrapolated values and the filtered velocity value are indicated in these system variables:

- *extrapolationData.position*
- *extrapolationData.velocity*
- *extrapolationData.filteredvelocity*

Actual value smoothing

Data recording is based on the position controller cycle. The calculation of further data is based on these data, for example the velocity. These derived variables are calculated based on the position controller cycle or the interpolator cycle. All system variables under *sensordata* are calculated within the position control cycle, those under *motionstatedata* (or *motionstate* for the external encoder) within the IPO cycle.

The velocity values *sensordata[1].velocity* (or *sensordata.velocity* for the external encoder) and *motionstatedata.actualvelocity* (or *motionstate.velocity* for the external encoder) are determined in the relevant cycle.

A PT1 filter can be used to smooth data.

The *TypeOfAxis.NumberOfEncoders.Encoder_1.Filter* (or *TypeOfAxis.Encoder_1.Filter* for the external encoder) configuration data here refer to the velocity that is calculated within a position control cycle.

The *TypeOfAxis.SmoothingFilter* configuration data relates to the velocity calculated in the IPO cycle. Here, you can select whether a PT1 filter is to be applied to the data, or whether the data are to be generated based on the mean value. Calculation of the mean value is based on the ratio between the cycles of the position controller and the interpolator.

A.3.3 External encoder settings

A.3.3.1 Setting the standstill signal

The standstill signal for the external encoder can be set in the configuration data in the Expert list of S7T Config:

- The "Velocity threshold standstill signal" is found in the configuration data *TypeOfAxis.StandStillSignal.maxVeloStandStill*
- The "Signal output delay" signal is found in the configuration data *TypeOfAxis.StandStillSignal.delayTimeToActivate*

A.3.3.2 External encoder - Synchronization with incremental encoders

The Technology CPU supports various synchronization modes for incremental encoders operating as external encoder. You can set the reference position of the external encoder in the S7T Config Experts list.

When synchronizing the encoder, the value of the homing position coordinate is assigned to the current encoder position:

- When the zero mark is reached (default setting)
- When the BERO is reached (set in the Expert list)

The homing mode of the external encoder can be set in the *TypeOfAxis.Encoder_1.IncHomingEncoder.passiveHomingMode* configuration data of the Expert list.

Options:

- *CAM_AND_ZM_PASSIVE(1)*
Passive homing with BERO and the next zero mark
- *ZM_PASSIVE(2)*
Passive homing with the next zero mark
- *CAM_PASSIVE(3)*
Passive homing with BERO
- *DEFAULT_PASSIVE(4)*
Depending on the encoder type, the homing mode *ZM_PASSIVE(2)* (with zero mark) or *CAM_PASSIVE(3)* (without zero mark) is used with or without zero mark

Also set the expected approach direction for homing at the configuration parameter *TypeOfAxis.Encoder_1.IncHomingEncoder.passiveApproachDirection*.

Options available:

- *APPROACH_NEGATIVE_PASSIVE(0)*
Homing with approach to zero mark in negative direction
- *APPROACH_POSITIVE_PASSIVE(1)*
Homing with approach to zero mark in positive direction
- *EDGE_POS_SIDE_NEG_PASSIVE(2)*
Homing with approach to BERO in positive direction
- *EDGE_POS_SIDE_POS_PASSIVE(3)*
Homing with approach to Bero in negative direction
- *EDGE_NEG_SIDE_NEG_PASSIVE(4)*
Homing with motion off the BERO in positive direction
- *EDGE_NEG_SIDE_POS_PASSIVE(5)*
Homing with motion off the Bero in negative direction
- *ACTUAL_DIRECTION_PASSIVE(6)*
Homing with the next edge at BERO or zero mark

The selection of the approach direction depends on the homing mode. The table below shows the relationship between the approach direction and the homing mode:

Approach direction	Homing mode			
	<i>CAM_AND_ZM_PASSIVE(1)</i>	<i>ZM_PASSIVE(2)</i>	<i>CAM_PASSIVE(3)</i>	<i>DEFAULT_PASSIVE(4)</i>
<i>APPROACH_NEGATIVE_PASSIVE(0)</i>	X	X	F	Gx
<i>APPROACH_POSITIVE_PASSIVE(1)</i>	X	X	F	Gx
<i>EDGE_POS_SIDE_NEG_PASSIVE(2)</i>	F	F	X	Gy
<i>EDGE_POS_SIDE_POS_PASSIVE(3)</i>	F	F	X	Gy
<i>EDGE_NEG_SIDE_NEG_PASSIVE(4)</i>	F	F	X	Gy
<i>EDGE_NEG_SIDE_POS_PASSIVE(5)</i>	F	F	X	Gy
<i>ACTUAL_DIRECTION_PASSIVE(6)</i>	X	X	N	Gx

- X - valid configuration
- F - invalid configuration
- N - function not supported
- Gx - encoder with zero mark (TTL, sine / cosine)
- Gy - encoder without zero mark (Endat)

Note

Please not that the homing modes listed earlier are not supported by all drive component (for details, refer to the corresponding documentation).

In *DEFAULT_PASSIVE(4)* homing mode, you can select the approach direction according to the encoder mode set in your configuration. If you define encoder with zero mark in the configuration, only the approach directions 0, 1, 6 are available. If you define encoder with zero mark in the configuration, only the approach directions 2, 3, 4, 5 are available. Other combinations will lead to configuration errors.

In *CAM_AND_ZM_PASSIVE(1)* homing mode, the Bero can be connected directly to a hardware input of the Technology CPU (address 66, for example) or of the distributed I/O at DP(DRIVE). The address is set in the following configuration data:

- Bit address
TypeOfAxis.Encoder_1.IncHomingEncoder.passiveBitNumberBero
- Byte address
TypeOfAxis.Encoder_1.IncHomingEncoder.passiveLogAdressBero

In *CAM_PASSIVE(3)* homing mode, the Bero must be connected to the relevant drive component of the corresponding axis.

A.3.4 Monitoring functions

A.3.4.1 Encoder monitoring functions

- Monitoring the zero mark of incremental encoders
A check on the number of increments between two zero marks can be activated. If the zero mark is not reached within the defined distance, an alarm is triggered.
In homing mode with zero mark, the path is monitored only after the axis has left the BERO.
- Permissible changes to the actual value of an absolute encoder
Monitoring of the permissible changes to the actual value for an absolute encoder can be activated.
- **Current velocity**
The maximum actual velocity value can be monitored. If the maximum value is exceeded, the system variable *sensordata.sensormonitoring.velocity* is output as *limitexceeded*. The velocity is not limited to this value.

A.3.4.2 Encoder limit frequency monitoring

Adherence to the encoder limit frequency is monitored. Actual velocity /actual acceleration monitoring is also used to identify errors in the control loop of the drives. An error is reported at the technology DB if the rise of the actual value exceeds the limit frequency of the encoder. The error is indicated in ErrorStatus "SensorFreqViolation" of the technology DB.

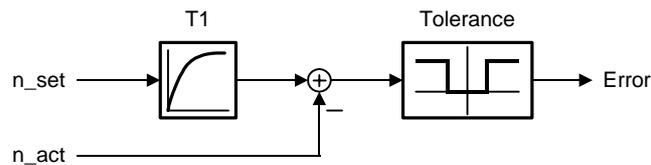
A.3.4.3 Velocity error monitoring

Velocity error monitoring is relevant only for velocity-controlled axes.

An encoder must be connected to the axis and configured to monitor the velocity error (setpoint value minus actual value).

The control loop is simulated by means of a PT1 model. The setpoint value is applied to this model as the input value, and the difference of the output value is compared with the physical actual value profile. The parameters for this model are set in the axis configuration data.

Block diagram "Velocity error monitoring"



Variable	Meaning	Associated value in configuration data
n_set	Velocity setpoint	
n_act	Actual velocity value	
T1	Smoothing time constant	<i>TypeOfAxis.NumberOfDataSets.DataSet_1.DynamicData.velocityTimeConstant</i>
Tolerance	Error triggering limit	<i>TypeOfAxis.NumberOfDataSets.DataSet_1.ControllerDynamic.maxVeloTolerance</i>
Error	ErrorID 801F Technology DB	

A.4 Technology parameters

A.4.1 List of technology parameters

The lists below contain the parameter numbers and the range of values of the technology parameters. These specifications are required, when using FB "MC_WriteParameter" to change the parameters of the (Axes, Output cams, External encoders, Traces, Measuring sensors) technology objects.

If the old value corresponds to the new value when parameters are modified, the restart specified in the list is not required. Parameter modifications of virtual axes do not necessarily require a restart either. Whether a restart is required, is indicated in the variable *Statusword.RequestRestart* of the corresponding technology DB.

Legend

No.	Parameters number
Name	Parameter name in the expert list of S7T Config.
Data type	There are several ranges of values of the data type DINT for parameters identified with "Enum...". You find these in the List of DINT values.
Min./Max.	Parameter range of values.
Access	R (Read): Parameters are read only. W (Write): Parameters can be edited.
Activation	Immediately: Parameter changes are applied immediately. Restart: Parameter are not applied until after the next restart, i.e. when the technology object is reinitialized. This is only possible when the technology object is locked.
Index	Range of index values.

Technology parameters - Axes

D: Speed axis, P: Positioning axis, V: Synchronization axis

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
1	Setpoint values. Position. Target position	positioningstate. commandposition	REAL	-	-1E+12	1E+12	R	-		X	X	Set position of the axis
2	Limits Position and Speed Software limit switches Negative	swlimit. minusposition	REAL	-	-1E+12	1E+12	R, W	Immediately		X	X	negative software limit switch
3	Limits Position and Speed Software limit switches Positive	swlimit. plusposition	REAL	-	-1E+12	1E+12	R, W	Immediately		X	X	positive software limit switch
4	Limits Position and Speed Software limit switches Activation	swlimit. state	DINT Enum active / inactive	-	-	-	R, W	Immediately		X	X	Activation software limit switch
6	Offset error monitoring functions. Activation	TypeOfAxis. NumberOfDataSets. DataSet_x. DynamicFollowing. enable	DINT EnumYesNo	1-16	-	-	R, W	Restart		X	X	Enable dynamic follow-up monitoring
7	Monitoring Offset error monitoring. Maximum	TypeOfAxis. NumberOfDataSets. DataSet_x. DynamicFollowing. maxPositionTolerance	REAL	1-16	-1E+12	1E+12	R, W	Immediately		X	X	Hi limit follow-up error trend
8	Limits Position and Speed Speed Maximum	TypeOfAxis. MaxVelocity. maximum	REAL	-	0.0	1E+12	R, W	Restart	X	X	X	Maximum permitted speed
10	Actual values Motion. Speed	motionstatedata. actualspeed	REAL	-	-1E12	+1E12	R	-	X	X	X	Actual speed of the axis
11	Setpoint values. Motion. Speed	motionstatedata. commandvelocity	REAL	-	-1E12	+1E12	R	-	X	X	X	Speed setpoint of the axis
12	Limits Dynamic response Acceleration Maximum	TypeOfAxis. MaxAcceleration. maximum	REAL	-	-1E+12	1E+12	R, W	Immediately	X	X	X	Maximum permitted acceleration
16	Limits Dynamic response Jerk Maximum	TypeOfAxis. MaxJerk. maximum	REAL	-	-1E+12	1E+12	R, W	Immediately	X	X	X	Maximum permitted jerk

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
1100	Mechanical spindle setting. Spindle pitch per axis revolution	LeadScrew.pitchVal	REAL	-	0.0	1E+12	R, W	Restart		X	X	Spindle pitch per axis revolution
1110	Synchronization extrapolator. Extrapolation time	TypeOfAxis.Extrapolation. ExtrapolationTime	REAL	-	0.0	1E+12	R, W	Immediately		X	X	Extrapolation time for master axis
1111	Synchronism.Extrapolator.Filter. Mode	TypeOfAxis.Extrapolation. Filter.Mode	DINT EnumAxis FilterMode	-	-	-	R, W	Restart		X	X	Selection criterion for actual value smoothing
1112	Synchronism.Extrapolator.Filter. Activation	TypeOfAxis.Extrapolation. Filter.enable	DINT EnumYesNo	-	-	-	R, W	Immediately		X	X	Activation status
1113	Synchronism.Extrapolator.Filter. Time constant	TypeOfAxis.Extrapolation. Filter.timeConstant	REAL	-	0.0	1E+12	R, W	Immediately		X	X	Time constant for PT1 smoothing
1114	Synchronization extrapolator. Tolerance range.Activation	TypeOfAxis.Extrapolation. ToleranceRange.Enable	DINT EnumYesNo	-			R, W	Immediately		X	X	Enable tolerance range
1115	Synchronization extrapolator. Tolerance range.Tolerance window	TypeOfAxis.Extrapolation. ToleranceRange.Value	REAL	-	-1E+12	1E+12	R, W	Immediately		X	X	Tolerance window
1120	Homing.Distance to Bero	TypeOfAxis.Homing. beroDistance	REAL	-	0.0	1E+12	R, W	Immediately		X	X	Traversing distance to BERO
1121	Homing.Approach direction	TypeOfAxis.Homing.direction	DINT Enum DirectionType	-	-	-	R, W	Immediately		X	X	Approach direction when homing
1122	Homing.Enable Bero monitoring	TypeOfAxis.Homing. enableBeroDistance	DINT EnumYesNo	-	-	-	R, W	Immediately		X	X	Monitoring mode enable status
1123	Homing.Homing necessary	TypeOfAxis.Homing. homingNecessary	DINT EnumYesNo	-	-	-	R, W	Immediately		X	X	Homing necessary
1201	Mechanical Modulo. Activation	Modulo. state	DINT Enum active / inactive	-	-		R, W	Restart		X	X	Activation of modulo settings
1202	Mechanical Modulo. Length	Modulo. length	REAL	-		1E+12	R, W	Restart		X	X	Modulo length
1203	Mechanical Modulo. Start value	Modulo. startValue	REAL	-	-1E+12	1E+12	R, W	Restart		X	X	Modulo start value
1211	Monitoring Acceleration Activation	TypeOfAxis. ActualAccelerationMonitoring. enable	DINT EnumYesNo	-	-	-	R, W	Immediately		X	X	Enable actual acceleration monitoring
1212	Monitoring Acceleration Maximum value	TypeOfAxis. ActualAccelerationMonitoring. maximum	REAL	-	-1E+12	1E+12	R, W	Immediately		X	X	Maximum permitted actual value of acceleration

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
1221	Monitoring Speed Activation	TypeOfAxis. ActualVelocityMonitoring. Enable	DINT EnumYesNo	-	-	-	R, W	Immediately	X	X	X	Enable actual speed monitoring
1222	Monitoring Speed Maximum value	TypeOfAxis. ActualVelocityMonitoring. maximum	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Maximum permitted actual speed
1231	Position control Static controller data Drift compensation	TypeOfAxis. Drift. enable	DINT EnumYesNo	-	-	-	R, W	Immediately	X	X	X	Activation of drift compensations
1241	Limits Position and Speed Emergency-off delay	TypeOfAxis. EmergencyRampGenerator. maxDeceleration	REAL	-	-1E+12	1E+12	R, W	Immediately		X	X	Delay of emergency-off ramp generator
1251	Position control Static controller data Fine interpolator type	TypeOfAxis. FineInterpolator. _type	DINT Enum AxisFine Interpolator Mode	-	-	-	R, W	Restart	X	X	X	Type of fine interpolator
1261	Position control Friction compensation Amplitude	TypeOfAxis.Friction. amplitude	REAL	-	-1E+12	1E+12	R, W	Immediately	X	X	X	Amplitude of the friction compensation trend
1262	Position control Friction compensation Decay time constant.	TypeOfAxis.Friction. decayTime	REAL	-	0.0	1E+12	R, W	Restart	X	X	X	Decay time constant.
1263	Position control Friction compensation Decay time constant standstill	TypeOfAxis. Friction. delayTimeStandStill	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Delay of standstill signal
1264	Position control Friction compensation Activation	TypeOfAxis. Friction. enable	DINT EnumYesNo	-	-	-	R, W	Restart	X	X	X	Activation of friction compensation
1265	Position control Friction compensation Maximum standstill speed	TypeOfAxis. Friction. maxVeloStandStill	REAL	-	-1E+12	1E+12	R, W	Immediately	X	X	X	Maximum value of standstill signal
1271	Monitoring Synchronous operation monitoring Actual value tolerance	TypeOfAxis. GearingPosTolerance. actualValueTolerance	REAL	-	-1E+12	1E+12	R, W	Immediately			X	Permissible actual value deviation
1272	Monitoring Synchronous operation monitoring Setpoint tolerance	TypeOfAxis. GearingPosTolerance. commandValueTolerance	REAL	-	-1E+12	1E+12	R, W	Immediately			X	Permissible setpoint deviation
1273	Monitoring Synchronous operation monitoring Activation of the actual value monitoring.	TypeOfAxis. GearingPosTolerance. enableActualValue	DINT EnumYesNo	-	-	-	R, W	Immediately			X	Actual value tolerance monitoring

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
1274	Monitoring Synchronous operation monitoring Activation of setpoint monitoring	TypeOfAxis.GearingPosTolerance.enableCommandValue	DINT Enum Gearing PosTolerance Command Value	-	-	-	R, W	Immediately			X	Setpoint tolerance monitoring
1275	Monitoring Synchronous operation monitoring Message to master	TypeOfAxis.GearingPosTolerance.enableErrorReporting	DINT Enum ErrorReporting	-	-	-	R, W	Immediately			X	Message of tolerance monitoring
1281	Limits Position and Speed Hardware limit switches Activation	TypeOfAxis.HWEndPos.Enable	DINT EnumYesNo	-	-	-	R, W	Restart	X	X	X	Activation of limit switches
1284	Position and speed limits Hardware limit switch.Modus	TypeOfAxis.HWEndPos.Mode	DINT EnumMount Switch	-	-		R, W	Restart	X	X	X	Position of the HW limit switch relative to the axis traversing range
1291	Limits Dynamic response Acceleration Activation of monitoring functions	TypeOfAxis.MaxAcceleration.enableSetPointMonitoring	EnumYesNo	-	-	-	R, W	Restart	X	X	X	Enable manipulated variable monitoring

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
1301	Configuration Neutral band compensation. Center point	TypeOfAxis. NeutralBand. centreValue	REAL	-	-1E+12	1E+12	R, W	Immediately	X	X	X	Center point of the neutral band
1302	Configuration Neutral band compensation. Activation	TypeOfAxis. NeutralBand. enable	DINT EnumYesNo	-	-	-	R, W	Restart	X	X	X	Enable neutral band compensation
1303	Configuration Neutral band compensation. Expansion	TypeOfAxis. NeutralBand. range	REAL	-	-1E+12	1E+12	R, W	Immediately	X	X	X	Expansion of the neutral band
1311	Monitoring Positioning and standstill monitoring. Message delay time	TypeOfAxis. PositionMonitoring. posWinTolDelayTime	REAL	-	0.0	1E+12	R, W	Immediately		X	X	Time to go until message is enabled
1312	Monitoring Positioning and standstill monitoring. Tolerance window delay time	TypeOfAxis. PositionMonitoring. posWinTolTime	REAL	-	0.0	1E+12	R, W	Immediately		X	X	Time to go until tolerance window is reached
1313	Monitoring Positioning and standstill monitoring. Tolerance	TypeOfAxis. PositionMonitoring. tolerance	REAL	-	-1E+12	1E+12	R, W	Immediately		X	X	Width of the positioning window
1321	Mechanical Measuring system. Axis reversal	TypeOfAxis. SetPointDriverInfo. InvertSetPoint. invSetPoint	DINT EnumYesNo	-	-	-	R, W	Restart	X	X	X	Enable reversal of direction
1331	Configuration Actual value smoothing Activation	TypeOfAxis. SmoothingFilter. enable	DINT EnumYesNo	-	-	-	R, W	Immediately	X	X	X	Enable filter functionality
1332	Configuration Actual value smoothing Mode	TypeOfAxis. SmoothingFilter. mode	DINT Enum AxisFilter Mode	-	-	-	R, W	Restart	X	X	X	Method for calculating actual value smoothing
1333	Configuration Actual value smoothing Time constant	TypeOfAxis. SmoothingFilter. timeConstant	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Time constant for PT1 smoothing
1341	Monitoring Positioning and standstill monitoring. Standstill message delay	TypeOfAxis. StandStillMonitoring. delayTimeToActivate	REAL	-	0.0	1E+12	R, W	Immediately		X	X	Message enable delay
1342	Monitoring Positioning and standstill monitoring. Standstill position tolerance	TypeOfAxis. StandStillMonitoring. stillStandTolerance	REAL	-	-1E+12	1E+12	R, W	Immediately		X	X	Permissible tolerance of standstill position
1351	Monitoring Standstill signal Message delay time	TypeOfAxis. StandStillSignal. delayTimeToActivate	REAL	-	0.0	214748	R, W	Immediately	X	X	X	Standstill signal delay
1352	Monitoring Standstill signal Filtering degree	TypeOfAxis. StandStillSignal. filterDegree	DINT	-	0	15	R, W	Immediately	X	X	X	Filtering degree
1353	Monitoring Standstill signal Filter frequency	TypeOfAxis. StandStillSignal. filterFrequency	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Filter frequency

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
1354	Monitoring Standstill signal Speed limit	TypeOfAxis.StandStillSignal. maxVeloStandStill	REAL	-	-1E+12	1E+12	R, W	Immediately	X	X	X	Standstill speed limit
1400	Position control Static controller data Control variable limiting. Activation	TypeOfAxis.SpeedLimitation. Enable	DINT Enum AxisFilterMode	-	-	-	R, W	Restart	X	X	X	Enable status of speed range limit
1402	Position control Static controller data Control variable limiting. Low limit	TypeOfAxis.SpeedLimitation. MinSpeed	REAL	-	-1E+12	1E+12	R, W	Immediately	X	X	X	Low speed limit
1403	Position control Static controller data Control variable limiting. High limit	TypeOfAxis.SpeedLimitation. MaxSpeed	REAL	-	-1E+12	1E+12	R, W	Immediately	X	X	X	High speed limit

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
2000	Configuration Data record changeover. Number of data records	TypeOfAxis.NumberOfData Sets.numberofDataSets	DINT	-	0	16	R	-	X	X	X	Number of data records
2001	Configuration Data record changeover. Initialization data record	TypeOfAxis.NumberOfData Sets.initDataSet	DINT	-	0	16	R, W	Restart	X	X	X	Initialization data record
2002	Configuration Data record changeover. Data record changeover mode	TypeOfAxis.NumberOfData Sets.changeMode	DINT Enum ChangeMode	-	-	-	R, W	Restart	X	X	X	Data record changeover mode
2010	Mechanical stop limits. Follow-up error	TypeOfAxis. NumberOfDataSets.DataSet_x. ClampingMonitoring. followingErrorDeviation	REAL	1-16	0.0	1E+12	R, W	Immediately		X	X	Definition of the necessary dynamic follow-up error for the detection of the mechanical stop position
2011	Mechanical stop limits. Position tolerance	TypeOfAxis. NumberOfDataSets.DataSet_x. ClampingMonitoring. positionTolerance	REAL	1-16	0.0	1E+12	R, W	Instantaneously		X	X	Permitted setpoint/actual value offset in clamped state
2012	Mechanical stop limits. Mode of mechanical stop position detection	TypeOfAxis. NumberOfDataSets.DataSet_x. ClampingMonitoring .recognitionMode	DINT Enum Recognition Mode	1-16	-	-	R, W	Restart		X	X	Torque monitoring activation method
2020	Mechanical.Load gear. Load rotations	TypeOfAxis.NumberOfData Sets.DataSet_x.Gear denFactor	DINT	1-16	0	2147483647	R, W	Restart	X	X	X	Gear ratio nominator
2021	Mechanical.Load gear. Motor rotations	TypeOfAxis.NumberOfData Sets.DataSet_x.Gear. numFactor	DINT	-	0	2147483647	R, W	Restart	X	X	X	Gear factor denominator
2031	Position control.Static controller data.PV controller.DSC activation	TypeOfAxis. NumberOfDataSets. DataSet_x. ControllerStruct. PV_Controller. enableDSC	DINT EnumYesNo	1-16	-	-	R, W	Restart		X	X	Enable DSC
2032	Position control.Static controller data.PV controller.Weighting factor	TypeOfAxis. NumberOfDataSets. DataSet_x. ControllerStruct. PV_Controller. kpc	REAL	1-16	0.0	150.0	R, W	Immediately		X	X	Precontrol weighting
2033	Position control.Static controller data.PV controller.kp	TypeOfAxis. NumberOfDataSets. DataSet_x. ControllerStruct. PV_Controller. kv	REAL	1-16	0.0	1E+12	R, W	Immediately		X	X	Pcontroller gain
2034	Position control.Static controller data.PV controller.Activation of the precontrol	TypeOfAxis. NumberOfDataSets. DataSet_x. ControllerStruct. PV_Controller. preCon	DINT EnumYesNo	1-16	-	-	R, W	Restart		X	X	Enable pre-control

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
2035	Position control.Static controller data.PV controller.Symmetry filter activation/mode	TypeOfAxis. NumberOfDataSets.DataSet_x. ControllerStruct.PV_Controller.balanceFilterMode	DINT EnumBalance FilterMode	1-16	-	-	R, W	Immediately		X	X	Symmetry filter mode
2041	Position control.Static controller data.PD controller.kp	TypeOfAxis. NumberOfDataSets.DataSet_x. ControllerStruct.PD_Controller.kp	REAL	1-16	0.0	100	R, W	Immediately		X	X	Pcontroller gain
2042	Position control.Static controller data.PD controller.Delay time	TypeOfAxis. NumberOfDataSets.DataSet_x. ControllerStruct.PD_Controller.decayTime	REAL	1-16	0.0	1E+12	R, W	Immediately		X	X	Time constant of the DT1 element
2043	Position control.Static controller data.PD controller.kd	TypeOfAxis. NumberOfDataSets.DataSet_x. ControllerStruct.PD_Controller.kd	REAL	1-16	0.0	1E+12	R, W	Immediately		X	X	Amplification of DT1 element
2051	Position control Dynamic compensation. Activation	TypeOfAxis. NumberOfDataSets.DataSet_x. DynamicComp.enable	DINT EnumYesNo	1-16	-	-	R, W	Restart		X	X	Enable dynamic compensation
2052	Position control Dynamic compensation. First time constant	TypeOfAxis. NumberOfDataSets.DataSet_x. DynamicComp.T1	REAL	1-16	0.0	1E+12	R, W	Immediately		X	X	First time constant
2053	Position control Dynamic compensation. Second time constant	TypeOfAxis. NumberOfDataSets.DataSet_x. DynamicComp.D2	REAL	1-16	0.0	1E+12	R, W	Immediately		X	X	Second time constant
2061	Position control Dynamic controller data Time constant of position control loop	TypeOfAxis. NumberOfDataSets.DataSet_x. DynamicData.positionTimeConstant	REAL	1-16	0.0	1E+12	R, W	Immediately		X	X	Substituted time constant of position control loop
2062	Position control Dynamic controller data Time constant of torque control loop	TypeOfAxis. NumberOfDataSets.DataSet_x. DynamicData.torqueTimeConstant	REAL	1-16	0.0	1E+12	R, W	Immediately	X	X	X	Substituted time constant of torque control loop
2063	Position control Dynamic controller data Time constant of speed control loop	TypeOfAxis. NumberOfDataSets.DataSet_x. DynamicData.velocityTimeConstant	REAL	1-16	0.0	1E+12	R, W	Immediately	X	X	X	Substituted time constant of speed control loop
2071	Monitoring dynamic follow-up error Monitoring Minimum	TypeOfAxis. NumberOfDataSets.DataSet_x. DynamicFollowing.minPositionTolerance	REAL	1-16	-1E+12	1E+12	R, W	Immediately		X	X	Lo limit of dynamic follow-up error trend
2072	Monitoring dynamic follow-up error Monitoring Min. speed	TypeOfAxis. NumberOfDataSets.DataSet_x. DynamicFollowing.minVelocity	REAL	1-16	-1E+12	1E+12	R, W	Immediately		X	X	Lo speed limit of dynamic follow-up error trend

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
2073	Monitoring dynamic follow-up error Monitoring Warning limit	TypeOfAxis.NumberOfDataSets. DataSet_x.DynamicFollowing. warningLimit	REAL	1-16	0.0	100.0	R, W	Immediately		X	X	Follow-up monitoring warning limit
2081	Position control.Static controller data.PID controller.kp	TypeOfAxis.NumberOfDataSets. DataSet_x.ControllerStruct.PID_ Controller.kp	REAL	10	0	1E+12	R, W			X	X	Gain of the P component
2082	Position control.Static controller data.PID controller.Evaluation factor	TypeOfAxis.NumberOfDataSets. DataSet_x.ControllerStruct.PID_ Controller.kpc	REAL	100	0	150	R, W			X	X	Weighting of the precontrol
2083	Position control.Static controller data.PID controller.PID controller.ki	TypeOfAxis.NumberOfDataSets. DataSet_x.ControllerStruct.PID_ Controller.ki	REAL	0	0	1E+12	R, W			X	X	Gain of the I component
2084	Position control.Static controller data.PID controller.Precontrol activation	TypeOfAxis.NumberOfDataSets. DataSet_x.ControllerStruct.PID_ Controller.preCon	DINT EnumYesNo	0			R, W			X	X	Activation of the precontrol
2085	Position control.Static controller data.PID controller.kd	TypeOfAxis.NumberOfDataSets. DataSet_x.ControllerStruct.PID_ Controller.kd	REAL	0	0	1E+12	R, W			X	X	Gain of the D component
2086	Position control.Static controller data.PID controller.Delay time	TypeOfAxis.NumberOfDataSets. DataSet_x.ControllerStruct.PID_ Controller.DecayTime	REAL	1	0	1E+12	R, W			X	X	Delay time of the DT1 component
2087	Position control.Static controller data.PID controller.Integrator limitation activation	TypeOfAxis.NumberOfDataSets. DataSet_x.ControllerStruct.PID_ Controller.EnableAntiWindUp	DINT EnumYesNo	1			R, W			X	X	Activation of the integrator limitation
2088	Position control.Static controller data.PID controller.Activation/mode balancing filter	TypeOfAxis.NumberOfDataSets. DataSet_x.ControllerStruct.PID_ Controller.BalanceFilterMode	DINT EnumBalance FilterMode	90			R, W			X	X	Specification of the balancing filter

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
3000	Mechanical.Measuring system. Number of encoders	TypeOfAxis.NumberOf Encoders.numberOfEncoders	DINT	-	0	8	R	-	X	X	X	Number of measuring systems
3010	Mechanical.Measuring system. Mounting of encoder	TypeOfAxis. NumberOfEncoders.Encoder_x. AssemblyBase.assemblyBase	DINT Enum AxisEncoder AssemblyType	1-8	-	-	R, W	Restart		X	X	Type of encoder assembly
3011	Mechanical.Measuring system. Measuring gear on motor side. Number of encoder revolutions	TypeOfAxis. NumberOfEncoders.Encoder_x. AdaptDrive.denFactor	DINT	1-8	1	2147483647	R, W	Restart		X	X	Denominator
3012	Mechanical.Measuring system. Measuring gear on motor side. Motor rotations	TypeOfAxis. NumberOfEncoders.Encoder_x. AdaptDrive.numFactor	DINT	1-8	1	2147483647	R, W	Restart		X	X	Numerator
3013	Mechanical.Measuring system. Measuring gear load side. Number of encoder revolutions	TypeOfAxis.NumberOf Encoders.Encoder_x. AdaptExtern. denFactor	DINT	1-8	1	2147483647	R, W	Restart	X	X	X	Denominator
3014	Mechanical.Measuring system. Measuring gear load side. Load rotations	TypeOfAxis.NumberOf Encoders.Encoder_x. AdaptExtern. numFactor	DINT	1-8	1	2147483647	R, W	Restart	X	X	X	Numerator
3015	Mechanical.Measuring system. External measuring gear.Distance per measuring wheel revolution	TypeOfAxis. NumberOfEncoders. Encoder_x.PathPerRevolution. length	REAL	1-8	0.0	1E+12	R, W	Restart		X	X	Distance per measuring wheel revolution
3016	Mechanical.Measuring system. External measuring gear.Number of encoder revolutions	TypeOfAxis. NumberOfEncoders. Encoder_x.AdaptLoad. denFactor	DINT	1-8	1	2147483647	R, W	Restart		X	X	Denominator
3017	Mechanical.Measuring system. External measuring gear.Distance per measuring wheel revolution	TypeOfAxis. NumberOfEncoders. Encoder_x.AdaptLoad. numFactor	DINT	1-8	1	2147483647	R, W	Restart		X	X	Numerator
3021	Mechanical backlash compensation. Activation	TypeOfAxis. NumberOfEncoders. Encoder_x. AbsBackLash. enable	DINT EnumYesNo	1-8	-	-	R, W	Immediately		X	X	Enable status of backlash compensation
3022	Mechanical backlash compensation. direction	TypeOfAxis. NumberOfEncoders. Encoder_x. AbsBackLash. _type	DINT Enum BackLash Type	1-8	-	-	R, W	Immediately		X	X	Direction of backlash compensation
3023	Mechanical backlash compensation. Preferred position	TypeOfAxis. NumberOfEncoders. Encoder_x. AbsBackLash. startUpDifference	DINT Enum BackLash Diff	1-8	-	-	R, W	Immediately		X	X	Preferred position

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
3024	Mechanical backlash compensation. Value	TypeOfAxis. NumberOfEncoders. Encoder_x. AbsBackLash. length	REAL	1-8	-1E+12	1E+12	R, W	Immediately		X	X	Value
3025	Mechanical backlash compensation. Speed	TypeOfAxis. NumberOfEncoders. Encoder_x. AbsBackLash. velocity	REAL	1-8	-1E+12	1E+12	R, W	Immediately		X	X	Speed of backlash compensation
3031	Homing Offset	TypeOfAxis. NumberOfEncoders. Encoder_x. AbsHomingEncoder. absShift	REAL	1-8	0.0	1E+12	R, W	Immediately		X	X	Absolute value encoder offset
3041	Configuration Measuring system. Filter Activation	TypeOfAxis. Encoder_x. Filter. enable	DINT EnumYesNo	1-8	-	-	R, W	Immediately				Enable status of filter functionality
3042	Configuration Measuring system. Filter Time constant	TypeOfAxis. Encoder_x. Filter. timeConstant	REAL	1-8	0.0	1E+12	R, W	Immediately				Time constant for PT1 smoothing (actual value smoothing)
3042	Configuration Measuring system. Filter Time constant	TypeOfAxis. NumberOfEncoders. Encoder_x. Filter. timeConstant	REAL	1-8	0.0	1E+12	R, W	Immediately		X	X	Time constant for PT1 smoothing (actual value smoothing)
3051	Mechanical backlash compensation. direction	TypeOfAxis. NumberOfEncoders. Encoder_x. IncBackLash. _type	DINT Enum BackLash Type	1-8	-	-	R, W	Immediately		X	X	Direction of action of backlash compensation
3052	Mechanical backlash compensation. Activation	TypeOfAxis. NumberOfEncoders. Encoder_1. IncBackLash. enable	DINT EnumYesNo	1-8	-	-	R, W	Immediately		X	X	Enable status of backlash compensation
3053	Mechanical backlash compensation. Value	TypeOfAxis. NumberOfEncoders. Encoder_x. IncBackLash. length	REAL	1-8	-1E+12	1E+12	R, W	Immediately		X	X	Backlash value
3054	Mechanical backlash compensation. Speed	TypeOfAxis. NumberOfEncoders. Encoder_x. IncBackLash. velocity	REAL	1-8	-1E+12	1E+12	R, W	Immediately		X	X	Specifies the speed at which backlash compensation is active.
3061	Homing.Active homing. Approach direction	TypeOfAxis. NumberOfEncoders. Encoder_x.IncHomingEncoder. approachDirection	DINT EnumAxis Approach Direction	1-8	-	-	R, W	Immediately		X	X	Homing.Approach direction
3063	Homing.Enable zero mark monitoring	TypeOfAxis. NumberOfEncoders. Encoder_x.IncHomingEncoder. enableZeroMarkDistance	DINT EnumYesNo	1-8	-	-	R, W	Immediately		X	X	Enable status of zero mark monitoring
3064	Homing.Active homing. Homing mode	TypeOfAxis. NumberOfEncoders. Encoder_x. IncHomingEncoder. homingMode	DINT Enum AxisHoming Mode	1-8	-	-	R, W	Restart		X	X	Active homing mode

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
3066	Homing.Passive homing. Approach direction	TypeOfAxis. NumberOfEncoders.Encoder_x. IncHomingEncoder. passiveApproachDirection	DINT EnumAxis Passive Approach Direction	1-8	-	-	R, W	Immediately		X	X	expected approach direction
3068	Homing.Passive homing. Homing mode	TypeOfAxis.NumberOf Encoders.Encoder_x. IncHomingEncoder. passiveHomingMode	DINT EnumAxis Passive HomingMode	1-8	-	-	R, W	Restart		X	X	Passive homing mode
3070	Homing.Active homing. Homing position offset	TypeOfAxis. NumberOfEncoders. Encoder_x. IncHomingEncoder. proceedShiftPos	REAL	1-8	-1E+12	1E+12	R, W	Immediately		X	X	Reference point shift at incremental encoders
3071	Homing.Zero mark distance	TypeOfAxis. NumberOfEncoders. Encoder_x.IncHomingEncoder. zeroMarkDistance	REAL	1-8	0.0	1E+12	R, W	Immediately		X	X	maximum distance between BERO and zero mark

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access-	Active	D	P	V	Description
4001	Configuration Application of changes	Activationmodechanged configdata	DINT EnumTo Activation ModeSet ConfigData	-	-	-	R, W	Immediately	X	X	X	Activate modified configuration data
4010	Homing Absolute encoder adjustment Total offset	absoluteEncoder_x.totalOffsetValue	2 x DWORD	1-8	-	-	R, W	-		X	X	Measuring system status of the absolute value encoder, including total offset
4011	Homing Absolute encoder adjustment Measuring system status	absoluteEncoder_x.state	DINT EnumYesNo	1-8	-	-	R	-		X	X	Measuring system status of the absolute value encoder, including total offset
4020	Actual values Data record changeover. Active data record	datasetmonitoring.actualdataset	DINT	-	0	8	R	-	X	X	X	Currently effective data record number
4030	Actual values.Motion. Superimposed motion. Position	superimposedmotion.position	REAL	-	-1E+12	1E+12	R	-		X	X	Position in the superimposed coordinate system
4031	Actual values.Motion. Superimposed motion. Speed	superimposedmotion.velocity	REAL	-	-1E+12	1E+12	R	-		X	X	Speed in the superimposed coordinate system
4040	Actual values.Motion. Basic motion.Position	basicmotion.position	REAL	-	-1E+12	1E+12	R	-	X	X	X	Position in basic coordinate system
4041	Actual values.Motion. Basic motion. Speed	basicmotion.velocity	REAL	-	-1E+12	1E+12	R	-	X	X	X	Speed in basic coordinate system
4050	Actual values.Sensor.Status	sensordata_x.state	DINT EnumSensorState				R		X	X	X	Measuring system status
4121	Limits Dynamic response Negative acceleration	minuslimitsofdynamics.negativeaccel	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Limits of negative acceleration / deceleration
4122	Limits Dynamic response Negative jerk	minuslimitsofdynamics.negativeacceljerk	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Limiting of jerk during acceleration / deceleration
4123	Limits Dynamic response Positive acceleration	minuslimitsofdynamics.positiveaccel	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Limits of positive acceleration / deceleration
4124	Limits Dynamic response Positive jerk	minuslimitsofdynamics.positiveacceljerk	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Limiting of jerk during acceleration and deceleration
4125	Limits Position and Speed Speed	minuslimitsofdynamics.velocity	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Speed limit
4141	Setpoint values. Override Acceleration	override.acceleration	REAL	-	1.0	1000.0	R, W	Immediately	X	X	X	Acceleration override in [%]

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access-	Active	D	P	V	Description
4142	Setpoint values. Override Speed	override.velocity	REAL	-	0.0	200.0	R, W	Immediately	X	X	X	Speed override in [%]
4151	Limits Dynamic response Negative acceleration	pluslimitsofdynamics.negativeaccel	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Limits of negative acceleration / deceleration
4152	Limits Dynamic response Negative jerk	pluslimitsofdynamics.negativeacceljerk	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Limiting of jerk during acceleration / deceleration
4153	Limits Dynamic response Positive acceleration	pluslimitsofdynamics.positiveaccel	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Limits of positive acceleration / deceleration
4154	Limits Dynamic response Positive jerk	pluslimitsofdynamics.positiveacceljerk	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Limiting of jerk during acceleration and deceleration
4155	Limits Position and Speed Speed	pluslimitsofdynamics.velocity	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Speed limit
4162	Actual values Commands. Positioning Distance to go	poscommand.distancetogo	REAL	-	-1E+12	1E+12	R	-		X	X	Current distance to destination
4173	Actual values Homing Homing position coordinate	positioningstate.homeposition	REAL	-	-1E+12	1E+12	R	-		X	X	Homing position coordinate
4174	Actual values.Homing.Status Bero	homingcommand.berostate	DINT Enum ActiveInactive	-			R	-		X	X	BERO active (homing with zero mark and BERO)
4180	Homing Homing position coordinate	userdefaultomg.homeposition	REAL	-	-1E+12	1E+12	R, W	Immediately		X	X	Homing position coordinate
4181	Homing Approach velocity	userdefaultomg.homingapproachvelocity	REAL	-	0.0	10000.0	R, W	Immediately		X	X	Homing point approach speed
4182	Homing Entry velocity	userdefaultomg.homingentryvelocity	REAL	-	0.0	2000.0	R, W	Immediately		X	X	Homing point approach speed
4183	Homing Reduced velocity	userdefaultomg.homingreducedvelocity	REAL	-	0.0	1000.0	R, W	Immediately		X	X	Homing point shutdown speed
4190	Position control.Static controller data.Offset compensation	servosettings.setpointoffset compensation	REAL	0.0	-1E+12	1E+12	R, W	Immediately	X	X	X	Offset compensation for the analog drive interface

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
4231	Limits "Mechanical end stop" Clamping value	userdefaultclamping. clampingvalue	REAL	-	0.0	1E+12	R, W	Immediately		X	X	Clamping value (e.g. running up to a mechanical end stop)
4241	Default values Default value. Dynamic. direction	userDefaultDynamics.direction	DINT Enum Direction	-	-	-	R, W	Immediately	X	X	X	Direction preset
4242	Default values Default value. Dynamic. Negative acceleration	userDefaultDynamics. negativeAccel	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	negative acceleration / deceleration
4243	Default values Default value. Dynamic. Jerk at end of deceleration	userDefaultDynamics. negativeAccelEndJerk	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	jerk limiting during deceleration
4244	Default values Default value. Dynamic. Jerk at the start of deceleration	userDefaultDynamics. negativeAccelStartJerk	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	jerk limiting during acceleration
4245	Default values Default value. Dynamic. Positive acceleration	userDefaultDynamics. positiveAccel	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Positive acceleration
4246	Default values Default value. Dynamic. Jerk at the end of acceleration	userDefaultDynamics. positiveAccelEndJerk	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Limiting jerk at the end of acceleration
4247	Default values Default value. Dynamic. Jerk at the start of acceleration	userDefaultDynamics. positiveAccelStartJerk	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Limiting jerk at the start of acceleration
4248	Default values Default value. Dynamic. Speed profile	userDefaultDynamics.profile	DINT Enum Profile	-	-	-	R, W	Immediately	X	X	X	Speed profile type
4249	Default values Default value. Dynamic.Emergency-stop time	userDefaultDynamics.stopTime	REAL	-	0.0	1E+12	R, W	Immediately	X	X	X	Specified time for emergency-off
4250	Default values Default value. Dynamic. Speed	userDefaultDynamics.velocity	REAL	-	-1E+12	1E+12	R, W	Immediately	X	X	X	Specified speed
4262	Synchronous operation Synchronous cam operation (cam synchronism) Master offset	userdefault. cammingsettings. camstartpositionmaster	REAL	1-2	-1E+12	1E+12	R, W	Immediately			X	Offset for cam disk start position at 'relative' master
4266	Synchronous operation Curve synchronization Synchronizing mode	userdefault.cammingSettings. synchronizingMode	DINT Enum Sync Mode Camming	1-2	-	-	R, W	Immediately			X	Cam disk synchronizing criterion

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
4267	Synchronous operation Curve synchronization Sync Off mode	userdefault.cammingSettings.syncOffMode	DINT Enum SyncOff Mode Camming	1-2	-	-	R, W	Immediately			X	Sync Off mode criterion cam disk
4268	Synchronous operation Curve synchronization Master position for synchronizing	userdefault.cammingSettings.syncPositionMaster	REAL	1-2	-1E+12	1E+12	R, W	Immediately			X	Master position for synchronization
4269	Synchronous operation Curve synchronization Slave position for synchronizing	userdefault.cammingSettings.syncPositionSlave	REAL	1-2	-1E+12	1E+12	R, W	Immediately			X	Slave position for synchronization
4270	Synchronism.Camming. Synchronization direction of slave	userdefault.cammingsettings.synchronizingDirection	DINT Enum Following Object Synchronizing Direction	1-2	-	-	R, W	Immediately			X	Synchronization direction of slave
4286	Synchronous operation Gear synchronization. Synchronizing criteria	userdefault.gearingSettings.synchronizingMode	DINT Enum SyncMode Gearing	1-2	-	-	R, W	Immediately			X	Gearing criterion
4287	Synchronous operation Gear synchronization. Sync OFF criteria	userdefault.gearingSettings.syncOffMode	DINT Enum SyncOff ModeGearing	1-2	-	-	R, W	Immediately			X	Gear sync OFF criterion
4288	Synchronous operation Gear synchronization. Master position	userdefault.gearingSettings.syncPositionMaster	REAL	1-2	-1E+12	1E+12	R, W	Immediately			X	Synchronization position of master
4289	Synchronous operation Gear synchronization. Slave position	userdefault.gearingSettings.syncPositionSlave	REAL	1-2	-1E+12	1E+12	R, W	Immediately			X	Synchronization position of slave
4291	Synchronous operation Gear synchronization. Synchronization direction of slave	userdefault.gearingsettings.synchronizingDirection	DINT Enum Following Object Synchronizing Direction	1-2	-	-	R, W	Immediately			X	Synchronization direction of slave

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
4301	Synchronous operation Dynamic. Negative acceleration	userDefault.syncDynamics. negativeAccel	REAL	1-2	0.0	1E+12	R, W	Immediately			X	Negative acceleration
4302	Synchronous operation Dynamic. Jerk at end of deceleration	userdefault. syncdynamics. negativeaccelendjerk	REAL	1-2	0.0	1E+12	R, W	Immediately			X	Jerk limit during deceleration
4303	Synchronous operation Dynamic. Jerk at the start of deceleration	userdefault. syncdynamics. negativeaccelstartjerk	REAL	1-2	0.0	1E+12	R, W	Immediately			X	Jerk limit during acceleration
4304	Synchronous operation Dynamic. Positive acceleration	userDefault.syncDynamics. positiveAccel	REAL	1-2	0.0	1E+12	R, W	Immediately			X	Positive acceleration
4305	Synchronous operation Dynamic. Jerk at the end of acceleration	userdefault. syncdynamics. positiveaccelendjerk	REAL	1-2	0.0	1E+12	R, W	Immediately			X	Jerk limit at end of acceleration
4306	Synchronous operation Dynamic. Jerk at the start of acceleration	userdefault. syncdynamics. positiveaccelstartjerk	REAL	1-2	0.0	1E+12	R, W	Immediately			X	Jerk limit at start of acceleration
4307	Synchronous operation Dynamic. Speed	userDefault.syncDynamics. velocity	REAL	1-2	-1E+12	1E+12	R, W	Immediately			X	Speed
4308	Synchronous operation Dynamic. Speed profile	userdefault. syncdynamics. velocityprofile	DINT Enum Profile	1-2	-	-	R, W	Immediately			X	Speed profile type
4321	Synchronous operation Synchronization Master sync OFF position	userdefault. syncoffpositions. master	REAL	1-2	-1E+12	1E+12	R, W	Immediately			X	Master sync OFF position
4322	Synchronous operation Synchronization Slave sync OFF position	userdefault. syncoffpositions. slave	REAL	1-2	-1E+12	1E+12	R, W	Immediately			X	Slave sync OFF position
4331	Synchronous operation Synchronization Synchronizing distance	userdefault.syncProfile. syncLength	REAL	1-2	0	1E+12	R, W	Immediately			X	Synchronizing length for master axis-related synchronizing profile
4332	Synchronous operation Synchronization Sync Off distance	userdefault.syncProfile. syncOffLength	REAL	1-2	0	1E+12	R, W	Immediately			X	Sync OFF length for master axis-related synchronizing profile
4333	Synchronous operation Synchronization Sync OFF reference	userdefault.syncProfile. syncOffPositionReference	DINT Enum SyncOff Position Reference	1-2	-	-	R, W	Immediately			X	Position of the sync OFF profile to sync OFF position

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	D	P	V	Description
4334	Synchronous operation Synchronization Synchronization reference	userdefault.syncProfile.syncPositionReference	DINT Enum SyncPosition Reference	1-2	-	-	R, W	Immediately			X	Position of the synchronization profile to the synchronizing position
4335	Synchronous operation Synchronization Profile reference	userdefault.syncprofile.syncprofilereference	DINT Enum SyncProfile Reference	1-2	-	-	R, W	Immediately			X	Reference variable of synchronization profile
4400	Actual values.limits. SW limit switch.Status SW limit switch minus	swlimitstate.swlimitswitchminus	DINT EnumLimit ExceededOk	-	-	-	R	-	-	X	X	Software limit switch minus
4401	Actual values.limits. SW limit switch.Status SW limit switch plus	swlimitstate.swlimitswitchplus	DINT EnumLimit ExceededOk	-	-	-	R	-	-	X	X	Software limit switch plus
4410	Actual values.limits. Hardware limit switches Status HW limit switch minus	sensormonitoring.hwlimitswitchminus	DINT EnumLimit ExceededOk	-	-	-	R	-	X	X	X	Hardware limit switch minus
4411	Actual values.limits. Hardware limit switches Status HW limit switch plus	sensormonitoring.hwlimitswitchplus	DINT EnumLimit ExceededOk	-	-	-	R	-	X	X	X	Hardware limit switch plus
4412	Actual values.Measuring system.Active encoder	sensormonitoring.actualsensor	DINT	-	1	16	R	-	X	X	X	Number of active encoder/sensor
4500	Setpoints.Drive.Control word. Control word	driveData.stw.STW	CDWORD	-	-	-	R, W	-	X	X	X	Control word 1 and 2
4501	Actual values.Drive. Status word.Status word	driveData.ztw.ZTW	DWORD	-	-	-	R	-	X	X	X	Status word 1 and 2

Technology parameters - Cams

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	Description
1361	Configuration Enable cam output	LogAddress. enableOutput	DINT EnumYesNo	-	-	-	R, W	Restart	Cam output status The status of the hardware output can not be modified at a high-speed cam.
1362	Configuration Logic operation	LogAddress. logicOperation	DINT EnumLogic Operation	-	-	-	R, W	Restart	Logical link operation for cam signals
1371	Configuration Output cam type	OcaType. _type	DINT EnumOutput CamType	-	-	-	R, W	Restart	Output cam type
4001	Configuration Application of changes	activationmodechangedconfigdata	DINT EnumTo ActivationMode SetConfigData	-	-	-	R, W	Immediately	Activate modified configuration data

Technology parameters - External encoders

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	Description
1100	Mechanical spindle setting. Spindle pitch per axis revolution	LeadScrew.pitchVal	REAL	-	0.0	1E+12	R, W	Restart	Spindle pitch per axis revolution
1110	Synchronization extrapolator. Extrapolation time	TypeOfAxis.Extrapolation. ExtrapolationTime	REAL	-	0.0	1E+12	R, W	Immediately	Extrapolation time for master axis
1111	Synchronism.Extrapolator.Filte r. Mode	TypeOfAxis.Extrapolation. Filter.Mode	DINT EnumAxisFilter Mode	-	-	-	R, W	Restart	Selection criterion for actual value smoothing
1112	Synchronism.Extrapolator.Filte r. Activation	TypeOfAxis.Extrapolation. Filter.enable	DINT EnumYesNo	-	-	-	R, W	Immediately	Activation status
1113	Synchronism.Extrapolator.Filte r. Time constant	TypeOfAxis.Extrapolation. Filter.timeConstant	REAL	-	0.0	1E+12	R, W	Immediately	Time constant for PT1 smoothing
1114	Synchronization extrapolator. Tolerance range.Activation	TypeOfAxis.Extrapolation. ToleranceRange.Enable	DINT EnumYesNo	-	-	-	R, W	Immediately	Enable tolerance range
1115	Synchronization extrapolator. Tolerance range. Tolerance window	TypeOfAxis.Extrapolation. ToleranceRange.Value	REAL	-	-1E+12	1E+12	R, W	Immediately	Tolerance window
1201	Mechanical Modulo. Activation	Modulo.state	DINT EnumActive Inactive	-	-	-	R, W	Restart	Activation of modulo settings
1202	Mechanical Modulo. Length	Modulo.length	REAL	-	-1E+12	1E+12	R, W	Restart	Modulo length
1203	Mechanical Modulo. Start value	Modulo.startValue	REAL	-	-1E+12	1E+12	R, W	Restart	Modulo start value
1221	Monitoring Speed Activation	TypeOfAxis. ActualVelocityMonitoring. enable	DINT EnumYesNo	-	-	-	R, W	Immediately	Enable actual speed monitoring
1222	Monitoring Speed Maximum value	TypeOfAxis. ActualVelocityMonitoring. maximum	REAL	-	0.0	1E+12	R, W	Immediately	Maximum permitted actual speed
1331	Configuration Actual value smoothing Activation	TypeOfAxis. SmoothingFilter. enable	DINT EnumYesNo	-	-	-	R, W	Immediately	Enable filter functionality
1332	Configuration Actual value smoothing Mode	TypeOfAxis. SmoothingFilter. mode	DINT Enum AxisFilterMode	-	-	-	R, W	Restart	Method for calculating actual value smoothing
1333	Configuration Actual value smoothing Time constant	TypeOfAxis. SmoothingFilter. timeConstant	REAL	-	0.0	1E+12	R, W	Immediately	Time constant for PT1 smoothing
1351	Monitoring Standstill signal Message delay time	TypeOfAxis. StandStillSignal. delayTimeToActivate	REAL	-	0.0	214748	R, W	Immediately	Standstill signal delay

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	Description
1352	Monitoring Standstill signal Filtering degree	TypeOfAxis. StandStillSignal. filterDegree	DINT	-	0	15	R, W	Immediately	Filtering degree
1353	Monitoring Standstill signal Filter frequency	TypeOfAxis. StandStillSignal. filterFrequency	REAL	-	0.0	1E+12	R, W	Immediately	Filter frequency
1354	Monitoring Standstill signal Speed limit	TypeOfAxis. StandStillSignal. maxVeloStandStill	REAL	-	-1E+12	1E+12	R, W	Immediately	Standstill speed limit
2020	Mechanical.Load gear. Load rotations	TypeOfAxis.Gear.denFactor	DINT	-	0	2147483647	R, W	Restart	Gear ratio nominator
2021	Mechanical.Load gear. Motor rotations	TypeOfAxis.Gear.numFactor	DINT	-	0	2147483647	R, W	Restart	Gear factor denominator
3010	Mechanical.Measuring system. Mounting of encoder	TypeOfAxis.Encoder_1. AssemblyBase.assemblyBase	DINT Enum AxisEncoder AssemblyType	-	-	-	R, W	Restart	Type of encoder assembly
3011	Mechanical.Measuring system. Measuring gear on motor side. Number of encoder revolutions	TypeOfAxis.Encoder_1. AdaptDrive.denFactor	DINT	-	1	2147483647	R, W	Restart	Numerator
3012	Mechanical.Measuring system. Measuring gear on motor side. Motor rotations	TypeOfAxis.Encoder_1. AdaptDrive.numFactor	DINT	-	1	2147483647	R, W	Restart	Counter
3013	Mechanical.Measuring system. Measuring gear load side. Number of encoder revolutions	TypeOfAxis.Encoder_1. AdaptExtern. denFactor	DINT	-	1	2147483647	R, W	Restart	Numerator
3014	Mechanical.Measuring system. Measuring gear load side. Load rotations	TypeOfAxis.Encoder_1. AdaptExtern. numFactor	DINT	-	1	2147483647	R, W	Restart	Counter
3015	Mechanical.Measuring system. External measuring gear. Distance per measuring wheel revolution	TypeOfAxis.Encoder_1. PathPerRevolution.length	REAL	-	0.0	1E+12	R, W	Restart	Distance per measuring wheel revolution
3016	Mechanical.Measuring system. External measuring gear. Number of encoder revolutions	TypeOfAxis.Encoder_1. AdaptLoad.denFactor	DINT	-	1	2147483647	R, W	Restart	Numerator
3017	Mechanical.Measuring system. External measuring gear. Number of measuring wheel revolutions	TypeOfAxis.Encoder_1. AdaptLoad.numFactor	DINT	-	1	2147483647	R, W	Restart	Counter
3031	Homing Offset	TypeOfAxis. Encoder_1. AbsHomingEncoder. absShift	REAL	-	0.0	1E+12	R, W	Immediately	Absolute value encoder offset
3041	Configuration Measuring system. Filter Activation	TypeOfAxis.Encoder_1. Filter. enable	DINT EnumYesNo	-	-	-	R, W	Immediately	Enable status of filter functionality

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	Description
3042	Configuration Measuring system. Filter Time constant	TypeOfAxis.Encoder_x.Filter.timeConstant	REAL	8	0.0	1E+12	R, W	Immediately	Time constant for PT1 smoothing (actual value smoothing)
3063	Homing.Enable zero mark monitoring	TypeOfAxis.Encoder_1.IncHomingEncoder.enableZeroMarkDistance	DINT EnumYesNo	-	-	-	R, W	Immediately	Enable status of zero mark monitoring
3066	Homing Passive homing.Approach direction	TypeOfAxis.Encoder_1.IncHomingEncoder.passiveApproachDirection	DINT EnumAxisPassive _Approach_Direction	-	-	-	R, W	Immediately	expected approach direction
3068	Homing.Passive homing. Homing mode	TypeOfAxis.Encoder_1.IncHomingEncoder.passiveHoming Mode	DINT EnumAxisPassive Homing_Mode	-	-	-	R, W	Restart	Passive homing mode
3071	Homing.Zero mark distance	TypeOfAxis.Encoder_1.IncHomingEncoder.zeroMarkDistance	REAL	-	0.0	1E+12	R, W	Immediately	maximum distance between BERO and zero mark
4001	Configuration Application of changes	Activationmodechanged configdata	DINT EnumTo ActivationMode SetConfigData	-	-	-	R, W	Immediately	Activate modified configuration data
4010	Homing Absolute encoder adjustment Total offset	absoluteEncoder.totalOffset Value	2 x DWORD	-	-	-	R, W		Measuring system status of the absolute value encoder, including total offset
4011	Homing Absolute encoder adjustment Measuring system status	absoluteEncoder.state	DINT EnumYesNo	-	-	-	R		Measuring system status of the absolute value encoder, including total offset
4341	Default values Default values. Synchronizing position	userdefault. syncposition	REAL	-	-1E+12	1E+12	R, W	Immediately	Synchronizing position
4410	Actual values.limits. Hardware limit switches Status HW limit switch minus	sensormonitoring.hwlimitswitchminus	DINT EnumLimit ExceededOk	-	-	-	R	-	Hardware limit switch minus
4411	Actual values.limits. Hardware limit switches Status HW limit switch plus	sensormonitoring.hwlimitswitchplus	DINT EnumLimit ExceededOk	-	-	-	R	-	Hardware limit switch plus

Technology parameters – Cams

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	Description
4001	Configuration Application of changes	Activationmodechanged configdata	DINT EnumToActivationModeSet ConfigData	-	-	-	R, W	Immediately	Activate modified configuration data
4201	Actual values Cam disk type	interpolation. camMode	DINT EnumCam Mode	-	-	-	R	-	Marginal conditions of interpolation
4202	Actual values Interpolation type	interpolation. interpolationMode	DINT EnumCam InterpolationMode	-	-	-	R	-	Interpolation type
4211	Default values Default values. Coordinate reference	userDefault. camPositionMode	DINT EnumCam PositionMode	-	-	-	R, W	Immediately	Reference of specified coordinates

Technology parameters - Measuring sensors

No.	Name (standard in S7T Config)	Name (Expert list in S7T Config)	Data type	Index	min.	max.	Access	Active	Description
4001	Configuration Application of changes	Activationmodechanged configdata	DINT EnumTo ActivationMode SetConfigData	-	-	-	R, W	Immediately	Activate modified configuration data

A.4.2 List of DINT values for technology parameters

The list below contains the DINT values of technology parameters, for which several ranges of values can be selected. These specifications are required, when using FB "MC_WriteParameter" to edit the parameters of technology objects.

Name (Expert list in S7T Config)	Values	Description	S7	Int. technology
EnumActiveInactive	INACTIVE	-	0	61
	ACTIVE	-	1	4
EnumAxis Approach Direction	APPROACH_NEGATIVE	Approach direction negative zero mark	15	0
	APPROACH_POSITIVE	Approach direction positive zero mark	16	1
	EDGE_POS_SIDE_NEG	Positive edge at negative side BERO	17	2
	EDGE_POS_SIDE_POS	Positive edge at positive side BERO	18	3
	EDGE_NEG_SIDE_POS	Negative edge at positive side BERO	19	4
	EDGE_NEG_SIDE_NEG	Negative edge at negative side BERO	20	5
EnumAxisEncoderAssemblyType	ASSEMBLY_BASE_DRIVE	Drive side	83	0
	ASSEMBLY_BASE_LOAD	Load side	84	1
	ASSEMBLY_BASE_EXTERN	External	85	2
	ASSEMBLY_BASE_LINEAR	LINEAR	86	3
EnumAxisFilterMode	DEFAULT_MODE	Mean value of the IPO clock to Servo clock ratio	9	0
	AVERAGING	Mean value	10	1
	PT1	Smoothing by filtering; adjustment based on time constant	11	2
EnumAxisFineInterpolatorMode	DIRECT_MODE	No interpolation	12	0
	LINEAR_MODE	Linear interpolation	13	1
	CUBIC_MODE	Constant speed interpolation	14	2
EnumAxisHomingMode	MODE_CAM_AND_ZM	BERO and zero mark	22	1
	MODE_ZM	Zero mark only	23	2
	MODE_CAM	BERO only	24	3
	MODE_NO_REFERENCE	no mode	88	0
EnumAxisPassiveApproach Direction	APPROACH_NEGATIVE_PASSIVE	Approach direction negative zero mark	15	0
	APPROACH_POSITIVE_PASSIVE	Approach direction positive zero mark	16	1

Name (Expert list in S7T Config)	Values	Description	S7	Int. technology
	EDGE_POS_SIDE_NEG_PASSIVE	Positive edge at negative side BERO	17	2
	EDGE_POS_SIDE_POS_PASSIVE	Positive edge at positive side BERO	18	3
	EDGE_NEG_SIDE_POS_PASSIVE	Negative edge at positive side BERO	19	4
	EDGE_NEG_SIDE_NEG_PASSIVE	Negative edge at negative side BERO	20	5
	ACTUAL_DIRECTION_PASSIVE	next edge	21	6
EnumAxisPassiveHomingMode	CAM_AND_ZM_PASSIVE	BERO and zero mark	22	1
	ZM_PASSIVE	Zero mark only	23	2
	CAM_PASSIVE	BERO only	24	3
	DEFAULT_PASSIVE	Preset depending on encoder type with zero mark: ZM_PASSIVE without zero mark: CAM_PASSIVE	25	4
EnumBackLashDiff	DIFF_POSITIVE	Positive	26	0
	DIFF_NEGATIVE	Negative	27	1
EnumBackLashType	NEGATIVE	Negative	4	1
	POSITIVE	Positive	5	0
EnumBalanceFilterMode	OFF	Symmetry filter disabled	89	0
	MODE_1	Balance filter enabled	90	1
	MODE_1	Extended balance filter enabled	91	2
EnumCamInterpolationMode	B_SPLINE	Approximation by means of Bezier splines	28	25
	C_SPLINE	Interpolation by means of cubic splines	29	38
	LINEAR	Linear interpolation	30	72
EnumCammingDirection	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed direction	3	45
	NEGATIVE	In the opposite direction	4	85
	POSITIVE	In the same direction	5	107
EnumCammingMode	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed setting	3	45

Name (Expert list in S7T Config)	Values	Description	S7	Int. technology
	CYCLIC	Cyclic cam:	31	35
	NOCYCLIC	Acyclic cam	32	92
EnumCamMode	CYCLIC_ABSOLUTE	Cyclic absolute cam disk	35	36
	CYCLIC_RELATIVE	Cyclically relative cam disk	36	37
	NO_CONSTRAINTS	Acyclic cam	37	96
EnumCamPositionMode	USER_DEFAULT	User default / default	2	149
	ACTUAL	Indication with scaling and offset	33	7
	BASIC	Indication without scaling and offset	34	16
EnumChangeMode	NEVER	no changeover	92	0
	IN_POSITION	Changeover when axis is in positioning window	93	1
	IN_STANDSTILL	Changeover when axis is below zero speed	94	3
	IMMEDIATELY	Immediate changeover	95	7
EnumDirection	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed default direction	3	45
	NEGATIVE	Negative	4	85
	POSITIVE	Positive	5	107
	BY_VALUE	From sign of speed setpoint value	38	24
	SHORTEST_WAY	Shortest path	39	121
EnumDirectionType	NEGATIVE	Negative direction	4	1
	POSITIVE	Positive direction	5	0
EnumErrorReporting	NO_REPORTING	No	40	0
	COMMAND_VALUE_Tolerance	Setpoint values	41	1
	ACTUAL_VALUE_TOLERANCE	Actual values	42	2
EnumFollowingObject SynchronizingDirection	USER_DEFAULT	User default / default	2	149
	SHORTEST_WAY	Shortest distance without direction preset	96	121
	SYSTEM_DEFINED	Compatibility mode	97	316
	SAME_DIRECTION	Same direction as master	98	317
	POSITIVE_DIRECTION	Positive synchronization direction	99	319
	NEGATIVE_DIRECTION	Negative synchronization direction	100	320
EnumForceDirection	USER_DEFAULT	User default / default	2	149

Name (Expert list in S7T Config)	Values	Description	S7	Int. technology
	EFFECTIVE	Last programmed effective direction	3	45
	NEGATIVE	Negative direction of action	4	85
	POSITIVE	Positive direction of action	5	107
	BOTH	Positive and negative effective direction	43	20
EnumGearingDirection	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed direction	3	45
	NEGATIVE	In the opposite direction	4	85
	POSITIVE	In the same direction	5	107
	BY_VALUE	Sign	38	24
	CURRENT	Current slave direction	44	33
	REVERSE	Opposite to the current slave direction	45	116
EnumGearingMode	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed type	3	45
	GEARING_WITH_FRACTION	Gear ratio as fraction	46	55
	GEARING_WITH_RATIO	Gear ratio as floating-point number	47	56
EnumGearingPosTolerance CommandValue	NO_ACTIVATE	No	48	0
	WITHOUT_JERK	Without jerk	49	1
	WITH_JERK	With jerk	50	2
EnumGearingType	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed type	3	45
	ABSOLUTE	Absolute gear	6	1
	RELATIVE	Relative gear	7	115
EnumLogicOperation	OPERATION_OR	Logical OR	51	0
	OPERATION_AND	Logical AND	52	1
EnumLimitExceededOk	LIMIT_EXCEEDED		101	71
	O_K_	within permitted range	102	102
EnumMasterMode	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed master mode	3	45
	ABSOLUTE	Reference to master is absolute	6	1
	RELATIVE	Reference to master is relative	7	115

Name (Expert list in S7T Config)	Values	Description	S7	Int. technology
EnumMeasuredEdge	USER_DEFAULT	User default / default	2	149
	FALLING_EDGE	Negative edge (hi to lo)	53	86
	RISING_EDGE	Positive edge (lo to hi)	54	117
	BOTH_EDGES	Measurement triggered at both edges	55	224
	BOTH_EDGES_FIRST_RISING	Measurement triggered at both edges, starting at the positive edge (lo to hi)	56	225
	BOTH_EDGES_FIRST_FALLING	Measurement triggered at both edges, starting at the negative edge (hi to lo)	57	226
EnumMeasuringRangeMode	USER_DEFAULT	User default / default	2	149
	WITHOUT_SPECIFIC_AREA	Measurement without specified area	58	168
	WITH_SPECIFIC_AREA	Measurement in the specified area	59	170
EnumMountSwitch	END_MOUNTED_SWITCH	limit switch outside the permissible traversing range is always active	103	0
	FLEXIBLE_MOUNTED_SWITCH	Limit switch may be passed	104	1
EnumOutputCamType	TYPE_WAY	Position-based cam	60	0
	TYPE_TIME	Time-based cam	61	1
EnumProfile	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed speed profile	3	45
	PARABOLIC	Parabolic speed profile/not available	64	103
	SINUSOIDAL	Sinusoidal speed profile / not available	65	122
	SMOOTH	Smooth acceleration curve	66	124
	TRAPEZOIDAL	Trapezoidal speed profile	67	146
EnumRecognitionMode	DO_NOT_CLAMP	no detection	105	0
	CLAMP_BY_FOLLOWING_ERROR_DEVIATION	when value of follow-up error is exceeded	106	1
	CLAMP_WHEN_TORQUE_LIMIT_REACHED	when torque limit is reached /not available (or to be verified)	107	2
EnumSlaveMode	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed slave mode	3	45
	ABSOLUTE	Reference to slave is absolute	6	1
	RELATIVE	Reference to slave is relative	7	115
EnumSensorState	NOT_VALID	Invalid	109	204
	WAIT_FOR_VALID	Waiting for validity	110	205

Name (Expert list in S7T Config)	Values	Description	S7	Int. technology
	VALID	Values are valid	111	206
EnumSyncModeCamming	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed setting	3	45
	IMMEDIATELY	Effective immediately	8	60
	AT_THE_END_OF_CAM_CYCLE	Transition at the end of the active cam	68	14
	NEXT_WITH_REFERENCE	At the next master axis position/not available	69	90
	ON_MASTER_AND_SLAVE_POSITION	Specification of the sync position of the master axis and slave axis	70	99
	ON_MASTER_POSITION	Default synchronization position of master axis	71	100
EnumSyncModeGearing	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed setting	3	45
	IMMEDIATELY	Effective immediately	8	60
	NEXT_WITH_REFERENCE	At the next master axis position/not available	69	90
	ON_MASTER_AND_SLAVE_POSITION	Specification of the sync position of the master axis and slave axis	70	99
	ON_MASTER_POSITION	Default synchronization position of master axis	71	100
	ON_SLAVE_POSITION	Synchronization before synchronization position	72	101
EnumSyncOffMode Camming	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed setting	3	45
	IMMEDIATELY	Effective immediately	8	60
	AT_THE_END_OF_CAM_CYCLE	End of cam cycle	68	14
	ON_MASTER_POSITION	At position of master axis	71	100
	ON_SLAVE_POSITION	at the position of the slave axis	72	101
EnumSyncOffModeGearing	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed setting	3	45
	IMMEDIATELY	Effective immediately	8	60
	ON_MASTER_POSITION	Default SyncOff position of the master axis	71	100
	ON_SLAVE_POSITION	Default SyncOff position of the slave axis	72	101
EnumSyncOffPositionReference	USER_DEFAULT	User default / default	2	149

Name (Expert list in S7T Config)	Values	Description	S7	Int. technology
	EFFECTIVE	Last programmed setting	3	45
	AXIS_STOPPED_AT_POSITION	Stop before SyncOff position	73	15
	BEGIN_TO_STOP_WHEN_POSITION_REACHED	Stop at SyncOff position	74	18
	STOP_SYMMETRIC_WITH_POSITION	Stop symmetrically to SyncOff position	75	137
EnumSyncPositionReference	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed setting	3	45
	BE_SYNCHRONOUS_AT_POSITION	Synchronize before sync position	76	19
	SYNCHRONIZE_SYMMETRIC	Synchronize symmetrically to sync position	77	143
	SYNCHRONIZE_WHEN_POSITION_REACHED	Synchronize from sync position	78	144
EnumSyncProfileReference	USER_DEFAULT	User default / default	2	149
	EFFECTIVE	Last programmed setting	3	45
	RELATE_SYNC_PROFILE_TO_LEADING_VALUE	Master axis specific synchronization profile	79	113
	RELATE_SYNC_PROFILE_TO_TIME	Timerelated synchronization profile	80	114
EnumToActivationMode SetConfigData	ACTIVATE_CHANGED_CONFIG_DATA	Enable configuration data immediately	81	291
	COLLECT_CHANGED_CONFIG_DATA	Collect changed configuration data, do not enable	82	292
EnumYesNo	NO	Enable: No	0	91
	YES	Enable: Yes	1	173
RESERVE_EnumOutput CamType	TYPE_SWITCH	Switching cams	62	2
	TYPE_REVERSE	Reversing cam	63	3

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