TIA Portal V15.1
Example projects V 4.3 for SD6, SC6 and SI6

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1 Foreword

For easy use of the drive controllers, STOBER provides a Siemens SIMATIC function block which you can use if you have configured the Drive Based application in Command operating mode. Since the SIMATIC function block is not subject to any know-how protection, you can customize it to your requirements.

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2 User information

For making efficient use of the example projects provided by STOBER, you should be familiar with the PROFINET network technology and the associated Siemens SIMATIC automation systems, particularly programming with the Siemens TIA Portal as well as creating and editing the hardware configuration.

2.1 Timeliness

Check whether this document is the latest version of the documentation. We make the latest document versions for our products available for download on our website:
http://www.stoeber.de/en/downloads/.

2.2 Original language

The original language of this documentation is German; all other language versions are derived from the original language.

2.3 Described product

Drive controllers of the SD6 series in combination with the DriveControlSuite software in V 6.4-D or later and associated firmware in V 6.4-D or later, or drive controllers of the SC6 or SI6 series in combination with the DriveControlSuite (DS6) software in V 6.4-D or later and associated firmware in V 6.4-D-PN or later.

2.4 Applicable documentation

This documentation supplements the PROFINET for SD6 or PROFINET for SI6 and SC6 operating manuals as well as the Drive Based application manual. You may use the documentation at hand only in combination with the listed manuals.

2.5 Legal disclaimer

The example projects provided in the STOBER download center for commissioning a PROFINET network consisting of multiple STOBER drive controllers of the 6th generation in combination with a SIMATIC S7-1200 or SIMATIC S7-1500 controller from Siemens are available as a free service.

The examples contain solely the basic procedure for creating a PLC program and are provided without obligation. STOBER assumes no liability for their content, function and applicability in a real-world machine or application.

2.6 Markup of text elements

Certain elements of the continuous text are distinguished as follows.

Important information	Words or expressions with a special meaning
Interpolated position mode	Optional: File or product name or other name
Detailed information	Internal cross-reference
http://www.samplelink.com	External cross-reference

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Software and displays

The following formatting is used to identify the various information content of elements referenced by the software interface or a drive controller display, as well as any user entries.

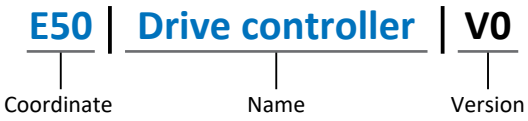
Main menu Settings	Window names, dialog box names, page names or buttons, combined proper nouns, functions referenced by the interface
Select `Referencing method A`	Predefined entry
Save your `<own IP address>`	User-defined entry
EVENT 52: COMMUNICATION	Display indicators (status, messages, warnings, faults) for status information referenced by the interface

Keyboard shortcuts and command sequences or paths are represented as follows.

[CTRL], [CTRL] + [S]	Key, shortcut
Table > Insert table	Navigation to menus/submenus (path specification)

Interpretation of parameter identification

Parameter identification consists of the following elements, where short forms are also possible, i.e. only specifying a coordinate or the combination of coordinate and name.



2.7 Trademarks

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SIMATIC®, TIA Portal®	SIMATIC® and TIA Portal® are registered trademarks of Siemens AG, Munich, Germany.

All other trademarks not listed here are the property of their respective owners.

Products that are registered as trademarks are not specially indicated in this documentation. Existing property rights (patents, trademarks, protection of utility models) are to be observed.

3 STOBER EASY example projects

The STOBER example projects were created with the Siemens Engineering System Totally Integrated Automation Portal (TIA Portal), Version V15 SP1 or V 6.4-D. They include the following files, which differ based on the type of SIMATIC controller used:

- SAT_EasyExample_V15_1200.zap15_1
  TIA Portal archive for the SIMATIC S7-1200 controller.
- SAT_EasyExample_V15_1500.zap15_1
  TIA Portal archive for the SIMATIC S7-1500 controller.
- TIA EASY example drive controller V 4.3.ds6
  The DS6 project file contains an example configuration for the drive controller.

Both TIA Portal example projects contain SIMATIC function blocks in order to control axes using STOBER drive controllers of the 6th generation, i.e. the SD6, SC6 and SI6 with the Drive Based application in Command operating mode. This documentation is valid for both projects.

The function blocks are not protected and can thus be adapted individually.

Scope of functions

The example projects each include one of the SD6, SC6 and SI6 drive controllers – both in single-axis and double-axis design, in combination with the Drive Based application and the Command operating mode.

The axes of all drive controllers can each be operated with their own instance of the same function block. For double-axis controllers, each of the physical axes is generally controlled using a separate function block.

The cyclical data to and from a drive controller is defined in the function block using a static variable. While it can only be changed by changing the structure in the definition block, this is always a possibility.

The acyclical communication services are not required in the EASY example project.

Prerequisite – System environment

In order to be able to use the V 4.3 example projects, the following system environment is required:

- STOBER drive controllers of the SD6 series in combination with the DriveControlSuite software in V 6.4-D or later and associated firmware in V 6.4-D-PN or later or
- STOBER drive controllers of the SC6 or SI6 series in combination with the DriveControlSuite software in V 6.4-D or later and associated firmware in V 6.4-D-PN or later

in combination with

- Siemens Totally Integrated Automation Portal (TIA Portal) V15 SP1 automation software
- Siemens SIMATIC S7-1200 controller (firmware version 4.3 or later) or
- Siemens SIMATIC S7-1500 controller (firmware version 2.0 or later)

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4 Process data mapping

Control and status information as well as actual and set values are transmitted over a process data channel in real time from an IO controller to an IO device and vice versa. The direction of data flow is important in this data transfer. From the perspective of the IO device, PROFINET IO distinguishes between receive PZD (RxPZD) and transmit PZD (TxPZD).

STOBER drive controllers of the 6th generation support a flexible assignment of the parameter values to be transmitted.

The RxPZD and TxPZD process data that is exchanged between the IO controller and IO device during cyclical data transfer depends on the projected application and is pre-assigned accordingly.

4.1 Cyclical process data mapping

The following mapping is used for the example projects (see below). It features deviations from the default mapping between the drive controller and controller. If you adapt the mapping according to your application case, be aware that you must apply the mapping to both the drive controller and controller.

Mapping on the receiving side of the drive controller

Coordinate	Name	Length [byte]
A180	Control byte device	1
J37	Control byte command	1
I210	Control word application	2
J40	Command	1
J41	Motion-ID	1
J42	Position	4
J43	Velocity 1	4
J56	Velocity Override	4
G469	Torque/Force reference	4
J44	Acceleration	4
J45	Deceleration	4
I213	Control word user defined	2
I34	Reference position	4
J36	Position D (Master Sync Position) (only in synchronous operation)	4
		40

Mapping on the sending side of the drive controller

Coordinate	Name	Length [byte]
E200[0]	Status byte device	1
E200[1]	Status byte device	1
E201	Status word 2	2
I212	Status byte application	1
J39	Status byte command	1
I200	Status word application	2
I80	Current position	4
I88	Actual speed	4
E90	Actual torque/force	4
A67	Status word user-defined	2
E80	Operating condition	1
E82	Event type	1
E48	Device control state	1
I90	PLCOpen ErrrorStop cause	1
G80	master actual position	4
		30

Process data modules

The communication elements that are sent and received in specific process data can be freely selected.

The length and structure of process data are defined as part of project configuration by means of the process data modules.

Currently, for each drive controller of the SC6 or SI6 series, process data with a maximum total of 48 parameters to be transmitted (24 per axis) can be exchanged between IO controller and IO device over both axes; for the drive controllers of the SD6 series, a maximum of 18 parameters. Note that the process data length is limited to a maximum of 36 words or 72 bytes.

For the example projects, select a suitable process data module in the hardware configuration of the TIA Portal with a size that at least matches the overall length of the parameters to be transmitted (20 words). As a rule, larger modules can also be used; non-assigned words are transmitted with a value of 0.

We recommend the M106 24 W PZD process data module (24 words, inputs and outputs) with the all consistent transmission type (the process data packet is processed as soon as the packet has been fully received).
All commands can be controlled and provided with set values using this process data module.

Function blocks, functions, data types

Apart from the G6_Easy_Cmd_Mode function block, no other function blocks, functions or data types are required. This function block is functional on its own.

4.2 Expanding cyclical process data mapping

If additional parameters are to be transmitted beyond the cyclical PROFINET standard RxPZD and TxPZD mapping, you can add to the standard mapping on an individual basis. In this process, the parameters in question are entered both in DriveControlSuite (configuration of process data transmission) and in the G6_Easy_CMD_Mode function block in the structures of the static variables _act_value and _ref_value.

If the selected M106 24 W PZD process data module is not sufficient for increased data transmission, it must be replaced with a larger module in the TIA hardware configuration.

This change requires that the associated drive controller is restarted.

Information

Note the use of data in the G6_Easy_CMD_Mode function block if you decrease the suggested mapping.

5 Function blocks

5.1 G6_Easy_Cmd_Mode

The G6_Easy_Cmd_Mode function block controls an axis using the Drive Based application, Command operating mode.

Information

Note that the function block absolutely must be called cyclically.

Function

The cyclical data of the drive controller is read in at the start of function block processing. It is copied to the static variable _act_value. Then, the block inputs are evaluated and the set values formed in the static variable _ref_value , which are sent to the drive controller.

The submodule of the drive controller must be connected to the hw_submodul block input. The length of the module must be entered at the len block input.

5.1.1 Starting movement

To start a movement, the drive controller must be ready to operate and enabled, and the necessary set values must be at the xExecute input when triggering a rising edge. Depending on the motion command (usiComand), necessary set values include position (lrSetPosition), velocity (lrSetVel), acceleration (lrSetAcc), deceleration (lrSetDec) and override (rOverride).

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5.1.2 Inputs and outputs

The G6_Easy_Cmd_Mode [FB 1] function block provides the necessary interfaces for controlling an axis. G6_Easy_Cmd_Mode [FB 1] communicates using the inputs and outputs described below.

Inputs

Input	Data type	Associated parameters	Description
xEnableDrive	BOOL	A180 Control byte device, bit 0 A60 Source additional enable = 2: Parameter	Enable signal of the drive controller using a high level. The xDriveReady output is used as a return signal, which then switches to the High state. If xDriveReady does not switch to the High state, the enable signal is locked and error 6 is output.
xQuickStop	BOOL	A180 Control byte device, bit 2 A62 Source /quick stop = 2: Parameter	A high level triggers a quick stop of the motor. The xQuickstopActive output is used as the return signal.
xResetError	BOOL	A180 Control byte device, bit 1 A61 Source fault reset = 2: Parameter	A positive edge triggers an error reset in the drive controller. The xError output is used as the return signal. A low level ends the error state and a new command can be started.
xJogPos	BOOL	I210 Control word application, bit 5 I104 Source jog enable = 2: Parameter I105 Source positive jog = 2: Parameter	Using this input, the axis is moved in jog mode in the positive direction. The configured set values in the drive controller apply. The xJogActive output is used as the return signal.
xJogNeg	BOOL	I210 Control word application, bit 6 I104 Source jog enable = 2: Parameter I106 Source negativ jog = 2: Parameter	Using this input, the axis is moved in jog mode in the negative direction. The configured set values in the drive controller apply. The xJogActive output is used as the return signal.
usiComand	USINT	J40 Command	This input contains the command which is to be executed in the event of an edge at the xExecute input. For a list of available commands, see the chapter Motion commands [▶ 17].

Input	Data type	Associated parameters	Description
xExecute	BOOL	I210 Control word application, bit 0 I100 Source execute = 2: Parameter	Using this input, the pending command is executed. The xJogActive output is used as the return signal.
lrSetPosition	LREAL	J42 Position	Set position for the most recently started movement.
lrSetVel	LREAL	J43 Velocity 1 G461 Source external velocity = 4: Parameter G460	Set velocity for the most recently started movement.
lrSetAcc	LREAL	J44 Acceleration	Set acceleration for the most recently started movement.
lrSetDec	LREAL	J45 Deceleration	Set deceleration for the most recently started movement.
rOverride	REAL	J56 Velocity Override	Velocity override for the current movement. Only for position and velocity commands. The override is transmitted cyclically, i.e. it can be adapted dynamically during the movement. The set value must be between 1.0 (100%) and 0.0 (0%).
byDirection	BYTE	I210 Control word application, bit 9 and bit 10 C241 Source movement direction = 2: Parameter I210	Specification of direction for the MC_MoveAbsolute command in case of an endless travel range. The following values apply to this: ▪ 0: Directionally optimized ▪ 1: Positive direction ▪ 2: Negative direction ▪ 3: Maintain most recent direction The axis moves to the set position in the configured direction.
rSetTorque	REAL	G469 Torque/Force reference G470 Source torque/force reference = 4: Parameter G469	Cyclical torque set value in torque mode. The value refers to the current torque limits of the motor. The associated set value must be between 1.0 (100%) and 0.0 (0%).
rSetRefPos	LREAL	I34 Reference position	Reference position of the axis that is taken over with MC_Home.

Input	Data type	Associated parameters	Description
rSetPosMastr	LREAL	J36 Position D (Master Sync Position)	Set position for the MC_GearInPosition command. Absolute position of the master, after which the slave axis is to move in sync with the master.
wUserControlWord	WORD	I213 Control word user defined	The user-defined control word can be used freely. The function block simply takes the content and puts it on the mapping for the drive controller. The sources for I213 are defined in I214.
hw_submodul	HW_SUBMODUL	–	This input must contain the module name of the process data module of the axis. For process data module, see Devices & Networks in the TIA Portal.
len	INT	–	This input must contain the length of the process data to be read and written. If all of the axis data is evaluated by the block itself, the entire length of the process data module can be entered. If, for example, another block is to be created for a virtual master, the process data can be divided accordingly, with one part of the mapping used for axis control and the other part for a virtual master. In this case, the len input needs to have been reduced accordingly. For process data module, see Devices & Networks in the project navigation in the TIA Portal.
i_I06DecimalPlaces	INT	I06 Decimal places position	This input must be supplied with the content of the parameter I06 from the drive controller. If I06 is not visible in DriveControlSuite, I06 = 4. This value is used to convert all axis positions to the LREAL format.
l_G46DecimalPlacesMstrPos	INT	G46 Decimal places	This block input must be supplied with the content of the parameter G46 from the drive controller. This value is used to convert all master positions to the LREAL format. Only relevant for synchronous operation: If a synchronous command is not used, this input has no function.

Tab. 1: G6_Easy_Cmd_Mode – Input

Outputs

Output	Data type	Associated parameters	Description
xSwitchOnDisable	BOOL	E200[0] Status byte device, bit 0	The drive controller cannot be enabled because it is in the Switch on disabled state.
xReadyToSwitchOn	BOOL	E48 Device control state	The drive controller is ready to switch on and can be enabled. This corresponds to parameter E48 = 2: Ready for switch-on.
xAxisEnabled	BOOL	E200[0] Status byte device, bit 0	The drive controller is enabled and the axis can be moved.
xQuickStopActive	BOOL	E200[0] Status byte device, bit 2	The drive controller is in the quick stop state.
xDone	BOOL	I212 Status byte application, bit 1	The instructed motion task was executed. Note: This signal behaves the same way as in the drive controllers and does not conform to PLCopen.
xHandshakeOut	BOOL	I212 Status byte application, bit 0	The xHandshakeOut signal is generated in the drive controller if xExecute = true and xDone = false. The signal is required for a clean handshake between the controller and drive controller. If the xHandshakeOut signal = true, the currently pending Execute signal is in progress. If the xHandshakeOut signal = false, a new command can be sent. The rising edge of the xHandshakeOut signal is used to reset the xExecute signal in the controller. The falling edge of the xExecutes signal is also used to reset the xHandshakeOut signal (delayed by the bus runtime).
xError	BOOL	E200[0] Status byte device	This signal indicates a device error.
xDenied	BOOL	I90 PLCOpen ErrrorStop cause	This signal indicates that a motion command was declined. It is formed from I90 PLCOpen ErrrorStop cause = 1..4 or 10..15
xInPos	BOOL	I200 Status word application, bit 5 I180 Actual position in window	The actual position of the axis is located in the target window.
xInRef	BOOL	E201 Status word 2, bit 9 I86 In reference	This bit indicates whether the axis is referenced.
xStandstill	BOOL	E80 Operating condition	Indicates an axis standstill. This corresponds to parameter E80 Operating condition = 14: Standstill.
xAborted	BOOL	I200 Status word application, bit 3	Indicates that an ongoing command was canceled.

Output	Data type	Associated parameters	Description
xAccelerating	BOOL	I200 Status word application, bit 8	The axis is accelerating.
xDecelerating	BOOL	I200 Status word application, bit 9	The axis brakes.
xVelZero	BOOL	I200 Status word application, bit 15 I88 Actual speed	The axis has a velocity of zero.
xVelPos	BOOL	I200 Status word application, bit 14 / bit 15 I88 Actual speed	The axis has a positive velocity.
xVelNeg	BOOL	I200 Status word application, bit 14 / bit 15. I88 Actual speed	The axis has a negative velocity.
xInSync	BOOL	I212 Status byte application, bit 2	Indicates that the axis is in the synchronous state.
xSTOactive	BOOL	E67 STO state, bit 0	The STO safety function was triggered in the drive controller and the motor is no longer supplied with current.
xJogActive	BOOL	E201 Status word 2	The axis is in jog mode.
lrActPos	LREAL	I80 Current position I06 Decimal places position	Current position of the axis in the parameterized unit.
lrActVel	REAL	I88 Actual speed	Current velocity of the axis in the parameterized unit.
lrActTorque	REAL	E90 Actual torque/force	Indicates the current torque as a % in relation to parameter B18 or C09. 1.0 corresponds to 100%. Depending on the axis model, the reference value for 100% is B18 (motor side) or C09 (drive side).
lrActMstrPos	LREAL	G80 master actual position G46 Decimal places	Current position of the master in the parameterized unit. This parameter is only availble if you have configured the drive controller for synchronous operation.
w_A67UserStateWord	WORD	A67 Status word user-defined	User-specific status word which can be filled with any information in the drive controller. The function block takes over the information from fieldbus mapping and puts the word at the output. If you do not need the status word, you can delete it from the input, output and mapping. The sources for A67 are defined in A66.

Output	Data type	Associated parameters	Description
usi_E80DeviceState	USINT	E80 Operating condition	The output includes the parameter E80 Operating condition, which contains helpful information for the diagnostics of the drive controller.
usi_E82Event	USINT	E82 Event type	Includes the parameter E82 Event type, which contains helpful information for the error diagnostics of the drive controller.
usi_I90PLCopenErrorStop	USINT	I90 PLCOpen ErrrorStop cause	Includes the parameter I90 PLCOpen ErrrorStop cause, which contains helpful information for the error diagnostics of positioning.

Tab. 2: G6_Easy_Cmd_Mode – Output

5.1.3 Motion commands

The individual operating modes feature special commands based on the PLCopen standard, in addition to three STOBER-specific commands (MC_DoNothing, MC_MoveSpeed and MC_TorqueControl). Each of these commands – with the exception of MC_Stop – can be overridden during execution. To be able to execute a command, the following requirements must be met:

- Local and jog mode may not be activated.
- A drive controller may not be in the Switch on disabled or Fault device state.

Command	Feature	Control type	Necessary motion variables
0: MC_DoNothing	–	–	–
1: MC_MoveAbsolute	Move to an absolute position	Position	▪ Position ▪ Velocity, override ▪ Acceleration ▪ Deceleration ▪ Jerk
2: MC_MoveRelative	Move a distance relative to the actual position	Position	▪ Position ▪ Velocity, override ▪ Acceleration ▪ Deceleration ▪ Jerk
3: MC_MoveAdditive	Move a distance relative to the set position	Position	▪ Position ▪ Velocity, override ▪ Acceleration ▪ Deceleration ▪ Jerk
4: MC_MoveVelocity	Move without end at set velocity	Position	▪ Velocity, override ▪ Acceleration ▪ Deceleration ▪ Jerk
5: MC_Stop	Unconditional stop	Velocity	▪ Deceleration ▪ Jerk
6: MC_Home	Reference the axis	–	▪ Velocity, override ▪ Acceleration ▪ Deceleration ▪ Jerk ▪ Torque/force
8: MC_MoveSpeed	Move without end at set velocity	Velocity	▪ Velocity, override ▪ Acceleration ▪ Deceleration ▪ Jerk

Command	Feature	Control type	Necessary motion variables
9: MC_TorqueControl	Move without end at target torque/force	Torque/force	▪ Torque/force
11: MC_Halt	Stop	Velocity	▪ Deceleration ▪ Jerk
12: MC_GearIn	Move synchronously to a master axis; velocity-based coupling	Position	▪ Velocity ▪ Acceleration ▪ Deceleration ▪ Jerk
13: MC_GearOut	End the ongoing synchronous motion (electronic gear unit) and continue at the last synchronous velocity	Position	▪ Override ▪ Acceleration ▪ Deceleration ▪ Jerk
14: MC_GearInPosition	Move in sync (electronic gear unit) with a master axis; position-based coupling	Position	▪ Position, master position

Tab. 3: Drive Based – Available commands

6 Visualization

The example projects contain a visualization function that makes operating the blocks easier. Image Axis 1 can be referenced as a template for your own HMI images, or directly called over the user's PC through a simulation.

The associated procedure is as follows:

1. Copy either the HMI_1 tree to your project completely or, if you have already configured a visualization, just the Axis 1 image as well as the content of the standard variable table from the HMI variables branch.
2. TIA Portal: Open the Axis 1 image.
3. For proper connection to the controller, the PG interface must be configured correctly.
   Tools > Settings > Online & diagnostics: Check the configuration settings and correct them if necessary.
4. Mark the HMI_1 tree in the project navigation.
5. Online > Simulation > Start: Start the simulated display of the image.

⇨ Using the buttons and input fields of the visualization function, the block can be filled with values and operated. The states of the inputs and outputs are visualized by the indicator lights.

If a connection cannot be established, check the configuration of the PG/PC interface of your computer:
Start > Control Panel > PG/PC interface: Select the network connection you are using.

7 Appendix

7.1 Abbreviations

Abbreviation	Meaning
DB	Data Block
FB	Function Block
FC	Function Call
I/O	Input/Output
IP	Internet Protocol
OB	Organization Block
PROFINET	Process Field Network
PZD	Process Data
RDREC	Read Record
RxD	Receive data
PLC	Programmable Logic Controller
STRUCT	Structure
TIA	Totally Integrated Automation
TCP	Transmission Control Protocol
TxD	Transmit data
UDP	User Data Protocol
WRREC	Write Record

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7.2 Detailed information

The documentation listed in the following table offers additional relevant information about the associated drive controllers.

Current document versions can be found at http://www.stoeber.de/en/downloads/.

Device/Software	Documentation	Contents	ID
PROFINET communication – SD6	Manual	Installation, electrical installation, data transfer, commissioning, detailed information	442710
PROFINET communication – SC6, SI6	Manual	Installation, electrical installation, data transfer, commissioning, detailed information	443039
SD6 drive controller	Manual	System setup, technical data, project configuration, storage, installation, connection, commissioning, operation, service, diagnostics	442426
Multi-axis drive system with SI6 and PS6	Manual	System setup, technical data, project configuration, storage, installation, connection, commissioning, operation, service, diagnostics	442728
Multi-axis drive system with SI6 and PS6	Commissioning instructions	System setup, technical data, storage, installation, connection, commissioning	442731
Drive Based (DB) application	Manual	Project planning, configuration, parameterization, function test, detailed information	442706

Additional information and sources that form the basis of this documentation or are referenced by the documentation:

Information concerning PROFINET

You can find general information on PROFINET on the PROFIBUS & PROFINET International (PI) website at http://www.profibus.com. PROFINET-specific guidelines, profiles, presentations, brochures and software are available in the corresponding download area.

Information concerning the Siemens TIA Portal

The most important information about the Siemens TIA Portal and additional documents, links and training courses can be found at
http://www.industry.siemens.com/topics/global/en/tia-portal/pages/default.aspx.

8 Contact

8.1 Consultation, service and address

We would be happy to help you!

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8.2 Your opinion is important to us

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Your suggestions, opinions, wishes and constructive criticism help us to ensure and further develop the quality of our documentation.
If you want to contact us for a specific reason, we would be happy to receive an e-mail from you at:
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Thank you for your interest.
Your STOBER editorial team

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