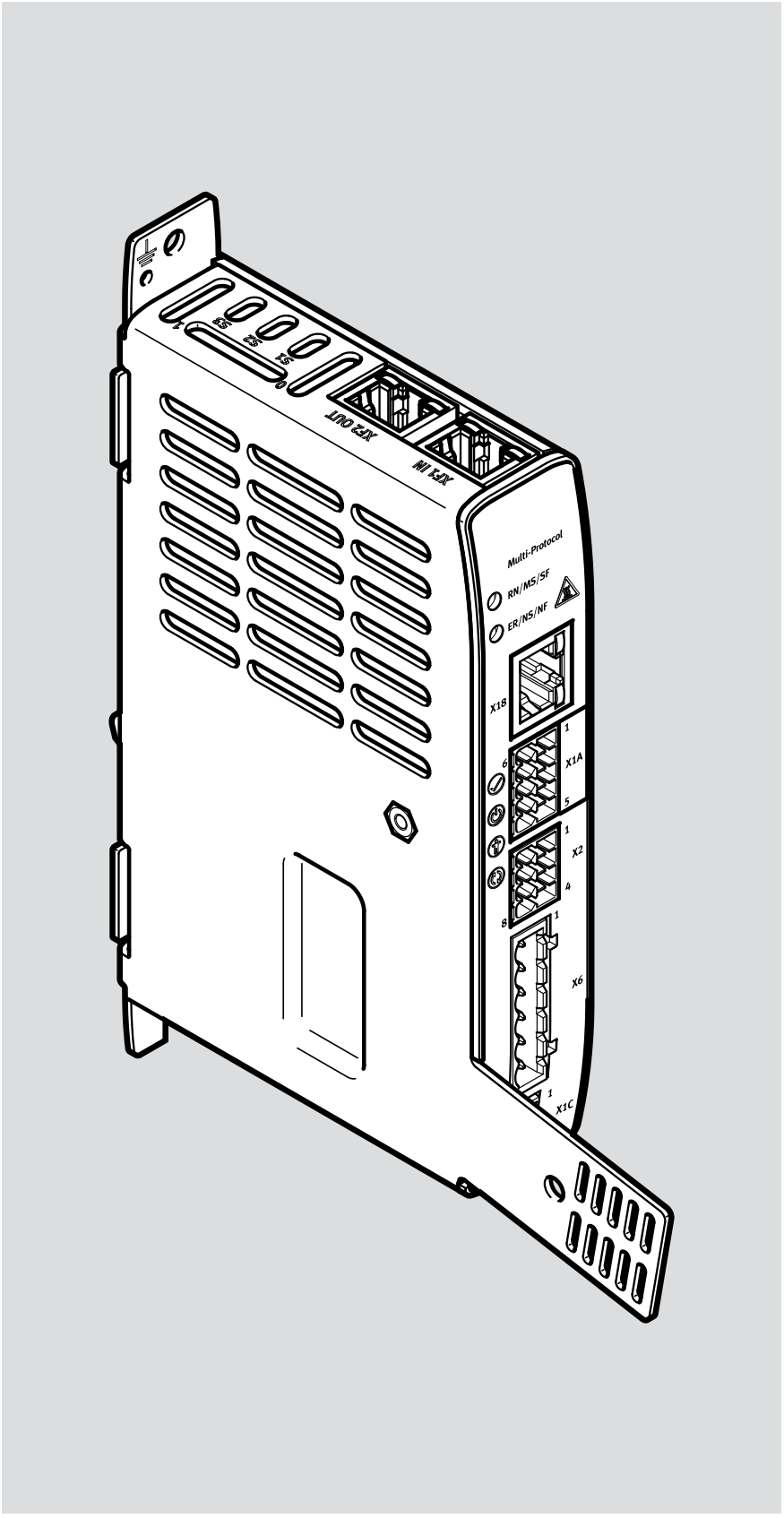
CMMT-ST
Servo drive



FESTO

Manual | Software, Function, Fieldbus, Device profile

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2026-060
[8259159]

Original instructions

BiSS, CANopen, CIP Sync, CODESYS, CiA, EnDat, EtherCAT®, EtherNet/IP, Hiperface, Microsoft, MODBUS, ODVA, PI PROFIBUS PROFINET, PROFIdrive, SIEMENS, STEP 7, TIA Portal, WINDOWS are registered trademarks of the respective trademark owners in certain countries.

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1 About this document

1.1 Notes regarding this documentation

This documentation is intended for safe working with the servo drive and describes the following components:
- Device-specific plug-in for the Festo Automation Suite
- Servo drive firmware
- Bus protocol EtherCAT and device profile CiA402
- Bus protocol PROFINET and device profile PROFIdrive
- Bus protocol EtherNet/IP and drive profile
- Bus protocol Modbus TCP and drive profile

1.2 Target group

This documentation is intended exclusively for technicians trained in control and automation technology who have experience in installation, commissioning, programming and diagnostics of electrical drive systems.

1.3 Applicable documents



All available documents for the product ➔ www.festo.com/sp.

The user documentation for the product also includes the following documents:

Identifier	Content
Operating instructions for the product	Installation, safety sub-function
Manuals for the product	Detailed description for assembly and installation
	Detailed description of safety sub-function
Manual/online help plug-in	Cyber security measures. Plug-in: – Functions and operation of the software – Initial commissioning wizard Firmware functions: – Configuration and parameterisation – Operating modes and operational functions – Diagnostics and optimisation Bus protocol/control: – Device profile – Controller and parameterisation
Festo Automation Suite online help	– Function of the Festo Automation Suite – Management and integration of device-specific plug-ins

Tab. 1: User documentation for the product

1.4 Product version

This documentation refers to the following datasets.

Servo drive[1)]	Firmware package	Plug-in for the Festo Automation Suite
CMMT-ST-...-MP-S0 from revision 1	CMMT-...-MP from version V37.1	CMMT-ST plug-in from version 2.12.0

1) Revision ➔ Product labelling

Tab. 2: Versions

For newer versions, check whether there is a corresponding newer version of the documentation ➔ www.festo.com/sp.

1.5 Safety instructions

Incorrect parameterisation may cause the drive system to perform unwanted or unexpected movements.
- Prior to commissioning, ensure that the resulting movements of the connected actuator technology cannot endanger anyone.
- During commissioning, systematically check all control functions and the communication and signal interfaces between the controller and servo drive.

Further general safety instructions for the servo drive can be found in the operating instructions for the product (Installation, Safety sub-function) ➔ 1.3 Applicable documents.

1.6 Cyber security measures

Accidental or improper execution of functions on the product can lead to failure or malfunction of the product and thus the entire connected system. In addition, unauthorised access to information stored on the product may be possible. The system operator must therefore take appropriate measures to prevent accidental or improper access to the product. Cyber security information ➔ www.festo.com/psirt.

Functions and ports	80	502	7507	7508	10002	10004	PROFINET	EtherCAT	EtherNet/IP
Search	–	–	–	x	x	–	x	x	x
Network	x	x	x	–	x	–	x	x	x
Firmware	x		x	–	–	–	–	x	–
Backup/restore	x	x	x	–	–	–	x	x	x
Homepage	x	–	–	–	–	–	–	–	–
Identification	–	x	x	x	x	–	x	x	x
Firmware with backup	x	–	x	–	–	–	–	x	–
File transfer	x	–	x	–	–	–	–	x	–
Repair	x	–	x	–	–	–	–	x	–
Reboot	x	x	x	–	–	–	x	x	x

Tab. 3: Functions and ports

The homepage, identification and file transfer functions can be run during operation. To avoid potential damage to the system do not perform the other functions during operation.

Ports	Protocol	Interface
80, 502, 990, 7507, 7508	TCP	[X18]
10002, 10004	UDP/MULTICAST	[X18]
PROFINET, EtherCAT, EtherNet/IP	Fieldbus protocol	[X19] ([X18])

Tab. 4: Port allocation

Function	Description
Search	The device can be found on the network using a search protocol.
Network	The device supports the display and setting of the network parameters. On completion of setting the device will restart.
Firmware	The device supports the download of a new firmware version.
Backup/restore	The device supports data backup and data recovery. This will restart the device.

Function	Description
Homepage	The device provides a web server.
Identification	The device supports the identification requirement with flashing LED display.
Firmware with backup	The device supports the download of a new firmware version with upstream data backup and downstream restoration of the backed up data in an automatic process.
File transfer	The device supports file transfer in the command line mode.
Repair	The device can be repaired after an aborted or faulty firmware update.
Reboot	The device can be restarted.

Tab. 5: Description of the functions

1.7 Conventions

The following conventions are used in this document:
- Hexadecimal values are marked by a prefixed “0x”.
- Parameters and diagnostic messages are identified by prefixed letters:
  - Parameter (P ...) ➔ 3.2.1 View of the parameters
  - Diagnostic messages (D ...) ➔ 9.4.2 Structure of messages
- Objects assigned to the parameters are displayed according to the applicable device profile, e.g. objects according to CiA 402 are shown as hexadecimal values with index and subindex ➔ 3.2.3 View of the objects specific to the device profile

2 CMMT-ST Plug-in

2.1 Getting to know the CMMT-ST plug-in

2.1.1 Overview

Function

The CMMT-ST plug-in is integrated in the Festo Automation Suite and enables parameterisation, commissioning, diagnostics and manual control of servo drives of the CMMT-ST range. The plug-in can be loaded and used in a Festo Automation Suite project.
When adding Festo components, the component-specific parameters are copied from a device directory (database) and do not need to be input. The application-specific parameters are input by the user. This applies to all components within the drive configuration. The plug-in keeps the data automatically synchronised. Entries added to the plug-in are immediately transferred to the device if there is an existing device connection ➔ 2.1.5 Automatic data synchronisation

Functions of the Festo Automation Suite

The installation, update, uninstallation and language switchover of the plug-in is managed in the Festo Automation Suite. If a text in the plug-in is not available in the selected language, it switches back to the default language – English. Projects that contain the devices are also managed via the Festo Automation Suite ➔ Festo Automation Suite online help.

Device parameter set

The device parameter set (user parameter set) is part of the project and is managed with the project in the Festo Automation Suite.
Unsaved changes are marked with “*” behind the project name in the title bar.
The "Save" or "Save as" function of the Festo Automation Suite saves the parameter sets with the project. The default project file in the program options is recommended as the default storage location. The default path is "%USERPROFILE%\Documents\Festo Automation Suite Projects".
A project can be stored anywhere in the file system:
– by entering a different directory in the program options or when saving the file
– by moving the project manually in the file system



Recommendation: archive completed projects so that the parameter set is available if the device is replaced. Standard mechanisms can be used, such as the creation of a ZIP archive. After unpacking, the archived project can be opened again in the suite.

Communication ports

The plug-in uses the following communication ports. If you have problems with remote access, configure the communication ports correctly in the router and set the IP address of the target device manually in the connection control of the plug-in.

Connection	Protocol	Port
Device connection of the plug-in	TCP/IP	7507

Tab. 6: Communication ports

2.1.2 User interface

2.1.2.1 Overview

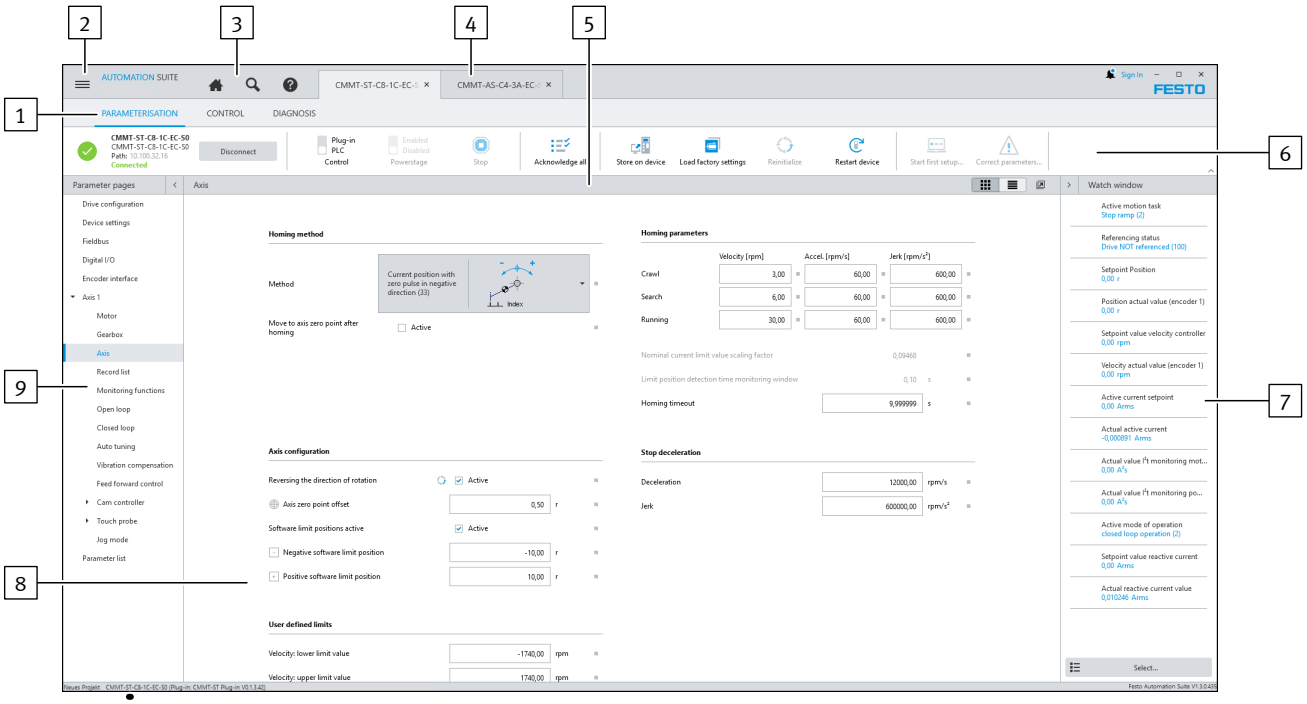


Fig. 1: User interface of the plug-in (example)

1 Selection of context-dependent sections ➔ 2.1.2.2 Contexts

2 Backstage section of the Festo Automation Suite

3 Program sections of the Festo Automation Suite

4 Tabs of device instances that are currently open

5 Title bar of working section ➔ 2.1.2.5 Working section with title bar

6 Toolbar ➔ 2.1.2.3 Toolbar

7 Sidebar ➔ 2.1.2.7 Sidebar with Watch List and device information

8 Working section ➔ 2.1.2.5 Working section with title bar

9 Navigator ➔ 2.1.2.4 Navigator

2.1.2.2 Contexts

Functions and commands contained in the plug-in are divided into contexts. Contexts support the phases in which the user uses the plug-in to commission and optimise the servo drive. The corresponding function is displayed in the working section by clicking on a context. The content of the toolbar and sidebar are adjusted to the relevant context that is selected.

Context	Description
'Parameterization'	Parameterise drive by reading and writing device parameters ➔ 2.3 Parameterization.
'Control'	Manually control the device ➔ 2.4.1 Control.
'Diagnosis'	Performing diagnostics on the device status ➔ 2.5 Diagnosis.

Tab. 7: Description of the contexts

2.1.2.3 Toolbar

The toolbar contains frequently used commands:
- context-independent default commands and sections, e.g. for connection control, error acknowledgement or re-initialisation
- context-dependent commands for the contexts:
  - ‘Parameterization’
  - ‘Control’
  - ‘Diagnosis’

Compatibility with firmware
If the firmware functions are unknown or missing, the command is not executed in the plug-in but a message is displayed instead. This means that the plug-in remains functional with newer or older firmware versions.

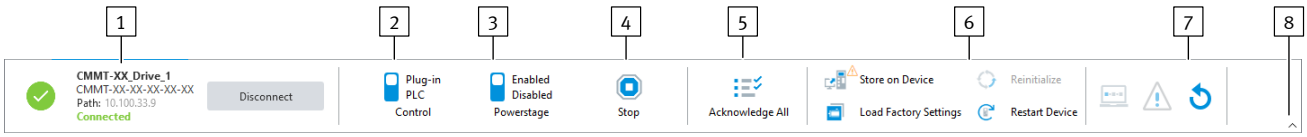


Fig. 2: Toolbar section

1 Connection control
2 Control
3 Powerstage
4 Stop
5 Acknowledge All
6 Additional buttons with an active online connection, reduced here due to the window size
7 More buttons for parameter handling, here only symbols due to the window size
8 Toggle visibility of toolbar

Section/command	Description
 Connection control	Functions: – Connect or disconnect the plug-in with a device. – Display current connection and device status. – Manage the plug-in communication settings. More information ➔ 2.2.2.1 Connection control.
 ‘Control’	Assign or withdraw master control to or from the plug-in or higher-order controller. The displayed scroll bar shows the current setting. The tool tip for the ‘Control’ command contains the IP address and the port number of the device. Requirements: – The plug-in is connected to a device. – No other plug-in has the master control.
	If another plug-in has the master control, an information symbol is displayed over the deactivated ‘Control’ command.
 ‘Powerstage’	Enable or disable the power stage of the servo drive. A check during activation of the controller enable determines whether re-initialisation is required. If the command is executed, a selection dialogue shows the following options: – ‘Ok’: the re-initialisation is executed and controller enable is activated. – ‘Cancel’: the re-initialisation is not executed and controller enable remains deactivated. The scroll bar shows the current setting. Requirements: – The plug-in is connected to a device. – The plug-in has the master control. – The device is not in error status.

Section/command	Description
 ‘Powerstage’	ℹ If another plug-in has the master control, an information symbol is displayed over the deactivated ‘Powerstage’ command. The tool tip for the ‘Powerstage’ command contains the IP address and the port number of the device.
 ‘Stop’	Send stop command to the servo drive (category 2 stop). Requirement: – The plug-in is connected to a device. – The plug-in has the master control. – Controller enable is activated.
 ‘Acknowledge All’	Acknowledge all cancelled diagnostic messages for the servo drive. Requirements: – The plug-in is connected to a device. – The plug-in has the master control. More information ➔ 2.5.1 Device State.
 ‘Store on Device’	Permanently save the current parameterisation on the device. Requirement: – The plug-in is connected to a device.
 ‘Reinitialize’	Re-initialise the device. The re-initialisation will update the device parameters but not save them. If the function for accepting changed device parameters must be executed, the button is highlighted. Requirements: – The plug-in is connected to a device. – The device parameters that required a re-initialisation have been changed. – Controller enable is deactivated.
 ‘Restart Device’	Re-initialise and restart the device. If the function for accepting changed device parameters must be executed, the button is highlighted. If the command is executed, a selection dialogue offers the following options: – ‘Store and Restart’: the data are saved on the device before the restart. – ‘Restart Device Only’: the device is restarted without saving the data. A dialogue showing the status of the connection setup is displayed during the restart. If the connection attempt fails, the process is aborted with a connection error and the plug-in is offline. If a connection is not established within 30 seconds, the plug-in aborts the process with a connection error. Requirement: – The plug-in is connected to a device.
 ‘Start Trace’	Start currently configured recording on the device. Requirements: – The plug-in is connected to a device. – Recording is not currently active.
	ℹ If a recording is active or the device is waiting for a trigger, an information symbol is displayed over the deactivated ‘Start Trace’ button. The remaining runtime is displayed during the trace.
Additionally in context ‘Parameterization’	
 ‘Load Factory Settings’	Load factory parameter record for the device. Requirements: – The plug-in is connected to a device.
 ‘Start First Setup...’	Open initial commissioning wizard for the device. Requirements: – The plug-in is **not** connected to a device. – The drive configuration is **not** open for editing.

Section/command	Description
 ‘Correct Parameters’	Open the parameter correction wizard. Requirements: – The plug-in is **not** connected to a device. – At least one limit value violation has occurred (error or warning).
 ‘Reset to Default Values’	All parameters are reset to the plug-in default values after confirming the query, except for the drive configuration, the record table and the trace settings. The controller parameters and the limit value calculation are recalculated immediately after the reset. All changed values are displayed in the parameter correction wizard.

Tab. 8: Toolbar commands

2.1.2.4 Navigator

For selection in the navigator, all content screens of the selected context are displayed in a navigation tree. Selected content screens are displayed in the working area. ➔ 2.1.2.5 Working section with title bar.

2.1.2.5 Working section with title bar

The working section displays the current content panel of the selected context. The title bar of the working section shows commands available for the current content panel:

Symbol		Description
	‘Undock Page’	Current content panel is opened in a separate window.

Tab. 9: Description of the symbols in the title bar of the working section

Depending on the selected content panel, further commands are visible in the title bar, e.g.:

– Parameter panels for the Parameterisation context ➔ 2.3 Parameterization
– Diagnostics panel ‘Error Log’ for the Diagnostics context ➔ 2.5.4 Error Log
– Control panel ‘Manual Movement’ for the Control context ➔ 2.4.1 Manual Movement

2.1.2.6 Display of errors and warnings

Plug-in errors and warnings

The plug-in checks parameter values and other entries for consistency, violation of the allowed value range and other incorrect entries.



Only the display of errors and warnings of the plug-in is described here.
Messages from the device are displayed here:

- Toolbar ➔ 2.1.2.3 Toolbar
- Diagnostics context ➔ 2.5.1 Device State.

Display of errors and warnings on the parameter, diagnostic and control screens

Errors and warnings are indicated by the corresponding colour coding of the adorner and the frame.

Status	Colour	Description
Warning	Orange	Warnings indicate unfavourable or inconsistent values. The plug-in determines useful default values and critical limits for the parameters, e.g. so that individual drive components are not overloaded by the parameterisation. Parameters with warnings can be written to the device.
Error	red	Errors indicate invalid values; function is not guaranteed. Parameters with errors **cannot** be written to the device.

Tab. 10: Colour coding

Display of errors and warnings in the context and navigator

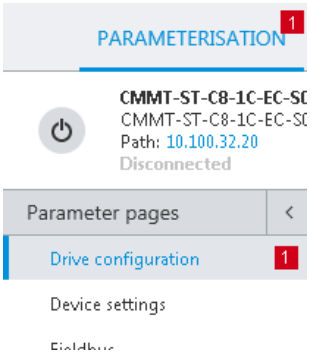


Fig. 3: Displaying errors in the navigator

If parameters on a panel contain errors or warnings, the number is displayed in the navigator. The display of errors has priority.
The total number of errors is also displayed in the context. If the same error occurs on more than one panel, it is only counted once in the total number.

2.1.2.7 Sidebar with Watch List and device information

On the ‘Drive Configuration’ panel the sidebar with the and buttons can be switched between the ‘Watch List’ view and the ‘Device Details’ view with additional device information.
When using the current Festo Automation Suite the Virtual Assistant can also be displayed and used; see the help for the Festo Automation Suite.
The sidebar displays real-time values that are cyclically read and updated by the device when the device connection is active.

Depending on the bus variant, the specific status words and control words can also be displayed.

Adding real-time values to the watch list

In edit mode, the ‘Add parameter’ button can be used to add new real-time values using a pop-up. Any device parameter can be displayed as a real-time value. The pop-up supports multiple selection when selecting parameters by using the mouse in combination with the [Ctrl] key or the [Shift] key.
The button is only active if the following prerequisite is met:
– The maximum number of real-time values has not yet been created.

1. Switch the ‘Watch List’ view to edit mode with the ‘Edit Watch List’ button.
2. Press the ‘Add parameter’ button.
   ⇨ The pop-up for adding a real-time value opens.
   A direct search for a device parameter can be made in the search field using the ID, name or description.
3. Select the category for the device parameter to be recorded.
   The ‘Frequently used’ category contains the most common device parameters.
4. Select one or more device parameters from the list.
   Use the multiple selection options with the mouse in combination with the [Ctrl] key or the [Shift] key to select multiple device parameters simultaneously.
5. Press the ‘Apply’ button.
   ⇨ One or more real-time values are added depending on the number of selected parameters. No more than the maximum allowable number of recording channels is created in this process.

6. Changes made can be reset with the ‘Reset Watch List’ ⮌ button at any point during the editing process. This function will discard all user-defined changes.
7. Finally, confirm the changes with the ‘Apply’ button or reject them with the ‘Cancel’ button.
   ⇨ Edit mode of view ‘Watch List’ is closed.

Alternatively, parameters can be added to the watch list via a button in the adorner ➔ 2.1.2.8 Adorner. If the maximum number of parameters in the watch list is reached, the button is inactive.

Sorting parameters in the watch list

When the editing mode is active, the available parameters can be sorted as desired by dragging and dropping them with the mouse.

Deleting parameters from the watch list

Existing parameters can be deleted with the 🗑 button when edit mode is active.

Scaling the size of the displayed parameter values

The display of the parameter values can be scaled with the slider. Double-clicking on the percentage resets the scaling back to 100%.

2.1.2.8 Adorner

Overview

Adorners provide additional information for parameters. If the cursor is moved over an adorner, the associated pop-up opens. The contents and function range of the pop-up depend on the parameter.

Functions

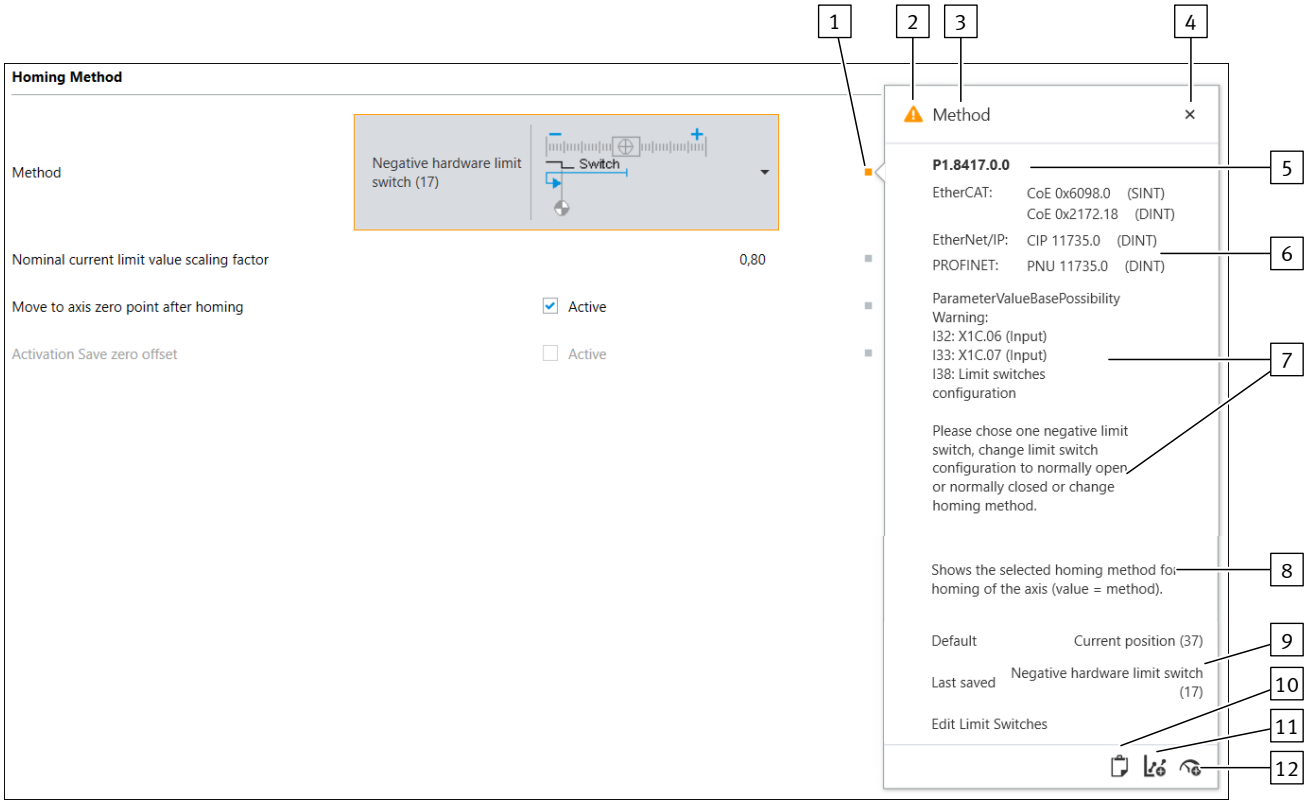


Fig. 4: Structure of an adorner and the pop-up

1 Adorner
2 Status icon
3 Title
4 Close pop-up
5 Parameter ID
6 Fieldbus-specific object number or parameter number with data type
7 Status message, if available
8 Description of the parameter

9 Command section with mouse-over buttons
10 Copy parameter ID to clipboard
11 Add parameters as a recording channel or remove them from the trace
12 Add parameters to the watch list or remove them from the watch list

For example, the plug-in shows settings for internal parameters (I...) on multiple device parameters (P...) or displays device-independent information.
The description of the display and operating components contains, for example, the following information for device parameters or internal parameters:
– Hexadecimal value of parameter
– ID of device parameter or the internal parameter ➔ 3.2.1 View of the parameters
– Fieldbus-specific object number or parameter number with data type
– Description of the parameter

Command section of the pop-up

Depending on the device parameter, corresponding buttons for further actions are available in the command section of the pop-up:
– Change the value of the device parameter (examples ➔ Tab. 11 Buttons for changing the value of the device parameters)
– Reset values of other parameters
– Jump to another panel
– Accept the value for other parameters, e.g. software end positions

Button	Description
'Minimum'	Resets the device parameter to the displayed minimum value.
'Maximum'	Resets the device parameter to the displayed maximum value.
'Default'	Resets the device parameter to the displayed default value.
'Recomm. minimum'	Resets the device parameter to the displayed recommended minimum value.
'Recomm. maximum'	Resets the device parameter to the displayed recommended maximum value.
'Last saved'	Resets the device parameter to the most recently saved value in the project.

Tab. 11: Buttons for changing the value of the device parameters

Displaying information, warnings or errors

The current state of the device parameters is displayed as information, warning or error as follows:
– Colour-coded identification of the adorner
– Status icon in the pop-up



If the adorner has an input field, its border has the same colour as the adorner.

If the values of corresponding parameters are not consistent, the corresponding parameter panels can be opened with a button in the adorner.

Status	Colour of the adorner	Status icon	Description
Information	Grey		The pop-up shows an information icon, the title and description of the applicable parameter. The parameter is in the normal status.
Warning	Orange		The pop-up shows a warning icon, the title and description of the warning. The parameter can be written to the device.
Error	Red		The pop-up shows an error icon, the title and description of the error. The parameter **cannot** be written to the device.

Tab. 12: Description of possible statuses

Diagnostic messages The diagnostic message adorner shows detailed information about the diagnostic message as an overview, including troubleshooting measures.

2.1.2.9 Pop-ups for extensive configurations

Pop-ups for extensive configurations often enable processing in several steps. When a button to open such a pop-up is clicked, only one step of the pop-up opens at first. It is often possible in the pop-up to switch to another step of the pop-up.

The content and number of steps of a pop-up depend on the specific function. Only the currently selected step is visible. The following figure shows an example of both steps of a 2-step pop-up:

User interface

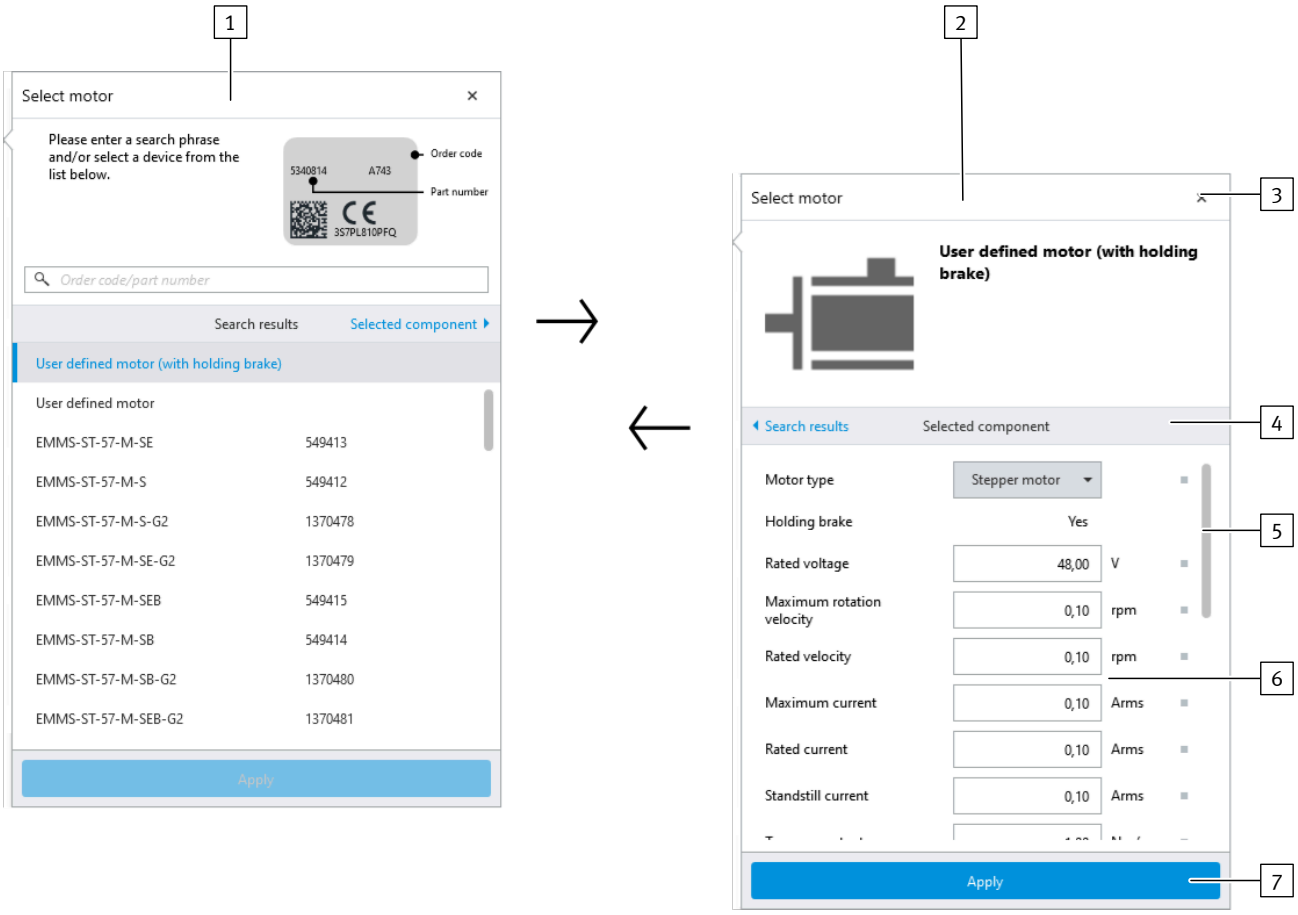


Fig. 5: Multi-level pop-ups (example)

1 Pop-up step 1
2 Pop-up step 2
3 Close pop-up
4 Area for step selection

5 Scrollbar
6 Working section of the selected step
7 Button (in this case data migration)

You can switch between the available steps in the area for the step selection. The working section of the opened step can be scrolled horizontally with the scroll bar e.g. to make a selection or to edit parameters. In the example shown, the button in the lower area of the pop-up permits the adoption of changed values.
If the pop-up is in the last processing step and the user accidentally clicks next to the pop-up, the current status of the pop-up data is automatically saved before the pop-up is closed.

2.1.2.10 Pop-up for automatic values changes

If the plug-in must automatically correct user inputs directly during input, a pop-up is displayed to the left of the input field for two to three seconds.
The plug-in corrects user inputs in the following cases:

Case	Description
Transmission error	– A transmission error occurs during automatic value synchronisation. – An error symbol is displayed in the pop-up. – The value in the input field is automatically reset to the value specified by the device.
Value change or value rounding	– An entered value is automatically changed, rounded up/down by the plug-in. – An information symbol is displayed in the pop-up.

Tab. 13: Correction of user inputs

2.1.2.11 No longer show messages

Various actions must be confirmed before execution. For certain actions, the displayed message can generally be confirmed by setting the ‘Don't show again’ option. Similar actions are then executed directly without a prompt.
The deactivated messages can be reactivated globally for all in the Festo Automation Suite options.

2.1.3 Keyboard shortcuts

The plug-in can be operated via the keyboard with the following keyboard shortcuts:

Keyboard shortcut	Function
General	
[F1]	Open the online help for the plug-in.
[Tab]	Access next input field, next checkbox or next button.
[Shift] + [Tab]	Access previous input field, previous checkbox or previous button.
[Space bar]	Activate or deactivate activated checkboxes. Actuate activated buttons.
Parameter panels	
[Ctrl] + [F6]	Switch between graphic and tabular display. More information ➔ Title bar of the working section.
Parameter panels (tabular display)	
[Ctrl] + [L]	Show/hide all filters ➔ Title bar of the working section.
[Ctrl] + [F]	Switch to search field in title bar of the working section ➔ Title bar of the working section.
[Enter]	Switch from the search back to the parameter panel.

Keyboard shortcut	Function
[Tab]	Access next column header. If the last column header has been accessed, it switches to the currently selected list element. It switches from the currently selected list element to the first column header.
[Shift] + [Tab]	Access previous column header. If the first column header has been accessed, it switches to the currently selected list element. It switches from the currently selected list element to the last column header.
[Arrow keys]	Navigate within the table.
Pop-up (to edit components and events)	
[Tab]	Access next input field, next list, next checkbox or next button.
[Arrow keys]	Navigate within an accessed list.
[Enter]	If available, press button to complete processing.
[Esc]	Close pop-up.

Tab. 14: Description of the keyboard shortcuts of the plug-in

2.1.4 Basic and user units

The plug-in provides the option to select specific user units. The following units are supported and applied to the corresponding values:
– Increments [Inc, Inc/s, ...]
– Rev [r, r/s, ...]
– Rev [r, r/min, ...]
– Rad [rad, rad/s, ...]
– Degree [°, °/s, ...]
– Metric [m, m/s, ...]
– Imperial [in, in/s, ...]

Defining user units

The user units are specified on one of the following panels during configuration of the axis:
– ➔ 2.2.3.1 Initial commissioning wizard
– ➔ 3.3 Drive configuration
If there is a change to the user unit with the plug-in, a query appears prompting whether the values of the affected parameters should be reset to default values. With ‘No’ the values of the relevant parameters are converted to the new unit with reference to the feed constant. With ‘Yes’ the values of the relevant parameters are reset to the default values in the firmware.

The feed constant for linear drives in the plug-in is always set in mm/revolution regardless of the set user unit ➔ 2.3.11 Encoder Interface.
The feed constant for linear drives is always interpreted in meters/revolution in the firmware. The plug-in automatically takes the scaling into account.

2.1.5 Automatic data synchronisation

If the plug-in is connected to a device, the plug-in automatically ensures that the data remains synchronised.
Entries by the user are immediately transferred to the device when exiting the input field or when the [Enter] button is actuated.
A synchronisation is therefore required when a connection to the device is established ➔ 2.2.2.4 Synchronising the configuration and parameters.

2.2 Working with the CMMT-ST plug-in

2.2.1 Open plug-in

When you first open a device that was added from the device catalogue, the following options are displayed on the ‘Drive Configuration’ panel:

– ‘Start First Setup...’ to open the initial commissioning wizard, which guides the user through the most important steps in parameterisation ➔ 2.2.3 Initial commissioning wizard.
– ‘Manual Setup...’ for customised input of parameters, starting with the parameter panel for the drive configuration ➔ 2.3.3 Drive Configuration.

Once one of the options has been selected, the ‘Drive Configuration’ panel will be displayed when it is opened again.

2.2.2 Connecting the Plug-in to the Device

2.2.2.1 Connection control

The connection control elements are the same in every context and every plug-in.

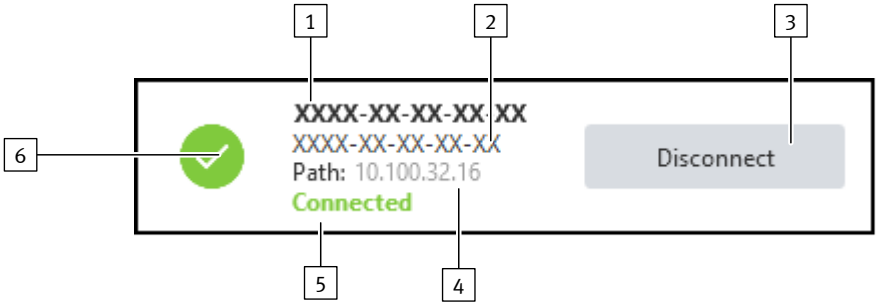


Fig. 6: Device status

1 Device name
2 Name of device range
3 ‘Connect’ or ‘Disconnect’
4 Connection address
5 Connection status
6 Device status

No.	Designation	Function
1	Device name	Display and define device name.
2	Name of device range	Display device range (type of equipment).
3	‘Connect’ or ‘Disconnect’	Establish and disconnect a connection to the device ➔ 2.2.2.2 Establishing and disconnecting a connection.
4	Connection address	Display and define connection address of the device ➔ 2.2.2.2 Establishing and disconnecting a connection.
5	Connection status	Display connection status ➔ Tab. 16 Connection status symbols.
6	Device status	Connected device: display device status (device warning or error) ➔ Tab. 16 Connection status symbols.

Tab. 15: Legend

Connection status

The connection status between plug-in and device is indicated by the following symbols:

Symbol	Connection status	Description
	Disconnected (offline)	The plug-in is not connected to a device.
Dependent on the device status, see table	connected (online)	The plug-in is connected with the device from the configured address.

Tab. 16: Connection status symbols

Device status

If there is a connection to the device, the device status is displayed by the following symbols:

Symbol	Device status	Description
	No error	No diagnostic message is active for the device.
	Information	At least one diagnostic message in the "Information" category is active for the device.
	Warning	At least one diagnostic message in the "Warning" category is active for the device.
	Error	At least one diagnostic message in the "Error" category is active for the device.

Tab. 17: Device status symbols

Displaying details of the device status symbol

If a diagnostic message is active, a pop-up displays further information about the symbol of the device status:

- Hover the mouse pointer over the symbol of the device status.
  ⇨ The pop-up is displayed.

The pop-up contains a description of the current device status, the error number and the ‘Show details’ button.

Setting device name

The device name can be edited regardless of the connection status of the plug-in.

1. Click on the device name.
2. Enter the new device name.

Observe the following rule when entering the device name:
- The device name must not exceed 126 characters.
- Umlauts (ä, ö, ü) and special characters (ß, @ ...) are counted as two characters.

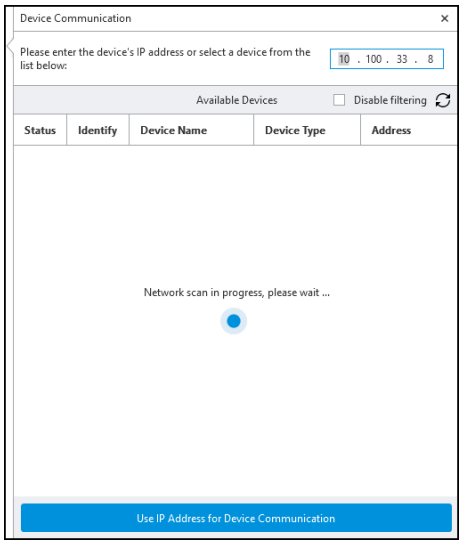
The device name cannot be changed if a connection between the device and a controller is configured in the topology editor and the plug-in of the controller is connected (online) at the same time.
In this case, to change the device name, first disconnect the online connection of the plug-in to the controller. Only if there is no online connection can the device name be changed to the control program.

2.2.2.2 Establishing and disconnecting a connection

Device communication

Before establishing a connection, the device must be addressed with its IP address in the plug-in:

1. Click on the IP address in the toolbar to open the dialogue for device communication.
   ⇨ The dialogue is displayed and the network is automatically scanned for available devices.



2. Select device or enter IP address:
   – Selecting device in the network ➔ Further information
   – Entering IP address of a device ➔ Further information

The dialogue also supports:
– switching off the filtering of compatible devices ➔ Deactivating filtering of compatible devices
– identification of a device from the device list in the network ➔ Further information
– individual definition of a device name ➔ Further information
– the network settings of a device ➔ Further information

Communication ports

The plug-in uses the following communication ports. If you have problems with remote access, configure the communication ports correctly in the router and set the IP address of the target device manually in the connection control of the plug-in.

Connection	Protocol	Port
Device connection of the plug-in	TCP/IP	7507

Tab. 18: Communication ports

Deactivating filtering of compatible devices

Filtering of compatible devices can be deactivated with the ‘Disable filtering’ checkbox. After filtering has been deactivated, all devices found in the network are displayed.

Selecting device in the network

Requirements:
– The device communication dialogue is open.
– Devices were found in the network.

1. To sort the device list, click on the column name in the column header.
   ⇨ The list is sorted in ascending or descending order according to the selected column
2. Select the desired device.

3. Press the ‘Apply’ button.
   ⇨ The IP address of the selected device is accepted and the device communication dialogue closes.

Entering IP address of a device

Requirements:
– The device communication dialogue is open.

1. Enter the IP address of the device in the input field.
2. Press the ‘Apply’ button.
   ⇨ The dialogue for device communication is closed.

Identifying device

A signal can be sent to the required device in order to identify devices, e.g. in a control cabinet.
Requirements:
– The device communication dialogue is open.
– Devices were found in the network.

1. Search for suitable device in the device list
2. Move the slider in the ‘Identify’ column to the right. Optional: click on the appropriate device with the right mouse button and select ‘_Identify Device’.
   ⇨ A device-specific signal is activated on the device, for example, a flashing LED on the device.
3. To switch off the signal: move the slider to the left.

Setting device name

NOTICE

Unpredictable behaviour of the machine when the device is restarted.
Depending on the device, a restart (reboot) may be required to complete the following functions. A safety note is displayed before the restart.
- Only acknowledge the safety note once you have ensured that any unpredictable or unexpected behaviour of the connected machine cannot cause any damage.

Requirements:
– The device communication dialogue is open.
– Devices were found in the network.

1. Click on the required device with the right mouse button.
2. Select ‘Change _Device Name’.
3. Enter the device name.

Observe the following rule for the device name:
- The device name must not exceed 126 characters.
- Umlauts (ä, ö, ü) and special characters (e.g. ß, @) are counted as two characters.

4. Press the ‘Apply’ button.
5. If the device needs to be restarted, a message appears:
   – Eliminate any hazards caused by the behaviour of the machine when restarting.
   – Then confirm the displayed message with ‘Ok’.
   ⇨ The device name is changed.

The device name cannot be changed if a connection between the device and a controller is configured in the topology editor and the plug-in of the controller is connected (online) at the same time.

In this case, to change the device name, first disconnect the online connection of the plug-in to the controller. Only if there is no online connection can the device name be changed to the control program.

Defining network settings

The network settings of different devices can vary depending on the specific device.

Requirements:
– The device communication dialogue is open.
– Devices were found in the network.

1. Click on the required device with the right mouse button.
2. Select ‘Change _Network Settings’.
   ⇨ The current network settings are displayed.
3. Change the network settings.
   – ‘DHCP’ activated: the dynamic assignment of the IP address is activated. This is only permissible if a DHCP server is available in the network. If DHCP is activated, the following settings (subnet mask, gateway and DNS) are greyed out.
   – ‘DHCP’ deactivated: the network settings implemented in the following lines are applied.
4. Press the ‘Apply’ button.
5. If the device needs to be restarted, a message appears:
   – Eliminate any hazards caused by the behaviour of the machine when restarting.
   – Then confirm the displayed message with ‘Ok’.
   ⇨ The network settings are changed.
6. **NOTICE**

   Unpredictable behaviour of the machine when the device is restarted.
   Depending on the device, a restart (reboot) may be required to complete the following functions. A safety note is displayed before the restart.
   • Only acknowledge the safety note once you have ensured that any unpredictable or unexpected behaviour of the connected machine cannot cause any damage.

   Ensure that any unpredictable behaviour by the device cannot cause any damage. Confirm message with ‘Ok’.
   ⇨ The network settings are changed.

Establishing connection to the device

When the connection is established, the data of the plug-in and the device are compared. The configuration and parameterisation of the project and device are checked ➔ 2.2.2.4 Synchronising the configuration and parameters.

If other stations are already connected to the device, the plug-in shows the following information when the connection is established:
• IP address and TCP port of the other stations
• Connection ID for identification of the station with master control
The connection can then be optionally established or cancelled.

If the device is a CODESYS controller, a connection is also automatically established with CODESYS.

Before the plug-in establishes a connection, the firmware is checked to ensure that it is compatible with the current version of the plug-in. If the firmware is not compatible, a connection to the servo drive is not established.

- Press the ‘Connect’ button.
  ⇨ The connection status is updated. The data are automatically synchronised as long as the connection is established.
  The current connection process is cancelled by pressing the button again.

Disconnecting the device

If the connection is disconnected, parameter changes are lost after a power failure or restart.

The ‘Disconnect’ button is visible in the toolbar when the plug-in is connected to a device.
To disconnect the connection:

1. Press the ‘Disconnect’ button
2. Before the plug-in disconnects, it checks whether parameter changes need to be saved.
   Select the appropriate option:
   – Cancel the disconnection process to save parameter changes on the device, or
   – Continue the disconnection process without saving the changes.

2.2.2.3 Synchronising device data

While the connection is being established, the compatibility of the defined device data of the plug-in and the connected device is checked, e.g. when establishing the connection with the IP address of a device. If non-conforming data are found, the non-conformity is displayed. The connection is not established until the non-conformity is corrected.

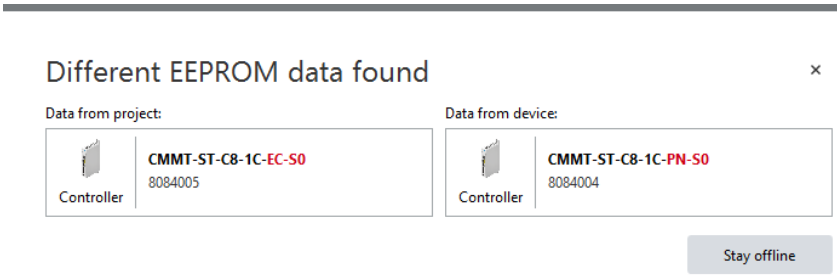


Fig. 7: Message for synchronising the device data

2.2.2.4 Synchronising the configuration and parameters

If device parameter values are changed while connected, the changes are transferred directly to the device ➔ 2.1.5 Automatic data synchronisation.

– Before the connection is established, the firmware version installed on the device is checked to ensure that it is compatible with the plug-in. Parameters that are not supported by the device are detected and displayed in the ‘Parameter synchronisation’ dialogue. The ‘Parameter synchronisation’ dialogue contains the following entries in case of incompatibility:
– The information that parameters are not supported by the device.
– A list of parameters that are not supported by the device.

Parameters that are not supported by the device are marked with a warning. Non-conforming parameters on the device are displayed as "Not supported". Then, when the connection is established, the plug-in checks that the parameters of the device match those in the project.

– If all parameters in the project are valid and match the parameters of the device, the connection to the device is established without further prompts.
– If parameters in the project are invalid, if the parameters of the project and the device do not match or if there are no data in the project or device, a query appears indicating the conflict and offering possible actions for conflict resolution. For example, the following actions are offered depending on the cause:

Cause	Actions	Description
Configuration not available in the project and on the device.	‘Start First Setup...’ (default)	– Connection to the device is established. – Servo drive data are imported. The motor data are also imported for motors in which the motor data are stored in the EEPROM of the integrated encoder. – Connection is terminated. – Initial commissioning wizard is launched.
	‘Connect’	– Connection to the device is established.
	‘Cancel’	– A connection is not established.
Configuration only available in the project	‘Write to Device’	– Connection to the device is established. – Configuration is transferred from the project to the device. The units used in the project and on the device are checked. If the units differ, re-initialisation is required. The unit saved in the project is written to the device. The parameter set is saved and the device executes a re-initialisation.
	‘Apply’	– A connection to the device is established. – The motor data are read out from the EEPROM and transferred to the project. – The connection is then interrupted again.
	‘Cancel’	– Query is terminated without any further action. – A connection is not established.
Configuration available only on the device	‘Read from device’	– Connection to the device is established. – Configuration is transferred from the device to the project.
	‘Cancel’	– A connection is not established.
Configuration available in the project and on the device	‘Write to Device’ (default)	– Connection to the device is established. – Configuration is transferred from the project to the device. The units used in the project and on the device are checked. If the units differ, re-initialisation is required. The unit saved in the project is written to the device. The parameter set is saved and the device executes a re-initialisation.
	‘Read from device’	– Connection to the device is established. – Configuration is transferred from the device to the project.
	‘Cancel’	– Query is terminated without any further action. – A connection is not established.

Tab. 19: Possible actions

2.2.2.5 Device control (master control)

The device control (Device Control) is an exclusive access right and it ensures that the actuator is always controlled by only one single connection. Simultaneous control by multiple connections would result in uncontrolled behaviour of the drive.

The plug-in can remove master control from the higher-level controller in the following conditions:

– The plug-in is connected to the device.
– No other device (another plug-in) already has the master control.

If the connection is interrupted, the plug-in returns master control to the PLC.

Master control is set in the plug-in via a slide switch in the toolbar. If a plug-in has the master control, dependent functions of the toolbar (master control, controller enable) are deactivated for other devices connected with the device.

This status is marked in the plug-in as follows:

– Information symbol over the deactivated command
– Tool tip of the deactivated command with IP address and port of the device with the master control.

2.2.3 Initial commissioning wizard

2.2.3.1 Overview

The drive components are selected and configured in the initial commissioning wizard. The settings for the application data, hardware switches, homing and software end positions are also made here.

The initial commissioning wizard can be operated if the following prerequisite is met:

– The plug-in is **not** connected to a device.

The initial commissioning wizard is started with the ‘Start First Setup...’ button in the toolbar.

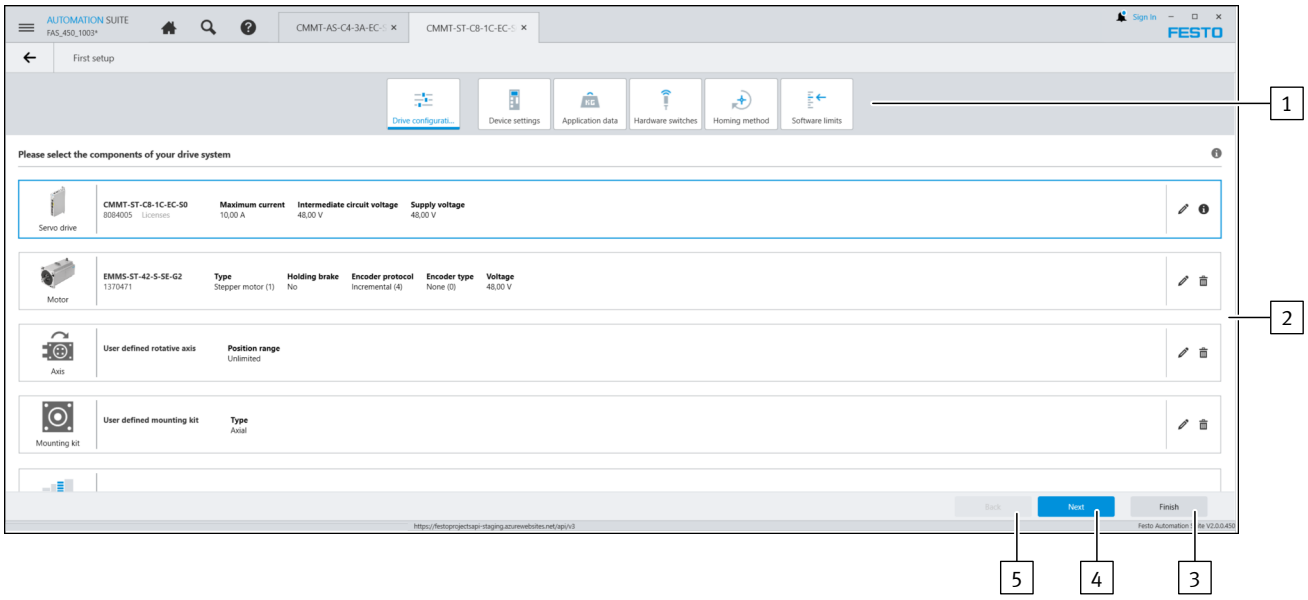


Fig. 8: Initial commissioning wizard start panel

1 Header with selection of the commissioning steps
2 Drive configuration start panel in the initial commissioning wizard
3 Finishes initial commissioning and closes the wizard

4 Continue with the next commissioning step
5 Back to the previous commissioning step

The ‘Configuring drive’ panel is displayed first. The following steps can only be edited when the drive configuration is complete. If the ‘Configuring drive’ configuration panel has been completed, all panels can be processed in any order.

Page		Use
	‘Configuring drive’	Selection of the hardware components of the drive ➔ 2.2.3.2 Drive configuration
	‘Device Settings’	Device-dependent settings e.g.: – Selection of a variant for controller enable of the servo drive – Telegram selection for EtherNet/IP process data – IP configuration of the standard Ethernet interface – Setting the mains voltage for single-phase devices
	‘Fieldbus’	Setting of the fieldbus configuration for multi-protocol devices CMMT-...-MP ➔ 2.2.3.4 Configuring fieldbus, MP devices
	‘Application Data’	Setting specific application data and the reversal of the direction of rotation ➔ 2.2.3.5 Setting application data
	‘Hardware Switches’	Configuration of the limit switches and reference switches ➔ 2.2.3.6 Configuring the hardware switch
	‘Homing Method’	Selected settings for homing, e.g. method ➔ 2.2.3.7 Setting homing
	‘Software Limits’	Selected settings of software end positions and the offset to the axis zero point ➔ 2.2.3.8 Setting software end positions

Tab. 20: Panels of the initial commissioning wizard

Use the following buttons for navigation to the various panels:
– Buttons in the header
– ‘Next’ and ‘Back’ buttons in the footer
The initial commissioning wizard is closed with the ‘Finish’ button in the footer.



At the end of the initial commissioning wizard, changes are applied directly to the project and displayed in the ‘Parameterization’ context on the applicable panels

2.2.3.2 Drive configuration

Using the parameter panel



The operation of the ‘Drive Configuration’ parameter panel of the initial commissioning assistant and the ‘Parameterization’ context is identical. Changes in the parameterisation are automatically applied in both panels.

The ‘Drive Configuration’ parameter panel can only be operated if the following prerequisite is met:
– The plug-in is **not** connected to a device.

The drive components in use are selected and configured in the drive configuration. A drive is fully configured with the following drive components:
– Servo drive
– Motor
– Axis
– Mounting kit
One or more gear units can be optionally selected.

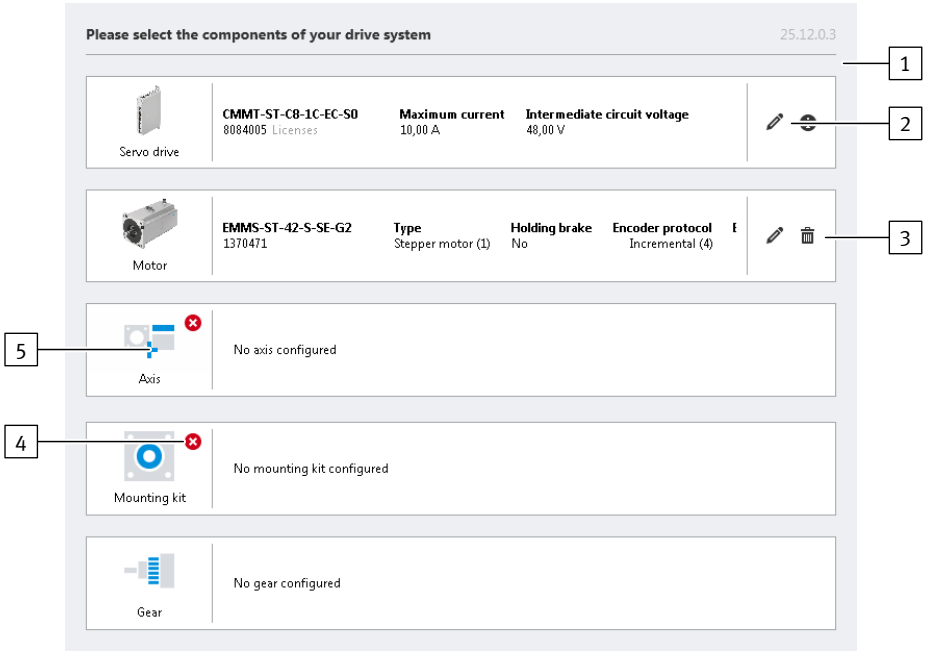


Fig. 9: User interface of the ‘Configuring drive’ parameter panel

1 Overview of drive components
2 Editing drive components
3 Deleting drive components
4 Status of the drive components
5 Selecting new drive components

Selecting new drive components

The drive is configured in several steps in a pop-up. The user can scroll horizontally through the following pop-up components:
– Step 1: select drive components in the search field and/or results list
– Step 2: check properties and settings of the selected components.



1. Move the mouse over the placeholder symbol for the drive component (mouse-over).
   ⇨ A plus symbol is displayed.
2. Click on plus symbol to open the pop-up.
   ⇨ Step 1: the pop-up displays the selection of the drive components
3. Select required drive component. Optional methods:
   – Input order code or part number in the search field.
   – Click the order code of the drive components in the results list.
   Dependent drive components that are automatically added (motor, axis, mounting kit, gear unit) are displayed as icons beside the list entry ➔ Section Automatically adding drive components.
   ⇨ Step 2: the pop-up scrolls automatically to check the properties or setting of the component.
   Optional: if necessary scroll back to the selection with the ‘Search Results’ button and select drive component again
4. With user-specific components: set all parameters

5. Actuate settings with the ‘Apply’ button.
   ⇨ The pop-up is closed. The drive component is applied to the drive configuration and is displayed in the overview.

Editing drive components

Previously configured drive components can be edited as follows:

1. Press the button.
   ⇨ The pop-up shows step 2 to check the properties or setting of the component.
   Optional: if necessary scroll back to the selection with the ‘Search Results’ button and select drive component again
2. With user-specific components: change parameterisation or set all parameters with newly selected components.
3. Actuate settings with the ‘Apply’ button.
   ⇨ The pop-up is closed. The drive component is applied to the drive configuration and is displayed in the overview.

Removing drive components

Remove existing removable drive components as follows:

- Press the button beside the drive component.
  ⇨ The drive component is deleted after confirmation with the security dialogue.

Drive components that cannot be removed are marked by a icon with a tool tip, e.g.:
- Servo drive
- automatically added drive components

Automatically added drive components cannot be removed separately but only as a group with the associated axis or axis-motor combination.

Automatically adding drive components

The program can automatically add more drive components when one component is selected.
The Festo axis-motor combinations (e.g. EPCO, ERMO, EHMD) are easily configured by this automatic additional of the drive components. An axis-motor combination can be selected in the motor and axis configuration level. When importing the selected component, the relevant integrated components (e.g. the mounting kit) are entered automatically and displayed in the drive configuration. Separate selection of further components is therefore not necessary.
Examples of automatically adding drive components:
– Mounting kit after selection of an axis for which there is only one recommended mounting kit.
– Mounting kit after selection of an axis with an integrated mounting kit.
– Gear unit after selection of an axis-motor combination with integrated gear unit
– Motor and mounting kit after selection of a Festo axis-motor combination

Symbol	Automatically added drive component
	Motor
	Axis, linear
	Axis, rotary

Symbol	Automatically added drive component
	Connection shaft
	Gearbox

Tab. 21: Symbols of the automatically added drive components

Automatically added components are identified by the corresponding ⓘ icon with tool tip and are shown in the selection dialogue. Previously selected single components are overwritten during adding. Integrated components are shown by symbols in the drive configuration overview.
Automatically added drive components cannot be edited. The drive components cannot be removed separately but only as a group with the associated axis or axis-motor combination.

Status of drive components

The plug-in automatically checks that the selected drive components are compatible and that the configuration is complete. Incompatible drive components are marked with a warning symbol:

Symbol	Description
No symbol is displayed.	Drive component has been selected and is supported.
	Warning – the selected drive component is not supported by the drive configuration.
	Drive component is missing.

Tab. 22: Drive component status

Compatibility of the components		Criteria for checking	Check negative
Servo drive	Motor	– The load voltage of the servo drive matches that of the motor. – The motor encoder system is supported by the servo drive (encoder interfaces).	 Servo drive Motor
Motor	Gear	The gear unit is mechanically compatible with the motor.	 Motor Gear
Mounting Kit	Motor Gear Axis	The mounting kit is mechanically compatible with the motor or the gear unit and the axis.	 Mounting Kit
Gear	Gear	The total transmission ratio matches the defined gear units (gear unit 1 * gear unit 2 * gear unit 3).	 Gear

Tab. 23: Check of the drive configuration

Notes on parameterisation



After selection of the drive components, additional application-specific parameters for the configured drive components can be set or displayed in the plug-in. Additional information on drive configuration and the application-specific parameterisation ➔ 3.3 Drive configuration

After selecting or changing components, the plug-in automatically calculates the corresponding controller data after a query.

Components	Parameterisation
Servo drive	Configuration not required
Motor	When configuring Festo motors using the plug-in, the motor data are automatically imported from the database after selection of the motor. The data must be entered manually when configuring third-party motors. When selecting a linear motor, a user-defined linear axis and a user-defined mounting kit are automatically set; a gear unit is not included. The following parameters for the motor cable are set on the 'Application Data' panel of the initial commissioning wizard or on the axis x panel, 'Closed Loop': – Length motor cable (P1.1206.0.0) – Cable cross section (P1.1208.0.0) The following parameters depend on the encoder and are automatically set on selection of the motor: – Encoder type = multi-turn P0.3237.0.0 Encoder permanently homed = true Px.4001.0.0 Activation of open loop operation = false – Encoder type = no encoder P0.3237.0.0 Encoder permanently homed = true Px.4001.0.0 Activation of open loop operation = true – other encoder types P0.3237.0.0 Encoder permanently homed = false Px.4001 Activation of open loop operation = false
Axis	Specification of the user units ➔ 2.1.4 Basic and user units. The following units are available for linear axes: – Increments [Inc, Inc/s, ...] – Rev [r, r/s, ...] – Rev [r, r/min, ...] – Rad [rad, rad/s, ...] – Degree [°, °/s, ...] – Metric [m, m/s, ...] – Imperial [in, in/s, ...] The following units are available for rotary axes: – Increments [Inc, Inc/s, ...] – Rev [r, r/s, ...] – Rev [r, r/min, ...] – Rad [rad, rad/s, ...] – Degree [°, °/s, ...] Certain toothed belt axes can be configured in the axis configuration as 2 axes arranged in parallel. These toothed belt axes are recommended for parallel attachment and operation and are marked with a symbol for toothed belt axes in the right column of the drive configuration catalogue. A tool tip for the symbol indicates this suitability. Depending on the axis type and axis structure, additional parameters must be entered, e.g. length of the axis, feed constant, length of the connecting shaft (for with driven parallel axis). If an axis structure with a guide axis or a driven parallel axis is selected, a double axis is displayed as an image of the axis. The type and length of the connecting shaft must be configured for toothed belt axes with driven parallel axis. If a user-defined connecting shaft is selected, the inertia of the user-defined coupling must be entered in an additional input field (P1.100835.0.0). The configured axis structure, the connecting shaft and the length of the connecting shaft are displayed in the overview of the drive components. The selected axis configuration influences the controller design by the plug-in.
Mounting Kit	– Parameterisation is not required for Festo mounting kits. – The transmission ratio with numerator (input variable) and denominator (output variable) must be specified when selecting user-defined mounting kits.
Gear	– Parameterisation is not required for Festo gear units. – The transmission ratio with numerator (input variable) and denominator (output variable) must be specified when selecting user-defined gear units. Example: a transmission ratio of 3:1 indicates that there are 3 revolutions on the gear unit input → 1 revolution on the gear unit output.

Tab. 24: Notes on the parameterisation of components

Parameters		Description
Motor		
I46	'EMF constant'	Electromotive voltage constant (Phase-Phase)
I26	Maximal peak motor torque	Displays the maximum torque calculated from the maximum current Px.7120 and the torque constant Px.7135 of the configured motor.
I25	Nominal motor torque	Displays the nominal torque calculated from the rated current Px.7117 and the torque constant Px.7135 of the configured motor.
I42	'Encoder type'	Type of the motor encoder

Tab. 25: Information on internal parameters

2.2.3.3 Device settings

The panel is opened with the 'Device Settings' button.

'Enable Servo Drive'

The signals required for controller enable are specified in this parameter group.

The setting can also be made on the Device Settings parameter panel after initial commissioning.

Additional information on controller enable ➔ 4.1.9.1 Switch-on/off behaviour and controller enable.

'Telegram' for EtherNet/IP

In this parameter group, the telegram is selected for setting the receive and send telegram for process data (PD).

The setting can also be made on the Fieldbus parameter panel after initial commissioning.

Additional information on the telegrams for EtherNet/IP ➔ 13.6.5 Telegrams
Additional information on the connection properties EtherNet/IP ➔ 13.3.4 Connection characteristics

'Configuration' for EtherNet/IP

This parameter group shows the connection parameters for the EtherNet/IP interface, e.g.:
– IP address
– Subnet mask
– Gateway address
The parameter group enables the IP configuration of the standard Ethernet interface [X18]:
– DHCP activated
  → The device obtains its IP configuration from a DHCP server in the network.
  → If the device connection is active, the current connection parameters are displayed.
– DHCP deactivated
  → The IP configuration of the device can be permanently assigned manually.
Additional information on the connection parameters for EtherNet/IP ➔ 13.3.3 Connection parameters

'Supply Voltage'

The supply voltage for the servo drive is defined in this parameter group. The value is used by the plug-in for the limit value calculation of dependent parameters.

The setting can also be made on the Device Settings parameter panel after initial commissioning.

Parameter name	Description
Mains voltage	Specifies the mains voltage with which the servo drive controller is supplied. This specification is only used for limit value calculation by the plug-in and has no influence on the behaviour of the servo drive controller.

Tab. 26: Parameters

Px	Parameter name
Lower load voltage limit value	Specifies the lower limit value for load voltage monitoring.
Lower limit value DC link voltage	Specifies the lower limit value for the monitoring of the DC link voltage.

Tab. 27: Dependent parameters

'External Brake Resistor' (only with CMMT-ST-...-MP)

An external braking resistor can be activated and parameterised or deactivated in this parameter group.
The motor works as a generator during braking processes. In these cases, the motor returns electrical energy to the DC link. Alternatively, a certain part of the regenerated energy can also be dissipated internally. If the energy feedback is too high, an external braking resistor must be connected, which absorbs the energy and converts it into heat. The energy absorption integrated into the device is sufficient for many applications with moderate cycle times and small moving masses. This means that an external braking resistor is often not required.
– Connect an external braking resistor if greater pulse power or continuous power must be absorbed during braking.

Additional information about the external braking resistor ➔ 3.5.5.5 Pulse energy monitoring of the braking resistor

2.2.3.4 Configuring fieldbus, MP devices

The panel can be opened with the 'Fieldbus' button.

'Fieldbus Configuration'

The desired bus protocol can be selected in this parameter group.
Additional information on selecting the bus protocol ➔ 3.4 Bus protocols of the MP devices.

'EtherNet/IP - ModbusTCP configuration'

The parameter group is only visible if the EtherNet/IP bus protocol has been selected.
The connection parameters for EtherNet/IP can be set in this parameter group, e.g.:
– Telegram selection
– Activate DHCP
– IP address
– Subnet mask
– Gateway address

The parameter optionally enables automatic or manual IP configuration of the standard Ethernet interface [X18]:
– DHCP activated
  ➔ The device obtains its IP configuration from a DHCP server in the network.
– DHCP deactivated
  ➔ The IP configuration of the device can be permanently assigned manually.

2.2.3.5 Setting application data

The panel is opened with the 'Application Data' button.

‘Application Data’

The ‘Application mass’ (linear axes) or ‘Application moment of inertia’ (rotary drive) parameter is set in this parameter group and the mass moment of inertia of the axis and the total mass moment of inertia or the axis mass and the total mass are displayed. The maximum mass or the maximum mass moment of inertia of the moving payload is typically entered as ‘Application mass’ or ‘Application moment of inertia’.
After changing the ‘Application mass’ or ‘Application moment of inertia’ parameter the controller data are recalculated.
‘Application mass’ or ‘Application moment of inertia’ cannot be changed here for imported drive configurations.

‘Load Compensation’

A weight compensation for linear axes in a vertical mounting position can be defined with the Px.969 "Offset torque" parameter to prevent the axis from dropping when the closed-loop controller is activated ➔ 6.3.1 Setpoint value connection.
In order to determine a suitable value for the "Offset torque" parameter, for example, the average of the workpiece masses encountered during operation is input into the "Workpiece mass" field. The plug-in calculates a default value for the "Offset torque" parameter from the workpiece mass and the mounting position of the axis as defined in the ‘Mounting Position’ parameter group.
The input fields are inactive and the parameters are set to 0 for a horizontal mounting position.

Parameters		Description
I87	Use application mass for load compensation	Use application mass for load compensation If the checkbox is activated, the value from parameter Px.1193 "Application mass" (Load weight / load inertia) is used for the load compensation. If the checkbox is deactivated, the value from parameter I85 "Workpiece mass" is used for the load compensation.
I85	Workpiece mass	Mass of a workpiece.

Tab. 28: Information on internal parameters

‘Mounting Position’

A weight compensation for linear axes can be defined with the Px.101741 "Mounting position Axis" parameter in order to prevent the axis from dropping when the closed-loop controller is activated ➔ 6.3.1 Setpoint value connection.

Parameters		Description
I86	Axis orientation	Axis orientation Value list: 1: Horizontal. Sets the Px.101741 "Mounting position Axis" parameter to 0°. 2: Vertical: sets the Px.101741 "Mounting position Axis" parameter to 90°. 3: User-defined: for input of any angle for the Px.101741 "Mounting position Axis" parameter

Tab. 29: Information on internal parameters

‘Mounting Position (Graphic)’, MP devices

In this parameter group, the direction of movement of the load is matched and displayed with the direction of rotation of the motor:
- automatic allocation of the direction of motion to the positive direction of rotation of the motor, depending on the mounting position of the motor on the axis.
- individual allocation of the direction of motion/direction of rotation by reversing the direction of rotation.

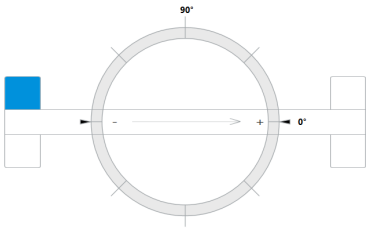
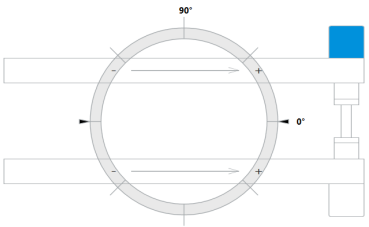
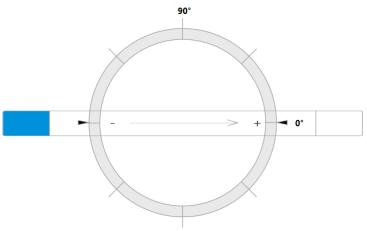
For example, the direction of movement of the load depends on the installation position of the motor, the spindle type of the axis (clockwise/anti-clockwise) and the gear unit. Reversing the direction of rotation can be advantageous when angular or toothed belt gear units are used.
The reversal of the direction of rotation is activated:
– by clicking the arrow
– with the checkbox below the interactive graphic
Further information on reversing the direction of rotation Px.1170 ➔ 3.2.5 Dimension reference system.

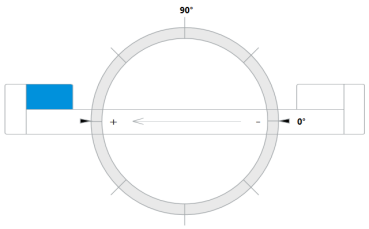
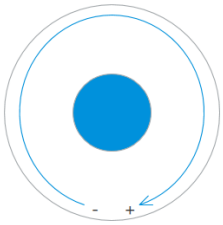
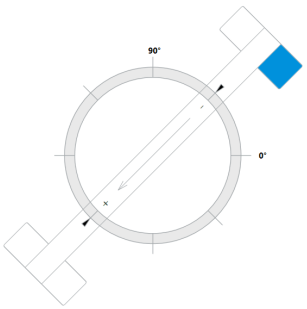
During commissioning:
- check the direction of rotation/direction of motion of the drive, e.g. by jogging.
- Optional: activate/deactivate reversal of direction of rotation.
- After changing the reversal of the direction of rotation: run homing again.

The mounting position of the motor is set using the interactive display of the axis. The currently set position is marked in blue.
The parameterisable mounting position depends on the selected axis type and the mounting kit.

Drive variant	Number of mounting positions of the motor
Toothed belt axis	4
Ball screw axis without parallel kit	2
Ball screw axis with parallel kit	2
Rotary drive	–

Tab. 30: Mounting positions of the motor

Drive variant	Direction of motion (default)
Toothed belt axis (individual axis or toothed belt axis with guide axis)	
Toothed belt axis with driven parallel axis	
Ball screw axis with axial kit	

Drive variant	Direction of motion (default)
Ball screw axis with parallel kit	
Rotary drive	
Example toothed belt axis with angle = 45°	

Tab. 31: Mounting positions of the motor and direction of movement of the load

To change the mounting position:

1. Move the mouse pointer over the selected mounting position until the position is activated with a blue frame ("mouse-over").
2. Select the mounting position by clicking.
   ⇨ The direction of movement of the load is indicated by a direction arrow and a plus/minus symbol.

'Rotation Polarity', EC/EP/PN devices

The EC/EP/PN devices support the parameterisation of the reversal of the direction of rotation and the selection of the installation position of the motor, as described for the MP devices.

'Motor Cable'

The following parameters for the motor cable are set in this parameter group:
– Length of motor cable (Px.1206)
– Cable cross-section (Px.1208)
The setting is also optionally possible on the 'Axis 1', 'Closed Loop' panel.

2.2.3.6 Configuring the hardware switch

The panel is opened with the 'Hardware Switches' button.

'Hardware Switches'

The hardware limit switches and the reference switch are configured in this parameter group. The use and switch type (N/C contact or N/O contact) can be selected for each of the switches. Switches in use are automatically assigned to the following digital inputs:

Switch	Digital input
Reference switch	X1C.2
Positive/negative hardware limit switch	X1A.7, X1A.8

Tab. 32: Digital inputs of the switches

Parameters		Comment
I53	Reference switch	Defines the function of the reference switch. The setting affects parameter Px.101200.
I54	Limit switches	Determines the switching function of both limit switches. The setting of the switching function affects the two parameters Px.101100 and Px.101101. The configuration of the inputs affects the parameters Px.11201 and Px.11202.

Tab. 33: Information on the internal parameters

Additional information on the digital inputs and outputs ➔ 2.3.10 Digital I/O.

2.2.3.7 Setting homing

The panel is opened with the ‘Homing Method’ button. The following settings for homing are defined in the ‘Homing Method’ parameter group:

Setting	Description
Referencing method (Px.8417.0.0)	Selection of the method for homing the drive.
Move to axis zero point after homing (Px.841.0.0)	Specifies whether the drive is to move to the axis zero-point after homing.
Nominal current limit value scaling factor (Px.8414.0.0)	Specifies the limit value for stop detection. The scaling factor refers to the nominal value of the motor current. This parameter applies specifically to the homing methods with impact detection. The standard values of the stop detection function are used with all other homing methods ➔ 5.8 Stop reached.

Tab. 34: Setting homing

If a homing method is selected that is not consistent with other settings, such as the configuration of the corresponding switch, the parameter is marked with a warning. The reason for the warning is displayed in the adorner, and a jump to the relevant parameter panel is also possible by pressing a button.

2.2.3.8 Setting software end positions

The panel is opened with the ‘Software Limits’ button.

Defining parameters

The following parameters can be set with the ‘Software Limits’ parameter group and in part also in the interactive graphic:
– Axis zero point offset
– Software limit positions active
– Negative software limit position
– Positive software limit position
The software end positions can be activated with the ‘Software limits enabled’ checkbox.

If the software end positions are activated, the positive and negative software end positions can be specified via the interactive graphic or in the ‘Software Limits’ parameter group.
If the software end positions are not activated, the interactive graphic does not contain the software end positions and the corresponding input fields in the ‘Software Limits’ parameter group are blocked.

Interactive graphic

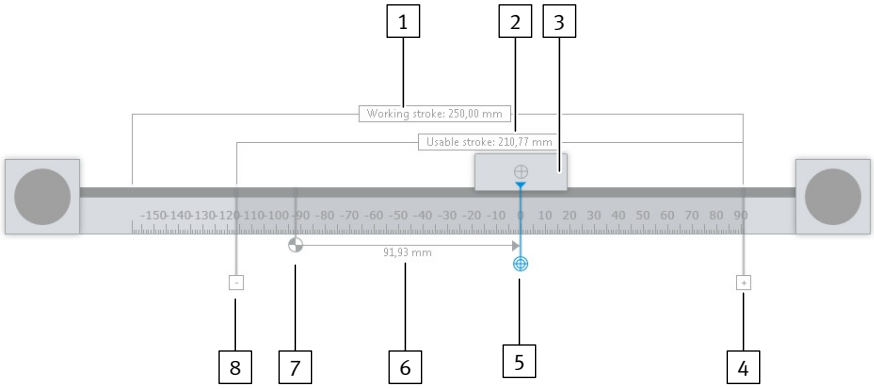


Fig. 10: Interactive graphic for gantry axes

1 Working Stroke
2 Usable stroke
3 Slide
4 Positive software end position
5 Axis zero point
6 Measurement arrow for distance measurement
7 Reference point
8 Negative software end position

Designation	Description
Working Stroke	Theoretically available working stroke of the axis.
Usable stroke	Actual available stroke of the axis based on the current configuration.
Reference point	Homing point for the system of measurement units. The position of the homing point is dependent on the selected homing method.
Slide (for linear axes) Piston rod (for electric cylinders) Drive shaft adapter (for rotary axes)	Axis reference point; moveable part of the axis.
Axis zero point	Axis zero point of the system of measurement units.
Negative software end position	Software end position in negative direction of movement.
Positive software end position	Software end position in positive direction of movement.
Measurement arrow for distance measurement	Distance between two points, e.g. offset between homing point and axis zero point.

Tab. 35: Description of the interactive graphic elements

Defining the axis zero point

If the axis zero point is selected in the interactive graphic, it is displayed in blue and can be moved. The distance between the axis zero point and the homing point is set in the ‘Software Limits’ parameter group.
When the axis zero point is moved, the scale is moved at the same time.
The values of the software end positions remain the same. The displayed positions of the software end positions are moved.
The homing point value is modified. The displayed position of the homing point remains the same.
The axis zero point value can also be specified in the ‘Software Limits’ parameter group and is then adjusted in the interactive graphic.

Defining software end positions

If the software end positions are selected in the interactive graphic, they are displayed in blue and can be moved. The values of the software end positions are adjusted in the ‘Software Limits’ parameter group.
When the software end positions are moved, the usable stroke is calculated, and the corresponding text field is updated in the graphic. The values of the software end positions can also be specified in the ‘Software Limits’ parameter group and are then updated in the interactive graphic.

Defining homing point

The default value of the homing point is 0.0 if a homing method with a negative direction is selected.
If a homing method with a positive direction is selected, the homing point is at the position of the set working stroke. The scale is shown negatively.
If the reference point is selected in the interactive graphic, it is displayed in blue and can be moved. When the homing point is moved, the scale is moved at the same time.
The values of the software end positions and axis zero point remain the same. The displayed positions of the software end positions and axis zero point are moved.

2.2.4 Wizard for parameter correction

The CMMT plug-in checks whether the entered parameter values are within calculated limits. The CMMT plug-in behaves tolerantly and allows limit value violations within certain limits, depending on the parameter.
Festo recommends checking all existing limit value violations and complying with the calculated limit values.
The wizard for parameter correction is started with the ‘Correct Parameters’ button in the toolbar. If the plug-in is connected to the device or if a limit value is not violated, the button is deactivated.
All existing limit value violations, together with the calculated limit values, are displayed in tabular form centrally in the working section of the wizard and marked as errors or warnings.

Colour of the adorner	Meaning	Description
Orange	Warning	Limit value violation is tolerated and can be loaded into the device. Warnings should be corrected.
Red	Error	Limit value violations are not tolerated and cannot be loaded into the device. Errors must be corrected.

Tab. 36: Identification of limit value violations

The wizard for parameter correction offers the option of correcting the affected parameters to the calculated limit values. Limit value violations that are to be corrected automatically to the calculated limit value can be selected or deselected with the checkbox in the first column.
The checkbox in the column header of the first column can also be used for selection. This allows you to select or deselect all parameters regardless of their previous selection status.

Column header	Description
	Displays the selection status. Some parameters are selected (checkboxes in column 1).
	All parameters are selected (checkboxes in column 1).
	No parameters are selected (checkboxes in column 1).
ID	Shows the parameter ID of the specific parameter.
Name	Shows the name of the parameter.
Actual value	Shows the currently set value of the parameter. This value is outside the recommended limit value range.

Column header	Description
(none)	Shows the adorner for every parameter. Hovering the mouse pointer over an adorner opens a pop-up with additional information.
Recommended value	Displays the calculated limit value.
Unit	Shows the unit of the relevant parameter.

Tab. 37: Table columns in the wizard for parameter correction

Accepting parameter corrections

The ‘Apply’ button can be used to correct all selected parameters to the limit values calculated by the plug-in.

2.3 Parameterization

2.3.1 View of the parameters

Title bar of the working section

The title bar of the working section for the ‘Parameterization’ context contains additional commands.
The title bar of the working section or the [Ctrl]+[F5] or [Ctrl]+[F6] key combinations can be used to switch between the available views of the current parameter panel ➔ 2.1.3 Keyboard shortcuts.



When switching the view of a parameter panel, all other parameter panels of the plug-in are switched synchronously. If the view setting for a parameter panel does not exist, the option with the highest priority is displayed.

The available views are displayed via the following symbols in the title bar depending on the parameter panel:

Symbol		Description	Priority
	‘Page View’	Switch to the grouped view. This view shows the parameters usually required for configuration in parameter groups with dialogue boxes.	1
	‘Diagram View’	Switch to the functional view. This view shows functionally related parameters, e.g. in a block diagram.	2
	‘List View’	Switch to the tabular complete view. This view shows all parameters and allows you to edit all writeable parameters listed by parameter groups.	3

Tab. 38: Description of the symbols for switching the panel view

Tabular view

If the tabular view is selected, the title bar of the working section contains the following additional commands for the current parameter panel:

Symbol		Description
	‘Paste parameters from clipboard’	Inserts the parameters from the clipboard into the current panel. The deviating parameters are displayed in a dialogue. The individual parameters can be disabled for the import. The parameters are imported with ‘Import’, and the process is aborted with ‘Cancel’. If the parameters are unchanged or incompatible, a message will be displayed.
	‘Copy parameters to clipboard’	Copies the parameters of the current panel to the clipboard. For example, the parameters can then be pasted to the same panel on another device.
	‘Import parameters’	Only on the ‘Parameter List’ panel: Imports a saved parameter list as a file in the JSON format. After selecting a file, the deviating parameters are displayed in a dialogue. The individual parameters can be disabled for the import. The parameters are imported with ‘Import’, and the process is aborted with ‘Cancel’. If the parameters are unchanged or incompatible, a message will be displayed.
	‘Export parameters’	Only on the ‘Parameter List’ panel: Exports the device parameters to a file in the JSON format.

Symbol		Description
	‘Refresh’	Update entire filtered list or relevant parameter group.
	‘Expand All’	Open parameter groupings.
	‘Collapse All’	Close parameter groupings.
	‘Filter’	Manage all column filters applicable to the parameter view. The set filters remain set after acceptance until a reset is carried out. The function can also be activated with the key combination [Ctrl] + [L].
	–	Search device parameters. Entering any text or numerical values in the search field filters the displayed parameter entries according to the search text in the ‘ID’, ‘Name’ and ‘Value’ columns. The search field can also be activated with the key combination [Ctrl] + [F]. Inputs are not case-sensitive. The following wildcards can be used: – ‘*’ replaces any number of characters. – ‘?’ replaces a single character. This search is carried out in parallel and thus in addition to the column filters. In the search result the search filter can be changed to the name of the parameter group (‘/Axis1/group ...’ or ‘/System/group ...’) with the ‘Show all parameter of this group.’ context menu command to show the complete parameter group.

Tab. 39: Description of the symbols in the title bar

The table is split into the following columns:

Column name	Description
‘ID’	Display ID of device parameter in data model of the device.
‘Name’	Display name of the device parameter.
‘Value’	Display value of the device parameter.
‘Unit’	Display physical unit of the device parameter.
– (adorner)	Adorner of the device parameter with status indicator.

Tab. 40: Description of the parameter list columns

Click on the symbol in the column header to assign specific filters for the individual columns. The symbol is blue for columns with an activated filter.
Click on the column name in the column header to sort the device parameters in ascending or descending order based on the selected column:
– The parameters can only be sorted by one column.
– The sorting of the parameters does not have any influence on the grouping of the device parameters.
– The sorting is implemented exclusively within the parameter groups.

Display of the values on a parameter panel

The following applies to write-protected parameters:
- In the functional view, the parameter name is displayed via adorners in the pop-up window.
- If the device is connected, the current value is displayed.
- If there is no device connection, the parameters are deactivated.

The display of the device parameter values varies according to data type. The following options are available:

Type	Display in a parameter list	
Numerical values or text	Input box	0
Boolean expression (activated or deactivated)	Checkbox	Active
Values lists of parameters	Combo box	AmPrimaryEncoder (0)
Read-only parameters	single entry, black	1,00
For the current setting of non-relevant parameters	single entry, grey	0,20

Tab. 41: Display of the values on a parameter panel

Changing values

The modified value is applied as follows:
– Exit the input field.
– Press the [Enter] on the keyboard.
If device parameter values are changed while connected, they are transferred to the device ➔ 2.1.5 Automatic data synchronisation.

The modified value is only applied if the entered value is valid.

2.3.2 Entering parameters

Operability of the parameter panels

Parameter panels can only be edited if the drive configuration is complete. This does not apply to the drive configuration itself and the parameter list.
The parameter panels are then displayed in read mode. Control elements are deactivated.

Handling unknown and missing device objects

If the plug-in connects to the device, it receives the device description with all parameters from the device. It may be the case that the device description in the plug-in is different to the one in the device.
The following cases can occur:
– unknown parameters
– missing parameters
– conflicting parameters
The following displays are possible depending on the view:
– Display in the grouped view.
  The grouped view is disabled and cannot be used if a parameter is not present in the device description transferred from the device or is defined inconsistently. Or individual parameter groups are deactivated.
  Corresponding information is displayed.
– Display in tabular view.
  The cases in the tabular display are depicted in colour as follows:

Case	Colour display[1)]	Meaning
Unknown parameter	different shades of light blue	This parameter is supported by the device firmware, but was previously unknown to the plug-in. Like all other parameters, it can be changed, and value changes are imported to the device and saved in the project file. A newer version of the plug-in may provide a parameter panel that allows more convenient parameterisation of the device function in question.
Missing parameters	different shades of yellow	This parameter is not supported by the device firmware. Please update the firmware to use it.
Inconsistent parameter	different shades of light red	Please contact Festo.

1) The different colours are intended to provide a better overview in the tabular display and have no further significance.

Tab. 42: Colour display of possible cases

Permissible characters

The following characters are permitted for input values:
- texts: Unicode, UTF-8.
- whole numbers: numbers 0 … 9 and the minus sign.
- decimal numbers: numbers 0 … 9, the minus sign and the decimal separator dot or comma.

Number formats, e.g. decimal and thousand separators are dependent on the settings of the operating system.

Invalid values

Invalid values occur in the following cases:
- The input field is empty.
- The permissible value range of numerical values has not been observed.
- Invalid characters have been entered for numerical values.
- The minimum or maximum number of characters within a text has not been observed.

Check of entries

The plug-in checks inputs and displays corresponding errors and warnings
➔ 2.1.2.6 Display of errors and warnings.

Identification of parameters

Some parameters contains identification marks that are displayed to the left of the input and display panel. Parameters can contain the following identification marks:

Symbol	Explanation
	Any changes to this parameter only become effective following reinitialisation of the device. The reinitialisation cannot be completed if a parameter, that requires a reinitialisation, is modified and controller enable is activated. If controller enable is not activated and a reinitialisation is required, controller enable cannot be activated.
	Any changes to this parameter only become effective once they have been saved and the device has subsequently been restarted. Restarting the device includes a reinitialisation. Modified parameters only remain effective following a restart if they have been saved beforehand.

Tab. 43: Description of parameter identification marks

2.3.3 Drive Configuration

Selection for drive configuration

After adding a device to a project from the device catalogue, the data model is created when the plug-in is opened for the first time and the ‘Drive Configuration’ panel with the following dialogue for selecting the commissioning method is displayed:

Button	Description
‘Start First Setup...’	Closes the dialogue and starts the initial commissioning wizard, which guides the user through the most important parameterisation steps.
‘Manual Setup...’	Closes the dialogue and starts the manual setting of the drive parameters.

Tab. 44: Selection for drive configuration

When the plug-in is opened again, manual commissioning is started automatically. The selection dialogue is no longer displayed. If required, the initial commissioning wizard can be started with the ‘Start First Setup...’ button in the toolbar.
In the panel view the title bar of the working section contains the following additional commands for the current parameter panel:

Symbol		Description
	‘Copy parameters to clipboard’	Pastes drive configuration parameters from the clipboard into the current panels. After selecting a file, the deviating parameters are displayed in a dialogue. The individual parameters can be disabled for the import. Use ‘Import’ to import the parameters, ‘Cancel’ to cancel the process. If the parameters are unchanged or incompatible, a message will be displayed.
	‘Copy configuration to clipboard’	Copies the drive configuration parameters to the clipboard. For example, the parameters can then be pasted to the same panel on another device.

Tab. 45: Description of the symbols in the ‘Drive Configuration’ parameter panel

Structure of the parameter panel

The drive components for configuring the drive are displayed in an overview in the working section of the parameter panel.
Click on a configured drive component to show additional information for that component in the right sidebar:

- Device details, e.g. for the servo drive (device name, firmware version, Product Key, etc.)
- Support documents and files (user manual, application notes, device description, etc.)

If there is no connection to the device yet, initial values are displayed as device details. If there is already a connection to the device, the device details are saved together with the project and displayed whether there is a connection or not.

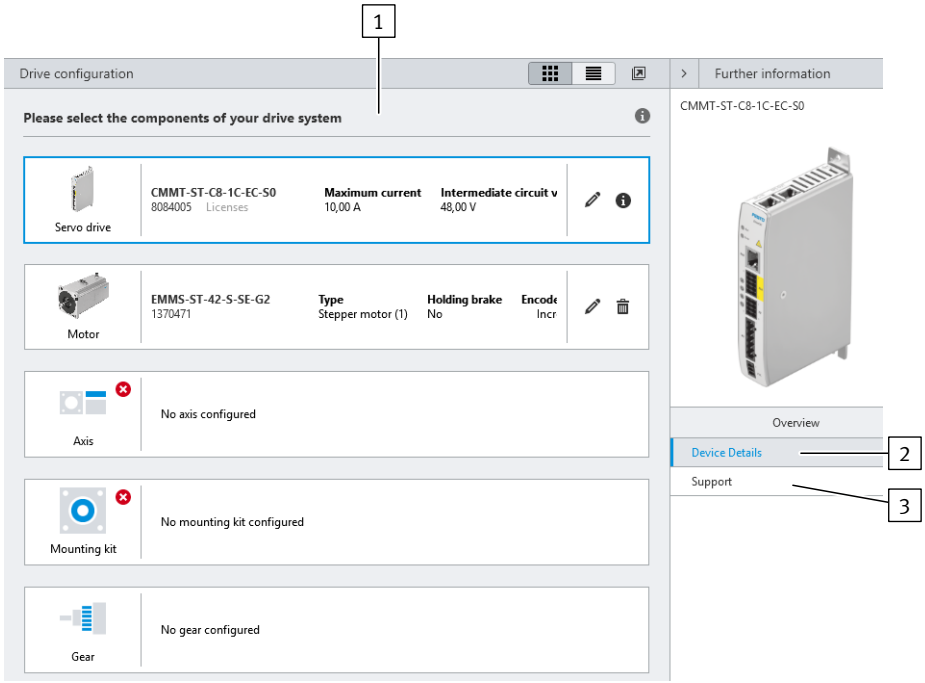


Fig. 11: User interface of the Drive Configuration parameter panel

1 Overview of drive components

2 Device details

3 Selection of device-specific documentation

Using the parameter panel

The operation of the ‘Drive Configuration’ parameter panel of the initial commissioning assistant and the ‘Parameterization’ context is identical. Changes in the parameterisation are automatically applied in both panels.

The ‘Drive Configuration’ parameter panel can only be operated if the following prerequisite is met:

– The plug-in is **not** connected to a device.

The drive components in use are selected and configured in the drive configuration. A drive is fully configured with the following drive components:

– Servo drive
– Motor
– Axis
– Mounting kit

One or more gear units can be optionally selected.

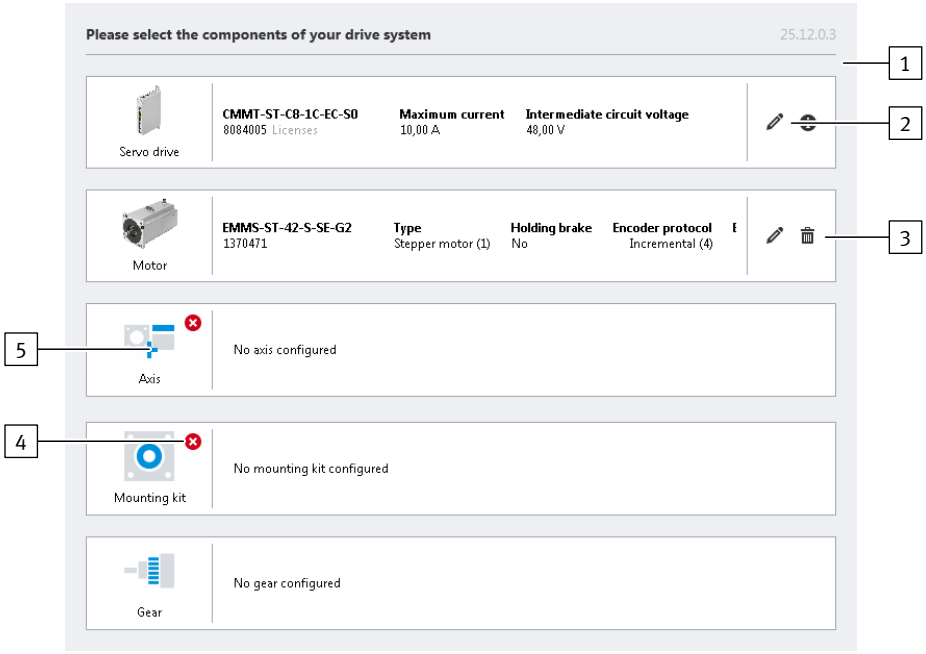


Fig. 12: User interface of the ‘Configuring drive’ parameter panel

1 Overview of drive components
2 Editing drive components
3 Deleting drive components
4 Status of the drive components
5 Selecting new drive components

Selecting new drive components

The drive is configured in several steps in a pop-up. The user can scroll horizontally through the following pop-up components:
– Step 1: select drive components in the search field and/or results list
– Step 2: check properties and settings of the selected components.



1. Move the mouse over the placeholder symbol for the drive component (mouse-over).
   ⇨ A plus symbol is displayed.
2. Click on plus symbol to open the pop-up.
   ⇨ Step 1: the pop-up displays the selection of the drive components
3. Select required drive component. Optional methods:
   – Input order code or part number in the search field.
   – Click the order code of the drive components in the results list.
   Dependent drive components that are automatically added (motor, axis, mounting kit, gear unit) are displayed as icons beside the list entry ➔ Section Automatically adding drive components.
   ⇨ Step 2: the pop-up scrolls automatically to check the properties or setting of the component.
   Optional: if necessary scroll back to the selection with the ‘Search Results’ button and select drive component again
4. With user-specific components: set all parameters
5. Actuate settings with the ‘Apply’ button.
   ⇨ The pop-up is closed. The drive component is applied to the drive configuration and is displayed in the overview.

Editing drive components

Previously configured drive components can be edited as follows:

1. Press the ✎ button.
   ⇨ The pop-up shows step 2 to check the properties or setting of the component.
   Optional: if necessary scroll back to the selection with the ‘Search Results’ button and select drive component again
2. With user-specific components: change parameterisation or set all parameters with newly selected components.
3. Actuate settings with the ‘Apply’ button.
   ⇨ The pop-up is closed. The drive component is applied to the drive configuration and is displayed in the overview.

Removing drive components

Remove existing removable drive components as follows:

- Press the 🗑 button beside the drive component.
  ⇨ The drive component is deleted after confirmation with the security dialogue.

Drive components that cannot be removed are marked by a ⓘ icon with a tool tip, e.g.:
- Servo drive
- automatically added drive components

Automatically added drive components cannot be removed separately but only as a group with the associated axis or axis-motor combination.

Status of drive components

The plug-in automatically checks that the selected drive components are compatible and that the configuration is complete. Incompatible drive components are marked with a warning symbol:

Symbol	Description
No symbol is displayed.	Drive component has been selected and is supported.
⚠	Warning – the selected drive component is not supported by the drive configuration.
⊗	Drive component is missing.

Tab. 46: Drive component status

Compatibility of the components		Criteria for checking	Check negative
Servo drive	Motor	– The load voltage of the servo drive matches that of the motor. – The motor encoder system is supported by the servo drive (encoder interfaces).	⚠ Servo drive Motor
Motor	Gear	The gear unit is mechanically compatible with the motor.	⚠ Motor Gear
Mounting Kit	Motor Gear Axis	The mounting kit is mechanically compatible with the motor or the gear unit and the axis.	⚠ Mounting Kit
Gear	Gear	The total transmission ratio matches the defined gear units (gear unit 1 * gear unit 2 * gear unit 3).	⚠ Gear

Tab. 47: Check of the drive configuration

Automatically adding drive components

The program can automatically add more drive components when one component is selected.
The Festo axis-motor combinations (e.g. EPCO, ERMO, EHMD) are easily configured by this automatic additional of the drive components. An axis-motor combination can be selected in the motor and axis configuration level. When importing the selected component, the relevant integrated components (e.g. the mounting kit) are entered automatically and displayed in the drive configuration. Separate selection of further components is therefore not necessary.
Examples of automatically adding drive components:
- Mounting kit after selection of an axis for which there is only one recommended mounting kit.
- Mounting kit after selection of an axis with an integrated mounting kit.
- Gear unit after selection of an axis-motor combination with integrated gear unit
- Motor and mounting kit after selection of a Festo axis-motor combination

Symbol	Automatically added drive component
	Motor
	Axis, linear
	Axis, rotary
	Connection shaft
	Gearbox

Tab. 48: Symbols of the automatically added drive components

Automatically added components are identified by the corresponding ⓘ icon with tool tip and are shown in the selection dialogue. Previously selected single components are overwritten during adding. Integrated components are shown by symbols in the drive configuration overview.
Automatically added drive components cannot be edited. The drive components cannot be removed separately but only as a group with the associated axis or axis-motor combination.

Notes on parameterisation

After selection of the drive components, additional application-specific parameters for the configured drive components can be set or displayed in the plug-in. Additional information on drive configuration and the application-specific parameterisation ➔ 3.3 Drive configuration

After selecting or changing components, the plug-in automatically calculates the corresponding controller data after a query.

Components	Parameterisation
Servo drive	Configuration not required
Motor	When configuring Festo motors using the plug-in, the motor data are automatically imported from the database after selection of the motor. The data must be entered manually when configuring third-party motors. When selecting a linear motor, a user-defined linear axis and a user-defined mounting kit are automatically set; a gear unit is not included. The following parameters for the motor cable are set on the 'Application Data' panel of the initial commissioning wizard or on the axis x panel, 'Closed Loop': – Length motor cable (P1.1206.0.0) – Cable cross section (P1.1208.0.0) The following parameters depend on the encoder and are automatically set on selection of the motor: – Encoder type = multi-turn P0.3237.0.0 Encoder permanently homed = true Px.4001.0.0 Activation of open loop operation = false – Encoder type = no encoder P0.3237.0.0 Encoder permanently homed = true Px.4001.0.0 Activation of open loop operation = true – other encoder types P0.3237.0.0 Encoder permanently homed = false Px.4001 Activation of open loop operation = false
Axis	Specification of the user units ➔ 2.1.4 Basic and user units. The following units are available for linear axes: – Increments [Inc, Inc/s, ...] – Rev [r, r/s, ...] – Rev [r, r/min, ...] – Rad [rad, rad/s, ...] – Degree [°, °/s, ...] – Metric [m, m/s, ...] – Imperial [in, in/s, ...] The following units are available for rotary axes: – Increments [Inc, Inc/s, ...] – Rev [r, r/s, ...] – Rev [r, r/min, ...] – Rad [rad, rad/s, ...] – Degree [°, °/s, ...] Certain toothed belt axes can be configured in the axis configuration as 2 axes arranged in parallel. These toothed belt axes are recommended for parallel attachment and operation and are marked with a symbol for toothed belt axes in the right column of the drive configuration catalogue. A tool tip for the symbol indicates this suitability. Depending on the axis type and axis structure, additional parameters must be entered, e.g. length of the axis, feed constant, length of the connecting shaft (for with driven parallel axis). If an axis structure with a guide axis or a driven parallel axis is selected, a double axis is displayed as an image of the axis. The type and length of the connecting shaft must be configured for toothed belt axes with driven parallel axis. If a user-defined connecting shaft is selected, the inertia of the user-defined coupling must be entered in an additional input field (P1.100835.0.0). The configured axis structure, the connecting shaft and the length of the connecting shaft are displayed in the overview of the drive components. The selected axis configuration influences the controller design by the plug-in.
Mounting Kit	– Parameterisation is not required for Festo mounting kits. – The transmission ratio with numerator (input variable) and denominator (output variable) must be specified when selecting user-defined mounting kits.
Gear	– Parameterisation is not required for Festo gear units. – The transmission ratio with numerator (input variable) and denominator (output variable) must be specified when selecting user-defined gear units. Example: a transmission ratio of 3:1 indicates that there are 3 revolutions on the gear unit input → 1 revolution on the gear unit output.

Tab. 49: Notes on the parameterisation of components

Parameters		Description
Motor		
I46	'EMF constant'	Electromotive voltage constant (Phase-Phase)
I26	Maximal peak motor torque	Displays the maximum torque calculated from the maximum current Px.7120 and the torque constant Px.7135 of the configured motor.
I25	Nominal motor torque	Displays the nominal torque calculated from the rated current Px.7117 and the torque constant Px.7135 of the configured motor.
I42	'Encoder type'	Type of the motor encoder

Tab. 50: Information on internal parameters

2.3.4 Device Settings

The working section contains the following parameter groups for device setting:
– 'Supply Voltage'
– 'Intermediate Circuit Voltage'
– 'Enable Servo Drive'

'Supply Voltage'

The supply voltage for the servo drive is defined in this parameter group. The value is used by the plug-in for the limit value calculation of dependent parameters.

Parameter name	Description
'Mains voltage'	Specifies the mains voltage with which the servo drive controller is supplied. This specification is only used for limit value calculation by the plug-in and has no influence on the behaviour of the servo drive controller.

Tab. 51: Parameters

Parameter name	Description
'Lower load voltage limit value'	Specifies the lower limit value for load voltage monitoring.
'Lower limit value DC link voltage'	Specifies the lower limit value for the monitoring of the DC link voltage.

Tab. 52: Dependent parameters

'Intermediate Circuit Voltage'

In addition to the usual separate power supply, the device can also be supplied with DC voltage via a DC link coupling. If the DC link is coupled to the DC link of another servo drive, the fast discharge function must be deactivated to protect the device.
This parameter group supports the following settings:
– Parameterisation of the DC link voltage
Additional information on monitoring the DC link voltage ➔ 3.5.5 Mains and DC link monitoring.

'Enable Servo Drive'

The signals required for controller enable are specified in this parameter group.
Additional information on controller enable ➔ 4.1.9.1 Switch-on/off behaviour and controller enable.

2.3.5 Application Data

'Application Data'

The 'Application mass' (linear axes) or 'Application moment of inertia' (rotary drive) parameter is set in this parameter group and the mass moment of inertia of the axis and the total mass moment of inertia or the axis mass and the total mass are displayed. The maximum mass or the maximum mass moment of inertia of the moving payload is typically entered as 'Application mass' or 'Application moment of inertia'.
After changing the 'Application mass' or 'Application moment of inertia' parameter the controller data are recalculated.

‘Application mass’ or ‘Application moment of inertia’ cannot be changed here for imported drive configurations.

‘Load Compensation’

A weight compensation for linear axes in a vertical mounting position can be defined with the Px.969 "Offset torque" parameter to prevent the axis from dropping when the closed-loop controller is activated ➔ 6.3.1 Setpoint value connection.
In order to determine a suitable value for the "Offset torque" parameter, for example, the average of the workpiece masses encountered during operation is input into the "Workpiece mass" field. The plug-in calculates a default value for the "Offset torque" parameter from the workpiece mass and the mounting position of the axis as defined in the ‘Mounting Position’ parameter group.
The input fields are inactive and the parameters are set to 0 for a horizontal mounting position.

Parameters		Description
I87	Use application mass for load compensation	Use application mass for load compensation If the checkbox is activated, the value from parameter Px.1193 "Application mass" (Load weight / load inertia) is used for the load compensation. If the checkbox is deactivated, the value from parameter I85 "Workpiece mass" is used for the load compensation.
I85	Workpiece mass	Mass of a workpiece.

Tab. 53: Information on internal parameters

‘Mounting Position’

A weight compensation for linear axes can be defined with the Px.101741 "Mounting position Axis" parameter in order to prevent the axis from dropping when the closed-loop controller is activated ➔ 6.3.1 Setpoint value connection.

Parameters		Description
I86	Axis orientation	Axis orientation Value list: 1: Horizontal. Sets the Px.101741 "Mounting position Axis" parameter to 0°. 2: Vertical: sets the Px.101741 "Mounting position Axis" parameter to 90°. 3: User-defined: for input of any angle for the Px.101741 "Mounting position Axis" parameter

Tab. 54: Information on internal parameters

‘Mounting Position (Graphic)’, MP devices

In this parameter group, the direction of movement of the load is matched and displayed with the direction of rotation of the motor:
– automatic allocation of the direction of motion to the positive direction of rotation of the motor, depending on the mounting position of the motor on the axis.
– individual allocation of the direction of motion/direction of rotation by reversing the direction of rotation.

For example, the direction of movement of the load depends on the installation position of the motor, the spindle type of the axis (clockwise/anti-clockwise) and the gear unit. Reversing the direction of rotation can be advantageous when angular or toothed belt gear units are used.
The reversal of the direction of rotation is activated:
– by clicking the arrow
– with the checkbox below the interactive graphic

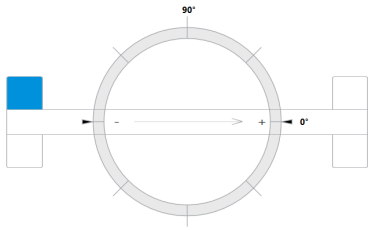
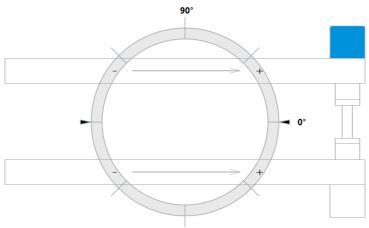
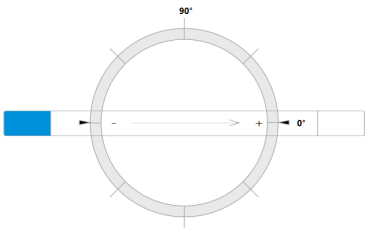
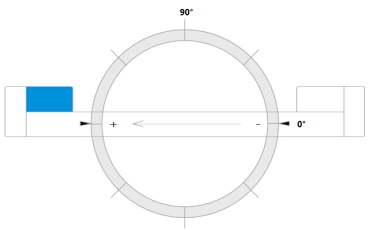
Further information on reversing the direction of rotation Px.1170 ➔ 3.2.5 Dimension reference system.

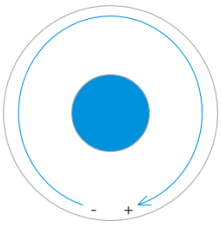
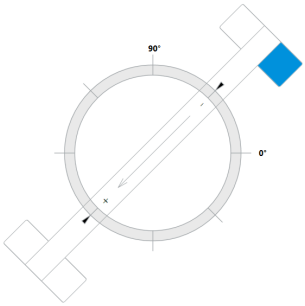
During commissioning:
- check the direction of rotation/direction of motion of the drive, e.g. by jogging.
- Optional: activate/deactivate reversal of direction of rotation.
- After changing the reversal of the direction of rotation: run homing again.

The mounting position of the motor is set using the interactive display of the axis.
The currently set position is marked in blue.
The parameterisable mounting position depends on the selected axis type and the mounting kit.

Drive variant	Number of mounting positions of the motor
Toothed belt axis	4
Ball screw axis without parallel kit	2
Ball screw axis with parallel kit	2
Rotary drive	–

Tab. 55: Mounting positions of the motor

Drive variant	Direction of motion (default)
Toothed belt axis (individual axis or toothed belt axis with guide axis)	
Toothed belt axis with driven parallel axis	
Ball screw axis with axial kit	
Ball screw axis with parallel kit	

Drive variant	Direction of motion (default)
Rotary drive	
Example toothed belt axis with angle = 45°	

Tab. 56: Mounting positions of the motor and direction of movement of the load

To change the mounting position:

1. Move the mouse pointer over the selected mounting position until the position is activated with a blue frame ("mouse-over").
2. Select the mounting position by clicking.
   ⇨ The direction of movement of the load is indicated by a direction arrow and a plus/minus symbol.

'Rotation Polarity', EC/EP/PN devices

The EC/EP/PN devices support the parameterisation of the reversal of the direction of rotation and the selection of the installation position of the motor, as described for the MP devices.

'Motor Cable'

The following parameters for the motor cable are set in this parameter group:
– Length of motor cable (Px.1206)
– Cable cross-section (Px.1208)
The setting is also optionally possible on the 'Axis 1', 'Closed Loop' panel.

2.3.6 Energy Recovery

The working section contains the following parameter groups:
– 'Reactive Current Braking'
– 'DC-Link Recovery'
– 'External Brake Resistor'
– 'Current Active Voltage'

'Reactive Current Braking'

Reactive current braking and automatic voltage detection can be activated or deactivated in this parameter group. If there is an active device connection, the valid switch-on threshold and the end value of the reactive current braking are displayed ➔ 3.5.5.3 Return energy feed.

'DC-Link Recovery'

The intermediate circuit feedback and the automatic voltage determination can be activated or deactivated in this parameter group. If there is an active device connection, the valid switch-on threshold and the end value of the intermediate circuit feedback are displayed ➔ 3.5.5.3 Return energy feed.

'External Brake Resistor'

An external braking resistor can be activated and parameterised or deactivated in this parameter group.

The motor works as a generator during braking processes. In these cases, the motor returns electrical energy to the DC link. Alternatively, a certain part of the regenerated energy can also be dissipated internally. If the energy feedback is too high, an external braking resistor must be connected, which absorbs the energy and converts it into heat. The energy absorption integrated into the device is sufficient for many applications with moderate cycle times and small moving masses. This means that an external braking resistor is often not required.
– Connect an external braking resistor if greater pulse power or continuous power must be absorbed during braking.

Additional information about the external braking resistor ➔ 3.5.5.5 Pulse energy monitoring of the braking resistor

'Current Active Voltage'

The dynamic graphic shows the threshold from which and up to which value energy recovery is active.
If a device connection is active, the current values are displayed, without a device connection, the calculated values.

2.3.7 Fieldbus, MP devices

2.3.7.1 Fieldbus overview, MP devices



The parameter panels for the multi-protocol device CMMT-...-MP are described here. The parameter panels for the bus-specific devices CMMT-...-EC/PN/EP are described here ➔ 2.3.9 Fieldbus, EC/PN/EP devices.

The following parameter panels are available for the various bus protocols:
– Display or definition of the active fieldbus protocol ➔ 2.3.7.2 Configuration
– Parameters for EtherCAT ➔ 2.3.7.3 EtherCAT
– Parameters for PROFINET ➔ 2.3.7.4 PROFINET
– Parameters for EtherNet/IP and Modbus TCP ➔ 2.3.7.5 EtherNet/IP - ModbusTCP

2.3.7.2 Configuration

The parameter panel contains parameter groups for configuring the bus protocol of the servo drive for devices with multi-protocol CMMT-...-MP.

'Prepared Values', 'Fieldbus Configuration'

In this parameter group, the current switch position and the bus protocol effective the next time the device is switched on are displayed.
If the device connection is active, the DIL switch setting of the connected servo drive is displayed in the graphic. Switch position 0 is displayed in grey, switch position 1 is displayed in blue.
The desired bus protocol can be parameterised depending on the switch setting.

'Active Values', 'Fieldbus Configuration'

The current bus protocol and the active switch position of the connected servo drive controller when switching on are displayed in this parameter group.
The parameter panels under 'Fieldbus' and 'Profiles' that are not relevant for the current bus protocol are displayed in grey.
Additional information on configuration of the bus protocol ➔ 3.4 Bus protocols of the MP devices.

2.3.7.3 EtherCAT

The parameter panel contains connection parameters for EtherCAT.

‘EtherCAT Device Parameters’

This parameter group displays the current connection parameters when the device connection is active, e.g.:
– Vendor ID
– Synchronisation mode
– EtherCAT state machine state (ESM)

‘Profiles’

Direct link to parameter panel ➔ 2.3.8.2 CiA 402

2.3.7.4 PROFINET

The parameter panel contains connection parameters for PROFINET.

‘Active’

This parameter group displays the current connection parameters when the device connection is active, e.g.:
– Name of Station
– Active IP address
– Active subnet mask
– Active gateway address
– MAC address
Additional information on the connection parameters for PROFINET ➔ 12.3.4 Connection parameters.

‘Profiles’

Direct link to parameter panel ➔ 2.3.8.3 PROFIdrive

2.3.7.5 EtherNet/IP - ModbusTCP

The parameter panel contains connection parameters for EtherNet/IP and Modbus TCP.

‘Configuration’

The connection parameters for EtherNet/IP and Modbus TCP can be set in this parameter group, e.g.:
– Activate DHCP
– IP address
– Subnet mask
– Gateway address
The ‘Activate DHCP’ parameter optionally enables the automatic or manual IP configuration of the standard Ethernet interface [X18]:
– DHCP activated
  ➔ The device obtains its IP configuration from a DHCP server in the network.
  ➔ The current connection parameters in the Active parameter group are displayed when the device connection is active.
– DHCP deactivated
  ➔ The IP configuration of the device can be permanently assigned manually.

‘Active’

This parameter group displays the current connection parameters when the device connection is active, e.g.:
– Active IP address
– Active subnet mask
– Active gateway address
– MAC address
Additional information on the connection parameters for Ethernet/IP ➔ 13.3.3 Connection parameters

‘Profiles’

Direct link to parameter panel ➔ 2.3.8.3 PROFIdrive

2.3.8 Profiles, MP devices

2.3.8.1 Profiles overview, MP devices

The parameter panels for the multi-protocol device CMMT-...-MP are described here. The parameter panels for the bus-specific devices CMMT-...-EC/PN/EP are described here ➔ 2.3.9 Fieldbus, EC/PN/EP devices.

The following parameter panels are available for the various drive profiles:
- Drive profile ➔ 2.3.8.2 CiA 402 via EtherCAT
- Drive profile ➔ 2.3.8.3 PROFIdrive via PROFINET, EtherNet/IP or Modbus TCP
  - ➔ Factor Group
  - ➔ Telegram
  - ➔ AC4 (PROFINET)
  - ➔ Extended Process Data
  - ➔ 2.3.12.16 Travel to Fixed Stop

2.3.8.2 CiA 402

The parameter panel contains parameter groups for communication between the servo drive and the higher-level controller via the fieldbus.

'Factor Group'

The parameters of the factor group define the resolution at which user units are scaled for transmission via the fieldbus.
The resolution is indicated by a scaling factor for each of the physical quantities, e.g. the following physical quantities:
- Position
- Speed

The scaling factor is given as a power of ten. The servo drive calculates the corresponding parameter values of the physical variables from the specified unit of measurement and the scaling factor.

Power of ten		Resolution
Minimum	-9	0.000 000 001 m/s
Default	-3	0.001m/s (= 1mm/s)
Maximum	9	100 000 000 m/s

Tab. 57: Example of scaling factor of velocity, user unit m/s

The setting ranges of the scaling factor of the physical quantities may differ from the example given here. Note the information in the adorners of the factor group.
Additional information on the user units ➔ 3.2.4.2 Configurable measuring units ("user unit").
Additional information on the factor group ➔ 3.2.4.3 Scaling of internal units for fieldbus ("Factor group").

Fieldbus

Direct link to parameter panel ➔ 2.3.7.3 EtherCAT

2.3.8.3 PROFIdrive

Factor Group

The parameter panel contains parameter groups for communication between the servo drive and the higher-level controller via the fieldbus.

‘Factor Group’

The parameters of the factor group define the resolution at which user units are scaled for transmission via the fieldbus.
The resolution is indicated by a scaling factor for each of the physical quantities, e.g. the following physical quantities:
– Position
– Speed
The scaling factor is given as a power of ten. The servo drive calculates the corresponding parameter values of the physical variables from the specified unit of measurement and the scaling factor.

Power of ten		Resolution
Minimum	-9	0.000 000 001 m/s
Default	-3	0.001m/s (= 1mm/s)
Maximum	9	100 000 000 m/s

Tab. 58: Example of scaling factor of velocity, user unit m/s

The setting ranges of the scaling factor of the physical quantities may differ from the example given here. Note the information in the adorners of the factor group.
Additional information on the user units ➔ 3.2.4.2 Configurable measuring units ("user unit").
Additional information on the factor group ➔ 3.2.4.3 Scaling of internal units for fieldbus ("Factor group").

Telegram

‘Telegram - PROFINET’

Connection properties are defined or displayed in this parameter group, e.g.:
– telegram selection for setting the receive and send telegram for process data (PZD)
– with active device connection: display of the current application class
Information on the telegrams for PROFIdrive ➔ 12.4.5 Telegrams
Additional information on the connection properties for PROFINET ➔ 12.3.5 Connection characteristics.

‘Telegram - EtherNet/IP - ModbusTCP’

Connection properties are defined or displayed in this parameter group, e.g.:
– telegram selection for setting the receive and send telegram for process data
– with active device connection: display of the current application class
Information on the telegrams for Ethernet/IP ➔ 13.6.5 Telegrams
Additional information on the connection properties for Ethernet/IP ➔ 13.3.4 Connection characteristics

‘Dynamic Values’

The dynamic values for motion commands are specified in this parameter group, e.g.:
– acceleration for application class 1 (AC1)
– basic value for the application class of velocity in user unit
– basic value of the velocity for transfer to the configuration tool for the controller
To determine the internal setpoint value, the normalised value in the process data is multiplied by this basic value.
The graphic next to the parameters shows the effectiveness of the various dynamic values in the various application classes.
Additional information on the basic values for PROFIdrive ➔ 12.4.2.1 Basic values and reference values in the application classes

Additional information on the basic values for Ethernet/IP ➔ 13.6.2.1 Basic values and reference values in the application classes

AC4 (PROFINET)

‘AC4’

This parameter group contains parameters for application class AC4 of PROFIdrive. Certain parameter values must always be set to identical values for controller and servo drive, e.g:
– Basic value and maximum velocity (maximum)
– Number of revolutions
– Maximum torque
– Resolution per revolution for the sensor interfaces Gn_XIST (Px.231545) ➔ 12.4.8.7 Encoder n actual position value 1 (Gn_XIST1)

To synchronise the settings:
– The recommended maximum value for the parameter Base value velocity (P1.11280701.0.0) is always half of the parameterised maximum speed (P1.4660.0.0 * factor 0.5).
– Note the information in the adorners of the parameters.
– Compare values with configuration software of the master. If necessary, transfer the parameter values to the master configuration software (e.g. TIA Portal).

The parameterised bus cycle time of this parameter group is used for the internal, model-based controller design of the KPC position controller (runtime compensation). The bus cycle time can be taken from the configuration software of the master.

Further information on application class 4 ➔ 12.4.2.4 Application Class 4 - central motion control (Motion).

Extended Process Data

Process data, e.g. setpoint values/actual values, control/status data, are transmitted cyclically via telegrams. An additional telegram can be configured to transmit user-defined process data. The additional telegram has a fixed length of 32 bytes for each transmission direction in which up to 8 parameters can be transmitted.
Additional information on the process data for PROFINET ➔ 12.4.7 Additional telegram Extended Process Data.
Additional information on the process data for Ethernet/IP ➔ 13.6.7 Additional telegram Extended Process Data.
The ‘Extended Process Data’ parameter panel enables the assignment of up to 8 parameters to the input and output data of the additional telegram.
Prerequisite for displaying current parameter values:
– Establish device connection.

Status

You can set whether the extended process data should be transferred in this parameter group for EtherNet/IP. This is defined with the master configuration software for PROFINET.
In addition, a parameter indicates whether the extended process data are active or inactive.

‘Sent Data’ and ‘Received Data’

The process channels to be transferred are defined in these parameter groups. The data type of the PNU to be transferred is displayed in field ‘Type’.

The start position of the process channel within the send data or receive data is displayed in field ‘Byte position’.
The number assigned to the data type is displayed in the ‘Function Block ID’ field, which is transferred to the Festo block (Festo_CMMT_PN-Lib) for configuration of the input data and the output data.
The number of bytes of the data to be transferred is displayed under the list of process data channels. In the ‘PLC output configuration’ and ‘PLC input configuration’ fields, the numbers assigned to the data types are output one after the other in the order in which they were transferred to the module.

Adding process channel

1. Open the selection dialogue with the ‘Add Process Channel’ button.
   The number of occupied bytes of the transmit data Tx or receive data Rx is displayed below the button.
2. Select parameters by category, ID, name or description.
3. Accept the selection and exit the dialogue with the ‘Apply process channel’ button.
   ⇨ The process channel is added at the end of the table view under the ‘Sent Data’ group or the ‘Received Data’ group.

Editing the process channel

1. Select the process channel in the table view of the send or receive data.
2. Open the selection dialogue with the ‘Edit Process Channel’ button.
3. Select parameters by category, ID, name or description.
4. Accept the selection and exit the dialogue with the ‘Apply process channel’ button.

Changing the order of the process channels

The order of the process channels can be changed within the ‘Sent Data’ and ‘Received Data’ parameter groups by drag and drop.

Removing process channel

1. Open the selection dialogue with the ‘Delete Process Channel’ button.
2. Confirm remove.
   ⇨ The process channel is deleted from the table view.

Removing all transmit data or all receive data

Button	Description
‘Delete All Sent Data’	Removes all process channels from the ‘Sent Data’ group.
‘Delete All Received Data’	Removes all process channels from the ‘Received Data’ group.

Tab. 59: Functions for the entire parameter panel

2.3.9 Fieldbus, EC/PN/EP devices

2.3.9.1 Configuration for EtherCAT

The parameter panel for the bus-specific device CMMT-...-EC is described here. The parameter panels for the multi-protocol device CMMT-...-MP are described here ➔ 2.3.7 Fieldbus, MP devices.

The parameter panel contains parameter groups for communication between the servo drive and the higher-level controller via the fieldbus.

‘Factor Group’

The parameters of the factor group define the resolution at which user units are scaled for transmission via the fieldbus.

The resolution is indicated by a scaling factor for each of the physical quantities, e.g. the following physical quantities:
– Position
– Speed
The scaling factor is given as a power of ten. The servo drive calculates the corresponding parameter values of the physical variables from the specified unit of measurement and the scaling factor.

Power of ten		Resolution
Minimum	-9	0.000 000 001 m/s
Default	-3	0.001m/s (= 1mm/s)
Maximum	9	100 000 000 m/s

Tab. 60: Example of scaling factor of velocity, user unit m/s

The setting ranges of the scaling factor of the physical quantities may differ from the example given here. Note the information in the adorners of the factor group.
Additional information on the user units ➔ 3.2.4.2 Configurable measuring units ("user unit").
Additional information on the factor group ➔ 3.2.4.3 Scaling of internal units for fieldbus ("Factor group").

2.3.9.2 Configuration for PROFINET

The parameter panel for the bus-specific device CMMT-...-PN is described here. The parameter panels for the multi-protocol device CMMT-...-MP are described here ➔ 2.3.7 Fieldbus, MP devices.

The parameter panel contains parameter groups for communication between the servo drive and the higher-level controller via the fieldbus.

'Telegram'

Connection properties are defined or displayed in this parameter group, e.g.:
– telegram selection for setting the receive and send telegram for process data (PZD)
– with active device connection: display of the current application class
Information on the telegrams for PROFIdrive ➔ 12.4.5 Telegrams
Additional information on the connection properties for PROFINET ➔ 12.3.5 Connection characteristics.

'Factor Group'

The parameters of the factor group define the resolution at which user units are scaled for transmission via the fieldbus.
The resolution is indicated by a scaling factor for each of the physical quantities, e.g. the following physical quantities:
– Position
– Speed
The scaling factor is given as a power of ten. The servo drive calculates the corresponding parameter values of the physical variables from the specified unit of measurement and the scaling factor.

Power of ten		Resolution
Minimum	-9	0.000 000 001 m/s
Default	-3	0.001m/s (= 1mm/s)
Maximum	9	100 000 000 m/s

Tab. 61: Example of scaling factor of velocity, user unit m/s

The setting ranges of the scaling factor of the physical quantities may differ from the example given here. Note the information in the adorners of the factor group.
Additional information on the user units ➔ 3.2.4.2 Configurable measuring units ("user unit").
Additional information on the factor group ➔ 3.2.4.3 Scaling of internal units for fieldbus ("Factor group").

'Dynamic Values'

The dynamic values for motion commands are specified in this parameter group, e.g.:
– acceleration for application class 1 (AC1)
– basic value for the application class of velocity in user unit
– basic value of the velocity for transfer to the configuration tool for the controller
  To determine the internal setpoint value, the normalised value in the process data is multiplied by this basic value.

The graphic next to the parameters shows the effectiveness of the various dynamic values in the various application classes.
Additional information on the basic values for PROFIdrive ➔ 12.4.2.1 Basic values and reference values in the application classes

'AC4'

This parameter group contains parameters for application class AC4 of PROFIdrive. Certain parameter values must always be set to identical values for controller and servo drive, e.g:
– Basic value and maximum velocity (maximum)
– Number of revolutions
– Maximum torque
– Resolution per revolution for the sensor interfaces Gn_XIST (Px.231545)
  ➔ 12.4.8.7 Encoder n actual position value 1 (Gn_XIST1)

To synchronise the settings:
– The recommended maximum value for the parameter Base value velocity (P1.11280701.0.0) is always half of the parameterised maximum speed (P1.4660.0.0 * factor 0.5).
– Note the information in the adorners of the parameters.
– Compare values with configuration software of the master. If necessary, transfer the parameter values to the master configuration software (e.g. TIA Portal).

The parameterised bus cycle time of this parameter group is used for the internal, model-based controller design of the KPC position controller (runtime compensation). The bus cycle time can be taken from the configuration software of the master.

Further information on application class 4 ➔ 12.4.2.4 Application Class 4 - central motion control (Motion).

2.3.9.3 Configuration for EtherNet/IP

The parameter panel for the bus-specific device CMMT-...-PN is described here. The parameter panels for the multi-protocol device CMMT-...-MP are described here ➔ 2.3.7 Fieldbus, MP devices.

The parameter panel contains parameter groups for communication between the servo drive and the higher-level controller via the fieldbus.

'Telegram'

Connection properties are defined or displayed in this parameter group, e.g.:
– telegram selection for setting the receive and send telegram for process data (PZD)
– with active device connection: display of the current application class
Information on the telegrams for Ethernet/IP ➔ 13.6.5 Telegrams
Additional information on the connection properties for Ethernet/IP ➔ 13.3.4 Connection characteristics

'Factor Group'

The parameters of the factor group define the resolution at which user units are scaled for transmission via the fieldbus.
The resolution is indicated by a scaling factor for each of the physical quantities, e.g. the following physical quantities:
– Position
– Speed
The scaling factor is given as a power of ten. The servo drive calculates the corresponding parameter values of the physical variables from the specified unit of measurement and the scaling factor.

Power of ten		Resolution
Minimum	-9	0.000 000 001 m/s
Default	-3	0.001m/s (= 1mm/s)
Maximum	9	100 000 000 m/s

Tab. 62: Example of scaling factor of velocity, user unit m/s

The setting ranges of the scaling factor of the physical quantities may differ from the example given here. Note the information in the adorners of the factor group.
Additional information on the user units ➔ 3.2.4.2 Configurable measuring units ("user unit").
Additional information on the factor group ➔ 3.2.4.3 Scaling of internal units for fieldbus ("Factor group").

'Dynamic Values'

The dynamic values for motion commands are specified in this parameter group, e.g.:
– acceleration for application class 1 (AC1)
– basic value for the application class of velocity in user unit
– basic value of the velocity for transfer to the configuration tool for the controller
To determine the internal setpoint value, the normalised value in the process data is multiplied by this basic value.
The graphic next to the parameters shows the effectiveness of the various dynamic values in the various application classes.
Additional information on the basic values for Ethernet/IP ➔ 13.6.2.1 Basic values and reference values in the application classes

2.3.9.4 Interface for EtherNet/IP, PROFINET

The parameter panels for the bus-specific devices CMMT-...-PN/EP are described here. The parameter panels for the multi-protocol device CMMT-...-MP are described here ➔ 2.3.7 Fieldbus, MP devices.

The parameter panel contains connection parameters for the applicable fieldbus.

'Configuration' for EtherNet/IP

The connection parameters for EtherNet/IP can be set in this parameter group, e.g.:
– Activate DHCP
– IP address
– Subnet mask
– Gateway address

The parameter group optionally enables automatic or manual IP configuration of the standard Ethernet interface [X18]:
– DHCP activated
  ➔ The device obtains its IP configuration from a DHCP server in the network.
  ➔ The current connection parameters in the Active parameter group are displayed when the device connection is active.
– DHCP deactivated
  ➔ The IP configuration of the device can be permanently assigned manually.

'Active' for EtherNet/IP, PROFINET

This parameter group displays the current connection parameters when the device connection is active, e.g.:
– Active IP address
– Active subnet mask
– Active gateway address
– MAC address

Additional information on the connection parameters for PROFINET ➔ 12.3.4 Connection parameters.
Additional information on the connection parameters for Ethernet/IP ➔ 13.3.3 Connection parameters

2.3.9.5 Extended Process Data (additional telegram) for EtherNet/IP, PROFINET

The parameter panels for the bus-specific devices CMMT-...-PN/EP are described here. The parameter panels for the multi-protocol device CMMT-...-MP are described here ➔ 2.3.7 Fieldbus, MP devices.

Process data, e.g. setpoint values/actual values, control/status data, are transmitted cyclically via telegrams. An additional telegram can be configured to transmit user-defined process data. The additional telegram has a fixed length of 32 bytes for each transmission direction in which up to 8 parameters can be transmitted.
Additional information on the process data for PROFINET ➔ 12.4.7 Additional telegram Extended Process Data.
Additional information on the process data for Ethernet/IP ➔ 13.6.7 Additional telegram Extended Process Data.
The 'Extended Process Data' parameter panel enables the assignment of up to 8 parameters to the input and output data of the additional telegram.

Prerequisite for displaying current parameter values:
– Establish device connection.

Status

You can set whether the extended process data should be transferred in this parameter group for EtherNet/IP. This is defined with the master configuration software for PROFINET.
In addition, a parameter indicates whether the extended process data are active or inactive.

‘Sent Data’ and ‘Received Data’

The process channels to be transferred are defined in these parameter groups.
The data type of the PNU to be transferred is displayed in field ‘Type’.
The start position of the process channel within the send data or receive data is displayed in field ‘Byte position’.
The number assigned to the data type is displayed in the ‘Function Block ID’ field, which is transferred to the Festo block (Festo_CMMT_PN-Lib) for configuration of the input data and the output data.
The number of bytes of the data to be transferred is displayed under the list of process data channels. In the ‘PLC output configuration’ and ‘PLC input configuration’ fields, the numbers assigned to the data types are output one after the other in the order in which they were transferred to the module.

Adding process channel

1. Open the selection dialogue with the ‘Add Process Channel’ button.
   The number of occupied bytes of the transmit data Tx or receive data Rx is displayed below the button.
2. Select parameters by category, ID, name or description.
3. Accept the selection and exit the dialogue with the ‘Apply process channel’ button.
   ⇨ The process channel is added at the end of the table view under the ‘Sent Data’ group or the ‘Received Data’ group.

Editing the process channel

1. Select the process channel in the table view of the send or receive data.
2. Open the selection dialogue with the ‘Edit Process Channel’ button.
3. Select parameters by category, ID, name or description.
4. Accept the selection and exit the dialogue with the ‘Apply process channel’ button.

Changing the order of the process channels

The order of the process channels can be changed within the ‘Sent Data’ and ‘Received Data’ parameter groups by drag and drop.

Removing process channel

1. Open the selection dialogue with the ‘Delete Process Channel’ button.
2. Confirm remove.
   ⇨ The process channel is deleted from the table view.

Removing all transmit data or all receive data

Button	Description
‘Delete All Sent Data’	Removes all process channels from the ‘Sent Data’ group.
‘Delete All Received Data’	Removes all process channels from the ‘Received Data’ group.

Tab. 63: Functions for the entire parameter panel

2.3.10 Digital I/O

The working section contains parameter groups to configure the digital inputs and outputs. Depending on the application, different signals can be allocated to specific digital inputs and outputs.
Additional information on the digital inputs and outputs ➔ 3.3.6 Digital inputs and outputs.

‘General settings’ (only for CMMT-ST-...-EC/PN/EP)

The characteristics of the inputs and outputs can be parameterised.
Additional information for parameterisation of the PNP input and output response ➔ 3.3.6 Digital inputs and outputs.

‘X1A’ and ‘X1C’

The configurable inputs and outputs are grouped according to the relevant X1A and X1C plugs.
Interrelated parameterisations are partly shown on multiple device parameters (Px...) by the plug-in with internal parameters (I...). For example, this can refer to the assignment and switching function of the switch at the input.

Parameters		Description
I50	‘X1C.02 (Input)’	Defines the function of the digital input signal at connection X1C.02. The setting affects parameter Px.101200.
I51	‘X1A.07 (Input)’	Defines the function of the digital input signal at terminal X1A.07. The setting affects parameter Px.11201.

Tab. 64: Information on internal parameters

If a conflict results from assignments, this is displayed as a warning and can be resolved with command buttons in the pop-up of the corresponding adorner.
The graphics beside the parameters show the pin allocation. Configurable inputs and outputs are shown in blue. The terminal name, function and description are displayed as a tool tip.
Additional information on the parameterisation of digital I/Os ➔ 3.3.6.1 Digital inputs and outputs.

2.3.11 Encoder Interface

The encoder selection on this parameter panel determines which encoder type will be used after the next re-initialisation. If the wrong type is set during encoder selection, the connected encoder can be damaged by an inadmissibly high supply voltage. This is prevented by protection mechanisms only with EnDat and Hiperface encoders.

The configuration and parameterisation options are dependent on the properties of the encoder.
The configuration data are automatically applied to the project or read out in the following cases:
– For Festo motors from the database.
– For motors or encoders with electronic rating plate and existing device connection.

The parameter group for displaying, configuring and parameterising the following encoders is located in the working section:

Encoder	Function
'Encoder 1 (X2)'	Primary encoder at connection X2 – Actual value acquisition of the position for the position controller – Commutation – Velocity control

Tab. 65: Encoder

The configuration and parameterisation options are dependent on the properties of the encoder.
The configuration data are automatically applied to the project or read out in the following cases:
– For Festo motors from the database.
– For motors or encoders with electronic rating plate and existing device connection.

'Feed Constant'

This parameter group is visible if a linear axis is configured in the drive configuration.

Feed constant	Description
Encoder feed constant at encoder interface 1	The feed constant cannot be configured when using Festo linear axes. The feed constant can be configured when using user-defined linear axes: – Setting in the initial commissioning wizard – Setting on the 'Drive Configuration' parameter panel (axis)

Tab. 66: Setting the feed constants

The feed constant in the plug-in is always set in mm/revolution and automatically converted to metres/revolution for the device parameters independently of the specified user unit ➔ 3.3.4 Gear unit.

Parameters		Description
I27	'Encoder interface 1'	Defines the feed constant determined by the user for encoder interface 1. The feed constant is converted into a numerator (Px.1194) and denominator (Px.1195) representation.

Tab. 67: Information on internal parameters

A corresponding message is displayed if the calculated value of the feed constant must be rounded off.

'Encoder 1 (X2)'

The motor encoder at encoder interface 1 is configured in this parameter group. If a device connection is established, the currently configured encoder selection and the absolute position related to the axis zero point are displayed.

The encoder selection cannot be configured when using Festo motors. The encoder selection can be configured when using user-defined motors.

The displayed parameters depend on the encoder used:
– Encoder with BiSS interface (Protokoll Continuous Mode).
– Incremental encoder.
Additional information on the encoder configuration ➔ 3.3.3 Encoder configuration.

2.3.12 Axis 1

2.3.12.1 Axis 1 grouped parameter panels

'Axis 1' grouped parameter panels

The axis-specific parameter panels are grouped under the 'Axis 1' panel.

Panel	Description
‘Drive Settings’	
‘Motor’	➔ 2.3.12.2 Motor
‘Gearbox’	➔ 2.3.12.3 Gearbox
‘Axis’	➔ 2.3.12.4 Axis
‘Servo Drive Functions’	
‘Record Table’	➔ 2.3.12.5 Record Table
‘Monitoring Functions’	➔ 2.3.12.6 Monitoring Functions
‘Open Loop’	➔ 2.3.12.7 Open Loop
‘Closed Loop’	➔ 2.3.12.8 Closed Loop
‘Auto Tuning’	➔ 2.3.12.9 Auto Tuning
‘Vibration Compensation’	➔ 2.3.12.11 Vibration Compensation
‘Feed Forward Control’	➔ 2.3.12.12 Feed Forward Control
‘Position Trigger’	➔ 2.3.12.14 Position Trigger (cam control mechanism)
‘Touch Probe’	➔ 2.3.12.15 Touch Probe (position detection)
‘Manual Movement’	➔ 2.3.12.17 Manual Movement

Tab. 68: Subordinate panels of the grouped view

2.3.12.2 Motor

The working section contains parameter groups to display and specify the characteristics of the stepper motor or the EC motor.

The encoder parameters must be set for user-defined motors. If a user-defined motor is selected in the drive configuration, the encoder selection (P1.11616.0.0) on the ‘Encoder Interface’parameter panel must be configured by the user. Additional parameters depending on the encoder selected are displayed in the parameter group.

‘Motor (User Defined Configuration)’ or ‘Motor (active configuration)’

The motor parameters are displayed and, if necessary, modified in this parameter group. The motor parameters for Festo motors are automatically transferred from the database on selection of the motor. The motor parameters must be defined manually for motors from other manufacturers.

If the plug-in is **not** connected to a device, the ‘Motor (User Defined Configuration)’parameter group is displayed.
If the plug-in is connected to a device, the ‘Motor (active configuration)’parameter group is displayed.

Parameters		Description
I26	‘Maximal peak motor torque’	Displays the maximum torque calculated from the maximum current Px.7120 and the torque constant Px.7135 of the configured motor.
I25	‘Nominal motor torque’	Displays the nominal torque calculated from the rated current Px.7117 and the torque constant Px.7135 of the configured motor.
I46	‘EMF constant’	Electromotive voltage constant (Phase-Phase)

Tab. 69: Information on internal parameters

Additional information on the motor configuration ➔ 3.3.1 Motor configuration.

‘Holding Brake 1 (Motor, User Configuration)’

The characteristics of the holding brake on the motor (holding brake 1) are specified in this parameter group. This is necessary to take mechanical properties (inertia, time delay) into consideration.
Additional information on the brake control ➔ 3.3.2.1 Brake control.

‘Holding Current Reduction Brake 1’

The holding current reduction of the holding brake is activated in this parameter group.
Additional information on the holding current reduction ➔ Holding current reduction.

‘Field Weakening’

The field weakening is activated in this parameter group.
Additional information on the field weakening ➔ 7.4 Field weakening.

2.3.12.3 Gearbox

The working section contains parameter groups to display and specify the gear ratios.

‘Mounting Kit’

The transmission factor of the mounting kit is displayed in this parameter group.

‘Gear 1’, ‘Gear 2’ and ‘Gear 3’

The transmission factors of gear units 1, 2 and 3 are displayed in these parameter groups.

‘Gear Ratio (Total)’

The total transmission factor is displayed in this parameter group, consisting of the transmission factors for mounting kit, gear unit 1, 2 and 3.
Additional information on the transmission ratio ➔ 3.3.4 Gear unit.

2.3.12.4 Axis

The working section contains parameter groups to display and specify axis-specific parameters, e.g. for homing, axis configurations, stop delay times and limit values.

Interactive graphic

The reference system of the axis depending on the homing mode, axis zero point and software end positions is displayed in an interactive graphic based on the selected axis type.
The interactive graphic is displayed if the following prerequisite is met:
– An axis with a finite working stroke has been configured.

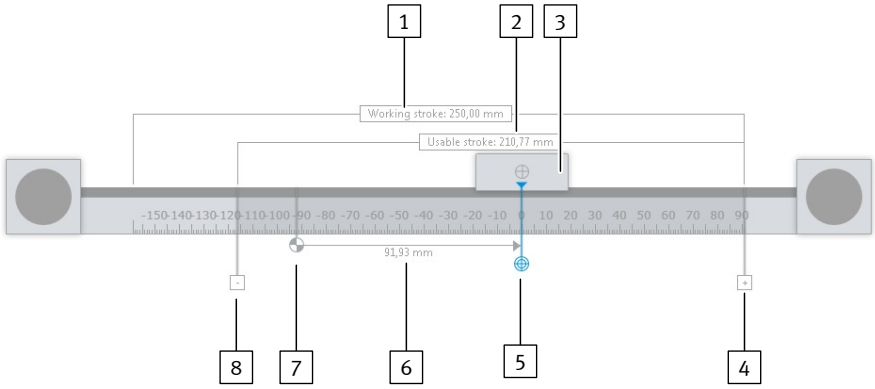


Fig. 13: Interactive graphic for gantry axes

1 Working Stroke
2 Usable stroke
3 Slide
4 Positive software end position
5 Axis zero point
6 Measurement arrow for distance measurement
7 Reference point
8 Negative software end position

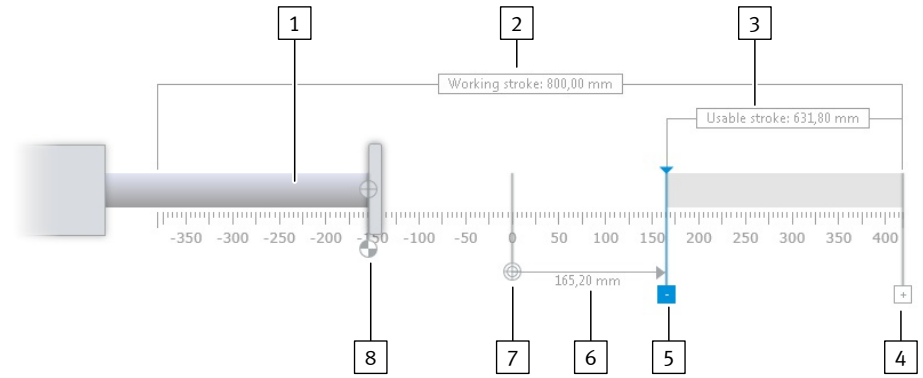


Fig. 14: Interactive graphic for cantilever axes

1 Piston rod
2 Working Stroke
3 Usable stroke
4 Positive software end position
5 Negative software end position
6 Measurement arrow for distance measurement
7 Axis zero point
8 Reference point

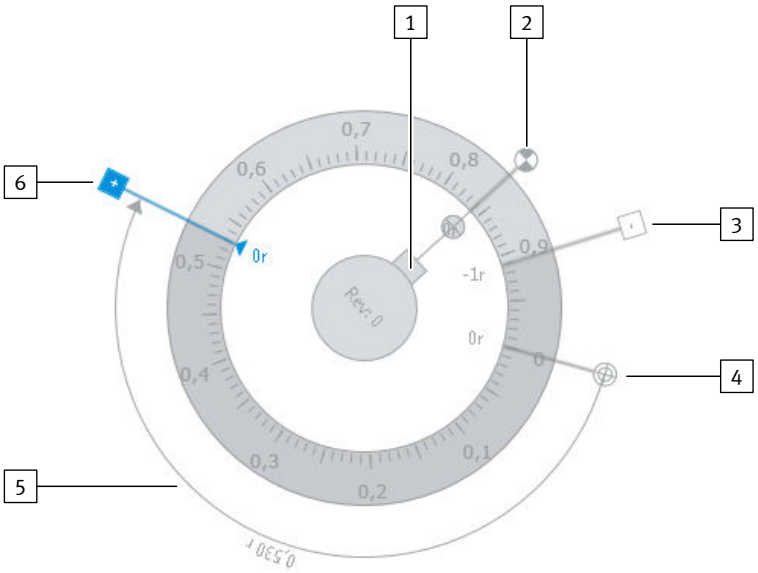


Fig. 15: Interactive graphic for rotation axes

1 Drive shaft adapter
2 Reference point
3 Negative software end position
4 Axis zero point
5 Measurement arrow for distance measurement
6 Positive software end position

Designation	Description
Working Stroke	Theoretically available working stroke of the axis
Usable stroke	Actual available stroke of the axis based on the current configuration
Reference point	Homing point for the system of measurement units The position of the homing point is dependent on the selected homing method.
Slide (for linear axes) Piston rod (for electric cylinders) Shaft drive adapter (for rotary axes)	Axis reference point; moveable part of the axis
Axis zero point	Axis zero point of the system of measurement units
Negative software end position	Software end position in negative direction of movement

Designation	Description
Positive software end position	Software end position in positive direction of movement
Measurement arrow for distance measurement	Distance between two points, e.g. offset between homing point and axis zero point

Tab. 70: Description of the interactive graphic elements

The interactive graphic is always displayed with the following units regardless of the unit settings:
– Millimetres for linear axes
– Revolutions for rotation axes

Positioning homing point

If the homing point is selected, it is displayed in blue and can be moved.
When the homing point is moved, the scale is moved at the same time.
The values of the software end positions and axis zero point remain the same. The displayed positions of the software end positions and axis zero point are moved.

Positioning axis zero point

If the axis zero point is selected, it is displayed in blue and can be moved.
When the axis zero point is moved, the scale is moved at the same time.
The values of the software end positions remain the same. The displayed positions of the software end positions are moved.
The homing point value is modified. The displayed position of the homing point remains the same.

The axis zero point value also changes in the ‘Axis Configuration’ parameter group.
If the axis zero point value is specified via the ‘Axis Configuration’ parameter group, the value also changes in the interactive graphic.

Positioning axis homing point

The axis homing point is either positioned at the homing point or at the axis zero point.
If in the ‘Homing Method’ parameter group the ‘Go to axis zero point after homing’ status is set, the slide is positioned at the axis zero point.

Positioning software end positions

If the software end positions are selected, they are displayed in blue and can be moved.
When the software end positions are moved, the effective stroke is calculated and the corresponding text field in the graphic is updated.
The software end positions are checked by the plug-in for plausibility upon input.
If the set software end positions are implausible, the frames around the two ‘Negative software limit position’ and ‘Positive software limit position’ input fields and for linear axes the frame around the ‘Usable stroke’ text field are shown in orange, e.g. if the negative software end position is greater than the positive software end position.

The values of the software end positions also change in the ‘Axis Configuration’ parameter group.
If the values of the software end positions are specified via the ‘Axis Configuration’ parameter group, the values also change in the interactive graphic.

‘Homing Method’

The following is defined in this parameter group:

Parameters	Description
‘Method’	Homing method for homing the axis
‘Move to axis zero point after homing’	Determines whether the travel to the axis zero point function should be executed after a valid homing run.

Tab. 71: Parameters of the Homing Method group

Additional information on homing ➔ 4.4 Homing.
If a homing method is selected that is not consistent with other settings, such as the configuration of the corresponding switch, the parameter is marked with a warning. The reason for the warning is displayed in the adorner, and a jump to the relevant parameter panel is also possible by pressing a button.

‘Homing Parameters’

The values for the velocity, acceleration and jerk limitation for the homing are specified in this parameter group.
Additional specific parameters are displayed in this parameter group depending on the selected homing method ➔ 4.4.3 Homing methods.
Additional information on homing ➔ 4.4 Homing.

‘Axis Configuration’

The values for the axis zero point and software end positions are specified in this parameter group.
The values can also be determined via the interactive graphic.
Additional information on the dimension reference system ➔ 3.2.5.1 Dimension reference system and axis zero point ➔ 4.4 Homing.
Additional information on monitoring the software end positions ➔ 5.6 Software end position reached.

‘Stop Deceleration’

The stop ramp is parameterised in this parameter group.
Additional information on stopping ➔ 4.2.1 Stop.

‘User Defined Limits’

General limit values for the control limiter are specified in this parameter group.
Additional information on limit values ➔ 6.2.2 Control limitation.

2.3.12.5 Record Table

New records can be created, existing records edited and record sequences created in the working section.
If records or record sequences have been created, the following symbols are displayed to the right:

Symbol		Description
	‘Add Transition’	Create new record sequence.
	‘Edit Record Set’	Edit record or record sequence.
	‘Delete Record Set’	Delete record or record sequence.
	‘Execute record set’	Execute record set
	‘Stop record set’	Stop record set

Tab. 72: Description of the symbols in the ‘Record Table’ parameter panel

Parameters		Description
I22	‘Record name’	Description of the record
I23	‘Record sequence Name’	Name of the record sequence

Tab. 73: Information on internal parameters

Additional information on records and record sequences ➔ 4.5 Task via record selection.
In the panel view the title bar of the working section contains the following additional commands for the current parameter panel:

Symbol		Description
	‘Delete all record sets’	Removes all records from the record table.
	‘Paste parameters from clipboard’	Inserts the parameters from the clipboard into the current panel. The deviating parameters are displayed in a dialogue. The individual parameters can be disabled for the import. The parameters are imported with ‘Import’, and the process is aborted with ‘Cancel’. If the parameters are unchanged or incompatible, a message will be displayed.
	‘Copy parameters to clipboard’	Copies the parameters of the record list to the clipboard. For example, the parameters can then be pasted to the same panel on another device.
	‘Import parameters’	Imports a saved parameter list of the record list as a file in the JSON format. After selecting a file, the deviating parameters are displayed in a dialogue. The individual parameters can be disabled for the import. The parameters are imported with ‘Import’, and the process is aborted with ‘Cancel’. If the parameters are unchanged or incompatible, a message will be displayed.
	‘Export parameters’	Exports the device parameters to a file in the JSON format.

Tab. 74: Description of the symbols in the ‘Record Table’ parameter panel

Creating new record

Up to 128 records can be created depending on the product variant and the firmware. Proceed as follows to create a new record:

Record numbers must not be duplicated.
The ⚠ symbol next to the record number in the record list indicates an invalid number.
The records are listed in ascending order based on the assigned numbers.

1. Press the ‘Add Record Set’ button.
   ⇨ The pop-up to create a new record is opened.
2. Define the record number and the record name. If necessary, enter a comment on the sentence, e.g. to describe which step the machine executes in this sentence.
3. Define the record type.
4. Define the record group.

5. Define the record parameters for the selected record group. Information about the parameter is displayed in the adorner.
   Default values are entered for the following records:
   – Position
   – Speed
   – Force/torque
   – Stop
6. Press the ‘Apply record set’ button.
   ⇨ The record is added to the record table.

Creating and editing a record sequence

Up to three record sequences can be created for every record. Up to 128 record sequences can be created depending on the product variant and the firmware.

If 3 record sequences have already been created for a record, the 🔗 ‘Add Transition’ button is deactivated.
If a type of record sequence that has not been described is specified, this is indicated by a symbol next to the record number in the record table. The 🔗 ‘Add Transition’ button is disabled.

1. Press the 🔗 ‘Add Transition’ button.
   ⇨ The pop-up to create a new record sequence is opened.
2. Define the name of the record sequence.
3. Select the record sequence condition.
4. Define the parameter for the selected condition.
   This step is skipped if a record sequence condition does not have any parameters.
5. Define the consecutive record for the record sequence.
   Records that have already been created and non-existent records can be specified as the consecutive record.
   If a non-existent record is specified as the consecutive record, this is indicated by a symbol next to the number of the consecutive record in the record table.



6. Press the ‘Apply transition’ button.
   ⇨ The record sequence is displayed underneath the record for which it was created.

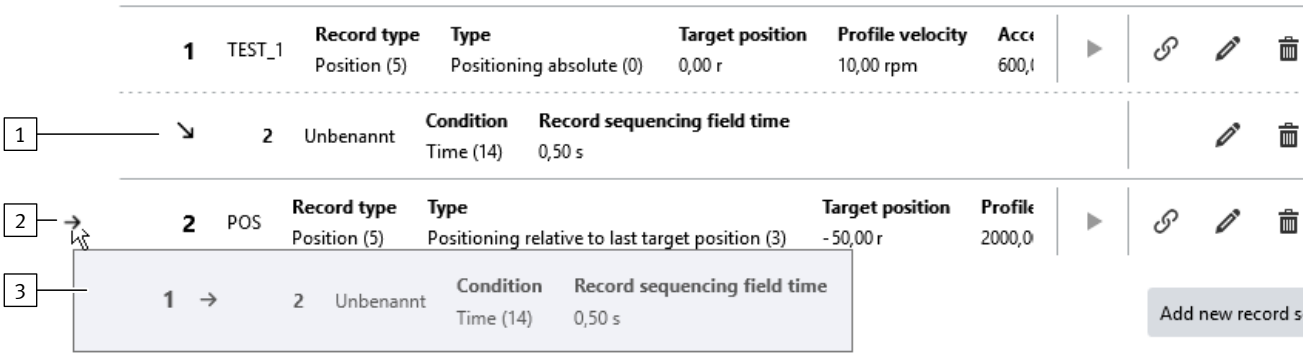


Fig. 16: Elements of a record sequence

1 Overview of a record sequence
2 Indication that this record is part of a record sequence
3 Tool tip that displays the record sequences that refer to this record

Deleting and editing records and record sequences

Records and record sequences can be edited or deleted with the corresponding ✎ 'Edit Record Set' and 🗑 'Delete Record Set' buttons beside the record or the record sequence ➔ Tab. 72 Description of the symbols in the 'Record Table' parameter panel.

ⓘ If a record type that has not been described is specified, this is indicated by a symbol next to the record number in the record table. The ✎ 'Edit Record Set' button is disabled.

Copying and pasting record

The following commands are available in the record context menu for duplicating records.

Menu command	Description
'Duplicate'	Inserts a copy of the record at the end of the record list.

Tab. 75: Commands of the context menu of a record

Executing or stopping record

The commands are opened with the ▶ 'Execute record set' and ■ 'Stop record set' symbols ➔ Tab. 72 Description of the symbols in the 'Record Table' parameter panel.

The record currently being executed is marked by an arrow and a blue record number.

Records can be executed or stopped if the following prerequisites are met:

- The plug-in is connected to a device.
- The plug-in has the master control.
- For motion tasks: the controller enable is activated. The status of the controller enable is not relevant for other tasks of the record table.

Setting velocity override

A velocity override between 0% and 200% can be set for commissioning purposes with the slider in the upper right corner. When changing the percentage value, the associated Px.1309 Velocity override parameter is written directly with the corresponding value between 0 and 2.

Double-clicking on the displayed percentage resets the percentage to 100%. The Px.1309 Velocity override parameter is written with the value 1 again.

2.3.12.6 Monitoring Functions

The working section contains parameter groups to parameterise the monitoring functions.

	Monitoring and protective functions monitor the quality of the control system and adherence to limit values. The functions also protect the device from overload. Additional information on monitoring functions ➔ 5 Motion monitoring and ➔ 3.5 Protective functions.
'Following Error of Position' and 'Following Error of Velocity'	The position and velocity following an error are parameterised in these parameter groups. Following error monitoring is active as long as the target has not been reached. Additional information on the following error ➔ 5.3 Following error.
'Target Reached'	The target window monitoring is parameterised in this parameter group. The target reached monitoring indicates whether a target figure has been reached. Additional information on the target window monitoring ➔ 5.2 Target Window Reached.
'Target Position Left'	The target monitoring parameters are defined in this parameter group. Additional information on the target monitoring ➔ 5.4 Target area monitoring.
'Standstill'	The standstill monitoring is parameterised in this parameter group. The standstill monitoring indicates that the drive is not moving or is moving below the parameterised threshold value. The position monitoring indicates drifting. Additional information on standstill monitoring ➔ 5.7 Standstill monitoring.
'Limit Block'	The stop detection is parameterised in this parameter group. The stop detection monitors the actual current and velocity values to check if they have reached a specified limit. Additional information on the stop detection ➔ 5.8 Stop reached.
'Limit Velocity'	The maximum velocity parameters are defined in this parameter group. Additional information on velocity monitoring ➔ 5.10 Speed monitoring (spinning protection).
'Pushback'	Feedback monitoring is parameterised in this parameter group. The feedback control monitors the movement of the drive as a function of the effective direction of the torque. Additional information on the feedback monitoring ➔ 5.11 Pushback monitoring.
'Remaining Distance'	The remaining distance is parameterised in this parameter group. The remaining distance indicates that the remaining path determined during ongoing positioning is below the specified limit value. Additional information on remaining distance monitoring ➔ 5.12 Remaining distance monitoring.
'Relative Motor-Temperature'	The I^2T monitoring of the motor is parameterised in this parameter group. Additional information on I^2T monitoring of the motor ➔ 3.5.2 I^2t monitoring of motor.
'I^2t Monitoring'	The parameters for monitoring I^2T are defined in this parameter group. I^2T monitoring protects the power output stage and the motor from thermal destruction caused by excessive electrical energy. Additional information on I^2t monitoring for the output stage ➔ 3.5.1 I^2t monitoring of the power output stage and I^2t monitoring for the motor ➔ 3.5.2 I^2t monitoring of motor.

2.3.12.7 Open Loop

‘Mode’

The mode and the switching threshold for open-loop or closed-loop operation is specified in this parameter group. If a motor without encoder is configured in the drive configuration, the parameter group is deactivated. Otherwise the parameter group is activated.
More information ➔ 7.3 Open-loop operation

‘Current for Open Loop’

The current values for open-loop operation are specified in this parameter group. The following parameters are active only if the ‘Current reduction activation’ parameter is activated:
– ‘Current reduction delay time’
– ‘Current reduction scaling factor’,
However, the P1.270.0.0 parameter is always active.
More information ➔ 7.3 Open-loop operation

2.3.12.8 Closed Loop

Switching the panel view

The view of the parameter panels can be switched via the title bar of the working section.

Symbol		Description
	‘Page View’	Switch to the grouped view. This view shows all parameter groups usually required for calculating and manually optimising the controller settings in the working section. In this view, parameter sets can be copied to data sets and reactivated if required. All available data sets are displayed in the lower working section and can also be edited there.
	‘Diagram View’	Switch to the functional view. The working section shows the following: – a symbolic illustration in the upper left section of the working window for using active elements to switch quickly between the block views of the controller components. – the signal flow of the controller or individual controller components for setting the parameters. Optional: navigation to detailed views via active elements at the beginning and end of the signal flow.
	‘List View’	Switch to the complete tabular view of the parameters, listed according to parameter groups.

Tab. 76: Description of the panel view

‘Application Data’ parameter group of the grouped view

This parameter group enables parameterisation of the Px.1193 ‘Application mass’ or ‘Application moment of inertia’ parameter (Load weight / load inertia) in accordance with the application. If the ‘Application mass’ or ‘Application moment of inertia’ parameter is changed, the controller data are recalculated. The total calculated inertia indicates the moment of inertia of the drivetrain (axis, gear unit, motor, load) as a function of the gear unit output.

Parameters		Comment
I55	‘Inertia ratio’	Inertia ratio of the system.

Tab. 77: Information on internal parameters

‘Velocity Control’ parameter group of the default view

The velocity controller is parameterised in this parameter group.
Additional information on the velocity controller ➔ 6.1.3 Speed controller.

	Parameters	Comment
I61	'Integral time'	The I component ensures that control can be carried out without permanent control deviation. The reset time is a measure of the extent to which the time duration of the control deviation is included in the control. A long reset time means a small influence of the I component and vice versa.

Tab. 78: Information on internal parameters

'Position Control' parameter group of the default view

The position controller is parameterised in this parameter group.
Additional information on the position controller ➔ 6.1.2 Position controller.

'Closed Loop Calculation' parameter group of the default view

The current status of the controller data is displayed in this group and the controller calculation is carried out again if necessary. The status provides information on the determination and validity of the controller data.

Status	Description
Default values	The controller data originate from the device description file in the plug-in.
Calculated values	The controller data were determined with one of the following options: – By pressing the 'Calculate' button. – By the drive configuration based on the selected motor, the Festo axis and the set controller dynamics. The inertia ratio of the Festo drive was taken into consideration when calculating the controller data.
Online optimized values	The displayed controller data were read from the last connected device.
Open shaft	The displayed controller data correspond to the controller data of the configured motor with open shaft.
Unsupported values	The controller data were determined with one of the following options: – By pressing the 'Calculate' button. – By the drive configuration based on the selected motor, the axis and the set controller dynamics. The database does not contain any valid data for the configured motor-axis combination. The controller data must be edited manually to avoid overloading the components.
Invalid values	No useful data could be calculated for the velocity controller. The data must be edited manually.

Tab. 79: Status of the controller data



The 'manually changed' suffix is appended to the actual status as soon as at least one controller parameter has been manually changed.

Calculation

The dynamic of the closed-loop controller is set with the slider in the working section to calculate the controller data. The 'Hard' setting generally improves the positioning behaviour, but can also lead to rough control behaviour and a motor with a high-frequency humming sound.
Countermeasures:
– Move slider in the 'Soft' direction.
– Increase the filter time constant of the velocity filter ('Velocity Control' parameter group).
– Check the Px.1193 'Application mass' or 'Application moment of inertia' parameter (Load weight / load inertia).

The 'Calculate' button starts the calculation of the controller data for the current drive configuration.

The button is only active if the following prerequisites are met:
– A drive configuration has been completed.
– The plug-in does **not** have the master control.



After changing the following parameters, calculate the controller data again:
- Ground
- Moment of inertia
- Properties of the motor cable

‘Calculate With Open Shaft’

The calculation of suitable controller data without load is started with the ‘Calculate With Open Shaft’ button based on the current drive configuration. The calculated controller data are only useful for operation of a motor that is not connected to the load (axis). A test run with open shaft is often useful during initial commissioning.

‘Reset to Default Values’

The ‘Reset to Default Values’ button can be used to reset certain controller parameters.
The button is only active if the following prerequisites are met:
– A complete drive configuration has been created.
– The plug-in does **not** have the master control.
The controller parameters are set according to the following table.

Parameters	Name	Action
Slider	–	The slider for calculating the controller data is reset to ‘Middle’.
Px.11618	Velocity filter filter time constant	The filter time constant is reset to the calculated value.
Px.958	Time constant velocity set-point value filter	The time constant on the ‘Feed Forward Control’ panel is reset to the calculated value.
Px.221	Dead zone position controller	The dead space is reset to the default value.

Tab. 80: Reset to Default Values

The Px.1193 Load weight / load inertia parameter for the application is not changed.
The controller data are automatically recalculated with the modified controller parameters.

Transferring data to controller data record

Active controller settings are transferred to a controller data record with the ⬇ ‘Copy Active Parameters to Closed Loop Parameter Set’ button.
The button is active if the following prerequisites are met:
– A complete drive configuration has been created.
– The plug-in does **not** have the master control.
Proceed as follows to transfer the active controller data to a controller data record:

1. Press the ⬇ ‘Copy Active Parameters to Closed Loop Parameter Set’ button at the top of the parameter panel.
   ⇨ A pop-up to select the controller data record opens.
2. Click checkbox of the required controller data record.
3. Press the ‘Apply’ button.
   ⇨ The active controller data are transferred to the selected controller data record.

Overview of the controller data records

An overview of the existing controller data records is displayed at the bottom of the parameter panel.

Symbol		Description
	'Edit Closed Loop Parameter Set'	Edit the associated controller data set.
	'Activate Closed Loop Parameter Set'	Apply the controller data set to the active parameters.

Tab. 81: Description of the symbols in the overview

The buttons are only active if the following prerequisites are met:
– A complete drive configuration has been created.
– The plug-in does **not** have the master control.

Parameters		Description
I63	'Integral time'	The I component ensures that control can be carried out without permanent control deviation. The reset time is a measure of the extent to which the time duration of the control deviation is included in the control. A long reset time means a small influence of the I component and vice versa.

Tab. 82: Information on internal parameters

Editing controller data record

Proceed as follows to edit a controller data record:

1. Press the ✎ 'Edit Closed Loop Parameter Set' button.
   ⇨ A pop-up to define the parameters opens.
2. Edit parameters of the controller data record.
3. Press the 'Save changes' button.



The parameters are only transferred to the active parameters after the ↥ Activate Closed Loop Parameter Set button is pressed.

Transferring controller data record to active parameters

A controller data record can be transferred to the active parameters by pressing the ↥ 'Activate Closed Loop Parameter Set' button.

2.3.12.9 Auto Tuning



The results of the auto-tuning are effective in the following operating modes:
- in closed-loop operation
- in open-loop operation with encoder

Auto-tuning is a process in which the controller parameters for position and velocity controllers are automatically adjusted. The process can be completed statically (when the motor is at a standstill) or dynamically (when the motor is running). The dynamic process is suitable for drive systems for which the properties are not known. The calculation is based on the following data:
– previously configured current regulator
– suitable start parameters for position and velocity controllers
– amplitude of the excitation signal

'Servo Drive Start Values'

The start values for the position controller and velocity controller are determined in this parameter group. The start parameters are determined automatically based the drive configuration.
Additional information on auto-tuning ➔ 6.5.1 Auto-tuning.

'Results'

The auto-tuning results are displayed in this parameter group once the values have been accepted in the wizard.
Additional information on auto-tuning ➔ 6.5.1 Auto-tuning.

‘Measurement of Movement (Identification)’ and ‘Test Movement (Validation)’

The properties for the motion measurement and motion test are defined by a test run in these parameter groups.
The following parameters are initially not synchronised with the corresponding acceleration and deceleration parameters:
– ‘Measurement of Movement (Identification)’
  – ‘Maximum acceleration during the identification’
  – ‘Maximum deceleration during the identification’
– ‘Test Movement (Validation)’
  – ‘Maximum acceleration during validation movement’
  – ‘Maximum deceleration during validation movement’
This ensures that different values can be specified for acceleration and deceleration. A synchronisation is not carried out until the function is started in the wizard.
Additional information on auto-tuning ➔ 6.5.1 Auto-tuning

‘Start Auto Tuning...’

Press the ‘Start Auto Tuning...’ button to display the wizard for configuration and execution of the auto-tuning. The button is only active if the following prerequisites are met:
– The plug-in is connected to the device.
– The plug-in has the master control.
Additional information on the wizard for auto-tuning ➔ Panels of the Auto Tuning Wizard

2.3.12.10 Wizard for auto-tuning

Overview

The wizard can be started from the ‘Closed Loop’ or ‘Auto Tuning’ panel with the ‘Start Auto Tuning...’ button. The start panel shows the currently set marginal conditions for motions during the motion measurement (identification). The following steps are run with the ‘Next’ button or by selecting the next panel in the toolbar.

Symbol		Description
	‘Constraints’	Display marginal conditions for motion measurement (identification) and parameterisation (wizard start panel)
	‘Start’	Start the auto-tuning after setting the rigidity and the dynamics of the closed-loop controller (soft, medium or hard).
	‘Status’	Display the auto-tuning status
	‘Results’	Display the auto-tuning results

Tab. 83: Description of the toolbar symbols for auto-tuning

Section/command	Description
 ‘Control’	Function: – Assign master control to the plug-in or higher-order controller The scroll bar shows the current setting. The master control can be withdrawn from the fieldbus using the plug-in. If the master control is enabled again, it automatically goes to the fieldbus. If the connection is interrupted, the plug-in enables the master control again.
	Requirement: – The plug-in is connected to a device. – No other plug-in has the master control.

Section/command	Description
	If another device has the master control, an information symbol is displayed over the deactivated ‘Control’ command. The tool tip for the ‘Control’ command contains the IP address and the port number of the device.
 ‘Powerstage’	Function: – Enable power stage of the servo drive The scroll bar shows the current setting.
	Requirement: – The plug-in is connected to a device. – The plug-in has the master control. – The device is not in error status.
	A check during activation of the controller enable determines whether re-initialisation is required. If re-initialisation is required, a query is displayed offering the following options: – ‘Ok’: the re-initialisation is executed and controller enable is activated. – ‘Cancel’: the re-initialisation is not executed and controller enable remains deactivated.
	If another plug-in has the master control, an information symbol is displayed over the deactivated command ‘Powerstage’. The tool tip for the ‘Powerstage’ command contains the IP address and the port number of the device.
 ‘Stop’	Function: – Send stop command to the servo drive (category 2 stop)
	Requirement: – The plug-in is connected to a device. – The plug-in has the master control. – Controller enable is activated.
 ‘Acknowledge All’	Function: – Acknowledge all cancelled diagnostic messages for the servo drive. More information ➔ 2.5.1 Device State.
	Requirement: – The plug-in is connected to a device. – The plug-in has the master control.

Tab. 84: Description of the toolbar symbols for motion control

Copying device parameters from the wizard to the plug-in

Device parameters that are defined or calculated in the auto-tuning wizard are only transferred to the plug-in by specific actions. The device parameters are not transferred if the actions are not executed and the wizard is cancelled.

Action	Transferred parameters
Press the ‘Start Auto Tuning...’ button.	– ‘Identification with movement’ – ‘Maximum movement stroke during the identification’ – ‘Maximum velocity during the identification’ – ‘Maximum acceleration during the identification’ – ‘Maximum deceleration during the identification’
Press the ‘Execute test run’ button.	– ‘Number of validation movements’ – ‘Movement stroke during validation movement’ – ‘Maximum velocity during validation movement’ – ‘Maximum acceleration during validation movement’ – ‘Maximum deceleration during validation movement’
Press the ‘Apply Values’ button.	– ‘Result of position controller amplification gain’ – ‘Result of velocity controller amplification gain’ – ‘Result of velocity controller integration constant’

Tab. 85: Transferring the device parameters

Panels of the Auto Tuning Wizard

– ‘Constraints’ panel: input of motion parameters for identification.
  ➔ Page Constraints
– ‘Start’ panel: definition of the boundary conditions and starting the auto-tuning.
  ➔ Page Start
– ‘Status’ panel is displayed

➔ Page Status

– ‘Results’ panel: display of the results, performance of a motion test for validation, transfer of the results to the plug-in.

➔ Page Results

Additional information on the function, parameterisation and motion test (test run) ➔ 6.5.1 Auto-tuning.

Page Constraints

Before identification:

1. Define the motion parameters for the identification on the ‘Constraints’ panel of the wizard.



If the maximum acceleration value is changed during the identification, the maximum deceleration value changes by the same amount during the identification.

2. Press the ‘Next’ button.
   ⇨ The ‘Start’ panel is displayed ➔ Page Start.

Page Start

After entering the boundary conditions:

1. On the ‘Start’ panel:
   – Adjust the rigidity to the axis type.
   – The dynamics for the closed-loop controller calculation can be defined with the slider. When the slider is changed, the start values for the controller parameters are automatically recalculated.
   The controller data is manually recalculated with the ‘Calculate’ button based on the settings.



The start parameters for the closed-loop controller are influenced by the selection. A default value for the rigidity is recommended depending on the selected configuration. The relevant value is highlighted with the ‘(recommended)’ addition.

   ⇨ Once the marginal conditions are set, the motion measurement can be carried out. The ‘Start Auto Tuning...’ button is only active if the following prerequisites are met:
   – The plug-in is connected to the device.
   – The plug-in has the master control.
   – Controller enable is activated.
2. If the requirements are met, press the ‘Start Auto Tuning...’ button.
   ⇨ The ‘Status’ panel is displayed ➔ Page Status, the auto-tuning calculation is performed.

Page Status

After starting the auto-tuning, the ‘Status’ panel is displayed.

1. The ‘Auto tuning is executing, please wait...’ message is displayed while the auto-tuning is running.
   On completion of the process the ‘The auto tuning calculation has completed successfully.’ message is displayed.
2. Press the ‘Next’ button.
   ⇨ The ‘Results’ panel is displayed ➔ Page Results.

Page Results

The ‘Results’ panel shows the current and newly calculated parameter values of the speed and position controller.

1. A motion test (validation) can optionally be run:
   – Adjust the motion parameters for validation.
   – Start the validation with the ‘Execute test run’ button.
2. If required: repeat identification.
   The ‘Retry’ button returns to the ‘Constraints’ panel of the wizard.
3. Once the auto-tuning is complete, use the ‘Apply Values’ button to transfer the results to the plug-in.
   The following new values are then displayed on the ‘Closed Loop’ and the ‘Auto Tuning’ panels:
   – ‘Result of position controller amplification gain’
   – ‘Result of velocity controller amplification gain’
   – ‘Result of velocity controller integration constant’

In order to optimise the controller data for specific applications, the auto-tuning measurement result can be evaluated as follows on the ‘Auto Tuning’ diagnostics panel:
- Display or export logarithmic diagrams
- Export the data to a CSV file

2.3.12.11 Vibration Compensation

‘Notch Filter 1’, ‘Notch Filter 2’ and ‘Notch Filter 3’

Three notch filters are provided to suppress interfering frequencies. The filters are activated in the applicable parameter groups and the following properties are defined:
– Filter frequency
– Filter band width
Additional information on the notch filter ➔ 6.4.2 Notch filter.

‘Vibration Frequency 1’ and ‘Vibration Frequency 2’

If vibration suppression is activated, the specified natural frequency is suppressed in the "Positioning" operating mode.

2.3.12.12 Feed Forward Control

The pilot control prepares the deactivation variables for the closed-loop controller. This ensures that the positioning behaviour of the drive and run-in behaviour can be improved in accordance with the target position and that the following error can be reduced. The input variables for the pilot control are directly connected to the output variable or are adjusted using a mathematical operation.

Recommendation for vertically mounted axis
For weight compensation by the feed forward control a value typical for the load used is specified as Offset torque.

Additional information on pilot control ➔ 6.3 Pilot control (closed-loop control setpoint values).

Switching the panel view

The view of the parameter panels can be switched via the title bar of the working section.

Symbol		Description
	‘Page View’	Switch to the grouped view. This view shows in the working section all parameters of the parameter group usually required for calculating and manually optimising the controller settings.
	‘Diagram View’	Switch to the functional view. The working section shows the following: – a symbolic illustration in the upper left section of the working window for using active elements to switch quickly between the block views of the controller components – the signal flow of the controller or individual controller components for setting the parameters. Optional: navigation to detailed views via active elements at the beginning and end of the signal flow.
	‘List View’	Switch to the complete tabular view of the parameters, listed according to parameter groups.

Tab. 86: Description of the symbols for switching the panel view

The following applies to write-protected parameters:
- In the block view, the parameter name is displayed via adorner in the pop-up window.
- If the device is connected, the current value is displayed.
- If there is no device connection, the parameters are deactivated.

Setting the torque offset (block view)

With active device connection, the adorner (pop-up) of the ‘Offset torque’ parameter displays the current value of the ‘Setpoint torque’ parameter. The displayed value can be accepted as ‘Offset torque’ with a mouse click.

Setting friction compensation (block view)

The friction compensation is set via a look-up table. A maximum of 16 velocity and torque support points are set in the table:
– Velocity [rad/s] of the drivetrain (axis, gear unit, motor, load) as a function of the gear unit output.
– Torque [Nm] of the drive train (axis, gear unit, motor, load) as a function of the gear unit output.

1. Click on the ‘Velocity/torque’ component in the block view.
   ⇨ The pop-up with the look-up table opens.
2. Define support points for velocity and torque.
3. Press the ‘Apply parameters’ button.

If the pop-up is not closed with the ‘Apply parameters’ button, the modified values will not be applied.

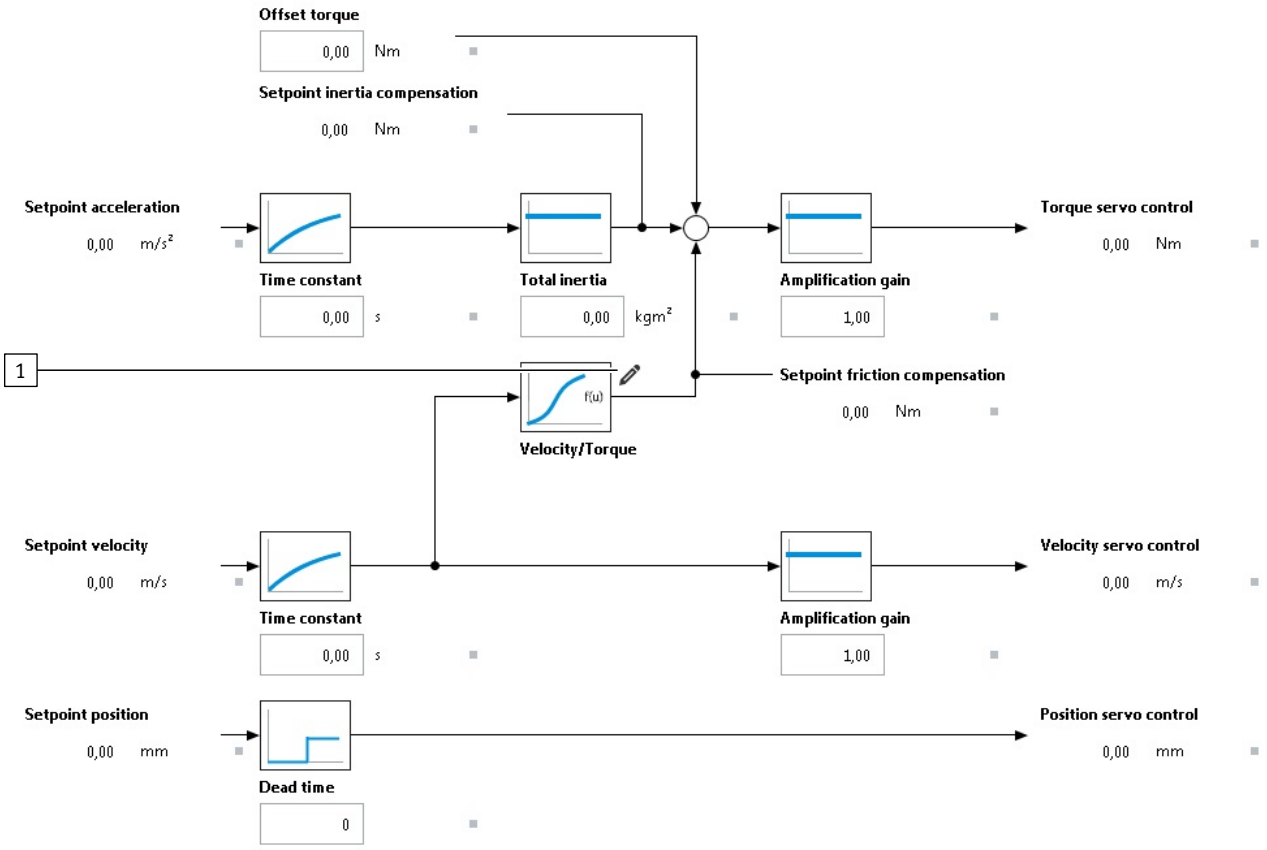


Fig. 17: Block view of the ‘Feed Forward Control’ parameter panel

1 Edit friction

2.3.12.13 Modulo Mode

Modulo mode simplifies the implementation of intermittent endless movements, e.g. the operation of rotary indexing tables and conveyor belts.
Detailed information on the parameterisation of the modulo operation ➔ 7.5 Modulo operation.

‘Prepared Values’

The parameters for the modulo mode and for the limit values can be entered in this parameter group.
The ‘Apply Values’ button activates the values in the servo drive.

‘Active Values’

If there is an active device connection, the current limit values and the offset of the modulo function are displayed.
The blue point on the scale shows the value of the current modulo position within the limits.

2.3.12.14 Position Trigger (cam control mechanism)

For example, position switches and rotor position switches can be simulated in positioning mode with the position trigger function.
The navigation tree under the ‘Position Trigger’ panel has a ‘Position Trigger 0’ ... ‘n’ panel for parameterisation of the position trigger for every position trigger of the device. The number of possible position triggers depends on the device and its firmware.
The relevant panel can be directly selected by selecting the corresponding panel in the navigation tree. Links in the working section of the ‘Position Trigger’ panel can also be used to select the ‘Position Trigger 0’ ... ‘n’ panel.

Detailed information on parameterisation of the function of the position trigger ➔ 7.1 Position trigger (cam controller).

‘Prepared Values’

The initial values of the relevant position trigger can be defined in the ‘Prepared Values’ parameter.
Parameters can be set in the ‘General Parameters’ subgroup depending on the selected mode of the position trigger. Parameters that are not relevant for the selected mode are not visible.

General parameters	Brief description
‘Position trigger mode’	Specifies the mode of the position trigger ➔ Tab. 623 Possible modes of the position trigger function.
‘Configured output’	Internal parameter I56: Displays the configured output for the Position Trigger.
‘Position trigger source’	Specifies the source of the measured values.
‘Switching time (manual)’	Specifies the switching time for time-based manual switching (mode 4/5).
‘T_{t1}’ Inactive time compensation of first switching point	Specifies the inactive time compensation for the signal change for the first switching point. With this parameter, switch-on delays of external components can be compensated.
‘T_{t2}’ Inactive time compensation of second switching point	Specifies the inactive time compensation for the signal change for the second switching point. With this parameter, switch-on delays of external components can be compensated.
‘-Mod’ Lower limit value modulo	Specifies the lower limit value for the modulo calculation. When the lower limit value is undershot, the position jumps to the upper limit value.
‘+Mod’ Upper limit value modulo	Specifies the upper limit value for the modulo calculation. When the upper limit value is exceeded, the position jumps to the lower limit value.
‘Hy’ Hysteresis	Through the determination of the hysteresis range, undesired switching procedures are suppressed around the switching point during fluctuations.
‘Offset’ Offset modulo position	Offset of the modulo position

Tab. 87: ‘Prepared Values’, ‘General Parameters’

Timing diagram (automatic mode)

The timing diagram is only visible if the ‘Actual Position Trigger mode’ parameter is set to ‘Automatic’.
The timing diagram shows an example of the signal path for the positive direction of motion. The timing diagram has input fields. Parameters for the automatic mode are entered directly into the timing diagram.

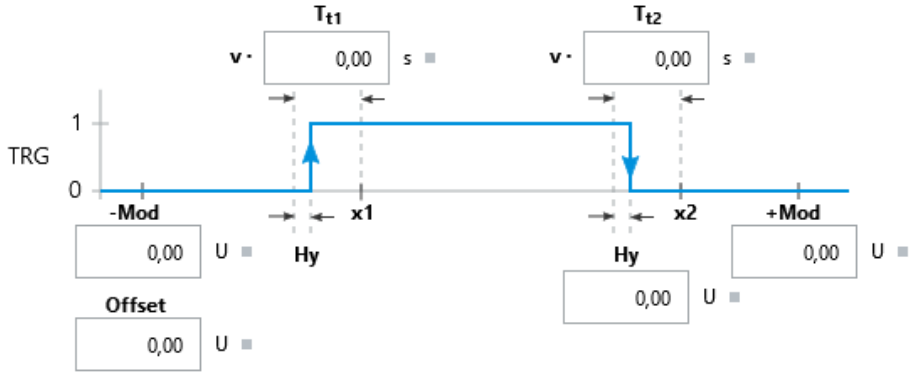


Fig. 18: Timing diagram with input fields for the ‘Automatic’ mode

‘Position Switches’

This parameter group is only visible if the ‘Position trigger mode’ parameter is set to Automatic. New position switches can be defined for the automatic mode and existing position switches can be edited in the parameter group.

When editing a position switch, a pop-up appears within which the selected position switch can be edited step by step. When editing the existing position switches, the last step of the pop-up control is opened.
Symbols can be used to trigger the following commands:

Symbol		Description
	'Edit Position Switch'	Allows editing of the corresponding position switch.
	'Delete Position Switch'	Deletes the position switch after a query from the list.
'New Position Switch' button		Adds a new entry to the list.

Tab. 88: Commands and symbols

Accepting initial values as active values

The 'Apply Values' button can only be activated if the plug-in is connected to the device. When the button is activated, the set initial values are imported by the device as the active value and are then visible in the 'Active Values' parameter group.

Active Values

If the plug-in is disconnected from the device, the default value of the Actual Position Trigger mode parameter is displayed.
If it is connected to the device, the active parameters of the position trigger in the device are displayed in the Active Values parameter group.

General parameters	Brief description
'Actual Position Trigger mode'	Specifies the actual mode of the Position Trigger function.
'Configured output'	Internal parameter I56: Displays the configured output for the Position Trigger.
'Actual Position Trigger source'	Specifies the actual source of the position values of the Position Trigger.
'Actual switching time (manual)'	Specifies the actual switch-on time for mode 4.
'T_{t1}' Actual inactive time first switching point	Specifies the actual delay compensation of the first switching point for the switch-on process.
'T_{t2}' Actual inactive time second switching point	Specifies the actual delay compensation of the second switching point for the switch-on process.
'-Mod' Actual lower limit value modulo	Specifies the actual determined lower limit value for the modulo calculation.
'+Mod' Actual upper limit value modulo	Specifies the actual determined upper limit value for the modulo calculation.
'Hy' Actual hysteresis	Specifies the actual hysteresis. In the hysteresis range, switching procedures are suppressed around the switching point during fluctuations.
'Offset' Actual offset modulo position	Specifies the actual used offset of the modulo position.

Tab. 89: Active Values, General Parameters

The timing diagram is only visible if the 'Automatic' mode is active.
The timing diagram shows an example of the signal curve for the positive direction of motion with the active parameters for the automatic mode.

Position Switches

This parameter group is only visible if the ‘Automatic’ mode is active. The parameter group shows the parameters for the position switches defined for the automatic mode.

2.3.12.15 Touch Probe (position detection)

The Touch Probe function enables precise detection of current positions while commands are being processed. In this process the position detection function is triggered by the trigger signals at a trigger input (CAP).
The navigation tree under the ‘Touch Probe’ panel has a ‘Touch Probe 0’ … n panel for parameterising the position detection for every trigger input of the device. The number of possible position detections depends on the device and its firmware.
The relevant panel can be directly selected by selecting the corresponding panel in the navigation tree. Links in the working section of the ‘Touch Probe’ panel can also be used to select the ‘Touch Probe 0’ … n panel.
The panels provide the following functions:
– selection of the desired Touch Probe mode
– selection and display of the input configured for the Touch Probe function
– graphically supported input option for the parameters relevant to the selected operating mode
– When connected to the device: option for activation of the selected settings
– Display of active parameters and additional actual values as real-time values
Detailed information on the parameterisation of the Touch Probe function ➔ *7.2 Position detection (touch probe)*.

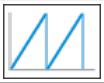
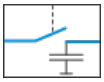
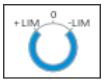
‘Prepared Values’

The initial values of the specific position acquisition can be defined in the ‘Prepared Values’ parameter group.
Parameters can be set in the ‘General Parameters’ subgroup depending on the selected position acquisition mode. Parameters that are not relevant for the selected mode are not visible.

General parameters	Brief description
‘Touch probe mode’	Specifies the mode of the touch probe function. The specified mode is effective on activation of the touch probe function. Available modes ➔ *7.2 Position detection (touch probe)*.
‘Selection trigger event’	Specifies the type of signal edge with which the measurement shall be triggered.
‘Configuration input’	Internal parameter I58: Determines the digital input for the touch probe function.
‘Touch probe source’	Specifies the source of the measured values.
‘+MOD’ Upper limit value modulo	Specifies the upper limit value for the modulo calculation. When the upper limit value is exceeded, the position jumps to the lower limit value.
‘–MOD’ Lower limit value modulo	Specifies the lower limit value for the modulo calculation. When the lower limit value is undershot, the position jumps to the upper limit value.
‘Offset’ Offset modulo position	Offset of the modulo position

General parameters	Brief description
'+MOD' Upper limit value trigger event	Specifies the upper limit for trigger signals within the modulo range. Trigger signals at positions above the limit are ignored. Only relevant in the following modes: once with window and cyclic with window
'–MOD' Lower limit value trigger event	Specifies the lower limit for trigger signals within the modulo range. Trigger signals at positions below the limit are ignored. Only relevant in the following modes: once with window and cyclic with window

Tab. 90: Parameters in the Touch Probe block diagram

Symbol	Description
Trigger event at configured input	
	Single rising edge
	Single falling edge
	Single rising and falling edge
	Cyclically rising edge
	Cyclically falling edge
	Cyclically rising and falling edge
Trigger function	
	Modulo function
	Trigger
	Trigger event limitation by the +LIM and -LIM input variables The block and the two input variables +LIM and -LIM are only displayed if a Touch Probe mode with window is selected.

Tab. 91: Description of the symbols in the Touch Probe block diagram

Accepting initial values as active values

The 'Apply Values' button can only be activated if the plug-in is connected to the device. When the button is activated, the set initial values are imported by the device as the active value and are then visible in the 'Active Values' parameter group.

'Active Values'

If the plug-in is disconnected from the device, the default value of the 'Actual touch probe mode' parameter is displayed.
If there is a connection with the device, the parameters of the position detection active in the device are displayed in the 'Active Values' parameter group.

General parameters	Brief description
'Actual touch probe mode'	Specifies the actual mode of the touch probe function.
Current values	
'Actual selection trigger event'	Specifies the actual defined signal edge of the trigger event.
'Configuration input'	Internal parameter I58: Determines the digital input for the touch probe function.

General parameters	Brief description
‘Actual touch probe source’	Specifies the actual sources of the measured values.
‘Absolute position in user units’	Display the position in the user units in relation to the axis zero point.
‘+MOD’ Actual upper limit value modulo	Specifies the actual determined upper limit value for the modulo calculation.
‘–MOD’ Actual lower limit value modulo	Specifies the actual determined lower limit value for the modulo calculation.
‘Offset’ Actual offset modulo position	Specifies the actual used offset of the modulo position.
‘+MOD’ Actual upper limit value trigger event	Specifies the upper limit for trigger signals within the modulo range. Trigger signals at positions above the limit are ignored.
‘–MOD’ Actual lower limit value trigger event	Specifies the lower limit for trigger signals within the modulo range. Trigger signals at positions below the limit are ignored.
‘Modulo position’	Modulo of the reference position
Results	
‘Time stamp touch probe position’	Specifies the time of the last measurement based on the system time of the device.
‘Touch probe position’	Specifies the position of the last measurement.
‘Trigger event initiated’	Display whether the trigger signal was triggered within the specified range. With cyclic acquisition, the signal is set up to the transition of the modulo limit and is reset at the transition.
‘Trigger event NOT initiated’	Specifies whether a trigger signal has been triggered within the defined range if the module limit is exceeded. 1 means that the trigger signal has not been triggered
‘Trigger events counter triggered’	Specifies the number of valid measurements. The parameter value increases at every valid measurement.
‘Trigger events counter NOT triggered’	Specifies the number of invalid measurements. The parameter value increases at every invalid measurement.

Tab. 92: Parameter for displaying the active values

2.3.12.16 Travel to Fixed Stop

The working area contains parameter groups for parameterisation of the "Travel to Fixed Stop" function.

‘Monitoring Settings’ The monitoring settings when moving to a fixed stop are specified in the parameter group ➔ Move to fixed stop (application class 3)

‘Diagnosis Function’ The diagnostic categories of the associated diagnostic messages are defined in the parameter group.

‘Travel to Fixed Stop’ Diagram for moving to fixed stop ➔ Move to fixed stop (application class 3).

2.3.12.17 Manual Movement

The working area contains parameter groups for configuring the movement parameters for jog mode and for manual movement.
The functions allow the drive to be moved manually. This is required in the following situations and others:
– Moving to a teach position.
– Moving to a safe position following a system malfunction.

The functions are carried out on the ‘Manual Movement’ control panel or by the PLC.

‘Dynamic Values - Jog Mode’

The individual parameters for jog mode are specified in this parameter group. The currently selected parameter is highlighted in the interactive graphic. Additional information on jog mode ➔ 4.6 Jog mode.

‘Dynamic Values - Single Step Mode’

The separate default values for individual steps are defined in this parameter group.

2.3.13 Parameter List

The working section contains a table with all the servo drive parameters.
The ‘Parameter List’ parameter panel is always displayed in a table view. Switch-over to panel view is not possible.

Information on working with the tabular view of parameters ➔ 2.3.1 View of the parameters, ➔ Tab. 39 Description of the symbols in the title bar.

Notes on entering parameters ➔ 2.3.2 Entering parameters.

2.3.14 CODESYS

This parameter panel is only displayed under the following conditions:
– The ‘Topology Editor’ section of the Festo Automation Suite has a connection to another plug-in ➔ 2.6 Integrating a device in a Festo controller. Additional information ➔ Festo Automation Suite online help.
– The other plug-in connector is active.

Every time the currently set operating mode and version are modified, the corresponding data are transmitted to the connected control components.

If a device in the ‘Topology Editor’ section is copied or the device is cut from the network and pasted at another position, the previous settings are retained in the CODESYS editors.
If other devices belonging to the servo drive are subordinate to the CODESYS device, (e.g. for a SoftMotion axis object), their editors are equally accessible via corresponding entries in the navigator.
The designation of the entries depends on the names of the CODESYS devices. The device belonging to the servo drive is named according to the device name in the project. If CODESYS does not support characters in the name assigned for the device in the Festo Automation Suite, they are replaced by an underscore. To facilitate the integration of the device into the control program by its name, the name actually assigned in CODESYS is displayed in the navigator.
The device properties can be opened and the device deactivated and reactivated using buttons in the panel title bar.

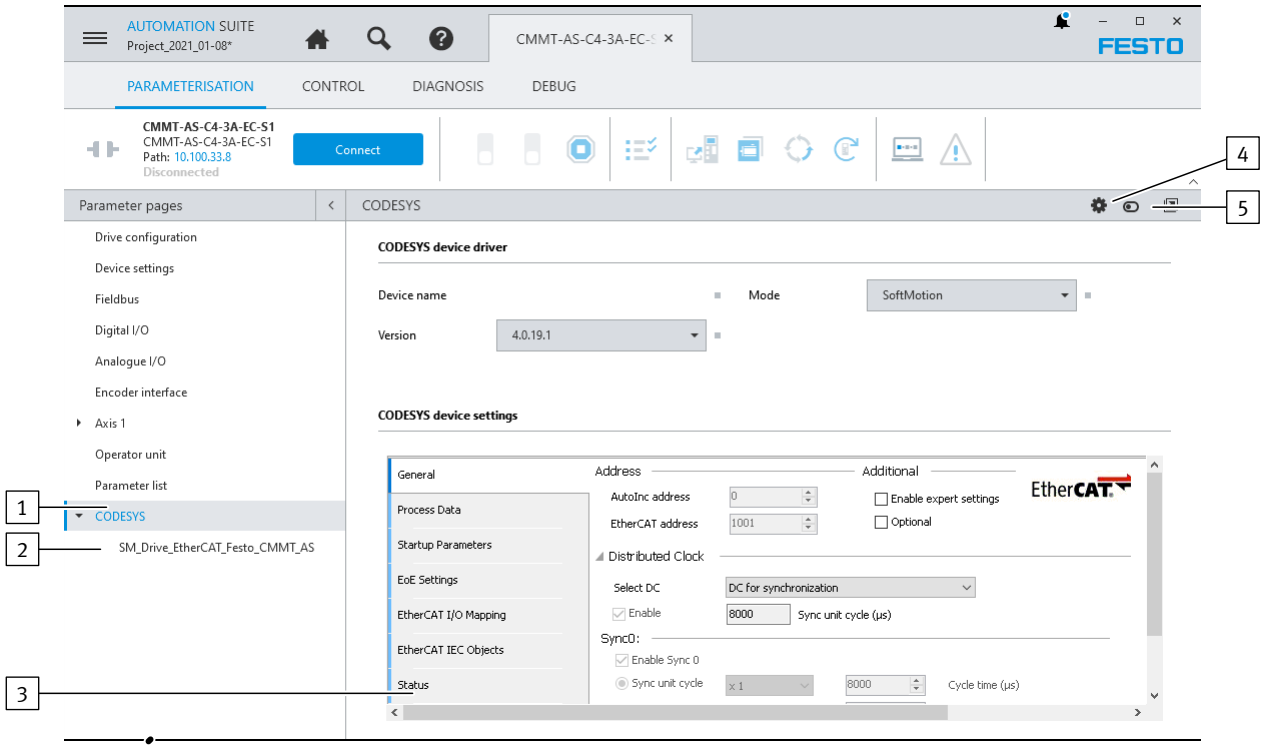


Fig. 19: CODESYS editor

1 Entry for the CODESYS device belonging to the servo drive

2 Entry for subordinate devices, in this case SoftMotion axis object

3 CODESYS editor including register

4 Opens the CODESYS device properties

5 Deactivates or activates the device in CODESYS

CODESYS Device Driver Display of the CODESYS device name, selection of the operating mode and version of the CODESYS device driver.

CODESYS device settings CODESYS editor with the settings of the device.
If the device settings are opened in the ‘Programming’ context of the master, the device settings are hidden here. The device settings can be displayed again with the ‘Show editor here again’ button and hidden in the plug-in of the master.

Information on the device settings can be found in the documentation for the CODESYS extension for the Festo Automation Suite.

2.4 Control

2.4.1 Manual Movement

The working section contains sections for running homing and executing manual motions.
Requirements:
- The plug-in is connected to a device.
- The plug-in has the master control.
- Controller enable is activated. Only homing with method 37 can be carried out with controller enable inactive.

Using default values Default values for some parameter settings are defined that are read out from the device. Values entered by the user have priority. If the user does not specify a value, the default value is used.

The ‘Reset Dynamic Values to Default’ button in the working section title bar overwrites the entered target position and velocity values with the default values.

‘Homing’

The ‘Homing’ section shows:
– the homing run status
– the homing method set on the ‘Axis’ parameter panel
The ‘Start Homing’ button executes homing with the current homing method.
After successful completion of the homing run, the "Homed" homing run status is displayed.

Depending on the drive configuration, a zero point offset is determined during homing. After successful completion of the homing run, the calculated zero point offset must be saved.
Requirements:
- The drive configuration contains a motor with encoder.
- The homing of the drive is valid (homing status "Homed").

The ‘Save Zero Point Offset’ button permanently saves the zero point offset. This ensures that the value is retained when the device is restarted.

‘Manual Movement’

The ‘Manual Movement’ section supports simple manual operation and does not require an active control program. For example, this function enables testing and setup of the mechanics of a machine during commissioning.

The current actual position is displayed and can be adopted using the command buttons in the adorner pop-up, e.g. for setting the software end position.

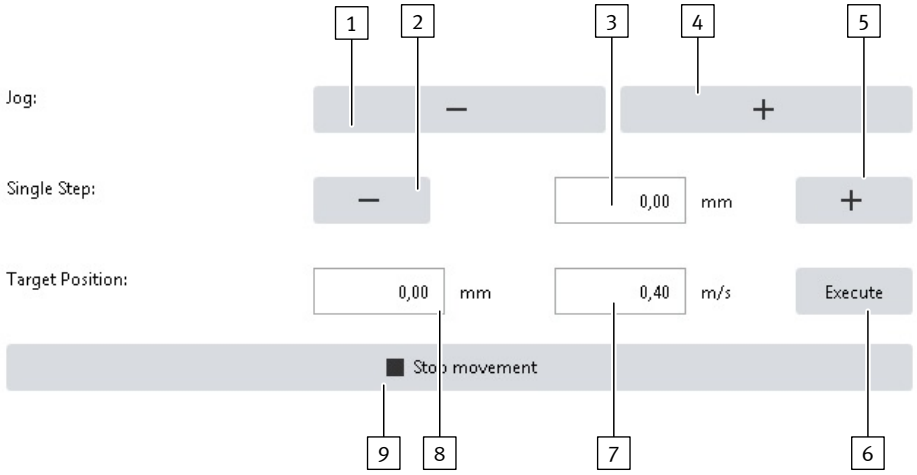


Fig. 20: Manual movements

1 Jogging in negative direction
2 Single step in negative direction
3 Distance for single steps
4 Jogging in positive direction
5 Single step in positive direction
6 Execute the movement to target position
7 Speed
8 Target position
9 Stop current motion

No.	Name	Function
Jog mode		
[1]	'Jog Negative'	Jog movement in negative direction Motion parameters: – Jog mode parameter panel – ➔ 2.3.12.17 Manual Movement,
[4]	'Jog Positive'	Jog movement in positive direction Motion parameters: – Jog mode parameter panel – ➔ 2.3.12.17 Manual Movement.
Single step, target position		
[3]	Distance for single steps	Indication of the traverse path per step
[2]	'Single Step Negative'	Execution of a single step: – in negative direction – with indicated distance and velocity – with standstill at target achievement
[5]	'Single Step Positive'	Execution of a single step: – in positive direction – with indicated distance and velocity – with standstill at target achievement
[9]	'Target position'	Define target position of motion.
[8]	Speed	Parameterisation of the velocity for the following functions: – Executing a single step – Executing movement to the target position
[7]	'Execute'	Start moving to target position Standstill when target is reached
[6]	'Stop Movement'	Issue stop command

Tab. 93: Legend for 'Manual Movement'

'Holding Brake'

The status of the holding brake is displayed in this section and the holding brake can be opened or closed manually with the ■ Holding Brake button. The section is only visible if the device configuration includes a motor with a brake.
The button in this section can be operated if the following requirements are met:
– The plug-in is connected to a device.
– Only the master control is set.

'Active Closed Loop Parameter Set'

A different controller data record can be transferred to the active closed-loop parameters in this section.
The controller data records are parameterised on the 'Closed Loop' panel ➔ 2.3.12.8 Closed Loop.

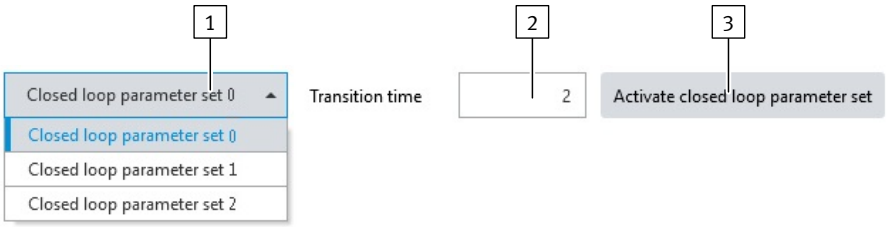


Fig. 21: Manual motions – controller data record

1 Select controller data record

2 Transition period during which the controller data record should be transferred to the active closed-loop parameters

3 Activate the closed-loop data record

2.4.2 Record Table

All of the records and record sequences that were created in the ‘Record Table’ parameter panel (➔ 2.3.12.5 Record Table) are listed in the working section.
Records can be started and stopped on this control side. The records cannot be created, edited or deleted.
Records can be started or stopped if the following prerequisites are met:
– The plug-in is connected to a device.
– The plug-in has the master control.
– For motion tasks: the controller enable is activated. The status of the controller enable is not relevant for other tasks of the record table.

Executing or stopping record

Records can be executed and stopped with the corresponding button. If a record is being executed, the ▶ ‘Execute record set’ symbol switches to the ■ ‘Stop record set’ symbol.
The record currently being executed is marked by an arrow and a blue record number.

Symbol		Description
▶	Execute record set	Executes the associated record.
■	Stop record set	Stops execution of the related record.

Tab. 94: Description of the control side symbols

Setting velocity override

A velocity override between 0% and 200% can be set for commissioning purposes with the slider in the upper right corner. When changing the percentage value, the associated Px.1309 Velocity override parameter is written directly with the corresponding value between 0 and 2.
Double-clicking on the displayed percentage resets the percentage to 100%. The Px.1309 Velocity override parameter is written with the value 1 again.

2.5 Diagnosis

2.5.1 Device State

During an active device connection, the ‘Device State’ diagnostic panel displays the current status of the servo drive and axis and the message directory.
List of all diagnostic messages ➔ 9.4.6 Diagnostic messages with information for fault clearance.
Additional information on the message directory ➔ 9.4.3 Message directory.
Additional information on the category ➔ 9.2 Classification of Diagnostic Events.
Additional information on the status of messages ➔ 9.4.1 Status of messages.

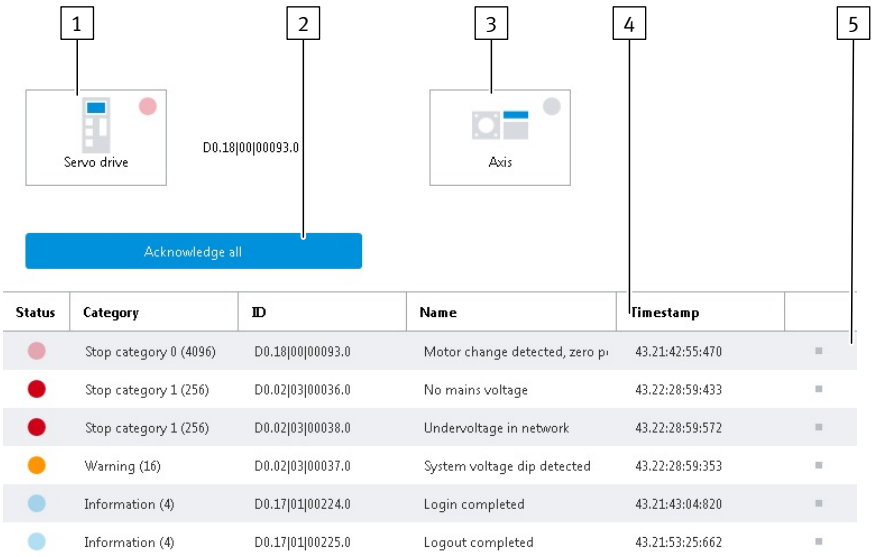


Fig. 22: Device status

1 Servo Drive status
2 Acknowledge All
3 Axis status
4 Message directory
5 Adorner with information on the message

No.	Designation	Function
1	'Servo Drive' status	Servo drive symbol including colour display of the status as provided in the message directory. If available, display of the currently applicable number of the diagnostic message with the highest priority for the servo drive.
2	'Acknowledge All'	Acknowledge all pending diagnostic messages ➔ 9.4.5 Acknowledging messages and errors.
3	'Axis' status	Axis symbol including colour display of the status as provided in the message directory. If available, display of the currently applicable number of the diagnostic message with the highest priority for the axis.
4	Message directory	Display all diagnostic messages sorted according to status, priority or time stamp Information on subdividing the error messages into the main group, subgroup and by number ➔ 9.4.2 Structure of messages
5	Adorner with information on the message	The adorner displays detailed information about the diagnostic message as an overview, including measures for troubleshooting.

Tab. 95: Legend for device status

Message directory

The message directory shows all of the current diagnostic messages.
It is sorted according to the following criteria:
– descending according to the category
– descending according to the status
– ascending within the category based on the time stamp
A diagnostic message can have various categories and statuses. They are displayed as follows in the message table:

Category	Status	Meaning	Colour display
Error: diagnostic message with a high degree of severity			
Stop category 0 Stop category 1 Stop category 2	active	Cause is active.	
	cancelled	Cause is no longer active.	

Category	Status	Meaning	Colour display
Stop category 0 Stop category 1 Stop category 2	acknowledged	Diagnostic message has already been acknowledged.	
Warning: diagnostic message with a medium degree of severity			
Warning	active	Cause is active.	
	cancelled	Cause is no longer active.	
	acknowledged	Diagnostic message has already been acknowledged.	
Information: diagnostic message with a low degree of severity			
Information Ignore (not displayed in the message list)	active	Cause is active.	
	cancelled	Cause is no longer active.	
	acknowledged	Diagnostic message has already been acknowledged.	
No diagnostic message (not displayed in the message list)			
–	–	No current diagnostic message	

Tab. 96: Categories and status of the message list

2.5.2 Process Data

The ‘Process Data’ diagnostics panel is only available with the multi-protocol devices CMMT-AS-...-MP.

The ‘Process Data’ diagnostics panel shows the specific process data dynamically depending on the activated fieldbus and the configured telegram when the device connection is active for devices that are connected to a master.

EtherCAT:

- Status information of the CiA 402 state machine ➔ 11.7 CiA 402 finite state machine
- Status word 0x6041 ➔ 11.7.3 Status words (objects 0x6041)
- Control word 0x6040 ➔ 11.7.2 Control word (object 0x6040)

PROFINET:

- Telegrams ➔ 12.4.5 Telegrams
- Process data signals ➔ 12.4.8 Process data signals in detail

EtherNet/IP:

- Telegrams ➔ 13.6.5 Telegrams
- Process data signals ➔ 13.6.8 Process data signals in detail

Status	Display
Signal active (logic 1)	
Signal inactive (logic 0)	

Tab. 97: Display of the states

2.5.3 I/O State

The following I/O interfaces are displayed in the working section:
– ‘X1A’
– ‘X1C’
The logic state of the relevant input or output is displayed for the individual interface pins, e.g. to check the external circuitry or wiring.
The statuses are displayed in different colours. The following statuses are possible:

Status	Display
Signal active (logic 1)	
Signal inactive (logic 0)	
No signal present	

Tab. 98: Description of possible statuses

2.5.4 Error Log

The following prerequisite applies for reading out the error memory on the ‘Error Log’ diagnostics panel:
– The plug-in is connected to a device.
A table of all the diagnostic messages currently on the device is available in the working section. The continuous error index is displayed in the first column. The last column contains adorners with information about the cause of the error and how to correct it.
The following information is displayed for the diagnostic messages currently contained in the error memory:
– ‘State’
– ‘Category’
– ‘ID’
– ‘Name’
– ‘Timestamp’
The sequence of the entries is determined by the time when they occurred. The latest message is in first position of the error memory, ready to be read out.
More information:
– on the error memory ➔ 9.4.4 Error memory.
– on classifying the error messages into main group, subgroup and number ➔ 9.4.2 Structure of messages

Reading out error memory

The error memory can be read out with the ‘Update’ command.
The error memory is read out automatically in the following cases:
– The contents panel is opened.
– The contents panel is opened, and the plug-in establishes a connection to the device.

Exporting diagnostic data

The diagnostic data can be exported as a .csv file with the ‘Export to CSV...’ button in the title bar of the working section.

All servo drive parameters can also be exported. The following files are saved in a .zip file during this process:
– "DeviceParameters.csv" with device parameters
– "Diagnosis.csv" with diagnostic data
– "InternalParameters.csv" with internal parameters
– "Recorded trace_[period].csv" for every recorded trace

When exporting diagnostic data, all parameters are exported, even if they are not visible to the user.

2.5.5 Error Classification

Additional information on error classification ➔ 9.2 Classification of Diagnostic Events.
The ‘Error Classification’ diagnostic panel contains a table with all of the diagnostic messages from the device for which the classification has been changed.
The table is split into the following columns:

Column name	Description
‘ID’	Display ID of diagnostic message.
‘Name’	Display name of diagnostic message.
‘Category (actual configured)’	Display or determine category of the diagnostic message.

Tab. 99: Description of the error classification columns

‘Category (actual configured)’ column

The category of a diagnostic message can be changed via the dropdown menu.
The categories are depicted colour-coded as follows:

Category	Colour display
‘Ignore (2)’	
‘Information (4)’	
‘Warning (16)’	
‘Stop category 2 (64)’	
‘Stop category 1 (256)’	
‘Stop category 0 (4096)’	

Tab. 100: Display of the categories

‘Store warnings to error log’

Diagnostic messages that have been classified as warnings can be written to the diagnostic memory with the ‘Store warnings to error log’ checkbox above the table.
The checkbox can have the following statuses:

Status	Description
	There are various settings. Some messages that have been classified as warnings are written to the diagnostic memory, others are not.
	All messages that have been classified as warnings are written to the diagnostic memory.
	All messages that have been classified as warnings are not written to the diagnostic memory.

Tab. 101: Description of the statuses of the ‘Store warnings to error log’ checkbox

Switching to the ‘Error Log’ panel

Pressing the ‘Go to Diagnosis Page "Error Log"’ button via the table opens the ‘Error Log’ diagnostics panel.

2.5.6 Trace Configuration

The working section contains parameter groups to configure a trace recording.
All available device parameters can be recorded. The recordings enable the system behaviour to be monitored and optimised and possible errors to be identified.
Recording channels can be created, edited and deleted in the ‘Trace Channels’ parameter group.
Additional information on recording measurement data ➔ 9.6 Recording measuring data (trace).

‘Trace Channel Configuration’

The current trace configuration can be saved in the ‘Trace Channel Configuration’ parameter group, saved trace configurations can be opened or predefined trace configurations can be loaded.
A ‘Standard’ profile and also a predefined profile for each of the safety functions are available in the ‘Predefined Channels’ selection list.
The ‘Save Configuration’ button opens a pop-up in which the current trace configuration can be saved as defined by the user. The saved profiles in this pop-up can be allocated to an existing group in the ‘Group’ field. The new name is input in the ‘Name’ field. The trace configurations saved in this way are then immediately available in the ‘Predefined Channels’ selection list and can be selected, edited or deleted there.
If changes are made to the trace configuration under ‘Trace Channels’, the value in the selection list automatically changes to ‘User-defined (no profile)’.

Symbol		Description
	‘Delete All’	Removes the existing recording channel from the ‘Trace Channels’ parameter group.
	‘Import Trace Channel Profiles’	Opens a dialogue for importing trace channel profiles (JSON file).
	‘Export Trace Channel Profiles’	Only active if a user-defined trace channel configuration is active: opens a dialogue to save the current configuration as a file (JSON).

Tab. 102: Description of the diagnostics panel buttons

Creating a new recording channel

New recording channels can be created with the ‘Add Trace Channel’ button using a pop-up. The pop-up supports multiple selection when selecting parameters by using the mouse in combination with the [Ctrl] key or the [Shift] key.
The button is only active if the following prerequisite is met:
– The maximum number of trace channels has not been created yet.

1. Press the ‘Add Trace Channel’ button.
   ⇨ The pop-up to create a recording channel opens.
2. First, select the type of recording in the ‘Recording type’ section:
   – ‘Total signal’: the parameter selected in the next step will be recorded as a numerical value.
   – ‘Bits’: the parameter selected in the next step is recorded as a bit array with selection of the bitmask. This selection subsequently allows only the selection of suitable parameters.

3. Select one or more device parameters from the list.
   The parameters are grouped into categories corresponding to the parameter panel.
   The additional ‘General’ category contains the most common device parameters.
   Select the category for the device parameter to be recorded.
   A direct search for a device parameter can be made in the search field using the ID, name or description.
   In order to select multiple device parameters simultaneously with ‘Total signal’ recording type, use the options for multiple selection with the mouse in combination with [Ctrl] or [Shift].
4. If the ‘Bit’ recording type has been selected, the bits for recording are selected after selection of the parameter. A single bit or multiple bits can be selected here.
5. Press the ‘Apply Trace Channel’ button.
   ⇨ Depending on the number of selected parameters, one or more recording channels are created and listed in the overview. No more than the maximum allowable number of recording channels is created in this process. The selection of parameters that already exist in the trace configuration is ignored.

Activating, editing and deleting recording channels

Existing recording channels can be activated, edited or deleted using the following buttons:

Symbol		Description
Active	Activate or deactivate the existing recording channel	The recording channel can be temporarily removed from the recording without being deleted.
	‘Edit Trace Channel’	Enables editing of the existing recording channel.
	‘Delete Trace Channel’	Removes the existing recording channel from the ‘Trace Channels’ parameter group.

Tab. 103: Description of the buttons for the recording channels

‘Record Settings’

This parameter group is only visible if at least one recording channel is created. The recording duration can be set in this parameter group. The resolution is also displayed in this parameter group.
The resolution depends on the recording duration, the number of recording channels and the data type and is automatically calculated.

Parameters		Description
I16	Trace duration	Configured duration with selected trace resolution in s.
I14	Trace resolution	Sets the resolution of the trace recording.

Tab. 104: Information on internal parameters

‘Trigger Preferences’

The trigger can be selected and configured in this parameter group. The parameter group is only visible if at least one recording channel is created.

Parameters		Description
I20	Trace delay	Defines the pre- or post-trigger time with which a recording starts when the trigger condition occurs (positive values: pre-trigger time, negative values: post-trigger time). If trigger is not configured, the ‘Trace delay’ field is inactive.

Tab. 105: Information on internal parameters

If the trigger time is to be set by pressing the ‘Start Trace’ button, it is not necessary to add a trigger. Then trigger settings are not required (trigger type 0).
If data in the parameter directory for the device (trigger type 1) or a diagnostic result (trigger type 2) are to be used as a trigger, the trigger is selected as follows:

1. If a trigger has not yet been configured, press the ‘Add New Trigger’ button. If a trigger has already been configured, press the ‘Edit Trigger’ symbol.
   ⇨ The pop-up to edit a trigger is opened. If a trigger has already been configured, the pop-up directly displays the last edit step. Buttons in the pop-up enable scrolling to the previous or next step.
2. Select the trigger type in the first editing step of the pop-up (‘Data trigger (1)’ or ‘Diagnostics trigger (2)’).
   ⇨ The following steps depend on the selected trigger type.

If the ‘Data trigger (1)’ trigger type was selected, the following steps are required:

1. Select the category of the device parameter.
   The ‘Frequently used’ category contains the most common device parameters.
   A direct search for a device parameter can be made in the search field using the ID, name or description.
2. Select the device parameter.
   The device parameters are combined in groups. The group can be expanded or collapsed by clicking on the group title.
3. The trigger condition bit mask or the threshold value can be selected depending on the data type of the selected device parameter. If the selected data type only allows the ‘Threshold’ selection, it is automatically set. Continue to the next step.
4. Select the second trigger condition (e.g. ‘Falling edge’) e.g. below the threshold value.
5. If the ‘Threshold’ trigger condition has been selected, set the threshold value. If the bit mask trigger condition has been selected, set bit mask. The pop-up supports multiple selection with the mouse in connection with the [CTRL] key or the [Shift] key.
6. Press the ‘Change trigger’ button.
   ⇨ The selected data trigger is then displayed in the parameter group and can be changed or deleted again if required.

If the ‘Diagnostics trigger (2)’ trigger type was selected, the following steps are required:

1. Select the trigger condition.
2. Select the diagnostic element.
   A direct search for a diagnostic element can be completed via the search field using the ID, name or description.
3. Press the ‘Change trigger’ button.
   ⇨ The selected diagnostic trigger is then displayed in the parameter group and can be changed or deleted again if required.

The ‘Trace delay’ parameter specifies during which period measurements are performed before and after the trigger event.
The ‘Trace delay’ parameter can only be set if at least one recording channel has been activated for the recording.

The following options are available:
– Positive value: the recording starts before the trigger event occurs (lead time).
– Negative value: the recording starts after the trigger event occurs (follow-up time).
The ‘Trace delay’ parameter is limited in such a way that at least one measurement is performed.

‘Status’

The current status of the recording is displayed in this parameter group. The parameter group is only visible if at least one recording channel is created.
The buttons to start and stop a recording are located underneath the status.

Starting trace

Recordings can be started with the ‘Start Trace’ button or the ‘Start Trace’ symbol on the toolbar.
The button and the ‘Start Trace’ symbol are active if the following prerequisites are met:
– A valid trace configuration is set.
– The plug-in is connected to a device.
– Recording is not currently active.

Stopping trace

The recording is stopped with the ‘Stop Trace’ button.
The ‘Stop Trace’ button is active if the following prerequisites are met:
– The plug-in is connected to a device.
– A recording is currently being performed.

The ‘Stop Trace’ button stops the recording even if the recording is not fully completed.

2.5.7 Trace Display

Finished recordings are automatically read from the device if there is a connection to the device. The ‘Trace Display’ diagnostics panel enables display, analysis and export of the read trace data.
The recording is configured with the aid of the ‘Trace Configuration’ diagnostic panel ➔ 2.5.6 Trace Configuration.
For example, recordings can be started with the toolbar of the ‘Diagnosis’ context with the ‘Start Trace’ command.
If there are no recordings available, a corresponding message is displayed in the graph section of the ‘Trace Display’ diagnostic panel. If there are recordings, the current session recordings are plotted in the graph section starting with the most recent recording.
The recorded signals and the recording trigger are displayed as elements under the recording names. The graph section shows the recorded signals and trigger for the recording selected in the list.
The trace display offers the following modes:

Mode		Description
	‘Standard Trace Display’	When new trace data arrives, the trace data is added to a new recording. In this mode, a list of all recordings with date and time is visible in the left section of the trace display.
	‘Single Trace Display’	When new trace data are received, the trace data of the currently displayed recording are overwritten by the new trace data. If the overwritten trace data have not been previously saved as an FMD or CSV file, they cannot be restored. In this mode, the list of all recordings and elements is hidden.

Tab. 106: Trace display modes

The desired mode can be toggled with the buttons on the title bar ➔ Tab. 109 Symbols in the title bar of the working section.

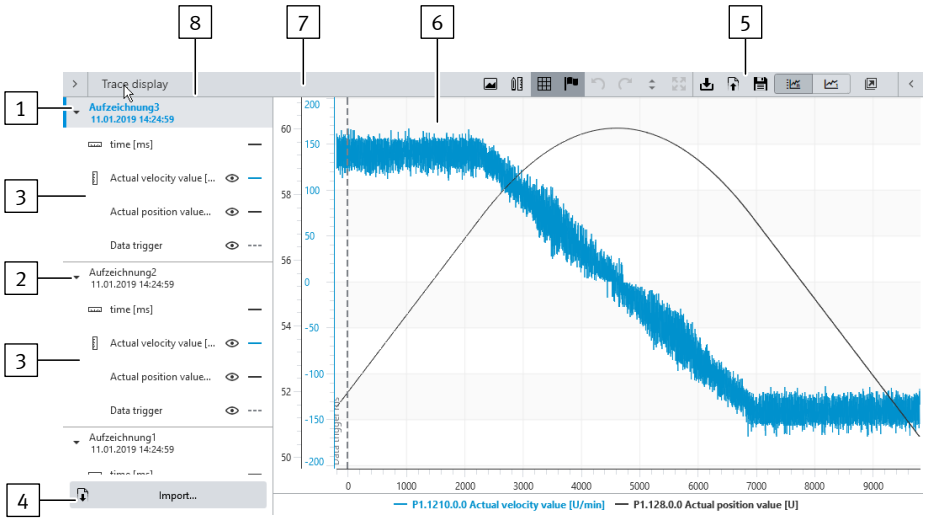


Fig. 23: User interface of the ‘Trace Display’ diagnostics panel

1 Recording (selected)
2 Recording (deselected)
3 Elements of the preceding recording
4 ‘Import...’ button
5 Buttons in the title bar
6 Graph section
7 Y primary axis
8 List of recordings and elements

No.	Designation	Function
1	Recording (selected) (only visible in ‘Standard Trace Display’ mode)	Name, date and time of the recording shown in the graph section; The text of the selected recording is highlighted in bold.
2	Elements of the preceding recording (only visible in ‘Standard Trace Display’ mode)	Elements of the recording are the recorded channels and the trigger for the recording. The list contains the element name and the assigned line type. The visibility of the element in the graph can be switched on or off with a symbol if the element is scaled on the Y primary axis. Elements that are scaled on the X axis do not have a symbol, as the visibility of these elements cannot be switched over. The signal path and the axes of selected elements are highlighted in the graph. This changes the line thickness. The data points are marked. The channels are sorted by channel number in ascending order from top to bottom. The channel number is displayed in the tool tip of the element.

No.	Designation	Function
3	Recording (deselected) (only visible in ‘Standard Trace Display’ mode)	Name, date and time of recordings that are not currently shown in the graph section are not highlighted in bold. Clicking on the entry switches over the display and shows the recording in the graph section.
4	‘Import...’ button (only visible in ‘Standard Trace Display’ mode)	Recordings previously exported can be imported into the list of recordings.
5	Buttons in the title bar	➔ Tab. 109 Symbols in the title bar of the working section
6	Graph section	In this section, the selected recording is shown as a graph. The signal curves are shown in the same colour as the label for the associated Y axis.
7	Y primary axis	The scaling of the Y primary axis influences the pattern of the grid. In addition, the scaling of the Y primary axis is also used for measuring bars.
8	List of recordings and their elements (only visible in ‘Standard Trace Display’ mode)	The list contains the available recordings and their elements. Elements are recorded signals and the trigger for the respective recording.

Tab. 107: Legend

The list of recordings is only visible in the ‘Standard Trace Display’ mode. The symbols in the list of recordings have the following function:

Symbol		Description
	‘Toggle visibility’ Element visible	Indicates that the element is visible if the associated recording is shown in the graph section. Clicking on it switches the element to non-visible. If an element is hidden that is scaled on the Y primary axis, the following visible element is scaled on the Y primary axis, and it is not scaled on the X axis. The visibility of elements that are scaled on the X axis cannot be changed.
	‘Toggle visibility’ Element non-visible	Indicates that the element is non-visible if the associated recording is shown in the graph section. Clicking on it switches the element to visible.
	Opened	The elements of the assigned recording are visible. Clicking the symbol closes the elements of the recording in the recording list. This hides all elements of the recording in the list. Alternatively, the elements can also be collapsed by double-clicking the recording.
	Closed	The elements of the assigned recording are hidden. Clicking the symbol opens the elements of the recording in the recording list. This shows all elements of the recording in the list. Alternatively, the elements can also be opened by double-clicking the recording.
	‘Y primary axis’	The marked element is scaled on the Y primary axis.
	‘X axis’	The marked element is scaled on the X axis.
	Combined Y-axis	The Y-axis of the selected element is combined with the Y-axis of another element with the same selection (scaling several elements on one Y-axis).

Symbol		Description
	‘Manage Views’ button	Opens a pop-up for managing user-defined views. A separate panel for every user-defined view is displayed in the navigation tree under the ‘Trace Display’ panel ➔ 2.5.8 Trace display, subpanels of the user-defined views.
	‘Import...’ button	Enables the import of recordings that were previously exported as: – FMD file (Festo measurement data) – CSV file (Comma-separated values)

Tab. 108: Symbols in the working section

The following commands can be triggered with the symbols in the title bar of the working section:

Symbol		Description
	‘Start Trace’	Starts the recording.
	‘Read Trace’	Reads the trace data from the device that recorded the device before it was connected to the plug-in ➔ 9.6 Recording measuring data (trace).
	‘Combine all axes’	Combines the Y-axes of selected elements with the same unit. The elements are then scaled on the same combined Y-axis.
	‘Split all axes’	Separates the combined Y-axes of the elements again. Each element is scaled on its own Y-axis.
	‘Store to trace list’	Allows you to save the current recording in the ‘Single Trace Display’ mode. The stored recordings can be selected in the ‘Standard Trace Display’ mode via the list of recordings.
	‘Show/Hide Cursor’	Displays a cursor as a measuring bar with which points in the graph can be marked. The recorded values, parameter number and parameter names are displayed as tool tips at the highlighted points.
	‘Enable/Disable Grid’	Shows or hides a grid in the graph section. The grid is aligned to the last selected element.
	‘Enable/Disable Legend’	Shows and hides the legend below the graph. The legend shows signal names and the corresponding signal colours.
	‘Lock view port setting’	Locks or unlocks the view settings.
	‘Previous View’	Switches back to the previous view.
	‘Next View’	Switches to the next view.
	‘Zoom to Y Extents’	Expands the graph to the maximum extension of the Y-axes.
	‘Reset View’	Resets the view to its original state.
	‘Save as Image’	Opens a dialogue for saving the displayed diagram as an image file.
	‘Save as CSV’	Opens a dialogue for saving the data as an CSV file.
	‘Save as FMD’	Opens a dialogue for saving the data as an FMD file.
	‘Standard Trace Display’	Switches the trace display to the ‘Standard Trace Display’ mode (add new recordings).
	‘Single Trace Display’	Switches the trace display to the ‘Single Trace Display’ mode (replace trace data of the current recording).

Tab. 109: Symbols in the title bar of the working section

Commands of the context menu

Separate context menus with the following commands and symbols are available for the graph section, recordings and elements of the recordings:

Symbol	Menu command	Description
	‘Save as Image’	Exports the selected graph as an image file.
	‘Copy to clipboad’	Copies the selected graph as an image to the WINDOWS clipboard.

Tab. 110: Commands of the context menu for the graph section

Symbol	Menu command	Description
	‘Copy to clipboard’	Copies the recording as a CSV file to the clipboard.
	‘Save as FMD’	Saves the recording as an FMD file.
	‘Save as CSV’	Exports the recording as a CSV file.
	‘Add user defined channel’	Adds a custom channel to an existing recording.
	‘Rename’	Enables renaming of the recording (also possible with the [F2] function key).
	‘Delete’	Removes the graph of the selected recording from the trace display.
	‘Delete All’	Removes all graphs from the trace display.
	‘Delete All But This’	Removes all graphs from the trace display except the selected graph.
	‘Expand All’	Expands the elements of all recordings in the recording list.
	‘Collapse All’	Collapses the elements of all recordings of the recording list.
	‘Collapse all but this’	Collapses the elements of all other recordings. The elements of the selected recordings are expanded.

Tab. 111: Commands of the context menu for recording names

Symbol	Menu command	Description
	‘Show’	Shows the element in the graph.
	‘Hide’	Hides the element in the graph.
	‘Set as Primary Axis’	Scales the element on the Y primary axis.
	‘Set as X Axis’	Scales the element on the X-axis.
	‘Combine axes’	Combines the Y-axes of selected elements with the same unit. The elements are then scaled on the same combined Y-axis.
	‘Split axes’	Separates the combined Y-axes of the elements again. Each element is scaled on its own Y-axis.
	‘Change color’	Opens a dialogue for changing the signal colour of the recording channel.

Symbol	Menu command	Description
	‘Edit’	Allows you to edit the custom channel. The range of functions for processing depends on whether the configuration data of the channel are available. For example, if the recording was created with an older plug-in or imported as a CSV file, the configuration data are not available. The channel can then only be renamed. If the configuration data are available, the custom channel can be fully edited.
	‘Delete’	Removes the user-defined channel from the recording list.

Tab. 112: Commands of the context menu for the elements

Adjusting graph display

The graph section can be moved, zoomed and re-scaled. The changes can be made with the following mouse-keyboard combinations:

Adjustment	Required action	Behaviour
Move graph	– Press and hold [Space] and click on the graph with the [left mouse button] – Press and hold the [left mouse button] and move the mouse.	The cursor changes to a hand. The graph moves with the mouse motion.
Zooming with the zoom box	– Press and hold the [left mouse button] and drag the mouse. – Release the [left mouse button] at the desired end point.	The zoom box will stretch from the start point to the current mouse position. Releasing the [left mouse button] will zoom the zoom box.
Zooming with the mouse wheel	– Press and hold the [Ctrl] key and point with the mouse at the graph section. – Zooming in or out with the mouse wheel	Zooming will occur as soon as the mouse wheel is moved.
Rescaling the axis	– Move the mouse over the axis to be rescaled. – Press and hold the [left mouse button] and move the mouse. A vertical movement is required to scale the Y axes and a horizontal movement to scale the X axis.	The scaling follows the movements of the mouse when the [left mouse button] is pressed.

Tab. 113: Adjusting graph display

If a graph is moved, zoomed or re-scaled with the stated actions, the ‘Previous View’ command can be used restore the previous view and the ‘Next View’ command can be used to move to the next view.
This history goes back to when the changes were made. The history is cleared when the view is reset to its initial state.
Double-clicking on the graph or the ‘Reset View’ button resets all display changes.

Combining Y-axes of elements with the same unit

Signals with the same unit can be scaled together on a common Y-axis. The number of Y-axes in the graph is reduced accordingly. The reduction and combination of Y-axes can increase the clarity of the graph view.

1. Click the element name in the recording list whose Y-axis is to be combined.
   ⇨ The line with the element name is highlighted.
2. Press and hold the [Ctrl key].
3. Click other element names with the same unit.
   ⇨ The line is also highlighted.

4. Repeat the above step until all desired items are highlighted.
5. Select the ‘Combine axes’ command in the context menu of a selected element.
   ⇨ The scales of the Y-axes of previously selected elements are combined on a single Y-axis.

Changing signal colour of an element

Signal colours can be set individually.

1. Select the ‘Change color’ command in the context menu of the element.
   ⇨ A dialogue opens in which the signal colour can be changed.
2. Select predefined colour or set custom colour by entering the RGB value or the hex value (6-digit).
   ⇨ The selected or defined colour is displayed as a preview in the dialogue.
3. Press the ‘Apply’ button in the dialogue.
   ⇨ The dialogue is then closed and the selected colour is imported into the graph display.

Add user defined channel

You can add a custom channel to an existing recording. Custom channels enable the following:
– View of individual bits of a recorded signal in the diagram (calculation bit mask)
– Calculation of measurement data with formulas and graphical representation of the results in the diagram for further analyses

1. Select the ‘Add user defined channel’ command in the context menu of the recording name.
   ⇨ This will open a pop-up that allows you to add a custom channel.
   Step 1: the pop-up offers input fields for the channel name and the unit and offers a selection of calculations (e.g. bit mask).
2. Enter channel name and unit and select a method from the ‘Computation’ list.
   ⇨ Step 2: the pop-up will display the available recording channels depending on the selected method name.
3. Select the desired channel from the ‘Source channels’ list.
   ⇨ Step 3: the pop-up displays additional input fields depending on the selected channel.
4. Edit input fields and activate settings with the ‘Apply’ button.
   ⇨ The pop-up is closed. The custom channel is added to the list of elements and displayed graphically in the graph.

Adding the measuring bar

Simple measurements related to the X-axis and the Y-primary axis can be made in the graph with the measuring bar. Measuring bars can be added to the graph using the following mouse-keyboard combinations:

Measuring bar type	User action	Behaviour
Measuring bar with dimensional reference to the X-axis	Drag with [Alt] + [Shift] + [left mouse button] pressed	The measuring bar will stretch to the entire graph height.
Measuring bar with dimensional reference to the X-axis and to the Y-primary axis	Drag with [Shift] + [left mouse button] pressed	The measuring bar will stretch from the start point to the current mouse position.

Tab. 114: Expanding measuring bar

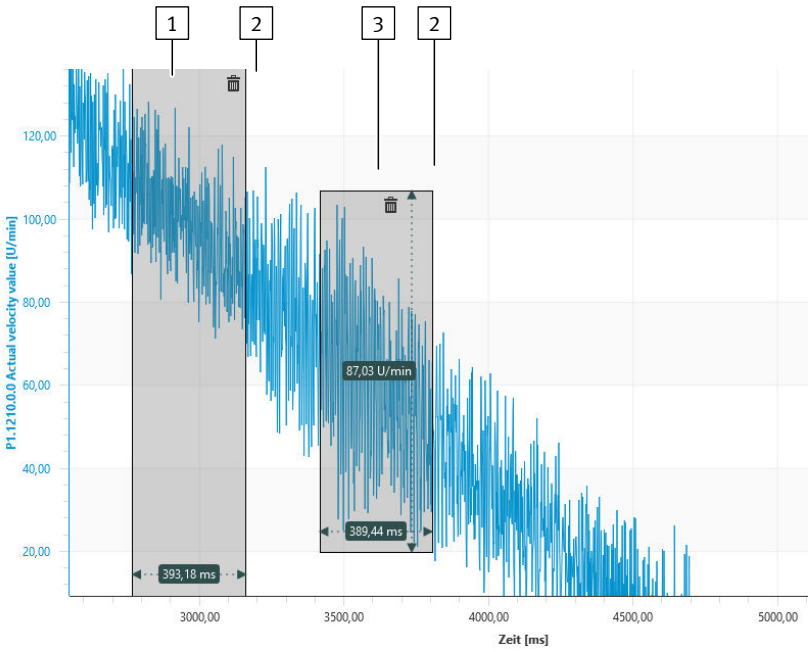


Fig. 24: Measuring bar

1 Measuring bar with dimensional reference to the X-axis

2 Symbol ‘Delete’

3 Measuring bar with dimensional reference to the X-axis and to the Y-primary axis

Depending on the measuring bar, the distance between the measuring bar edges is displayed with reference to the X-axis or with reference to the X-axis and Y-axis. Clicking on the ‘Delete’ symbol in the measuring bar will remove the measuring bar from the graph. If the scaling of the Y-primary axis or the X-axis is changed, all measuring bars are removed from the graph. This action cannot be undone.

Cursor with measured value display

The cursor of the graph can be activated and deactivated with the ‘Show/Hide Cursor’ symbol in the title bar of the working section. The cursor works in the following two modes:

Mode	Description
Line	If the time is plotted on the X-axis, a line is shown in the graph. The position of the line is attached to the mouse cursor. At the intersection points of the line with the graph curves, information boxes are displayed with the name and the current Y-value of the signals. The time is displayed in an information box on the X-axis.
Cross-hair pointer	If time is not plotted on the X-axis, a cross-hair pointer is shown. The position of the crosshairs is attached to the mouse pointer. If the mouse cursor is over one or more data points, an information box with the corresponding Y-value and signal name is displayed at this position per data point.

Tab. 115: Modes of the ‘Show/Hide Cursor’ command

Managing user-defined views

The ‘Manage Views’ button opens a pop-up where user-defined views can be created, renamed or deleted.
A separate panel for every user-defined view in which the view can be edited is displayed in the navigation tree below the ‘Trace Display’ panel ➔ 2.5.8 Trace display, subpanels of the user-defined views.

Exporting recording

Recordings can be exported as FMD file, CSV file and image file or they can be copied directly as an image or as CSV data to the clipboard.

CSV files can be further processed with external programs or imported into older versions of the plug-in. However, CSV files do not contain configuration data of the user-defined channels.
FMD files contain all data of the recording, including the configuration data of the user-defined channels.

Exporting recording as FMD file (Festo measurement data)

- Select the ‘Save as FMD’ command in the context menu of the recording name or in the title bar of the working section.
  ⇨ A dialogue that enables the file to be saved opens.

Exporting recording as CSV file (Comma-separated values)

- Select the ‘Save as CSV’ command in the context menu of the recording name or in the title bar of the working section.
  ⇨ A dialogue that enables the file to be saved opens.

Copying CSV data of the recording to the clipboard

- Select the ‘Copy to clipboad’ command in the context menu of the recording name.
  ⇨ The recording is then copied as CSV data to the clipboard.

Exporting the recording as an image

1. Select the recording name so that the recording is shown in the graph section.
2. Select the ‘Save as Image’ command in the context menu of the graph section or in the title bar of the working section.
   ⇨ A dialogue that enables the file to be saved opens.

Copying the recording as an image to the clipboard

1. Select the recording so that this is shown in the graph section.
2. Select the ‘Copy to clipboard’ command in the context menu of the graph section.
   ⇨ The image is then copied to the clipboard.

Importing a recording

Recordings previously exported to CSV or FMD files can be imported as follows:

1. Press the ‘Import...’ button.
   ⇨ A dialogue opens that enables the imported file to be selected.
2. Select file format (*.csv or *.fmd).
3. Find and select the required file.
4. Press the ‘Open’ button.

Deleting recording

The recordings can be deleted with the ‘Delete’ command in the context menu of the recording name.

2.5.8 Trace display, subpanels of the user-defined views

A separate diagnostics panel is available for every user-defined view created on the ‘Trace Display’ panel in the navigation tree below the ‘Trace Display’ panel.
The signals from a trace recording can be combined for a clear overview with user-defined views. Graphs can be created for a user-defined view. For example, all signals for position control can be combined from a recording into one view, and all signals for the execution of a safety sub-function can be combined in another graph.
Any signals from the recording can be added to the user-defined views either with a pop-up opened with the context menu or by drag-and-drop from the right sidebar.
User-defined views are also included in the import or export of trace records.
The symbols in the list of graphs have the following function:

Symbol		Description
	‘Toggle visibility’ Element visible	Indicates that the element is visible if the associated signal is shown in the graph section. Clicking on it switches the element to non-visible. If an element is hidden that is scaled on the Y primary axis, the following visible element is scaled on the Y primary axis, and it is not scaled on the X axis. The visibility of elements that are scaled on the X axis cannot be changed.
	‘Toggle visibility’ Element non-visible	Indicates that the element is not visible if the associated signal is shown in the graph section. Clicking on it switches the element to visible.
	Opened	The elements of the assigned signals are visible. Clicking on the symbol closes the elements in the recording list. This hides all elements in the list. Alternatively, the elements can also be collapsed by double-clicking the recording.
	Closed	The elements of the assigned signals are hidden. Clicking on the symbol opens the elements in the recording list. This shows all elements in the list. Alternatively, the elements can also be opened by double-clicking the recording.
	‘Y primary axis’	The marked element is scaled on the Y primary axis.
	‘X axis’	The marked element is scaled on the X axis.
	Combined Y-axis	The Y-axis of the selected element is combined with the Y-axis of another element with the same selection (scaling several elements on one Y-axis).
–	‘Add Graph’ button	Adds another graph to the view.

Tab. 116: Symbols in the working section

The following commands can be triggered with the symbols in the title bar of the working section:

Symbol		Description
	‘Sync Charts’	Synchronises the x-axis of the graphs.
	‘Reset To Default Size’	Resets the graphs to the default size.
	‘Combine all axes’	Combines the Y-axes of selected elements with the same unit. The elements are then scaled on the same combined Y-axis.
	‘Split all axes’	Separates the combined Y-axes of the elements again. Each element is scaled on its own Y-axis.
	‘Show/Hide Cursor’	Displays a cursor as a measuring bar with which points in the graph can be marked. The recorded values, parameter number and parameter names are displayed as tool tips at the highlighted points.
	‘Enable/Disable Grid’	Shows or hides a grid in the graph section. The grid is aligned to the last selected element.
	‘Enable/Disable Legend’	Shows and hides the legend below the graph. The legend shows signal names and the corresponding signal colours.
	‘Lock view port setting’	Locks or unlocks the view settings.
	‘Previous View’	Switches back to the previous view.
	‘Next View’	Switches to the next view.

Symbol		Description
	‘Zoom to Y Extents’	Expands the graph to the maximum extension of the Y-axes.
	‘Reset View’	Resets the view to its original state.
	‘Save as Image’	Opens a dialogue for saving the displayed diagram as an image file.
	‘Save as CSV’	Opens a dialogue for saving the data as an CSV file.
	‘Save as FMD’	Opens a dialogue for saving the data as an FMD file.

Tab. 117: Symbols in the title bar of the working section

Commands of the context menu

Separate context menus with the following commands and symbols are available for the graph section, recordings and elements of the recordings:

Symbol	Menu command	Description
	‘Save as Image’	Exports the selected graph as an image file.
	‘Copy to clipboad’	Copies the selected graph as an image to the WINDOWS clipboard.

Tab. 118: Commands of the context menu for the graph section

Symbol	Menu command	Description
	‘Add Channels’	Opens a pop-up to add signals from the recording to the diagram.
	‘Copy to clipboard’	Copies the view data to the clipboard as a CSV file.
	‘Save as FMD’	Saves the view data as an FMD file.
	‘Save as CSV’	Exports the view data as a CSV file.
	‘Rename’	Allows you to rename the view.
	‘Delete’	Removes the graph of the selected recording from the trace display.

Tab. 119: Commands of the context menu for the diagram names

Symbol	Menu command	Description
	‘Show’	Shows the element in the graph.
	‘Hide’	Hides the element in the graph.
	‘Set as Primary Axis’	Scales the element on the Y primary axis.
	‘Set as X Axis’	Scales the element on the X-axis.
	‘Combine axes’	Combines the Y-axes of selected elements with the same unit. The elements are then scaled on the same combined Y-axis.
	‘Split axes’	Separates the combined Y-axes of the elements again. Each element is scaled on its own Y-axis.

Symbol	Menu command	Description
	‘Change color’	Opens a dialogue for changing the signal colour of the recording channel.
	‘Delete’	Removes the user-defined channel from the recording list.

Tab. 120: Commands of the context menu for the elements

2.5.9 Auto Tuning (evaluation)

Functions

In order to optimise the controller data for specific applications, the auto-tuning measurement result can be evaluated as follows on the ‘Auto Tuning’ diagnostics panel:
- Display or export logarithmic diagrams
- Export the data to a CSV file

Requirements for using the functions:
- Perform auto-tuning.
- Establishing connection to the device.
- Read out data.

Read Data From Device

The data can be read from the device with the ‘Read Data From Device’ symbol if there is a connection to the device. The data are then immediately shown in the graphs.

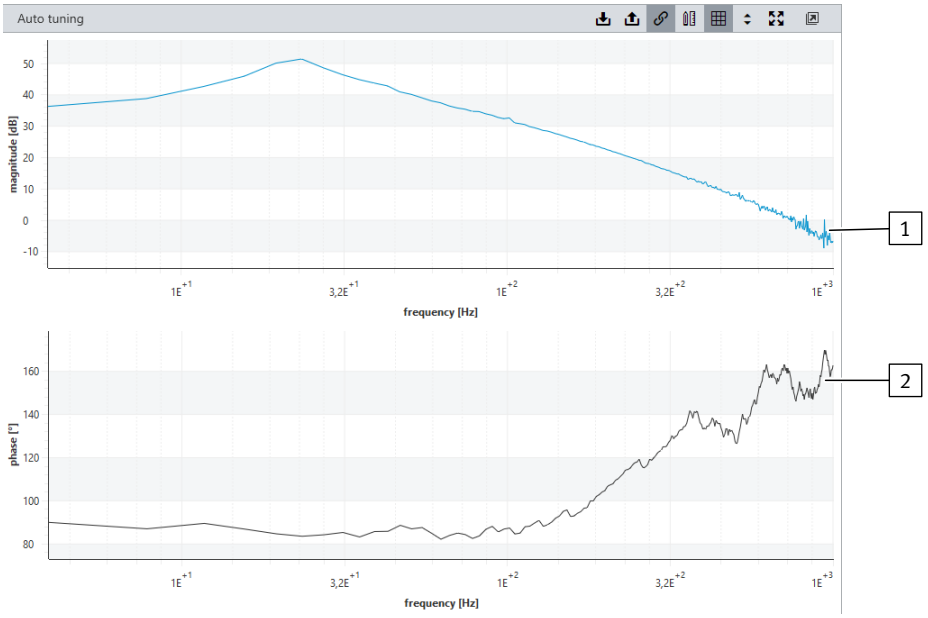


Fig. 25: Auto-tuning measurement result

1 Logarithmic view of the frequency response

2 Logarithmic view of the phase response

Functions for evaluating the auto-tuning

The following graphs are displayed on the ‘Auto Tuning’ diagnostics panel for evaluation of the closed-loop controller settings:
- logarithmic view of the frequency response (top graph)
- logarithmic view of the phase response (bottom graph)

The following actions for both graphs are synchronised by default:
- Zoom actions
- Move actions
- Scaling the frequency axis (x-axis)
- Show/Hide Cursor

The synchronisation of the actions for the diagrams is activated or deactivated with the ‘Enable/Disable Synchronization’ symbol.
The ‘Enable/Disable Grid’, ‘Zoom to Y Extents’ and ‘Reset View’ commands are not synchronised but are applied independently to both graphs.

Symbol		Description
	‘Read Data From Device’	Reads auto-tuning settings from the device.
	‘Save as CSV’	Exports the displayed settings to a CSV file.
	‘Export Chart as Image’	Exports the displayed graphs to a .png common image file. The generated files contains the names of the measured variables and their measured values.
	‘Enable/Disable Synchronization’	Activates or deactivates synchronisation of the graphs.
	‘Show/Hide Cursor’	Shows or hides the cursor in the graphs. If the cursor is activated, the associated values are displayed in a window by positioning a vertical reference line on the values curve of the graphs.
	‘Enable/Disable Grid’	Activates or deactivates the grid in the graphs.
	‘Zoom to Y Extents’	Zoom y-axes of the graphs to maximum extension with reference to the data.
	‘Reset View’	Reset graphs to maximum extension with reference to the settings.

Tab. 121: Functions of the title bar of working section

2.6 Integrating a device in a Festo controller

2.6.1 Device network and CODESYS device settings

Devices can be integrated into networks using connectors in the ‘Topology Editor’ section.

Functions for the device
Functions that are available to the applicable device in the CODESYS extension of the Festo Automation Suite are described in more detail in the documentation of the relevant device library.
The device library and the related documentation are automatically integrated into the CODESYS program.

Whether a device supports a connection type can be seen from the colour of the connectors in the topology editor ➔ Festo Automation Suite Help. The supported connection type for multi-protocol devices may also depend on the parameterisation.
The parameterisation for CMMT-...-MP is preset accordingly when the device is inserted from the corresponding bus section in the device catalogue.
The following example describes the integration of a CMMT servo drive into a CODESYS program.

Connecting device to a controller as a slave

- Connect the device as a slave to a Festo controller ➔ Online help of the Festo Automation Suite.
  - ⇨ The slave device appears as a child device in the navigation tree of the ‘Programming’ context of the controller (master device).
  - ⇨ The slave device is automatically integrated into the control program on connection with the open-loop control (master device).
  - ⇨ The slave device can be activated under the name specified in the Festo Automation Suite in the CODESYS extension of the Festo Automation Suite.

CODESYS device settings of the slave device

If the slave device is double-clicked in the navigation tree of the ‘Programming’ context, the CODESYS device settings can be made for the slave device.
The CODESYS device settings can also be set in the slave device plug-in. The settings are then automatically hidden in the plug-in of the master device.
The device settings can be displayed again by double-clicking on the slave device in the navigation tree. The settings are then automatically hidden in the plug-in of the slave device.

2.6.2 Application example of servo drive

Setting the operating mode on the ‘CODESYS’ parameter panel

If the device is connected to a controller, the following can be set in the plug-in of the servo drive on the ‘CODESYS’ parameter panel:
– the operating mode in which the servo drive is to be addressed in the control program
– the version of the CODESYS device driver
The following operating modes are available:

Mode	Description
‘Point to point’	The servo drive receives a positioning command from the controller. To execute the movement, the servo drive uses the integrated trajectory generator to calculate the required position setpoint values. This operating mode is suitable for controlling an axis regardless of the other axes (uncoordinated movement).
‘SoftMotion’	The controller sends the position setpoints to the servo drive over the fieldbus. This operating mode enables the coordinated movement of several axes. It requires a controller with CODESYS SoftMotion function.

Tab. 122: Operating modes for servo drives

Device drivers for the CODESYS extension of the Festo Automation Suite can be components of device-specific plug-ins for the Festo Automation Suite. Installing a new plug-in version also installs new versions of the device drivers. The latest available device driver version is used when establishing a device connection in the ‘Topology Editor’ section of the Festo Automation Suite. If a different driver version is required, this version can be selected in the plug-in of the respective device.

Functions in the CODESYS extension of the Festo Automation Suite with selection of the ‘SoftMotion’ operating mode

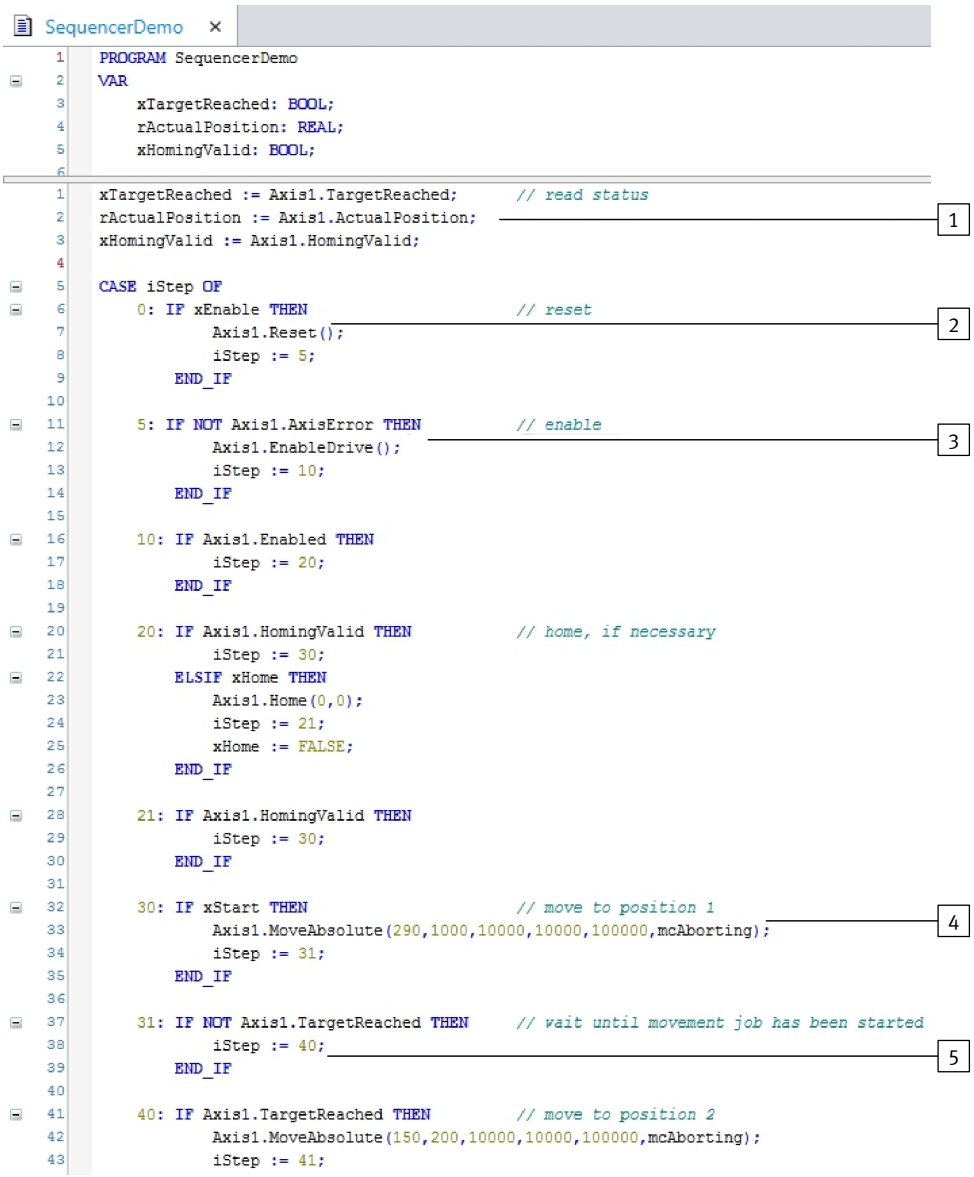
The ‘SoftMotion’ operating mode is based on the CODESYS SoftMotion and requires a controller with SoftMotion function. It is integrated into the control program as in CODESYS by transfer of the SoftMotion axis object to PLCopen modules for SoftMotion.

Functions in the COD-ESYS extension of the Festo Automation Suite with selection of the 'Point to point' operating mode

Two options for integrating the device into the control program are available when selecting the 'Point to point' operating mode:
- Transferring an axis object to PLCopen modules (similar to "Interpolated" operating mode/SoftMotion).
- Directly accessing methods and properties of axis objects.

Parameters for travel commands (e.g. setpoint position or velocity) are always transferred in user units. If necessary, the device driver automatically adapts internally to the parameterisation stored in the device (e.g. scaling of setpoints).
The mapping of the process data is also completed automatically and does not need to be implemented manually in the control program.
The PLCopen blocks are contained in the *'Festo_PtP_Base → PLCopen'* library. This library has the following categories:
- Administrative FBs: modules without a movement function, e.g. for issuing controller enable, resetting device errors or importing actual values
- Continuous Motion FBs: modules to execute continuous movement types (velocity- or torque-controlled operation)
- Discrete Motion FDB: modules to execute positioning tasks (absolute, additive and relative)
- Other FBD: modules for other or manufacturer-specific functions, e.g. homing or record operation

Methods and properties of the axis object can primarily be accessed via the structured text. Ensure that a method is only called up once and not cyclically. The device driver then executes the relevant function automatically. The status can be evaluated by querying the corresponding properties.
For additional information on the available methods, see ➔ Library documentation.



```
SequencerDemo
PROGRAM SequencerDemo
VAR
    xTargetReached: BOOL;
    rActualPosition: REAL;
    xHomingValid: BOOL;

xTargetReached := Axis1.TargetReached;      // read status
rActualPosition := Axis1.ActualPosition;                                  1
xHomingValid := Axis1.HomingValid;

CASE iStep OF
    0: IF xEnable THEN                      // reset
            Axis1.Reset();                                                2
            iStep := 5;
        END_IF

    5: IF NOT Axis1.AxisError THEN          // enable
            Axis1.EnableDrive();                                          3
            iStep := 10;
        END_IF

    10: IF Axis1.Enabled THEN
            iStep := 20;
        END_IF

    20: IF Axis1.HomingValid THEN           // home, if necessary
            iStep := 30;
        ELSIF xHome THEN
            Axis1.Home(0,0);
            iStep := 21;
            xHome := FALSE;
        END_IF

    21: IF Axis1.HomingValid THEN
            iStep := 30;
        END_IF

    30: IF xStart THEN                      // move to position 1
            Axis1.MoveAbsolute(290,1000,10000,10000,100000,mcAborting);   4
            iStep := 31;
        END_IF

    31: IF NOT Axis1.TargetReached THEN     // wait until movement job has been started
            iStep := 40;                                                  5
        END_IF

    40: IF Axis1.TargetReached THEN         // move to position 2
            Axis1.MoveAbsolute(150,200,10000,10000,100000,mcAborting);
            iStep := 41;
```

Fig. 26: Example: control program with an integrated slave device (axis1)

1 Access to actual values via properties of axis object

2 Call up axis object method including direct switchover to the next step

3 Wait for successful execution of the method by requesting the corresponding property

4 Start a positioning command including transfer of position and dynamic values in user units

5 Wait to start and subsequently terminate the positioning process

2.7 Import functions and export functions

2.7.1 Importing the drive configuration

A complete drive configuration, consisting e. g. of drive, motor and servo drive controller, can be conveniently configured and exported to a file with the aid of suitable sizing software. For example, this is possible with the Handling Guide Online or Electric Motion Sizing sizing software.

This configured drive configuration can be imported into the project as a new device in the backstage section of the Festo Automation Suite, ➔ Help for the Festo Automation Suite.

Selection of the parameters

When an imported device is opened for the first time, the ‘Import Engineering Tools’ dialogue is displayed showing the parameters for the import. Parameters can be disabled in the list if necessary. The selected parameters are applied to the project with ‘Apply’. Disabled parameters are used with their default values. Where possible, derived parameters, such as the activation of software endpoints, are set accordingly during the import.

2.7.2 Exporting the parameterisation

The parameterisation of the servo drive can be exported in the Backstage section of the Festo Automation Suite ➔ Help for the Festo Automation Suite. The available export formats depend on the type of equipment or the fieldbus settings. With the exported parameterisation, the axis configuration can be imported into control software, e.g. to parameterise the servo drive directly via the PLC. Various additional settings are possible depending on the type of equipment and the export format. For example, the entire parameter file can be exported, only modified parameters can be exported, or the record table can be excluded from the export.

3 Product configuration

3.1 Controller

3.1.1 Communication interfaces

IP address

The device can be set to a concrete IP address or, alternatively, obtain the address via DHCP ➔ Online help for Festo Automation Suite.
Factory setting: 192.168.0.1
The Ethernet interface [X18] supports 2 connections of which only one may assume the master control. The "Identify device" function enables a flashing sequence to be activated on the connected servo drive.

MAC addresses

The device has 4 MAC addresses in total. The first MAC address can be found on the type plate, while the other three have consecutive numbers based on the first address. MAC addresses 1, 2 and 3 are allocated to the device profile. MAC address 4 is allocated to the communication interface [X18].

3.1.2 Firmware

Firmware management

The servo drive supports the use of any number of compatible firmware packages. This allows the device to be updated to the latest firmware package. However, an older firmware package can also be loaded if necessary, e.g. to use the same firmware version in multiple identical systems.
The firmware can be updated with the Festo Automation Suite.

Compatibility check

Before a firmware package is downloaded, the system checks that the firmware is compatible with the following:
– Fundamentally for the type of equipment: CMMT-ST-...-MP-S0, CMMT-ST-...-EC-S0 etc.
– The hardware version of the device
The Festo Automation Suite runs the check before starting the download.

Firmware download

The available firmware packages are downloaded to the PC with the Festo Automation Suite.
The firmware file download and firmware update on the device are performed in the Scan section ➔ Help for Festo Automation Suite.



The firmware download may take several minutes and must not be interrupted. Do not turn off the device! Do not close the software! Incorrectly or improperly executed firmware downloads can render the device unusable (service case).

To update the firmware, perform the following steps:

1. Download the firmware files onto the device.
2. Start the firmware update. The firmware update is not connected to the download of the firmware files.
3. Start the update procedure. The update procedure is performed internally in the device in interaction between the firmware management component and the bootloader.
   The Festo Automation Suite runs the above steps automatically in sequence.

Firmware information

The firmware package of a device can be read via parameters.

ID Px.	Parameter	Description	
9550	Firmware package version	Firmware package version	
		Access	read/–
		Update	effective immediately
		Unit	–
9560	Major version firmware package	Major version of the firmware package	
		Access	read/–
		Update	effective immediately
		Unit	–
9570	Minor version firmware package	Minor version of the firmware package	
		Access	read/–
		Update	effective immediately
		Unit	–
9580	Patch version firmware package	Patch version of firmware package	
		Access	read/–
		Update	effective immediately
		Unit	–
9590	Build version firmware package	Build version of firmware package	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 123: Parameter

Diagnostic messages for the firmware update

ID Dx.	Name	Description
11 | 04 | 00181 (184811701)	Writing of firmware failed	Writing of firmware failed
11 | 04 | 00182 (184811702)	Reading of firmware failed	Reading of firmware failed
11 | 04 | 00183 (184811703)	Firmware invalid	Firmware invalid
11 | 04 | 00184 (184811704)	Firmware incompatible	Firmware incompatible
11 | 04 | 00185 (184811705)	Firmware save location invalid	Firmware save location invalid
11 | 04 | 00186 (184811706)	Firmware save location empty	Firmware save location empty
11 | 04 | 00187 (184811707)	Firmware update not allowed	Firmware update not allowed
11 | 04 | 00188 (184811708)	Firmware package in use	Firmware package in use
11 | 04 | 00189 (184811709)	System error during firmware update	System error occurred during firmware update
11 | 04 | 00190 (184811710)	Firmware update failed	Firmware update failed

Tab. 124: Diagnostic messages

3.1.2.1 CiA 402

Objects for the firmware

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
9550	0x2129.08	Firmware package version	STRING(30)
9560	0x2129.09	Major version firmware package	UDINT
9570	0x2129.0A	Minor version firmware package	UDINT
9580	0x2129.0B	Patch version firmware package	UDINT
9590	0x2129.0C	Build version firmware package	UDINT

Tab. 125: Objects

3.1.2.2 PROFIdrive

PNUs for firmware

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
9550	2807.0 ... 29	Firmware package version	STRING(30)
9560	2808.0	Major version firmware package	UDINT
9570	2809.0	Minor version firmware package	UDINT
9580	2810.0	Patch version firmware package	UDINT
9590	2811.0	Build version firmware package	UDINT

Tab. 126: PNUs

3.1.3 Parameter set

Default and factory settings, user parameter set

Various parameter sets are available for work on the servo drive.

Parameter set	Description
Default parameter set	Device-independent parameter, only used within the firmware.
Factory parameter set	Device-specific parameter set, contains the specific default values of the servo drive.
User parameter set	Application-specific parameter set in device; parameter values are defined by the user.
Project parameter set	Application-specific parameter set in the project (plug-in), parameter values are defined by the user.

Tab. 127: Parameter sets

If an online connection is active, the user parameter set and project parameter set are identical.

Changed parameters must be saved on the device; otherwise the last parameter set will become active again after a restart

Sequence at the start-up of the servo drive and establishment of an online connection

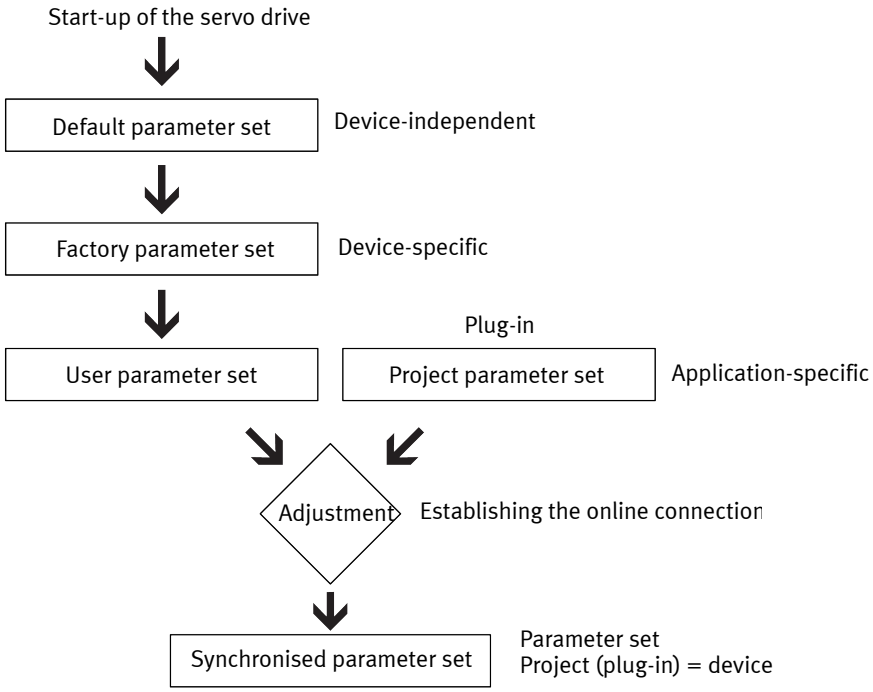


Fig. 27: Sequence at start-up

3.1.4 Master control

Master control determines the interface through which the motion commands may be started.

Motion commands can always be started only through one of the following interfaces:

– Interface of the device profile (factory setting)
– Standard Ethernet (through the device-specific plug-in)
– I/O interface

Ex works, the device profile interface has the master control after activation (master control via fieldbus).

If no other device with a plug-in has the master control, master control can be taken at any time with the plug-in. The master control is withdrawn from the fieldbus (interface of the device profile). If the master control is released again with the plug-in, the master control goes back to the fieldbus.

Assuming and relinquishing the master control

Through the revocation of the master control by the plug-in, active setpoint settings are interrupted, such as those made in the device profile.

The plug-in can assume and relinquish the master control at any time, even during an active motion for example. If the plug-in assumes or relinquishes the master control, the device performs a Category 1 stop. Depending on the parameterisation, the master control then returns to the device profile interface (factor setting) or I/O interface.

Recommendation: When relinquishing the master control, proceed as follows:

1. Make sure the drive is at a standstill in a regulated manner (e.g. by a stop command, stop category 2).
2. Revoke the controller enable (stop category 1, drive is at a standstill in an unregulated manner).
3. Relinquish the master control.

No master control is required for parameterisation. Parameterisation through the standard Ethernet and device profile interfaces is always possible.

Simultaneous connections via standard Ethernet interface

Through the standard Ethernet interface, 2 connections at once are technically possible, e.g. through 2 device-specific plug-ins. If the master control has been assumed by a device-specific plug-in, the plug-in has the master control until it relinquishes the master control again.

If the plug-in relinquishes the master control, the device performs a Category 1 stop.

Time-out

If the device-specific plug-in has the master control, the device detects when the connection to the plug-in has been interrupted. The device executes the parameterised reaction. The time-out time is typically 5 s. For slow networks, a longer time-out time can be selected.

3.1.5 Device services and methods

3.1.5.1 Process and return codes

Device services are executed by the methods described in the following sections. Functions close to the hardware, such as reset of the device, can be called.
Before calling a method again, the method call must be reset (control = 0). After that execution of the method is possible again, as shown in the following diagram.

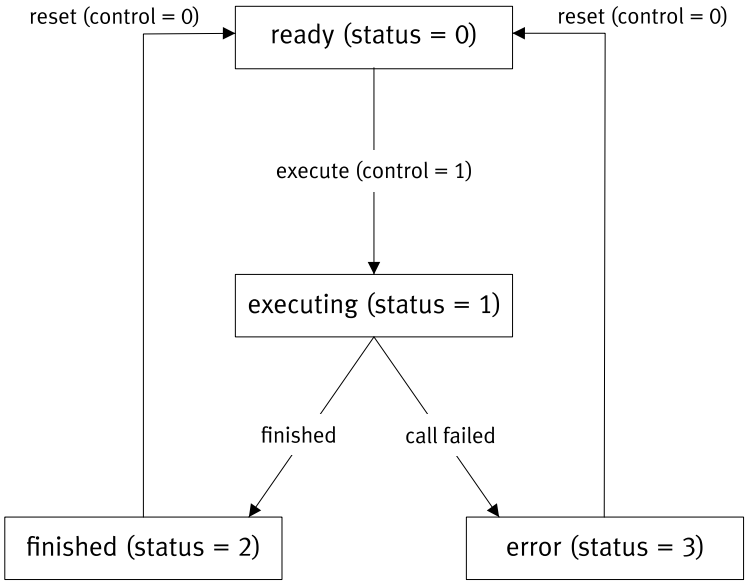


Fig. 28: Method call

The status query of a method delivers one of the following return values:
Method status:
- 0 = ready
- 1 = execute
- 2 = ended
- 3 = error

The method is called specifically for the drive profiles CiA 402 and PROFIdrive (drive profile via PROFINET, EtherNet/IP, Modbus TCP).

The query of the return code of a method delivers one of the following return values:
– 0 = successful
– 1 = error
The methods can report the following return codes.

Value	Description
0	Device access successful
1	Device access internal error
2	Device access in progress
3	Device access NOT permitted
1001	Data NOT present
1002	Data - no write access
1003	Data - no read access
1004	Data - no access rights
1005	Data - value length invalid
1006	Data - incorrect data type
1007	Data - range limits violated
2001	File system SLOT empty
2002	File system SLOT not available
2003	File system SLOT - size too small
2004	File system internal memory full
2005	File system file invalid
2006	File system firmware NOT compatible
2007	File system file transfer in progress
3001	Trace channel invalid
3002	Trace no recording available
3003	Trace data recording in progress
3004	Trace data memory index exceeded
3005	Trace data recording selection invalid
3006	Trace trigger selection invalid
3007	Trace data recording configuration invalid
3008	Trace trigger configuration invalid
3009	Trace trigger event invalid
4001	Axis selection invalid
4002	Device status invalid
5001	Exception delete failed
6001	HCI access failed
9001	Role - user invalid
9002	Role - password invalid
9003	Role - User already exists
9004	Role - maximum number of users exceeded
9005	Role - session ID invalid
9006	Role - session ID expired

Value	Description
9007	Role - maximum number of session IDs exceeded
9008	Role - Login not possible, a user is logged in

Tab. 128: Return codes

3.1.5.2 Reset device

CiA 402

Method	Object	Data type	Function	Description
Reset Device	0x2000.01	USINT	Control	Value = 1: execute method Value = 0: reset method

Tab. 129: Reset device

PROFIdrive

Method	PNU	Data type	Function	Description
Reset Device	1000	Unsigned8	Control	Value = 1: execute method Value = 0: reset method

Tab. 130: Reset device

3.1.5.3 Controller parameter set switchover

CiA 402

Method	Object	Data type	Function	Description
Controller parameter set switchover	0x2001.01	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x2001.02	USINT	Status	Status
	0x2001.03	UDINT	Transfer value	0 ... 2: controller parameter set ID
	0x2001.04	REAL	Transfer value	0 ... 100: transition time [s]
	0x2001.05	UINT	Return value	Return code

Tab. 131: Controller parameter set switchover

PROFIdrive

Method	PNU	Data type	Function	Description
Controller parameter set switchover	1002	USINT	Control	Value = 1: execute method Value = 0: reset method
	1003	USINT	Status	Status
	1004	UDINT	Transfer value	0 ... 2: controller parameter set ID
	1005	REAL	Transfer value	0 ... 100: transition time [s]
	1006	UINT	Return value	Return code

Tab. 132: Controller parameter set switchover

3.1.5.4 Save zero point offset

CiA 402

Method	Object	Data type	Function	Description
Save zero point offset	0x2002.01	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x2002.02	USINT	Status	Status
	0x2002.03	UINT	Return value	Return code

Tab. 133: Save zero point offset

PROFIdrive

Method	PNU	Data type	Function	Description
Save zero point offset	1007	USINT	Control	Value = 1: execute method Value = 0: reset method
	1008	USINT	Status	Status
	1009	UINT	Return value	Return code

Tab. 134: Save zero point offset

3.1.5.5 Request ReInit

CiA 402

Method	Object	Data type	Function	Description
Request ReInit	0x2003.01	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x2003.02	USINT	Status	Status
	0x2003.03	UINT	Return value	Return code

Tab. 135: Request ReInit

PROFIdrive

Method	PNU	Data type	Function	Description
Request ReInit	1010	USINT	Control	Value = 1: execute method Value = 0: reset method
	1011	USINT	Status	Status
	1012	UINT	Return value	Return code

Tab. 136: Request ReInit

3.1.5.6 Delete parameter set

CiA 402

Method	Object	Data type	Function	Description
Delete parameter set	0x2004.01	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x2004.02	USINT	Status	Status
	0x2004.03	UINT	Transfer value	Value = 1: parameter set 1 Value > 1: reserved
	0x2004.04	UINT	Return value	Return code
	0x2004.05	UINT	Return value	Value = 1

Tab. 137: Delete parameter set

PROFIdrive

Method	PNU	Data type	Function	Description
Delete parameter set	1013	USINT	Control	Value = 1: execute method Value = 0: reset method
	1014	USINT	Status	Status
	1015	UINT	Transfer value	Value = 1: parameter set 1 Value > 1: reserved
	1016	UINT	Return value	Return code
	1017	UINT	Return value	Value = 1

Tab. 138: Delete parameter set

3.1.5.7 Back up parameter set

CiA 402

Method	Object	Data type	Function	Description
Save parameter set	0x2005.01	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x2005.02	USINT	Status	Status
	0x2005.03	UINT	Transfer value	Value = 1: parameter set 1 Value > 1: reserved
	0x2005.04	UINT	Return value	Return code
	0x2005.05	UINT	Return value	Value = 1

Tab. 139: Back up parameter set

PROFIdrive

Method	PNU	Data type	Function	Description
Save parameter set	1018	USINT	Control	Value = 1: execute method Value = 0: reset method
	1019	USINT	Status	Status
	1020	UINT	Transfer value	Value = 1: parameter set 1 Value > 1: reserved
	1021	UINT	Return value	Return code
	1022	UINT	Return value	Value = 1

Tab. 140: Back up parameter set

3.1.5.8 Position trigger 0

CiA 402

Method	Object	Data type	Function	Description
Cam controller 0	0x2006.01	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x2006.02	USINT	Status	Status
	0x2006.03	UINT	Transfer value	Mode (Px.112700 ➔ Tab. 623 Possible modes of the position trigger function)
	0x2006.04	UINT	Transfer value	Update mode – 0 = apply immediately – 1 = apply with the next modulo overflow
	0x2006.05	UINT	Return value	Return code

Tab. 141: Position trigger 0

PROFIdrive

Method	PNU	Data type	Function	Description
Cam controller 0	1036	USINT	Control	Value = 1: execute method Value = 0: reset method
	1037	USINT	Status	Status
	1038	UINT	Transfer value	Mode (Px.112700 ➔ Tab. 623 Possible modes of the position trigger function)
	1039	UINT	Transfer value	Update mode – 0 = apply immediately – 1 = apply with the next modulo overflow
	1040	UINT	Return value	Return code

Tab. 142: Position trigger 0

3.1.5.9 Position trigger 1

CiA 402

Method	Object	Data type	Function	Description
Cam controller 1	0x2007.01	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x2007.02	USINT	Status	Status
	0x2007.03	UINT	Transfer value	Mode (Px.112700 ➔ Tab. 623 Possible modes of the position trigger function)
	0x2007.04	UINT	Transfer value	Update mode – 0 = apply immediately – 1 = apply with the next modulo overflow
	0x2007.05	UINT	Return value	Return code

Tab. 143: Position trigger 1

PROFIdrive

Method	PNU	Data type	Function	Description
Cam controller 1	1041	USINT	Control	Value = 1: execute method Value = 0: reset method
	1042	USINT	Status	Status
	1043	UINT	Transfer value	Mode (Px.112700 ➔ Tab. 623 Possible modes of the position trigger function)
	1044	UINT	Transfer value	Update mode – 0 = apply immediately – 1 = apply with the next modulo overflow
	1045	UINT	Return value	Return code

Tab. 144: Position trigger 1

3.1.5.10 Position capture (touch probe) 0

CiA 402 For information ➔ 7.2.2 CiA 402.

PROFIdrive

Method	PNU	Data type	Function	Description
Position Capture (Touch-Probe) 0	1046	USINT	Control	Value = 1: execute method Value = 0: reset method
	1047	USINT	Status	Status
	1048	UINT	Transfer value	Mode (Px.113000 ➔ Tab. 630 Possible modes of the touch probe function)
	1049	UINT	Return value	Return code

Tab. 145: Position capture (touch probe) 0

3.1.5.11 Position capture (touch probe) 1

CiA 402 For information ➔ 7.2.2 CiA 402.

PROFIdrive

Method	PNU	Data type	Function	Description
Position Capture (Touch-Probe) 1	1050	USINT	Control	Value = 1: execute method Value = 0: reset method
	1051	USINT	Status	Status
	1052	UINT	Transfer value	Mode (Px.113000 ➔ Tab. 630 Possible modes of the touch probe function)
	1053	UINT	Return value	Return code

Tab. 146: Position capture (touch probe) 1

3.1.5.12 Modulo operation

CiA 402

Method	Object	Data type	Function	Description
Modulo	0x2008.01	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x2008.02	USINT	Status	Status
	0x2008.03	UINT	Transfer value	Modulo mode – 0 = Inactive (modulo positioning switched off) – 1 = Shortest path – 2 = Shortest path with turns – 3 = Within the modulo limits – 4 = Only positive path – 5 = Only positive path with turns – 6 = Only negative path – 7 = Only negative path with turns – 8 = Set modulo position – 9 = Reset modulo position
	0x2008.04	UINT	Return value	Return code

Tab. 147: Modulo operation

PROFIdrive

Method	PNU	Data type	Function	Description
Modulo	10010	USINT	Control	Value = 1: execute method Value = 0: reset method
	10011	USINT	Status	Status
	10012	UINT	Transfer value	Modulo mode – 0 = Inactive (modulo positioning switched off) – 1 = Shortest path – 2 = Shortest path with turns – 3 = Within the modulo limits – 4 = Only positive path – 5 = Only positive path with turns – 6 = Only negative path – 7 = Only negative path with turns – 8 = Set modulo position – 9 = Reset modulo position
	10013	UINT	Return value	Return code

Tab. 148: Modulo operation

3.1.5.13 Start event table

CiA 402

Method	Object	Data type	Function	Description
Start event table	0x200B.01	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x200B.02	USINT	Status	Status
	0x200B.03	UINT	Return value	Return code

Tab. 149: Start event table

PROFIdrive

Method	PNU	Data type	Function	Description
Start event table	10014	USINT	Control	Value = 1: execute method Value = 0: reset method
	10015	USINT	Status	Status
	10016	UINT	Return value	Return code

Tab. 150: Start event table

3.1.5.14 Stop event table

CiA 402

Method	Object	Data type	Function	Description
Stop event table	0x200C.01	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x200C.02	USINT	Status	Status
	0x200C.03	UINT	Return value	Return code

Tab. 151: Stop event table

PROFIdrive

Method	PNU	Data type	Function	Description
Stop event table	10017	USINT	Control	Value = 1: execute method Value = 0: reset method
	10018	USINT	Status	Status
	10019	UINT	Return value	Return code

Tab. 152: Stop event table

3.1.5.15 Reset homing status

CiA 402

Method	Object	Data type	Function	Description
Reset homing status	0x2012.1	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x2012.2	USINT	Status	Status
	0x2012.3	UINT	Return value	Return code

Tab. 153: Reset homing status

PROFIdrive

Method	PNU	Data type	Function	Description
Reset homing status	10020	USINT	Control	Value = 1: execute method Value = 0: reset method
	10021	USINT	Status	Status
	10022	UINT	Return value	Return code

Tab. 154: Reset homing status

3.1.5.16 PNU Method Test

PROFIdrive

Method	PNU	Data type	Function	Description
PNU Method Test	1023	USINT	Control	Value = 1: execute method Value = 0: reset method
	1024	USINT	Status	Status
	1025	BOOL	Parameter 1	Transfer parameters 1

Method	PNU	Data type	Function	Description
PNU Method Test	1026	UINT	Parameter 2	Transfer parameters 2
	1027	UINT	Return value	Return code

Tab. 155: PNU Method Test

3.1.5.17 LED device identification

CiA 402

Method	Object	Data type	Function	Description
LED device identification	0x200D.1	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x200D.2	USINT	Status	Status
	0x200D.3	UINT	Transfer value	0 = Off 1 = On 2 = On (time-controlled)
	0x200D.4	UINT	Return value	Return code

Tab. 156: LED device identification

PROFIdrive

Method	PNU	Data type	Function	Description
LED device identification	1054	USINT	Control	Value = 1: execute method Value = 0: reset method
	1055	USINT	Status	Status
	1056	UINT	Transfer value	0 = Off 1 = On 2 = On (time-controlled)
	1057	UINT	Return value	Return code

Tab. 157: LED device identification

3.1.5.18 Set internal system clock

CiA 402

Method	Object	Data type	Function	Description
Set internal system clock	0x200E.1	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x200E.2	USINT	Status	Status
	0x200E.3	LINT	Time	Microsoft time base
	0x200E.4	UINT	Return value	Return code

Tab. 158: Set internal system clock

PROFIdrive

Method	PNU	Data type	Function	Description
Set internal system clock	1058	USINT	Control	Value = 1: execute method Value = 0: reset method
	1059	USINT	Status	Status
	1060	LINT	Time	Microsoft time base
	1061	UINT	Return value	Return code

Tab. 159: Set internal system clock

3.1.5.19 Activate firmware update

CiA 402

Method	Object	Data type	Function	Description
Activate firmware update	0x2011.1	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x2011.2	LINT	Status	Status
	0x2011.3	UINT	Slot	Value = 0: firmware 0 Value > 0: reserved
	0x2011.4	UINT	Return value	Return code
	0x2011.5	UINT	Slot	–

Tab. 160: Activate firmware update

PROFIdrive

Method	PNU	Data type	Function	Description
Activate firmware update	1068	USINT	Control	Value = 1: execute method Value = 0: reset method
	1069	USINT	Status	Status
	1070	UINT	Slot	Value = 0: firmware 0 Value > 0: reserved
	1071	UINT	Return value	Return code
	1072	UINT	Slot	–

Tab. 161: Activate firmware update

3.1.5.20 Activation of factory parameter set

CiA 402

Method	Object	Data type	Function	Description
Activation of factory parameter set	0x2013.1	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x2013.2	USINT	Status	Status
	0x2013.3	UINT	Return value	Return code

Tab. 162: Activation of factory parameter set

PROFIdrive

Method	PNU	Data type	Function	Description
Activation of factory parameter set	1073	USINT	Control	Value = 1: execute method Value = 0: reset method
	1074	USINT	Status	Status
	1075	UINT	Return value	Return code

Tab. 163: Activation of factory parameter set

3.1.5.21 Start data recording

CiA 402

Method	Object	Data type	Function	Description
Start data recording	0x200F.1	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x200F.2	USINT	Status	Status
	0x200F.3	UINT	Return value	Return code

Tab. 164: Start data recording

PROFIdrive

Method	PNU	Data type	Function	Description
Start data recording	1062	USINT	Control	Value = 1: execute method Value = 0: reset method
	1063	USINT	Status	Status
	1064	UINT	Return value	Return code

Tab. 165: Start data recording

3.1.5.22 Stop data recording

CiA 402

Method	Object	Data type	Function	Description
Stop data recording	0x2010.1	USINT	Control	Value = 1: execute method Value = 0: reset method
	0x2010.2	USINT	Status	Status
	0x2010.3	UINT	Return value	Return code

Tab. 166: Stop data recording

PROFIdrive

Method	PNU	Data type	Function	Description
Stop data recording	1065	USINT	Control	Value = 1: execute method Value = 0: reset method
	1066	USINT	Status	Status
	1067	UINT	Return value	Return code

Tab. 167: Stop data recording

3.2 Fundamentals of parameterisation

3.2.1 View of the parameters

Structure of the parameter IDs

All parameter IDs consist of the following 5 components for unique identification of the parameters:

P	System/ axis	Number	Instance	Index
.	.	.	.	[5] ➔ Identifier for distinguishing similar parameters within an instance, e.g. record number: 0 = record 1 1 = record 2 2 = record 3
.	.	.	.	
.	.	.	.	
.	.	.	.	
.	.	.	.	
.	.	.	[4] ➔ Identifier for distinguishing similar parameters of several components, e.g.: 0 = encoder 1 1 = encoder 2	
.	.	.		
.	.	.		
.	.	.		
.	.	[3] ➔ ID number of the parameter		
.	.			
.	[2] ➔ Identification of system or axis parameters: 0 = system x = number of the related axis (1 = axis 1, 2 = axis 2, ...)			
.				
.				
[1] ➔ Identification P = parameter				

Tab. 168: Parameter ID Px....

Parameter ID					Description
[1]	[2]	[3]	[4]	[5]	**System parameters "Encoder resolution"**
P	0.	10040.	0.	0	Encoder resolution for instance = 0 ➔ encoder 1

Tab. 169: Example of parameter ID encoder resolution

Parameter ID					Description
[1]	[2]	[3]	[4]	[5]	**"Record number" axis parameters**
P	1.	1811.	0.	0	Data record for axis 1 Index = 0 ➔ record number of the first internal data record
P	1.	1811.	0.	2	Data record for axis 1 Index = 2 ➔ record number of the third internal data record

Tab. 170: Example of parameter ID record number

Functional description in parameter tables

The description of the parameters included in the scope of functions is provided via parameter tables with the following structure:

ID Px.	Parameter	Description		
8416 [1]	Axis zero point offset [2]	Specifies the offset of the axis zero point to the reference mark.		[3]
		Access	read/write	[4]
		Update	effective immediately	[5]
		Unit	user defined	[6]

Tab. 171: Sample representation using the example of axis parameter ID Px.8416

No.	Description
[1]	Number of the system or axis parameter
[2]	Name of the system or axis parameter
[3]	Brief description of the parameter, optional: additional information on the parameter, e.g. value list for instance/index of the parameter ID
[4]	Optional access to the parameter: – Access: read The parameter setting can be evaluated. – Access: read/write The parameter setting can be evaluated and changed.
[5]	Measure for updating the function when the parameter is changed – Update: effective immediately Modification of the parameter takes effect immediately, without <Reinitialize> or <Restart device>. – Update: re-initialisation Changing the parameter takes effect after a <Reinitialize>. – Update: restart Changing the parameter takes effect after a <Restart device>.
[6]	Information on the unit of measurement of the parameter: – Unit: — The parameter has no unit of measurement. – Unit: user-defined The parameter has a configurable measuring unit. Typical for position, velocity, acceleration or jerk motion variables corresponding to the parameterisation (➔ Px.1150.0.0, Actual user unit). – Unit: Nm, kg, s … The measurement unit of the parameter cannot be configured and is displayed explicitly

Tab. 172: Explanation of the sample display

3.2.2 Data types

Data types used and their value ranges:

Data type PN/EP/EC	Data type plug-in	Variable and sign	Value range
BOOL	BOOL	8-bit without sign	0 … 255
USINT	UINT8	8-bit without sign	0 … 255
SINT	SINT8	8-bit with sign	–128 … 127
UINT	UINT16	16-bit without sign	0 … 65535
INT	SINT16	16-bit with sign	–32768 … 32767
UDINT	UINT32	32-bit without sign	0 … $(2^{32}-1)$
DINT	SINT32	32-bit with sign	-2^{31} … $(2^{31}-1)$
ULINT	UINT64	64-bit without sign	0 … $(2^{64}-1)$
LINT	SINT64	64-bit with sign	-2^{63} … $(2^{63}-1)$
REAL	FLOAT32	32-bit with floating decimal	$1.17 * 10^{-38}$ … $3.4 * 10^{38}$
LREAL	FLOAT64	64-bit with floating decimal	$2.2 * 10^{-308}$ … $1.8 * 10^{308}$
STRING(X)	CHAR	X * 8-bit without sign	X * 0 … 255

Tab. 173: Data types

3.2.3 View of the objects specific to the device profile

The function descriptions in the profile-specific section contain tables in which the profile-specific objects or parameters assigned to the relevant parameters are listed.

Structure of the CiA 402 object tables

The function descriptions in the device-specific section contain tables in which objects allocated to the parameters involved are listed.
The CiA 402 object tables are structured as follows in the descriptions of the individual functions:

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.** [1]		
468	0x6068.00	Damping time target reached	UINT
469	0x6067.00	Monitoring window target position	UDINT
4610	0x606D.00	Monitoring window target velocity	UINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.** [2]		
468	0x2166.09	Damping time target reached	REAL
469	0x2166.0A	Monitoring window target position	REAL
4610	0x2166.0B	Monitoring window target velocity	REAL
4611	0x2166.0C	Monitoring window target torque	REAL
[3]	[4]	[5]	[6]

Tab. 174: Example of object table

Cell	Content/description
[1]	Range for CiA 402 objects: only the parameters that are allocated to an object of the standardised device profile for drives and motion controls
[2]	Range for manufacturer-specific objects: all parameters are allocated to an object in the manufacturer-specific range
[3]	Parameter number
[4]	Allocated index and sub-index (hexadecimal)
[5]	Name of the parameter
[6]	Data type of the object; may differ from the data type of the parameter

Tab. 175: Legend for the example of object table

Structure of the PNU parameter tables

The PNU parameter tables are structured as follows in the descriptions of the individual functions:

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters** [1]		
11280606	36.0	Acceleration MDI	INT
11280607	37.0	Deceleration MDI	INT
11280604	34.0	Target position MDI	DINT
11280605	35.0	Profile velocity MDI	UDINT
Px.	**Manufacturer-specific parameters** [2]		
11280606	12341.0	Acceleration MDI	REAL
11280607	12342.0	Deceleration MDI	REAL
11280604	12339.0	Target position MDI	LINT
11280605	12340.0	Profile velocity MDI	REAL
...	...	...	...
[3]	[4]	[5]	[6]

Tab. 176: Examples of PNUs

Cell	Content/description
[1]	Range for profile-specific PNUs: only the parameters that are allocated to PNUs of the PROFIdrive device profile.
[2]	Range for manufacturer-specific PNUs: parameters are allocated to the PNUs from the manufacturer-specific range.
[3]	Parameter number
[4]	Assigned PNU (decimal)
[5]	Name of the parameter
[6]	Data type of the PNU; can differ from the data type of the parameter

Tab. 177: Legend for the PNU table example

3.2.4 Measuring units

3.2.4.1 Defined measuring units

Basic units are defined measuring units in the servo drive that typically characterise physical properties. These units cannot be changed by the user.

Size		Basic unit		Data type
Temperature	T	Degrees Celsius	°C	FLOAT32
Current	I	Ampere	A	FLOAT32
Voltage	r	Volt	V	FLOAT32
Energy	E	Joule/Watt second	J/Ws	FLOAT32
Torque	M	Newton-metre	Nm	FLOAT32
Resistance (electrical)	R	Ohm	Ω	FLOAT32
Inductance	L	Henry	H	FLOAT32
Capacity (electrical)	C	Farad	F	FLOAT32
Power	P	Watt	W	FLOAT32
Time	t	Second	s	FLOAT32
Value specification in percent	%	—	—	FLOAT32

Tab. 178: Basic units

3.2.4.2 Configurable measuring units ("user unit")

Configurable units adapted to the respective application by the user are typically required for motion variables. They generally refer to the output-side motion variables. The user units can be only be converted in the "pre-operational" state and the conversion requires re-initialisation of the servo drive. As a result, all the

relevant parameters in the servo drive are converted to the new user unit. The controller parameters do require recalculation during a conversion of the units. The configured user unit also applies for the drive profile. A conversion of the measuring unit using the drive profile also converts the unit of the entire device.

Measuring units (position)		Decimal places	Data type
Increments	incr	0	SINT64
Metre	m	10	SINT64
Imperial	in	8	SINT64
Revolution	r	9	SINT64
Radian	rad	8	SINT64
Degree	°	6	SINT64

Tab. 179: Configurable measuring units of the position

All measuring units for the position are shown and preset with the SINT64 data type. The position is shown with a different number of decimal places in every measuring unit.

Examples for showing of positions

– 0.001 m x 10^{10} ≙ 1 x 10^{7}
– 1 degree x 10^{6} ≙ 1 x 10^{6}

To simplify the entry for the user, the plug-in performs the necessary conversion in the Festo commissioning software. When the plug-in is in use, the units shown there and/or the resolution must be used for the input of the relevant parameters.
Using the drive profile, the resolutions set there always apply.

All position differences and derivations from the position are displayed as FLOAT32 values in the device. As a result, a resolution (decimal place) does not have to be taken into consideration.

Variables/measuring units	Position difference	Speed	Acceleration	Jerk	Data type
Increments	incr	incr/s	incr/s²	incr/s³	FLOAT32
Metre	m	m/s	m/s²	m/s³	FLOAT32
Imperial	in	in/s	in/s²	in/s³	FLOAT32
Revolution	r	r/s	r/s²	r/s³	FLOAT32
Revolution [1)]	r	r/min	r/min/s	r/min/s²	FLOAT32
Radian	rad	rad/s	rad/s²	rad/s³	FLOAT32
Degree	°	°/s	°/s²	°/s³	FLOAT32

1) Default

Tab. 180: Configurable measuring units of the position difference and derived variables of the position

In user parameter sets, parameters are always saved in the unit set by the user. When a user unit is set, the derived variable obtains the same length reference (m, m/s, m/s², etc.).

Parameters for the configurable measuring units

ID Px.	Parameter	Description	
1150	Actual user unit	Specifies the active user unit.	
		Access	read/–
		Update	effective immediately

ID Px.	Parameter	Description	
1150	Actual user unit	Unit	–
1151	Selection of next user unit	Selection of the next user unit that is active after reinitialization. – 0: Internal increments [Inci, Inci/s, ...] – 1: Increments [Inc, Inc/s, ...] – 2: Rev [r, r/s, ...] – 3: Rev [r, r/min, ...] – 4: Rad [rad, rad/s, ...] – 5: Degree [°, °/s, ...] – 6: Metric [m, m/s, ...] – 7: Imperial [in, in/s, ...]	
		Access	read/write
		Update	reinitialization
		Unit	–
1152	User unit status	Specifies whether the user unit is active	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 181: Parameter

CiA 402

Objects for the configurable measuring units

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1150	0x217C.01	Actual user unit	UDINT
1151	0x217C.02	Selection of next user unit	UDINT
1152	0x217C.03	User unit status	UDINT

Tab. 182: Objects

PROFIdrive

PNUs for the configurable measuring units

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1150	11277.0	Actual user unit	UDINT
1151	11278.0	Selection of next user unit	UDINT
1152	11279.0	User unit status	UDINT

Tab. 183: PNUs

3.2.4.3 Scaling of internal units for fieldbus ("Factor group")

The "factor group" and user unit are directly Factor groupinterdependent. If the unit in the "Factor group" is changed, the user unit also changes and vice versa. The prefix in the "Factor group" used for scaling has no influence on the internal display of the parameters in the servo drive. The units are scaled to user units in accordance with the CiA 402 specification ("Factor group"). Scalability is limited to the power of 10.
Different user units cannot be set for position, velocity, acceleration and jerk. When the user unit is changed, the derivations are changed as well.

CiA 402 increments

When CiA 402 increments are used, values can be specified entirely in CiA increments as an alternative to the user units described above.

The units can also be scaled as motor-side CiA 402 increments, regardless of the specified user unit. The units are converted accordingly on access via the bus interface.
Parameters Px.7864 and Px.7866 are effective after a reinit based on the corresponding parameters Px.7865 and Px.7867.
The values for the position of the SI unit (0x60A8), the speed of the SI unit (0x60A9), the acceleration/deceleration of the SI unit (0x60AA) and the jerk of the SI unit (0x60AB) are adjusted accordingly.
The SI numerator for the CiA 402 increments is 0xC5 ➔ Object 0x60A8 SI unit position CiA402, etc.

Parameters for the internal units for the fieldbus

ID Px.	Parameter	Description	
7841	Resolution position	Specifies the resolution of the position. The value is interpreted as ten-expont e.g. with meter and -6 the resolution is 1 µm.	
		Access	read/write
		Update	reinitialization
		Unit	–
7842	Resolution velocity	Specifies the resolution of the velocity. The value is interpreted as ten-expont e.g. with meter and -3 the resolution is 1 mm/s.	
		Access	read/write
		Update	reinitialization
		Unit	–
7843	Resolution acceleration	Specifies the resolution of the acceleration. The value is interpreted as ten-expont e.g. with meter and -3 the resolution is 1 mm/s².	
		Access	read/write
		Update	reinitialization
		Unit	–
7844	Resolution jerk	Specifies the resolution of the jerk. The value is interpreted as ten-expont e.g. with meter and -3 the resolution is 1 mm/s³.	
		Access	read/write
		Update	reinitialization
		Unit	–
7851	User unit position	Specifies the user unit of the position.	
		Access	read/write
		Update	effective immediately
		Unit	–
7852	User unit velocity	Specifies the user unit of the velocity.	
		Access	read/write
		Update	effective immediately
		Unit	–
7853	User unit acceleration	Specifies the user unit of the acceleration.	
		Access	read/write
		Update	effective immediately
		Unit	–
7854	User unit jerk	Specifies the user unit of the jerk.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
7864	Actual increments per revolution	Displays the active increments per revolution.	
		Access	read/–
		Update	effective immediately
		Unit	–
7865	Selection of next increments per revolution	Selection of the next increments per revolution. Values 2^x, x ≤ 12 and ≥ 30	
		Access	read/write
		Update	reinitialization
		Unit	–
7866	Actual status Activation increments per revolution	Displays the actual status Activation increments per revolution. Value list: 0: inactive 1: active	
		Access	read/–
		Update	effective immediately
		Unit	–
7867	Selection of activation of increments per revolution	Selection for activation Increments per revolution	
		Access	read/write
		Update	reinitialization
		Unit	–

Tab. 184: Parameter

CiA 402

Objects for the scaling of internal units for fieldbus

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
7860	0x60A8.00	SI unit position CiA402	UDINT
7861	0x60A9.00	SI unit and velocity CiA402	UDINT
7862	0x60AA.00	SI unit acceleration CiA402	UDINT
7863	0x60AB.00	SI unit and jerk CiA402	UDINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
7841	0x2194.01	Resolution position	SINT
7842	0x2194.02	Resolution velocity	SINT
7843	0x2194.03	Resolution acceleration	SINT
7844	0x2194.04	Resolution jerk	SINT
7851	0x216E.01	User unit position	UINT
7852	0x216E.02	User unit velocity	UINT
7853	0x216E.03	User unit acceleration	UINT
7854	0x216E.04	User unit jerk	UINT
7860	0x216E.05	SI unit position CiA402	UDINT
7861	0x216E.06	SI unit and velocity CiA402	UDINT
7862	0x216E.07	SI unit acceleration CiA402	UDINT
7863	0x216E.08	SI unit and jerk CiA402	UDINT
7864	0x216E.09	Actual increments per revolution	UDINT
7865	0x216E.0A	Selection of the next increments per revolution.	UDINT

Parameter	Index.Subindex	Name	Data type
7866	0x216E.0B	Actual status Activation increments per revolution	USINT
7867	0x216E.0C	Selection of activation of increments per revolution	USINT

Tab. 185: Objects

Object 0x60A8 SI unit position CiA402

This object is used to specify the position user unit and the exponent of ten for all objects with the position unit.
The structure of this 32-bit object:

Prefix		SI numerator		SI denominator		Profile-specific	
31	24	23	16	15	8	7	0
MSB							LSB

Tab. 186: Bit allocation of the object 0x60A8

The following values are possible for these units:

Prefix	Multiplier
0xF7 (-9)	10^{-9}
...	...
0xFD (-3)	10^{-3}, default at rpm
...	...
0x09 (9)	10^{9}

Tab. 187: Prefix

SI numerator	Unit	default prefix	Unit
0x01	m (metre)	0xFA, (-6), 10^{-6}	µm
0x10	rad (radian)	0xFD, (-3), 10^{-3}	mrad
0x41	° (degree)	0xFD, (-3), 10^{-3}	m°
0xB4	rev (revolution (rps))	0xFD, (-3), 10^{-3}	mU
0xB5	inc (increments)	0x00, (0), 10^{0}	inc
0xC0	" (inch)	0xFA, (-6), 10^{-6}	inch
0xC3	inci (increments internal)	0x00, (0), 10^{0}	inci
0xC4	rpm (revolution (rpm)), default	0xFD, (-3), 10^{-3}	mU
0xC5	CiA402 increments	2^{x}, x ≤ 12 and ≥ 30	inc ➔ CiA 402 increments

Tab. 188: SI numerator

SI denominator	Unit
0x00	none (dimensionless), default

Tab. 189: SI denominator

Object 0x60A9 SI unit and velocity CiA402

This object is used to specify the user unit velocity and the exponent of ten for all objects with the velocity unit.
The structure of this 32-bit object:

Prefix		SI numerator		SI denominator		Profile-specific	
31	24	23	16	15	8	7	0
MSB							LSB

Tab. 190: Bit allocation of the object 0x60A9

The following values are possible for these units:

Prefix	Multiplier
0xF7 (-9)	10^{-9}
...	...
0x00 (0)	10^{0}, default at rpm
...	...
0x09 (9)	10^{9}

Tab. 191: Prefix

SI numerator	Unit	default prefix	Unit
0x01	m (metre)	0xFD, (-3), 10^{-3}	mm/s
0x10	rad (radian)	0x00, (0), 10^{0}	rad/s
0x41	° (degree)	0x00, (0), 10^{0}	°/s
0xB4	rev (revolution (rps))	0x00, (0), 10^{0}	rev/s
0xB5	inc (increments)	0x03, (3), 10^{3}	kinc/s
0xC0	" (inch)	0xFD, (-3), 10^{-3}	minch/s
0xC3	inci (increments internal)	0x03, (3), 10^{3}	kinci/s
0xC4	rpm (revolution (rpm)), default	0x00, (0), 10^{0}	rpm
0xC5	CiA402 unit increments	2^{x}, x ≤ 12 and ≥ 30	inc/s ➔ CiA 402 increments

Tab. 192: SI numerator

SI denominator	Unit
0x03	s (second)
0x47	min (minute), default

Tab. 193: SI denominator

Object 0x60AA SI unit acceleration CiA402

This object is used to specify the acceleration user unit and the exponent of ten for all objects with the acceleration unit.
The structure of this 32-bit object:

Prefix		SI numerator		SI denominator		Profile-specific	
31	24	23	16	15	8	7	0
MSB							LSB

Tab. 194: Bit allocation of the object 0x60AA

The following values are possible for these units:

Prefix	Multiplier
0xF7 (-9)	10^{-9}
...	...
0x00 (0)	10^{0}, default at rpm
...	...
0x09 (9)	10^{9}

Tab. 195: Prefix

SI numerator	Unit	default prefix	Unit
0x01	m (metre)	0x00, (0), 10^{0}	m/s2
0x10	rad (radian)	0x03, (3), 10^{3}	krad/s2
0x41	° (degree)	0x03, (3), 10^{3}	k°/s2
0xB4	rev (revolution (rps))	0x00, (0), 10^{0}	rev/s2

SI numerator	Unit	default prefix	Unit
0xB5	inc (increments)	0x06, (6), 10^6	Minc/s2
0xC0	" (inch)	0x00, (0), 10^0	inch/s2
0xC3	inci (increments internal)	0x06, (6), 10^6	Minci/s2
0xC4	rpm (revolution (rpm)), default	0x00, (0), 10^0	rpm/s
0xC5	CiA402 unit increments	2^x, x ≤ 12 and ≥ 30	inc/s^2 ➔ CiA 402 increments

Tab. 196: SI numerator

SI denominator	Unit
0x57	s^2 (square second)
0xC1	(rpm)(rps) (per minute per second), default

Tab. 197: SI denominator

Object 0x60AB SI unit and jerk CiA402

This object specifies the user unit jerk and the exponent of ten for all objects with the unit jerk.
The structure of this 32-bit object:

Prefix		SI numerator		SI denominator		Profile-specific	
31	24	23	16	15	8	7	0
MSB							LSB

Tab. 198: Bit allocation of the object 0x60AB

The following values are possible for these units:

Prefix	Multiplier
0xF7 (-9)	10^{-9}
...	...
0x03 (3)	10^3, default at rpm
...	...
0x09 (9)	10^9

Tab. 199: Prefix

SI numerator	Unit	default prefix	Unit
0x01	m (metre)	0x03, (3), 10^3	km/s^3
0x10	rad (radian)	0x06, (6), 10^6	Mrad/s^3
0x41	° (degree)	0x06, (6), 10^6	M°/s^3
0xB4	rev (revolution (rps))	0x03, (3), 10^3	kU/s^3
0xB5	inc (increments)	0x09, (9), 10^9	Ginc/s^3
0xC0	" (inch)	0x03, (3), 10^3	kinch/s^3
0xC3	inci (increments internal)	0x09, (9), 10^9	Ginci/s^3
0xC4	rpm (revolution (rpm)), default	0x03, (3), 10^3	kU/min/s^2
0xC5	CiA402 unit increments	2^x, x ≤ 12 and ≥ 30	inc/s^3 ➔ CiA 402 increments

Tab. 200: SI numerator

SI denominator	Unit
0xA0	s^3 (cubic second)
0xC2	(rpm)(1/s^2) (per minute per square second), default

Tab. 201: SI denominator

Unit coding for user units CiA 402 (Px.7851 ... Px.7854)

User unit	Values lists
Position	256: SI Unit METER 4096: SI Unit RAD 16640: SI Unit DEGREE 46080: SI Unit ROUND (rps) 46336: SI Unit INC 49152: SI Unit INCH 49920: SI Unit INCI 50176: SI Unit ROUND (rpm)
Speed	259: SI Unit METER 1/s 4099: SI Unit RAD 1/s 16643: SI Unit DEGREE 1/s 46083: SI Unit ROUND (rps) 1/s 46339: SI Unit INC 1/s 49155: SI Unit INCH 1/s 49923: SI Unit INCI 1/s 50247: SI Unit ROUND (rpm) 1/min
Acceleration	343: SI Unit METER 1/s^2 4183: SI Unit RAD 1/s^2 16727: SI Unit DEGREE 1/s^2 46167: SI Unit ROUND (rps) 1/s^2 46423: SI Unit INC 1/s^2 49239: SI Unit INCH 1/s^2 50007: SI Unit INCI 1/s^2 50369: SI Unit ROUND (rpm) 1/(min*s)
Jerk	416: SI Unit METER 1/s^3 4256: SI Unit RAD 1/s^3 16800: SI Unit DEGREE 1/s^3 46240: SI Unit ROUND (rps) 1/s^3 46496: SI Unit INC 1/s^3 49312: SI Unit INCH 1/s^3 50080:SI Unit INCI 1/s^3 50370: SI Unit ROUND (rpm) 1/(min*s^2)

Tab. 202: Unit coding values list

Example

The device is parameterised for "revolutions" and "revolutions per minute". This setting shall also be used through the device profile.

The following shall be parameterised:

– position increment 0.00001 rev = 10 µrev
– velocity increment 1 rpm
– acceleration increment 1 m/s^2
– jerk increment 1 m/(min*s^2)

Setting factor group parameters (example)		
Parameters	Value	Comment
Resolution position		
P1.7841.0.0	-5	Resolution 10^{-5}
Resolution velocity		
P1.7842.0.0	0	Resolution 10^{-0}
Resolution acceleration		
1.7843.0.0	0	Resolution 10^{-0}

Setting factor group parameters (example)		
Parameters	Value	Comment
Resolution jerk		
1.7843.0.0	0	Resolution 10^{-0}

Tab. 203: Setting the parameters of the factor group (example)

In CODESYS the increments must be set to 100000 so the module writes the position in the correct resolution.

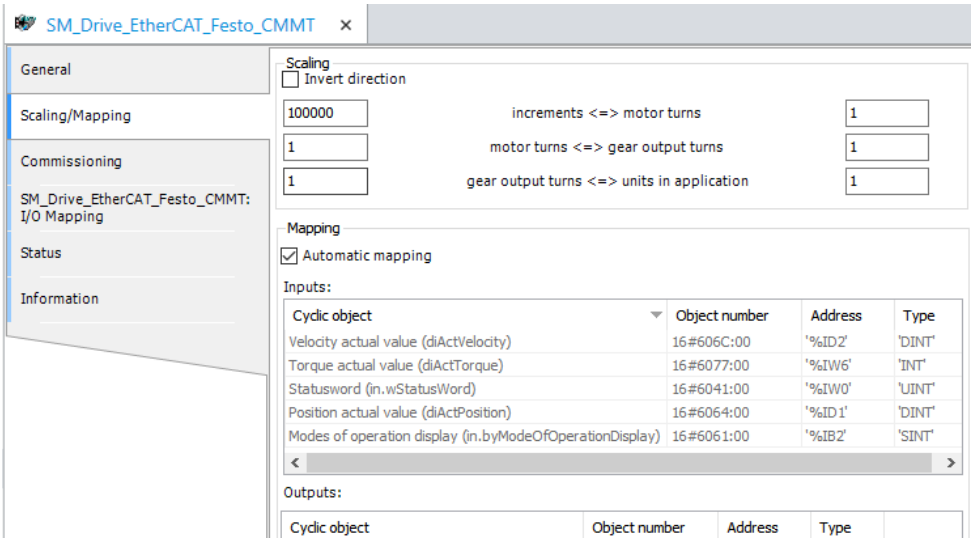


Fig. 29: Example of the user unit for revolutions

Example

The device is parameterised to "metre". This setting shall also be used through the device profile.

The following shall be parameterised:

- Position increment 0.000001 m = 1 µm
- velocity 0.001 m/s = 1 mm/s
- acceleration 0.001 m/s² = 1 mm/s²
- jerk 0.001 m/s³ = 1 mm/s³

Setting the parameters of the factor group (example)		
Parameters	Value	Comment
Resolution position		
P1.7841.0.0	-6	Resolution 10^{-6}
Resolution velocity		
P1.7842.0.0	-3	Resolution 10^{-3}
Resolution acceleration		
1.7843.0.0	-3	Resolution 10^{-3}
Resolution jerk		
1.7843.0.0	-3	Resolution 10^{-3}

Tab. 204: Setting the parameters of the factor group (example)

In CODESYS the “Increments” field must be set to 1000000 so the module writes the position in the correct resolution.

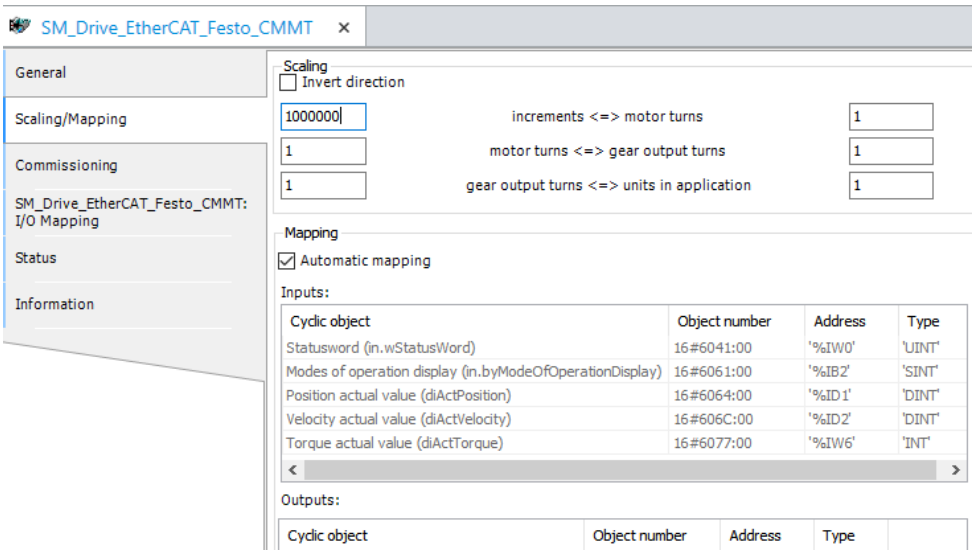


Fig. 30: Example of the user unit for metres

PROFIdrive

PNUs for the scaling of internal units for fieldbus

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
7841	11724.0	Resolution position	SINT
7842	11725.0	Resolution velocity	SINT
7843	11726.0	Resolution acceleration	SINT
7844	11727.0	Resolution jerk	SINT
7864	13016.0	Actual increments per revolution	UDINT
7865	13017.0	Selection of the next increments per revolution.	UDINT
7866	13018.0	Actual status Activation increments per revolution	BOOL
7867	13019.0	Selection of activation of increments per revolution	BOOL

Tab. 205: PNUs

3.2.5 Dimension reference system

3.2.5.1 Function

The correct positioning of the drive requires a defined dimension reference system. To define the dimension reference system, the following steps must be taken during initial commissioning:

- Defining the axis zero point
- Limitation of the usable range by software end positions and/or limit switches
- Determine the reference point with a homing run and move the factory-set zero point of the absolute encoder

Signs and directions in the measuring reference system



Fig. 31: Positive direction of rotation

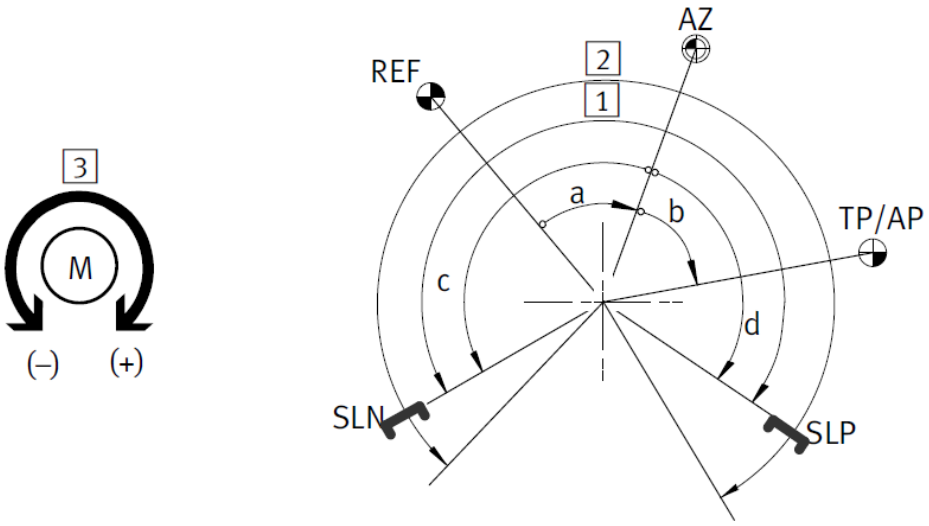
The indication of the signs or directions refer to the view towards the front face of the motor drive shaft. The signs of all directional variables are defined at the factory as follows:

- Positive (+) = direction of motion with clockwise direction of rotation of the motor shaft
- Negative (–) = direction of motion with anticlockwise direction of rotation of the motor shaft

The direction of motion of the load, for example, depends on the spindle type of the axis (clockwise/anticlockwise) and on the gear unit employed. If angular or toothed belt gear units are used, the opposite allocation of the direction of rotation can be advantageous and parameterised accordingly.

Rotational dimension reference system

Example: rotary drive



REF	Reference point (Reference Point)
AZ	Axis zero point (Axis Zero Point)
SLN	Software end position negative (SW Limit Negative)
SLP	Software end position positive (SW Limit Positive)
TP	Target position (Target Position)
AP	Actual position/current position (Actual Position)
a	Axis zero point offset (AZ)
b	Target/actual position (TP/AP)
c	Optional: negative software end position (SLN)[1)]
d	Optional: software end position positive (SLP)[1)]
1	Usable range
2	Working section
3	Direction of rotation with factory setting, looking at the face of the motor shaft

1) An end position cannot be parameterised for rotating axes with the “unlimited” configuration.

Tab. 206: Rotational dimension reference system (positive direction of rotation)

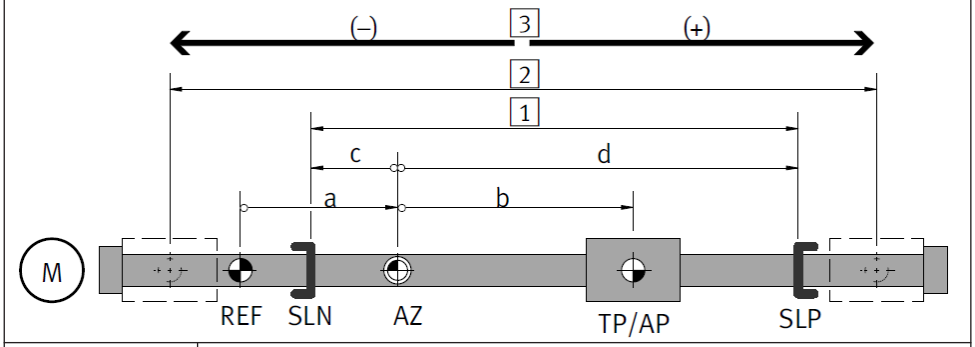
Reference point	Calculation rule		
Axis zero point	AZ	= REF + a	
Software end position negative	SLN	= AZ + c	= REF + a + c
Software end position positive	SLP	= AZ + d	= REF + a + d
Target position/actual position	TP/AP	= AZ + b	

Tab. 207: Rotational dimension reference system – calculation rules

The various positions are specified according to the configured user unit. The variables are converted automatically on conversion of the user unit.

Linear measuring reference system

Example: linear drive



REF	Reference point (Reference Point)
AZ	Axis zero point (Axis Zero Point)
SLN	Software end position negative (SW Limit Negative)
SLP	Software end position positive (SW Limit Positive)
TP	Target position (Target Position)
AP	Actual position/current position (Actual Position)
a	Axis zero point offset (AZ)
b	Target/actual position (TP/AP)
c	Software end position negative (SLN)
d	Software end position positive (SLP)
1	Usable range (Usable stroke)
2	Working section (Working Stroke)
3	Direction of movement with the factory setting

Tab. 208: Linear dimension reference system

Reference point	Calculation rule		
Axis zero point	AZ	= REF + a	
Software end position negative	SLN	= AZ + c	= REF + a + c
Software end position positive	SLP	= AZ + d	= REF + a + d
Target position/actual position	TP/AP	= AZ + b	= REF + a + b

Tab. 209: Linear dimension reference system – calculation rules

The various positions are specified according to the configured user unit. The variables are converted automatically on conversion of the user unit ➔ 3.2.4 Measuring units.

Limitation of the usable range

The usable range can be limited by software end positions and hardware limit switches.

Software end position SLN/SLP

The delimitation of a usable range within the working section involves the parameterisation of software end positions. The position is specified relative to the axis zero point AZ.
The controller checks whether the target position of the command record lies between the software end positions SLN/SLP.

Before the software end position is reached, the drive is decelerated according to the error response, so that, if possible, the software end position is not passed. After stopping, the positioning direction is blocked.
If the controller is not released or is not referenced, software end positions are not monitored. If the drive is moved manually behind a software end position, it can only move toward the usable range after release of the controller. If the target of the next positioning motion is beyond the software end position, an error is returned. If the target is in the permitted range, it is possible to move out of the software end position without error.

More information ➔ 5.6 Software end position reached.

Hardware limit switch HLP/HLN

Limit switches limit the absolute usable range of the drive. The switching functions “N/C contact” or “N/O contact” can be parameterised depending on the limit switch type. The reaction of the device to limit switch signals can be parameterised with the error management function.
The drive is blocked in the positioning direction of the active limit switch. As soon as the limit switch is active, motion is possible only in the reverse direction after acknowledgment of the error.

More information ➔ 5.5 Hardware limit switch reached.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
1170	Reversing direction of motion	Specifies whether the reversal of the direction of motion shall be activated. This means: – 0: inactive – 1: active	
		Access	read/write
		Update	reinitialization
		Unit	–
1171	Invert encoder signal	Specifies whether the encoder signal shall be inverted. This means: – 0: inactive (do not invert the encoder signal) – 1: active (invert the encoder signal) One encoder is allocated to every index ➔ Tab. 264 Index to the invert encoder signal parameter (Px.1171)	
		Access	read/write
		Update	reinitialization
		Unit	–
1172	Phase rotation	Specifies whether the sequence of phases is swapped. The usual phase sequence for the servomotor to turn clockwise is ascending (U, V, W). If the servomotor has the phase sequence U, W, V, the phase sequence is reversed. 0 for the phase sequence U, V, W and 1 for the phase sequence U, W, V. For a stepper motor, the phase sequence for 0 is the assignment A-#A and B-#B. For the phase sequence equal to 1, the assignment A-#A and #B-B is. Changing the phase sequence changes the rotating field of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	–

Tab. 210: Parameters

Diagnostic messages

No specific diagnostic messages are allocated to the function.

3.2.5.2 CiA 402

Objects for the measuring reference system

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
1170	0x607E.00	Reversing direction of motion	USINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1170	0x217D.01	Reversing direction of motion	USINT
1171	0x226E.01 ... 03	Invert encoder signal	USINT
1172	0x217D.02	Phase rotation	USINT

Tab. 211: Objects

3.2.5.3 PROFIdrive

PNUs for the measuring reference system

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1170	11287.0	Reversing direction of motion	BOOL
1171	11288.0 ... 2	Invert encoder signal	BOOL
1172	11289.0	Phase rotation	BOOL

Tab. 212: PNUs

3.3 Drive configuration

3.3.1 Motor configuration

3.3.1.1 Function

The device supports Festo motors and the use of motors from other manufacturers (third-party motors). Information on the installed motor must be provided to the device during configuration of the drive system. The following options are available for configuration:

Configuration options	Description
Readout of motor data from the motor encoder	The motor data for certain Festo motors are stored in the EEPROM of the integrated encoder. If a corresponding Festo motor is used, the motor data can be read out using the plug-in and applied to the current project.
Configuring motor data	All required information on the motor can be configured with the plug-in or transferred to the device via the device profile. In the case of third-party motors, the required information must be taken from the datasheet of the motor. In the case of Festo motors, the information is saved in the database of the current plug-in and automatically applied to the project during configuration with the plug-in.

Tab. 213: Motor configuration options

For the configuration of the motor, parameters with the following motor data are present in the device:

- Active motor data (currently effective motor data, ➔ 3.3.1.8 Active motor data parameters
- Motor data from the EEPROM of the encoder (if present ➔ 3.3.1.5 Parameter and diagnostic messages for motor data from the EEPROM memory)
- Motor data from the user configuration (imported from the database or transferred manually, ➔ 3.3.1.2 Parameters and diagnostic messages for motor data from the user configuration)

Incorrect motor data can damage the motor!
- Check data before import.
- Re-initialise device for import.

The motor data are generally not imported until after re-initialisation.

Transfer of motor data and encoder data

With Px.14 the sources of the 'Actual commutation angle' (Px. 3220) and 'Actual commutation angle valid' parameters (Px.3230) can be switched between encoder memory and user configuration.

The response described below applies from firmware version ≥ V37.1.

The following diagram shows the sources of active motor data and encoder data.

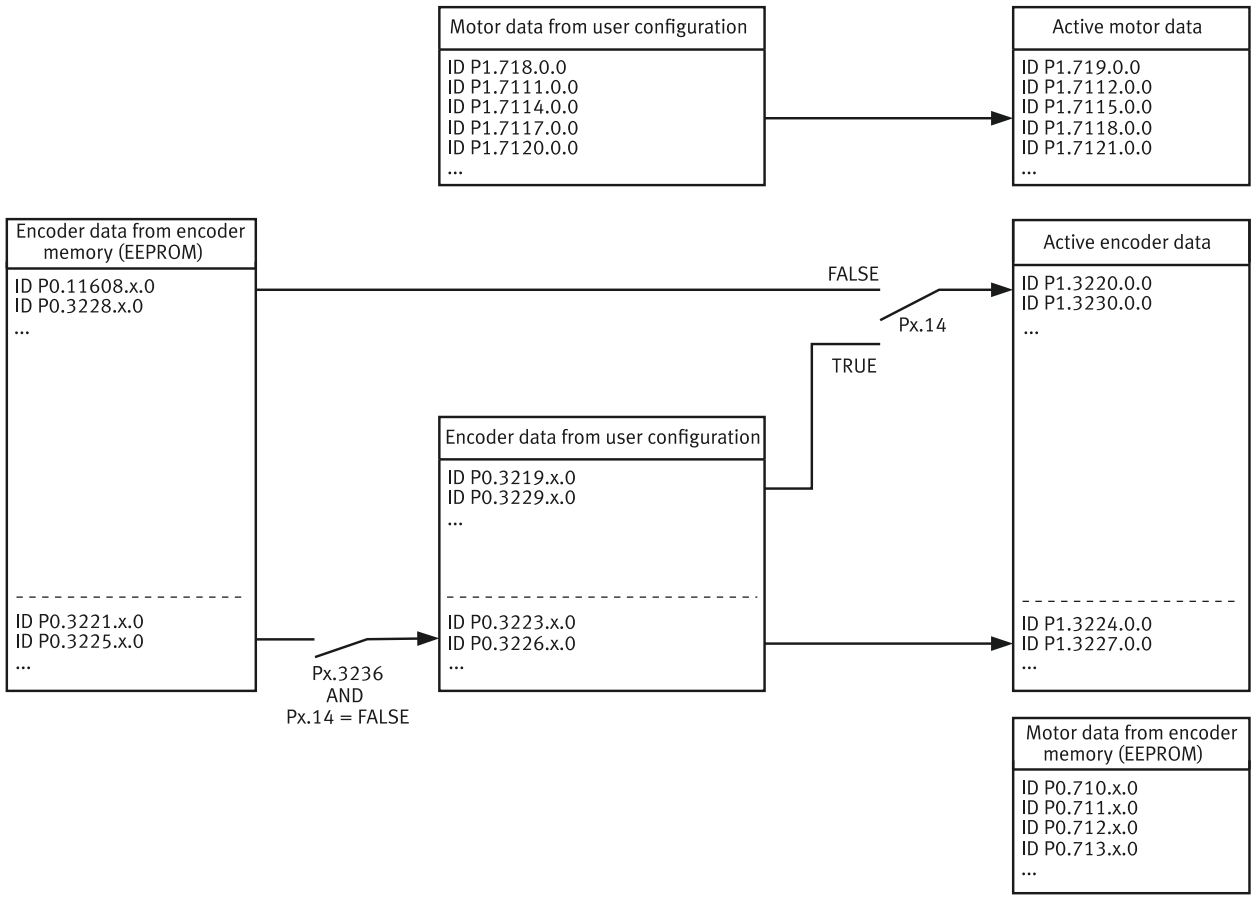


Fig. 32: Allocation of motor and encoder data

Active motor data, always from the user configuration

The motor data are always taken from the user-defined parameters, independently from Px.14.

Parameters	ID Px. active parameters	ID Px. User configuration	Encoder memory
Pole pairs	719	718	*
Motor inertia	7112	7111	*
Phase sequence	7115	7114	*
Nominal current	7118	7117	*
Maximum current	7121	7120	*
Maximum rpm	7124	7123	*
Nominal rotary velocity	7127	7126	*
* Parameter is not relevant because of the use of user-defined data.			

Parameters	ID Px. active parameters	ID Px. User configuration	Encoder memory
Winding inductance	7130	7129	*
Winding resistance	7133	7132	*
Torque constant	7136	7135	*
Fieldweakening: Max. rotary speed	71370	71371	*
Time constant I^2t	7145	7144	*
Winding temperature	7148	7147	*
Nominal motor voltage	71422	71421	*
Temperature sensor	7154	7153	*
Temperature sensor characteristic	7157	7156	*
Holding brake	7160	7159	*
Switch-on delay holding brake 1	7163	7162	*
Switch-off delay holding brake 1	7166	7165	*
Denominator pole pairs	7191	7185	*
Continuous current	71425	71424	*
Encoder data set ID	7189	7184	*
Lq inductance	71426	71430	*
Ld inductance	71427	71431	*
Motor type	71428	71432	*
Pitch length	102704	102901	*
Nominal velocity linear	7127	102904	*
Maximum velocity linear	7124	102905	*
Maximum velocity fieldweakening linear	71370	102906	*
Force constant linear	102927	102907	*
Slide weight linear	102929	102928	*
Order code	7188	7182	*
* Parameter is not relevant because of the use of user-defined data.			

Tab. 214: Active motor data, always from the user configuration

Encoder data, source selection with Px.14

Px.14 defines the source for the active parameters with these parameters.

Parameters	ID Px. active parameters	Source at Px.14 = TRUE	Source at Px.14 = FALSE
Actual commutation angle	3220	3219 (user configuration)*	11608 (encoder memory)
Actual zero point offset	3224	3223 (user configuration)	3223 (user configuration) 3221 (encoder memory)**
Actual referencing is valid	3227	3226 (user configuration)	3226 (user configuration) 3225 (encoder memory)**
Actual commutation angle valid	3230	3229 (user configuration)*	3228 (encoder memory)
* See ➔ Parameters of the commutation-angle detection. ** With motor change activated: ➔ Fig. 32.			

Tab. 215: Encoder data, source selection with Px.14

Parameters independent of Px.14

Parameters	ID Px.	Source
Resulting nominal torque	7139	Derived (I_rated × force factor)
Resulting maximum torque	7142	Derived (I_rated × force factor)
Activation virtual drive	71434	User configuration
Activate virtual encoder	102034	User configuration

Parameters	ID Px.	Source
K1 factor	102224	User configuration
K2 factor	102225	User configuration
Tk factor	102226	User configuration
Activation commutation angle transfer (CMMP type plate)	11626	User configuration (always active)

Tab. 216: Parameters independent of Px.14

Read-only parameters from the electronic rating plate

The parameters are always imported from the encoder memory.

Parameters	ID Px. electronic rating plate
Product key	710
Order code	711
Material number	712
Serial number	713
Minor version hardware	7150
Temperature sensor	7151
Major version motor data set	7186
Minor version motor data set	7187
Encoder type from encoder memory	320
Supply voltage of the encoder from encoder memory	323

Tab. 217: Read-only parameters from the electronic rating plate

3.3.1.2 Parameters and diagnostic messages for motor data from the user configuration

The following list contains the modifiable motor data. During the configuration of Festo motors using the plug-in, the motor data are automatically imported from the database after selection of the motor. The data must be entered manually when configuring third-party motors.

ID Px.	Parameter	Description	
718	Pole pairs (user defined)	Specifies the number of pole pairs of the motor -> data sheet of the motor. 1 pole pair = 2 poles!	
		Access	read/write
		Update	reinitialization
		Unit	–
7111	Motor inertia (user defined)	Specifies the inertia of the motor used -> data sheet of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	kgm²
7114	Phase sequence (user defined)	Specifies whether the sequence of phases is swapped. The usual phase sequence for the servomotor to turn clockwise is ascending (U, V, W). If the servomotor has the phase sequence U, W, V, the phase sequence is reversed. 0 for the phase sequence U, V, W and 1 for the phase sequence U, W, V. For a stepper motor, the phase sequence for 0 is the assignment A-#A and B-#B. For the phase sequence equal to 1, the assignment A-#A and #B-B is. Changing the phase sequence changes the rotating field of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	–
7117	Nominal current (user defined)	Specifies the root mean square value of the nominal current of the motor when loading with the nominal torque -> data sheet of the motor.	
		Access	read/write

ID Px.	Parameter	Description	
7117	Nominal current (user defined)	Update	reinitialization
		Unit	Arms
7120	Maximum peak current (user defined)	Specifies the permissible root mean square value of the maximum current that may flow through the motor in the short term -> data sheet of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	Arms
7123	Maximum rpm (user defined)	Specifies the maximum permissible velocity of the motor used -> data sheet of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	rpm
7126	Nominal rotary velocity (user defined)	Specifies the nominal rotary velocity of the motor -> data sheet of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	rpm
7129	Winding inductance (user defined)	Specifies the inductance between 2 motor phases for a servomotor. Indicates the inductance of a motor phase in a stepper motor -> data sheet of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	H
7132	Winding resistance (user defined)	Specifies the winding resistance between 2 motor phases for a servomotor. Specifies the winding resistance of a motor phase for a stepper motor -> data sheet of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	Ω
7135	Torque constant (user defined)	Specifies the ratio of the motor torque to the root mean square value of the current -> data sheet of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	Nm/Arms
7144	Time constant I^2t (user defined)	Specifies the duration for which the parameterised maximum current may act. In the case of a servomotor, the current setpoint is automatically limited to the rated current at the end of the period and the corresponding diagnostic message with the parameterised behaviour is generated (I^2t monitoring). If a thermal model is used for I^2t monitoring, as for a stepper motor with rated current=maximum current, the time constant is used as the filter time constant.	
		Access	read/write
		Update	reinitialization
		Unit	s
7147	Winding temperature (user defined)	Specifies the maximum permissible winding temperature of the motor -> data sheet of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	°C
7153	Temperature sensor (user defined)	Specifies the sensor type of the temperature sensor -> data sheet of the motor. Possible sensor types ➔ Tab. 219 Value list of the temperature sensor parameters.	
		Access	read/write
		Update	reinitialization
		Unit	–

ID Px.	Parameter	Description	
7156	Temperature sensor characteristic (user defined)	Specifies the characteristic of the temperature sensor -> data sheet of the motor. The temperature characteristic is described by a straight line whose increase is determined by the gain and whose position is determined by the offset. Index 0: Gain. Index 1: Offset.	
		Access	read/write
		Update	reinitialization
		Unit	–
7159	Holding brake (user defined)	Specifies whether the motor has an integrated holding brake and whether it shall be used -> data sheet of the motor. – 0: inactive, holding brake not available – 1: active, holding brake available	
		Access	read/write
		Update	reinitialization
		Unit	–
7162	Switch-on delay holding brake 1 (user defined)	user-configured switch-on delay Determines how long the next command is delayed after a controller enable. This parameter adapts the behaviour of the device to the inertia of the holding brake. No orders are processed until the switch-on delay has elapsed, so the holding brake can release completely.	
		Access	read/write
		Update	reinitialization
		Unit	s
7165	Switch-off delay holding brake 1 (user defined)	user-configured switch-off delay Determines how long the closed-loop controller shall hold the current position so that the holding brake can be closed completely. This parameter adapts the behaviour of the device to the inertia of the holding brake. The position controller is switched off after expiration of the switch-off delay. The holding brake should then be completely closed.	
		Access	read/write
		Update	reinitialization
		Unit	s
7182	Order code motor (user defined)	Specifies the order code of the motor -> product labelling of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	–
7184	Database ID motor (user defined)	Specifies the database ID of the configured motor.	
		Access	read/write
		Update	reinitialization
		Unit	–
71421	Nominal motor voltage (user defined)	Specifies the nominal motor voltage of the motor -> data sheet of the motor. An excessive DC link voltage can destroy the motor!	
		Access	read/write
		Update	reinitialization
		Unit	V
71424	Continuous current (user defined)	Specifies the effective current that the motor requires to apply the stall torque -> data sheet of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	Arms
71430	Lq inductance (user defined)	The inductance is orthogonal to the direction of the field. This value is a theoretical construct and cannot be measured -> data sheet of the motor.	
		Access	read/write
		Update	reinitialization

ID Px.	Parameter	Description	
71430	Lq inductance (user defined)	Unit	H
71431	Ld inductance (user defined)	The inductance is in parallel with the direction of the field. This value is a theoretical construct and cannot be measured -> data sheet of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	H
71432	Motor type	Selection of motor type -> data sheet of the motor. – 1: stepper motor – 2: servo motor (EC motor)	
		Access	read/write
		Update	reinitialization
		Unit	–

Tab. 218: Parameters

Value list of the temperature sensor parameters (settable using Px.7153)		
Value	Temperature sensor	Description
0	Without temperature sensor	No temperature sensors available
1000	Temperature value from encoder	Temperature sensor in encoder

Tab. 219: Value list of the temperature sensor parameters

ID Dx.	Name	Description
06 | 00 | 00248 (100663544)	Motor type is not supported	The parameterised motor type (servo, stepper etc.) is not supported

Tab. 220: Diagnostic messages

3.3.1.3 CiA 402

Motor data objects from the user configuration

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
718	0x216C.01	Pole pairs (user defined)	UDINT
7111	0x216C.02	Motor inertia (user defined)	REAL
7114	0x216C.03	Phase sequence (user defined)	USINT
7117	0x216C.04	Nominal current (user defined)	REAL
7120	0x216C.05	Maximum peak current (user defined)	REAL
7123	0x216C.06	Maximum rpm (user defined)	REAL
7126	0x216C.07	Nominal rotary velocity (user defined)	REAL
7129	0x216C.08	Winding inductance (user defined)	REAL
7132	0x216C.09	Winding resistance (user defined)	REAL
7135	0x216C.0A	Torque constant (user defined)	REAL
7144	0x216C.0B	Time constant I^2t (user defined)	REAL
7147	0x216C.0C	Winding temperature (user defined)	REAL
7153	0x216C.0D	Temperature sensor (user defined)	UDINT
7156	0x225B.01 ... 02	Temperature sensor characteristic (user defined)	REAL
7159	0x216C.0E	Holding brake (user defined)	USINT
7162	0x216C.0F	Switch-on delay holding brake 1 (user defined)	REAL
7165	0x216C.10	Switch-off delay holding brake 1 (user defined)	REAL
7182	0x216C.11	Order code motor (user defined)	STRING(32)
7184	0x216C.12	Database ID motor (user defined)	UDINT

Parameter	Index.Subindex	Name	Data type
71421	0x216C.13	Nominal motor voltage (user defined)	REAL
71424	0x216C.14	Continuous current (user defined)	REAL
71430	0x216C.15	Lq inductance (user defined)	REAL
71431	0x216C.16	Ld inductance (user defined)	REAL
71432	0x216C.17	Motor type	USINT

Tab. 221: Objects

3.3.1.4 PROFIdrive

Motor data PNUs from the user configuration

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
718	11184.0	Pole pairs (user defined)	UDINT
7111	11686.0	Motor inertia (user defined)	REAL
7114	11688.0	Phase sequence (user defined)	BOOL
7117	11690.0	Nominal current (user defined)	REAL
7120	11692.0	Maximum peak current (user defined)	REAL
7123	11694.0	Maximum rpm (user defined)	REAL
7126	11696.0	Nominal rotary velocity (user defined)	REAL
7129	11698.0	Winding inductance (user defined)	REAL
7132	11700.0	Winding resistance (user defined)	REAL
7135	11702.0	Torque constant (user defined)	REAL
7144	11706.0	Time constant I^2t (user defined)	REAL
7147	11708.0	Winding temperature (user defined)	REAL
7153	11710.0	Temperature sensor (user defined)	UDINT
7156	11712.0 ... 1	Temperature sensor characteristic (user defined)	REAL
7159	11714.0	Holding brake (user defined)	BOOL
7162	11716.0	Switch-on delay holding brake 1 (user defined)	REAL
7165	11718.0	Switch-off delay holding brake 1 (user defined)	REAL
7182	11720.0 ... 31	Order code motor (user defined)	STRING(32)
7184	11721.0	Database ID motor (user defined)	UDINT
71421	11918.0	Nominal motor voltage (user defined)	REAL
71424	11920.0	Continuous current (user defined)	REAL
71430	11926.0	Lq inductance (user defined)	REAL
71431	11927.0	Ld inductance (user defined)	REAL
71432	11928.0	Motor type	USINT

Tab. 222: PNUs

3.3.1.5 Parameter and diagnostic messages for motor data from the EEPROM memory

If the motor data are stored in the EEPROM of the integrated encoder, the motor data can be read out. The read-out motor data are transferred to the parameters listed here.

The device has an encoder interface. The parameters of the encoder interface are allocated to instance 0.

ID Px.	Parameter	Description	
710	Product key	Specifies the product key of the motor.	
		Access	read/–
		Update	reinitialization

ID Px.	Parameter	Description	
710	Product key	Unit	–
711	Order code	Specifies the order code of the motor.	
		Access	read/–
		Update	reinitialization
		Unit	–
712	Material number	Specifies the material number of the motor.	
		Access	read/–
		Update	reinitialization
		Unit	–
713	Serial number	Specifies the serial number of the motor.	
		Access	read/–
		Update	reinitialization
		Unit	–
717	Pole pairs	Specifies the number of pole pairs of the motor used.	
		Access	read/–
		Update	reinitialization
		Unit	–
7110	Motor inertia	Specifies the inertia of the motor.	
		Access	read/–
		Update	reinitialization
		Unit	kgm²
7113	Phase sequence	Specifies whether the sequence of phases is swapped. The usual phase sequence for the servomotor to turn clockwise is ascending (U, V, W). If the servomotor has the phase sequence U, W, V, the phase sequence is reversed. 0 for the phase sequence U, V, W and 1 for the phase sequence U, W, V. For a stepper motor, the phase sequence for 0 is the assignment A-#A and B-#B. For the phase sequence equal to 1, the assignment A-#A and #B-B is. Changing the phase sequence changes the rotating field of the motor.	
		Access	read/–
		Update	reinitialization
		Unit	–
7116	Nominal current	Specifies the root mean square value of the nominal current when loading the motor with the nominal torque.	
		Access	read/–
		Update	reinitialization
		Unit	Arms
7119	Maximum current	Specifies the root mean square value of the permissible maximum current that may flow through the motor in the short term.	
		Access	read/–
		Update	reinitialization
		Unit	Arms
7122	Maximum rpm	Specifies the maximum permissible velocity of the motor.	
		Access	read/–
		Update	reinitialization
		Unit	rpm
7125	Nominal rotary velocity	Specifies the nominal rotary velocity of the motor.	
		Access	read/–
		Update	reinitialization
		Unit	rpm

ID Px.	Parameter	Description	
7128	Winding inductance	Display the inductance between 2 motor phases for a servomotor. Indicates the inductance of a motor phase in a stepper motor.	
		Access	read/–
		Update	reinitialization
		Unit	H
7131	Winding resistance	Specifies the winding resistance between 2 motor phases for a servomotor. Specifies the winding resistance of a motor phase for a stepper motor.	
		Access	read/–
		Update	reinitialization
		Unit	Ω
7134	Torque constant	Specifies the ratio of the motor torque to the root mean square value of the current (root mean square value).	
		Access	read/–
		Update	reinitialization
		Unit	Nm/Arms
7143	Time constant I^2t	Specifies the duration for which the parameterised maximum current may act. In the case of a servomotor, the current setpoint is automatically limited to the rated current at the end of the period and the corresponding diagnostic message with the parameterised behaviour is generated (I^2t monitoring). If a thermal model is used for I^2t monitoring, as for a stepper motor with rated current=maximum current, the time constant is used as the filter time constant.	
		Access	read/–
		Update	reinitialization
		Unit	s
7146	Winding temperature	Specifies the maximum winding temperature of the motor. When the specified temperature threshold is exceeded, the corresponding diagnostic message is generated with the parameterised behaviour (temperature monitoring of motor).	
		Access	read/–
		Update	reinitialization
		Unit	°C
7149	Nominal motor voltage	Specifies the nominal motor voltage of the motor.	
		Access	read/–
		Update	reinitialization
		Unit	V
7150	Major version hardware	Specifies the major version number of the hardware.	
		Access	read/–
		Update	reinitialization
		Unit	–
7151	Minor version hardware	Specifies the minor version number of the hardware.	
		Access	read/–
		Update	reinitialization
		Unit	–
7152	Temperature sensor	Sensor type of temperature sensor. Possible sensor types ➔ Tab. 219 Value list of the temperature sensor parameters.	
		Access	read/–
		Update	reinitialization
		Unit	–

ID Px.	Parameter	Description	
7155	Temperature sensor characteristic	Specifies the characteristic of the temperature sensor. The temperature characteristic is described by a straight line resulting from the gain (increase) and the offset. Index 0: gain Index 1: offset	
		Access	read/–
		Update	reinitialization
		Unit	–
7158	Holding brake	Specifies whether the motor has an integrated holding brake. – 0: inactive, holding brake not available – 1: active, holding brake available	
		Access	read/–
		Update	reinitialization
		Unit	–
7161	Switch-on delay holding brake 1	Switch-on delay saved in the EEPROM for the execution of a command if an electronic data sheet for the Festo motor is stored.	
		Access	read/–
		Update	reinitialization
		Unit	s
7164	Switch-off delay holding brake 1	The delay saved in the EEPROM for the deactivation of the controller if an electronic data sheet for the Festo motor is stored.	
		Access	read/–
		Update	reinitialization
		Unit	s
7181	Continuous current	Specifies the effective current that the motor requires to apply the stall torque.	
		Access	read/–
		Update	reinitialization
		Unit	Arms
7183	Encoder data set ID	Specifies the ID of the encoder data set.	
		Access	read/–
		Update	reinitialization
		Unit	–
7186	Major version motor data set	Specifies the major version of the motor data set.	
		Access	read/–
		Update	reinitialization
		Unit	–
7187	Minor version motor data set	Specifies the minor version of the motor data set.	
		Access	read/–
		Update	reinitialization
		Unit	–
7428	Lq inductance	The inductance is orthogonal to the direction of the field. This value is a theoretical construct and cannot be measured -> data sheet of the motor.	
		Access	read/–
		Update	reinitialization
		Unit	H
7429	Ld inductance	The inductance is in parallel with the direction of the field. This value is a theoretical construct and cannot be measured -> data sheet of the motor.	
		Access	read/–
		Update	reinitialization
		Unit	H

ID Px.	Parameter	Description	
7430	Motor type	Selection of motor type -> data sheet of the motor.	
		Access	read/–
		Update	reinitialization
		Unit	–

Tab. 223: Parameter

ID Dx.	Name	Description
06 | 00 | 00248 (100663544)	Motor type is not supported	The parameterised motor type (servo, stepper etc.) is not supported

Tab. 224: Diagnostic messages

3.3.1.6 CiA 402

Motor data objects from the EEPROM memory

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
710	0x2106.01 ... 02	Product key	STRING(15)
711	0x2106.03 ... 04	Order code	STRING(32)
712	0x2106.05 ... 06	Material number	UDINT
713	0x2106.07 ... 08	Serial number	STRING(20)
717	0x2106.09 ... 0A	Pole pairs	UDINT
7110	0x2106.0B ... 0C	Motor inertia	REAL
7113	0x2106.0D ... 0E	Phase sequence	USINT
7116	0x2106.0F ... 10	Nominal current	REAL
7119	0x2106.11 ... 12	Maximum current	REAL
7122	0x2106.13 ... 14	Maximum rpm	REAL
7125	0x2106.15 ... 16	Nominal rotary velocity	REAL
7128	0x2106.17 ... 18	Winding inductance	REAL
7131	0x2106.19 ... 1A	Winding resistance	REAL
7134	0x2106.1B ... 1C	Torque constant	REAL
7143	0x2106.1D ... 1E	Time constant I^2t	REAL
7146	0x2106.1F ... 20	Winding temperature	REAL
7149	0x2106.21 ... 22	Nominal motor voltage	REAL
7150	0x2106.23 ... 24	Major version hardware	STRING(2)
7151	0x2106.25 ... 26	Minor version hardware	UINT
7152	0x2106.27 ... 28	Temperature sensor	UDINT
7155	0x2202.01 ... 04	Temperature sensor characteristic	REAL
7158	0x2106.29 ... 2A	Holding brake	USINT
7161	0x2106.2B ... 2C	Switch-on delay holding brake 1	REAL
7164	0x2106.2D ... 2E	Switch-off delay holding brake 1	REAL
7181	0x2106.2F ... 30	Continuous current	REAL
7183	0x2106.31 ... 32	Encoder data set ID	UDINT
7186	0x2106.33 ... 34	Major version motor data set	STRING(2)
7187	0x2106.35 ... 36	Minor version motor data set	UINT
7428	0x2106.37 ... 38	Lq inductance	REAL
7429	0x2106.39 ... 3A	Ld inductance	REAL
7430	0x2106.3B ... 3C	Motor type	USINT

Tab. 225: Objects

3.3.1.7 PROFIdrive

PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
710	2215.0 … 14	Product key	STRING(15)
711	2217.0 … 31	Order code	STRING(32)
712	2219.0	Material number	UDINT
713	2221.0 … 19	Serial number	STRING(20)
717	2223.0	Pole pairs	UDINT
7110	2721.0	Motor inertia	REAL
7113	2723.0	Phase sequence	BOOL
7116	2725.0	Nominal current	REAL
7119	2727.0	Maximum current	REAL
7122	2729.0	Maximum rpm	REAL
7125	2731.0	Nominal rotary velocity	REAL
7128	2733.0	Winding inductance	REAL
7131	2735.0	Winding resistance	REAL
7134	2737.0	Torque constant	REAL
7143	2739.0	Time constant I^2t	REAL
7146	2741.0	Winding temperature	REAL
7149	2743.0	Nominal motor voltage	REAL
7150	2745.0 … 1	Major version hardware	STRING(2)
7151	2747.0	Minor version hardware	UINT
7152	2749.0	Temperature sensor	UDINT
7155	2751.0 … 1	Temperature sensor characteristic	REAL
7158	2753.0	Holding brake	BOOL
7161	2755.0	Switch-on delay holding brake 1	REAL
7164	2757.0	Switch-off delay holding brake 1	REAL
7181	2759.0	Continuous current	REAL
7183	2761.0	Encoder data set ID	UDINT
7186	2763.0 … 1	Major version motor data set	STRING(2)
7187	2765.0	Minor version motor data set	UINT
7428	2767.0	Lq inductance	REAL
7429	2769.0	Ld inductance	REAL
7430	2771.0	Motor type	USINT

Tab. 226: Motor data object PNUs from the EEPROM memory

3.3.1.8 Active motor data parameters

The following parameters contain the active motor data. Parameter Px.14.0.0 can be used to determine which motor data are to be imported as active motor data after re-initialisation ➔ Fig. 32.

The active parameters are read-only, with one exception: Px.7118 Actual nominal current.
The active nominal current can be described in CiA 402 via object 0x6075.
The accepted value range must be less than the nominal current stored in the Px.7117 configuration or the EEprom data Px.7116 used. The value is saved in the parameter set.

Examples for different motors

- Motor 1: nominal current 5 A
- Motor 2: nominal current 10 A
- Motor 3: nominal current 2 A

Case	Motor	Write value in Px.7118	Result in PX.7118	Comment
1	Motor 1.	7 A	5 A	The value is limited to the nominal current of the motor.
2	Motor 1.	3 A	3 A	The value remains as written.
3	Motor 1 is replaced with motor 2.	No new value.	Value from case 1 or 2 is retained.	No limit.
4	Motor 1 is replaced with motor 3.	No new value.	2 A	The value is limited to the nominal current of the motor.

Tab. 227: Examples

ID Px.	Parameter	Description	
14	Use of user specific motor data	Specifies whether the user specific motor data should be adopted as the active motor data following reinitialisation. – 0: motor data from the EEPROM of the encoder – 1: user-specific motor data from device memory	
		Access	read/write
		Update	reinitialization
		Unit	–
719	Actual pole pairs	Specifies the number of pole pairs of the actual motor.	
		Access	read/–
		Update	effective immediately
		Unit	–
7112	Actual motor inertia	Specifies the inertia of the active motor used.	
		Access	read/–
		Update	effective immediately
		Unit	kgm²
7115	Actual phase sequence	Specifies whether the sequence of phases is swapped. The usual phase sequence for the servomotor to turn clockwise is ascending (U, V, W). If the servomotor has the phase sequence U, W, V, the phase sequence is reversed. 0 for the phase sequence U, V, W and 1 for the phase sequence U, W, V. For a stepper motor, the phase sequence for 0 is the assignment A-#A and B-#B. For the phase sequence equal to 1, the assignment A-#A and #B-B is. Changing the phase sequence changes the rotating field of the motor.	
		Access	read/–
		Update	effective immediately
		Unit	–
7118	Actual nominal current	Specifies the root mean square value of the nominal current when loading the motor with the nominal torque.	
		Access	read/write
		Update	reinitialization
		Unit	Arms
7121	Actual maximum current	Specifies the permissible root mean square value of the maximum current that may flow through the motor in the short term.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
7124	Actual maximum velocity	Specifies the actual maximum velocity of the actual motor.	
		Access	read/–

ID Px.	Parameter	Description	
7124	Actual maximum velocity	Update	effective immediately
		Unit	user defined
7127	Actual nominal velocity	Specifies the actual nominal velocity of the active motor.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
7130	Actual winding inductance	Specifies the inductance between 2 motor phases of the active servomotor. Indicates the inductance of a motor phase in a stepper motor.	
		Access	read/–
		Update	effective immediately
		Unit	H
7133	Actual winding resistance	Specifies the winding resistance between 2 motor phases of the active servomotor. Specifies the winding resistance of a motor phase for a stepper motor.	
		Access	read/–
		Update	effective immediately
		Unit	Ω
7136	Actual torque constant	Specifies the ratio of the motor torque to the root mean square value of the current of the active motor (root mean square value)	
		Access	read/–
		Update	effective immediately
		Unit	Nm/Arms
7139	Resulting nominal torque	Specifies the resulting nominal torque of the active motor (current nominal current x current torque constant).	
		Access	read/–
		Update	effective immediately
		Unit	Nm
7142	Resulting maximum torque	Specifies the resulting maximum torque of the active motor (current maximum current x current torque constant).	
		Access	read/–
		Update	effective immediately
		Unit	Nm
7145	Actual time constant I^2t	Specifies the duration for which the parameterised maximum current may act. In the case of a servomotor, the current setpoint is automatically limited to the rated current at the end of the period and the corresponding diagnostic message with the parameterised behaviour is generated (I^2t monitoring). If a thermal model is used for I^2t monitoring, as for a stepper motor with rated current=maximum current, the time constant is used as the filter time constant.	
		Access	read/–
		Update	effective immediately
		Unit	s
7148	Actual winding temperature	Specifies the maximum permissible winding temperature of the actual motor.	
		Access	read/–
		Update	effective immediately
		Unit	°C
7154	Actual temperature sensor motor	Specifies the sensor type of the temperature sensor. Possible sensor types ➔ Tab. 219 Value list of the temperature sensor parameters.	
		Access	read/–
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
7157	Actual temperature sensor characteristic motor	Specifies the characteristic of the temperature sensor. – Index 0: gain – Index 1: offset	
		Access	read/–
		Update	effective immediately
		Unit	–
7160	Holding brake	Specifies whether the motor has an integrated holding brake and whether it shall be used -> data sheet of the motor. – 0: inactive, holding brake not available – 1: active, holding brake available	
		Access	read/–
		Update	effective immediately
		Unit	–
7163	Actual switch-on delay holding brake 1	Specifies the actual used switch-on delay of the holding brake. Determines how long the next command is delayed after a controller enable. This parameter adapts the behaviour of the device to the inertia of the holding brake. No orders are processed until the switch-on delay has elapsed, so the holding brake can release completely.	
		Access	read/–
		Update	effective immediately
		Unit	s
7166	Actual switch-off delay holding brake 1	Specifies the actual effective delay for switching off the closed-loop control. Determines how long the closed-loop controller shall hold the current position so that the holding brake can be closed completely. This parameter adapts the behaviour of the device to the inertia of the holding brake. The position controller is switched off after expiration of the switch-off delay. The holding brake should then be completely closed.	
		Access	read/–
		Update	effective immediately
		Unit	s
7188	Actual order code motor	Specifies the order code of the motor -> product labelling of the motor.	
		Access	read/–
		Update	effective immediately
		Unit	–
71422	Actual nominal motor voltage	Specifies the nominal motor voltage of the motor. An excessive DC link voltage can destroy the motor!	
		Access	read/–
		Update	effective immediately
		Unit	V
71425	Actual continuous current	Specifies the effective current that the motor requires to apply the stall torque.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
71426	Actual Lq inductance	Specifies the actual used inductance orthogonal to the direction of the field. This value is a theoretical construct and cannot be measured.	
		Access	read/–
		Update	effective immediately
		Unit	H
71427	Actual Ld inductance	Specifies the actual used inductance along the direction of the field. This value is a theoretical construct and cannot be measured.	
		Access	read/–
		Update	effective immediately

ID Px.	Parameter	Description	
71427	Actual Ld inductance	Unit	H
71428	Actual motor type	Specifies the actual selection of the motor type.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 228: Parameters

3.3.1.9 CiA 402

Motor data objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
7118	0x6075.00	Actual nominal current	UDINT
7188	0x6403.00	Actual order code motor	STRING(32)
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
14	0x2162.01	Use of user specific motor data	USINT
719	0x2162.02	Actual pole pairs	UDINT
7112	0x2162.03	Actual motor inertia	REAL
7115	0x2162.04	Actual phase sequence	USINT
7118	0x2162.05	Actual nominal current	REAL
7121	0x2162.06	Actual maximum current	REAL
7124	0x2162.07	Actual maximum velocity	REAL
7127	0x2162.08	Actual nominal velocity	REAL
7130	0x2162.09	Actual winding inductance	REAL
7133	0x2162.0A	Actual winding resistance	REAL
7136	0x2162.0B	Actual torque constant	REAL
7139	0x2162.0C	Resulting nominal torque	REAL
7142	0x2162.0D	Resulting maximum torque	REAL
7145	0x2162.0E	Actual time constant I^2t	REAL
7148	0x2162.0F	Actual winding temperature	REAL
7154	0x2162.10	Actual temperature sensor motor	UDINT
7157	0x225A.01 ... 02	Actual temperature sensor characteristic motor	REAL
7160	0x2162.11	Holding brake	USINT
7163	0x2162.12	Actual switch-on delay holding brake 1	REAL
7166	0x2162.13	Actual switch-off delay holding brake 1	REAL
7188	0x2162.14	Actual order code motor	STRING(32)
71422	0x2162.16	Actual nominal motor voltage	REAL
71425	0x2162.17	Actual continuous current	REAL
71426	0x2162.18	Actual Lq inductance	REAL
71427	0x2162.19	Actual Ld inductance	REAL
71428	0x2162.1A	Actual motor type	USINT

Tab. 229: Active motor data object parameters

3.3.1.10 PROFIdrive

Motor configuration PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
14	11001.0	Use of user specific motor data	BOOL
719	11185.0	Actual pole pairs	UDINT
7112	11687.0	Actual motor inertia	REAL
7115	11689.0	Actual phase sequence	BOOL
7118	11691.0	Actual nominal current	REAL
7121	11693.0	Actual maximum current	REAL
7124	11695.0	Actual maximum velocity	REAL
7127	11697.0	Actual nominal velocity	REAL
7130	11699.0	Actual winding inductance	REAL
7133	11701.0	Actual winding resistance	REAL
7136	11703.0	Actual torque constant	REAL
7139	11704.0	Resulting nominal torque	REAL
7142	11705.0	Resulting maximum torque	REAL
7145	11707.0	Actual time constant I^2t	REAL
7148	11709.0	Actual winding temperature	REAL
7154	11711.0	Actual temperature sensor motor	UDINT
7157	11713.0 ... 1	Actual temperature sensor characteristic motor	REAL
7160	11715.0	Holding brake	BOOL
7163	11717.0	Actual switch-on delay holding brake 1	REAL
7166	11719.0	Actual switch-off delay holding brake 1	REAL
7188	11722.0 ... 31	Actual order code motor	STRING(32)
71422	11919.0	Actual nominal motor voltage	REAL
71425	11921.0	Actual continuous current	REAL
71426	11922.0	Actual Lq inductance	REAL
71427	11923.0	Actual Ld inductance	REAL
71428	11924.0	Actual motor type	USINT

Tab. 230: Active motor data PNU parameters

3.3.1.11 Linear motor support

The system must be configured accordingly in order to use a linear drive.
Parameterisation for linear motors:

- P1.1194/P1.1195 must be set to the step size of the linear motor (as numerator/denominator pair).
- P1.102901 magnetic period (also electrical cycle length).
- P1.102904 nominal speed.
- P1.102905 maximum speed.
- P1.102906 maximum speed in field weakening operation.
- P1.102907 force constant.
- P1.102928 slide mass.
- P1.71432 must be set to "linear motor" type.
- P1.718/P1.7185 must be set to 1, because the slope length applies to one electrical cycle (as numerator/denominator pair).

Other motor-related parameters such as inductance and current are parameterised in the same way as rotary drives.

The system is designed to offer a simple and easy-to-understand configuration for linear position measurement.
Linear encoder configuration:
– P0.102903 encoder resolution in metres.
  The parameter for encoders of type Hiperface SIN/COS encoders must include the period length.
  Example: period length 1 mm → encoder resolution: 15.258789 nm.
– P0.102908 activation of linear measurement.

The feed constant P1.1194/P1.1195 and the pitch length P1.102901 must be consistent. The user is solely responsible; these parameters are not verified internally.
P1.718/P1.7185 are also not tested. The user must ensure that they are set to 1 if a linear motor is selected.
Linear motors must not be parameterised with gear units, even if the configuration is technically permitted. Set all gear ratios to 1 and set the motor inertias and gear inertias to 0.

Linear motor parameters

ID Px.	Parameter	Description	
1194	Feed constant numerator	Specifies the numerator of the feed constant (data type UINT32). Only values less than 17 bits are valid.	
		Access	read/write
		Update	reinitialization
		Unit	–
1195	Feed constant denominator	Specifies the denominator of the feed constant (data type UINT32). Only values less than 17 bits are valid.	
		Access	read/write
		Update	reinitialization
		Unit	–
102901	Pitch length (user defined)	Specifies the pitch length for a linear motor -> data sheet of the motor	
		Access	read/write
		Update	reinitialization
		Unit	mRes
102904	Rated velocity linear (user defined)	Specifies the rated velocity for a linear motor -> data sheet of the motor	
		Access	read/write
		Update	reinitialization
		Unit	mpsMotor
102905	Maximum velocity linear (user defined)	Specifies the maximum velocity for a linear motor -> data sheet of the motor	
		Access	read/write
		Update	reinitialization
		Unit	mpsMotor
102906	Maximum velocity fieldweakening linear (user defined)	Specifies the maximum velocity in field weakening for a linear motor -> data sheet of the motor	
		Access	read/write
		Update	reinitialization
		Unit	mpsMotor
102907	Force constant (user defined)	Specifies the force constant for a linear motor -> data sheet of the motor	
		Access	read/write
		Update	reinitialization

ID Px.	Parameter	Description	
102907	Force constant (user defined)	Unit	N/Arms
102928	Slide weight linear (user defined)	Specifies the slide weight for linear drive -> data sheet of the motor	
		Access	read/write
		Update	reinitialization
		Unit	kg
71432	Motor type	Selection of motor type -> data sheet of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	–
718	Pole pairs (user defined)	Specifies the number of pole pairs of the motor -> data sheet of the motor. 1 pole pair = 2 poles!	
		Access	read/write
		Update	reinitialization
		Unit	–
7185	Denominator pole pairs (user-defined)	Specifies the denominator for the calculation of the pole pairs.	
		Access	read/write
		Update	reinitialization
		Unit	–
102903	Encoder resolution	Specifies the resolution of the encoder in meter (in case of SincCos/Hiperface: Period-Length).	
		Access	read/write
		Update	reinitialization
		Unit	mRes
102908	Enable linear measurement	Defines if the encoder measurement shall be reconfigured for linear encoders.	
		Access	read/write
		Update	reinitialization
		Unit	–

Tab. 231: Parameter

3.3.1.12 CiA 402

Linear motor objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
1194	0x60E9.01	Feed constant numerator	UDINT
1195	0x60EE.01	Feed constant denominator	UDINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1194	0x217E.04	Feed constant numerator	UDINT
1195	0x217E.05	Feed constant denominator	UDINT
102901	0x216C.1B	Pitch length (user defined)	REAL
102904	0x216C.1C	Rated velocity linear (user defined)	REAL
102905	0x216C.1D	Maximum velocity linear (user defined)	REAL
102906	0x216C.1E	Maximum velocity fieldweakening linear (user defined)	REAL
102907	0x216C.1F	Force constant (user defined)	REAL
102928	0x216C.20	Slide weight linear (user defined)	REAL
71432	0x216C.17	Motor type	USINT
718	0x216C.01	Pole pairs (user defined)	UDINT
7185	0x216C.18	Denominator pole pairs (user-defined)	UDINT

Parameter	Index.Subindex	Name	Data type
102903	0x2130.F7 … F9	Encoder resolution	REAL
102908	0x2130.FA … FC	Enable linear measurement	USINT

Tab. 232: Linear motor objects

3.3.1.13 PROFIdrive

Linear motor PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1194	11296.0	Feed constant numerator	UDINT
1195	11297.0	Feed constant denominator	UDINT
102901	13261.0	Pitch length (user defined)	REAL
102904	13262.0	Rated velocity linear (user defined)	REAL
102905	13263.0	Maximum velocity linear (user defined)	REAL
102906	13264.0	Maximum velocity fieldweakening linear (user defined)	REAL
102907	13265.0	Force constant (user defined)	REAL
102928	13266.0	Slide weight linear (user defined)	REAL
71432	11928.0	Motor type	USINT
718	11184.0	Pole pairs (user defined)	UDINT
7185	12594.0	Denominator pole pairs (user-defined)	UDINT
102903	4677.0	Encoder resolution	REAL
102908	4680.0	Enable linear measurement	BOOL

Tab. 233: Linear motor PNUs

3.3.2 Brake control

3.3.2.1 Function

The device has 1 switching output for direct connection of the holding brake in the motor.

Output	Port	Name in the plug-in	Description
BR+/BR–	X6	Holding brake 1	Motor holding brake

Tab. 234: Output for the brakes (holding brake)

The output is intended for the control of a brake that actuates when the system is in a non-energised status and to hold the motor or the axis in position.
The mechanical delay of the brakes means that it takes a certain length of time to release and activate them. The behaviour of the device can be adapted to the mechanical delay of the brake using parameters:

Parameters	Description
Switch-on delay	Delay in switching on the closed-loop controller until an order is accepted – The holding brake is not released until the controller is enabled. The closed-loop controller takes over the control (actual position = setpoint position). – No orders are processed until the switch-on delay has elapsed, so the holding brake can release completely. – After the switch-on delay has elapsed, orders are accepted.
Switch-off delay	Delay prior to shut-down of the closed-loop controller: – Removal of the controller enable triggers a category 1 stop. If the setpoint rotational speed is 0, the signal for closing the holding brake is given. – The drive is maintained in its current position until the switch-off delay has elapsed. – The closed-loop controller is switched off after the switch-off delay has elapsed.

Tab. 235: Switch-on and switch-off delay

Control of the brake

The device controls the output for the brake.

Control of the brake	
Event	Behaviour
#STO request	– The power stage is switched off immediately. – The outputs are switched off. The brakes are immediately actuated. – The device enters the “Not ready for operation” status. – An error message is emitted (error status). The error must be acknowledged. When the request is rescinded, the drive can be set to the "Ready for operation" status again via the controller enable.
The controller enable (RF) is rescinded	– Stop category 1 – If the setpoint velocity is 0, the outputs for the brakes are switched off. The brakes are actuated. – The closed-loop controller is switched off when the parameterised delay has elapsed to prevent unwanted movement of the drive.
The controller enable (RF) is granted	– The outputs are switched on to release the brakes (exception: force with brake operating mode). The brakes are released with a mechanical delay. – The position controller assumes the control (actual position = setpoint position). – The motion commands are not accepted until the parameterized delay has elapsed.

Tab. 236: Control of the brake

Manual release of the holding brake or clamping unit

If the controller release is withdrawn, the output is reset and the holding brake is actuated. The holding brake can be released manually in this status.

- When the brake is released manually, suspended loads generally drop.

Manual release by ...	Description
Open holding brake input (configurable)	The holding brake is released at a high level or low level depending on the parameterised switching function ➔ 3.3.2.2 Parameters and diagnostic messages.
Plug-in	➔ 2.4.1 Manual Movement
Device profile	➔ 3.3.2.3 CiA 402 ➔ 3.3.2.4 PROFIdrive

Tab. 237: Releasing the holding brake

When the closed-loop controller is released again, the output is controlled as required for the active operating mode. Rescinding the controller enable again will actuate the holding brakes ➔ Tab. 236 Control of the brake. In order to release the holding brake again, a new level change from low to high is required.

Timing

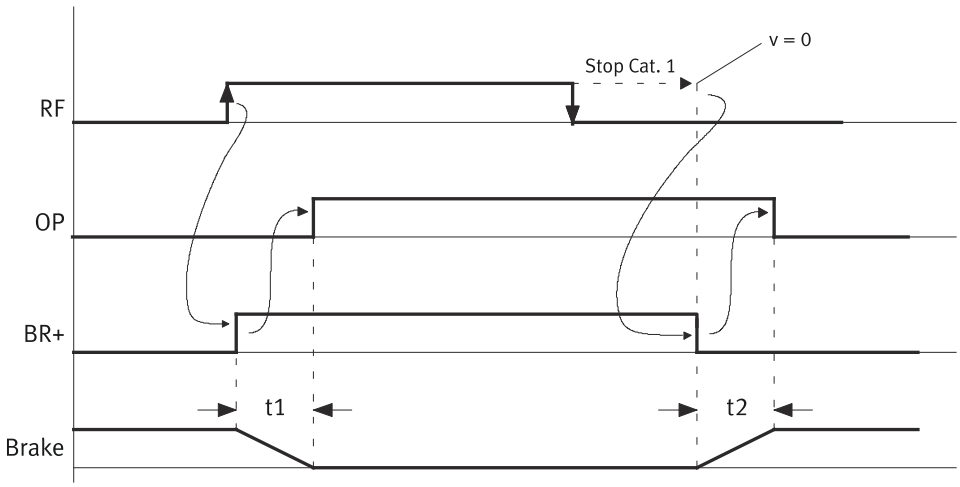


Fig. 33: Brake control timing (example)

Name	Description
RF	Controller enable signal
OP	Motion commands are accepted
BR+	Brake output
brake	Mechanical behaviour of brake (released and set)
t1	Delay time depending on the parameterised switch-on delay
t2	Delay time depending on the parameterised switch-off delay

Tab. 238: Legend for the brake control timing image (example)

Holding current reduction

The servo drive has a voltage reduction for the holding brake. The holding current reduction is activated with Px.40001.
If the function of the holding current reduction is not activated, the voltage from Px.40003 is output to open the holding brake.
If the function of the holding current reduction is activated, after the holding brake has been opened, the voltage is first output in Px.40003 and after a delay time of Px.40002 the voltage reduction is performed to the parameterised voltage value of Px.40004.

The voltages for the holding brake in Px.40003 and Px.40004 may not be higher than the logic supply voltage regardless of the parameterization.

3.3.2.2 Parameters and diagnostic messages

ID Px.	Parameter	Description	
20	Switch-on delay holding brake 1	Specifies how long the next command is delayed after a controller enable. No commands are processed until the switch-on delay has elapsed so that holding brake 1 can release completely. During initial commissioning, the presets are assumed from the motor data set. Using this parameter, the behaviour can be adapted to application-specific concerns.	
		Access	read/–
		Update	effective immediately
		Unit	s
21	Switch-off delay holding brake 1	Specifies how long the closed-loop controller shall hold the actual position so that the holding brake can be closed completely. The position controller is switched off after expiration of the switch-off delay. Holding brake 1 should then be completely closed. During initial commissioning, the presets are assumed from the motor data set. Using this parameter, the behaviour can be adapted to application-specific concerns.	
		Access	read/–
		Update	effective immediately
		Unit	s
24	Status holding brake 1	Specifies the status of the corresponding holding brake. Possible status ➔ Tab. 240 Holding brake status parameter values list.	
		Access	read/–
		Update	effective immediately
		Unit	–
29	Selection of holding brake	Selection of the holding brakes that are opened when the holding brake is opened and that are used for the automatic brake test. – 0: holding brake 1	
		Access	read/write
		Update	reinitialization
		Unit	–
7162	Switch-on delay holding brake 1 (user defined)	user-configured switch-on delay	
		Access	read/write

ID Px.	Parameter	Description	
7162	Switch-on delay holding brake 1 (user defined)	Update	reinitialization
		Unit	s
7165	Switch-off delay holding brake 1 (user defined)	user-configured switch-off delay	
		Access	read/write
		Update	reinitialization
		Unit	s
7163	Actual switch-on delay holding brake 1	Specifies the actual used switch-on delay of the holding brake.	
		Access	read/–
		Update	effective immediately
		Unit	s
7166	Actual switch-off delay holding brake 1	Specifies the actual effective delay for switching off the closed-loop control.	
		Access	read/–
		Update	effective immediately
		Unit	s
7161	Switch-on delay holding brake 1	Switch-on delay saved in the EEPROM for the execution of a command if an electronic data sheet for the Festo motor is stored.	
		Access	read/–
		Update	reinitialization
		Unit	s
7164	Switch-off delay holding brake 1	The delay saved in the EEPROM for the deactivation of the controller if an electronic data sheet for the Festo motor is stored.	
		Access	read/–
		Update	reinitialization
		Unit	s
40001	Activation current reduction holding brake	Activation current reduction holding brake	
		Access	read/write
		Update	effective immediately
		Unit	–
40002	Delay time	Specifies the time with which the current reduction for the holding brake is initiated.	
		Access	read/write
		Update	effective immediately
		Unit	s
40003	Supply voltage holding brake	Specifies the voltage supplied to the holding brake before current reduction is initiated. The voltage is only output if the current reduction for the holding brake is activated (Px.4026.0.0)	
		Access	read/write
		Update	effective immediately
		Unit	V
40004	Holding voltage	Specifies the voltage to which it is reduced after elapse of the delay time.	
		Access	read/write
		Update	effective immediately
		Unit	V

Tab. 239: Parameters

Value	Holding brake status	Description
0	Holding brake closed	The holding brake is closed.
1	Holding brake opened	The holding brake is open.

Value	Holding brake status	Description
2	Holding brake is opening	The holding brake is currently released.
3	Holding brake is closing	The holding brake is currently closed.

Tab. 240: Holding brake status parameter values list

Diagnostic messages No specific diagnostic messages are allocated to the function.

3.3.2.3 CiA 402

Holding brake objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
20	0x2150.01	Switch-on delay holding brake 1	REAL
21	0x2150.02	Switch-off delay holding brake 1	REAL
24	0x2150.05	Status holding brake 1	UDINT
29	0x2150.09	Selection of holding brake	UDINT
7162	0x216C.0F	Switch-on delay holding brake 1 (user defined)	REAL
7165	0x216C.10	Switch-off delay holding brake 1 (user defined)	REAL
7163	0x2162.12	Actual switch-on delay holding brake 1	REAL
7166	0x2162.13	Actual switch-off delay holding brake 1	REAL
7161	0x2106.2B ... 2C	Switch-on delay holding brake 1	REAL
7164	0x2106.2D ... 2E	Switch-off delay holding brake 1	REAL
40001	0x21A7.01	Activation current reduction holding brake	USINT
40002	0x21A7.02	Delay time	REAL
40003	0x21A7.03	Supply voltage holding brake	REAL
40004	0x21A7.04	Holding voltage	REAL

Tab. 241: Objects

3.3.2.4 PROFIdrive

Holding brake PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
20	11002.0	Switch-on delay holding brake 1	REAL
21	11003.0	Switch-off delay holding brake 1	REAL
24	11006.0	Status holding brake 1	UDINT
29	11011.0	Selection of holding brake	UDINT
7162	11716.0	Switch-on delay holding brake 1 (user defined)	REAL
7165	11718.0	Switch-off delay holding brake 1 (user defined)	REAL
7163	11717.0	Actual switch-on delay holding brake 1	REAL
7166	11719.0	Actual switch-off delay holding brake 1	REAL
7161	2755.0	Switch-on delay holding brake 1	REAL
7164	2757.0	Switch-off delay holding brake 1	REAL
40001	12409.0	Activation current reduction holding brake	BOOL
40002	12410.0	Delay time	REAL
40003	12411.0	Supply voltage holding brake	REAL
40004	12412.0	Holding voltage	REAL

Tab. 242: PNUs

3.3.3 Encoder configuration

3.3.3.1 Function

The Festo motor series has integrated encoders. If a Festo motor is used and configured with the device-specific plug-in, the required data for the encoder configuration is automatically imported to the project from the stored database with the selection of the motor.
The device has an encoder interface that supports different encoder protocols and standards.

Protocols and standards	Supported encoders
Digital incremental encoder (with differential A, B and N signals)	Digital incremental encoder (differential A, B, N-signals), e.g. ROD 426 or compatible
BiSS C protocol	Absolute encoders with BiSS interface that support the BiSS C protocol.

Tab. 243: Supported standards and protocols

3.3.3.2 Encoder, general

Encoder parameters and diagnostic messages

The parameters named below are used to configure which encoder is used. The parameters also show the currently used data of the configured encoder. The options for configuration and parameterisation of the encoder depend on the properties of the encoder.
The device provides configurable parameters from the parameter set and data from the EEPROM of the encoder if corresponding data can be found in the EEPROM. The data saved in the EEPROM are imported as active data during re-initialisation independently of parameter Px.14.0.0 ➔ Fig. 32.

Motor replacement monitoring

The CMMT performs a check in the switch-on phase as to whether the detected motor encoder corresponds with the last motor encoder used. If the CMMT detects a deviation, a diagnostic message is sent and the zero point offset is reset.
To ensure that a diagnostic message is not triggered in the switch-on phase, valid homing must be carried out for the active motor encoder and the parameter set must then be saved.
A compatible motor replacement can be activated via parameter P0.3236 in order to suppress the diagnostic message and the reset of the zero point offset when replacing the motor with a motor of identical design with electronic rating plate (EMMT series).
Requirement for the compatible engine exchange:
– The drive is referenced.
– The parameter Px.14 = FALSE.
– Motor of the EMMT series with multiturn encoder.
– The parameter Px.3237 must be set (permanently referenced) for motors of the EMMT series with a single-turn encoder.

ID Px.	Parameter	Description	
3219	Commutation angle from user configuration	Specifies the commutation angle saved in the parameter set. Parameter P0.3219.0.0 is responsible for the commutation angle on encoder channel 1 and parameter P0.3219.1.0 for the commutation angle on encoder channel 2 (device specific).	
		Access	read/write
		Update	reinitialization
		Unit	–

ID Px.	Parameter	Description	
3220	Actual commutation angle	Specifies the actual used commutation angle.	
		Access	read/–
		Update	effective immediately
		Unit	–
3221	Zero point offset from encoder memory	Specifies the zero point offset saved in the encoder.	
		Access	read/write
		Update	reinitialization
		Unit	r
3223	Zero point offset from user configuration	Specifies the zero point offset saved in the parameter set.	
		Access	read/write
		Update	reinitialization
		Unit	r
3224	Actual zero point offset	Specifies the actual used zero point offset	
		Access	read/–
		Update	effective immediately
		Unit	user defined
3225	Encoder referencing is valid	Displays whether the homing status saved in the encoder shall still be valid. This means: – 0: invalid – 1: valid	
		Access	read/–
		Update	reinitialization
		Unit	–
3226	Referencing in user configuration is valid	Specifies whether the homing status saved in the parameter set shall still be valid. This means: – 0: invalid – 1: valid	
		Access	read/write
		Update	reinitialization
		Unit	–
3227	Actual referencing is valid	Displays whether the actual homing status shall be valid. This means: – 0: invalid – 1: valid	
		Access	read/–
		Update	effective immediately
		Unit	–
3228	Valid commutation angle from encoder memory	Displays whether the commutation angle saved in the encoder shall be valid. This means: – 0: invalid – 1: valid	
		Access	read/–
		Update	reinitialization
		Unit	–
3229	Valid commutation angle from user configuration	Displays whether the commutation angle saved in the parameter set shall be valid. This means: – 0: invalid – 1: valid	
		Access	read/–
		Update	reinitialization

ID Px.	Parameter	Description	
3229	Valid commutation angle from user configuration	Unit	–
3230	Actual commutation angle valid	Displays whether the actual commutation status shall be valid. This means: – 0: invalid – 1: valid	
		Access	read/–
		Update	effective immediately
		Unit	–
3234	Electrical angular frequency filtered	Specifies the actual angular frequency as a filtered value.	
		Access	read/–
		Update	effective immediately
		Unit	Hz
3236	Activate compatible motor change	Specifies whether a compatible motor replacement should be activated. If the compatible motor change is activated, the motor change monitoring is switched off. Prerequisite for this is the presence of an electronic type plate on the motor and that the motor type must be identical.	
		Access	read/write
		Update	reinitialization
		Unit	–
3237	Encoder permanently homed	For single-turn encoders, determines whether the encoder shall indicate the "Homed" status after activation. For encoders that deliver the "Homed" status, a new homing run is not mandatory. This means: – 0: inactive – 1: active	
		Access	read/write
		Update	reinitialization
		Unit	–
3250	Activation automatic encoder detection	Specifies whether the automatic encoder detection shall be active. The automatic encoder detection attempts to detect the connected encoder in the switch-on phase. If the automatic encoder detection is active, various voltage levels are set automatically for the encoder supply in the switch-on phase. Long encoder lines can lead to the connected encoder not being detected at the defined voltage level and the connected encoder being destroyed at a higher supply voltage due to an increase in the voltage for an encoder type. This means: – 0: inactive – 1: active	
		Access	read/write
		Update	reinitialization
		Unit	–
3251	Selection gear ratio group	Specifies the gear ratio group of the encoder interface containing the gear ratio and feed constant. The gear ratio and feed constant can be set individually for each encoder. In the process, the gear ratio and feed constant are described by a numerator and denominator, respectively. The gear ratio indicates the transmission ratio between the drive side (numerator) and output side (denominator). The feed constant determines the ratio between a motor revolution and the feed in the user unit on the output. 3 gear ratio groups are available for selection ➔ Fig. 34	
		Access	read/write
		Update	reinitialization
		Unit	–
11600	Standardised encoder position	Specifies the 24 bit standardised position of the encoder. In case of an encoder with a resolution of 18 bits, the increments are multiplied at a factor of e.g.64 for standardisation. Encoder resolution of 18 bits: 262143 incr/rev	

ID Px.	Parameter	Description	
11600	Standardised encoder position	Access	read/–
		Update	effective immediately
		Unit	–
11601	Absolute position in user units	Display the position in the user units in relation to the axis zero point.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
11602	Actual Velocity in user units	Specifies the actual velocity in the user units.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
11603	Filtered velocity in user units	Specifies the filtered velocity in user units.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
11604	Electrical angle	Specifies the electrical angle of the encoder calculated from the number of pole pairs, the pole pitch and the offset.	
		Access	read/–
		Update	effective immediately
		Unit	–
11605	Electrical angular frequency	Specifies the electrical angular frequency of the encoder.	
		Access	read/–
		Update	effective immediately
		Unit	Hz
11608	Commutation angle from encoder memory	Specifies the commutation angle saved in the encoder.	
		Access	read/write
		Update	reinitialization
		Unit	–
11615	Actual position	Specifies the actual standardised position in increments related to the output shaft of the gear unit or drive shaft of the mechanism.	
		Access	read/–
		Update	effective immediately
		Unit	–
11616	Encoder selection	Specifies the encoder type set to which the encoder interface shall be set after the next reinitialisation. The selection of the encoder type can influence the amount of supply voltage provided for the encoder. Incorrect parameterisation can damage the connected encoder due to impermissibly high supply voltage! In case of EnDat and Hiperface encoders, this is prevented by protection mechanisms. Possible encoder types ➔ Tab. 246 Encoder selection values list (Px.11616).	
		Access	read/write
		Update	reinitialization
		Unit	–
11617	Active encoder	Specifies the encoder type actual configured for the encoder interface.	
		Access	read/–
		Update	effective immediately
		Unit	–
11618	Velocity filter filter time constant	Specifies the filter time constant of the velocity filter. The filter time constant prevents or dampen signal noise in the encoder signal.	

ID Px.	Parameter	Description	
11618	Velocity filter filter time constant	Access	read/write
		Update	effective immediately
		Unit	s
71500	Actual acceleration value unfiltered	Displays the actual value of the acceleration unfiltered	
		Access	read/–
		Update	effective immediately
		Unit	user defined
71501	Actual acceleration value filtered	Displays the actual value of the acceleration filtered	
		Access	read/–
		Update	effective immediately
		Unit	user defined
71502	Filter time constant acceleration filter	Specifies the filter time constant for the actual value acceleration filter	
		Access	read/write
		Update	effective immediately
		Unit	s

Tab. 244: Encoder parameters

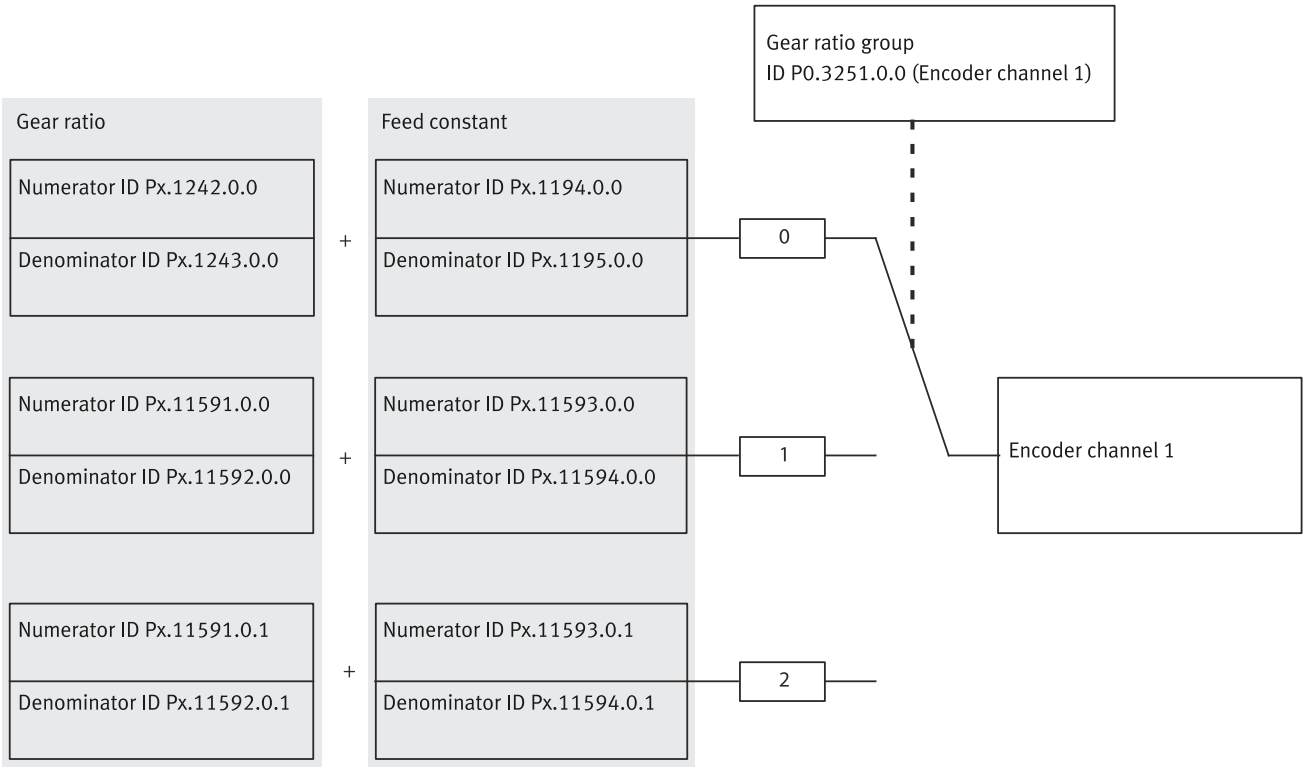


Fig. 34: Selection of the gear ratio and feed constant using the gear ratio group

Name	Description
Gear ratio	Gear ratio
Feed constant	Feed constant
Numerator	Numerator
Denominator	Denominator
Encoderchannel	Encoder channel

Tab. 245: Legend for selection of the gear ratio and feed constant

Value list of the encoder selection parameter (Px.11616)		
Value	Standards/loggers	Supported encoders
4	Incremental	digital incremental encoder (differential A, B and N signals), e.g. ROD 426 or compatible
7	Without encoder	none
8	BiSS-C	Absolute encoders with BiSS C protocol

Tab. 246: Encoder selection values list (Px.11616)

Example A motor with the incremental distance measuring system should be used.

Parameter settings (example)		
Parameters	Value	Comment
Encoder selection		
P0.11616.0.0	4	Instance 0 for encoder channel 1, encoder type: incremental encoder (A, B, N)

Tab. 247: Example: encoder selection

ID Dx.	Name	Description
18 | 00 | 00092 (301989980)	Motor change detected, commutation angle invalid	Motor change detected, commutation angle invalid
18 | 00 | 00093 (301989981)	Motor change detected, zero point offset invalid	Motor change detected, zero point offset invalid
18 | 00 | 00094 (301989982)	Commutation angle in encoder invalid	Commutation angle in encoder invalid
18 | 00 | 00095 (301989983)	Encoder type plate invalid	Encoder type plate invalid
18 | 00 | 00096 (301989984)	Encoder type plate (user defined) invalid	Encoder type plate (user defined) invalid
18 | 00 | 00227 (301990115)	Encoder identification reports incorrect encoder type	Encoder identification reports incorrect encoder type

Tab. 248: Encoder diagnostic messages

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Objects for encoder channels 1/2

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
3219	0x2130.20	Commutation angle from user configuration	LINT
3220	0x2130.21	Actual commutation angle	LINT
3221	0x2130.AC	Zero point offset from encoder memory	LINT
3223	0x2130.25	Zero point offset from user configuration	LINT
3224	0x2130.28	Actual zero point offset	LINT
3225	0x2130.29	Encoder referencing is valid	USINT
3226	0x2130.B0	Referencing in user configuration is valid	USINT
3227	0x2130.B1	Actual referencing is valid	USINT
3228	0x2130.30	Valid commutation angle from encoder memory	USINT
3229	0x2130.31	Valid commutation angle from user configuration	USINT
3230	0x2130.B4	Actual commutation angle valid	USINT
3234	0x2130.39	Electrical angular frequency filtered	REAL
3236	0x2130.B9	Activate compatible motor change	USINT
3237	0x2130.40	Encoder permanently homed	USINT
3250	0x2130.59	Activation automatic encoder detection	USINT
3251	0x2130.C8	Selection gear ratio group	USINT

Parameter	Index.Subindex	Name	Data type
11600	0x2130.C9	Standardised encoder position	LINT
11601	0x2130.60	Absolute position in user units	LINT
11602	0x2130.61	Actual Velocity in user units	REAL
11603	0x2130.CC	Filtered velocity in user units	REAL
11604	0x2130.CD	Electrical angle	UDINT
11605	0x2130.68	Electrical angular frequency	REAL
11608	0x2130.D1	Commutation angle from encoder memory	LINT
11615	0x2130.D8	Actual position	LINT
11616	0x2130.D9	Encoder selection	UDINT
11617	0x2130.80	Active encoder	UDINT
11618	0x2130.81	Velocity filter filter time constant	REAL
71500	0x2130.93	Actual acceleration value unfiltered	REAL
71501	0x2130.E5	Actual acceleration value filtered	REAL
71502	0x2130.98	Filter time constant acceleration filter	REAL

Tab. 249: Objects

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PNUs for encoder channels 1/2

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
3219	2408.0	Commutation angle from user configuration	LINT
3220	2410.0	Actual commutation angle	LINT
3221	2412.0	Zero point offset from encoder memory	LINT
3223	2414.0	Zero point offset from user configuration	LINT
3224	2416.0	Actual zero point offset	LINT
3225	2418.0	Encoder referencing is valid	BOOL
3226	2420.0	Referencing in user configuration is valid	BOOL
3227	2422.0	Actual referencing is valid	BOOL
3228	2424.0	Valid commutation angle from encoder memory	BOOL
3229	2426.0	Valid commutation angle from user configuration	BOOL
3230	2428.0	Actual commutation angle valid	BOOL
3234	2434.0	Electrical angular frequency filtered	REAL
3236	2438.0	Activate compatible motor change	BOOL
3237	2440.0	Encoder permanently homed	BOOL
3250	2466.0	Activation automatic encoder detection	BOOL
3251	2468.0	Selection gear ratio group	USINT
11600	2937.0	Standardised encoder position	LINT
11601	2939.0	Absolute position in user units	LINT
11602	2941.0	Actual Velocity in user units	REAL
11603	2943.0	Filtered velocity in user units	REAL
11604	2945.0	Electrical angle	UDINT
11605	2947.0	Electrical angular frequency	REAL
11608	2953.0	Commutation angle from encoder memory	LINT
11615	2967.0	Actual position	LINT
11616	2969.0	Encoder selection	UDINT
11617	2971.0	Active encoder	UDINT
11618	2973.0	Velocity filter filter time constant	REAL

Parameter	PNU	Name	Data type
71500	3073.0	Actual acceleration value unfiltered	REAL
71501	3075.0	Actual acceleration value filtered	REAL
71502	3077.0	Filter time constant acceleration filter	REAL

Tab. 250: PNUs

3.3.3.3 Digital incremental encoders (A, B and N signals)

Parameters for digital incremental encoders (A, B and N signals)

The device evaluates 4x incremental encoder signals.
The maximum encoder resolution that can be set via parameter Px.10040 is 65535 Inc/r. Alternatively, a higher encoder resolution of up to 18 Bit/r can be activated for every encoder instance via parameter Px.101502 and the resolution specified in parameter Px.101503 (maximum 262144). The resolution in parameter Px.10040 becomes inactive when the alternative resolution is activated.

ID Px.	Parameter	Description	
10040	Encoder resolution	Specifies the number of increments per encoder revolution. The parameter P0.10040.0.0 for the encoder at encoder interface 1, parameter P0.10040.1.0 for the encoder at encoder interface 2 (device-specific) and parameter P0.10040.2.0 for the slave input (device-specific).	
		Access	read/write
		Update	reinitialization
		Unit	Inc/r
10041	Raw value position	Specifies the raw position value delivered by the single-turn encoder in increments.	
		Access	read/–
		Update	effective immediately
		Unit	–
10042	Raw value number of revolutions	Specifies the raw value of the number of revolutions determined by the single-turn encoder.	
		Access	read/–
		Update	effective immediately
		Unit	–
101502	Activation of extended encoder resolution	Activates the extended encoder resolution for incremental encoders. Activation causes the parameter Px.101503 to be used for the encoder resolution instead of Px.10040.	
		Access	read/write
		Update	reinitialization
		Unit	–
101503	Extended encoder resolution	Specifies the extended encoder resolution. The parameter Px.101503 is used instead of Px.10040 for the extended encoder resolution. The maximum value is 262144 inc.	
		Access	read/write
		Update	reinitialization
		Unit	Inc/r
10053	Lower limit value encoder monitoring voltage	Lower limit value for the voltage of the encoder monitoring	
		Access	read/write
		Update	reinitialization
		Unit	V
10054	Maximum transverse mode voltage	Maximum permissible transverse mode voltage for the A/B track for encoder monitoring	
		Access	read/write
		Update	reinitialization
		Unit	V

ID Px.	Parameter	Description	
10051	Filter time constant quadrature evaluation	Filter time constant quadrature evaluation Value list: – 0: No filter – 1: Filter time 20ns – 2: Filter time 40ns – 3: Filter time 80ns (default) – 4: Filter time 160ns – 5: Filter time 320ns – 6: Filter time 640ns – 7: Filter time 1280ns – 8: Filter time 2560ns	
		Access	read/write
		Update	reinitialization
		Unit	–

Tab. 251: Parameters for digital incremental encoders (A, B and N signals)

ID Dx.	Name	Description
18 | 03 | 00235 (302186731)	Incremental encoder analysis invalid	Common error quadrature encoder

Tab. 252: Diagnostic messages for digital incremental encoders (A, B and N signals)

Example A motor with incremental displacement encoder is to be used (resolution 2000 inc/rev., quadrature evaluation, gear unit 3:1, feed constant = 90 mm/rev

Parameter settings (example)		
Parameters	Value	Comment
Encoder selection		
P0.11616.0.0	4	Instance 0 for encoder channel 1, encoder type: incremental encoder
Encoder resolution		
P0.10040.0.0	2000	A resolution of 2000 inc/rev means that there is an effective internal resolution of 8000 inc/rev.
Gear unit numerator		
P1.1242.0.0	3	Numerator of total gear unit ratio
Gear unit denominator		
P1.1243.0.0	1	Denominator of total gear unit ratio
Feed constant numerator		
P1.1194.0.0	9	0.09 m (corresponds to 9/100)
Feed constant denominator		
P1.1195.0.0	100	0.09 m (corresponds to 9/100)
Selection gear ratio group		
P0.3251.0.0	0	Gear ratio group 1 ➔ Fig. 34

Tab. 253: Example: encoder parameterisation

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Objects of digital incremental encoders (A, B and N signals)

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
10040	0x2138.01 ... 03	Encoder resolution	UINT
10041	0x2138.04 ... 06	Raw value position	UINT
10042	0x2138.07 ... 09	Raw value number of revolutions	INT
101502	0x2138.4F ... 51	Activation of extended encoder resolution	USINT

Parameter	Index.Subindex	Name	Data type
101503	0x2138.52 ... 54	Extended encoder resolution	UDINT
10053	0x2138.1F ... 21	Lower limit value encoder monitoring voltage	REAL
10054	0x2138.22 ... 24	Maximum transverse mode voltage	REAL
10051	0x2138.19	Filter time constant quadrature evaluation	UDINT

Tab. 254: Objects

PROFIdrive

PNUs for digital incremental encoders (A, B and N signals)

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
10040	2837.0	Encoder resolution	UINT
10041	2840.0	Raw value position	UINT
10042	2843.0	Raw value number of revolutions	INT
101502	4318.0	Activation of extended encoder resolution	BOOL
101503	4321.0	Extended encoder resolution	UDINT
10053	2867.0	Lower limit value encoder monitoring voltage	REAL
10054	2870.0	Maximum transverse mode voltage	REAL
10051	2861.0	Filter time constant quadrature evaluation	UDINT

Tab. 255: PNUs

3.3.3.4 BiSS-C

Parameters for encoders with the BiSS C protocol

The following baud rates are supported: 1.5 MHz, 3 MHz, 6 MHz, 12 MHz.
Note: the parameters for activating a correction table and extended encoder data are reserved for future functions.

ID Px.	Parameter	Description	
3601	Resolution single turn	Specifies the resolution in bits per revolution.	
		Access	read/write
		Update	reinitialization
		Unit	–
3602	Resolution multi-turn	Specifies the number of bits for the distinguishable revolutions of the multi-turn scanning of the encoder.	
		Access	read/write
		Update	reinitialization
		Unit	–
3603	Single-turn position	Specifies the actual position of the singleturn scanning of the encoder.	
		Access	read/–
		Update	effective immediately
		Unit	–
3604	Multi-turn numerator	Specifies the actual position of the multi-turn scanning of the encoder.	
		Access	read/–
		Update	effective immediately
		Unit	–
3612	Baud rate	Specifies the baud rate at which the encoder data is transmitted. The following baud rates are supported: 1.5 MHz, 3 MHz, 6 MHz and 12 MHz.	
		Access	read/write

ID Px.	Parameter	Description	
3612	Baud rate	Update	reinitialization
		Unit	–
3613	Activation of correction table	Specifies whether the correction table of the encoder is used. This means: – 0: inactive – 1: active	
		Access	read/write
		Update	effective immediately
		Unit	–
3618	Activation read out extended encoder data	Specifies whether the extended encoder data of the encoder should be used. This means: – 0: inactive – 1: active	
		Access	read/write
		Update	reinitialization
		Unit	–

Tab. 256: Parameters for encoders with the BiSS C protocol

ID Dx.	Name	Description
18 | 05 | 00239 (302317807)	BiSS-C encoder analysis invalid	Check the wiring of the encoder and the position resolution of the BiSS-C protocol.
18 | 05 | 00633 (302318201)	BiSS-C Timeout communication	The actual baud rate is too low for the encoder resolution
18 | 05 | 00812 (302318380)	BiSS-C encoder error	BiSS-C encoder error
18 | 05 | 00813 (302318381)	BiSS-C encoder warning	BiSS-C encoder warning

Tab. 257: Diagnostic messages for encoders with BiSS-C protocol

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Objects for encoders with the BiSS-C protocol

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
3601	0x21A2.01	Resolution single turn	UDINT
3602	0x21A2.02	Resolution multi-turn	UDINT
3603	0x21A2.03	Single-turn position	UDINT
3604	0x21A2.04	Multi-turn numerator	UDINT
3612	0x21A2.0C	Baud rate	UDINT
3613	0x21A2.0D	Activation of correction table	USINT
3618	0x21A2.0E	Activation read out extended encoder data	USINT

Tab. 258: Objects

PROFIdrive

PNUs for encoders with BiSS

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
3601	3327.0	Resolution single turn	UDINT
3602	3328.0	Resolution multi-turn	UDINT
3603	3329.0	Single-turn position	UDINT
3604	3330.0	Multi-turn numerator	UDINT

Parameter	PNU	Name	Data type
3612	3338.0	Baud rate	UDINT
3613	3339.0	Activation of correction table	BOOL
3618	3343.0	Activation read out extended encoder data	BOOL

Tab. 259: PNUs

3.3.3.5 Actual value management

Parameters of actual value management

ID Px.	Parameter	Description	
122	Selection encoder channel 1 position	Specifies the encoder interface to which the encoder is connection whose values shall be evaluated by the positional controller. 0 for encoder interface 1 (primary encoder) at connection [X2] and 1 for encoder interface 2 (secondary encoder) at connection [X3] (device specific).	
		Access	read/write
		Update	reinitialization
		Unit	–
128	Actual position value encoder channel 1	Specifies the actual position value of the primary encoder.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
1210	Actual velocity value encoder channel 1	Specifies the velocity measured by the primary encoder.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
1212	Electrical angle	Specifies the electrical angle used by the commutation.	
		Access	read/–
		Update	effective immediately
		Unit	–
1213	Electrical angular frequency	Specifies the electrical angular frequency used by the commutation.	
		Access	read/–
		Update	effective immediately
		Unit	Hz
113104	Actual value modulo	Actual value based on the modulo limits	
		Access	read/–
		Update	effective immediately
		Unit	user defined

Tab. 260: Parameters of actual value management

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Objects of the actual value management

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
128	0x60E4.01	Actual position value encoder channel 1	DINT
1210	0x606C.00	Actual velocity value encoder channel 1	DINT
113104	0x6064.00	Actual value modulo	DINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
122	0x2155.03	Selection encoder channel 1 position	UDINT
128	0x2155.09	Actual position value encoder channel 1	LINT

Parameter	Index.Subindex	Name	Data type
1210	0x2155.0B	Actual velocity value encoder channel 1	REAL
1212	0x2155.0D	Electrical angle	UDINT
1213	0x2155.0E	Electrical angular frequency	REAL
113104	0x2197.05	Actual value modulo	LINT

Tab. 261: Objects

PROFIdrive

PNUs of actual value management

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value encoder channel 1	INT
Px.	**Manufacturer-specific parameters**		
122	11061.0	Selection encoder channel 1 position	UDINT
128	11067.0	Actual position value encoder channel 1	LINT
1210	11311.0	Actual velocity value encoder channel 1	REAL
1212	11313.0	Electrical angle	UDINT
1213	11314.0	Electrical angular frequency	REAL

Tab. 262: PNUs

3.3.3.6 Direction of rotation manager

Parameters of direction of rotation manager

The following parameters influence the direction of rotation of the drive:

ID Px.	Parameter	Description	
1170	Reversing direction of motion	Specifies whether the reversal of the direction of motion shall be activated. This means: – 0: inactive – 1: active	
		Access	read/write
		Update	reinitialization
		Unit	–
1171	Invert encoder signal	Specifies whether the encoder signal shall be inverted. This means: – 0: inactive (do not invert the encoder signal) – 1: active (invert the encoder signal) One encoder is allocated to every index ➔ Tab. 264 Index to the invert encoder signal parameter (Px.1171)	
		Access	read/write
		Update	reinitialization
		Unit	–
1172	Phase rotation	Specifies whether the sequence of phases is swapped. The usual phase sequence for the servomotor to turn clockwise is ascending (U, V, W). If the servomotor has the phase sequence U, W, V, the phase sequence is reversed. 0 for the phase sequence U, V, W and 1 for the phase sequence U, W, V. For a stepper motor, the phase sequence for 0 is the assignment A-#A and B-#B. For the phase sequence equal to 1, the assignment A-#A and #B-B is. Changing the phase sequence changes the rotating field of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	–

Tab. 263: Parameters of direction of rotation manager

Index to the invert encoder signal parameter (Px.1171.0.x)	
Index	Allocation
0	Encoder at connection [X2]
1	Parameters available for future extensions
...	
8	
9	

Tab. 264: Index to the invert encoder signal parameter (Px.1171)

CiA 402

Objects of direction of rotation manager

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
1170	0x607E.00	Reversing direction of motion	USINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1170	0x217D.01	Reversing direction of motion	USINT
1171	0x226E.01 ... 03	Invert encoder signal	USINT
1172	0x217D.02	Phase rotation	USINT

Tab. 265: Objects

PROFIdrive

PNUs of direction of rotation manager

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1170	11287.0	Reversing direction of motion	BOOL
1171	11288.0 ... 2	Invert encoder signal	BOOL
1172	11289.0	Phase rotation	BOOL

Tab. 266: PNUs

3.3.3.7 Commutation-angle detection

Parameters of the commutation-angle detection

Depending on the type of motor and the installed encoder, the commutation angle can be read from the encoder or the commutation angle must be calculated by a process of detecting the commutation angle.
If a valid commutation angle was not found in the current data record and the commutation angle detection mode is set to "automatic", the commutation angle is automatically detected once at the first controller enable (Px.668 = 1).
Parameter Px.14 influences the origin of the current commutation angle (P0.3220).

Motor	Px.14 = true Motor data from the user configuration	Px.14 = false Motor data from the EEPROM of the encoder
EMMT-ST	Commutation angle is detected and stored in P0.3219	Commutation angle from encoder memory (P0.11608)
EMMT-EC	Commutation angle is detected and stored in P0.3219	Commutation angle from encoder memory (P0.11608)
EMMB-ST	Commutation angle is detected and stored in P0.3219	Commutation angle from encoder memory (P0.11608)

Motor	Px.14 = true Motor data from the user configuration	Px.14 = false Motor data from the EEPROM of the encoder
EMMS-ST	Commutation angle is detected and stored in P0.3219	not supported
User-defined motor	Commutation angle is detected and stored in P0.3219	not supported

Tab. 267: Source for the current commutation angle (P0.3220)

When reconfiguring via the plug-in the settings for determining the commutation angle for Festo motors are made automatically.

Digital incremental encoders do not provide an absolute position on one revolution. With these encoders, the commutation angle is detected once at the first controller enable. If a commutation-angle detection is required, the friction of the drive system must not be too high. The motor shaft should be freely rotating during the commutation- angle detection.
When the commutation-angle detection is started, the drive is moved to the magnetic zero position. A reactive current is injected for this purpose (Px.270). The reactive current should not be higher than the minimum from the maximum values of the motor or servo drive (Px.624).
The drive then begins to move in the positive direction around the magnetic zero position at the parameterised increment (Px.664) for 2 * increments and then in the negative direction for 3 * increments. The increment is specified as the electrical angle, e.g. 90°. For a motor with a pole pair number of 5, there is a mechanical movement at the output of 0.05 revolutions. If the expected position change is outside the monitoring window, a second attempt is made to run the drive freely. If the expected position change is exceeded again, an error message is returned (Px.6693).
The commutation angle detection is strongly influenced by the dynamic values and the waiting time for the position check. In the event of an error, the dynamic values should be reduced and the waiting time increased.
After successful detection of the commutation angle, the parameter set must be saved on the device.

ID Px.	Parameters	Description	
270	Setpoint value reactive current	Setpoint value of the reactive current	
		Access	read/write
		Update	effective immediately
		Unit	Arms
660	Status of state machine commutation finding	Specifies the status of the state machine of the commutation-angle detection.	
		Access	read/–
		Update	effective immediately
		Unit	–
661	Commutation finding status	Specifies the status of the commutation-angle detection.	
		Access	read/–
		Update	effective immediately
		Unit	–
662	Time current increase	Specifies the time duration of the current rise ramp for the commutation-angle detection.	
		Access	read/write

ID Px.	Parameters	Description	
662	Time current increase	Update	effective immediately
		Unit	s
664	Electrical Increment	Specifies the electrical increment for the commutation-angle detection. (Unit: electrical angle)	
		Access	read/write
		Update	effective immediately
		Unit	–
668	Mode	Specifies the mode of the commutation-angle detection. This means: – Always (0): always carry out commutation-angle detection with every controller enable. – Automatic (1): check once for the first controller enable whether there is a valid commutation angle. – From (2): no commutation angle detection; error message if there is no valid commutation angle.	
		Access	read/write
		Update	effective immediately
		Unit	–
669	Velocity	Specifies the set velocity for the commutation-angle detection.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
6691	Acceleration	Specifies the set acceleration for the commutation-angle detection.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
6692	Jerk	Specifies the set jerk for the commutation-angle detection.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
6693	Monitoring window angle	Specifies the size of the window for monitoring the commutation-angle detection. (Unit: electrical angle)	
		Access	read/write
		Update	effective immediately
		Unit	–
6694	Factor current setpoint value	Specifies the factor for the current setpoint used for the commutation angle determination.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 268: Parameters of the commutation-angle detection

ID Dx.	Name	Description
07 | 04 | 00136 (117702792)	Commutation finding failed	Commutation finding failed
07 | 04 | 00137 (117702793)	Commutation finding direction error	An error has occurred during the commutation angle search, the direction of rotation of the motor does not correlate with the position from the encoder.

Tab. 269: Diagnostic messages for the commutation-angle detection

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Objects of the commutation-angle detection

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
660	0x216B.01	Status of state machine commutation finding	UDINT
661	0x216B.02	Commutation finding status	UDINT
662	0x219C.03	Time current increase	REAL
664	0x216B.04	Electrical Increment	REAL
668	0x216B.06	Mode	UDINT
669	0x216B.07	Velocity	REAL
6691	0x216B.0A	Acceleration	REAL
6692	0x216B.0B	Jerk	REAL
6693	0x216B.0C	Monitoring window angle	REAL
6694	0x219C.14	Factor current setpoint value	REAL

Tab. 270: Objects

PROFIdrive

PNUs for commutation-angle detection

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
660	11177.0	Status of state machine commutation finding	UDINT
661	11178.0	Commutation finding status	UDINT
662	11179.0	Time current increase	REAL
664	11180.0	Electrical Increment	REAL
668	11182.0	Mode	UDINT
669	11183.0	Velocity	REAL
6691	11682.0	Acceleration	REAL
6692	11683.0	Jerk	REAL
6693	11684.0	Monitoring window angle	REAL
6694	11685.0	Factor current setpoint value	REAL

Tab. 271: PNUs

3.3.3.8 Replacing motors without an electronic datasheet

Encoders with BiSS-C have a communication interface. If a motor is used with such an encoder, the CMMT checks whether the motor with which the homing and zero point offset were performed is still connected during the switch-on phase. If the motor was replaced, the CMMT generates a corresponding error message.
The replacement of the motor requires another homing run because the zero point offset in the encoder is labelled as invalid.

After replacement of the motor

1. Check the configuration and parameterisation of the motor.
2. Reset the error message.
3. Perform homing again.
4. Save zero point offset in the device, e.g. using the device-specific plug-in (‘Control’ context, ‘Save Zero Point Offset’ command or in the toolbar section with the ‘Store on Device’ command).

Diagnostic messages

ID Dx.	Name	Description
18 | 00 | 00092 (301989980)	Motor change detected, commutation angle invalid	Motor change detected, commutation angle invalid
18 | 00 | 00093 (301989981)	Motor change detected, zero point offset invalid	Motor change detected, zero point offset invalid

Tab. 272: Diagnostic messages

3.3.4 Gear unit

3.3.4.1 Function

The device supports the use of several gear units within a drive chain. The correct transmission ratio for each gear unit used must be specified during configuration. The transmission ratio is specified using the gear ratio. The gear ratio consists of a numerator and denominator. The numerator indicates the number of revolutions on the drive side of the gear unit and the denominator indicates the number of resulting revolutions on the output side of the gear unit.

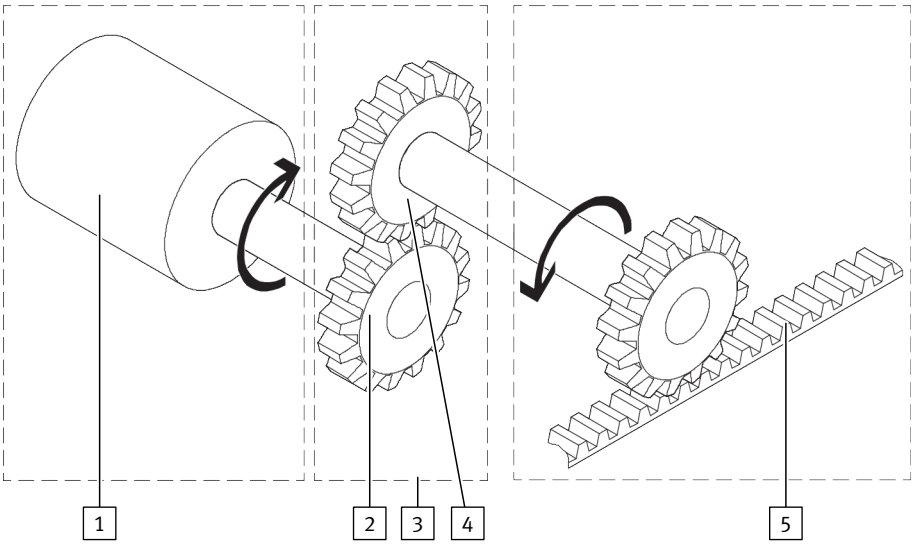


Fig. 35: Gear ratio (example)

1 Motor shaft
2 Drive side
3 Gear unit
4 Output side
5 Axis

Parameters of gear ratio groups 0, 1, 2

The device offers 3 gear ratio groups. A gear ratio and a feed constant can be set for each gear ratio group.

The feed constant for linear drives is always interpreted in meters/revolution in the firmware.

Parameter P0.3251.x.0 can be used to define which gear ratio group shall be used for the respective encoder interface ➔ Fig. 34. The gear ratio and feed constant can therefore be set individually for the encoder interface.
The total transfer factor of the gear denominator and numerator can be extended to 32 bits for gear factor group 0 with parameter Px.101905. The expansion is only allowed for rotary user units.
The following parameters form gear ratio group 0:

ID Px.	Parameter	Description	
1242	Total conversion factor gear unit numerator	Specifies the numerator of the total transmission factor (output side). Only values smaller than 14 bits are permitted. The parameter Px.101905 can be used to make the complete 31 bits available for rotary applications.	
		Access	read/write
		Update	reinitialization
		Unit	–
1243	Total conversion factor gear unit denominator	Specifies the denominator of the total transmission factor (drive side). Only values smaller than 14 bits are permitted. The parameter Px.101905 can be used to make the complete 31 bits available for rotary applications.	
		Access	read/write
		Update	reinitialization
		Unit	–
1194	Feed constant numerator	Specifies the numerator of the feed constant (data type UINT32). Only values less than 17 bits are valid.	
		Access	read/write
		Update	reinitialization
		Unit	–
1195	Feed constant denominator	Specifies the denominator of the feed constant (data type UINT32). Only values less than 17 bits are valid.	
		Access	read/write
		Update	reinitialization
		Unit	–
101905	Activation of extended gear ratio	Activation of the extended gear ratio to 31 bits. Activation is only permitted for rotative user units.	
		Access	read/write
		Update	reinitialization
		Unit	–

Tab. 273: Parameters for gear ratio group 0

The following parameters form gear ratio group 1 and 2:

ID Px.	Parameter	Description	
11591	Denominator gear unit (user defined)	Specifies the denominator of the gear ratio for the user-defined gear unit (output side). Only values less than 14 bits are valid. Index 0: gear ratio group 1 Index 1: gear ratio group 2	
		Access	read/write
		Update	reinitialization
		Unit	–
11592	Numerator gear unit (user defined)	Specifies the numerator of the gear ratio for the user-defined gear unit (drive side). Only values less than 14 bits are valid. Index 0: gear ratio group 1 Index 1: gear ratio group 2	
		Access	read/write
		Update	reinitialization
		Unit	–
11593	Numerator feed constant (user defined)	Specifies the numerator of the user-defined feed constant (data type UINT32). Only values less than 17 bits are valid. Index 0: gear ratio group 1 Index 1: gear ratio group 2	
		Access	read/write
		Update	reinitialization

ID Px.	Parameter	Description	
11593	Numerator feed constant (user defined)	Unit	–
11594	Denominator feed constant (user defined)	Specifies the denominator of the user-defined feed constant (data type UINT32). Only values less than 17 bits are valid. Index 0: gear ratio group 1 Index 1: gear ratio group 2	
		Access	read/write
		Update	reinitialization
		Unit	–

Tab. 274: Parameters of gear ratio groups 1 and 2

Parameters from the drive configuration

If a drive was configured using the plug-in, the parameters named in the following table are imported from the drive configuration. The plug-in calculates from the transmission ratio of the mounting kit (Px.101215 and Px.101216) and gear units 1 to 3 (Px.1232, Px.1233, Px.1236, Px.1237, Px.1240 and Px.1241) the numerator and denominator of the total transmission factor of the gear ratio group 0 (Px.1242, Px.1243).
The gear ratio of the selected gear ratio group is relevant for the closed-loop controller ➔ Fig. 34.
If gear ratio group 0 is selected, Px.1242 and Px.1243 parameters calculated by the plug-in can be changed as required. The change has no influence on the abovementioned parameters from the drive configuration (Px.1232, Px.1233, etc.).

ID Px.	Parameter	Description	
1230	Database ID gear unit 1	Specifies the database ID of the first gear unit.	
		Access	read/write
		Update	effective immediately
		Unit	–
1231	Order code gear unit 1	Specifies the order code of the first configured gear unit.	
		Access	read/write
		Update	effective immediately
		Unit	–
1232	Conversion factor gear unit 1 numerator	Specifies the numerator of the gear ratio for the first gear unit (drive side).	
		Access	read/write
		Update	effective immediately
		Unit	–
1233	Conversion factor gear unit 1 denominator	Specifies the denominator of the gear ratio for the first gear unit (output side).	
		Access	read/write
		Update	effective immediately
		Unit	–
1234	Database ID gear unit 2	Specifies the database ID of the second gear unit.	
		Access	read/write
		Update	effective immediately
		Unit	–
1235	Order code gear unit 2	Specifies the order code of the second configured gear unit.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
1236	Conversion factor gear unit 2 numerator	Specifies the numerator of the gear ratio for the second gear unit (drive side).	
		Access	read/write
		Update	effective immediately
		Unit	–
1237	Conversion factor gear unit 2 denominator	Specifies the numerator of the gear ratio for the second gear unit (output side).	
		Access	read/write
		Update	effective immediately
		Unit	–
1238	Database ID gear unit 3	Specifies the database ID of the third gear unit.	
		Access	read/write
		Update	effective immediately
		Unit	–
1239	Order code gear unit 3	Specifies the order code of the third configured gear unit.	
		Access	read/write
		Update	effective immediately
		Unit	–
1240	Conversion factor gear unit 3 numerator	Specifies the numerator of the gear ratio for the third gear unit (drive side).	
		Access	read/write
		Update	effective immediately
		Unit	–
1241	Conversion factor gear unit 3 denominator	Specifies the denominator of the gear ratio for the third gear unit (output side).	
		Access	read/write
		Update	effective immediately
		Unit	–
101215	Conversion factor gear unit 4 numerator	Specifies the numerator of the gear ratio for the drive-internal gear unit (drive side).	
		Access	read/write
		Update	effective immediately
		Unit	–
101216	Conversion factor gear unit 4 denominator	Specifies the denominator of the gear ratio for the drive-internal gear unit (output side).	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 275: Parameters from the drive configuration

3.3.4.2 CiA 402

Objects of gear ratio group 0

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
1242	0x60E8.01	Total conversion factor gear unit numerator	UDINT
1243	0x60ED.01	Total conversion factor gear unit denominator	UDINT
1194	0x60E9.01	Feed constant numerator	UDINT
1195	0x60EE.01	Feed constant denominator	UDINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1242	0x2182.0D	Total conversion factor gear unit numerator	UDINT
1243	0x2182.0E	Total conversion factor gear unit denominator	UDINT
1194	0x217E.04	Feed constant numerator	UDINT

Parameter	Index.Subindex	Name	Data type
1195	0x217E.05	Feed constant denominator	UDINT
101905	0x2182.12	Activation of extended gear ratio	USINT

Tab. 276: Objects

Objects of gear ratio groups 1 and 2

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
11591	0x60E8.02 ... 03	Denominator gear unit (user defined)	UDINT
11592	0x60ED.02 ... 03	Numerator gear unit (user defined)	UDINT
11593	0x60E9.02 ... 03	Numerator feed constant (user defined)	UDINT
11594	0x60EE.02 ... 03	Denominator feed constant (user defined)	UDINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
11591	0x226A.01 ... 02	Denominator gear unit (user defined)	UDINT
11592	0x226B.01 ... 02	Numerator gear unit (user defined)	UDINT
11593	0x226C.01 ... 02	Numerator feed constant (user defined)	UDINT
11594	0x226D.01 ... 02	Denominator feed constant (user defined)	UDINT

Tab. 277: Objects

Objects of the gear units from the drive configuration

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1230	0x2182.01	Database ID gear unit 1	UDINT
1231	0x2182.02	Order code gear unit 1	STRING(37)
1232	0x2182.03	Conversion factor gear unit 1 numerator	UDINT
1233	0x2182.04	Conversion factor gear unit 1 denominator	UDINT
1234	0x2182.05	Database ID gear unit 2	UDINT
1235	0x2182.06	Order code gear unit 2	STRING(37)
1236	0x2182.07	Conversion factor gear unit 2 numerator	UDINT
1237	0x2182.08	Conversion factor gear unit 2 denominator	UDINT
1238	0x2182.09	Database ID gear unit 3	UDINT
1239	0x2182.0A	Order code gear unit 3	STRING(37)
1240	0x2182.0B	Conversion factor gear unit 3 numerator	UDINT
1241	0x2182.0C	Conversion factor gear unit 3 denominator	UDINT
101215	0x2182.10	Conversion factor gear unit 4 numerator	UDINT
101216	0x2182.11	Conversion factor gear unit 4 denominator	UDINT

Tab. 278: Objects

3.3.4.3 PROFIdrive

PNUs for gear ratio group 0

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1242	11329.0	Total conversion factor gear unit numerator	UDINT
1243	11330.0	Total conversion factor gear unit denominator	UDINT
1194	11296.0	Feed constant numerator	UDINT
1195	11297.0	Feed constant denominator	UDINT
101905	13021.0	Activation of extended gear ratio	BOOL

Tab. 279: PNUs

PNUs for gear ratio groups 1 and 2

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
11591	11830.0 ... 1	Denominator gear unit (user defined)	UDINT
11592	11831.0 ... 1	Numerator gear unit (user defined)	UDINT
11593	11832.0 ... 1	Numerator feed constant (user defined)	UDINT
11594	11833.0 ... 1	Denominator feed constant (user defined)	UDINT

Tab. 280: PNUs

PNUs of gear units from the drive configuration

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1230	11317.0	Database ID gear unit 1	UDINT
1231	11318.0 ... 36	Order code gear unit 1	STRING(37)
1232	11319.0	Conversion factor gear unit 1 numerator	UDINT
1233	11320.0	Conversion factor gear unit 1 denominator	UDINT
1234	11321.0	Database ID gear unit 2	UDINT
1235	11322.0 ... 36	Order code gear unit 2	STRING(37)
1236	11323.0	Conversion factor gear unit 2 numerator	UDINT
1237	11324.0	Conversion factor gear unit 2 denominator	UDINT
1238	11325.0	Database ID gear unit 3	UDINT
1239	11326.0 ... 36	Order code gear unit 3	STRING(37)
1240	11327.0	Conversion factor gear unit 3 numerator	UDINT
1241	11328.0	Conversion factor gear unit 3 denominator	UDINT
101215	12683.0	Conversion factor gear unit 4 numerator	UDINT
101216	12684.0	Conversion factor gear unit 4 denominator	UDINT

Tab. 281: PNUs

3.3.5 Axis assembly

The device supports the use of individual axes and parallel axes. Certain toothed belt axes can be configured in the axis configuration as 2 axes arranged in parallel. One of the two parallel axes is then the drive axis. The second axis is either a driven parallel axis or a mechanically coupled guide axis.
The structure of the axis is defined via parameter Px.1197. The selected axis configuration influences the controller design by the plug-in.

Parallel axes	Description
Guide axis	The slide of the parallel guide axis follows the movements of the drive axis via the mechanical coupling.
With powered parallel axis	The parallel axis is coupled to the drive axis via a connecting shaft. The addition of the parallel axis doubles the maximum drive torque of the axis (Px.1199).

Tab. 282: Parallel axes

Parameters and diagnostic messages

ID Px.	Parameter	Description	
1197	Design axis	Design of the axis	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
1198	Length connecting shaft	Length of connecting shaft	
		Access	read/write
		Update	effective immediately
		Unit	–
1199	Maximum driving torque axis	Specifies the maximum driving torque of the axis.	
		Access	read/write
		Update	reinitialization
		Unit	Nm
100835	Inertia connecting shaft	Specifies the inertia of the connecting shaft.	
		Access	read/write
		Update	effective immediately
		Unit	kgm²

Tab. 283: Parameter

3.3.5.1 CiA 402

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1197	0x217E.07	Design axis	UDINT
1198	0x217E.08	Length connecting shaft	REAL
1199	0x217E.09	Maximum driving torque axis	REAL
100835	0x217E.0C	Inertia connecting shaft	REAL

Tab. 284: Objects

3.3.5.2 PROFIdrive

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1197	11299.0	Design axis	UDINT
1198	11300.0	Length connecting shaft	REAL
1199	11301.0	Maximum driving torque axis	REAL
100835	12682.0	Inertia connecting shaft	REAL

Tab. 285: PNUs

3.3.6 Digital inputs and outputs

3.3.6.1 Function

The function of these digital inputs and outputs can be parameterised. The signals at the digital inputs trigger the parameterised function (e.g. “Release holding brake”). The signals at the digital outputs map the parameterised signal (e.g. “Target reached”).
The status of the inputs and outputs of the [X1A] and [X1C] interfaces is mapped to the Px.10151 and Px.10152 parameters. The status of the inputs and outputs can be recorded by recording the parameters with the measuring data recording (trace).

Parameters and diagnostic Messages

ID Px.	Parameter	Description	
10151	Device interface X1A status	Status of the device interface X1A Assignment of the status word ➔ Tab. 287 Assignment of the status word of device interface X1A, CMMT-ST.	
		Access	read/–
		Update	effective immediately
		Unit	–
10152	Device interface X1C status	Status of the device interface X1C Assignment of the status word ➔ Tab. 288 Assignment of the status word of device interface X1C, CMMT-ST.	
		Access	read/–
		Update	effective immediately
		Unit	–
10153	Internal interface status	Status of the internal interface Assignment of the status word ➔ Tab. 289 Assignment of the status word of the internal interface, CMMT-ST.	
		Access	read/–
		Update	effective immediately
		Unit	–
11201	Digital input X1A.7	Specifies the function of the digital input signal at connection X1A.7. Possible functions ➔ Tab. 290 Configurable input signals at X1A.7 and X1A.8, CMMT-ST.	
		Access	read/write
		Update	reinitialization
		Unit	–
11202	Digital input X1A.8	Specifies the function of the digital input signal at connection X1A.8. Possible functions ➔ Tab. 290 Configurable input signals at X1A.7 and X1A.8, CMMT-ST.	
		Access	read/write
		Update	reinitialization
		Unit	–
11203	Digital output X1A.9	Specifies the function of the digital output signal at connection X1A.9. Possible signals ➔ Tab. 293 Configurable output signals at X1A.9 and X1A.10, CMMT-ST.	
		Access	read/write
		Update	reinitialization
		Unit	–
11204	Digital output X1A.10	Specifies the function of the digital output signal at connection X1A.10. Possible signals ➔ Tab. 293 Configurable output signals at X1A.9 and X1A.10, CMMT-ST.	
		Access	read/write
		Update	reinitialization
		Unit	–
11205	Digital input X1C.2	Specifies the function of the digital input signal at connection X1C.2. Possible signals ➔ Tab. 291 Configurable input signals at X1C.2, CMMT-ST.	
		Access	read/write
		Update	reinitialization
		Unit	–
101200	Reference switch configuration	Specifies the configuration of the reference switch. Possible switching functions ➔ Tab. 292 Switching function of the reference switch, CMMT-AS/ST.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
1128052	Digital inputs CiA402	Digital input image CiA402	
		Access	read/–
		Update	effective immediately
		Unit	–
1128054	Digital outputs CiA402	Digital output image CiA402	
		Access	read/write
		Update	effective immediately
		Unit	–
1128055	Bit mask digital outputs CiA402	Bit mask for digital outputs CiA402	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 286: Parameters, CMMT-ST

Parameter Device interface X1A status Px.10151			
Bit	Signal name	Brief description	Description
0	X1A.6	CTRL-EN	Power stage enable/acknowledge error
1	X1A.7	Base in 01	configurable input ➔ Tab. 290 Configurable input signals at X1A.7 and X1A.8, CMMT-ST
2	X1A.8	Base in 02	configurable input ➔ Tab. 290 Configurable input signals at X1A.7 and X1A.8, CMMT-ST
3	X1A.9	Base Out 01	configurable output ➔ Tab. 293 Configurable output signals at X1A.9 and X1A.10, CMMT-ST
4	X1A.10	Base Out 02	configurable output ➔ Tab. 293 Configurable output signals at X1A.9 and X1A.10, CMMT-ST

Tab. 287: Assignment of the status word of device interface X1A, CMMT-ST

Parameter Device interface X1C status Px.10152			
Bit	Signal name	Brief description	Description
0	X1C.2	REF/IN	Reference signal/limit switch signal

Tab. 288: Assignment of the status word of device interface X1C, CMMT-ST

Parameter Internal interface status Px.10153			
Bit	Signal name	Brief description	Description
0	STO-A	STO channel A	Internal parameters
1	STO-B	STO channel B	
2	STO FB A	STO feedback channel A	
3	STO FB B	STO feedback channel B	
4	PWM ENABLE	Power stage enable	
5	STA	Feedback STO	

Tab. 289: Assignment of the status word of the internal interface, CMMT-ST

Parameters of digital inputs X1A.7, X1A.8 (Px.11201, Px.11202)		
Value	Function	Description
1	No function	The input is deactivated.
3	Open holding brake 1	The input signal enables the functional release of one or more holding brakes.
6	Touch probe 0	The input provides the trigger signal for the high-precision recording of the current actual position. The saved values can be read out using the device profile.
7	Touch probe 1	

Parameters of digital inputs X1A.7, X1A.8 (Px.11201, Px.11202)		
Value	Function	Description
8	Negative hardware limit switch	The input indicates that the usable range has been overrun in a negative or positive direction. The switching functions can be set with parameters Px.101100 and Px.101101 (N/C or N/O contact). For additional information ➔ 5.5 Hardware limit switch reached
9	Positive hardware limit switch	
11	Record table input 0	The input can be used as a sequencing condition during record selection (ID Px.1831 = 4).
12	Record table input 1	

Tab. 290: Configurable input signals at X1A.7 and X1A.8, CMMT-ST

Parameters of digital input X1C.2 (Px.11205)		
Value	Function	Description
1	No function	The input is deactivated.
8	Negative hardware limit switch	The input indicates that the usable range has been overrun in a negative or positive direction. The switching functions can be set with parameters Px.101100 and Px.101101 (N/C or N/O contact). For additional information ➔ 5.5 Hardware limit switch reached.
9	Positive hardware limit switch	
10	Reference switch	The input returns the signal of the reference switch.

Tab. 291: Configurable input signals at X1C.2, CMMT-ST

Parameters for the reference switch (Px.101200)		
Value	Function	Description
0	No function	The input for the reference switch is deactivated.
1	N/O contact	Switching function N/O contact (normally open)
2	N/C contact	Switching function N/C contact (normally closed)

Tab. 292: Switching function of the reference switch, CMMT-AS/ST

Parameters of digital outputs X1A.9, X1A.10 (Px.11203 and Px.11204)		
Value	Function	Description
1	No function	The output has no function.
2	Servo drive ready	The output is active when the servo drive is ready for operation.
4	Holding brake 1 open	The output becomes active when holding brake 1 is released.
6	Permanent 0 V	The output is always inactive.
7	Permanent 24 V	The output is always active.
8	Trace trigger	Data trigger for the trace.
9	Position switch 0	The output provides the logical status of the corresponding cam switch.
10	Position switch 1	
12	Drive referenced	The output becomes active when the drive is homed.
13	Target position reached	The output becomes active when the actual position remains in the target window for the duration of the cushioning time.
14	Target velocity reached	The output becomes active when the actual speed is within the target window for the duration of the cushioning time.
15	Target torque reached	The output becomes active when the actual torque is within the target window for the duration of the cushioning time.
16	Position: following error	The output becomes active when the corresponding following error is present after the response delay has elapsed.
17	Velocity: following error	
18	Target range position	The output becomes active after the target range has been reached and becomes inactive again when the target range has been left.
19	Target range velocity	
20	Target range torque	
21	Positive hardware limit switch	The output provides the logical signal of the corresponding limit switch.
22	Negative hardware limit switch	

Parameters of digital outputs X1A.9, X1A.10 (Px.11203 and Px.11204)		
Value	Function	Description
23	Positive SW limit switch	The output becomes active if the software end position has been exceeded.
24	Negative SW limit switch	
25	Standstill position	The output becomes active when the corresponding standstill monitoring indicates standstill.
26	Standstill velocity	
27	Limit stop reached	The output becomes active when a stop ramp is operated.
28	Positive stroke limitation	The output becomes active if the stroke limitation has been exceeded in the corresponding direction.
29	Negative stroke limitation	
30	Velocity limit value	The output becomes active when the speed monitoring indicates that the limit value has been overrun.
31	Pushback	The output becomes active when the set torque and direction of movement do not correlate and the parameterised cushioning time has elapsed.
32	MC	The output provides the “Motion Complete” signal.
33	Record table output 0	The output becomes active if the output has been set using the record table.
34	Record table output 1	
35	Error	The output becomes active if an error is reported.
36	Variable message function	The output becomes active if the parameterised result of the variable message function is valid.
37	Bit 16 CiA402 0x60FE	Control of digital output 1, if parameterised as ‘Bit 16 CiA402 0x60FE (37)’.
38	Bit 17 CiA402 0x60FE	Control of digital output 2, if parameterised as ‘Bit 17 CiA402 0x60FE (38)’.

Tab. 293: Configurable output signals at X1A.9 and X1A.10, CMMT-ST

Parameters for digital inputs CiA 402 (Px.1128052, 0x60FD.00)		
Bit	Function	Description
0	Negative limit switch	Shows that the usable range has been overrun in a negative or positive direction
1	Positive limit switch	
2	Reference switch	Signal status of the reference switch
3	Power stage enable	Enabling of the power stage
4 ... 15	Reserved	–
Bit 16	X1A.6 (CTRL-EN)	Digital input
Bit 17 ... 23	Reserved	–
Bit 24	X1A.3 (STO-B)	Digital input
Bit 25	X1A.2 (STO-A)	Digital input
Bit 26	X1A.8 (CAP1)	Digital input
Bit 27	X1A.7 (CAP0)	Digital input
Bit 28 ... 31	Reserved	–

Tab. 294: Digital inputs CiA 402 (Px.1128052), CMMT-ST

Parameter for digital outputs CiA 402 (Px.1128054, 0x60FE.01)		
Bit	Function	Description
0	Holding brake requirement	1: release holding brake
16	Control digital output 1 (User_Control_Out_1)	Control of digital output 1, if parameterised as ‘Bit 16 CiA402 0x60FE (37)’. The value of the bit is not defined with all other parameterisations.
17	Control digital output 2 (User_Control_Out_2)	Control of digital output 2, if parameterised as ‘Bit 17 CiA402 0x60FE (38)’. The value of the bit is not defined with all other parameterisations.

Tab. 295: Digital outputs CiA 402 (Px.1128054)

ID Dx.	Name	Description
06 | 00 | 00085 (100663381)	Digital I/O configuration invalid	The configuration of the digital inputs or outputs is invalid

Tab. 296: Diagnostic messages

3.3.6.2 CiA 402

Objects of digital inputs and outputs

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
1128052	0x60FD.00	Digital inputs CiA402	UDINT
1128054	0x60FE.01	Digital outputs CiA402	UDINT
1128055	0x60FE.02	Bit mask digital outputs CiA402	UDINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
11201	0x212F.0A	Digital input X1A.7	UDINT
11202	0x212F.0B	Digital input X1A.8	UDINT
11203	0x212F.0C	Digital output X1A.9	UDINT
11204	0x212F.0D	Digital output X1A.10	UDINT
11205	0x212F.0E	Digital input X1C.2	UDINT
101200	0x218A.01	Reference switch configuration	UDINT
1128052	0x2195.01	Digital inputs CiA402	UDINT
1128054	0x2195.02	Digital outputs CiA402	UDINT
1128055	0x2195.03	Bit mask digital outputs CiA402	UDINT

Tab. 297: Objects

3.3.6.3 PROFIdrive

PNUs of digital inputs and outputs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
11201	3364.0	Digital input X1A.7	UDINT
11202	3365.0	Digital input X1A.8	UDINT
11203	3366.0	Digital output X1A.9	UDINT
11204	3367.0	Digital output X1A.10	UDINT
11205	3368.0	Digital input X1C.2	UDINT
101200	11947.0	Reference switch configuration	UDINT

Tab. 298: PNUs

3.4 Bus protocols of the MP devices

3.4.1 Function

The CMMT-AS-...-MP product variant provides several bus protocols (multi-protocol device). The desired bus protocol can be set with switches on the device and parameterised via the plug-in.



A change in the configuration only takes effect after the device is restarted (switch the device on again or restart the device via the plug-in).

Determination of the bus protocol in the initialisation phase

If the device's switches are set to a specific bus protocol, the selected bus protocol is activated in the initialisation phase.

If the switches are set to "Auto", the setting stored in the parameter set takes effect (P0.100159.0.0). The configured bus protocol is then activated or automatic detection of the bus protocol is started.

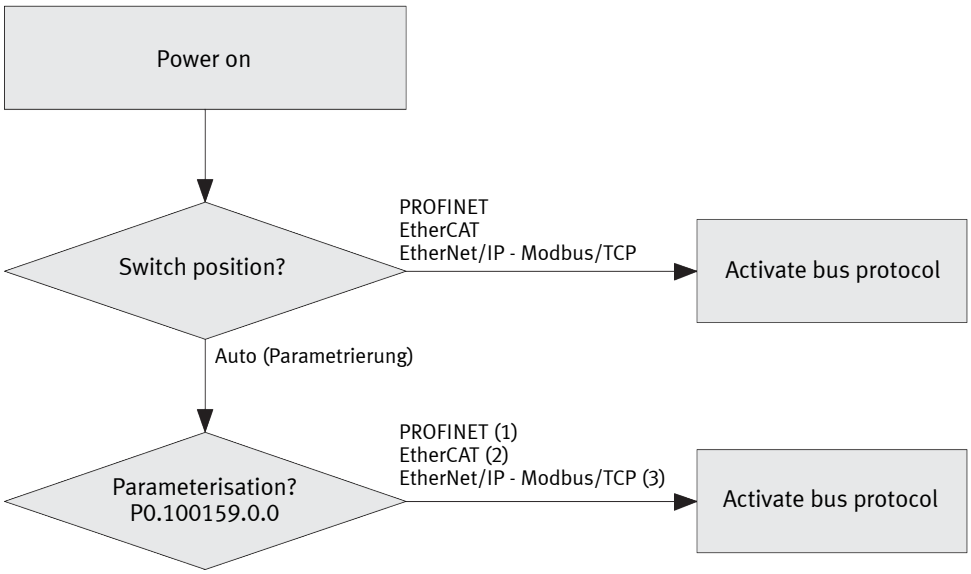


Fig. 36: Determination of the bus protocol

Activation of the bus protocol

Activating the bus protocol initialises the parameter access to the parameter model (RTE configuration of the firmware). This makes it possible to carry out full parameterisation via the relevant RTE profile.
A change in the configuration only takes effect after the device is restarted (switch the device on again or restart the device via the plug-in).

The device can go through several reinitialisation phases when another bus protocol is activated. The NRT communication via the Ethernet interface [X18] is not maintained.

Switches SW1, SW2, SW3

The switches for setting the bus protocol are located behind the dummy panel on the front of the device. The available protocols depend on the firmware used.

Protocol	S3	S2	S1
Parameterisation (Px.100159)	0	0	0
PROFINET	0	0	1
EtherCAT	0	1	0
EtherNet/IP, Modbus TCP	0	1	1
Reserved	1	0	0
	1	0	1
	1	1	0
Parameterisation (Px.100159)	1	1	1

Tab. 299: Switch setting

Parameters and diagnostic Messages

ID Px.	Parameter	Description	
100159	RTE Configuration (user defined)	Sets the configuration of the RTE interface that is activated when the device is started if the selection switches are all OFF.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
100179	RTE configuration active	Displays the RTE configuration detected during the startup phase of the device.	
		Access	read/–
		Update	effective immediately
		Unit	–
100181	RTE Configuration next	Displays the actual RTE configuration, which becomes active the next time the unit is restarted.	
		Access	read/–
		Update	effective immediately
		Unit	–
100185	RTE Switches device start	Display the RTE switches configuration that was detected during the startup phase of the device.	
		Access	read/–
		Update	effective immediately
		Unit	–
100189	RTE Switches Active	Displays the actual RTE switch setting.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 300: Parameter

Diagnostic messages No specific diagnostic messages are allocated to the function.

3.4.2 CiA 402

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
100159	0x21B6.01	RTE Configuration (user defined)	UDINT
100179	0x21B6.02	RTE configuration active	UDINT
100181	0x21B6.03	RTE Configuration next	UDINT
100185	0x21B6.04	RTE Switches device start	UDINT
100189	0x21B6.05	RTE Switches Active	UDINT

Tab. 301: Objects

3.4.3 PROFIdrive

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific parameters**		
100159	3647.0	RTE Configuration (user defined)	UDINT
100179	3648.0	RTE configuration active	UDINT
100181	3649.0	RTE Configuration next	UDINT
100185	3650.0	RTE Switches device start	UDINT
100189	3651.0	RTE Switches Active	UDINT

Tab. 302: PNUs

3.5 Protective functions

3.5.1 I^2t monitoring of the power output stage

The "I^2t monitoring power output stage" protective function is used to protect the power output stage from thermal damage due to excessive dissipation of electrical energy.

In the process, the limit values of a specific warning threshold and upper limit are monitored. When the specified limit value is reached, a diagnostic message is triggered. After the upper limit is reached, the current is limited to the nominal current. The limitation to the nominal current is automatically rescinded when the integrator value of the I²t monitoring is set to 0.
The function is effective in all operating modes. In force/torque mode or travel to (fixed) stop, make sure that the required current is below the nominal value or that the period for exceeding the nominal value is less than the I²t time.
An electrical rotational frequency ≤ 5 Hz at the output of the power output stage is monitored by a short I²t time and separate diagnostic messages.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
637	Scaling factor start value I²t monitoring power output stage	Specifies the scaling factor for the start value based on the limit value of the I²t monitoring of the power output stage at standstill.	
		Access	read/–
		Update	effective immediately
		Unit	–
638	Limit value I²t monitoring power output stage	Specifies the limit value for I²t monitoring of the power output stage.	
		Access	read/–
		Update	effective immediately
		Unit	A²s
639	Scaling factor maximum value after switching on	Displays the scaling factor for the maximum value based on the limit value after switching on.	
		Access	read/–
		Update	effective immediately
		Unit	–
6310	Actual value I²t monitoring power output stage	Specifies the actual value for I²t monitoring of the power output stage.	
		Access	read/–
		Update	effective immediately
		Unit	A²s
6311	Scaling factor warning limit I²t monitoring power output stage	Specifies the scaling factor for the warning limit based on the limit value of the I²t monitoring of the power output stage.	
		Access	read/write
		Update	effective immediately
		Unit	–
6313	Scaling factor start value I²t monitoring power output stage at standstill	Specifies the scaling factor for the start value based on the limit value of the I²t monitoring of the power output stage at standstill.	
		Access	read/–
		Update	effective immediately
		Unit	–
6314	Limit value I²t monitoring power output stage at standstill	Specifies the limit value for I²t monitoring of the power output stage at standstill.	
		Access	read/–
		Update	effective immediately
		Unit	A²s
6315	Scaling factor maximum value after drive at standstill	Displays the scaling factor for the maximum value based on the limit value, after drive is at standstill.	
		Access	read/–
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
6316	Actual value I²t monitoring power output stage at standstill	Specifies the actual value for I²t monitoring of the power output stage at standstill.	
		Access	read/–
		Update	effective immediately
		Unit	A²s
6317	Scaling factor warning limit I²t monitoring drive at standstill	Specifies the scaling factor for the warning limit based on the limit value of the I²t monitoring of the power output stage if the drive is at standstill.	
		Access	read/write
		Update	effective immediately
		Unit	–
6332	Actual value relative I²t monitoring of power output stage to limit	Specifies the actual value for relative I²t monitoring of the power output stage to the limit.	
		Access	read/–
		Update	effective immediately
		Unit	–
6333	Actual value relative I²t monitoring of power output stage at standstill to limit	Specifies the actual value for relative I²t monitoring of the power output stage at standstill to the limit.	
		Access	read/–
		Update	effective immediately
		Unit	–
6334	Actual value I²t monitoring of the total current	Specifies the current actual value of the I²t monitoring of the total current.	
		Access	read/–
		Update	effective immediately
		Unit	Arms

Tab. 303: Parameters of “I²t monitoring of power output stage”

ID Dx.	Name	Description
01 | 02 | 00014 (16908302)	I²t monitoring: output stage warning limit	I²t monitoring: output stage warning limit
01 | 02 | 00015 (16908303)	I²t monitoring: output stage error limit	I²t monitoring: output stage error limit
01 | 02 | 00016 (16908304)	I²t monitoring: output stage v0 warning limit	I²t monitoring: output stage in standstill warning limit
01 | 02 | 00017 (16908305)	I²t monitoring: output stage v0 error limit	I²t monitoring: output stage in standstill error limit

Tab. 304: Diagnostic messages of “I²t monitoring of the power output stage”

3.5.1.1 CiA 402

Objects of “I²t monitoring of the power output stage”

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
637	0x216A.07	Scaling factor start value I²t monitoring power output stage	REAL
638	0x216A.08	Limit value I²t monitoring power output stage	REAL
639	0x216A.09	Scaling factor maximum value after switching on	REAL
6310	0x216A.0A	Actual value I²t monitoring power output stage	REAL
6311	0x216A.0B	Scaling factor warning limit I²t monitoring power output stage	REAL
6313	0x216A.0C	Scaling factor start value I²t monitoring power output stage at standstill	REAL
6314	0x216A.0D	Limit value I²t monitoring power output stage at standstill	REAL
6315	0x216A.0E	Scaling factor maximum value after drive at standstill	REAL
6316	0x216A.0F	Actual value I²t monitoring power output stage at standstill	REAL

Parameter	Index.Subindex	Name	Data type
6317	0x216A.10	Scaling factor warning limit I²t monitoring drive at standstill	REAL
6332	0x216A.1E	Actual value relative I²t monitoring of power output stage to limit	REAL
6333	0x216A.1F	Actual value relative I²t monitoring of power output stage at standstill to limit	REAL
6334	0x216A.20	Actual value I²t monitoring of the total current	REAL

Tab. 305: Objects

3.5.1.2 PROFIdrive

PNUs of the I²t monitoring of the power output stage

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
637	11174.0	Scaling factor start value I²t monitoring power output stage	REAL
638	11175.0	Limit value I²t monitoring power output stage	REAL
639	11176.0	Scaling factor maximum value after switching on	REAL
6310	11655.0	Actual value I²t monitoring power output stage	REAL
6311	11656.0	Scaling factor warning limit I²t monitoring power output stage	REAL
6313	11657.0	Scaling factor start value I²t monitoring power output stage at standstill	REAL
6314	11658.0	Limit value I²t monitoring power output stage at standstill	REAL
6315	11659.0	Scaling factor maximum value after drive at standstill	REAL
6316	11660.0	Actual value I²t monitoring power output stage at standstill	REAL
6317	11661.0	Scaling factor warning limit I²t monitoring drive at standstill	REAL
6332	11675.0	Actual value relative I²t monitoring of power output stage to limit	REAL
6333	11676.0	Actual value relative I²t monitoring of power output stage at standstill to limit	REAL
6334	11677.0	Actual value I²t monitoring of the total current	REAL

Tab. 306: PNUs

3.5.2 I²t monitoring of motor

A simplified thermal motor model is used to protect the connected motor from thermal overload. The simplified thermal motor model is based on a deceleration member of the first order with a standardised status variable of 0 to 1 and a parameterisable filter time constant of Px.7144 ➔ 3.3.1 Motor configuration.
If the deceleration member reaches the value 1, this means that the motor is permanently operated with nominal current. If the value 1.05 of the status variable is reached, a diagnostic message is emitted. Between 0 and 1, a warning threshold can be parameterised.

Timing

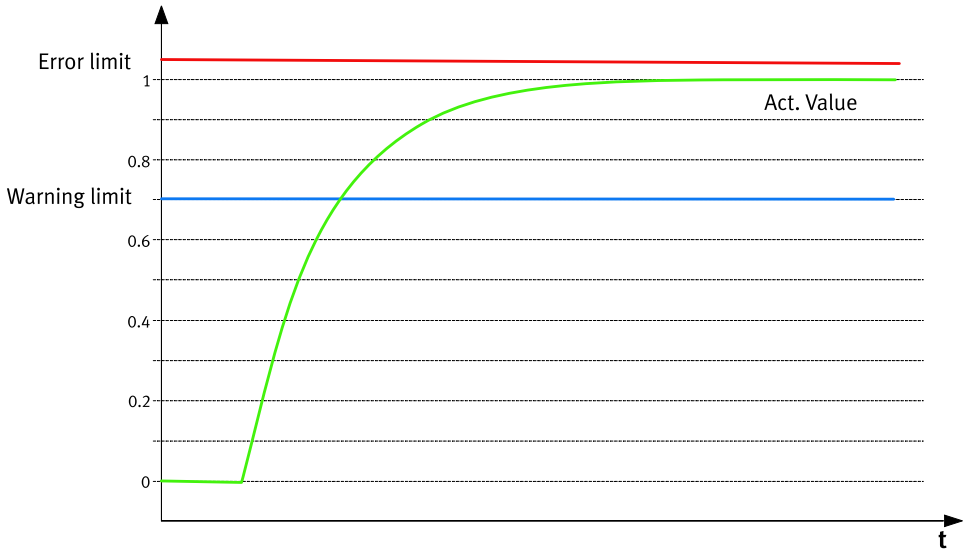


Fig. 37: Timing of I²t monitoring of motor

Name	Description
Error limit	Px.6306, Limit value I²t monitoring motor model
Warning limit	Px.6305, Scaling factor warning limit I²t monitoring motor model
Act. Value	Px.6302, Actual value I²T monitoring motor model

Tab. 307: Legend for timing of I²t monitoring of motor

Parameters and diagnostic messages

ID Px.	Parameter	Description	
6302	Actual value I²T monitoring motor model	Displays the actual value of I²t monitoring from the motor model.	
		Access	read/–
		Update	effective immediately
		Unit	–
6301	Scaling factor start value I²t monitoring motor model	Specifies the scaling factor for setting the start value for I²t monitoring based on the limit value of I²t monitoring of the motor model.	
		Access	read/write
		Update	effective immediately
		Unit	–
6305	Scaling factor warning limit I²t monitoring motor model	Specifies the scaling factor for setting the warning limit for I²t monitoring based on the limit value of I²t monitoring of the motor model.	
		Access	read/write
		Update	effective immediately
		Unit	–
6303	Maximum start value I²t monitoring motor model	Specifies the maximum permissible start value of I²t monitoring of the motor model.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 308: Parameters of I²t monitoring of motor

ID Dx.	Name	Description
01 | 02 | 00259 (16908547)	I²t monitoring: motor model error limit	I²t monitoring: motor model error limit
01 | 02 | 00258 (16908546)	I²t monitoring: motor model warning limit	I²t monitoring: motor model warning limit

Tab. 309: Diagnostic messages of I²t monitoring of the motor

3.5.2.1 CiA 402

Objects of I²t monitoring of the motor

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
6302	0x21A5.02	Actual value I²T monitoring motor model	REAL
6301	0x21A5.01	Scaling factor start value I²t monitoring motor model	REAL
6305	0x21A5.04	Scaling factor warning limit I²t monitoring motor model	REAL
6303	0x21A5.03	Maximum start value I²t monitoring motor model	REAL

Tab. 310: Objects

3.5.2.2 PROFIdrive

PNUs of I²t monitoring of motor

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
6302	12405.0	Actual value I²T monitoring motor model	REAL
6301	12404.0	Scaling factor start value I²t monitoring motor model	REAL
6305	12407.0	Scaling factor warning limit I²t monitoring motor model	REAL
6303	12406.0	Maximum start value I²t monitoring motor model	REAL

Tab. 311: PNUs

3.5.3 Temperature monitoring of the servo drive

The "Temperature monitoring servo drive" protective function protects the power module from over-temperature.
The upper and lower limit values of a certain warning threshold and of a certain upper and lower limit are monitored, including hysteresis. The hysteresis is 5 °C.
When the respective limit value is reached, a diagnostic message is triggered.
The diagnostic message can only be acknowledged if the temperature has left the threshold or the limit including the hysteresis range.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
920	Temperature power output stage	Specifies the actual temperature value of the power output stage.	
		Access	read/–
		Update	effective immediately
		Unit	°C
921	Temperature status power output stage	Specifies the status of the temperature monitoring of the power output stage	
		Access	read/–
		Update	effective immediately
		Unit	–
9314	Upper limit value warning threshold power output stage temperature	Specifies the upper limit value of warning threshold for the temperature monitoring of the power output stage.	
		Access	read/write

ID Px.	Parameter	Description	
9314	Upper limit value warning threshold power output stage temperature	Update	effective immediately
		Unit	°C
9315	Upper limit value power output stage temperature	Specifies the upper limit value of the temperature monitoring of the power output stage.	
		Access	read/write
		Update	effective immediately
		Unit	°C
9316	Lower limit value warning threshold power output stage temperature	Specifies the lower limit value of warning threshold for the temperature monitoring of the power output stage.	
		Access	read/write
		Update	effective immediately
		Unit	°C
9317	Lower limit value power output stage temperature	Specifies the lower limit value of the temperature monitoring of the power output stage.	
		Access	read/write
		Update	effective immediately
		Unit	°C
9322	Actual upper limit value warning threshold power output stage temperature	Specifies the actual upper limit value of the warning threshold for the temperature monitoring of the power output stage.	
		Access	read/–
		Update	effective immediately
		Unit	°C
9323	Actual upper limit value power output stage temperature	Specifies the actual upper limit value of the temperature monitoring of the power output stage.	
		Access	read/–
		Update	effective immediately
		Unit	°C
9324	Actual lower limit value warning threshold power output stage temperature	Specifies the actual lower limit value of the warning threshold for the temperature monitoring of the power output stage.	
		Access	read/–
		Update	effective immediately
		Unit	°C
9325	Actual lower limit value power output stage temperature	Specifies the actual lower limit value of the temperature monitoring of the power output stage.	
		Access	read/–
		Update	effective immediately
		Unit	°C

Tab. 312: Parameters of “Temperature monitoring of the servo drive”

Diagnostic messages No specific diagnostic messages are allocated to the function.

3.5.3.1 CiA 402

Objects of “Temperature monitoring of the servo drive”

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
920	0x2128.01	Temperature power output stage	REAL
921	0x2128.02	Temperature status power output stage	DINT
9314	0x2128.19	Upper limit value warning threshold power output stage temperature	REAL
9315	0x2128.1A	Upper limit value power output stage temperature	REAL

Parameter	Index.Subindex	Name	Data type
9316	0x2128.1B	Lower limit value warning threshold power output stage temperature	REAL
9317	0x2128.1C	Lower limit value power output stage temperature	REAL
9322	0x2128.21	Actual upper limit value warning threshold power output stage temperature	REAL
9323	0x2128.22	Actual upper limit value power output stage temperature	REAL
9324	0x2128.23	Actual lower limit value warning threshold power output stage temperature	REAL
9325	0x2128.24	Actual lower limit value power output stage temperature	REAL

Tab. 313: Objects

3.5.3.2 PROFIdrive

PNUs "temperature monitoring of the servo drive"

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
920	2246.0	Temperature power output stage	REAL
921	2247.0	Temperature status power output stage	DINT
9314	2795.0	Upper limit value warning threshold power output stage temperature	REAL
9315	2796.0	Upper limit value power output stage temperature	REAL
9316	2797.0	Lower limit value warning threshold power output stage temperature	REAL
9317	2798.0	Lower limit value power output stage temperature	REAL
9322	2803.0	Actual upper limit value warning threshold power output stage temperature	REAL
9323	2804.0	Actual upper limit value power output stage temperature	REAL
9324	2805.0	Actual lower limit value warning threshold power output stage temperature	REAL
9325	2806.0	Actual lower limit value power output stage temperature	REAL

Tab. 314: PNUs

3.5.4 System monitoring

The protective function monitors the internal system during initialisation and runtime. It is used to protect the control unit. If a system error is detected, the power output stage is switched off and the servo drive is put in an operationally safe condition. A system error can be eliminated by restarting the servo drive.

3.5.5 Mains and DC link monitoring

3.5.5.1 Mains voltage monitoring

The mains monitoring protective function is used to protect against mains failure, undershooting or exceeding the mains voltage.
When the respective limit value is undershot or exceeded over a certain period of time, a diagnostic message is triggered. The servo drive tolerates a short-term interruption of the mains voltage. The tolerance time is device-specific and cannot be changed by the user.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
491	Load voltage root mean square value	Specifies the load voltage root mean square value.	
		Access	read/–

ID Px.	Parameter	Description	
491	Load voltage root mean square value	Update	effective immediately
		Unit	V
493	Lower load voltage limit value	Specifies the lower limit value for load voltage monitoring.	
		Access	read/write
		Update	effective immediately
		Unit	V
494	Upper load voltage limit value	Specifies the upper limit value for load voltage monitoring.	
		Access	read/write
		Update	effective immediately
		Unit	V
28151	Actual lower limit value load voltage	Specifies the lower limit value for load voltage monitoring.	
		Access	read/–
		Update	effective immediately
		Unit	V
28152	Actual upper limit value load voltage	Specifies the upper limit value for load voltage monitoring.	
		Access	read/–
		Update	effective immediately
		Unit	V

Tab. 315: Mains voltage monitoring parameter

ID Dx.	Name	Description
02 | 03 | 00038 (33751078)	Undervoltage in load voltage	Undervoltage in load voltage
02 | 03 | 00039 (33751079)	Overvoltage in load voltage	Overvoltage in load voltage

Tab. 316: Mains voltage monitoring diagnostic messages

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Mains voltage monitoring objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
491	0x2115.02	Load voltage root mean square value	REAL
493	0x2115.04	Lower load voltage limit value	REAL
494	0x2115.05	Upper load voltage limit value	REAL
28151	0x2115.19	Actual lower limit value load voltage	REAL
28152	0x2115.1A	Actual upper limit value load voltage	REAL

Tab. 317: Objects

PROFIdrive

Mains voltage monitoring PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
491	2157.0	Load voltage root mean square value	REAL
493	2159.0	Lower load voltage limit value	REAL
494	2160.0	Upper load voltage limit value	REAL

Parameter	PNU	Name	Data type
28151	3052.0	Actual lower limit value load voltage	REAL
28152	3053.0	Actual upper limit value load voltage	REAL

Tab. 318: PNUs

3.5.5.2 Monitoring of the DC link voltage

The protective function is used to monitor the DC link voltage. In the process, the DC link voltage is monitored for a preset maximum value and parameterized minimum value. In addition, a limit value for the warning threshold can be parameterised. When the specified limit value is reached, a diagnostic message is triggered.

If the maximum permissible DC link voltage exceeded, a Category 0 stop is performed and the drive slowly comes to a stop.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
480	Actual value DC link voltage	Specifies the actual value of the DC link voltage.	
		Access	read/–
		Update	effective immediately
		Unit	V
4811	Warning threshold DC link voltage	Determine the warning threshold for the monitoring of the DC link voltage.	
		Access	read/write
		Update	effective immediately
		Unit	V
4813	Upper limit value DC link voltage	Specifies the upper limit value for the monitoring of the DC link voltage.	
		Access	read/write
		Update	effective immediately
		Unit	V
4814	Lower limit value DC link voltage	Specifies the lower limit value for the monitoring of the DC link voltage.	
		Access	read/write
		Update	effective immediately
		Unit	V
56799	Actual warning threshold DC link voltage	Specifies the actual used warning threshold for monitoring the DC link voltage.	
		Access	read/–
		Update	effective immediately
		Unit	V
56800	Actual upper limit value DC link voltage	Specifies the actual used upper limit value for monitoring the DC link voltage.	
		Access	read/–
		Update	effective immediately
		Unit	V
56801	Actual lower limit value DC link voltage	Specifies the actual used lower limit value for monitoring the DC link voltage.	
		Access	read/–
		Update	effective immediately
		Unit	V

Tab. 319: Parameters of “Monitoring of the DC link voltage”

ID Dx.	Name	Description
02 | 02 | 00030 (33685534)	Overvoltage in DC link	Overvoltage in DC link
02 | 02 | 00031 (33685535)	Undervoltage in DC link	Undervoltage in DC link
02 | 02 | 00032 (33685536)	DC link warning threshold reached	DC link warning threshold reached

Tab. 320: Diagnostic messages of “Monitoring of the DC link voltage”

CiA 402

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
480	0x6079.00	Actual value DC link voltage	UDINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
480	0x2114.01	Actual value DC link voltage	REAL
4811	0x2114.0A	Warning threshold DC link voltage	REAL
4813	0x2114.0C	Upper limit value DC link voltage	REAL
4814	0x2114.0D	Lower limit value DC link voltage	REAL
56799	0x2114.18	Actual warning threshold DC link voltage	REAL
56800	0x2114.19	Actual upper limit value DC link voltage	REAL
56801	0x2114.1A	Actual lower limit value DC link voltage	REAL

Tab. 321: Objects of “Monitoring of the DC link voltage”

PROFIdrive

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
480	2148.0	Actual value DC link voltage	REAL
4811	2533.0	Warning threshold DC link voltage	REAL
4813	2535.0	Upper limit value DC link voltage	REAL
4814	2536.0	Lower limit value DC link voltage	REAL
56799	3065.0	Actual warning threshold DC link voltage	REAL
56800	3066.0	Actual upper limit value DC link voltage	REAL
56801	3067.0	Actual lower limit value DC link voltage	REAL

Tab. 322: PNUs of "monitoring of the DC link voltage"

3.5.5.3 Return energy feed

Function

The drive can return generative energy to the servo drive during a deceleration phase.

The servo drive has reactive current braking. If the DC link voltage lies above a defined threshold value due to the return energy feed of the drive, the reactive current braking switches on and dissipates this energy in the drive and the motor cable.

The automatic detection of the threshold value for the reactive current braking can be switched off with Px.102107 and specified via the parameters Px.102108 and Px.102109.

The reactive current braking can be completely deactivated with Px.102104.

If the load supply of several devices is connected with one another, the energy returned from a drive can be used by other devices. If the DC link voltage rises above an automatically identified threshold value, the intermediate circuit is disconnected from the load supply to protect the other devices.
The automatic detection of the threshold value for the switch-off can be switched off with Px.10184 and specified via the parameter Px.10185.
With the CMMT-ST-...-MP: if the energy recovery in the application is still too high, it can be reduced with an external braking resistor ➔ 3.5.5.4 Energy recovery with brake chopper.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
10181	DC link recovery deactivation	Voltage from which the DC link recovery is deactivated	
		Access	read/–
		Update	effective immediately
		Unit	V
10182	DC link recovery status	DC link recovery status	
		Access	read/–
		Update	effective immediately
		Unit	–
10183	DC link recovery	Deactivation of the DC link regeneration	
		Access	read/write
		Update	effective immediately
		Unit	–
10184	Activate automatic voltage determination	Activation of the automatic voltage determination for the DC link regeneration. The switch-off threshold is determined via the scaling factor Px.10186. If voltage determination is deactivated, the shutdown threshold from parameter Px.10185 is used.	
		Access	read/write
		Update	reinitialization
		Unit	–
10185	Switch-off threshold power feedback	Specifies the switch-off threshold for regenerative power supply. The switch-off threshold is used if automatic voltage detection Px.10184 is deactivated.	
		Access	read/write
		Update	effective immediately
		Unit	V
10186	Scaling factor offset of voltage calculation	Specifies the scaling factor for the offset of the automatic voltage detection. The scaling factor has an influence on the automatic voltage determination Px.10184.	
		Access	read/write
		Update	effective immediately
		Unit	–
102101	Active switch-on threshold reactive current braking	Active switch-on threshold of reactive current braking	
		Access	read/–
		Update	effective immediately
		Unit	V
102102	Active end value reactive current braking	Active end value for reactive current braking	
		Access	read/–
		Update	effective immediately
		Unit	V
102103	Status reactive current braking	Status of the reactive current braking	

ID Px.	Parameter	Description	
102103	Status reactive current braking	Access	read/–
		Update	effective immediately
		Unit	–
102104	Activate reactive current braking	Activate reactive current braking	
		Access	read/write
		Update	effective immediately
		Unit	–
102105	Maximum reactive current reactive current braking	Maximum reactive current of the reactive current braking	
		Access	read/–
		Update	effective immediately
		Unit	Arms
102106	Actual value reactive current braking	Actual value of the reactive current braking	
		Access	read/–
		Update	effective immediately
		Unit	Arms
102107	Activate automatic voltage determination	Activation of the automatic voltage determination	
		Access	read/write
		Update	reinitialization
		Unit	–
102108	Switch-on threshold reactive current braking	Switch-on threshold of the reactive current braking	
		Access	read/write
		Update	effective immediately
		Unit	V
102109	End value reactive current braking	End value for the reactive current braking	
		Access	read/write
		Update	effective immediately
		Unit	V
102110	Scaling factor offset of voltage calculation	Specifies the scaling factor for the offset of the automatic voltage calculation	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 323: Parameter

CiA 402

Energy recovery objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
10181	0x213F.01	DC link recovery deactivation	REAL
10182	0x213F.02	DC link recovery status	USINT
10183	0x213F.03	DC link recovery	USINT
10184	0x213F.04	Activate automatic voltage determination	USINT
10185	0x213F.05	Switch-off threshold power feedback	REAL
10186	0x213F.06	Scaling factor offset of voltage calculation	REAL
102101	0x218D.01	Active switch-on threshold reactive current braking	REAL
102102	0x218D.02	Active end value reactive current braking	REAL
102103	0x218D.03	Status reactive current braking	USINT

Parameter	Index.Subindex	Name	Data type
102104	0x218D.04	Activate reactive current braking	USINT
102105	0x218D.05	Maximum reactive current reactive current braking	REAL
102106	0x218D.06	Actual value reactive current braking	REAL
102107	0x218D.07	Activate automatic voltage determination	USINT
102108	0x218D.08	Switch-on threshold reactive current braking	REAL
102109	0x218D.09	End value reactive current braking	REAL
102110	0x218D.0A	Scaling factor offset of voltage calculation	REAL

Tab. 324: Objects

PROFIdrive

Energy recovery PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
10181	3352.0	DC link recovery deactivation	REAL
10182	3353.0	DC link recovery status	BOOL
10183	3354.0	DC link recovery	BOOL
10184	3355.0	Activate automatic voltage determination	BOOL
10185	3356.0	Switch-off threshold power feedback	REAL
10186	3357.0	Scaling factor offset of voltage calculation	REAL
102101	12417.0	Active switch-on threshold reactive current braking	REAL
102102	12418.0	Active end value reactive current braking	REAL
102103	12419.0	Status reactive current braking	BOOL
102104	12420.0	Activate reactive current braking	BOOL
102105	12421.0	Maximum reactive current reactive current braking	REAL
102106	12422.0	Actual value reactive current braking	REAL
102107	12423.0	Activate automatic voltage determination	BOOL
102108	12424.0	Switch-on threshold reactive current braking	REAL
102109	12425.0	End value reactive current braking	REAL
102110	12426.0	Scaling factor offset of voltage calculation	REAL

Tab. 325: PNUs

3.5.5.4 Energy recovery with brake chopper

The servo drive has a brake chopper. If the DC link voltage lies above a defined threshold value due to the energy recovery of the drive, the brake chopper activates the braking resistor between the potentials of the DC link voltage.
The servo drive has a function for the dynamic increase of the brake chopper threshold. In this way, a DC link coupling of several devices can be implemented. The dynamic increase of the brake chopper threshold ensures an even distribution of the energy recovery to the devices with DC link coupling.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
4812	Switch-on threshold brake chopper	Specifies the switch-on threshold of the brake chopper.	
		Access	read/write
		Update	effective immediately
		Unit	V
4817	Brake chopper threshold actual value	Specifies the actual value of the brake chopper threshold.	
		Access	read/–

ID Px.	Parameter	Description	
4817	Brake chopper threshold actual value	Update	effective immediately
		Unit	V
56802	Actual switch-on threshold brake chopper	Specifies the actual used switch-on threshold of the brake chopper.	
		Access	read/–
		Update	effective immediately
		Unit	V

Tab. 326: Parameters of “brake chopper”

CiA 402

Objects of "brake chopper"

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
4812	0x2114.0B	Switch-on threshold brake chopper	REAL
4817	0x2114.10	Brake chopper threshold actual value	REAL
56802	0x2114.1B	Actual switch-on threshold brake chopper	REAL

Tab. 327: Objects

PROFIdrive

PNUs of "brake chopper"

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4812	2534.0	Switch-on threshold brake chopper	REAL
4817	2539.0	Brake chopper threshold actual value	REAL
56802	3068.0	Actual switch-on threshold brake chopper	REAL

Tab. 328: PNUs

3.5.5.5 Pulse energy monitoring of the braking resistor

The "pulse energy monitoring of braking resistor" protective function is used to protect the braking resistor from damage caused by high temperatures due to excessive pulse energy during braking (energy recovery). In the process, the limit values of a specific warning threshold and upper limit are monitored. When the specified limit value is reached, a diagnostic message is triggered.

In case of an external braking resistor, the following data of the braking resistor must be specified using parameters.

- Resistance value (➔ P0.6510.0.0)
- Nominal power (➔ P0.6511.0.0)
- Pulse energy (➔ P0.6512.0.0)

Parameters and diagnostic messages

ID Px.	Parameter	Description	
650	Scaling factor start value pulse energy monitoring braking resistor	Specifies the scaling factor for the start value based on the limit value of the pulse energy monitoring of the braking resistor.	
		Access	read/–
		Update	effective immediately
		Unit	–
651	Limit value pulse energy monitoring braking resistor	Specifies the limit value of the pulse energy monitoring of the braking resistor.	
		Access	read/–

ID Px.	Parameter	Description	
651	Limit value pulse energy monitoring braking resistor	Update	effective immediately
		Unit	Ws
652	Scaling factor maximum value after switching on	Specifies the scaling factor for the maximum value based on the limit value of the pulse energy monitoring of the braking resistor after switching on.	
		Access	read/–
		Update	effective immediately
		Unit	–
653	Actual value pulse energy monitoring braking resistor	Specifies the actual value of the pulse energy monitoring of the braking resistor.	
		Access	read/–
		Update	effective immediately
		Unit	Ws
654	Actual value pulse energy monitoring braking resistor (standardised)	Displays the actual value based on the limit value of the pulse energy monitoring of the braking resistor standardised.	
		Access	read/–
		Update	effective immediately
		Unit	–
655	Scaling factor warning limit pulse energy monitoring braking resistor	Specifies the scaling factor for the warning limit based on the limit value of the pulse energy monitoring of the braking resistor.	
		Access	read/write
		Update	effective immediately
		Unit	–
656	Actual value power dissipation braking resistor	Specifies the actual value of the power dissipation of the braking resistor.	
		Access	read/–
		Update	effective immediately
		Unit	W
658	Activate of external braking resistor	Specifies whether an external braking resistor shall be active instead of the internal one. 0: inactive 1: active	
		Access	read/write
		Update	restart
		Unit	–
659	Status selected braking resistor	Specifies whether an external braking resistor is active.	
		Access	read/–
		Update	effective immediately
		Unit	–
4801	Status brake chopper	Specifies the status of the brake chopper.	
		Access	read/–
		Update	effective immediately
		Unit	–
6510	Resistance value external braking resistor	Specifies the resistance value of the external braking resistor. The permissible maximum value depends on the device and is determined by the brake chopper.	
		Access	read/write
		Update	reinitialization
		Unit	Ω
6511	Nominal value of the power dissipation external braking resistor	Specifies the nominal value of the power dissipation for the external braking resistor. The permissible maximum value depends on the device and is determined by the brake chopper.	
		Access	read/write
		Update	reinitialization

ID Px.	Parameter	Description	
6511	Nominal value of the power dissipation external braking resistor	Unit	W
6512	Limit value pulse energy monitoring external braking resistor	Specifies the limit value of the pulse energy monitoring for the external braking resistor. The permissible maximum value depends on the device and is determined by the brake chopper.	
		Access	read/write
		Update	reinitialization
		Unit	Ws

Tab. 329: Parameters of “pulse energy monitoring of the braking resistor”

ID Dx.	Name	Description
01 | 03 | 00019 (16973843)	Warning: pulse energy monitoring, braking resistor	Warning: pulse energy monitoring, braking resistor
01 | 03 | 00020 (16973844)	Error: pulse energy monitoring, braking resistor	Error: pulse energy monitoring, braking resistor
01 | 03 | 00021 (16973845)	Parameterisation braking resistor pulse energy	Parameterization Pulse energy monitoring Braking resistor outside the valid range

Tab. 330: Diagnostic messages of “pulse energy monitoring of the braking resistor”

If the DC link voltage rise is impermissible during the braking of the drive with a Category 1 or 2 stop, the power output stage is deactivated (Category 0 stop) ➔ 3.5.5.2 Monitoring of the DC link voltage.

CiA 402

Objects of “pulse energy monitoring of the braking resistor”

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
650	0x211D.01	Scaling factor start value pulse energy monitoring braking resistor	REAL
651	0x211D.02	Limit value pulse energy monitoring braking resistor	REAL
652	0x211D.03	Scaling factor maximum value after switching on	REAL
653	0x211D.04	Actual value pulse energy monitoring braking resistor	REAL
654	0x211D.05	Actual value pulse energy monitoring braking resistor (standardised)	REAL
655	0x211D.06	Scaling factor warning limit pulse energy monitoring braking resistor	REAL
656	0x211D.07	Actual value power dissipation braking resistor	REAL
658	0x211D.09	Activate of external braking resistor	USINT
659	0x211D.0A	Status selected braking resistor	USINT
4801	0x21A0.01	Status brake chopper	USINT
6510	0x211D.0D	Resistance value external braking resistor	REAL
6511	0x211D.0E	Nominal value of the power dissipation external braking resistor	REAL
6512	0x211D.0F	Limit value pulse energy monitoring external braking resistor	REAL

Tab. 331: Objects

PROFIdrive

PNUs of "pulse energy monitoring of the braking resistor"

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
650	2201.0	Scaling factor start value pulse energy monitoring braking resistor	REAL
651	2202.0	Limit value pulse energy monitoring braking resistor	REAL

Parameter	PNU	Name	Data type
652	2203.0	Scaling factor maximum value after switching on	REAL
653	2204.0	Actual value pulse energy monitoring braking resistor	REAL
654	2205.0	Actual value pulse energy monitoring braking resistor (standardised)	REAL
655	2206.0	Scaling factor warning limit pulse energy monitoring braking resistor	REAL
656	2207.0	Actual value power dissipation braking resistor	REAL
658	2209.0	Activate of external braking resistor	BOOL
659	2210.0	Status selected braking resistor	BOOL
4801	2530.0	Status brake chopper	BOOL
6510	2700.0	Resistance value external braking resistor	REAL
6511	2701.0	Nominal value of the power dissipation external braking resistor	REAL
6512	2702.0	Limit value pulse energy monitoring external braking resistor	REAL

Tab. 332: PNUs

4 Motion control

4.1 Operating modes

4.1.1 Finite state machine

The internal finite state machine defines how the available operating statuses of the device are changed.
If the device completes the start-up phase without error, it automatically switches to the Ready status. If the closed-loop controller and the power stage are enabled, depending on the parameterisation the device automatically switches to the status Standstill or the status Profile ➔ Px.10234. The required operating mode can be activated in the Standstill status, e.g. by the device profile or the device-specific plug-in.

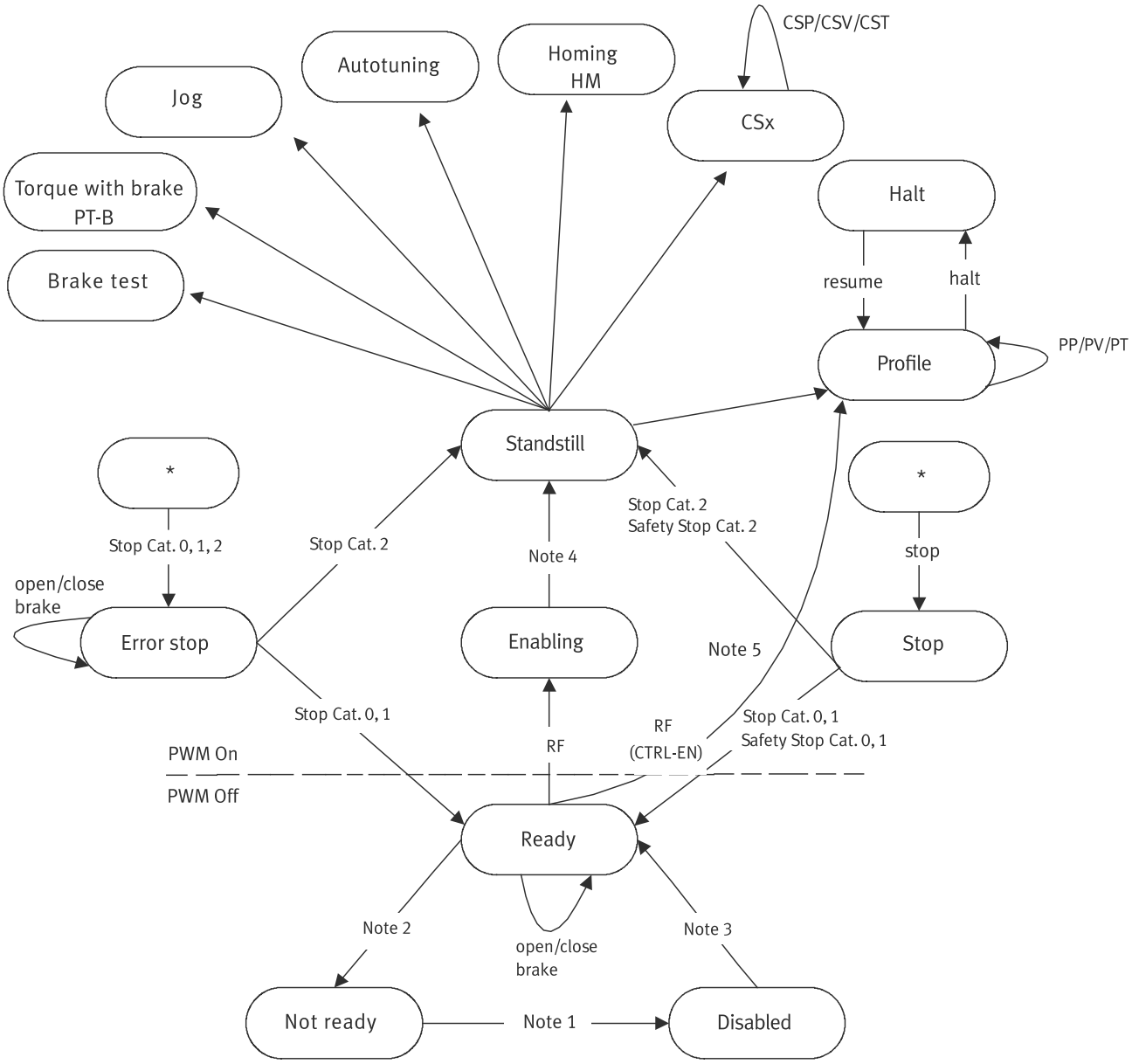


Fig. 38: Statuses and status transitions of the internal finite state machine

Statuses	Description
Not ready	The device is not ready because a precondition is not fulfilled, e.g. an encoder is not selected, or DC link voltage is not connected.
Disabled	The device is blocked. The power stage is blocked and switched off.
Ready	The device is ready. The power stage is switched off. The brake can be set and released manually ➔ 3.3.2 Brake control.
Enabling	The power output stage is switched on.
Standstill	The device is ready for operation and it is position-controlled.
Homing	The device is running a homing movement ➔ 4.4 Homing.
Jog	The device is in jog mode ➔ 4.6 Jog mode.
Autotuning	The device is running auto-tuning ➔ 6.5 Auto-tuning.
Torque with brake	The device is running force or torque commands with set brake ➔ 4.1.5 Force/torque mode (PT) with or without holding brake.
Brake test	The device is running the automatic brake test ➔ 4.1.10.1 Brake test. Force/torque mode with holding brake ➔ 4.1.5 Force/torque mode (PT) with or without holding brake.
Profile	The device is running motion commands ➔ 4.1.2 Operating modes for performing motion commands.
Halt	The current order was aborted via the device profile ➔ 4.3 Hold.
Stop	The device was stopped by a stop signal ➔ 4.2 Stop.
Error stop	The device was stopped by a diagnostic event. The brake can be set and released manually ➔ 3.3.2 Brake control.

Tab. 333: Statuses of the internal finite state machine

Status transitions	Description
Note 1	The transition to the Disabled status occurs if the power stage enable is cancelled or a safety stop is requested (e.g. STO).
Note 2	The transition to the Not ready status occurs, e.g. if the connection to the encoder is interrupted or the re-initialisation is requested or the intermediate circuit is not charged.
Note 3	The transition to the Ready status occurs once all preconditions have been fulfilled.
Note 4	automatic switch to the Standstill status if the power stage enable is not exclusively via the CTRL-EN input ➔ 4.1.9 Switch-on/off behaviour and controller enable.
Note 5	automatic transition to the Profile status if the power stage enable is exclusively via the CTRL-EN input ➔ 4.1.9 Switch-on/off behaviour and controller enable.
RF	Closed-loop controller and power stage enable ➔ 4.1.9 Switch-on/off behaviour and controller enable.
Stop Cat.	Stop of the corresponding category
stop	Stop command via device profile, record table or device-specific plug-in
halt	Stop command via device profile
resume	Resume command via device profile
PWM On	Power output stage is switched on
PWM Off	Power output stage is switched off

Tab. 334: Status transitions of the internal finite state machine

4.1.2 Operating modes for performing motion commands

The servo drive has the following operating modes for performing motion commands:

Operating modes	Description
Profile operating modes – Positioning mode(PP) – Speed mode (PV) – Force/torque mode (PT)	The servo drive uses the integrated trajectory generator to generate the relevant setpoint variables.
cyclic synchronised ... – ... positioning mode (CSP) – ... velocity mode (CSV) – ... force/torque mode (CST)	The setpoint values are specified at equidistant interpolation points via fieldbus, e.g. via EtherCAT. The time-equidistant command values are input by a fine interpolator of the closed-loop controller.

Tab. 335: Operating modes for performing motion commands

The cyclically synchronised operating modes are only available in the CiA402 profile.

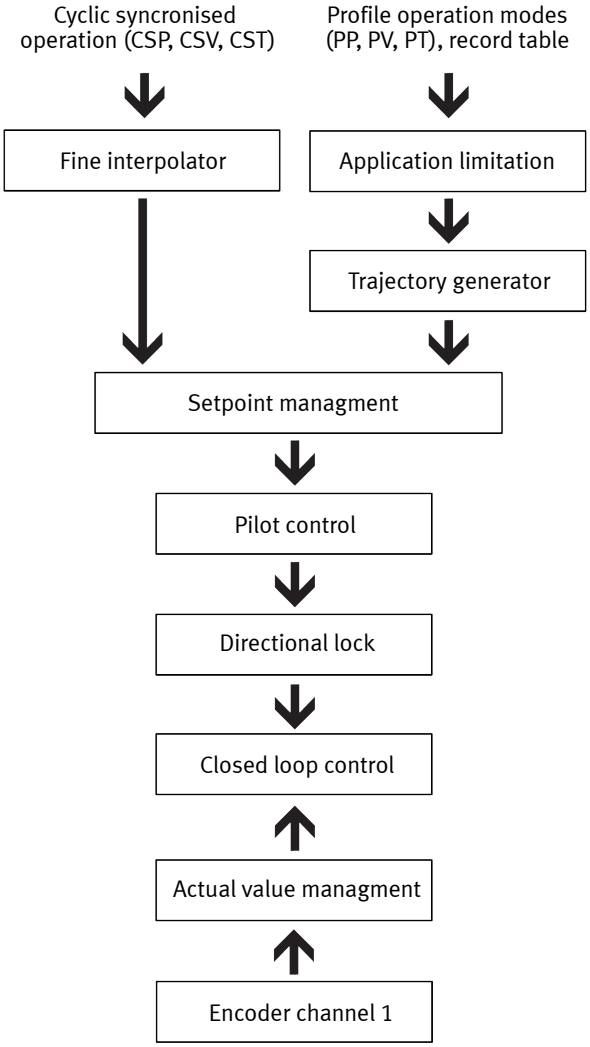


Fig. 39: Internal forwarding of the command values

4.1.2.1 Dynamic operating mode switch

The device can switch dynamically between some operating modes while the drive is moving. In the case of other operating modes, the current motion command must be completed or cancelled before switching the operating mode. See the following table for an overview:

From...	To...							
	PP	PV	PT	CSP	CSV	CST	HM	PT-B
PP	–	a	a	c	c	c	c	c
PV	a	–	a	c	c	c	c	c
PT	a	a	–	c	c	c	c	c
CSP	d	d	d	–	e	e	d	d
CSV	d	d	d	e	–	e	d	d
CST	d	d	d	e	e	–	d	d
HM	MC	MC	MC	MC	MC	MC	–	MC
PT-B	d	d	d	d	d	d	d	–
P	a	a	a	d	d	d	d	d
V	a	a	a	d	d	d	d	d
T	a	a	a	d	d	d	d	d

Tab. 336: Operating mode switch – part 1

Meaning	
a	The dynamic switch between the operating modes is possible at any time.
b	Dynamic switching is possible. Unwanted command value jumps after switching the operating mode must be avoided by input corresponding command value specification by the user or by the higher-order PLC (reconciliation between setpoint and actual value).
c	One of the following conditions must be met for switching the operating mode: – The current motion command has been closed by MC. – The current motion command has been aborted by a stop. Once the request for a switch of operating mode has been accepted, no more motion commands are accepted until the operating mode switch is complete (message). Unwanted command value jumps after switching the operating mode must be avoided by corresponding setpoint specification by the user or by the higher-order controller (reconciliation between setpoint and actual value).
d	The current motion command must be terminated by a stop before the new operating mode can be requested.
e	The dynamic switching of the operating mode is possible at any time if the required command values for the operating modes are mapped in the cyclic process data ➔ 4.1.2 Operating modes for performing motion commands.
MC	Motion complete
HM	Homing

Tab. 337: Operating mode switch – part 2

4.1.2.2 CiA 402

If a dynamic switch between the CSP, CSV and CST operating modes is required, the following objects must be mapped in the cyclic process data:
– Modes of operation (0x6060)
– Mode of operation display (0x6061)
– The required setpoint and actual values of the operating modes

Modes of operation (0x6060) and Mode of operation display (0x6061)

Value/abbreviation		Name
-128	–	Invalid
-20	RT	Record table
-3	PJ	Profile jog
0	PP	Profile position manufacturer-specific
1	PP	Profile position
3	PV	Profile velocity
4	PT	Profile torque
6	HM	Homing
8	CSP	Cyclic sync position

Value/abbreviation		Name
9	CSV	Cyclic sync velocity
10	CST	Cyclic sync torque

Tab. 338: Supported operation modes for CiA402

Switching operating mode

The following graph shows an example of the switch from the CSV operating mode to the CSP operating mode.

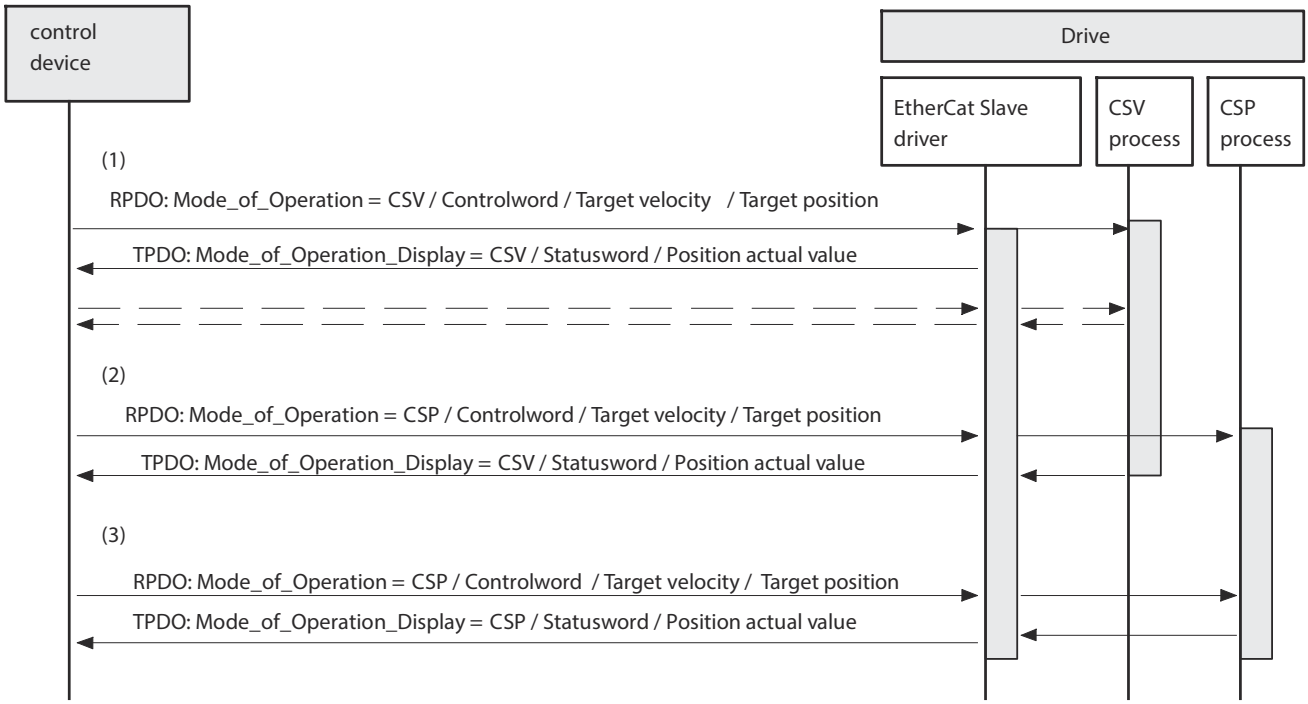


Fig. 40: Operating mode switch from CSV to CSP (example)

Explanations for the above graph:
(1) The CSV operating mode is active. The nominal velocity (Target velocity) and the nominal position (Target position) are sent. However, the target position is not used in the current operating mode.
(2) Switch to the CSP operating mode.
(3) The CSP operating mode is active. The nominal velocity (Target velocity) and the nominal position (Target position) are sent. However, the target velocity is not used in the current operating mode.

4.1.3 Positioning mode(PP)

4.1.3.1 Function

In the positioning operating mode the theoretical path curve is calculated by the integrated trajectory generator (Profile position mode). The trajectory for the target position is calculated based on the motion quantities for the profile speed, the acceleration, the deceleration and the jerk. If the value 0 is defined for the final speed and no other task is triggered, the drive remains position-controlled at the target position. The position controller, the speed controller and the current regulator are active in positioning mode. The following types of position specification are supported in positioning mode:

Position specification	Description
absolute	absolute position referenced to the axis origin
relative to the current actual position	Distance referenced to the current position (actual position)

Position specification	Description
relative to the current setpoint position	Distance referenced to the last setpoint position
relative to the last target position	Distance referenced to the last target position

Tab. 339: Variations of positioning mode

Relative position specifications may result in an overflow of the internally mapped position. In the event of an overflow the parameterised reaction is executed. The reaction must be taken into account by a higher-order controller.

In positioning mode new tasks can be triggered at any time. The current command may be aborted, or the new command appended in a buffer. A jerk-free switch between the PP, PV and PT pro- file operating modes is possible.

Monitoring functions

The monitoring functions marked with a dot are effective in this operating mode:

Motion monitoring function status word			
Bit	Code	Name	Effective
0	TRX	Target window reaches position	•
1	TRV	Target window reaches speed	•
2	TRT	Target window reaches torque	•
3	FEX	Position following error	•
4	FEV	Speed following error	–
5	–	Reserved	–
6	TMX	Position target area monitoring	•
7	TMV	Speed target area monitoring	•
8	TMT	Torque target area monitoring	–
9	–	Reserved	–
10	FEA	Acceleration following error	•
11	–	Reserved	–
12	HLP	Hardware limit switch reached positive	•
13	HLN	Hardware limit switch reached negative	•
14	SLP	Software end position reached positive	•
15	SLN	Software end position reached negative	•
16	STX	Standstill monitoring position/speed	•
17	STV	Standstill monitoring speed	•
18	LS	Stop reached	•
19	STLP	Stroke limit reached positive	–
20	STLN	Stroke limit reached negative	–
21	VM	Speed monitoring	•
22	PB	Reverse feed monitoring	–
23	RDX	Remaining distance monitoring	•
24	MC	Trajectory completed	•
25	REFS	Reference switch activated	•
26	TUR	Torque utilisation exceeded	–
27	FSPR	Fixed stop reached	–
28	ACC	Drive accelerated	•
29	DEC	Drive decelerated	•
30… 31	–	Reserved	–

Tab. 340: Motion monitoring function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Motion quantities

The path of a positioning process is largely influenced by the following motion quantities:

Motion quantities	Description
Target position	Target specification (specification of a route or absolute position)
Profile speed	Setpoint value for speed
Acceleration	Setpoint value for acceleration
Deceleration	Setpoint value for deceleration
Jerk	Maximum value for the jerk during the acceleration phase and deceleration phase
End speed	Speed at the target position

Tab. 341: Motion quantities

Triggering commands

- Record table
- Fieldbus (direct mode)
- ‘Manual Movement’ of the parameter of the device-specific plug-in

Requirements

- Valid homing
- Controller enable

Timing

Example: positioning command with end speed and unequal specifications for acceleration and deceleration

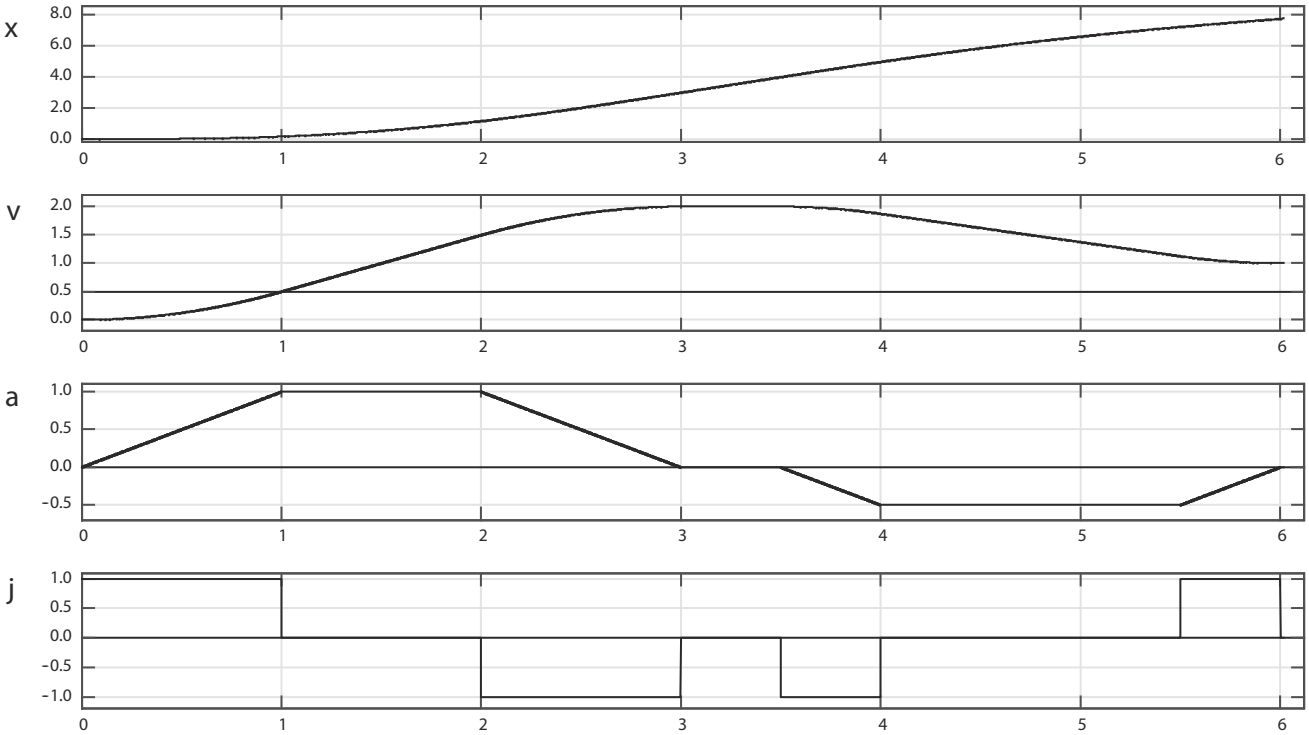


Fig. 41: Positioning mode timing graph (example)

Name	Description
x	Position
v	Speed
a	Acceleration
j	Jerk

Tab. 342: Legend for positioning mode timing graph

4.1.3.2 CiA 402

The following diagrams show an overview of the objects involved in the positioning mode and their interaction with the trajectory generator:

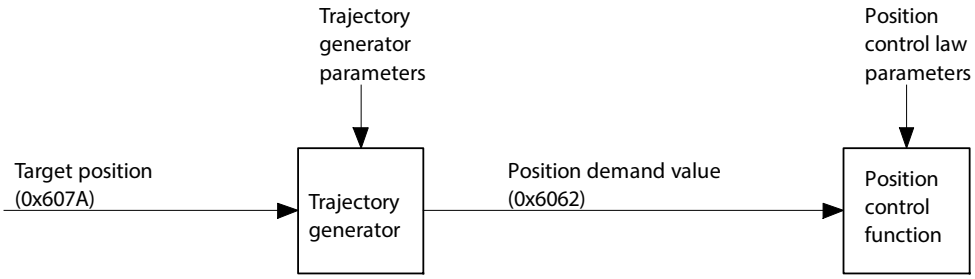


Fig. 42: Overview of the trajectory generator - position control operating mode (PP)

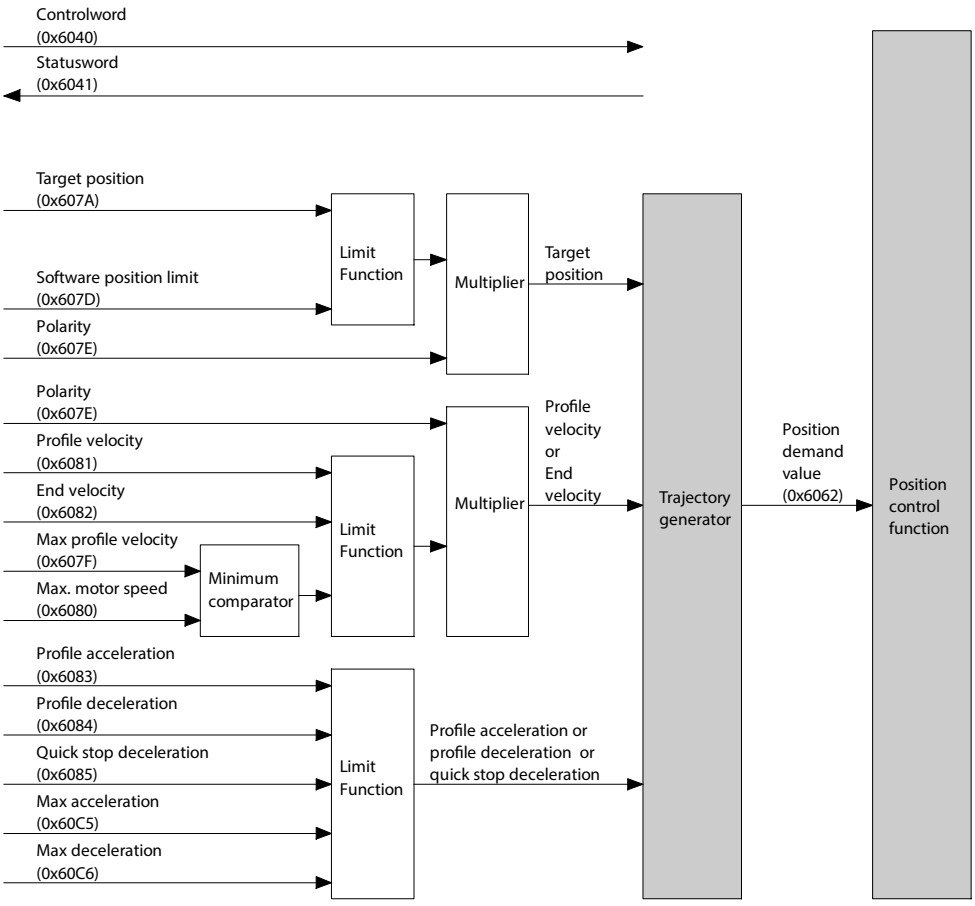


Fig. 43: Trajectory generator in positioning mode (PP)

Objects for positioning mode

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
730	0x6040.00	Control word CiA402	UINT
731	0x6041.00	Status word CiA402	UINT
90	0x6062.00	Setpoint position	DINT
128	0x60E4.01	Actual position value encoder channel 1	DINT
113104	0x6064.00	Actual value modulo	DINT
1210	0x606C.00	Actual velocity value encoder channel 1	DINT
151	0x6077.00	Actual torque value gear shaft	INT
8130	0x607A.00	Target position CiA402	DINT

Parameter	Index.Subindex	Name	Data type
4629	0x607D.01	Negative software limit position	DINT
4630	0x607D.02	Positive software limit position	DINT
1170	0x607E.00	Reversing direction of motion	USINT
1304	0x607F.00	Limit value velocity limit positive and negative direction of movement	UDINT
7123	0x6080.00	Maximum rpm (user defined)	UDINT
8131	0x6081.00	Profile velocity CiA402	UDINT
8132	0x6082.00	End velocity CiA402	UDINT
8133	0x6083.00	Profile acceleration CiA402	UDINT
8134	0x6084.00	Profile deceleration CiA402	UDINT
8135	0x6085.00	Quick stop deceleration CiA402	UDINT
8136	0x60A4.01	Profile jerk CiA402	UDINT
1305	0x60C5.00	Upper limit value acceleration limitation	UDINT
1306	0x60C6.00	Upper limit value deceleration limitation	UDINT
88817	0x60F2.00	Positioning option code CiA402	UINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
730	0x216D.01	Control word CiA402	UINT
731	0x216D.02	Status word CiA402	UINT
90	0x2154.01	Setpoint position	LINT
128	0x2155.09	Actual position value encoder channel 1	LINT
113104	0x2197.05	Actual value modulo	LINT
1210	0x2155.0B	Actual velocity value encoder channel 1	REAL
151	0x2157.02	Actual torque value gear shaft	REAL
8130	0x216F.03	Target position CiA402	LINT
4629	0x2166.1E	Negative software limit position	LINT
4630	0x2166.1F	Positive software limit position	LINT
1170	0x217D.01	Reversing direction of motion	USINT
1304	0x2183.04	Limit value velocity limit positive and negative direction of movement	REAL
7123	0x216C.06	Maximum rpm (user defined)	REAL
8131	0x216F.04	Profile velocity CiA402	REAL
8132	0x216F.05	End velocity CiA402	REAL
8133	0x216F.06	Profile acceleration CiA402	REAL
8134	0x216F.07	Profile deceleration CiA402	REAL
8135	0x216F.08	Quick stop deceleration CiA402	REAL
8136	0x216F.09	Profile jerk CiA402	REAL
1305	0x2183.05	Upper limit value acceleration limitation	REAL
1306	0x2183.06	Upper limit value deceleration limitation	REAL
88817	0x216F.0C	Positioning option code CiA402	UINT

Tab. 343: Objects

Precondition for positioning mode

The following conditions must be fulfilled for positioning mode:
- Modes of operation display (0x6061) = 1
- Statusword (0x6041) = 1X0X X11X X011 0111_b

Control and Monitoring

Object 0x6040: Controlword

The object controls the following functions of positioning mode:
- Bit 4: start motion command (New set-point)
- Bit 5: accept change immediately (Change set immediately)

– Bit 6: positioning type (absolute/relative)
– Bit 8: stop motion command (Halt)

Bit[1]				**Description**
8	6	5	4	
Positioning type				
0	0	x	x	absolute
0	1	x	x	relative; the reference point is defined in object 60F2h (Positioning option code).
Set new motion command				
0	x	0	0→1	If a motion command is currently running, the new motion command is saved. The new motion command is started on completion of the previous motion command.
Start motion command immediately				
0	x	1	0→1	The new motion command is started immediately.
Stop or continue motion command				
0	x	x	0	The motion command is run or continued with the acceleration ramp of the current motion command. Bit 4 must not be 0 but must not toggle. A rising edge in the stop status results in the motion command being aborted.
1	x	x	x	The motion command is interrupted with the stated deceleration ➔ object 0x6084, Profile deceleration.

1) signal status: 0 = low; 1 = high; 0→1 = rising edge

Tab. 344: Control positioning mode

Object 0x60F2, Positioning option code				
Bit 7	Bit 6	Bit 1	Bit 0	Description
Reference point for relative positioning				
x	x	0	0	New target position relative to the last target position (Target position) of the last motion command (relative to 0, if no last motion command is available).
x	x	0	1	New target position relative to the current setpoint position, output of path generator or current setpoint position of setpoint value management.
x	x	1	0	New target position relative to the current actual position, current actual position of the actual value management.
x	x	1	1	reserved
Directional option for rotary axes (modulo)				
0	0	x	x	Standard positioning as with linear axes; If the positioning limits are reached, the setpoint value will automatically set to the other side of the limit value. The positioning can be absolute or relative. Positioning beyond the modulo value is only possible with this bit combination.
0	1	x	x	Positioning in negative direction; If the setpoint position is greater than the actual position, the axis traverses past the minimum position limit to the setpoint position.
1	0	x	x	Positioning in positive direction; If the setpoint position is less than the actual position, the axis traverses past the maximum position limit to the setpoint position.
1	1	x	x	Positioning on shortest path to the setpoint position; If the distance between actual position and setpoint position is 180° with a modulo range of 360°, the axis moves in positive direction.

Tab. 345: Positioning option code

Object 0x6041: Status-word

The following statuses of positioning mode can be monitored with the object:
– Bit 10: target position reached (Target reached)
– Bit 12: motion command acknowledged (Set-point acknowledge)
– Bit 13: position following error (Following error)

Bit[1]			Description
13	12	10	
Target position reached (Target reached) (depending on bit 8 (Halt) in Controlword 0x6040)			
x	x	0	Halt = 0: target position has not yet been reached
x	x	1	Halt = 0: target position has been reached
x	x	0	Halt = 1: drive decelerated
x	x	1	Halt = 1: speed = 0
Motion command acknowledged (setpoint acknowledge)			
x	0	x	Wait for new motion command
x	1	x	Motion command has been acknowledged
Position following error (Following error)			
0	x	x	Position following error in tolerance range
1	x	x	Position following error limit reached

1) Signal status: 0 = low; 1 = high

Tab. 346: Monitoring positioning mode

4.1.3.3 PROFIdrive

Control and Monitoring

Application class ➔ 12.4.3.3 Finite State Machine Positioning Mode in Application Class 3
SATZANW ➔ 12.4.8.15 Record Selection (SATZANW)
AKTSATZ ➔ 12.4.8.16 Active record (AKTSATY)

Positioning mode PNUs

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value encoder channel 1	INT
113104	28.0	Actual value modulo	DINT
Px.	**Manufacturer-specific parameters**		
90	11045.0	Setpoint position	LINT
128	11067.0	Actual position value encoder channel 1	LINT
113104	12117.0	Actual value modulo	LINT
1210	11311.0	Actual velocity value encoder channel 1	REAL
151	11070.0	Actual torque value gear shaft	REAL
4629	11584.0	Negative software limit position	LINT
4630	11585.0	Positive software limit position	LINT
1170	11287.0	Reversing direction of motion	BOOL
1304	11334.0	Limit value velocity limit positive and negative direction of movement	REAL
7123	11694.0	Maximum rpm (user defined)	REAL
1305	11335.0	Upper limit value acceleration limitation	REAL
1306	11336.0	Upper limit value deceleration limitation	REAL

Tab. 347: PNUs

Move to fixed stop (application class 3)

Travel to (fixed) stop performs a positioning with reference to a defined max. clamping torque.
The dynamic torque increase by parameter Px.102223 (see ➔ 6.2.3 Torque limitation) enables the effective torque to be higher than that set via parameter Px.526801.

During move to a (fixed) stop, the (fixed) stop is approached from the current position before reaching the target position (e.g. at a workpiece). A torque is then created up to the desired clamping torque. For example, the following parameters can be set:
– Position
– Speed
– Acceleration
– Deceleration
– Clamping torque
– Clamping torque off set
A current positioning task can be switched by "STW2.8 Traverse to fixed endstop". The switching runs a positioning order with clamping torque. The closed-loop limit manager limits the motion to the clamping torque. On completion of the order, the original limit is restored.
The following error monitor of the motion monitor is not active during the order and the following status bits are set:
– ZSW2.8 Move to fixed stop active
– POS_ZSW2.14 Move to fixed stop active
The following error monitor of the motion monitor is used during the order to detect the fixed stop.
If the (fixed) stop is detected, "POS_ZSW2.12 Fixed stop reached" is set and the stroke limit monitoring of the motion monitoring is activated on the basis of the current position.
With pending clamping torque "POS_ZSW2.13 Fixed stop Clamping torque reached" is set.
The clamping torque remains in place until a new movement command starts.
When the stroke limits for the (fixed) stop monitor are reached, "POS_ZSW2.12 Fixed stop reached" is reset again.
The following graphs show the behaviour:

Timing

Example 1: Move to fixed stop with reaching and stopping at the fixed stop

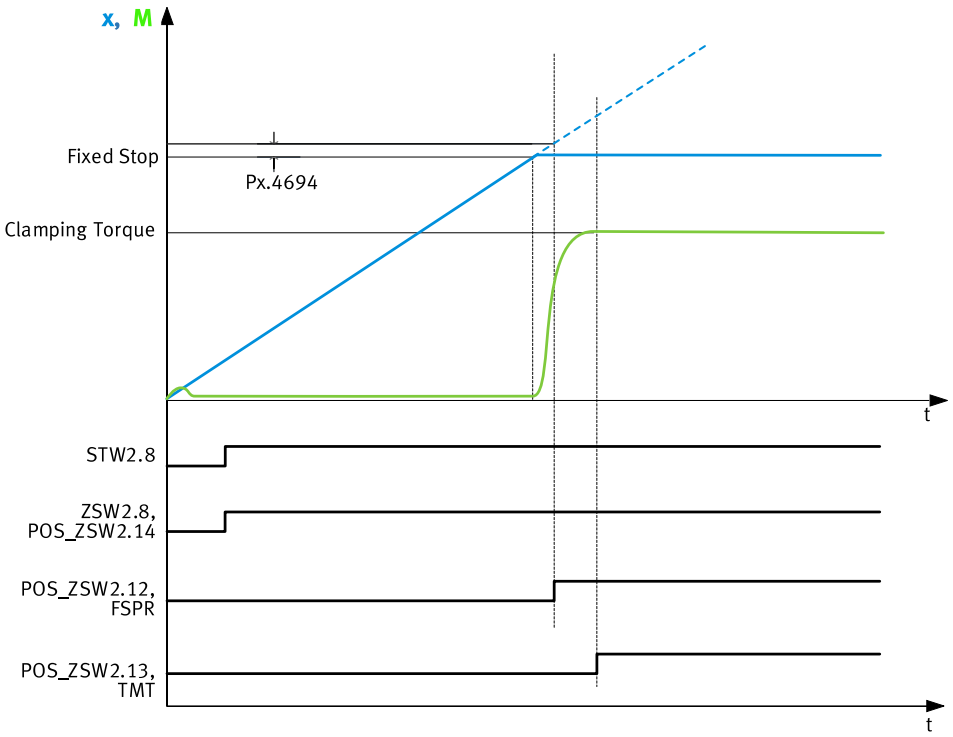


Fig. 44: Timing diagram move to (fixed) stop

Name	Description	ID Px.
Fixed Stop	(Fixed) stop	–
Clamping Torque	Clamping torque	526801
FSPR	Motion monitoring function "(fixed) stop reached" (1 = status reached)	460
TMT	Motion monitoring function "Target torque range monitor" (1 = status reached)	

Tab. 348: Legend for timing diagram move to fixed stop

Example 2: move to fixed stop without reaching the fixed stop

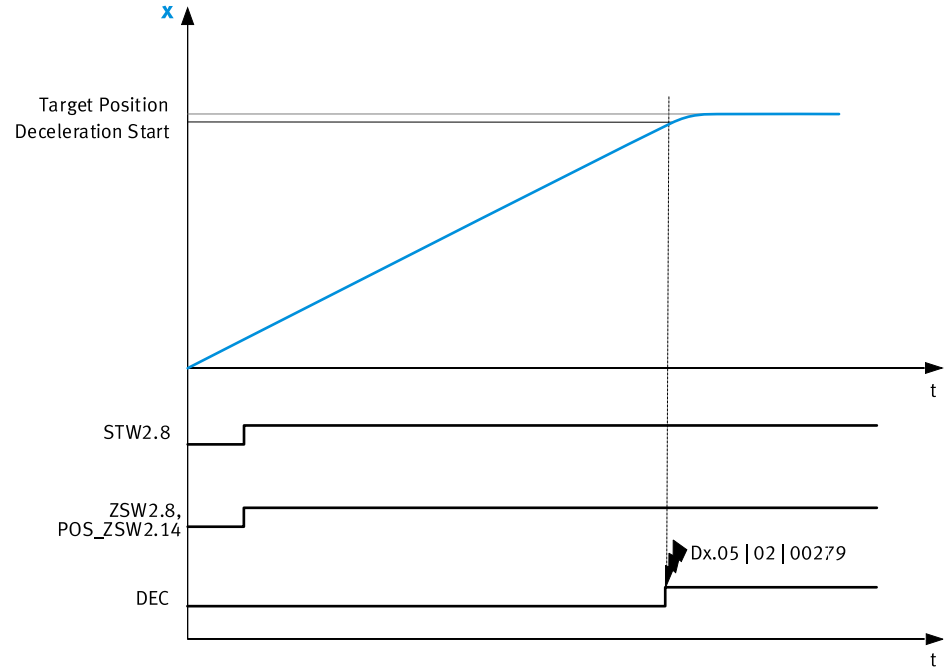


Fig. 45: Timing diagram (fixed) stop not reached

Name	Description	ID Px.
Target Position	Target position	–
Deceleration Start	Start of deceleration	
DEC	Motion monitoring function "Drive decelerated" (1 = status reached)	460
Dx.05|02|000279	Diagnostic message Fixed stop not detected	–

Tab. 349: Legend for timing diagram fixed stop not reached

Example 3: Move to fixed stop with reaching and feedback at the fixed stop

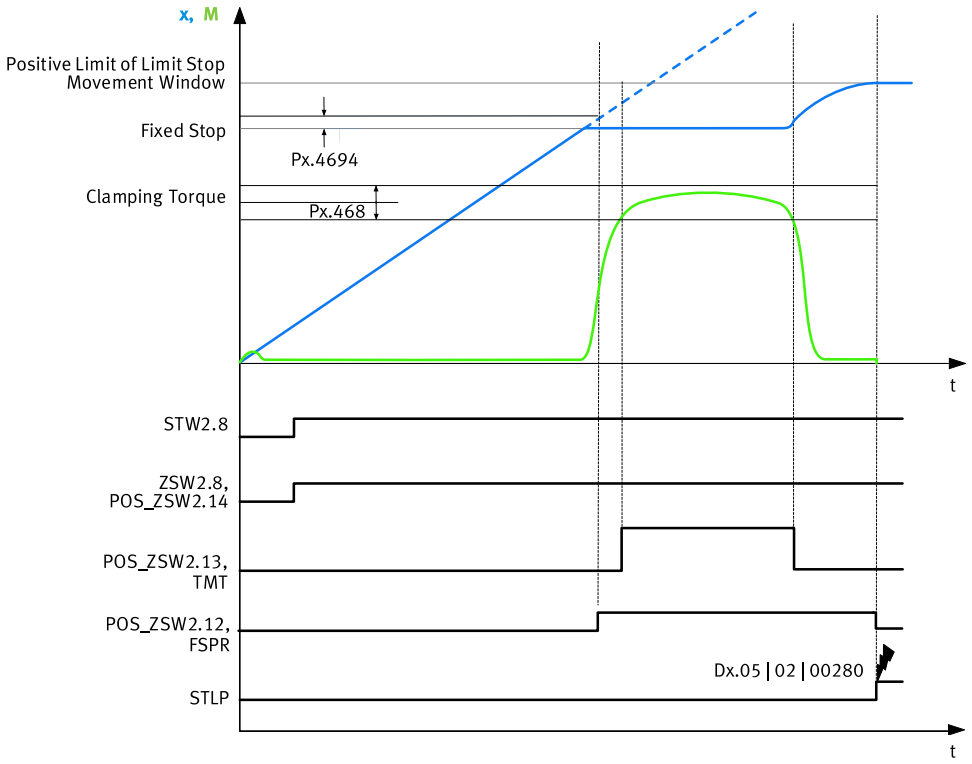


Fig. 46: Timing diagram (fixed) stop feeds back

Name	Description	ID Px.
Positive Limit of Limit Stop Movement Window	Stroke limit positive for detection of a fixed stop	11280408
Fixed Stop	(Fixed) stop	–
Clamping Torque	Clamping torque	526801
TMT	Motion monitoring function "Target torque range monitor" (1 = status reached)	460
FSPR	Motion monitoring function "(fixed) stop reached" (1 = status reached)	
STLP	Motion monitoring function "Stroke limit reached" (1 = status reached)	
Dx.05|02|280	Diagnostic message Monitoring window of fixed stop left	–

Tab. 350: Legend for timing diagram fixed stop feeds back

Parameters

Details of the motion monitoring functions ➔ 5.1 Motion monitoring functions.
The (fixed) stop detection acts like the following error monitor for position with limit value and timing ➔ 5.3 Following error. The following error of the position and a cushioning time are used (Px.4694, Px.4693).
The detection of the pending clamping torque acts like the target range monitor for torque with limit value and timing ➔ 5.4 Target area monitoring.
The monitoring of the stroke limits after a detected (fixed) stop acts like the motion monitor for stroke limits ➔ 5.9 Stroke limit reached.
The window limits can be set in the positive and negative directions (Px.11280408, Px.11280409 ➔ Tab. 351 Parameter).
If the motion leaves the monitoring window in the positive and negative direction it is detected and triggers the following diagnostic message:
– Monitoring window of fixed stop left: Dx.05 | 02 | 00280
The following parameter determines the braking behavior upon exit of the monitoring window:

– Activation of automatic stop ramp stroke limit: Px.4675
The clamping torque depends on the direction of motion. The set clamping torque is added with the offset. This means that the resulting clamping torque depends on the sign of the offset.
An asymmetrical clamping torque can be set with the offset for suspended axes (parameter Clamping torque offset, Px.11280407).

ID Px.	Parameter	Description	
460	Movement monitoring status	Status of movement monitoring	
		Access	read/–
		Update	effective immediately
		Unit	–
468	Damping time target reached	Specifies the damping time for the target position, velocity and torque. The signal is set if the actual value for the specified duration is in the monitoring window. The signal remains set if the actual value moves outside the monitoring window during the specified duration. The damping time is re-evaluated when the value returns to the window.	
		Access	read/write
		Update	effective immediately
		Unit	s
4693	Fixed stop detection damping time	Specifies the damping time for the fixed stop detection. If the absolute value of the following error for the specified time is above the limit value following error (Px.4694), the signal is set.	
		Access	read/write
		Update	effective immediately
		Unit	s
4694	Limit value following error	Specifies the limit value for the fixed stop detection. Is compared with the absolute value of the following error for fixed stop detection.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280409	Stroke limit negative for detection of a fixed stop	Specifies the negative stroke limit for detection of a fixed stop. The negative stroke limit must be lower than the positive stroke limit.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280408	Stroke limit positive for detection of a fixed stop	Specifies the positive stroke limit for detection of a fixed stop. The negative stroke limit must be lower than the positive stroke limit.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
4675	Activation of automatic stop ramp stroke limit	Specifies whether automatic braking should be activated. If automatic braking is active, the drive is decelerated so that it stops before the stroke limit, if possible. If automatic braking is deactivated, the drive is only stopped once it reaches the stroke limit.	
		Access	read/write
		Update	effective immediately
		Unit	–
4668	Monitoring window torque	Specifies the monitoring window for the target torque. The monitoring window is set symmetrically to the target value (window width = 2x parameter).	
		Access	read/write
		Update	effective immediately
		Unit	Nm

ID Px.	Parameter	Description	
526801	Clamping torque	Specifies the offset for the clamping torque for the approach to the fixed stop.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
11280407	Clamping torque offset	Specifies the offset for the clamping torque during approach to the fixed stop. The offset moves the clamping torque in order to retain an asymmetrical limit, e.g. for a vertical axis.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
11280606	Acceleration MDI	Displays the acceleration for the setpoint direct input MDI.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280607	Deceleration MDI	Displays the deceleration for the direct-value setpoint MDI.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280604	Target position MDI	Displays the target position for the setpoint direct MDI.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280605	Profile velocity MDI	Displays the profile velocity for the direct-value setpoint MDI.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
102223	Selection of dynamic torque boost	Specifies to which torque limit the dynamic boost is applied. Values: – 0: None – 1: Axis limitation – 2: All limitations	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 351: Parameter

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280606	36.0	Acceleration MDI	INT
11280607	37.0	Deceleration MDI	INT
11280604	34.0	Target position MDI	DINT
11280605	35.0	Profile velocity MDI	UDINT
Px.	**Manufacturer-specific parameters**		
460	11144.0	Movement monitoring status	UDINT
468	11152.0	Damping time target reached	REAL
4693	11635.0	Fixed stop detection damping time	REAL
4694	11636.0	Limit value following error	REAL
11280409	12331.0	Stroke limit negative for detection of a fixed stop	LINT
11280408	12330.0	Stroke limit positive for detection of a fixed stop	LINT

Parameter	PNU	Name	Data type
4675	11619.0	Activation of automatic stop ramp stroke limit	BOOL
4668	11614.0	Monitoring window torque	REAL
526801	12168.0	Clamping torque	REAL
11280407	12329.0	Clamping torque offset	REAL
11280606	12341.0	Acceleration MDI	REAL
11280607	12342.0	Deceleration MDI	REAL
11280604	12339.0	Target position MDI	LINT
11280605	12340.0	Profile velocity MDI	REAL
102223	13073.0	Selection of dynamic torque boost	USINT

Tab. 352: PNUs

Diagnostic messages

ID Dx.	Name	Description
05 | 02 | 00279 (84017431)	Fixed stop not detected	Fixed stop was not detected
05 | 02 | 00280 (84017432)	Monitoring window of fixed stop left	Monitoring window of fixed stop left

Tab. 353: Diagnostic messages

4.1.4 Speed mode (PV)

4.1.4.1 Function

In the speed operating mode the theoretical speed curve is calculated by the integrated trajectory generator (Profile velocity mode). The trajectory for the target speed is calculated based on the motion quantities for the profile speed, the acceleration, the deceleration and the jerk.
In speed mode the speed and current regulators are active.
The following types of speed settings are supported in speed mode:

Speed specification	Description
... with stroke limitation	When the stroke limitation is reached, the device reacts in accordance with parameterised STL monition monitoring ➔ 5.9 Stroke limit reached
... without stroke limitation	Speed mode without path limitation

Tab. 354: Types of speed mode

In speed mode new commands can be triggered at any time. The current command may be aborted, or the new command appended in a buffer. A jerk-free switch between the PP, PV and PT pro- file operating modes is possible.

Monitoring functions

The monitoring functions marked with a dot are effective in this operating mode:

Motion monitoring function status word			
Bit	Code	Name	Effective
0	TRX	Target window reaches position	–
1	TRV	Target window reaches speed	•
2	TRT	Target window reaches torque	–
3	FEX	Position following error	–
4	FEV	Speed following error	•
5	–	Reserved	–
6	TMX	Position target area monitoring	–
7	TMV	Speed target area monitoring	•

Motion monitoring function status word			
Bit	Code	Name	Effective
8	TMT	Torque target area monitoring	–
9	–	Reserved	–
10	FEA	Acceleration following error	•
11	–	Reserved	–
12	HLP	Hardware limit switch reached positive	•
13	HLN	Hardware limit switch reached negative	•
14	SLP	Software end position reached positive	•
15	SLN	Software end position reached negative	•
16	STX	Standstill monitoring position/speed	•
17	STV	Standstill monitoring speed	•
18	LS	Stop reached	•
19	STLP	Stroke limit reached positive	•
20	STLN	Stroke limit reached negative	•
21	VM	Speed monitoring	•
22	PB	Reverse feed monitoring	–
23	RDX	Remaining distance monitoring	•
24	MC	Trajectory completed	•
25	REFS	Reference switch activated	•
26	TUR	Torque utilisation exceeded	–
27	FSPR	Fixed stop reached	–
28	ACC	Drive accelerated	•
29	DEC	Drive decelerated	•
30... 31	–	Reserved	–

Tab. 355: Motion monitoring function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Motion quantities

The path of a positioning process is largely influenced by the following motion quantities:

Motion quantities	Description
Target speed	Command value for the target speed
Acceleration	Nominal acceleration
Deceleration	Nominal deceleration (with target speed < actual speed)
Jerk	Maximum value for the jerk during the acceleration phase and deceleration phase
Activation of stroke limits	Stroke limit monitoring must be activated by parameters.
Negative stroke limit	If the negative stroke limit is greater than or equal to the positive stroke limit, the stroke limit is not effective.
Positive stroke limit	

Tab. 356: Motion quantities

Triggering commands

- the record table
- the fieldbus (direct mode)

Requirements

- Controller enable

Timing

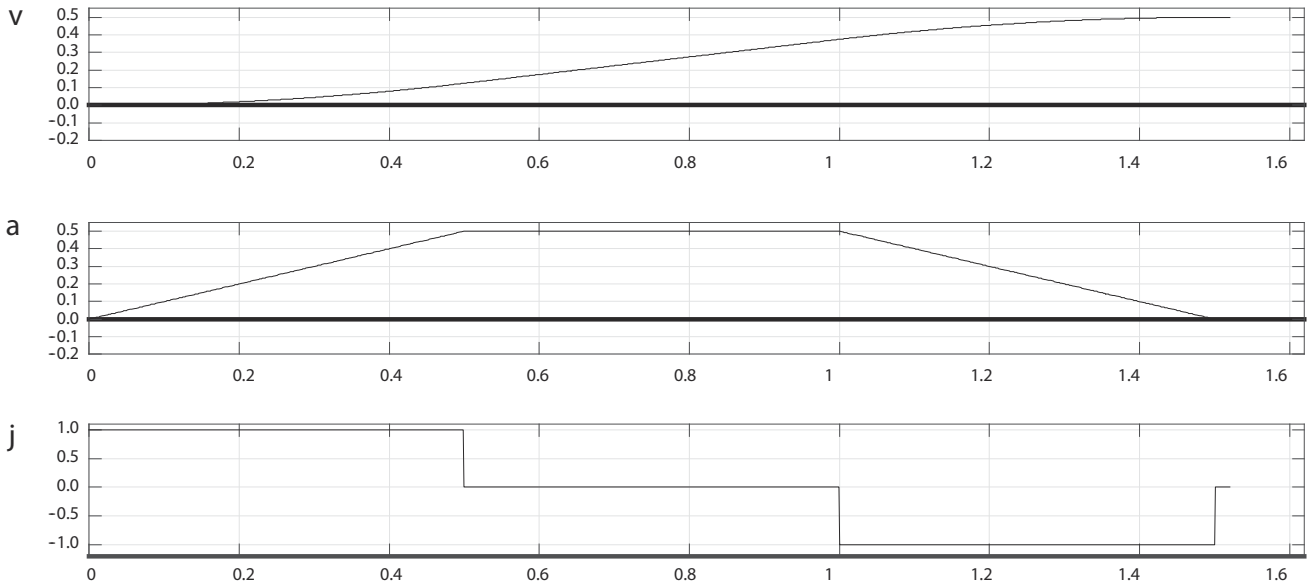


Fig. 47: Timing graph of speed mode (example)

Name	Description
v	Speed
a	Acceleration
j	Jerk

Tab. 357: Legend for timing graph of speed mode

4.1.4.2 CiA 402

The following diagram shows an overview of the objects involved in the speed mode and their interaction with the trajectory generator:

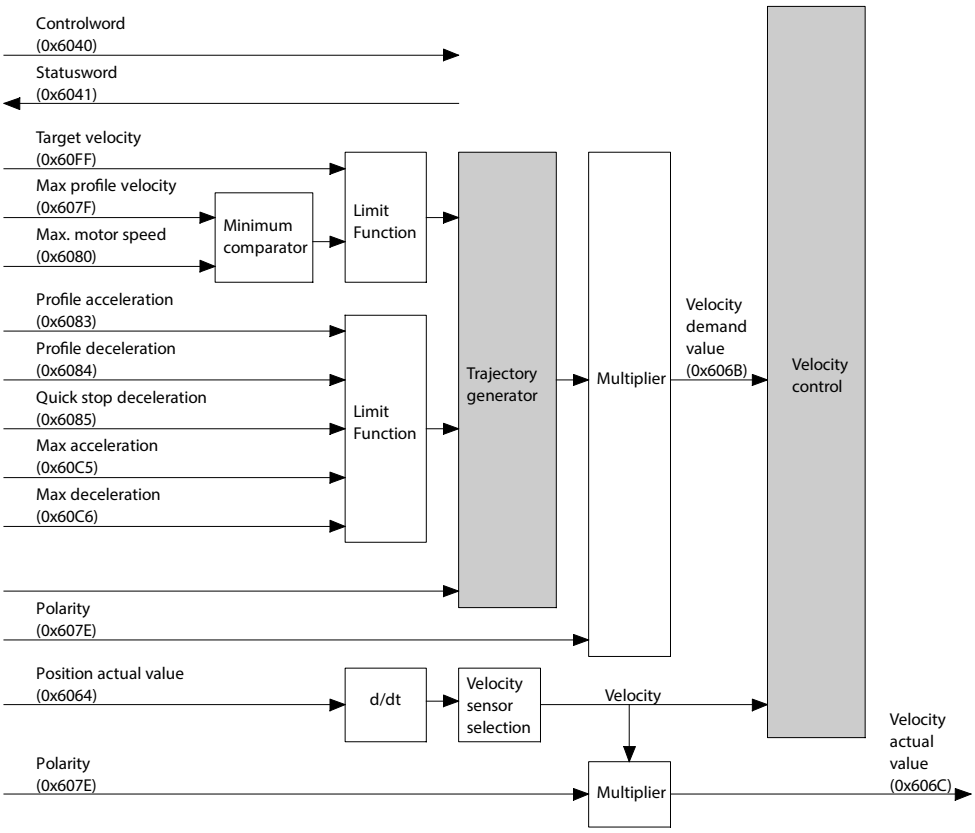


Fig. 48: Trajectory generator in speed mode (PV)

Speed mode objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
730	0x6040.00	Control word CiA402	UINT
731	0x6041.00	Status word CiA402	UINT
128	0x60E4.01	Actual position value encoder channel 1	DINT
113104	0x6064.00	Actual value modulo	DINT
1210	0x606C.00	Actual velocity value encoder channel 1	DINT
4610	0x606D.00	Monitoring window target velocity	UINT
468	0x6068.00	Damping time target reached	UINT
466	0x606F.00	Monitoring window velocity standstill monitoring	UINT
465	0x6070.00	Standstill damping time	UINT
1170	0x607E.00	Reversing direction of motion	USINT
1304	0x607F.00	Limit value velocity limit positive and negative direction of movement	UDINT
7123	0x6080.00	Maximum rpm (user defined)	UDINT
8133	0x6083.00	Profile acceleration CiA402	UDINT
8134	0x6084.00	Profile deceleration CiA402	UDINT
8135	0x6085.00	Quick stop deceleration CiA402	UDINT
1305	0x60C5.00	Upper limit value acceleration limitation	UDINT
1306	0x60C6.00	Upper limit value deceleration limitation	UDINT
464	0x60F8.00	Monitoring window velocity: following error	DINT
8137	0x60FF.00	Target velocity CiA402	DINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
730	0x216D.01	Control word CiA402	UINT
731	0x216D.02	Status word CiA402	UINT
128	0x2155.09	Actual position value encoder channel 1	LINT
113104	0x2197.05	Actual value modulo	LINT
1210	0x2155.0B	Actual velocity value encoder channel 1	REAL
4610	0x2166.0B	Monitoring window target velocity	REAL
468	0x2166.09	Damping time target reached	REAL
466	0x2166.07	Monitoring window velocity standstill monitoring	REAL
465	0x2166.06	Standstill damping time	REAL
1170	0x217D.01	Reversing direction of motion	USINT
1304	0x2183.04	Limit value velocity limit positive and negative direction of movement	REAL
7123	0x216C.06	Maximum rpm (user defined)	REAL
8133	0x216F.06	Profile acceleration CiA402	REAL
8134	0x216F.07	Profile deceleration CiA402	REAL
8135	0x216F.08	Quick stop deceleration CiA402	REAL
1305	0x2183.05	Upper limit value acceleration limitation	REAL
1306	0x2183.06	Upper limit value deceleration limitation	REAL
464	0x2166.05	Monitoring window velocity: following error	REAL
8137	0x216F.0A	Target velocity CiA402	REAL

Tab. 358: Objects

Precondition for speed mode

The following conditions must be fulfilled for speed mode:
- Modes of operation display (0x6061) = 3
- Statusword (0x6041) = XX0X XX1X X011 0111$_b$

Control and Monitoring

In speed mode start signal or starting edge is not required to start the movement.

Object 0x6040: Controlword

The object controls the following speed mode functions:
– Bit 8: stop motion command (Halt)

Bit[1)] 8	Description
Stop/continue motion (Halt)	
0	The motion is executed or continued
1	The motion is stopped with the stated deceleration (see object 0x6084, Profile deceleration)

1) Signal status: 0 = low; 1 = high

Tab. 359: Control speed mode

Object 0x6041: Statusword

The following statuses of speed mode can be monitored with the object:
– Bit 10: target speed reached (Target reached)
– Bit 12: speed (Speed)
– Bit 13: speed following error (Following error)

Bit[1)] 13	12	10	Description
Target speed reached (Target reached) (depending on bit 8 (Halt) in Controlword 0x6040)			
x	x	0	Halt = 0: target speed was not reached
x	x	1	Halt = 0: target speed was reached
x	x	0	Halt = 1: drive decelerated
x	x	1	Halt = 1: speed = 0
Standstill message			
x	0	x	Geschwindigkeitsistwert ≠ 0
x	1	x	Geschwindigkeitsistwert = 0
Speed following error (Following error)			
0	x	x	A speed following error is not active
1	x	x	Speed following error limit reached

1) signal status: 0 = low; 1 = high; x = any

Tab. 360: Monitoring speed mode

4.1.4.3 PROFIdrive

Control and Monitoring

Application class ➔ 12.4.3.2 Finite State Machine Velocity Mode in Application Class 1

Speed mode PNUs

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value encoder channel 1	INT
113104	28.0	Actual value modulo	DINT
Px.	**Manufacturer-specific parameters**		
128	11067.0	Actual position value encoder channel 1	LINT
113104	12117.0	Actual value modulo	LINT
1210	11311.0	Actual velocity value encoder channel 1	REAL
4610	11565.0	Monitoring window target velocity	REAL
468	11152.0	Damping time target reached	REAL

Parameter	PNU	Name	Data type
466	11150.0	Monitoring window velocity standstill monitoring	REAL
465	11149.0	Standstill damping time	REAL
1170	11287.0	Reversing direction of motion	BOOL
1304	11334.0	Limit value velocity limit positive and negative direction of movement	REAL
7123	11694.0	Maximum rpm (user defined)	REAL
1305	11335.0	Upper limit value acceleration limitation	REAL
1306	11336.0	Upper limit value deceleration limitation	REAL
464	11148.0	Monitoring window velocity: following error	REAL

Tab. 361: PNUs

4.1.5 Force/torque mode (PT) with or without holding brake

4.1.5.1 Function

In the force/torque operating mode the theoretical setpoint curve is calculated by the integrated trajectory generator (Profile torque mode). The trajectory for the target torque is calculated based on the torque rise time. The force/torque mode enables force control. The speed controller and the current regulator are active in force/torque mode.
The transition to the new setpoint quantity can be influenced by parameterization of the rise time.
The following variants are supported in force/torque mode:

Force/torque mode ...	Description
With speed and without stroke limitation	Force/torque with speed limitation
With speed and stroke limitation	Force/torque with speed and stroke limitation

Tab. 362: Variants of force/torque

In force/torque mode new commands can be triggered at any time. The current command may be aborted, or the new command appended in a buffer. A jerk-free switch between the PP, PV and PT pro- file operating modes is possible.

Torque values in servo drive controllers are by default referenced to the values at the gearbox output shaft (including gear ratio).
With the Px.1128062 parameter the torque values involved can be referenced to the transmission output shaft instead of the motor shaft ➔ 11.7.5 Torque switching.

Force/torque mode with brake (PT/B)

Force/torque mode with brake is a variant of force/torque mode in which a command for force/torque control is executed with set brake.

Monitoring functions

The monitoring functions marked with a dot are effective in this operating mode:

Motion monitoring function status word			
Bit	Code	Name	Effective
0	TRX	Target window reaches position	–
1	TRV	Target window reaches speed	–
2	TRT	Target window reaches torque	•
3	FEX	Position following error	–
4	FEV	Speed following error	–
5	–	Reserved	–
6	TMX	Position target area monitoring	–

Motion monitoring function status word			
Bit	Code	Name	Effective
7	TMV	Speed target area monitoring	–
8	TMT	Torque target area monitoring	•
9	–	Reserved	–
10	FEA	Acceleration following error	–
11	–	Reserved	–
12	HLP	Hardware limit switch reached positive	•
13	HLN	Hardware limit switch reached negative	•
14	SLP	Software end position reached positive	•
15	SLN	Software end position reached negative	•
16	STX	Standstill monitoring position/speed	•
17	STV	Standstill monitoring speed	•
18	LS	Stop reached	•
19	STLP	Stroke limit reached positive	•
20	STLN	Stroke limit reached negative	•
21	VM	Speed monitoring	•
22	PB	Reverse feed monitoring	•
23	RDX	Remaining distance monitoring	•
24	MC	Trajectory completed	•
25	REFS	Reference switch activated	•
26	TUR	Torque utilisation exceeded	–
27	FSPR	Fixed stop reached	–
28	ACC	Drive accelerated	–
29	DEC	Drive decelerated	–
30… 31	–	Reserved	–

Tab. 363: Motion monitoring function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Motion quantities

The path of a positioning process is largely influenced by the following motion quantities:

Motion quantities	Description
Target torque	Target specification
Torque rise time	Minimum time for reaching the target torque
Speed limit value	Maximum speed for reaching the target torque
Activation of stroke limits	Stroke limit monitoring must be activated by parameters.
Negative stroke limit	If the negative stroke limit is greater than or equal to the positive stroke limit, the stroke limit is not effective.
Positive stroke limit	

Tab. 364: Motion quantities

Triggering commands

– the record table
– the fieldbus (direct mode)

Requirements for force/ torque

– Controller enable

Timing

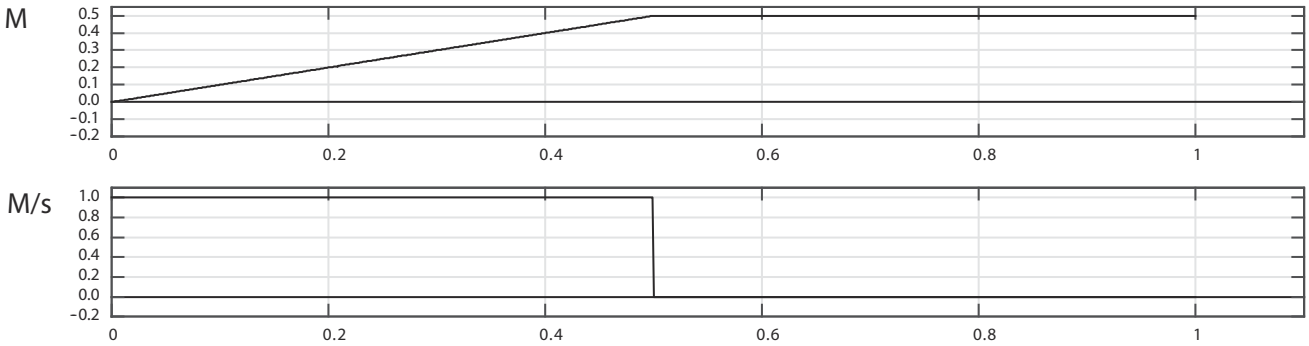


Fig. 49: Force/torque mode timing graph (example)

Name	Description
M	Torque
M/s	Torque increase

Tab. 365: Legend for force/torque mode timing graph

4.1.5.2 CiA 402

The following graph shows an overview of the objects involved in the force/torque mode and their interaction with the trajectory generator:

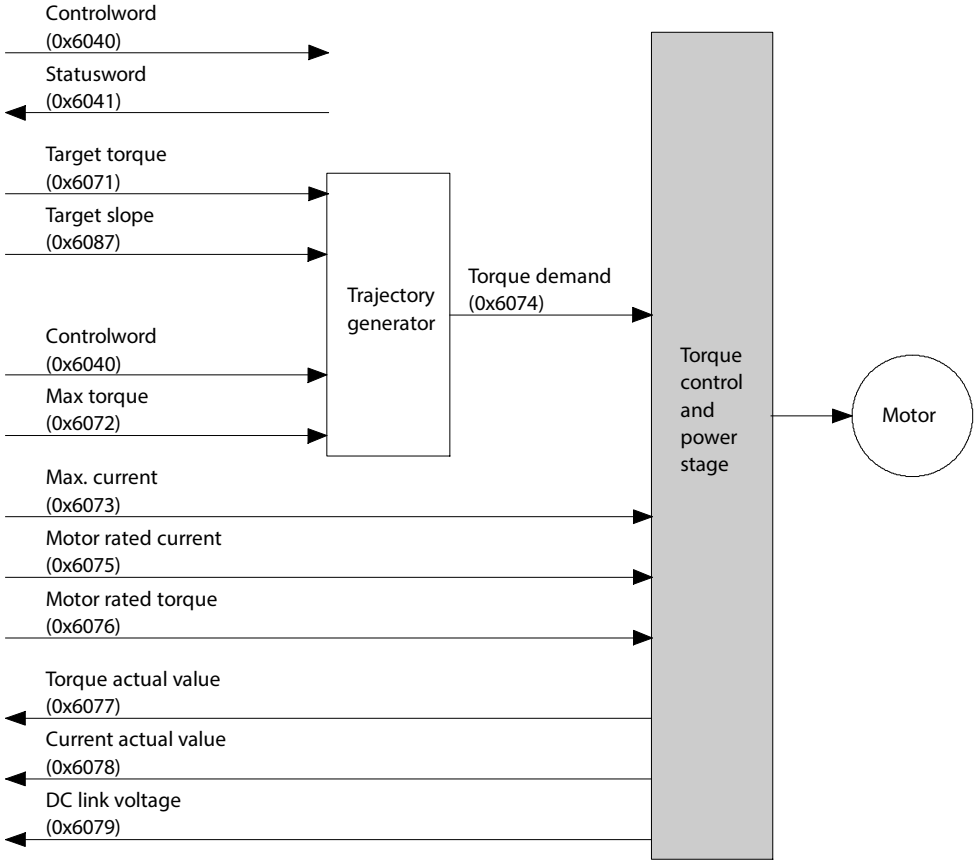


Fig. 50: Trajectory generator in force/torque (PT)

Speed and stroke limitation

As with the record table, a peed limitation and a stroke limitation can be activated for the Profil Torque Mode operating mode.
Parameters:
– Velocity limitation profile torque mode CiA402: Px.526800
– Activate stroke limit CiA402: Px.5268004

– Positive stroke limitation CiA402: Px.5268002
– Negative stroke limitation CiA402: Px.5268003

Force/torque mode objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
730	0x6040.00	Control word CiA402	UINT
731	0x6041.00	Status word CiA402	UINT
526795	0x6071.00	Target torque CiA402	INT
526796	0x6072.00	Maximum torque symmetrical	UINT
856	0x6073.00	Limit value total current (closed loop controller)	UINT
3014	0x6074.00	Setpoint generator output torque	INT
7118	0x6075.00	Actual nominal current	UDINT
151	0x6077.00	Actual torque value gear shaft	INT
814	0x6078.00	Actual active current value	INT
480	0x6079.00	Actual value DC link voltage	UDINT
526799	0x6087.00	Torque slope CiA402	UDINT
853	0x60E0.00	Upper limit value torque (closed loop controller)	UINT
852	0x60E1.00	Lower limit value torque (closed loop controller)	UINT
1304	0x607F.00	Limit value velocity limit positive and negative direction of movement	UDINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
730	0x216D.01	Control word CiA402	UINT
731	0x216D.02	Status word CiA402	UINT
526795	0x216F.0D	Target torque CiA402	REAL
526796	0x2168.17	Maximum torque symmetrical	REAL
856	0x2168.07	Limit value total current (closed loop controller)	REAL
3014	0x2188.07	Setpoint generator output torque	REAL
7118	0x2162.05	Actual nominal current	REAL
7139	0x2162.0C	Resulting nominal torque	REAL
151	0x2157.02	Actual torque value gear shaft	REAL
814	0x2153.0F	Actual active current value	REAL
480	0x2114.01	Actual value DC link voltage	REAL
526799	0x216F.0E	Torque slope CiA402	REAL
853	0x2168.04	Upper limit value torque (closed loop controller)	REAL
852	0x2168.03	Lower limit value torque (closed loop controller)	REAL
1304	0x2183.04	Limit value velocity limit positive and negative direction of movement	REAL
526800	0x216F.0F	Velocity limitation profile torque mode CiA402	REAL
526802	0x216F.10	Positive stroke limitation CiA402	LINT
526803	0x216F.11	Negative stroke limitation CiA402	LINT
526804	0x216F.15	Activate stroke limit CiA402	USINT

Tab. 366: Objects

Precondition for force/torque mode

The following conditions must be fulfilled for force/torque mode:
– Modes of operation display (0x6061) = 4
– Statusword (0x6041) = XX0X XX1X X011 0111_b

Control and Monitoring

Object 0x6040: Control-word

In force/torque mode, start signal or starting slope is not required to start movement.

The object controls the following force/torque mode functions:
– Bit 8: stopping, executing or continuing movement (Halt)

Bit[1]	Description
8	
Stop/continue motion (Halt)	
0	The motion is executed or continued.
1	The motion is stopped with the stated torque ramp (see object 0x6087, Torque slope)

1) Signal status: 0 = low; 1 = high

Tab. 367: Controlling force/torque mode

Object 0x6041: Status-word

The following statuses of force/torque mode can be monitored with the object:
– Bit 10: target reached (Target reached)

Bit[1]	Description
10	
Target reached (Target reached) (depending on Bit 8 (Halt) in Controlword 0x6040)	
0	Halt = 0: force/torque has not yet been reached.
1	Halt = 0: force/torque has been reached.
0	Halt = 1: drive decelerated
1	Halt = 1: speed = 0

1) Signal status: 0 = low; 1 = high

Tab. 368: Monitoring force/torque mode

4.1.5.3 PROFIdrive

Force/torque mode PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
526796	12166.0	Maximum torque symmetrical	REAL
856	11218.0	Limit value total current (closed loop controller)	REAL
3014	11502.0	Setpoint generator output torque	REAL
7118	11691.0	Actual nominal current	REAL
7139	11704.0	Resulting nominal torque	REAL
151	11070.0	Actual torque value gear shaft	REAL
814	11190.0	Actual active current value	REAL
480	2148.0	Actual value DC link voltage	REAL
853	11215.0	Upper limit value torque (closed loop controller)	REAL
852	11214.0	Lower limit value torque (closed loop controller)	REAL
1304	11334.0	Limit value velocity limit positive and negative direction of movement	REAL

Tab. 369: PNUs

4.1.6 Cyclic synchronised positioning mode (CSP)

4.1.6.1 Function

Cyclic synchronised positioning mode enables setpoint values to be pre-set for the device in a fixed time grid using the drive profile (SYNC interval). The import of the setpoint values is synchronised with the synchronisation signal of the higher-order controller. The synchronisation signal is generally slower by a whole number than the cycle of the closed-loop controller. The synchronisation time is generally set by the higher-order PLC (synchronisation time 1 ... 20 ms, increment 1 ms, ➔ Px.1051). The integrated fine interpolator therefore calculates intermediate support points and derivations from the setpoint value for the closed-loop controller (interpolation).

Monitoring functions

The monitoring functions marked with a dot are effective in this operating mode:

Motion monitoring function status word			
Bit	Code	Name	Effective
0	TRX	Target window reaches position	–
1	TRV	Target window reaches speed	–
2	TRT	Target window reaches torque	–
3	FEX	Position following error	•
4	FEV	Speed following error	–
5	–	Reserved	–
6	TMX	Position target area monitoring	–
7	TMV	Speed target area monitoring	–
8	TMT	Torque target area monitoring	–
9	–	Reserved	–
10	FEA	Acceleration following error	•
11	–	Reserved	–
12	HLP	Hardware limit switch reached positive	•
13	HLN	Hardware limit switch reached negative	•
14	SLP	Software end position reached positive	•
15	SLN	Software end position reached negative	•
16	STX	Standstill monitoring position/speed	•
17	STV	Standstill monitoring speed	•
18	LS	Stop reached	•
19	STLP	Stroke limit reached positive	–
20	STLN	Stroke limit reached negative	–
21	VM	Speed monitoring	•
22	PB	Reverse feed monitoring	–
23	RDX	Remaining distance monitoring	–
24	MC	Trajectory completed	–
25	REFS	Reference switch activated	•
26	TUR	Torque utilisation exceeded	–
27	FSPR	Fixed stop reached	–
28	ACC	Drive accelerated	–
29	DEC	Drive decelerated	–
30... 31	–	Reserved	–

Tab. 370: Motion monitoring function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Motion quantities

The path of a positioning process is largely influenced by the following motion quantities:

Motion quantities	Description
Setpoint position	The higher-order PLC supplies the setpoint position.
Speed (optional)	External pilot control values for the speed and the torque can also be specified (optional).
Torque (optional)	

Tab. 371: Motion quantities

Requirements

– Controller enable

Pilot control values

External pilot control values for the speed and the torque can also be specified (optional).
The integrated interpolator distinguishes the following operating modes in CSP operation, which can be selected with the parameter Px.11412:

Operating modes of the interpolator in CSP operation (ID Px.11412)	
Operating modes	Description
CSP	straight CSP operation without external pilot control values; feed forward control values are generated by an internal algorithm – Fourth order Ipo algorithm
CSP-V	external speed pilot control value – Third order Ipo algorithm
CSP-T	external torque pilot control value – Third order Ipo algorithm
CSP-VT	external speed and torque pilot control values – Second order Ipo algorithm

Tab. 372: Operating modes of the integrated interpolator in CSP operation

The interpolator has two sets of interpolator algorithm instances and can be switched between the CSP, CSV and CST operating modes. When switching, the required algorithm instances are first generated and populated with input data. When the algorithms reach the initialised status, the control is switched to the new operating mode.
The following graph shows an example of the input and output values for the interpolator in straight CSP operation without external pilot control values.

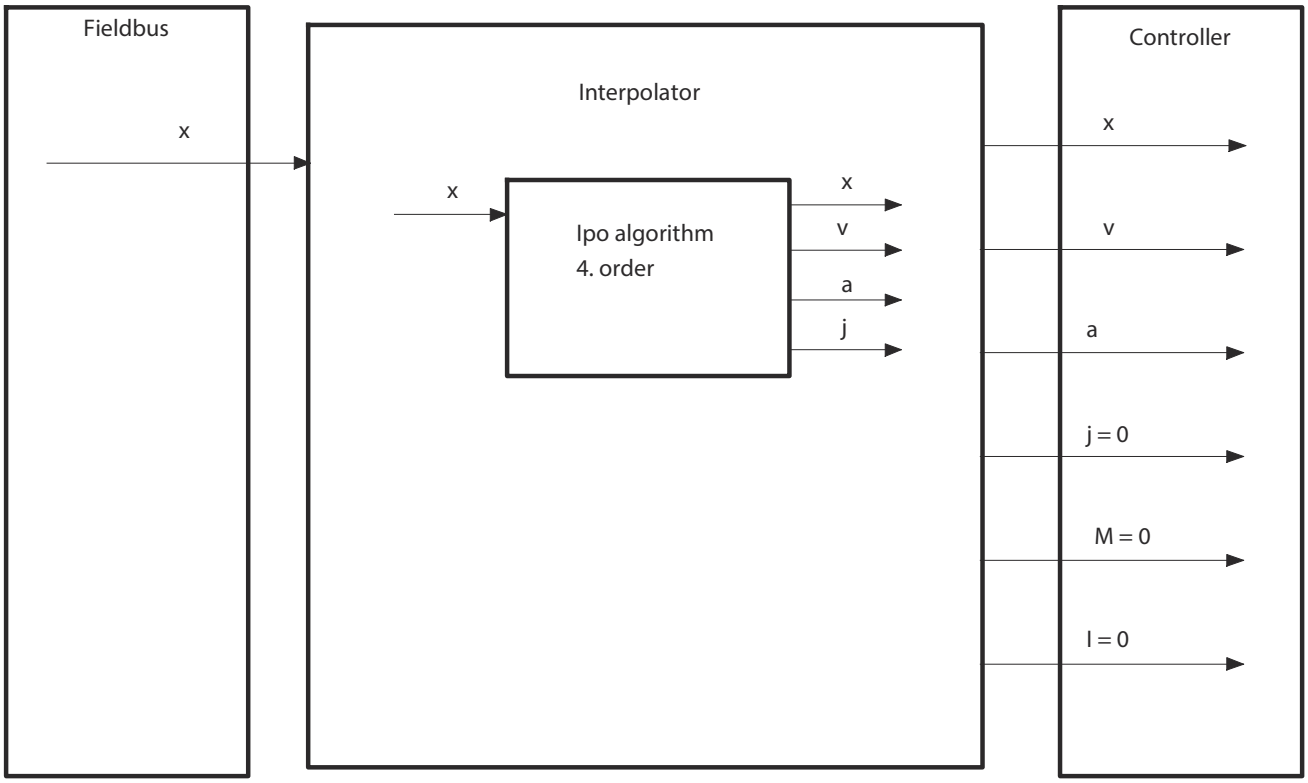


Fig. 51: CSP operation without external pilot control

The following graph shows an example of the input and output values for the interpolator in straight CSP operation with speed and torque pilot control values.

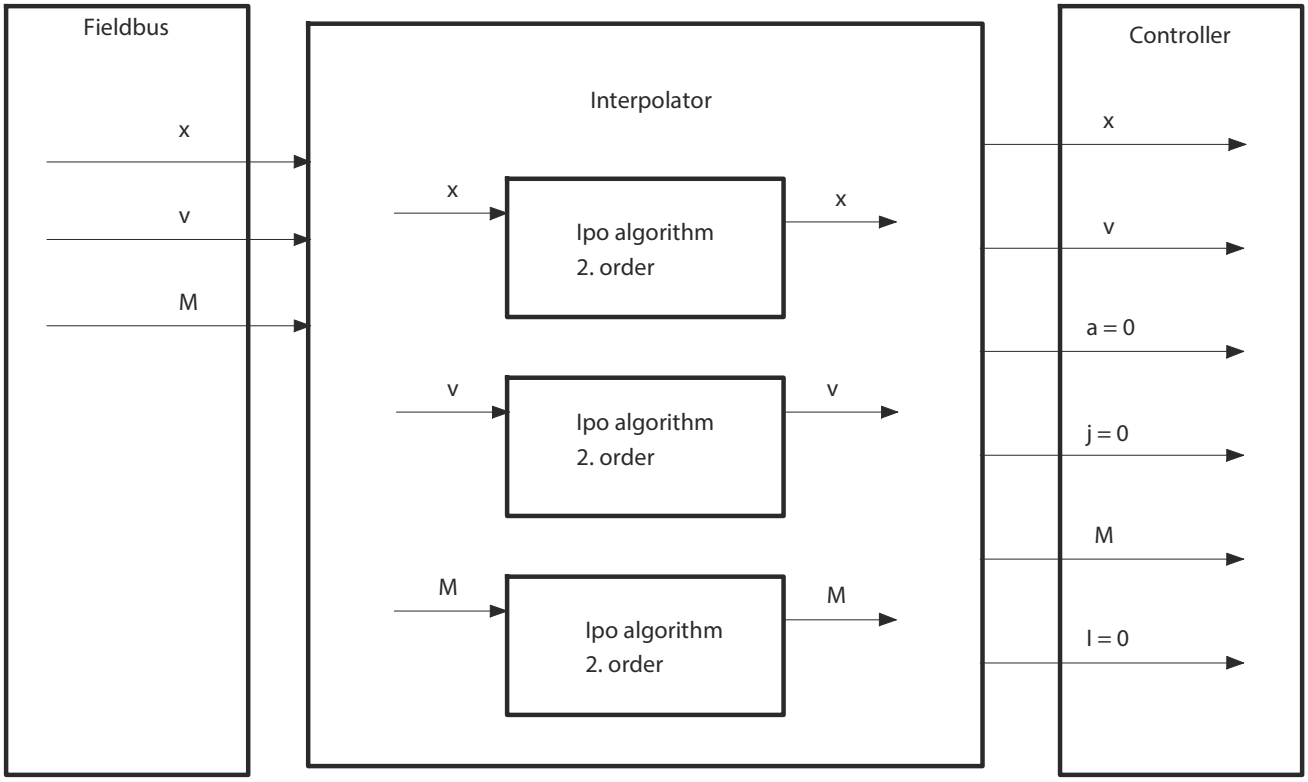


Fig. 52: CSP operation with external speed and torque pilot control (CSP-VT)

Parameters and diagnostic Messages

ID Px.	Parameter	Description	
11412	Interpolation mode CSP	Selection of CSx mode for the position default. The setting is accepted when the interpolation mode is activated by the device profile.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 373: Parameters

Diagnostic messages

ID Dx.	Name	Description
08 | 12 | 00250 (135004410)	Invalid mode of operation	An invalid mode of operation was requested

Tab. 374: Diagnostic messages

4.1.6.2 CiA 402

The following graphs show an overview of the objects involved in the cyclic synchronised positioning mode and their interaction with the closed-loop controller.

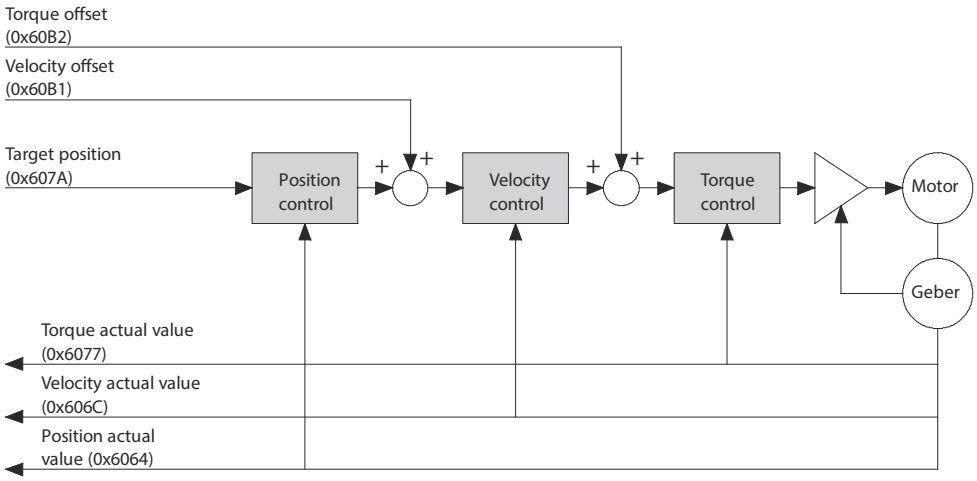


Fig. 53: Overview of the cyclic synchronised positioning mode (CSP)

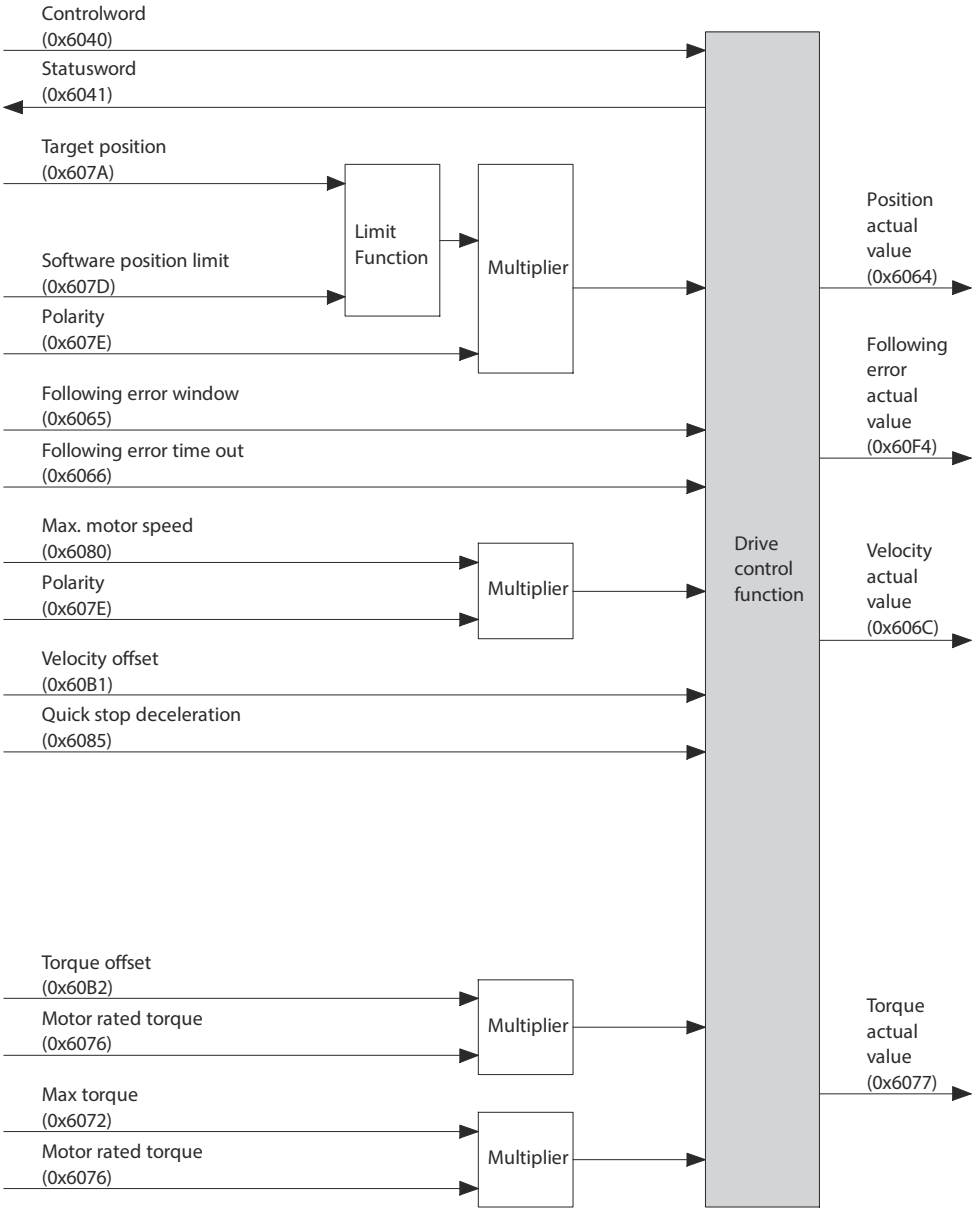


Fig. 54: Object overview of the cyclic synchronised positioning mode (CSP)

The position following error is only evaluated in the "operation enabled" status.

Cyclically synchronised position mode objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
730	0x6040.00	Control word CiA402	UINT
731	0x6041.00	Status word CiA402	UINT
128	0x60E4.01	Actual position value encoder channel 1	DINT
113104	0x6064.00	Actual value modulo	DINT
463	0x6065.00	Monitoring window position: following error	UDINT
462	0x6066.00	Damping time position: following error	UINT
1210	0x606C.00	Actual velocity value encoder channel 1	DINT
526796	0x6072.00	Maximum torque symmetrical	UINT
151	0x6077.00	Actual torque value gear shaft	INT
8130	0x607A.00	Target position CiA402	DINT

Parameter	Index.Subindex	Name	Data type
4629	0x607D.01	Negative software limit position	DINT
4630	0x607D.02	Positive software limit position	DINT
1170	0x607E.00	Reversing direction of motion	USINT
7123	0x6080.00	Maximum rpm (user defined)	UDINT
8135	0x6085.00	Quick stop deceleration CiA402	UDINT
8138	0x60B1.00	Velocity offset CiA402	DINT
8111	0x60B2.00	Torque offset CiA402	INT
4682	0x60F4.00	Actual position: following error	DINT
Px.	user defined		
730	0x216D.01	Control word CiA402	UINT
731	0x216D.02	Status word CiA402	UINT
128	0x2155.09	Actual position value encoder channel 1	LINT
113104	0x2197.05	Actual value modulo	LINT
463	0x2166.04	Monitoring window position: following error	REAL
462	0x2166.03	Damping time position: following error	REAL
1210	0x2155.0B	Actual velocity value encoder channel 1	REAL
526796	0x2168.17	Maximum torque symmetrical	REAL
7139	0x2162.0C	Resulting nominal torque	REAL
151	0x2157.02	Actual torque value gear shaft	REAL
8130	0x216F.03	Target position CiA402	LINT
4629	0x2166.1E	Negative software limit position	LINT
4630	0x2166.1F	Positive software limit position	LINT
1170	0x217D.01	Reversing direction of motion	USINT
7123	0x216C.06	Maximum rpm (user defined)	REAL
8135	0x216F.08	Quick stop deceleration CiA402	REAL
8138	0x216F.0B	Velocity offset CiA402	REAL
8111	0x216F.01	Torque offset CiA402	REAL
4682	0x2166.42	Actual position: following error	REAL
11412	0x217B.0D	Interpolation mode CSP	UDINT

Tab. 375: Objects

Objects in the different CSP operating modes

The objects marked with a dot are effective in the different CSP operating modes.

CSP	CSP-V	CSP-T	CSP-VT	Objects
•	•	•	•	0x607A
–	•	–	•	0x60B1
–	–	•	•	0x60B2

Tab. 376: Effective objects

Precondition for the cyclic synchronised positioning mode

The following conditions must be fulfilled for the cyclic synchronised positioning mode:
– Modes of operation display (0x6061) = 8
– Statusword (0x6041) = XX0X XX1X X011 0111_b

Control and monitoring

Object 0x6040: Controlword

Bits specific to operating modes are neither required or evaluated. The operating mode is active immediately.
The Halt bit in the control word is ignored.

Object 0x6041: Status-word

The following statuses of cyclic synchronised positioning mode can be monitored with the object:
– Bit 12: drive follows the setpoint value (Drive follows the command value)
– Bit 13: position following error (Following error)

Bit[1]		Description
13	12	
Drive follows the setpoint value (Drive follows the command value)		
x	0	Drive does not follow the setpoint value for internal reasons (e.g. because a safety function is active)
x	1	Drive in operation enabled status and follows the setpoint value.
Position following error (Following error)		
0	1	Position following error in tolerance range
1	1	Position following error limit reached

1) Signal status: 0 = low; 1 = high

Tab. 377: Monitoring cyclic synchronised positioning mode

4.1.6.3 PROFIdrive

Cyclically synchronised position mode objects

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
113104	28.0	Actual value modulo	DINT
1210	6.0	Actual velocity value encoder channel 1	INT
Px.	Manufacturer-specific parameters		
128	11067.0	Actual position value encoder channel 1	LINT
113104	12117.0	Actual value modulo	LINT
463	11147.0	Monitoring window position: following error	REAL
462	11146.0	Damping time position: following error	REAL
1210	11311.0	Actual velocity value encoder channel 1	REAL
526796	12166.0	Maximum torque symmetrical	REAL
7139	11704.0	Resulting nominal torque	REAL
151	11070.0	Actual torque value gear shaft	REAL
4629	11584.0	Negative software limit position	LINT
4630	11585.0	Positive software limit position	LINT
1170	11287.0	Reversing direction of motion	BOOL
7123	11694.0	Maximum rpm (user defined)	REAL
4682	11624.0	Actual position: following error	REAL

Tab. 378: PNUs

4.1.7 Cyclic synchronised speed mode (CSV)

4.1.7.1 Function

The cyclic synchronised speed mode enables setpoint values to be pre-set for the device in a fixed time grid using the drive profile (SYNC interval). The import of the setpoint values is synchronised with the synchronisation signal of the higher-order controller. The synchronisation signal is generally slower by a whole number than the cycle of the closed-loop controller. The synchronisation time is generally set by the higher-order PLC (synchronisation time 1 … 20 ms, increment 1 ms,

➔ Px.1051). The integrated fine interpolator therefore calculates intermediate support points and derivations from the setpoint value for the closed-loop controller (interpolation).

Monitoring functions

The monitoring functions marked with a dot are effective in this operating mode:

Motion monitoring function status word			
Bit	Code	Name	Effective
0	TRX	Target window reaches position	–
1	TRV	Target window reaches speed	–
2	TRT	Target window reaches torque	–
3	FEX	Position following error	–
4	FEV	Speed following error	•
5	–	Reserved	–
6	TMX	Position target area monitoring	–
7	TMV	Speed target area monitoring	–
8	TMT	Torque target area monitoring	–
9	–	Reserved	–
10	FEA	Acceleration following error	•
11	–	Reserved	–
12	HLP	Hardware limit switch reached positive	•
13	HLN	Hardware limit switch reached negative	•
14	SLP	Software end position reached positive	•
15	SLN	Software end position reached negative	•
16	STX	Standstill monitoring position/speed	•
17	STV	Standstill monitoring speed	•
18	LS	Stop reached	•
19	STLP	Stroke limit reached positive	–
20	STLN	Stroke limit reached negative	–
21	VM	Speed monitoring	•
22	PB	Reverse feed monitoring	–
23	RDX	Remaining distance monitoring	–
24	MC	Trajectory completed	–
25	REFS	Reference switch activated	•
26	TUR	Torque utilisation exceeded	–
27	FSPR	Fixed stop reached	–
28	ACC	Drive accelerated	–
29	DEC	Drive decelerated	–
30... 31	–	Reserved	–

Tab. 379: Motion monitoring function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Motion quantities

The path of a positioning process is largely influenced by the following motion quantities:

Motion quantities	Description
Nominal speed	The higher-order PLC supplies the setpoint speed.
Torque	Pilot control values for the torque can also be specified (optional).

Tab. 380: Motion quantities

Requirements – Controller enable

Pilot control values External pilot control values for the torque can also be specified (optional).
The integrated interpolator distinguishes the following operating modes in CSV operation, which can be selected with the parameter Px.11413:

Operating modes of the interpolator in CSV operation (ID Px.11413)	
Operating modes	Description
CSV	straight CSV operation without external pilot control values; pilot control values are generated by an internal algorithm. – Fourth order Ipo algorithm
CSV-T	external torque pilot control value – Third order Ipo algorithm

Tab. 381: Operating modes of the integrated interpolator in CSV operation

The interpolator has two sets of interpolator algorithm instances and can be switched between the CSP, CSV and CST operating modes. When switching, the required algorithm instances are first generated and populated with input data. When the algorithms reach the initialised status, the control is switched to the new operating mode.
The following diagrams show the input and output values for the interpolator in the CSV operating modes.

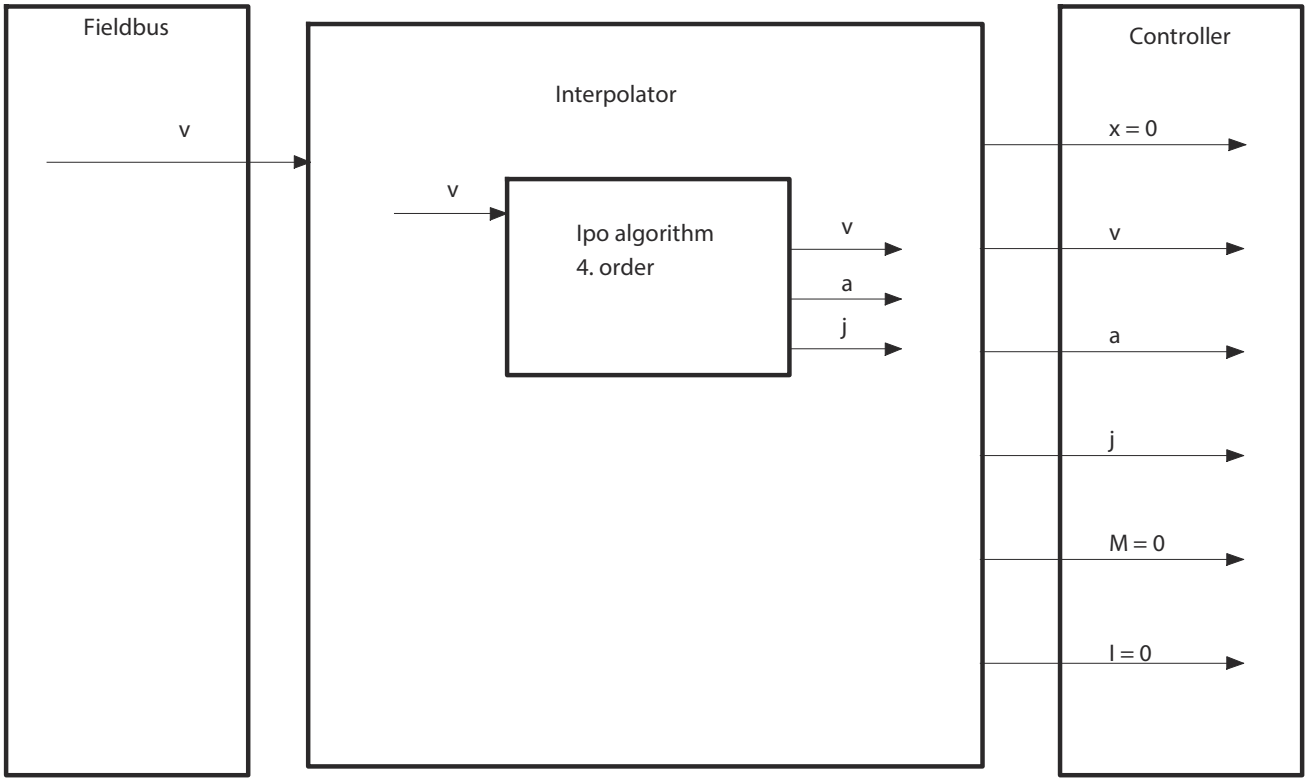


Fig. 55: CSV operation without external pilot control

The following diagram shows an example of the input and output values for the interpolator in straight CSV operation with speed and torque pilot control values.

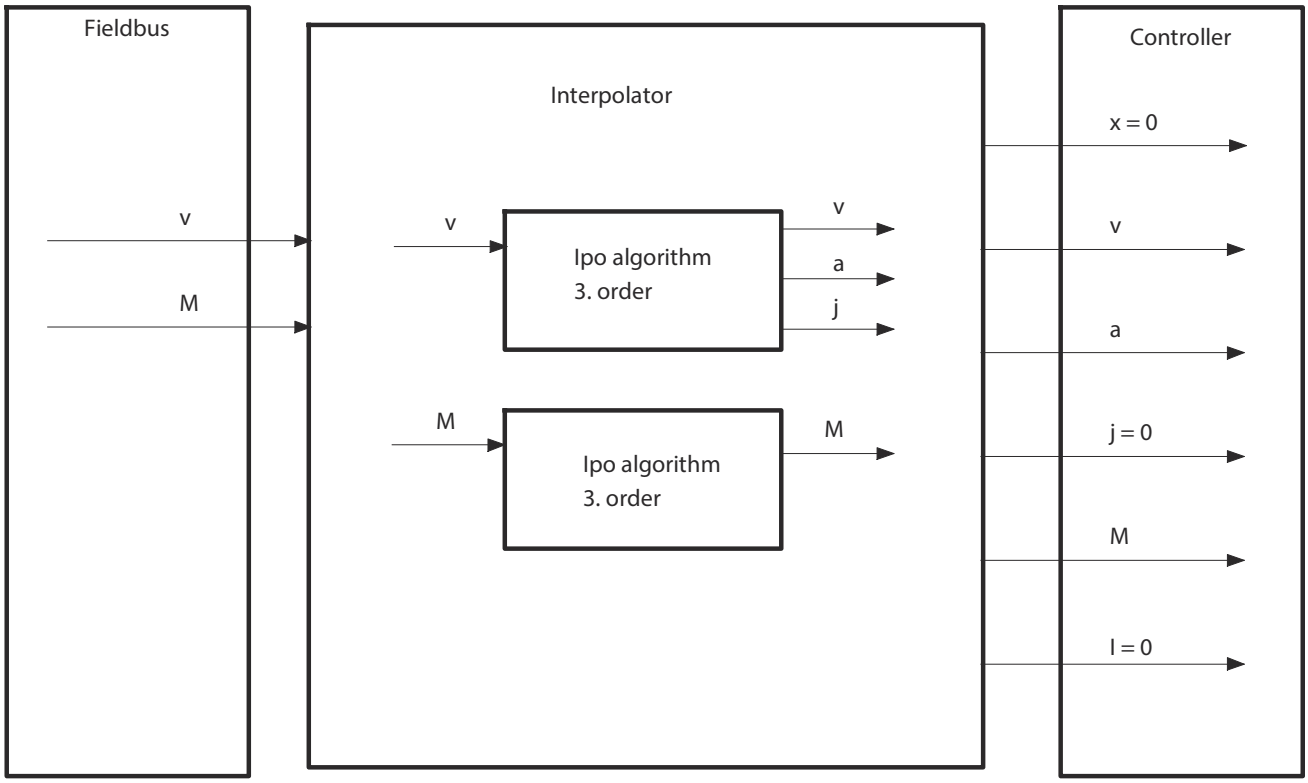


Fig. 56: CSV operation with external torque pilot control (CSV-T)

Parameters

ID Px.	Parameter	Description	
11413	Interpolation mode CSV	Selection of CSx mode for the velocity default. The setting is accepted when the interpolation mode is activated by the device profile.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 382: Parameters

Diagnostic messages

ID Dx.	Name	Description
08 | 12 | 00250 (135004410)	Invalid mode of operation	An invalid mode of operation was requested

Tab. 383: Diagnostic messages

4.1.7.2 CiA 402

The following graphs show an overview of the objects involved in the cyclic synchronised velocity mode and their interaction with the closed-loop controller.

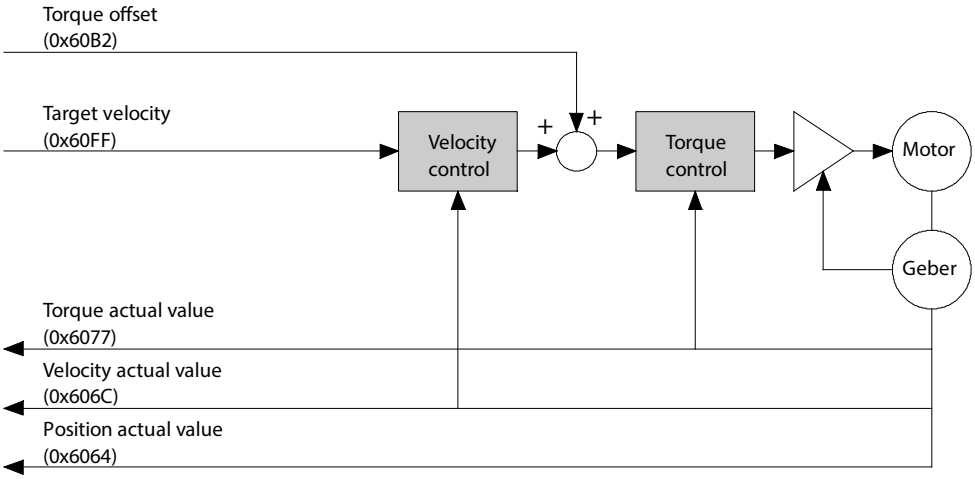


Fig. 57: Overview of the cyclic synchronised velocity mode (CSV)

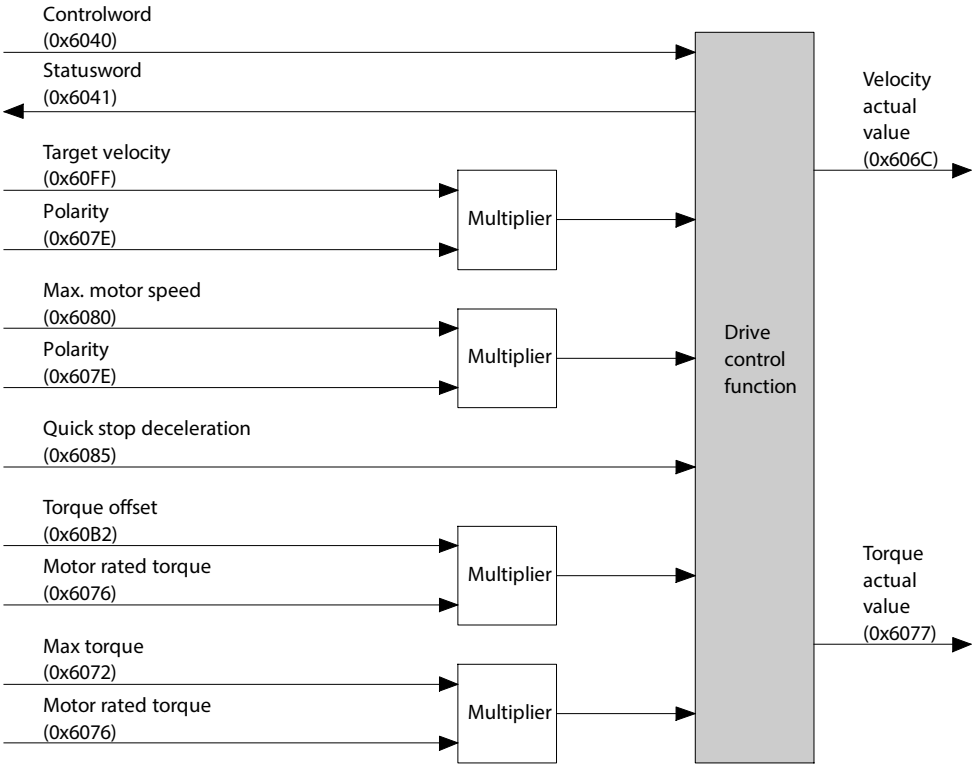


Fig. 58: Object overview of the cyclic synchronised velocity mode (CSV)

Cyclic synchronised speed mode objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
730	0x6040.00	Control word CiA402	UINT
731	0x6041.00	Status word CiA402	UINT
128	0x60E4.01	Actual position value encoder channel 1	DINT
113104	0x6064.00	Actual value modulo	DINT
1210	0x606C.00	Actual velocity value encoder channel 1	DINT
526796	0x6072.00	Maximum torque symmetrical	UINT
151	0x6077.00	Actual torque value gear shaft	INT
1170	0x607E.00	Reversing direction of motion	USINT
7123	0x6080.00	Maximum rpm (user defined)	UDINT
8135	0x6085.00	Quick stop deceleration CiA402	UDINT
8111	0x60B2.00	Torque offset CiA402	INT

Parameter	Index.Subindex	Name	Data type
8137	0x60FF.00	Target velocity CiA402	DINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
730	0x216D.01	Control word CiA402	UINT
731	0x216D.02	Status word CiA402	UINT
128	0x2155.09	Actual position value encoder channel 1	LINT
113104	0x2197.05	Actual value modulo	LINT
1210	0x2155.0B	Actual velocity value encoder channel 1	REAL
526796	0x2168.17	Maximum torque symmetrical	REAL
7139	0x2162.0C	Resulting nominal torque	REAL
151	0x2157.02	Actual torque value gear shaft	REAL
1170	0x217D.01	Reversing direction of motion	USINT
7123	0x216C.06	Maximum rpm (user defined)	REAL
8135	0x216F.08	Quick stop deceleration CiA402	REAL
8111	0x216F.01	Torque offset CiA402	REAL
8137	0x216F.0A	Target velocity CiA402	REAL
11413	0x217B.0E	Interpolation mode CSV	UDINT

Tab. 384: Objects

Objects in the different CSV operating modes

The objects marked with a dot are effective in the different CSV operating modes.

CSV	CSV-T	Objects
•	•	0x60FF
–	•	0x60B2

Tab. 385: Effective objects

Precondition for the cyclic synchronised velocity mode

The following conditions must be fulfilled for the cyclic synchronised velocity mode:
– Modes of operation display (0x6061) = 9
– Statusword (0x6041) = XX0X XX1X X011 0111_b

Monitoring

Object 0x6041: Statusword

The following statuses of cyclic synchronised velocity mode can be monitored with the object:
– Bit 12: drive follows the setpoint value (Drive follows the command value)

Bit[1)] 12	Description
Drive follows the setpoint value (Drive follows the command value)	
0	Drive does not follow the setpoint value for internal reasons (e.g. because a safety function is active)
1	Drive is in Operation enabled status and follows the setpoint value.

1) Signal status: 0 = low; 1 = high

Tab. 386: Monitoring cyclic synchronised velocity mode

4.1.7.3 PROFIdrive

Cyclic synchronised speed mode objects

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
113104	28.0	Actual value modulo	DINT
1210	6.0	Actual velocity value encoder channel 1	INT

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
128	11067.0	Actual position value encoder channel 1	LINT
113104	12117.0	Actual value modulo	LINT
1210	11311.0	Actual velocity value encoder channel 1	REAL
526796	12166.0	Maximum torque symmetrical	REAL
7139	11704.0	Resulting nominal torque	REAL
151	11070.0	Actual torque value gear shaft	REAL
1170	11287.0	Reversing direction of motion	BOOL
7123	11694.0	Maximum rpm (user defined)	REAL

Tab. 387: PNUs

4.1.8 Cyclic synchronised force/torque mode (CST)

4.1.8.1 Function

The cyclic synchronised force/torque mode enables command values to be pre-set for the device in a fixed time grid using the drive profile (SYNC interval). The import of the setpoint values is synchronised with the synchronisation signal of the higher-order controller. The synchronisation signal is generally slower by a whole number than the cycle of the closed-loop controller. The synchronisation time is generally set by the higher-order PLC (synchronisation time 1 … 20 ms, increment 1 ms, ➔ Px.1051). The integrated fine interpolator therefore calculates intermediate support points and derivations from the setpoint value for the closed-loop controller (interpolation).

Torque values in servo drive controllers are by default referenced to the values at the gearbox output shaft (including gear ratio).
With the Px.1128062 parameter the torque values involved can be referenced to the transmission output shaft instead of the motor shaft ➔ 11.7.5 Torque switching.

Monitoring functions

The monitoring functions marked with a dot are effective in this operating mode:

Motion monitoring function status word			
Bit	Code	Name	Effective
0	TRX	Target window reaches position	–
1	TRV	Target window reaches speed	–
2	TRT	Target window reaches torque	–
3	FEX	Position following error	–
4	FEV	Speed following error	•
5	–	Reserved	–
6	TMX	Position target area monitoring	–
7	TMV	Speed target area monitoring	–
8	TMT	Torque target area monitoring	–
9	–	Reserved	–
10	FEA	Acceleration following error	–
11	–	Reserved	–
12	HLP	Hardware limit switch reached positive	•
13	HLN	Hardware limit switch reached negative	•
14	SLP	Software end position reached positive	•

Motion monitoring function status word			
Bit	Code	Name	Effective
15	SLN	Software end position reached negative	•
16	STX	Standstill monitoring position/speed	•
17	STV	Standstill monitoring speed	•
18	LS	Stop reached	•
19	STLP	Stroke limit reached positive	–
20	STLN	Stroke limit reached negative	–
21	VM	Speed monitoring	•
22	PB	Reverse feed monitoring	•
23	RDX	Remaining distance monitoring	–
24	MC	Trajectory completed	–
25	REFS	Reference switch activated	•
26	TUR	Torque utilisation exceeded	–
27	FSPR	Fixed stop reached	–
28	ACC	Drive accelerated	–
29	DEC	Drive decelerated	–
30... 31	–	Reserved	–

Tab. 388: Motion monitoring function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Motion quantities

The path of a positioning process is largely influenced by the following motion quantities:

Motion quantities	Description
Target force/target torque	The higher-order PLC supplies the setpoint force.

Tab. 389: Motion quantities

Triggering commands

– Fieldbus (direct mode)

Requirements

– Controller enable

Pilot control values

Pilot control values are generated by an internal algorithm.
The input and output values of the interpolator in the CST operating mode are shown in the following graph.

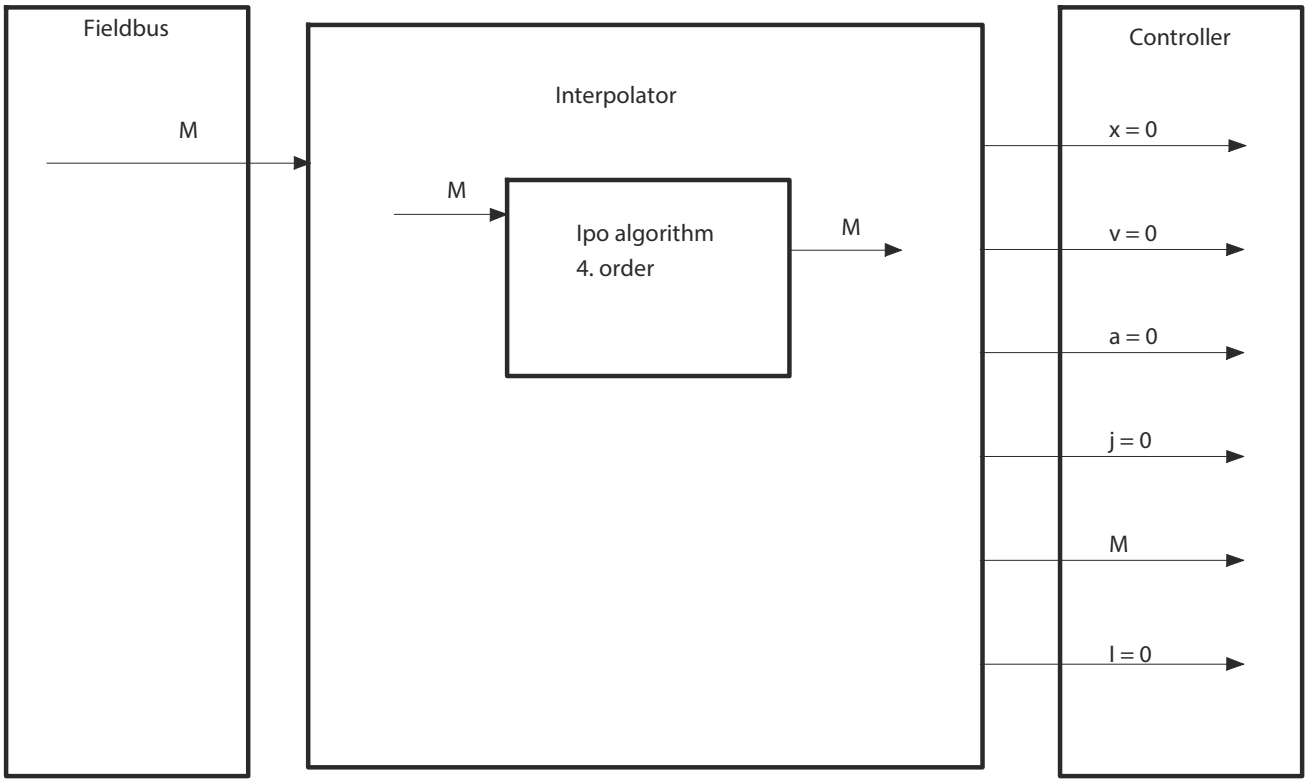


Fig. 59: CST operation

4.1.8.2 CiA 402

The following diagrams show an overview of the objects involved in the cyclic synchronised force/torque mode and their interaction with the closed-loop controller.

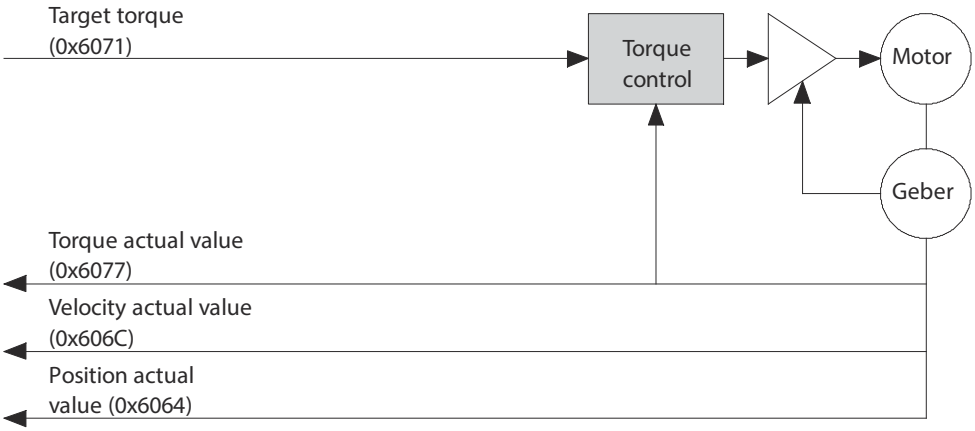


Fig. 60: Overview of the cyclic synchronised force/torque mode (CST)

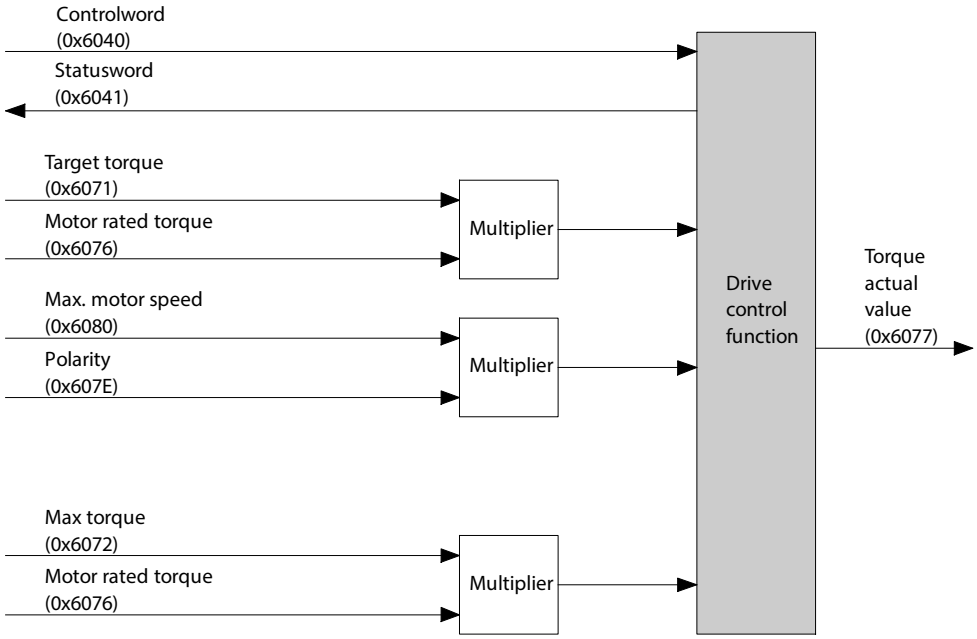


Fig. 61: Object overview of the cyclic synchronised force/torque mode (CST)

Cyclic synchronised force/torque mode objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
730	0x6040.00	Control word CiA402	UINT
731	0x6041.00	Status word CiA402	UINT
128	0x60E4.01	Actual position value encoder channel 1	DINT
113104	0x6064.00	Actual value modulo	DINT
1210	0x606C.00	Actual velocity value encoder channel 1	DINT
526795	0x6071.00	Target torque CiA402	INT
526796	0x6072.00	Maximum torque symmetrical	UINT
151	0x6077.00	Actual torque value gear shaft	INT
1170	0x607E.00	Reversing direction of motion	USINT
7123	0x6080.00	Maximum rpm (user defined)	UDINT
1304	0x607F.00	Limit value velocity limit positive and negative direction of movement	UDINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
730	0x216D.01	Control word CiA402	UINT
731	0x216D.02	Status word CiA402	UINT
128	0x2155.09	Actual position value encoder channel 1	LINT
113104	0x2197.05	Actual value modulo	LINT
1210	0x2155.0B	Actual velocity value encoder channel 1	REAL
526795	0x216F.0D	Target torque CiA402	REAL
526796	0x2168.17	Maximum torque symmetrical	REAL
151	0x2157.02	Actual torque value gear shaft	REAL
1170	0x217D.01	Reversing direction of motion	USINT
7123	0x216C.06	Maximum rpm (user defined)	REAL
1304	0x2183.04	Limit value velocity limit positive and negative direction of movement	REAL

Tab. 390: Objects

Precondition for the cyclic synchronised force/torque mode

The following conditions must be fulfilled for the cyclic synchronised force/torque mode:
– Modes of operation display (0x6061) = 10
– Statusword (0x6041) = XX0X XX1X X011 0111_b

Monitoring

Object 0x6041: Statusword

The following statuses of cyclic synchronised force/torque mode can be monitored with the object:
– Bit 12: drive follows the setpoint value (Drive follows the command value)

Bit[1]	Description
12	
Drive follows the setpoint value (Drive follows the command value)	
0	Drive does not follow the setpoint value (e. g. because a safety function is active)
1	Drive in operation enabled status and follows the setpoint value

1) Signal status: 0 = low; 1 = high

Tab. 391: Monitoring cyclic synchronised force/torque operation

4.1.8.3 PROFIdrive

Cyclic synchronised force/torque mode objects

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value encoder channel 1	INT
113104	28.0	Actual value modulo	DINT
Px.	**Manufacturer-specific parameters**		
128	11067.0	Actual position value encoder channel 1	LINT
113104	12117.0	Actual value modulo	LINT
1210	11311.0	Actual velocity value encoder channel 1	REAL
526796	12166.0	Maximum torque symmetrical	REAL
151	11070.0	Actual torque value gear shaft	REAL
1170	11287.0	Reversing direction of motion	BOOL
7123	11694.0	Maximum rpm (user defined)	REAL
1304	11334.0	Limit value velocity limit positive and negative direction of movement	REAL

Tab. 392: PNUs

4.1.9 Switch-on/off behaviour and controller enable

4.1.9.1 Function

Operating readiness status

The device can display that it is ready for operation via an output (Ready). For this, the output must be configured accordingly (Px.11203 or Px.11204 ➔ 3.3.6 Digital inputs and outputs). The output can also be configured via the device-specific plug-in on the ‘Digital I/O’ parameter panel.
The configured output is active if the servo drive is ready for operation.
If there is an error, the configured output is inactive.

Switch-on behavior

After the device is switched on, it runs through the start-up phase. For example, the following items are executed:
– The relevant EEPROM data are imported.
– The factory parameter set is loaded.
– The customer-specific parameter set is imported.

– The parameterised configuration is compared with the physical configuration (actual/setpoint comparison).
– The software components are initialised (I/O mapping, monitoring, limitations etc.).
– If the power supply is correct, the DC link is loaded.

If the start-up phase has been completed without errors, the device switches to the "Ready" status or the "Profile" status depending on the parameterisation ➔ Parameter, Parameter Px.10234.
The start-up phase may take several seconds, depending on the encoder used.

Switch-off response

When switching off the logic power supply, the device detects that it has dropped below the defined threshold value and reacts as follows:
– The power stage is switched off.
– With multi-turn encoders the multi-turn position is saved in the EEPROM.
– The operating hour counter is saved ➔ 9.7.4 Operating hour counter.
– The outputs are moved to a defined safe status.
– A corresponding message is generated.
– The last messages are saved in the diagnostic memory

When switching off the power supply the device detects that it has dropped below the defined threshold value and reacts as follows:
– A corresponding message is generated.
– A stop is initiated with the parameterised category ➔ 9.2 Classification of Diagnostic Events.
– If the logic power supply to the device is still on, the fast discharge of the DC link is initiated.
– The pre-charge relay is opened and this disconnects the DC Link capacitor from the rectifier.

Controller enable

Various options are available for requesting controller enable. Parameters can be defined for how the request for controller enable is to be triggered. The selection influences the operating mode that will be activated after the controller enable.
– If the request is to be sent via the device-specific plug-in or the device profile, the associated interface must have the master control ➔ 3.1.4 Master control.
– Regardless of the configured allocation of the controller release in the Px.10232 parameter, the plug-in can set the controller release if it also has the master control.
– If a commutation angle detection is required, the commutation angle detection is performed. Then the relevant operating mode is activated ➔ Tab. 395 Options for controller enable.
– If a commutation angle detection is not required, the relevant operating mode is activated immediately ➔ Tab. 395 Options for controller enable.

Behavior with controller enable
The motor is energised after controller enable. The closed-loop controller takes control.
Information on the automatic actuation of the holding brake on activation or deactivation of controller enable ➔ 3.3.2 Brake control.

Timing

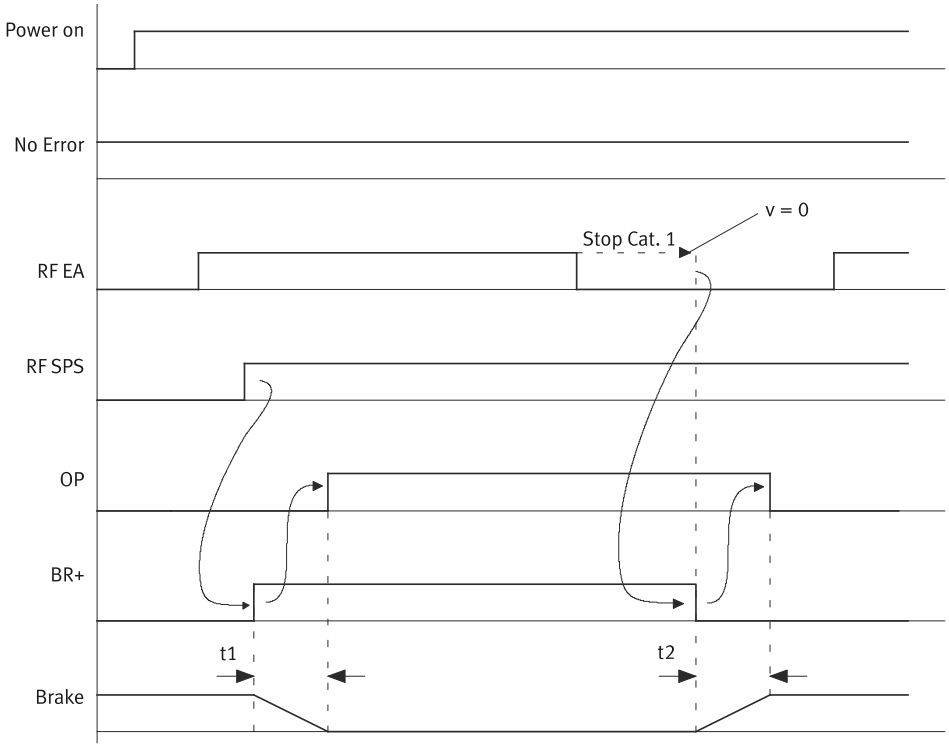


Fig. 62: Timing graph establish ready status – enable logic: I/O and fieldbus (example)

With a new enable signal via CTRL-EN the controller is also not enabled with pending enable via fieldbus. For controller enable high level must first be pending at the CTRL-EN input and then the rising edge of the enable signal must follow via fieldbus.

Name	Description	ID Px.
power on	Switch on power supplies	–
no error	No error	–
RF I/O	Controller release via CTRL-EN	–
RF PLC	Controller enable via fieldbus	–
OP	Ready for operation	–
BR+	Brake output	–
brake	Mechanical response of brake (released and set)	–
t1	Switch-on delay depending on the parameterized switch-on delay	
	Switch-on delay holding brake 1	20
t2	Switch-off delay depending on the parameterized switch-off delay	
	Switch-off delay holding brake 1	21
Stop Cat. 1	Stop category 1	–

Tab. 393: Legend for the establish timing ready status graph

Detailed information on automatic control of the holding brakes ➔ 3.3.2 Brake control.

Finding commutation angle and controller enable

If the drive moves during controller enable, an automatic commutation angle detection is not possible. The device reacts as follows:
– The device executes a category 0 stop ➔ 9.2 Classification of Diagnostic Events.
– A corresponding message is generated.

Removal of controller enable

Removal of the controller enable stops the ongoing task (category 1 stop). If the search velocity v = 0, the normally open contact (RDY) is opened and the controller is blocked. For product designs without a holding brake, the drive is then freely movable.

Parameter

ID Px.	Parameter	Description	
10231	Device status IO	Display the IO status of controller enable. This means: – 0: not enabled – 1: enabled	
		Access	read/–
		Update	effective immediately
		Unit	–
10232	Controller enable selection	Specifies how the controller is to be enabled. This means: – 0: I/O and fieldbus – 1: I/O (input CTRL-EN) – 2: Fieldbus – 3: I/O and Plug-in – 4: Plug-in – 5: I/O or fieldbus For detailed information ➔ Tab. 395 Options for controller enable.	
		Access	read/write
		Update	reinitialization
		Unit	–
10234	Controller enable operating mode	Specifies which operating mode is to be active after activation of controller enable by CTRL-EN. The operating mode selected here is only effective if the parameter Px.10232 has the value 1. Possible operating modes ➔ Tab. 396 Possible operating modes with controller enable via I/O.	
		Access	read/write
		Update	effective immediately
		Unit	–
10235	Target velocity for controller enable (velocity operation)	Specifies the target velocity with controller enable for velocity operation. The target velocity selected here is only effective if the parameter Px.10232 has the value 1.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
10236	Target torque for controller enable (torque operation)	Specifies the target torque with controller enable for torque operation. The target torque selected here is only effective if the parameter Px.10232 has the value 1.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
10237	Maximum velocity for controller enable (torque operation)	Specifies the maximum velocity with controller enable for torque operation. The maximum velocity selected here is only effective if the parameter Px.10232 has the value 1.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
10238	Index for controller enable	Specifies the index of the record that is to be started after controller enable if the record selection operating mode is activated with controller enable -> Px.10234.	
		Access	read/write
		Update	effective immediately

ID Px.	Parameter	Description	
10238	Index for controller enable	Unit	–
11280018	Torque increase for controller enable	Specifies the torque increase that is to be used to achieve the target torque after controller enable. The torque increase selected here is only effective if the parameter Px.10232 has the value 1.	
		Access	read/write
		Update	effective immediately
		Unit	Nm/s

Tab. 394: Parameter

Parameter Controller enable selection (Px.10232)			
Value	Enable via ...	Description	Operating mode after controller enable
0	I/O and fieldbus	The request of controller enable is output in common via the following: – the input CTRL-EN – the device profile The enable signal at the CTRL-EN input must be pending before the request is sent via the device profile.	Positioning mode
1	I/O	The request of controller enable is output exclusively via the CTRL-EN input.	Parameterised operating mode (Px.10234)
2	Fieldbus	The request of controller enable is issued exclusively via the fieldbus.	Positioning mode
3	I/O and Plug-in	The request of controller enable is output in common via the following: – the input CTRL-EN – the device-specific plug-in (Ethernet port) The enable signal at the CTRL-EN input must be pending before the request is sent via the device-specific plug-in.	
4	Plug-in	The request of controller enable is output exclusively via the device-specific plug-in (Ethernet port).	
5	I/O or fieldbus	The controller enable can be set via the CTRL-EN digital input or the device profile. If both sources are set and one of the sources is reset, the drive is switched off, regardless of which of the two sources switched the drive on.	

Tab. 395: Options for controller enable

If the device switches to operating mode on controller enable, a category 2 stop is executed ➔ 9.2 Classification of Diagnostic Events. After the switch-on delay has elapsed, new tasks can be processed.

Controller enable via CTRL-EN (Px.10232 = 1)

If the controller enable is set exclusively via the CTRL-EN input, the operating mode defined by the following parameters will be active after controller enable:

Parameter Controller enable operating mode (Px.10234)		
Value	Operating mode	Description
4	Speed	On issue of controller enable the velocity mode is activated. The device reacts as follows: – The actual velocity is used as the start velocity. – The parameterised target velocity is used as the target velocity (Px.10235). – The parameterised values for the stop deceleration are used as acceleration and jerk.
5	Position	On issue of controller enable the positioning mode is activated. The device reacts as follows: – Stop category 2 ➔ 9.2 Classification of Diagnostic Events.
7	Torque	On issue of controller enable the torque mode is activated. The device reacts as follows: – The actual torque is used as the starting torque. – The parameterised target torque is used as the target torque (Px.10236). – The parameterised values for the stop are used as acceleration and jerk.
15	Start record table	On issue of controller enable the record table is activated. The device reacts as follows: – Stop category 2 ➔ 9.2 Classification of Diagnostic Events. – After elapse of the switch-on delay the parameterised record is automatically run (Px.10238).

Tab. 396: Possible operating modes with controller enable via I/O

Controller enable via I/O or fieldbus (Px.10232 = 5)

This setting can be used to control the controller enable by the CTRL-EN input, for example in the event of a fieldbus connection failure.
This allows the following process to be implemented:

- The fieldbus has the master control and sets the controller enable.
- If the fieldbus connection is interrupted, the digital I/Os have the master control. After the error acknowledgment, the controller enable can now be reset. Edge change at CTRL-EN input: 0 → 1.
  The drive responds as defined with Px.10234 ➔ Tab. 396 Possible operating modes with controller enable via I/O.
- Edge change at CTRL-EN: 1 → 0, the controller enable is basically withdrawn → Stop Category 1.
- When the fieldbus connection is re-established, the master control is transferred to the fieldbus, which forces a stop. The drive can now be enabled again via the fieldbus.

4.1.9.2 CiA 402

Objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
10231	0x218E.01	Device status IO	UDINT
10232	0x218E.02	Controller enable selection	UDINT
10234	0x218E.03	Controller enable operating mode	UDINT
10235	0x218E.04	Target velocity for controller enable (velocity operation)	REAL
10236	0x218E.05	Target torque for controller enable (torque operation)	REAL
10237	0x218E.06	Maximum velocity for controller enable (torque operation)	REAL
10238	0x218E.07	Index for controller enable	DINT
11280018	0x218E.08	Torque increase for controller enable	REAL

Tab. 397: Objects

4.1.9.3 PROFIdrive

PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
10231	11800.0	Device status IO	UDINT
10232	11801.0	Controller enable selection	UDINT
10234	11802.0	Controller enable operating mode	UDINT
10235	11803.0	Target velocity for controller enable (velocity operation)	REAL
10236	11804.0	Target torque for controller enable (torque operation)	REAL
10237	11805.0	Maximum velocity for controller enable (torque operation)	REAL
10238	11806.0	Index for controller enable	DINT
11280018	12294.0	Torque increase for controller enable	REAL

Tab. 398: PNUs

4.1.10 Brake test

4.1.10.1 Function

During the brake test, the device runs an automatic brake test. The brake test can be activated via the record table or the plug-in.
The following can be parameterized:
- The direction in which the specific holding brake is to be tested (one or both directions)
- Torque rise ramps
- Monitoring window for position and torque
- Holding time for the torque
- Waiting time between the test phases
- Selection of encoder interface

The holding brake can be tested with a brake test in one direction or both directions in succession. The parameterised switch-on and switch-off delay is taken into account ➔ 3.3.2 Brake control.
If the holding brake is to be tested in both directions, the holding brake is tested first in a positive direction (test phase 1) and then in a negative direction (test phase 2).

Sequence of the brake test

Initialization phase:
- The holding brake is closed.
- The current position is saved internally after expiration of the switch-off delay (holding brake application time).

Test phase:
- The parameterized torque is set up in the desired direction, taking into account the torque increase ramp (Px.103114 or Px.103116, depending on the direction).
- When the torque is reached, the torque is held for the duration of the holding time (Px.103120).
- The torque is reduced again, taking the corresponding torque ramp into account.
- If this completes the brake test, the holding brake is opened again. The closed-loop controller takes control (actual position = setpoint position; status Standstill, ➔ Fig. 38). Tasks are only accepted after the switch-on delay has elapsed ➔ 3.3.2 Brake control.

If the holding brake is to be tested in a different direction, the holding brake remains closed. After expiration of the waiting time (Px.103121), the test is performed in the other direction (next test phase, ➔ Fig. 63).

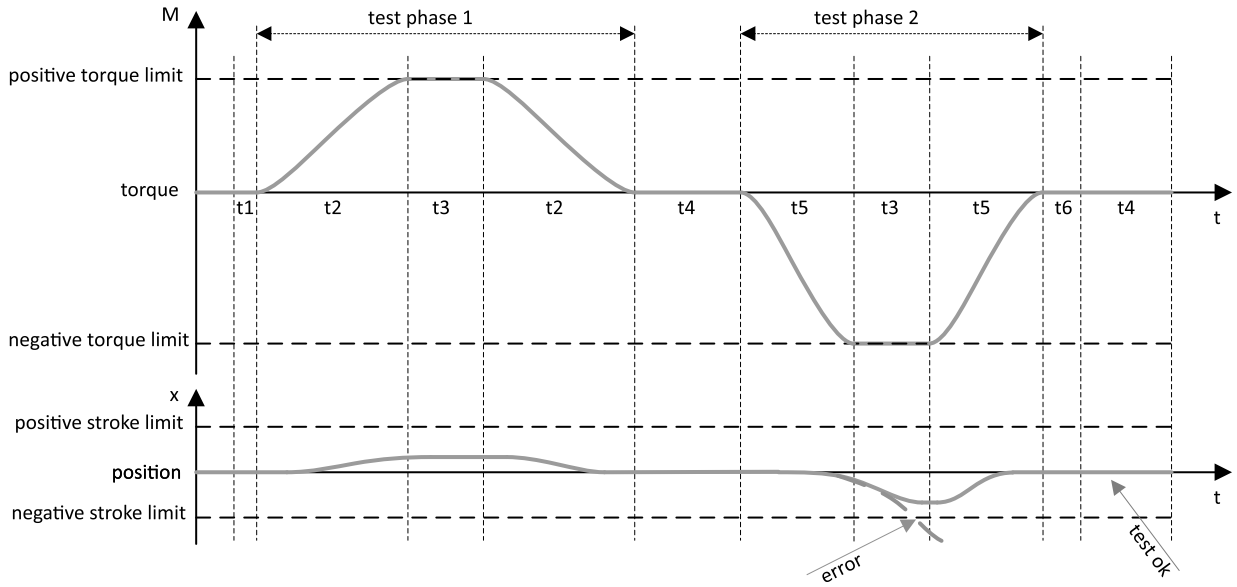


Fig. 63: Timing diagram for brake test

Name	Description	ID Px.
test phase 1/2	Test phase 1/2	–
Positive/negative torque limit	Positive/negative limit value of the torque	103113 103115
Positive/negative stroke limit	Monitoring window Position	103117
t1	Switch-off delay ➔ 3.3.2 Brake control	–
t2	Rise time (positive), dependent on torque rise ramp	103114
t3	Holding time torque	103120
t4	Waiting time between the test phases	103121
t5	Rise time (negative), dependent on torque rise ramp	103116
t6	Switch-on delay ➔ 3.3.2 Brake control	20

Tab. 399: Legend for the timing diagram of the brake test

During the brake test

The following is continuously monitored during the torque build-up and the subsequent holding time:

- Position monitoring window, Px.103117 (value of the difference between the initial position and the current position)
- Torque monitoring window, Px103118 (value of the difference between the positive/negative target torque and the current torque

If one of these variables lies outside the parameterized limit, the brake test is aborted immediately with a corresponding error message. Parameter Px.103122 returns the test result ➔ Tab. 402 Parameter of test result (Px.103122).

Parameters

ID Px.	Parameter	Description	
103112	Testing phase	Display the test phase in which the brake test is taking place.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
103113	Torque positive limit value	Specifies the positive limit value for the torque of the brake test.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
103114	Torque rise ramp Positive limit value	Specifies the torque rise ramp for the positive torque of the brake test.	
		Access	read/write
		Update	effective immediately
		Unit	Nm/s
103115	Torque negative limit value	Specifies the negative torque limit value for the brake test.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
103116	Torque rise ramp Negative limit value	Specifies the torque rise ramp for the negative torque of the brake test.	
		Access	read/write
		Update	effective immediately
		Unit	Nm/s
103117	Monitoring window Position	Specifies the monitoring window for position monitoring of the brake test. If the drive exceeds the monitoring window during an active brake test, a message is generated.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
103118	Torque monitoring window	Specifies the monitoring window for torque monitoring for the brake test. If the requested torque does not reach the value = target torque - monitoring window during an active brake test, a message is generated.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
103120	Holding time Torque	Specifies the holding time for the torque. The torque is held at the parameterized value for the specified time.	
		Access	read/write
		Update	effective immediately
		Unit	s
103121	Waiting time	Specifies the waiting time between the test phases.	
		Access	read/write
		Update	effective immediately
		Unit	s
103122	Test result	Displays the test result of the last brake test. Possible test results ➔ Tab. 402 Parameter of test result (Px.103122).	
		Access	read/–
		Update	effective immediately
		Unit	–
103123	Selection of encoder interface	Specifies the encoder interface on which position monitoring is performed.	
		Access	read/write
		Update	effective immediately
		Unit	–
101382	Reference point torque	Specifies the reference point for the torque to which the torque for the automatic brake test refers.	
		Access	read/write

ID Px.	Parameter	Description	
101382	Reference point torque	Update	effective immediately
		Unit	–

Tab. 400: Brake test parameters

Parameters of test phase (Px.103112)		
Bit	Function	Description
0	Inactive	no brake test
1	Test positive direction	Test brake in positive direction.
2	Test negative direction	Test brake in negative direction.
3	Test both direction	Test the brake first in a positive and then in a negative direction.

Tab. 401: Parameters of test phase (Px.103112)

Parameter of test result (Px.103122)		
Bit	Function	Description
0	Inactive	Brake test is inactive.
1	Active	Brake test is active.
2	Error negative direction	Error testing the brake in a negative direction.
3	Error positive direction	Error testing the brake in a positive direction.
4	Error Torque not reached	The parameterized torque was not reached during the brake test.
5	Passed	Brake test has been successfully completed.

Tab. 402: Parameter of test result (Px.103122)

ID Dx.	Name	Description
05 | 02 | 00282 (84017434)	Encoder not ready	Selected encoder not ready for brake test
05 | 02 | 00283 (84017435)	Brake test failed	Brake test failed
05 | 02 | 00284 (84017436)	Torque failed brake test	Torque for brake test cannot be built up

Tab. 403: Diagnostic messages

4.1.10.2 CiA 402

Brake test objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
103112	0x21AC.01 ... 02	Testing phase	UINT
103113	0x21AC.03 ... 04	Torque positive limit value	REAL
103114	0x21AC.05 ... 06	Torque rise ramp Positive limit value	REAL
103115	0x21AC.07 ... 08	Torque negative limit value	REAL
103116	0x21AC.09 ... 0A	Torque rise ramp Negative limit value	REAL
103117	0x21AC.0B ... 0C	Monitoring window Position	LINT
103118	0x21AC.0D ... 0E	Torque monitoring window	REAL
103120	0x21AC.0F ... 10	Holding time Torque	REAL
103121	0x21AC.11 ... 12	Waiting time	REAL
103122	0x21AC.13 ... 14	Test result	UINT

Parameter	Index.Subindex	Name	Data type
103123	0x21AC.15 ... 16	Selection of encoder interface	UDINT
101382	0x21AC.17 ... 18	Reference point torque	UDINT

Tab. 404: Objects

4.1.10.3 PROFIdrive

PNUs brake test

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
103112	12565.0	Testing phase	UINT
103113	12566.0	Torque positive limit value	REAL
103114	12567.0	Torque rise ramp Positive limit value	REAL
103115	12568.0	Torque negative limit value	REAL
103116	12569.0	Torque rise ramp Negative limit value	REAL
103117	12570.0	Monitoring window Position	LINT
103118	12571.0	Torque monitoring window	REAL
103120	12572.0	Holding time Torque	REAL
103121	12573.0	Waiting time	REAL
103122	12574.0	Test result	UINT
103123	12575.0	Selection of encoder interface	UDINT
101382	12828.0	Reference point torque	UDINT

Tab. 405: PNUs

4.2 Stop

4.2.1 Function

The stop command aborts the current motion command. The subsequent reactions to the stop command depend on what triggered the stop.

Stop command triggered by ...	Specific reaction
– Record table	– The motion command is aborted. – The drive is decelerated to a stop using the parameterised stop ramp of the command record. – If the standstill monitoring (STC signal ➔ 5.7 Standstill monitoring) detects that the drive has stopped moving on conclusion of the stop ramp, the closed-loop controller holds the drive at that position.
– Device profile (direct) or – Device-specific plug-in or – Diagnostic event of stop cat. 2	– The motion command is aborted. – The drive is decelerated to a stop using the parameterised stop ramp. – If the standstill monitoring (STC signal ➔ 5.7 Standstill monitoring) detects that the drive has stopped moving on conclusion of the stop ramp, the closed-loop controller holds the drive at that position.
– Diagnostic event of stop cat. 1 or – Removal of controller enable	– The motion command is aborted. – The drive is decelerated to a stop using the defined stop ramp. – If the standstill monitoring detects that the drive has stopped moving on conclusion of the stop ramp, the brake locks and the closed-loop controller switches off after the elapse of the parameterised delay (Px.21 and Px.23 ➔ 3.3.2 Brake control). The drive is switched off directly at standstill without the brake. – The drive is uncontrolled.
– Diagnostic event of stop cat. 0	– The motion command is aborted. – The power stage is switched off. – In the case of drives with a brake, the brake is actuated. Without a brake, the drive coasts to a stop. – The drive is uncontrolled.

Stop command triggered by ...	Specific reaction
Detection of software end position	Motion command is aborted, parameterized stop category is executed
Detection of stroke limit	

Tab. 406: Specific reactions to the stop command

Detailed information on the general fault reactions to diagnostic events ➔ 9.2 Classification of Diagnostic Events.

The stop ramps are executed with the aid of the trajectory generator. If a stop is triggered, the current motion command or the cyclic synchronised operation is aborted and a stop ramp with end velocity 0 is calculated (parameters for the stop ramp ➔ Tab. 407 Parameters). The closed-loop controller is switched to velocity control to execute the stop ramp.
With a stop via the record table or a category 2 stop:
– If the standstill monitor detects that the drive has stopped moving, the closed-loop controller switches to position control and uses the actual position value as the new setpoint value.

Parameters and diagnostic messages

Information on parameterisation of stop ramps via the record table ➔ 4.5 Task via record selection.

ID Px.	Parameter	Description	
12101	Deceleration Stop ramp	Specifies the deceleration for stops that are triggered by the device profile, the device-specific Plug-in, a safety sub-function or a category 1 and 2 diagnostic event. Information on the parameterisation of the deceleration for direct stops via the device profile Ci402 ➔ 4.2.2 CiA 402. Information on the parameterisation of the deceleration for direct stops via the device profile ➔ 4.2.3 PROFIdrive.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
12111	Jerk Stop ramp	Specifies the jerk for stops that are triggered by the following: – Device profile (direct) – Device-specific plug-in – Category 1 or 2 diagnostic events.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 407: Parameters

ID Dx.	Name	Description
05 | 02 | 00078 (84017230)	Stop ramp: Timeout	Stop ramp: Timeout

Tab. 408: Diagnostic messages

4.2.2 CiA 402

Objects for stopping

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
8135	0x6085.00	Quick stop deceleration CiA402	UDINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
8135	0x216F.08	Quick stop deceleration CiA402	REAL
12101	0x2180.01	Deceleration Stop ramp	REAL
12111	0x2180.02	Jerk Stop ramp	REAL

Tab. 409: Objects

Triggering and monitoring

Object 0x6040: control word

The stop command is triggered via the object:
– bit 2: stop (quick stop)
The deceleration is specified by the 0x6085 object. For additional information ➔ 4.1 Operating modes.

Object 0x6041: status word

If stop has been requested and executed, bit 5 is reset to 0.
– Bit 5: stop (quick stop active)
For additional information ➔ 4.1 Operating modes.

4.2.3 PROFIdrive

PNUs for stopping

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
12101	11834.0	Deceleration Stop ramp	REAL
12111	11835.0	Jerk Stop ramp	REAL

Tab. 410: PNUs

Control and monitoring

Priority of stop reactions:
The table shows the stop reactions in descending order. This means that coasting has the highest priority and intermediate stop ramp the lowest.

Deceleration	Condition	Comment	AC
Coast	STW1.1 = 0 or STW1.3 = 0	The voltage is shut off, the motor coasts to a stop.	AC1/AC3
Fast stop	STW1.2 = 0	Brake with the parameterised values and then shut down the output stage. Deceleration: PNU 11834.0, Px.12101.0.0 Jerk: PNU 11835.0, Px.12111.0.0	AC1/AC3
System stop	STW1.0 = 0 and STW1.4 = 0	Brake with the parameterised values and then shut down the output stage. Deceleration: PNU 12328.0, Px.11280405.0.0 Jerk: PNU 12434.0, Px.11280406.0.0	AC1
Stop ramp	STW1.0 = 0	Brake with the parameterised values and then shut down the output stage. Deceleration: PNU 12326.0, Px.11280403.0.0 Jerk: PNU 12327.0, Px.11280404.0.0	AC1/AC3

Deceleration	Condition	Comment	AC
Brakes	STW1.8 = 1 → 0 and STW1.9 = 0	Brake with the parameterised values. Output stage remains active. In jog mode the deceleration and acceleration are identical. Deceleration: PNU 11353.0, Px.1512.0.0 Jerk: PNU 11354.0, Px.1513.0.0	AC1/AC3
Brakes	STW1.8 = 0 and STW1.9 = 1 → 0	Brake with the parameterised values. Output stage remains active. In jog mode the deceleration and acceleration are identical. Deceleration: PNU 12129.0, Px.214536.0.0 Jerk: PNU 12130.0, Px.214537.0.0	AC1/AC3
System stop	STW1.4 = 0 or SATZANW.15 = 1 → 0 or POS_STW1.15 = 1→ 0	Brake with the parameterised values. The output stage remains active. Deceleration: PNU 12328.0, Px.11280405.0.0 Jerk: PNU 12434.0, Px.11280406.0.0	AC3
Brakes	STW1.4 = 1 and STW1.6 = 0	Brake with the parameterised values. Output stage remains active, velocity target value = 0 Deceleration: PNU 12326.0, Px.11280403.0.0 Jerk: PNU 12327.0, Px.11280404.0.0	AC1
Brakes	STW1.4 = 0	Brake with the parameterised values. Output stage remains active, velocity target value = 0 Deceleration: PNU 12328.0, Px.11280405.0.0 Jerk: PNU 12434.0 Px.11280406.0.0	AC1
Intermediate stop	STW1.5 = 0	Brake with the parameterised values. Output stage remains active. Deceleration: PNU 12342.0, Px.11280607.0.0 (parameters from MDI) Jerk: PNU 12327.0, Px.11280404.0.0	AC3

Tab. 411: Stop reactions

A stop with higher priority interrupts a stop with lower priority regardless of the cause.

4.3 Hold

4.3.1 Function

The reactions to the hold command depend on the active operating mode. If the cyclic synchronized operation is active, the hold command is ignored. In other operating modes the current command is aborted by the hold command and continued when the command is withdrawn.
Information on the operating modes ➔ 4.1.2 Operating modes for performing motion commands.
The stop ramp for the hold command in a profile operating mode is determined by the parameters valid for the operating mode ➔ 4.2 Stop.

Modes of Operations	Reaction to ...	
	... the hold command	... Withdrawal of the hold command
– PP – P	– The motion command is interrupted. – The drive is braked and remains position-controlled stationary with reference to parameters v, a and j. – A message is generated.	– The motion command is continued with reference to parameters v, a and j.
– HM (homing)		– The homing is not continued.
– PV – V	– The motion command is interrupted. – The drive is braked and remains position-controlled stationary with reference to parameters a and j. – A message is generated.	– The motion command is continued with reference to parameters a and j.
– PT, PT-B – T	– The motion command is interrupted. – The force is reduced braked and the drive remains position-controlled stationary with reference to the force ramp. – A message is generated.	– The motion command is continued with reference to the force ramp.
– CSP – CSV – CST – Jogging	– The hold command is ignored.	– The withdrawal of the hold command is ignored.

Tab. 412: Reaction to the hold command

4.3.2 CiA 402

Triggering and monitoring

Object 0x6040: control word

The hold command is triggered via the object:
– Bit 8: hold (hold)
The deceleration is determined by the deceleration set in the operating mode. For additional information ➔ 4.1 Operating modes.

Object 0x6041: status word

If hold is requested and executed in the PV operating mode (current velocity 0), bit 12 is set to 1.
– Bit 12: velocity (Speed)
If hold is requested and executed in other operating modes (current velocity 0), bit 10 is set to 1.
– Bit 10: target position reached (target reached)
For additional information ➔ 4.1 Operating modes.

4.3.3 PROFIdrive

Triggering and monitoring

Finite state machine application class 3 (STW1.5 Intermediate Stop) ➔ 12.4.3.3 Finite State Machine Positioning Mode in Application Class 3.

4.4 Homing

4.4.1 Function

In order to be able to approach an absolute, unique position in the positioning range, the drive must be homed to the dimensional reference system.
Homing of the drive includes:
– Homing
– Definition of the axis zero point
– Definition of the dimension reference system ➔ 3.2.5.1 Dimension reference system

Controller enable

A set controller enable is required for all homing methods except for method 37.

Reference mark

During homing, the position of the reference mark is determined according to the selected homing method. The reference mark is by default the absolute reference point for the dimensional reference system. A valid homing is required for all motion commands with the "position" target. Motion commands with the "speed, torque and jogging" targets can be run without a valid homing.



Fig. 64: Symbol: reference mark

Axis zero point

The absolute reference point of the dimensional reference system can be moved from the reference mark to the axis zero point with the "offset axis zero point" parameter.



Fig. 65: Symbol: axis zero point

Referencing method

The "limit switch, reference switch, stop, zero pulse or current position" target can be selected for the reference mark with the "homing method" parameter. The maximum positioning accuracy for the reference mark can be reached with the "zero pulse" method.

Check of homing methods of the open-loop operation without encoder

Homing methods with zero pulse and with stop detection are not available in the open-loop operation without encoder. Stop detection is only supported in closed-loop mode. A zero pulse cannot be detected without an encoder. Therefore, only the following referencing methods are supported in open-loop operation without encoder:

Homing methods for open-loop operation:
- Method 17: negative limit switch
- Method 18: positive limit switch
- Method 23: Reference switch positive
- Method 27: reference switch negative
- Method 37: Current position

Because stop monitoring is not possible during a homing movement, timeout monitoring is executed.

Homing parameters

The "acceleration, speed and jerk" setpoint values can be specified for "search, creep and move" with the corresponding parameters.

Homing

Homing is executed with the start using the "limit switch, reference switch, stop and zero pulse" homing methods. The motion phase that is run depends on the selected homing method. A motion with the "current position" homing method is only run if the "Move to the axis zero point" function is activated.
- Parameters:
  - Search path:
    The Px.8412 "Maximum search stroke in positive direction" and Px.8413 "Maximum search stroke in negative direction" parameters restrict the path distance for search relative to the current position.
  - Homing to the stop:

Move to the axis zero point is recommended for homing methods -17/-18 "Homing to stop" to prevent continuous control at the stop.
- Software end positions:
  Monitoring the software end positions is activated after a valid homing.

Axis zero point move

The axis zero point travel can be activated with the Px.841 "Move to axis zero point after homing" parameter. The axis zero point move is run immediately after a valid homing if the axis zero point offset Px.8416 ≠ 0.
- Parameters:
  - Limit switches, stops and following errors:
    The monitoring of limit switches, stops and following errors is activated for the duration of axis zero point move.

Position offset

A position can be specified as an offset to the reference mark using the Px.102222 parameter. The value for the position offset is only adopted if travel to axis zero is deactivated. The zero point offset Px.8416 is also taken into account for the resulting movement.
Example:
Px.841 = deactivated
Px.8416 = –10 revolutions
Px.102222 = –1 revolution
Homing method = 18 “limit switch positive direction”
Resulting distance = –-(Px.8416) + Px.102222 = 9 revolutions

Homing status

In the following cases the "homing status" changes:
- the status is reset
  - At the start of a new homing
  - Every time the device is restarted with single-turn encoder
  - After replacement of the motor with multi-turn encoder
- the status is set
  - After a valid homing

Single-turn encoders

Single-turn encoders with an axis zero point offset by one motor revolution can be permanently configured to the "Homing valid" status. For this, set Px.3237.0.0 = true (active).

Reference switch/limit switch with zero pulse (method: 1, 2, 7, 11)

For secure identification of the "zero pulse" reference mark, before the homing the falling edges of the reference switch (Ref)/limit switch (Lim) must be set centrally between two zero pulses.

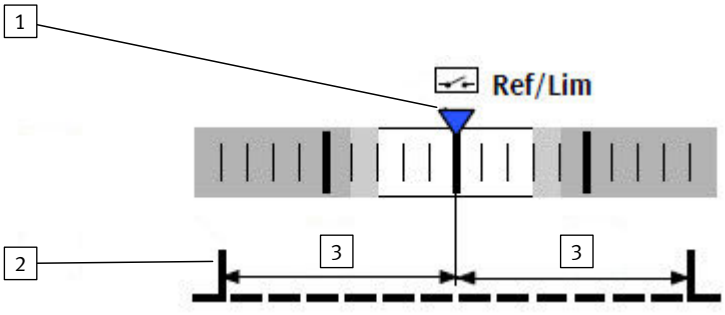


Fig. 66: Alignment of the falling edge of the reference switch

1 Position of the falling edge
2 Zero pulse
3 Distance to the zero pulse

Parameters and diagnostic Messages

ID Px.	Parameter	Description	
840	Referencing status	Specifies the status of referencing. 100: Drive NOT referenced 103: Save homing data 200: Drive referenced	
		Access	read/–
		Update	effective immediately
		Unit	–
843	Search for reference mark setpoint velocity	Specifies the setpoint velocity of searching for the reference mark.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
844	Search for reference mark setpoint acceleration	Specifies the setpoint acceleration of searching for the reference mark.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
845	Search for reference mark setpoint jerk	Specifies the setpoint jerk of searching for the reference mark.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
846	Setpoint reference mark creeping velocity	Specifies the setpoint velocity of creeping of the reference mark.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
847	Setpoint reference mark creeping acceleration	Specifies the setpoint acceleration of creeping of the reference mark.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
848	Setpoint reference mark creeping jerk	Specifies the setpoint jerk of creeping of the reference mark.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
849	Move to axis zero point setpoint velocity	Specifies the setpoint velocity of move to the axis zero point.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
8410	Move to axis zero point setpoint acceleration	Specifies the setpoint acceleration of the move to the axis zero point.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
8411	Search for move to axis zero point setpoint jerk	Specifies the setpoint jerk of searching for move to the axis zero point.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
8412	Maximum search stroke in positive direction	Specifies the maximum search stroke in positive direction (relativ to the current position).	
		Access	read/write
		Update	effective immediately

ID Px.	Parameter	Description	
8412	Maximum search stroke in positive direction	Unit	user defined
8413	Maximum search stroke in negative direction	Specifies the maximum search stroke in negative direction (relativ to the current position).	
		Access	read/write
		Update	effective immediately
		Unit	user defined
8417	Referencing method	Specifies the selected homing method for homing of the axis (value = method). – -27: Negative stop/limit switch with run to reference switch – -23: Positive stop/limit switch with run to reference switch – -18: Positive stop – -17: Negative stop – -2: Positive stop with zero pulse – -1: Negative stop with zero pulse – 1: Negative hardware limit switch with zero pulse – 2: Positive hardware limit switch with zero pulse – 7: Positive reference switch with zero pulse – 11: Negative reference switch with zero pulse – 17: Negative hardware limit switch – 18: Positive hardware limit switch – 23: Positive reference switch – 27: Negative reference switch – 33: Actual position with zero pulse in negative direction – 34: Actual position with zero pulse in positive direction – 37: Actual position (default setting) Homing methods with zero pulse detection and stop detection are not available because the closed-loop controller without encoder cannot detect a zero pulse or stop.	
		Access	read/write
		Update	effective immediately
		Unit	–
8418	Status state machine homing	Status of the state machine for homing	
		Access	read/–
		Update	effective immediately
		Unit	–
841	Move to axis zero point after homing	Specifies the status of the "move to axis zero point after homing" function. 0: deactivated 1: activated	
		Access	read/write
		Update	effective immediately
		Unit	–
842	Homing timeout	Specifies the time limit for homing with move to the axis zero-point.	
		Access	read/write
		Update	effective immediately
		Unit	s
8414	Nominal current limit value scaling factor	Specifies the scaling factor for the limit value of the stop detection. The scaling factor refers to the rated current of the motor. This parameter applies specifically to the homing methods with impact detection. The standard values of the stop detection function are used with all other homing methods ➔ 5.8 Stop reached.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
8415	Limit position detection time monitoring window	Specifies the time monitoring window for the limit position detection. This parameter applies specifically to the homing methods with impact detection. The standard values of the stop detection function are used with all other homing methods ➔ 5.8 Stop reached.	
		Access	read/write
		Update	effective immediately
		Unit	s
8416	Axis zero point offset	Specifies the offset of the axis zero point to the reference mark.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
102222	Offset position relative	Specifies a relative position offset with respect to the reference mark. If travel to the axis zero point is deactivated, the drive moves by the specified value after reaching the reference mark.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 413: Homing parameters

ID Dx.	Name	Description
05 | 01 | 00056 (83951672)	Configuration of homing run invalid	Parameterisation of homing run invalid
05 | 01 | 00057 (83951673)	Homing: Timeout	Homing: Timeout
05 | 01 | 00058 (83951674)	Homing: Search path exceeded	Homing: Search path exceeded
07 | 01 | 00111 (117506159)	Limitation negative direction	Limitation of direction of movement owing to negative software limit position
07 | 01 | 00112 (117506160)	Limitation positive direction	Limitation of direction of movement owing to positive software limit position
07 | 01 | 00114 (117506162)	Negative hardware limit switch reached	Negative hardware limit switch reached
07 | 01 | 00115 (117506163)	Positive hardware limit switch reached	Positive hardware limit switch reached
07 | 01 | 00116 (117506164)	Limitation by negative hardware limit switch	Limitation of direction of movement owing to negative hardware limit switch
07 | 01 | 00117 (117506165)	Limitation by positive hardware limit switch	Limitation of direction of movement owing to positive hardware limit switch
07 | 01 | 00118 (117506166)	Error: both hardware limit switches activated	Error: both hardware limit switches activated

Tab. 414: Diagnostic homing

4.4.2 Timing

Homing to reference switch or limit switch

The graph shows as an example homing to a reference or limit switch without zero pulse in a positive search direction and then move to the axis zero point in a negative direction.

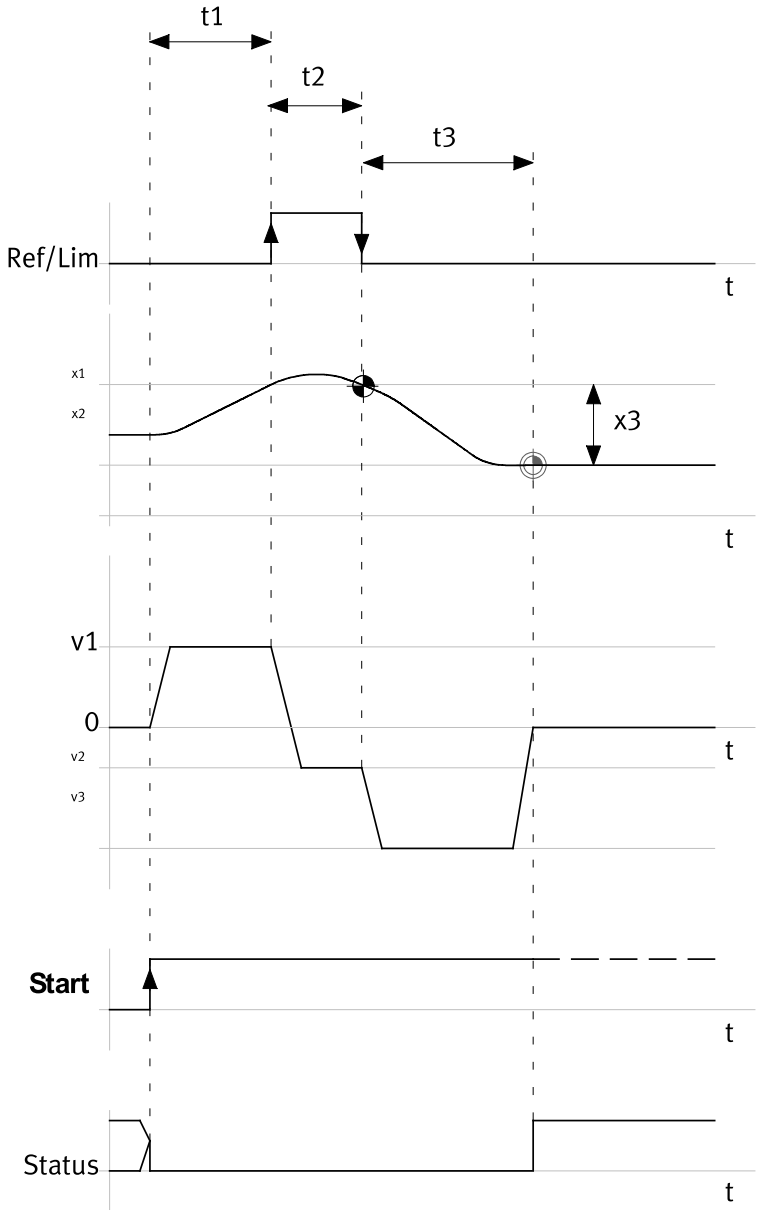


Fig. 67: Homing to reference switch or limit switch

Name	Description
Ref/Lim	Signal reference/limit switches
t1	Duration of search
t2	Duration of creep
t3	Duration of move to the axis zero point
v1	Target velocity search
v2	Target velocity creep
v3	Target velocity move
x1	Reference mark reference/limit switches
x2	Axis zero point
x3	Axis zero point offset
Start	Start homing
Status	Homing status

Tab. 415: Legend for homing to reference switch or limit switch

Homing to stop

The graph shows as an example homing to the stop without zero pulse in a positive search direction and then move to the axis zero point in a negative direction.

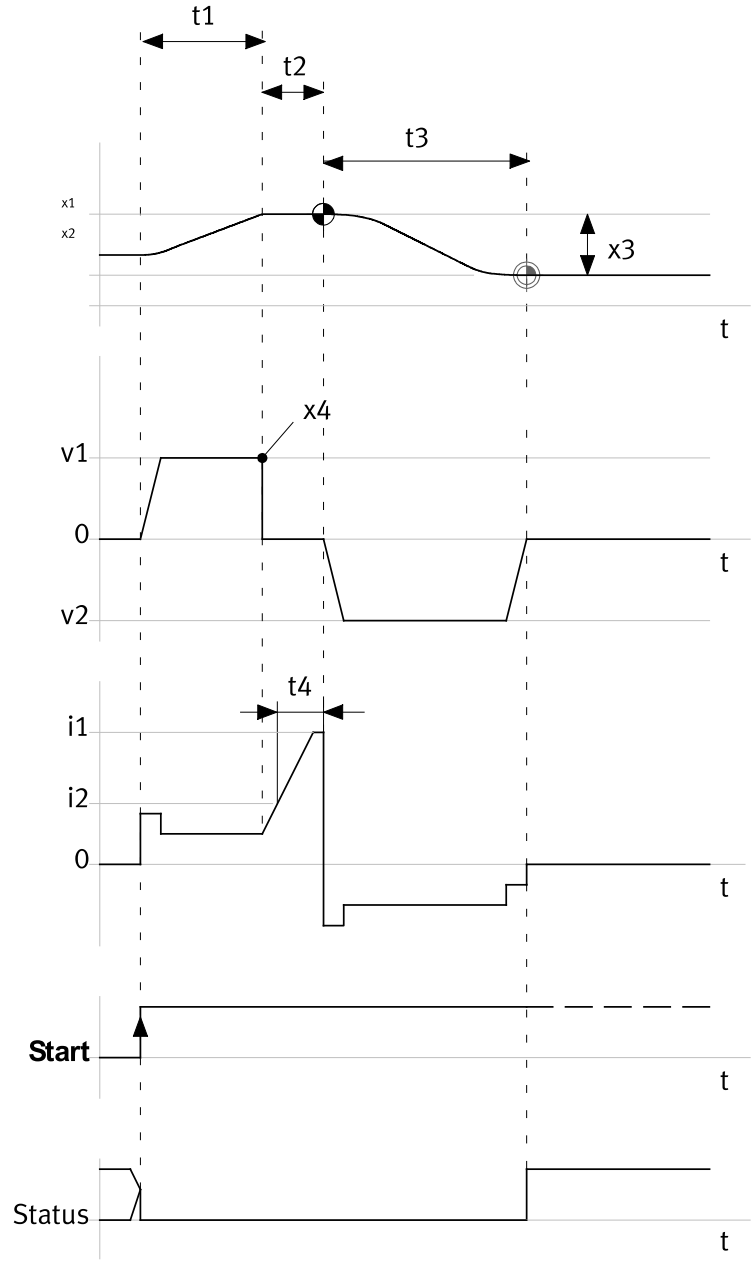


Fig. 68: Homing to stop

Name	Description
i1	Maximum current
i2	Percentage limit value of nominal current
t1	Duration of search
t2	Duration of stop detection
t3	Duration of move to the axis zero point
t4	Setpoint value time monitoring window stop detection
v1	Target velocity search
v2	Target velocity move
x1	Reference mark stop
x2	Axis zero point
x3	Axis zero point offset

Name	Description
x4	Stop
Start	Start homing
Status	Homing status

Tab. 416: Legend for homing to stop

4.4.3 Homing methods

The supported homing methods are oriented to the CANopen CiA 402 device profile for electric drives and additionally manufacturer-specific methods.

Methods

Target and direction of homing are specified by the selected homing method. Homing methods with zero pulse detection and stop detection are not available in the open-loop operation without encoder.
Example:
With method 2 "Limit switch positive with zero pulse", a search is executed for the "limit switch" primary target in the positive direction at search velocity. Then the "zero pulse" secondary target is identified at creep velocity in the negative direction. If travel to the axis zero point is activated, the parameterised axis zero point is approached at travel velocity.
The following homing methods are supported:

Method	No. (dec.)	Search direction	Primary target	Secondary target	Supported in controlled operation	Reference
Current position	37	–	Current position	–	✓	➔ 4.4.3.1
	34	Positive	Current position	Zero pulse	–	➔ 4.4.3.2
	33	Negative	Current position	Zero pulse	–	
Limit switch	18	Positive	Limit switch	–	✓	➔ 4.4.3.3
	17	Negative	Limit switch	–	✓	
	2	Positive	Limit switch	Zero pulse	–	➔ 4.4.3.4
	1	Negative	Limit switch	Zero pulse	–	
Reference switch	23	Positive	Reference switch	–	✓	➔ 4.4.3.5
	27	Negative	Reference switch	–	✓	
	7	Positive	Reference switch	Zero pulse	–	➔ 4.4.3.6
	11	Negative	Reference switch	Zero pulse	–	
	-23	Positive	Stop/limit switch	Reference switch	–	➔ 4.4.3.7
	-27	Negative	Stop/limit switch	Reference switch	–	
Stop	-18	Positive	Stop	–	–	➔ 4.4.3.8
	-17	Negative	Stop	–	–	
	-2	Positive	Stop	Zero pulse	–	➔ 4.4.3.9
	-1	Negative	Stop	Zero pulse	–	

Tab. 417: Homing methods

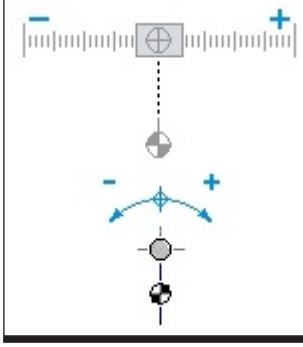
4.4.3.1 Method 37: Current position

The reference mark is found by the current axis position.
Sequence:

1. Set reference mark: current position is taken as the reference mark.
2. Set axis zero point: the axis zero point is set with reference to the reference mark.

3. Report status: "Homing status" is set.

Move to the axis zero point ➔ 4.4.3.10 Move to axis zero point. If the homing method is triggered without set controller enable, there is no movement to the axis zero point.

Method 37: Current position


Tab. 418: Sequence principle: current position

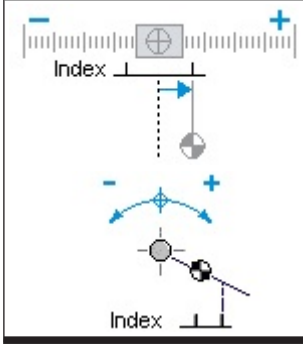
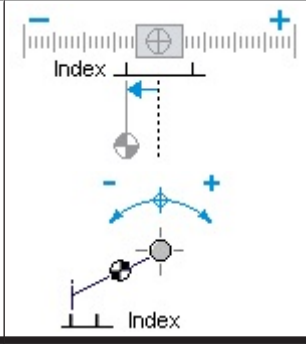
4.4.3.2 Method 33/34: Current position with zero pulse in negative/positive direction

The reference mark is found by the first zero pulse of the encoder.

Sequence:

1. Search zero pulse: a search is executed for the first zero pulse of the encoder at creep velocity in the search direction.
2. Set reference mark: position of the zero pulse is taken as the reference mark.
3. Set axis zero point: the axis zero point is set with reference to the reference mark.
4. Report status: "Homing status" is set.

Move to the axis zero point ➔ 4.4.3.10 Move to axis zero point.

Method 34: Positive search direction	Method 33: Negative search direction
	

Tab. 419: Sequence principle: Homing to zero pulse

Situation	Reaction
Zero pulse within one motor revolution not detected.	Homing aborted with fault message
Limit switch detected.	Homing aborted with fault message
Stop detected. The stop detection is parameterised via the parameters Px.4626 and Px.4627.	Homing aborted with fault message

Tab. 420: Different sequence scenarios

4.4.3.3 Method 17/18: negative/positive limit switch

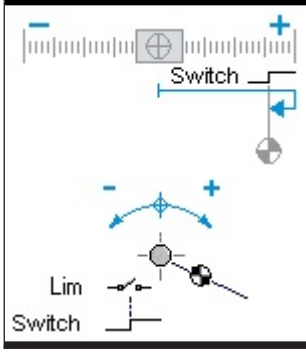
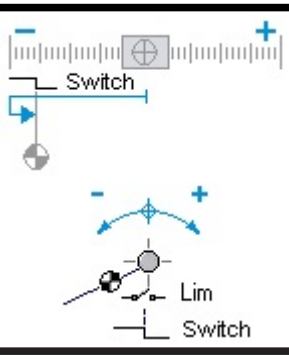
The reference mark is found by the switching edge of the limit switch.

The hardware limit switch monitoring must be activated for this (Px.101116).

Sequence:

1. Search limit switch: a search is executed for the rising edge of the limit switch at search velocity in the search direction.
2. Search limit switch edge: a search is executed for the falling edge of the limit switch (normal position) at creep velocity in the opposite direction.
3. Set reference mark: position of switching edge is taken as the reference mark.
4. Set axis zero point: the axis zero point is set with reference to the reference mark.
5. Report status: "Homing status" is set.

Move to the axis zero point ➔ 4.4.3.10 Move to axis zero point.

Method 18: Positive search direction	Method 17: Negative search direction
	

Tab. 421: Sequence principle - homing to limit switch

Situation	Reaction
"Search direction" limit switch not detected (rising edge).	Homing aborted with fault message
Limit switch edge not detected (falling edge).	Homing aborted with fault message
"Opposite direction" limit switch detected.	Homing aborted with fault message
Stop detected. The stop detection is parameterised via the parameters Px.4626 and Px.4627.	Homing aborted with fault message

Tab. 422: Different sequence scenarios

4.4.3.4 Method 1/2: negative/positive limit switch with zero pulse

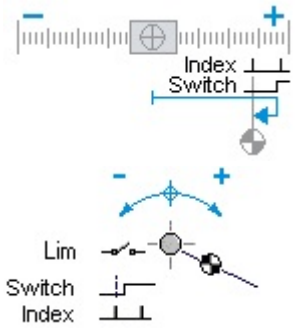
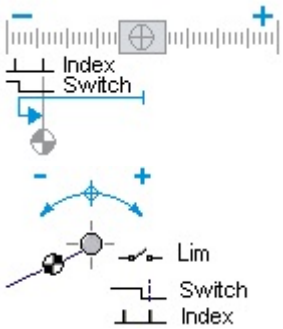
The reference mark is found after identification of the limit switch by the first zero pulse of the encoder.

The hardware limit switch monitoring must be activated for this (Px.101116).

Sequence:

1. Search limit switch: a search is executed for the rising edge of the limit switch at search velocity in the search direction.
2. Search limit switch edge: a search is executed for the falling edge of the limit switch (normal position) at creep velocity in the opposite direction.
3. Search zero pulse: first zero pulse of the encoder is searched again at creep velocity in the opposite direction.
4. Set reference mark: position of the zero pulse is taken as the reference mark.
5. Set axis zero point: the axis zero point is set with reference to the reference mark.
6. Report status: "Homing status" is set.

Move to the axis zero point ➔ 4.4.3.10 Move to axis zero point.

Method 2: Positive search direction	Method 1: Negative search direction
	

Tab. 423: Sequence principle - homing to limit switch with zero pulse

Situation	Reaction
"Search direction" limit switch not detected (rising edge).	Homing aborted with fault message
Limit switch edge not detected (falling edge).	Homing aborted with fault message
Zero pulse within one motor revolution not detected.	Homing aborted with fault message
"Opposite direction" limit switch detected.	Homing aborted with fault message
Stop detected. The stop detection is parameterised via the parameters Px.4626 and Px.4627.	Homing aborted with fault message

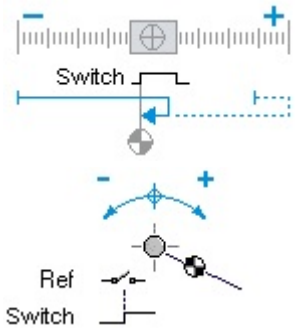
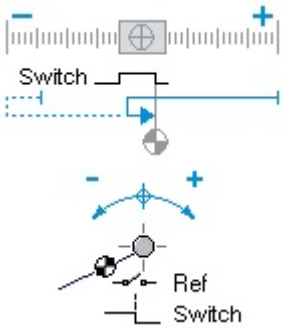
Tab. 424: Different sequence scenarios

4.4.3.5 Method 23/27: positive/negative reference switch

The reference mark is found by the switching edge of the reference switch.
Sequence:

1. Search for reference switch: the rising edge of the reference switch is searched at search speed in the search direction. If a stop is detected in the search direction, the search direction is reversed.
   The stop detection is parameterised via the parameters Px.4626 and Px.4627.
2. Search reference switch edge: falling edge of the reference switch (normal position) is searched at creep velocity in the opposite direction.
3. Set reference mark: position of switching edge is taken as the reference mark.
4. Set axis zero point: the axis zero point is set with reference to the reference mark.
5. Report status: "Homing status" is set.

Move to the axis zero point ➔ 4.4.3.10 Move to axis zero point.

Method 23: Positive search direction	Method 27: Negative search direction
	

Tab. 425: Sequence principle – homing to reference switch

Situation	Reaction
Reference switch edge not detected (falling edge).	The drive continues to run until the double time-out time has elapsed (2 x time-out monitoring). If a stop or limit switch in the opposite direction is detected, homing is aborted with an error message.
"Search direction" limit switch	Limit switch monitoring is deactivated.
"Opposite direction" limit switch	Limit switch monitoring is activated.

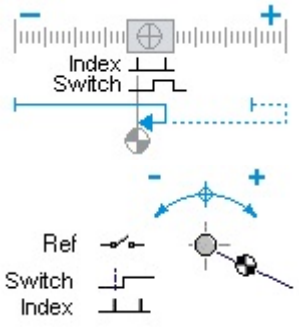
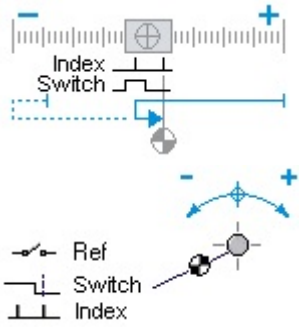
Tab. 426: Different sequence scenarios

4.4.3.6 Method 7/11: reference switch positive/negative with zero pulse

The reference mark is found after identification of the reference switch by the first zero pulse of the encoder.
Sequence:

1. Search for reference switch: the rising edge of the reference switch is searched at search speed in the search direction. If a stop is detected in the search direction, the search direction is reversed.
   The stop detection is parameterised via the parameters Px.4626 and Px.4627.
2. Search reference switch edge: falling edge of the reference switch (normal position) is searched at creep velocity in the opposite direction.
3. Search zero pulse: first zero pulse of the encoder is searched again at creep velocity in the opposite direction.
4. Set reference mark: position of the zero pulse is taken as the reference mark.
5. Set axis zero point: the axis zero point is set with reference to the reference mark.
6. Report status: "Homing status" is set.

Move to the axis zero point ➔ 4.4.3.10 Move to axis zero point.

Method 7: Positive search direction	Method 11: Negative search direction
	

Tab. 427: Sequence principle – homing to reference switch with zero pulse

Situation	Reaction
Reference switch edge not detected (falling edge).	The drive continues to run until the double time-out time has elapsed (2 x time-out monitoring). If a stop or limit switch in the opposite direction is detected, homing is aborted with an error message.
Zero pulse within one motor revolution not detected.	Homing aborted with fault message
"Search direction" limit switch	Limit switch monitoring is deactivated.
"Opposite direction" limit switch	Limit switch monitoring is activated.

Tab. 428: Different sequence scenarios

4.4.3.7 Method -23/-27: positive/negative stop/limit switch with run to reference switch

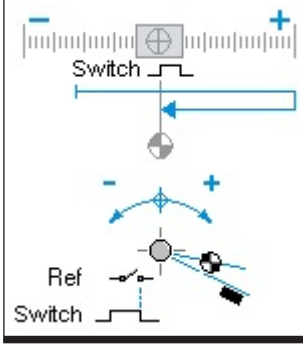
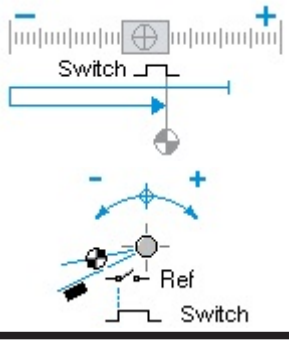
The reference mark is found by the switching edge of the reference switch after identification of the limit switch or the stop.

The hardware limit switch monitoring must be activated for this (Px.101116).

Sequence:

1. Search stop/limit switch: stop or rising edge of the limit switch is searched in search direction at search velocity.
   The stop detection is parameterised via the parameters Px.8414 and Px.8415.
2. Search for reference switch: the reference switch is searched at search speed in the opposite direction.
3. Search reference switch edge: falling edge of the reference switch (normal position) is searched further at creep velocity in the opposite direction.
4. Set reference mark: position of switching edge is taken as the reference mark.
5. Set axis zero point: the axis zero point is set with reference to the reference mark.
6. Report status: "Homing status" is set.

Move to the axis zero point ➔ 4.4.3.10 Move to axis zero point.

Method -23: Positive search direction	Method -27: Negative search direction
	

Tab. 429: Sequence principle – homing to stop/limit switch positive/negative with travel to reference switch

Situation	Reaction
"Search direction" stop and limit switch not detected.	Homing aborted with fault message
Limit switch edge not detected (falling edge).	Homing aborted with fault message
"Opposite direction" limit switch detected.	Homing aborted with fault message
Reference switch "search direction" detected.	Reference switch is ignored.
"Opposite direction" stop detected.	Homing aborted with fault message

Tab. 430: Different sequence scenarios

4.4.3.8 Method -17/-18: negative/positive stop

The reference mark is found by detection of the stop.

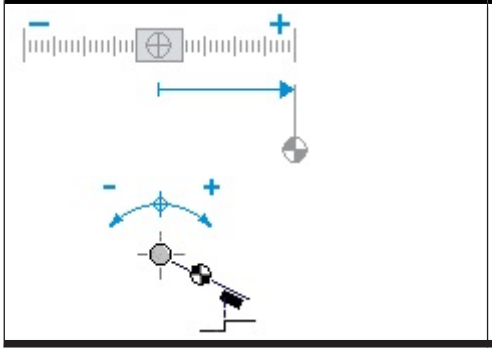
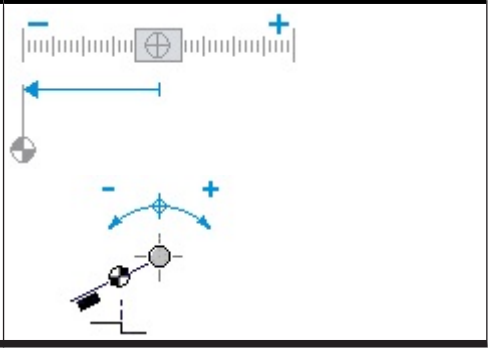
Sequence:

1. Search stop: stop is searched in the search direction at search velocity.
   The stop detection is parameterised via the parameters Px.8414 and Px.8415.
2. Set reference mark: position of the stop is taken as the reference mark.

3. Set axis zero point: the axis zero point is set with reference to the reference mark.
4. Report status: "Homing status" is set.

Move to the axis zero point ➔ 4.4.3.10 Move to axis zero point.

With the homing methods -17/-18 "Homing to stop", the drive stands controlled at the stop after the homing. The parameterisation of the move to the axis zero point makes continuous control at the stop unnecessary.

Method -18: Positive search direction	Method -17: Negative search direction
	

Tab. 431: Sequence principle - homing to stop

Situation	Reaction
"Search direction" stop not detected.	Homing aborted with fault message
"Search direction" limit switch detected.	Homing aborted with fault message
"Opposite direction" limit switch detected.	Homing aborted with fault message

Tab. 432: Different sequence scenarios

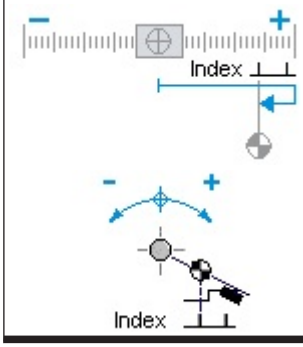
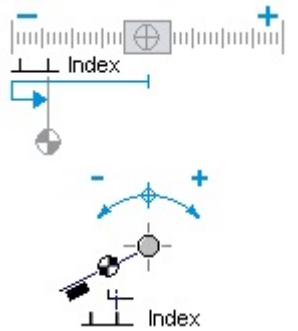
4.4.3.9 Method -1/-2 negative/positive stop with zero pulse

The reference mark is found after identification of the stop by the first zero pulse of the encoder.

Sequence:

1. Search stop: stop is searched in the search direction at search velocity.
   The stop detection is parameterised via the parameters Px.8414 and Px.8415.
2. Search zero pulse: first zero pulse of the encoder is searched at creep velocity in the opposite direction.
3. Set reference mark: position of the zero pulse is taken as the reference mark.
4. Set axis zero point: the axis zero point is set with reference to the reference mark.
5. Report status: "Homing status" is set.

Move to the axis zero point ➔ 4.4.3.10 Move to axis zero point.

Method -2: Positive search direction	Method -1: Negative search direction
	

Tab. 433: Sequence principle - homing to stop with zero pulse

Situation	Reaction
"Search direction" stop not detected.	Homing aborted with fault message
Zero pulse within one motor revolution not detected.	Homing aborted with fault message
"Search direction" limit switch detected.	Limit switch monitoring is deactivated.
"Opposite direction" limit switch detected.	Homing aborted with fault message

Tab. 434: Different sequence scenarios

4.4.3.10 Move to axis zero point

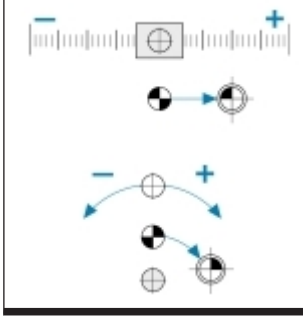
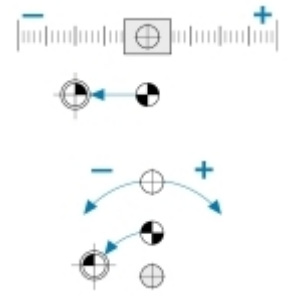
Move to axis zero point is run after a valid homing.

Prerequisites for move to the axis zero point are:

- "Activate move to axis zero point after completion of homing" parameter is activated.
- Reference mark was taken in accordance with the homing method.

Sequence:

1. Move to axis zero point: axis zero point is approached at movement velocity.
2. Set axis zero point: the axis zero point is set with reference to the reference mark.
3. Report status: "Homing status" is set.

Positive axis zero point offset: positive movement direction	Negative axis zero point offset: negative movement direction
	

Tab. 435: Sequence principle - move to axis zero point

Situation	Reaction
HEPP/axis zero point was not reached.	Homing aborted with fault message
Limit switch detected.	Homing aborted with fault message
Stop detected. The stop detection is parameterised via the parameters Px.4626 and Px.4627.	Homing aborted with fault message

Tab. 436: Different sequence scenarios

4.4.4 CiA 402

Objects for homing

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
843	0x6099.01	Search for reference mark setpoint velocity	UDINT
844	0x609A.00	Search for reference mark setpoint acceleration	UDINT
846	0x6099.02	Setpoint reference mark creeping velocity	UDINT
8416	0x607C.00	Axis zero point offset	DINT
8417	0x6098.00	Referencing method	SINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
840	0x2172.01	Referencing status	UDINT
841	0x2172.02	Move to axis zero point after homing	USINT
842	0x2172.03	Homing timeout	REAL
843	0x2172.04	Search for reference mark setpoint velocity	REAL
844	0x2172.05	Search for reference mark setpoint acceleration	REAL
845	0x2172.06	Search for reference mark setpoint jerk	REAL
846	0x2172.07	Setpoint reference mark creeping velocity	REAL
847	0x2172.08	Setpoint reference mark creeping acceleration	REAL
848	0x2172.09	Setpoint reference mark creeping jerk	REAL
849	0x2172.0A	Move to axis zero point setpoint velocity	REAL
8410	0x2172.0B	Move to axis zero point setpoint acceleration	REAL
8411	0x2172.0C	Search for move to axis zero point setpoint jerk	REAL
8412	0x2172.0D	Maximum search stroke in positive direction	LINT
8413	0x2172.0E	Maximum search stroke in negative direction	LINT
8414	0x2172.0F	Nominal current limit value scaling factor	REAL
8415	0x2172.10	Limit position detection time monitoring window	REAL
8416	0x2172.11	Axis zero point offset	LINT
8417	0x2172.12	Referencing method	DINT
8418	0x2172.13	Status state machine homing	UDINT
102222	0x2172.22	Offset position relative	LINT

Tab. 437: Objects

The overview shows the function of the homing mode:

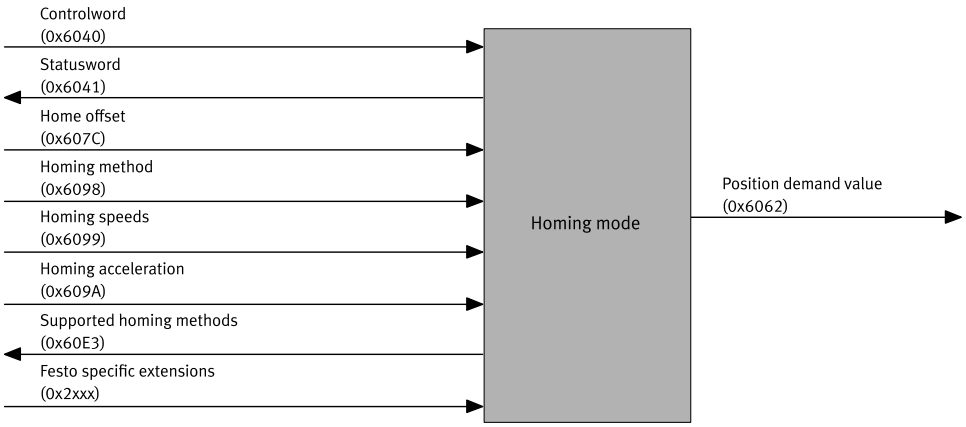


Fig. 69: Overview: homing mode

More information ➔ 4.4.3 Homing methods.

Axis zero point

The overview shows the dependency of reference mark (Home position), reference offset (Home offset) and axis zero point (Zero position).

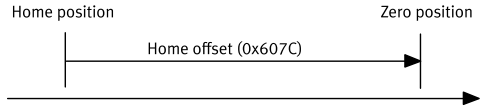


Fig. 70: Overview of reference offset

Calculation of the axis zero point:

The axis zero point is calculated as follows:
Axis zero point = reference mark + reference offset
All subsequent absolute positions are relative to the axis zero point.

Precondition for homing

All homing methods can only be performed in the "Operation enabled" status.

The following conditions must be fulfilled for homing mode.
– Operation mode display (Modes of operation display 0x6061) = 6
– Status word (Statusword 0x6041) = 0xXXXX X11X X011 0111

Control and Monitoring

Object 0x6040: control word (Controlword)

The object controls the following homing functions:
– Bit 4: start or abort homing (Homing operation start)
– Bit 8: prepare or abort homing (Halt)

Bit[1]		Description
8	4	
Prepare homing for start		
0	0	Homing not active
Start homing		
0	0→1	Start homing
Homing is executed		
0	x	Homing active
Cancel homing		
1	1	Cancel homing ➔ deceleration as per object 0x609A.01

1) signal status: 0 = low; 1 = high; 0→1 = rising edge; x = any

Tab. 438: Control homing

Object 0x6041: status word (Statusword)

The object controls the following homing functions:
– Bit10: target reached (Target reached)
– Bit 12: reference mark reached (Homing attained)
– Bit 13: homing error (Homing error)
– Bit 15: drive is referenced (Drive is referenced)

Bit[1]				Description
15	13	12	10	
Drive not referenced or homing was aborted				
0	0	0	1	If one of the following states has occurred – the homing was not started – the active homing was aborted with the falling edge in bit 4 of the control word – a homing error occurred and the speed = 0
Homing active				
0	0	0	0	Homing is executed
Drive homed				
1	0	1	1	Homing was successfully completed, drive is homed and the speed = 0
Homing error				
0	1	0	0	A homing error has occurred and the speed ≠ 0
0	1	0	1	A homing error has occurred and the speed = 0

1) signal status: 0 = low; 1 = high; x = any

Tab. 439: Monitor homing

4.4.5 PROFIdrive

PNUs for homing

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
840	11202.0	Referencing status	UDINT
841	11203.0	Move to axis zero point after homing	BOOL
842	11204.0	Homing timeout	REAL
843	11205.0	Search for reference mark setpoint velocity	REAL
844	11206.0	Search for reference mark setpoint acceleration	REAL
845	11207.0	Search for reference mark setpoint jerk	REAL
846	11208.0	Setpoint reference mark creeping velocity	REAL
847	11209.0	Setpoint reference mark creeping acceleration	REAL
848	11210.0	Setpoint reference mark creeping jerk	REAL
849	11211.0	Move to axis zero point setpoint velocity	REAL
8410	11728.0	Move to axis zero point setpoint acceleration	REAL
8411	11729.0	Search for move to axis zero point setpoint jerk	REAL
8412	11730.0	Maximum search stroke in positive direction	LINT
8413	11731.0	Maximum search stroke in negative direction	LINT
8414	11732.0	Nominal current limit value scaling factor	REAL
8415	11733.0	Limit position detection time monitoring window	REAL
8416	11734.0	Axis zero point offset	LINT
8417	11735.0	Referencing method	DINT
8418	11736.0	Status state machine homing	UDINT
102222	13072.0	Offset position relative	LINT

Tab. 440: PNUs

More information ➔ 4.4.3 Homing methods.

Control and Monitoring

Information on control and monitoring ➔ 12.4.3.4 Finite State Machine Homing Application Class 3.

4.5 Task via record selection

4.5.1 Record selection

4.5.1.1 Function

Command records can be saved in the device in a record table. The command records contain parameters for processing commands and can be addressed by a record number. To start a command record, e.g. via the device profile, the controlling PLC only needs to send the record number and the start signal in the output data. The record table can be activated either as a foreground process or a background process. However, motion commands can only be run as a foreground process ➔ Tab. 445 Command record type parameter (ID Px.1810).

Start record table ...	Description
... as foreground process	All command record types can be executed, including motion commands. The event table can monitor events at the same time.
... as background process	Motion commands are illegal and generate a category 1 stop. The event table can monitor events at the same time.

Tab. 441: Mode of record table

Besides the parameters for pure command processing, record selection offers the following options for influencing sequence control:

Options for sequence control	Description
Record switching	A start condition can be established for every record. The start condition specifies what the reaction should be to a start signal for the record if the current task has not been ended yet (abort, wait, ignore, Px.1838).
Record sequencing	Command sequences that can be started with a single start signal can be defined by sequencing records of the record table ➔ 4.5.2.1 Record sequencing.
Event table	The event table enables definition of the sequencing conditions that should also be monitored in parallel. (➔ 4.5.3 Monitoring of events).

Tab. 442: Options for sequence control

Key features of record table

- Possible as background or foreground process
- maximum 3 record sequences per command record
- depending on the product variant and firmware: up to 128 command records and up to 128 record sequences in total

The command records of the record table can be started as follows:

- the device profile of the higher-order controller
- the engineering interface, e.g. via the plug-in

Rules for processing

- The "write parameters" command record is always processed in one cycle and contains the start of the next task.
- The priority of the record sequences depends on the index of the data record in which the record sequence was created. Record sequences in data records with a smaller index have priority over record sequences in data records with a larger index. If conditions in multiple record sequences return the value "true" simultaneously, the record sequence in the data record with the smaller index is effective.

Timing

“Interrupt” start condition

The current order (here record A) is interrupted immediately and the newly addressed order (here record B) is then executed immediately.

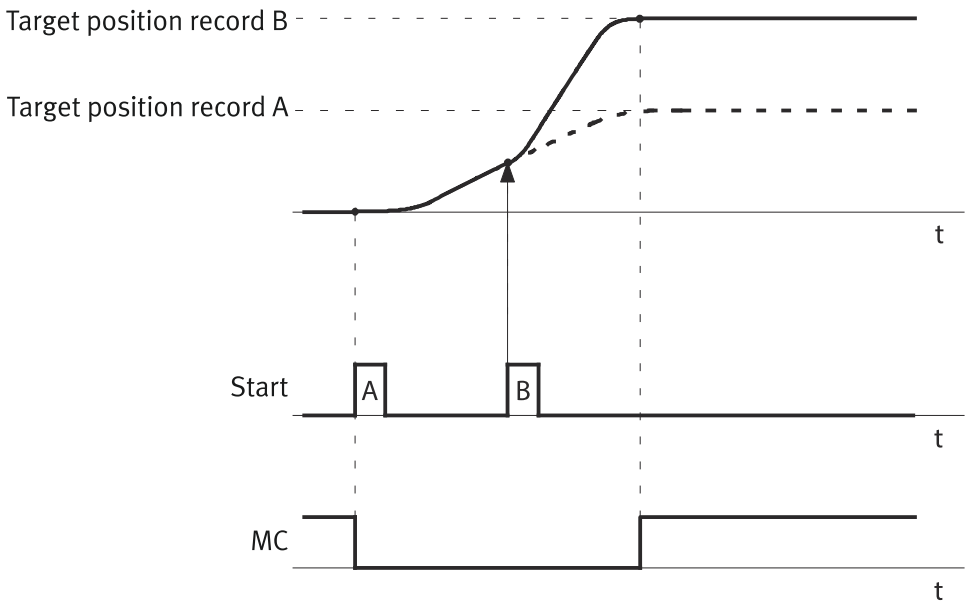


Fig. 71: “Interrupt” start condition (example)

Name	Description
Target position	Target position of the motion command
record A, B, C	Record A, B or C
Start	Start record
MC	Motion complete

Tab. 443: Legend for the "Interrupt" start condition image

Parameters and diagnostic Messages

The index is the number of the internal data record in which the command record is saved. It is addressed externally via the record number, which is saved in the parameter Px.1811.

The "record table field 1 ... 7" parameters depend on the value of the record type parameter.

ID Px.	Parameter	Description	
1130224	Activation background mode	Specifies whether the record table is activated as a foreground process or a background process. ➔ Tab. 441 Mode of record table This means: – 0: foreground process – 1: background process	
		Access	read/write
		Update	effective immediately
		Unit	–
1810	Command record type	Specifies the type of the command record. Px.1810.0.0: record type of data set 0 ... Px.1810.0.64: record type for data set 64 ... (depending on the product variant and the firmware) Permissible values ➔ Tab. 445 Command record type parameter (ID Px.1810).	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
1811	Record number	Specifies the record number with which the command record is to be addressed.	
		Access	read/write
		Update	effective immediately
		Unit	–
1812	Record table field 1	Specifies the value of the first parameter depending on the record type ➔ Tab. 445 Command record type parameter (ID Px.1810)	
		Access	read/write
		Update	effective immediately
		Unit	–
1813	Record table field 2	Specifies the value of the second parameter depending on the record type ➔ Tab. 445 Command record type parameter (ID Px.1810)	
		Access	read/write
		Update	effective immediately
		Unit	–
1814	Record table field 3	Specifies the value of the third parameter depending on the record type ➔ Tab. 445 Command record type parameter (ID Px.1810)	
		Access	read/write
		Update	effective immediately
		Unit	–
1815	Record table field 4	Specifies the value of the fourth parameter depending on the record type ➔ Tab. 445 Command record type parameter (ID Px.1810)	
		Access	read/write
		Update	effective immediately
		Unit	–
1816	Record table field 5	Specifies the value of the fifth parameter depending on the record type ➔ Tab. 445 Command record type parameter (ID Px.1810)	
		Access	read/write
		Update	effective immediately
		Unit	–
1817	Record table field 6	Specifies the value of the sixth parameter depending on the record type ➔ Tab. 445 Command record type parameter (ID Px.1810)	
		Access	read/write
		Update	effective immediately
		Unit	–
1818	Record table field 7	Specifies the value of the seventh parameter depending on the record type ➔ Tab. 445 Command record type parameter (ID Px.1810)	
		Access	read/write
		Update	effective immediately
		Unit	–
1838	Selection start condition record	Specifies the behaviour on switching to another command record. This means: – 0: interrupt ➔ Fig. 71 The current order is interrupted immediately, and the newly addressed order is executed directly.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
1846	Status of record table	Display the status of the actual record. – 0: inactive – 1: new – 2: active – 3: executed – 5: buffered – 6: cancelled – 7: synchronised	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 444: Parameter

Parameters depending on the record type

The meaning of the record table field 1 … record table field 7 parameters depends on the selected record type (value of the record type parameter).

Command record type parameter (ID Px.1810)				
Value	Command record type	Description	Parameters depending on the record type (record table field 1 … 7)	
0	Inactive	no operation	– (none)	
2	Stop ramp	Stop with parameterised brake ramp	1.	Deceleration
			2.	Jerk
3	Homing	Start homing	1.	Homing method as per CiA402 including manufacturer-specific methods
4	Velocity	Speed mode with or without stroke limitation:	1.	Target speed
			2.	Acceleration
			3.	Deceleration
			4.	Jerk
			5.	Activation of stroke limitation: – 0: inactive – 1: active
			6.	Stroke limitation negative
			7.	Stroke limitation positive
5	Position	Positioning mode (absolute or relative):	1.	Type of target specification: – 0: absolute – 1: relative to the current actual position – 2: relative to the current setpoint position – 3: relative to the last target position – 4: relative to the current touch probe position instance 0 – 5: relative to the current touch probe position instance 0
			2.	Target position
			3.	Profile speed
			4.	Acceleration
			5.	Deceleration
			6.	Jerk
			7.	End speed
7	Torque	Torque mode without or with stroke and velocity limitation	1.	Target torque
			2.	Torque rise time
			3.	Speed limit value

Command record type parameter (ID Px.1810)				
Value	Command record type	Description	Parameters depending on the record type (record table field 1 ... 7)	
7	Torque	Torque mode without or with stroke and velocity limitation	4.	Activation of stroke limitation: – 0: inactive – 1: active
			5.	Stroke limitation negative
			6.	Stroke limitation positive
9	Write parameter	Writing a parameter.	1.	System/axis
			2.	Parameter number
			3.	Instance
			4.	Index
			5.	New parameter value
10	Flow control	Does not execute an action. Used as placeholder for appending record sequencing.	– (none)	
25	Torque with holding brake	Torque mode with holding brake set	1.	Target torque
			2.	Torque rise time
			3.	Speed limit value
			4.	Activation of stroke limitation: – 0: inactive – 1: active
			5.	Stroke limitation negative
			6.	Stroke limitation positive
			7.	Selection of holding brake – 0: holding brake 1
26	Position trigger	Activation of the position trigger (also permissible for background process)	1.	Position trigger mode
			2.	Instance (number of the position trigger)
			3.	Trigger mode
27	Set digital output	Set digital output (also allowed for background process) The requested output must be configured as output for use in the record table ➔ 3.3.6 Digital inputs and outputs	1.	Output – 33: record table output 0 – 34: record table output 1
			2.	requested status (0, 1) – 0 = reset output – 1 = set output
28	Touch probe	Activate/deactivate position capture function (also allowed for background process)	1.	Touch probe mode
			2.	Channel of trigger input: – 0: CAP0 – 1: CAP1
29	Modulo	Activates the modulo mode for positioning mode (PP)	1.	Mode – 0: inactive – 1: shortest path – 3: shortest path within the modulo limit – 4: only positive path – 5: only negative path – 8: setting of the modulo position – 9: reset of the modulo position
30	Change closed loop parameter set	Switch to another controller parameter record (also allowed for background process)	1.	Controller parameter set ID
			2.	Transition time
31	Set position status word 2	Sets the corresponding bit 10/11 in POS_ZSW, the corresponding status depending on the status ID 1/2 (only relevant for PROFIdrive).	1.	Status ID 1 or 2
			2.	Status – 0: inactive – 1: active

Command record type parameter (ID Px.1810)				
Value	Command record type	Description	Parameters depending on the record type (record table field 1 ... 7)	
32	Moving to fixed stop	Activates the move to fixed stop mode ➔ Move to fixed stop (application class 3) (➔ 4.1.3.3).	1.	Type of target specification: – 0: absolute – 1: relative to the current actual position – 2: relative to the current setpoint position – 3: relative to the last target position – 4: relative to the current capture position
			2.	Target position
			3.	Profile speed
			4.	Acceleration
			5.	Deceleration
			6.	Jerk
33	Move to fixed stop parameter	Defines the parameters for move to fixed stop.	1.	Clamping torque
			2.	Clamping torque off set
			3.	Positive stroke limit
			4.	Negative stroke limit
34	Brake test	Activates the automatic brake test ➔ 4.1.10.1 Brake test.	– (none)	
37	Torque Percent	Torque mode without or with stroke and velocity limitation. The specification is set as a percentage of the motor nominal torque multiplied by the gear factor.	1.	Percentage of the motor nominal torque multiplied by the gear factor Example: Gear unit 5:1, target torque = 100%. Result: 20% torque at the motor.
			2.	Rise time percentage %/s
			3.	Speed limit value
			4.	Activation of stroke limitation: – 0: inactive – 1: active
			5.	Stroke limitation negative
			6.	Stroke limitation positive

Tab. 445: Command record type parameter (ID Px.1810)

Example

The command record no. 0 should be written in the first data record (0) and command record no. 1 should be written in the second data record (1) with the following parameters to the record table:

– Command record no. 0: positioning mode absolute to the zero point with the parameter values noted below:
  Target position 500 mm, maximum velocity 3 m/s, maximum acceleration 3 m/s², maximum deceleration 3 m/s², jerk 100 m/s³, final velocity 0 m/s, start condition "Interrupt"
– Command record no. 1: velocity mode with stroke limitation with the parameter values noted below
  Target velocity 2.3 m/s, maximum acceleration 3 m/s², maximum deceleration 4 m/s², jerk 200 m/s³, stroke limitation monitor active, negative stroke limit 10 mm, positive stroke limit 910 mm, start condition "Interrupt"

Parameters	Value	Comment
Table type		
P1.1810.0.0	5	Data record 0: positioning mode (5)
P1.1810.0.1	4	Data record 1: velocity mode (4)
Record number		
P1.1811.0.0	0	Record number 0
P1.1811.0.1	1	Record number 1
Record table field 1		
P1.1812.0.0	0	absolute position (0)
P1.1812.0.1	2.3	Target speed
Record table field 2		
P1.1813.0.0	5000000000	Target position (user unit metre, resolution 10^{10})
P1.1813.0.1	3	maximum acceleration
Record table field 3		
P1.1814.0.0	3	maximum velocity
P1.1814.0.1	4	maximum deceleration
Record table field 4		
P1.1815.0.0	3	maximum acceleration
P1.1815.0.1	200	maximum jerk
Record table field 5		
P1.1816.0.0	3	maximum deceleration
P1.1816.0.1	1	Activate stroke limitation (1 = active)
Record table field 6		
P1.1817.0.0	100	maximum jerk
P1.1817.0.1	100000000	Stroke limitation in negative direction (user unit metre, resolution 10^{10})
Record table field 7		
P1.1818.0.0	0	End speed
P1.1818.0.1	9100000000	Stroke limitation in the positive direction (user unit metre, resolution 10^{10})
Selection start condition record		
P1.1838.0.0	0	Interrupt
P1.1838.0.1	0	Interrupt

Tab. 446: Set basic parameters (example)

4.5.2 Record sequencing

4.5.2.1 Function

Sequencing multiple records of the record table enables specification of command sequences. A command sequence is executed after starting with no further start commands to the last record of the sequence. If the record table is activated as a foreground process, complex motion sequences and movement profiles can be created with command sequences, e.g.:

– Positioning and clamping in a motion sequence
– Moving a velocity profile
– Executing a force profile for pressing procedures

A maximum of 3 record sequences can be parameterised for every record of the record table. Every record sequence defines a condition and a subsequent record. The condition (comparator) can compare signals, states or parameters and is cyclically monitored. If one of the maximum of 3 conditions returns the value "true", the associated subsequent record is started.

Parameters for the sequence of command records of the record table

ID Px.	Parameter	Description	
1831	Record step enabling type	Specifies the enabling condition that is to be monitored along with the execution of the record. Possible record sequencing types ➔ Tab. 448 Record sequencing type parameter (ID Px.1831).	
		Access	read/write
		Update	effective immediately
		Unit	–
1832	Record sequencing record number start	Specifies the number of the record from which the record sequence starts (maximum 3 record sequence per record).	
		Access	read/write
		Update	effective immediately
		Unit	–
1833	Record sequencing record number target	Specifies the number of the target record to which the record sequence is targeted (maximum 1 target record per record sequence).	
		Access	read/write
		Update	effective immediately
		Unit	–
1834	Record sequencing field time	Specifies the value of the time parameter ➔ Tab. 448 Record sequencing type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	s
1835	Record sequencing field 1	Specifies the value of the first comparator type-dependent parameter ➔ Tab. 448 Record sequencing type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	–
1836	Record sequencing field 2	Specifies the value of the second comparator type-dependent parameter ➔ Tab. 448 Record sequencing type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	–
526778	Record sequencing field 3	Record sequencing field 3 ➔ Tab. 448 Record sequencing type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	–
526790	Record sequencing field 4	Record sequencing field 4 ➔ Tab. 448 Record sequencing type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	–
526791	Record sequencing field 5	Record sequencing field 5 ➔ Tab. 448 Record sequencing type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
526792	Record sequencing field 6	Record sequencing field 6 ➔ Tab. 448 Record sequencing type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	–
526793	Record sequencing field 7	Record sequencing field 7 ➔ Tab. 448 Record sequencing type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	–
1837	Actual record table index	Display the actual record number.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 447: Parameter

The record sequencing depends on the configured monitoring windows with a comparator that depends on a motion monitor.

Record sequencing type parameter (ID Px.1831)			
Value	Record sequencing types	The sequencing condition is achieved when ...	comparator type-dependent parameters
0	No comparator	– (comparator not specified)	– (none)
1	Target position reached	... the motion monitor reports that the target position has been reached.	– (none)
2	Target velocity reached	... the motion monitor reports that the target velocity has been reached.	– (none)
3	Target torque reached	... the motion monitor reports that the target torque has been reached.	– (none)
4	Digital Input	... the digital input checks the parameterised level (high or low level). The requested input must be configured as input for use in the record table ➔ 3.3.6 Digital inputs and outputs	1. **Input:** – 11: record table input 0 – 12: record table input 1 2. **Status:** – 0 = low level – 1 = high level
5	Position	... the actual position is within the pre-set window for the duration of the specified cushioning time.	1. lower limit 2. upper limit 3. Cushioning time
6	Velocity	... the actual speed is within the pre-set window for the duration of the specified cushioning time.	1. lower limit 2. upper limit 3. Cushioning time
7	Torque	... the actual torque is within the pre-set window for the duration of the specified cushioning time.	1. lower limit 2. upper limit 3. Cushioning time

Record sequencing type parameter (ID Px.1831)			
Value	Record sequencing types	The sequencing condition is achieved when ...	comparator type-dependent parameters
8	Position Modulo	... the actual modulo position is within the pre-set window for the duration of the specified cushioning time.	1. lower limit 2. upper limit 3. Cushioning time
9 ... 12	reserved		
13	Parameters	... the result of the parameterised comparison operation returns "true" (comparison of parameter and value).	1. Cushioning time 2. Parameter ID 3. **Operation:** – 0: within the range – 1: outside the range – 2: greater than – 3: less than 4. lower limit 5. upper limit
14	Time	... the duration measured from the start of the command is equal to or greater than the specified duration.	1. duration
15	MC	... the record is terminated by the trajectory generator.	– (none)
16	Execution completed	... the status of the task corresponds to DONE. In a motion command DONE corresponds to the status of target window reached (Target Reached = TRUE) This record sequencing cannot be used for the "stop ramp" record type. The speed record with v = 0 can be used instead.	– (none)
17	Movement monitoring status word		– And (4), Or (5) operator – Bit mask (32-bit)
18	Touch probe detected	The activated touch-probe function has detected a valid event.	1. No. of capture channel
19	Control word 1 BLOCK CHANGE	... in control word STW1.13 there is an edge change from 0 to 1.	
20	Fixed stop reached	... the (fixed) stop was detected	– (none)
21	Drive decelerated	... the drive decelerates	
22	Positive stroke limit reached	... the positive stroke limit has been reached	
23	Negative stroke limit reachedNegative stroke limit reached	... the negative stroke limit has been reached	

Tab. 448: Record sequencing type parameter (ID Px.1831)

Example

Record 1 should be sequenced with record 2 and record 3.
It should be switched to record 2 if the actual position is within a pre-set window for the duration of the specified cushioning time.
It should be switched to record 3 if the "record table 0" high level is pending at the digital input.

Setting parameters for record sequencing (example)		
Parameters	Value	Comment
Record sequencing type		
P1.1831.0.0	5	Record sequencing type 5 (position)
P1.1831.0.1	4	Record sequencing type 4 (digital input)
Record sequencing record number start		
P1.1832.0.0	1	First record sequence for record 1
P1.1832.0.1	1	Second record sequence for record 1
Record sequencing record number target		
P1.1833.0.0	2	Target record for the first record sequence
P1.1833.0.1	3	Target record for the second record sequence
Record sequencing field time		
P1.1834.0.0	0.1	Cushioning time of the first record sequence (0.1 s)
P1.1834.0.1	–	–
Record sequencing field 1		
P1.1835.0.0	950000000	Lower limit 950 mm (user unit metre, resolution 10^{10})
P1.1835.0.1	11	Input (here record table input 0)
Record sequencing field 2		
P1.1836.0.0	10500000000	Upper limit 1.05 m (user unit metre, resolution 10^{10})
P1.1836.0.1	1	High level

Tab. 449: Setting parameters for record sequencing (example)

4.5.3 Monitoring of events

4.5.3.1 Function

The event table enables the monitoring of events that are to be monitored parallel to the sequencing conditions of the current command record. If the event occurs, the current command record of the record table is interrupted and branched to the record of the record table that was defined in the event table. Characteristics of the event table:
– max. 16 events

Rules for processing

– The priority is ascending and depends on the index. Events in data records with a smaller index have priority over events in data records with a larger index. If multiple events occur simultaneously, it branches to the record that is saved in the data record with the smaller index. Priority:
  Data record with Index 0 has the highest priority: Px.1841.0.0
  ...
  Data record with Index 15 has the lowest priority: Px.1841.0.15

Example

The example shows how to react to the switching level of a digital input. If the condition is met, the system jumps directly to the parameterised record number of the record table.

Reaction to the switching level of a digital input (example)		
Parameters	Value	Comment
Activate event table (BOOL)		
P1.1840.0.0	1	Inactive (0): deactivate Active (1): activate
Event type		
P1.1841.0.0	4	Record sequencing types "Digital input"
Event sequencing target		
P1.1842.0.0	...	Target record number from the record table (here...)
Event sequencing field time		
P1.1843.0.0	0	Duration 0 s
Next event sequencing field 1 (UINT32)		
P1.1844.0.0	11	11: record table input 0 12: record table input 1
Next event sequencing field 2 (BOOL)		
P1.1845.0.0	Active	Inactive (0): Low level Active (1): high level

Tab. 450: Reaction to the switching level (example)

Parameters and diagnostic Messages

The index is the number of the internal data record in which the event is saved.

ID Px.	Parameter	Description	
1840	Activate Event table	Enables activation of event monitoring – 1 = activate – 0 = deactivate	
		Access	read/write
		Update	effective immediately
		Unit	–
1841	Event type	Specifies the type of step enabling condition. The same step enabling conditions as with record sequences can be used. Possible record sequencing types ➔ Tab. 448 Record sequencing type parameter (ID Px.1831).	
		Access	read/write
		Update	effective immediately
		Unit	–
1842	Next event target	Specifies the number of the target record to which the step enabling condition is targeted (maximum 1 target record per event).	
		Access	read/write
		Update	effective immediately
		Unit	–
1843	Next event field time	Specifies the value of the "time" parameter ➔ Tab. 448 Record sequencing type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	s
1844	Next event field 1	Specifies the value for the first comparator type-dependent parameter ➔ Tab. 448 Record sequencing type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
1845	Next event field 2	Specifies the value for the second comparator type-dependent parameter ➔ Tab. 448 Record sequencing type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 451: Parameter

Diagnostic messages

ID Dx.	Name	Description
06 | 00 | 00070 (100663366)	Invalid record table parameter	A record table parameter is invalid
06 | 00 | 00083 (100663379)	Record table incorrect	Record table incorrect

Tab. 452: Diagnostic messages

4.5.4 CiA 402

To start the record table via CiA402, the value -20 must be selected for the Modes of operation (0x6060) object. The mode is not active in the device until the selected mode is displayed in the Modes of operation display (0x6061) object.
The record number that is to be started is selected via the Next record table index (0x216F.14) object. The record number that is currently being executed is displayed in the Current record table index (0x2159.01) object.
The execution of the record table is controlled by the control word (0x6040) and the current states of the execution are displayed via the status word (0x6041).
Object 0x6040: control word
- Bit 4: start record (Start new record)
- Bit 5: apply change immediately (Change set immediately); If the bit is 1, the current record is interrupted and replaced by the new record.
- Bit 8: stop task (Halt); the bit must be 0 for the record to be executed.

Object 0x6041: status word
- Bit 10: command sequence completed (Record sequence done)
- Bit 12: confirm new command (New record acknowledge)
- Bit 13: individual record completed (Single record done)

Control objects record table

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
730	0x6040.00	Control word CiA402	UINT
731	0x6041.00	Status word CiA402	UINT
12234	0x6060.00	Modes of operation CiA402	SINT
12235	0x6061.00	Modes of operation display CiA402	SINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
730	0x216D.01	Control word CiA402	UINT
731	0x216D.02	Status word CiA402	UINT
12234	0x216D.0C	Modes of operation CiA402	SINT
12235	0x216D.0D	Modes of operation display CiA402	SINT
11280053	0x216F.14	Next record table index CiA402	DINT

Tab. 453: Objects

Objects command record table

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1130224	0x2159.0A	Activation background mode	USINT
1810	0x2230.01 ... 80	Command record type	UDINT
1811	0x2231.01 ... 80	Record number	DINT
1812	0x2232.01 ... 80	Record table field 1	LINT
1813	0x2233.01 ... 80	Record table field 2	LINT
1814	0x2234.01 ... 80	Record table field 3	LINT
1815	0x2235.01 ... 80	Record table field 4	LINT
1816	0x2236.01 ... 80	Record table field 5	LINT
1817	0x2237.01 ... 80	Record table field 6	LINT
1818	0x2238.01 ... 80	Record table field 7	LINT
1837	0x2159.01	Actual record table index	DINT
1838	0x223F.01 ... 80	Selection start condition record	UDINT
1846	0x2159.04	Status of record table	UDINT

Tab. 454: Objects

Objects command record sequence

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1831	0x2239.01 ... 80	Record step enabling type	UDINT
1832	0x223A.01 ... 80	Record sequencing record number start	DINT
1833	0x223B.01 ... 80	Record sequencing record number target	DINT
1834	0x223C.01 ... 80	Record sequencing field time	REAL
1835	0x223D.01 ... 80	Record sequencing field 1	LINT
1836	0x223E.01 ... 80	Record sequencing field 2	LINT
526778	0x2245.01 ... 80	Record sequencing field 3	LINT
526790	0x224B.01 ... 80	Record sequencing field 4	LINT
526791	0x224C.01 ... 80	Record sequencing field 5	LINT
526792	0x224D.01 ... 80	Record sequencing field 6	LINT
526793	0x224E.01 ... 80	Record sequencing field 7	LINT
1837	0x2159.01	Actual record table index	DINT

Tab. 455: Objects

Objects command record event table

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1840	0x2159.03	Activate Event table	USINT
1841	0x2240.01 ... 10	Event type	UDINT
1842	0x2241.01 ... 10	Next event target	DINT
1843	0x2242.01 ... 10	Next event field time	REAL
1844	0x2243.01 ... 10	Next event field 1	LINT
1845	0x2244.01 ... 10	Next event field 2	LINT

Tab. 456: Objects

4.5.5 PROFIdrive

Information on record selection and example of record execution ➔ 12.4.8.15 Record Selection (SATZANW).

PNUs of command record table

Parameter	PNU	Name	Data type
Px.	Manufacturer-specific parameters		
1130224	12182.0	Activation background mode	BOOL
1810	11380.0 ... 127	Command record type	UDINT
1811	11381.0 ... 127	Record number	DINT
1812	11382.0 ... 127	Record table field 1	LINT
1813	11383.0 ... 127	Record table field 2	LINT
1814	11384.0 ... 127	Record table field 3	LINT
1815	11385.0 ... 127	Record table field 4	LINT
1816	11386.0 ... 127	Record table field 5	LINT
1817	11387.0 ... 127	Record table field 6	LINT
1818	11388.0 ... 127	Record table field 7	LINT
1838	11396.0 ... 127	Selection start condition record	UDINT
1846	11404.0	Status of record table	UDINT

Tab. 457: PNUs

PNUs of command record sequence

Parameter	PNU	Name	Data type
Px.	Manufacturer-specific parameters		
1831	11389.0 ... 127	Record step enabling type	UDINT
1832	11390.0 ... 127	Record sequencing record number start	DINT
1833	11391.0 ... 127	Record sequencing record number target	DINT
1834	11392.0 ... 127	Record sequencing field time	REAL
1835	11393.0 ... 127	Record sequencing field 1	LINT
1836	11394.0 ... 127	Record sequencing field 2	LINT
526778	12153.0 ... 127	Record sequencing field 3	LINT
526790	12161.0 ... 127	Record sequencing field 4	LINT
526791	12162.0 ... 127	Record sequencing field 5	LINT
526792	12163.0 ... 127	Record sequencing field 6	LINT
526793	12164.0 ... 127	Record sequencing field 7	LINT
1837	11395.0	Actual record table index	DINT

Tab. 458: PNUs

PNUs of command record event table

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1840	11398.0	Activate Event table	BOOL
1841	11399.0 ... 15	Event type	UDINT
1842	11400.0 ... 15	Next event target	DINT
1843	11401.0 ... 15	Next event field time	REAL
1844	11402.0 ... 15	Next event field 1	LINT
1845	11403.0 ... 15	Next event field 2	LINT

Tab. 459: PNUs

4.6 Jog mode

4.6.1 Function

The drive can move to any position in jog mode. The drive is moved during jogging until the command for jogging is pending. If a command is not pending, a stop is initiated.
The following commands are available:
– Jogging 1 (positive direction)
– Jogging 2 (negative direction)
Jogging for unreferenced drives is restricted by hardware limit switches or stops.
The motion limits for jogging with referenced drives monitored by the software end positions. If the drive is in an invalid positioning range (outside the software limit switches), it may only move in the direction of the valid positioning range. In this state, jogging commands in the direction of the invalid positioning range are ignored.
If jogging the drive moves it further in the blocked direction, the set message is generated depending on the software end position monitoring function. This is also applicable for the hardware limit switch monitoring function, for both referenced and unreferenced drives.

Tasks

Jogging mode supports the following tasks:
– Approaching teach positions (e. g. in commissioning)
– Drive free running (e.g. after a system malfunction)
– Manual positioning as standard operating mode

Feedback

Standstill monitoring STV.

Phases

Different jogging variants are possible depending on the device profile and parameterisation:
– One phase (slow only or fast only)
– 2 phases (slow first then fast)
– Symmetrical dynamic value record, same dynamic values for jogging 1 (positive direction) and jogging 2 (negative direction)
– Asymmetrical dynamic value record, different dynamic values for jogging 1 (positive direction) and jogging 2 (negative direction)
– Incremental (relative positioning at specific distance – for PROFIdrive AC3 only)
Jogging in the plug-in supports jogging in 2 phases and with symmetrical or asymmetrical dynamic value records. Incremental jogging is not supported here.

Timing

The jogging motion consists of the following motion phases for jogging in 2 phases:
– Phase 1: motion at a slower velocity for precise positioning motions. (dynamic parameter record "slow")
– Phase 2: motion at a faster velocity for fast traversing through longer distances. (dynamic parameter record "fast")
– Phase 3: motion is stopped.

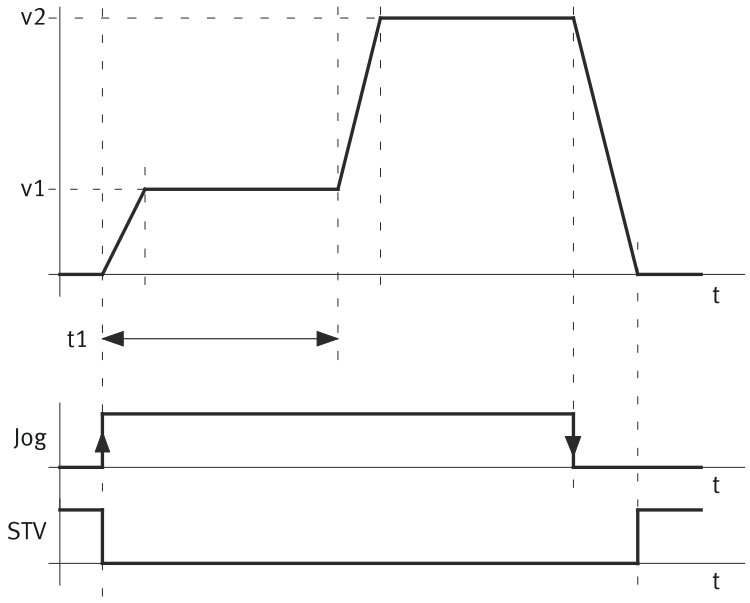


Fig. 72: Jog mode timing graph (example)

Name	Description	ID Px.
Jog	Command for jogging (positive example)	–
STV	Standstill monitoring signal	–
v1	Slow jog 1 velocity	1511
	Slow jog 2 velocity	214535
v2	Fast jog 1 velocity	1514
	Fast jog 2 velocity	214540
t1	Jog duration 1 movement	1510
	Jog duration 2 movement	214539

Tab. 460: Legend for jog mode timing graph

Symmetrical	Command	Additional parameters
yes	Jogging 1 (+) Jogging 1 (-)	Px.1510 (Jog duration 1 movement)
no	Jogging 1 (+)	
no	Jogging 2 (-)	Px.214539 (Jog duration 2 movement)

Tab. 461: Parameters for time period t1

The mode switches between symmetrical and asymmetrical with the Px.214526.0.0 parameter:
Symmetrical (default setting): the same dynamic parameter record is used for negative and positive. The speed sign is set automatically. (phase 1: 1 slow, -1 slow; phase 2: 1 fast, -1 fast)
Asymmetrical: there is a separate dynamic parameter record for negative and positive (phase 1: 1 slow, 2 slow; phase 2: 1 fast, 2 fast)
Stopping can also be defined with the Px.102395 parameter with the acceleration value or with a parameterisable delay. Default setting: acceleration = deceleration.

Design	Px.214526.0.0 (value)[1)]	Command	Dynamic value record	
			Phase 1	Phase 2
Static slow	1	Jogging 1 (+)	1 slow	–
	1	Jogging 2 (-)	-1 slow	

Design	Px.214526.0.0 (value)[1]	Command	Dynamic value record	
			Phase 1	Phase 2
Static slow	0	Jogging 1 (+)	1 slow	–
	0	Jogging 2 (-)	2 slow	
Static fast	1	Jogging 1 (+)	1 fast	
	1	Jogging 2 (-)	-1 fast	
	0	Jogging 1 (+)	1 fast	
	0	Jogging 2 (-)	2 fast	
2-phase	1	Jogging 1 (+)	1 slow	1 fast
	1	Jogging 2 (-)	-1 slow	-1 fast
	0	Jogging 1 (+)	1 slow	1 fast
	0	Jogging 2 (-)	2 slow	2 fast

1) 0 = asymmetrical; 1 = symmetrical

Tab. 462: Overview of the supported commands

Dynamic value record	Prefix	Speed	Acceleration	Delay[1]	Jerk
		Px.	Px.	Px.	Px.
1 slow	+	1511	1512	102397	1513
-1 slow	-	1511	1512	102397	1513
2 slow	+	214535	214536	102407	214537
1 fast	+	1514	1515	102401	1516
-1 fast	-	1514	1515	102401	1516
2 fast	+	214540	214541	102413	214542

1) Px.102395 = false

Tab. 463: Overview of dynamic parameters

Parameters and diagnostic messages

ID Px.	Parameter	Description	
1510	Jog duration 1 movement	Duration of phase 1 from detection of the command to jogging to switchover to phase 2. After elapse of the period the drive accelerates in phase 2 to the velocity for faster movement.	
		Access	read/write
		Update	effective immediately
		Unit	s
1511	Slow jog 1 velocity	Maximum velocity during phase 1.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1512	Slow jog 1 acceleration	Acceleration (and deceleration) during phase 1 if parameter Px.102395 is set.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1513	Slow jog 1 jerk	Jerk during phase 1.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1514	Fast jog 1 velocity	Maximum velocity during phase 2.	
		Access	read/write
		Update	effective immediately

ID Px.	Parameter	Description	
1514	Fast jog 1 velocity	Unit	user defined
1515	Fast jog 1 acceleration	Acceleration (and deceleration) during phase 2 if parameter Px.102395 is set.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1516	Fast jog 1 jerk	Jerk during phase 2.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
214526	Activation of symmetrical jog	If activation is set, this means that the dynamic values for jog 1 are used for the two jog motions (positive/negative direction). If activation is not set, the dynamic values for jog 1 or jog 2 will be used for every jog motion.	
		Access	read/write
		Update	effective immediately
		Unit	–
214535	Slow jog 2 velocity	Maximum velocity during phase 1.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
214536	Slow jog 2 acceleration	Acceleration (and deceleration) during phase 1 if parameter Px.102395 is set.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
214537	Slow jog 2 jerk	Jerk during phase 1.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
214539	Jog duration 2 movement	Duration of phase 1 from detection of the command to jogging to switchover to phase 2. After elapse of the period the drive accelerates in phase 2 to the velocity for faster movement.	
		Access	read/write
		Update	effective immediately
		Unit	s
214540	Fast jog 2 velocity	Maximum velocity during phase 2.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
214541	Fast jog 2 acceleration	Acceleration (and deceleration) during phase 2 if parameter Px.102395 is set.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
214542	Fast jog 2 jerk	Jerk during phase 2.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

ID Px.	Parameter	Description	
526917	Jogging state	Reports the status of the drive in jog mode. Value list: – 0: Jogging 1 with 2 movement phases – 1: Jogging 2 with 2 movement phases – 2: Stop jogging – 3: Jogging 1 fast – 4: Jogging 2 fast – 5: Jogging 1 slow – 6: Jogging 2 slow – 7: Incremental jog 1 – 8: Incremental jog 2 – 9: Velocity halt jog 1 – 10: Velocity halt jog 2 – 11: Velocity jog 1 – 12: Velocity jog 2	
		Access	read/–
		Update	effective immediately
		Unit	–
102395	Activation symmetrical acceleration/deceleration	Activates symmetrical acceleration and deceleration.	
		Access	read/write
		Update	effective immediately
		Unit	–
102397	Deceleration Jog 1 slow	Maximum deceleration during phase 1	
		Access	read/write
		Update	effective immediately
		Unit	user defined
102399	Actual used deceleration Jog 1 slow	Specifies the maximum deceleration actually used during phase 1.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
102401	Deceleration Jog 1 fast	Maximum deceleration during phase 1	
		Access	read/write
		Update	effective immediately
		Unit	user defined
102405	Actual used deceleration Jog 1 fast	Specifies the maximum deceleration actually used during phase 1.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
102407	Deceleration Jog 2 slow	Maximum deceleration during phase 2	
		Access	read/write
		Update	effective immediately
		Unit	user defined
102409	Actual used deceleration Jog 2 slow	Specifies the maximum deceleration actually used during phase 2.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
102413	Deceleration Jog 2 fast	Maximum deceleration during phase 2	
		Access	read/write
		Update	effective immediately
		Unit	user defined

ID Px.	Parameter	Description	
102415	Actual used deceleration Jog 2 fast	Specifies the maximum deceleration actually used during phase 2.	
		Access	read/–
		Update	effective immediately
		Unit	user defined

Tab. 464: Parameters

Diagnostic messages No specific diagnostic messages are allocated to the function.

4.6.2 CiA 402

Jog operation objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1510	0x2186.01	Jog duration 1 movement	REAL
1511	0x2186.02	Slow jog 1 velocity	REAL
1512	0x2186.03	Slow jog 1 acceleration	REAL
1513	0x2186.04	Slow jog 1 jerk	REAL
1514	0x2186.05	Fast jog 1 velocity	REAL
1515	0x2186.06	Fast jog 1 acceleration	REAL
1516	0x2186.07	Fast jog 1 jerk	REAL
526917	0x2186.08	Jogging state	UDINT
214526	0x2186.09	Activation of symmetrical jog	USINT
214535	0x2186.12	Slow jog 2 velocity	REAL
214536	0x2186.13	Slow jog 2 acceleration	REAL
214537	0x2186.14	Slow jog 2 jerk	REAL
214539	0x2186.16	Jog duration 2 movement	REAL
214540	0x2186.17	Fast jog 2 velocity	REAL
214541	0x2186.18	Fast jog 2 acceleration	REAL
214542	0x2186.19	Fast jog 2 jerk	REAL
102395	0x2186.28	Activation symmetrical acceleration/deceleration	USINT
102397	0x2186.29	Deceleration Jog 1 slow	REAL
102399	0x2186.2A	Actual used deceleration Jog 1 slow	REAL
102401	0x2186.2B	Deceleration Jog 1 fast	REAL
102405	0x2186.2C	Actual used deceleration Jog 1 fast	REAL
102407	0x2186.2D	Deceleration Jog 2 slow	REAL
102409	0x2186.2E	Actual used deceleration Jog 2 slow	REAL
102413	0x2186.2F	Deceleration Jog 2 fast	REAL
102415	0x2186.30	Actual used deceleration Jog 2 fast	REAL

Tab. 465: Objects

Control and monitoring Basic functions for jogging ➔ 4.6.1 Function.

Requirements
- Controller enable active (status Operation enabled)
- Jog mode is activated: object 0x6060 Modes of operation CiA402 = –3.
  Feedback: object 0x6061 Modes of operation display CiA402 = –3.

Control The 0x6040 Control word CiA402 object has the following specific bits in jog mode:

Bit	Name	Description
4	Jog positive	Jogging 1 (positive direction)
5	Jog negative	Jogging 2 (negative direction)
11	Jog with velocity 1	Optional: if the bit is set, jogging is with the dynamic values for slow motion.
12	Jog with velocity 2	Optional: if the bit is set, jogging is with the dynamic values for fast motion.

Tab. 466: Specific bits for jogging in the control word

If bits 4 and 5 are bot set, the drive does not move. If the other bit is also set during an active jog motion, the drive stops.
Bits 11 and 12 also control the slow and fast velocity for jogging with a motion phase. If both bits are not set, movement is first slow then fast (jogging with 2 motion phases). If both bits are set, there is no motion.
The following dynamic values are applied depending on the Px.214526.0.0 parameter:

Bit 11 / 12	Px.214526.0.0 (value)[1]	Command	Dynamic value record		Additional parameters
			Phase 1	Phase 2	
0 / 0	1	Jog positive	1 slow	1 fast	1510, Jog duration 1 movement
0 / 0	1	Jog negative	-1 slow	-1 fast	
0 / 0	0	Jog positive	1 slow	1 fast	
0 / 0	0	Jog negative	2 slow	2 fast	214539 Jog duration 2 movement
1 / 0	1	Jog positive	1 slow	–	–
1 / 0	1	Jog negative	-1 slow		
1 / 0	0	Jog positive	1 slow		
1 / 0	0	Jog negative	2 slow		
0 / 1	1	Jog positive	1 fast		
0 / 1	1	Jog negative	-1 fast		
0 / 1	0	Jog positive	1 fast		
0 / 1	0	Jog negative	2 fast		

1) 0 = asymmetrical; 1 = symmetrical

Tab. 467: Overview of the supported parameter combinations

Monitoring

The 0x6041 Status word CiA402 object has the following specific bits in jog mode:

Bit	Name	Description
10	STV	Jogging not active (before or after the motion)
12	Velocity 1 jog	Motion with the dynamic values for slow motion
13	Velocity 2 jog	Motion with the dynamic values for fast motion

Tab. 468: Specific bits for jogging in the status word

4.6.3 PROFIdrive

The jogging function has the following special features from PROFIdrive:
- Jogging in 2 phases can be activated via the parameter Px.100010.
- Jogging of a parameterized distance (can be switched with POS_STW2.5 incremental jogging; applicable only for AC3 with additional parameters).
- If STW1.8 and STW1.9 are both set, the drive does not move. If the other bit is also set during an active jog motion, the drive stops.

Additional parameters and diagnostic messages

PNUs of jog mode

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1511	11352.0	Slow jog 1 velocity	REAL
1512	11353.0	Slow jog 1 acceleration	REAL
1513	11354.0	Slow jog 1 jerk	REAL
100010	12679.0	Activation jog 2 phases	BOOL
214526	12126.0	Activation of symmetrical jog	BOOL
214530	12127.0	Relative position jog 1	LINT
214535	12128.0	Slow jog 2 velocity	REAL
214536	12129.0	Slow jog 2 acceleration	REAL
214537	12130.0	Slow jog 2 jerk	REAL
214538	12131.0	Relative position jog 2.	LINT

Tab. 469: PNUs

Starting from the value of the Px.214526.0.0 parameters, the following values are used depending on the application class.

Value of Px.214526.0.0[1]	Commands	Dynamic value record	Additional parameters
1	STW1.8 Jogging 1	1 slow	–
1	STW1.9 Jogging 2	-1 slow	
0	STW1.8 Jogging 1	1 slow	
0	STW1.9 Jogging 2	2 slow	

1) 0 = asymmetrical; 1 = symmetrical

Tab. 470: Overview of the supported commands for application class AC1

POS_STW2.5 (value)[1]	Px.214526.0.0 (value)[2]	Commands	Dynamic value record	Additional parameters
0	1	STW1.8 Jogging 1	1 slow	–
0	1	STW1.9 Jogging 2	-1 slow	
0	0	STW1.8 Jogging 1	1 slow	
0	0	STW1.9 Jogging 2	2 slow	
1	1	STW1.8 Jogging 1	1 slow	Px.214530.0.0 Relative position jog 1
1	1	STW1.9 Jogging 2	-1 slow	
1	0	STW1.8 Jogging 1	1 slow	
1	0	STW1.9 Jogging 2	2 slow	Px.214538.0.0 Relative position jog 2.

1) 0 = jogging velocity; 1 = incremental jogging
2) 0 = asymmetrical; 1 = symmetrical

Tab. 471: Overview of the supported commands for application class AC3

Control and monitoring

Jog operation is controlled by the following 3 bits of the control word 1 or control word 2.

Px.	Name	Description	PNU
1147080	12237.0	STW1.8 Jogging 1	BOOL
1147090	12238.0	STW1.9 Jogging 2	BOOL
112412100	12360.0	POS_ZSW1.10 Jogging active	BOOL

Px.	Name	Description	PNU
112414050	12384.0	POS_STW2.5 Jogging incremental active	BOOL
102395	13077.0	Activation symmetrical acceleration/deceleration	BOOL
102397	13078.0	Deceleration Jog 1 slow	REAL
102399	13079.0	Actual used deceleration Jog 1 slow	REAL
102401	13080.0	Deceleration Jog 1 fast	REAL
102405	13081.0	Actual used deceleration Jog 1 fast	REAL
102407	13082.0	Deceleration Jog 2 slow	REAL
102409	13083.0	Actual used deceleration Jog 2 slow	REAL
102413	13084.0	Deceleration Jog 2 fast	REAL
102415	13085.0	Actual used deceleration Jog 2 fast	REAL

Tab. 472: Control and status words

If one of the bits STW1.8 and STW1.9 is set and the other bit is also set, the ramp is frozen to the current speed. If the bits STW1.8 and STW1.9 are set simultaneously, jog operation is not executed.
Two independent parameter sets are valid for jogging operation. The direction of the two motions is defined exclusively by the sign of the velocities (velocity 1 and velocity 2).

Prerequisites

Requirements in the application class AC1: the drive is in the S61 RFG inactive status ➔ Fig. 135.
Requirements in the application class AC3: the drive is in the S41 Basic State Positioning Mode or S453 Intermediate Stop status ➔ Fig. 136

4.7 Directional lock

4.7.1 Function

The directional lock function blocks the movement of the drive in one or both directions.

Automatic activation of the directional lock

The directional lock is activated automatically in the following cases:

Directional lock trigger	Description
The actual position value has reached or exceeded the parameterised software end position.	Movement in the corresponding direction is automatically blocked. The closed-loop controller only allows movements in the opposite direction. The directional lock remains active after automatic activation until the cause of the directional lock is cleared or the drive has moved in the opposite direction.
A hardware limit switch has been triggered.	

Tab. 473: Directional lock

If a directional lock is requested during an error response (stop ramp), for example to monitor the software limit position, it is only activated once the stop ramp has been terminated.

Manual activation of the directional lock

The directional lock can be manually activated for one or both directions with the Px.10351 parameter.
Deactivation with the Px.10351 parameter is only possible if the directional lock was manually activated with the Px.10351 parameter.

Parameters and diagnostic Messages

ID Px.	Parameter	Description	
10351	Request directional lock	A directional lock can be triggered via this parameter. Value list: – Directional lock inactive (0) – Negative directional lock active (–1) – Positive directional lock active (1) – Negative/positive directional lock active (–11)	
		Access	read/write
		Update	effective immediately
		Unit	–
10352	Active directional lock	Display whether a directional lock has been requested by parameter Px.10351 or the motion monitoring function (software limit position or hardware limit switch reached).	
		Access	read/–
		Update	effective immediately
		Unit	–
10353	Status directional lock	Display whether the directional lock requested in Px.10352 is active. The values of parameters Px.10352 and Px.10353 are almost always identical. Exception: If, for example, an error stop ramp is completed in the blocked area, Px.10352 displays the request for a directional lock. Only once the stop ramp has been completed and the drive is at a standstill will Px.10353 indicate that the directional lock is active.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 474: Parameter

ID Dx.	Name	Description
05 | 02 | 00080 (84017232)	Simultaneous negative/positive directional lock	Simultaneous negative/positive directional lock

Tab. 475: Diagnostic messages

4.7.2 CiA 402

Directional lock objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
10351	0x218F.01	Request directional lock	DINT
10352	0x218F.02	Active directional lock	DINT
10353	0x218F.03	Status directional lock	DINT

Tab. 476: Objects

4.7.3 PROFIdrive

Directional lock PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
10351	11807.0	Request directional lock	DINT
10352	11808.0	Active directional lock	DINT
10353	11809.0	Status directional lock	DINT

Tab. 477: PNUs

5 Motion monitoring

5.1 Motion monitoring functions

The motion monitoring functions monitor the drive system and protect the drive components from damage. Every motion monitoring function reads out values from the servo drive and compares them to the expected behaviour (e.g. threshold variable).
The actual values from the actual value management, the setpoint values (pick-up between pilot control and directional lock), as well as the target values and configuration of the actual command are imported to monitor the motion.
All of the motion monitoring functions are executed in parallel during this process. Which functions will trigger an error response depends on the operating mode.

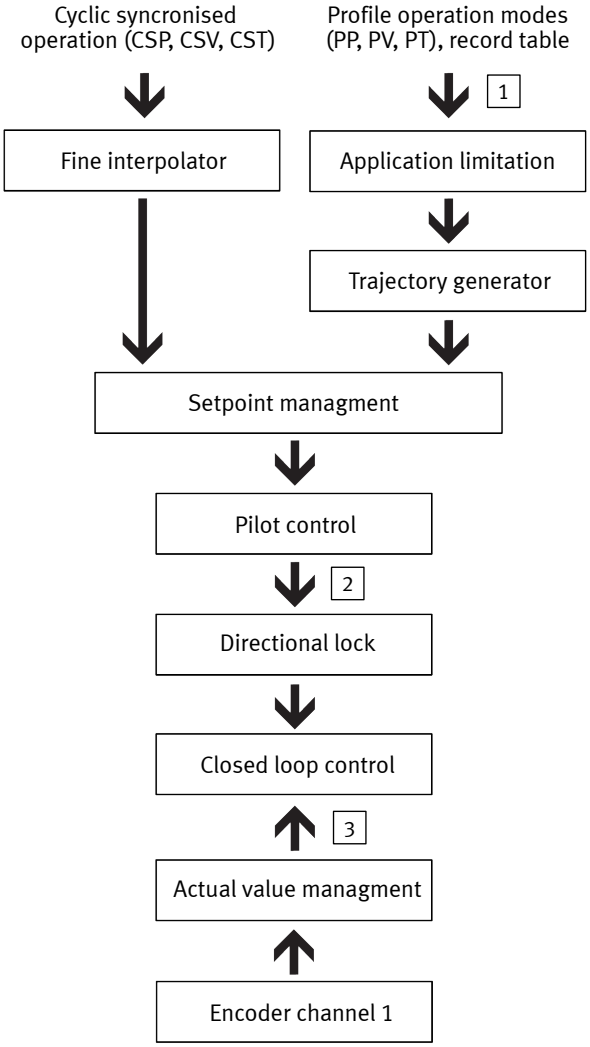


Fig. 73: Determining the target, setpoint and actual values

Name	Description
[1] Target value	Parameterised setpoint value of the trajectory during profile operation
[2] Setpoint variable	Setpoint values that change with time The pick-off of the setpoint values is determined between the pilot control and directional lock.
[3] Actual variable	Actual values that change with time The actual values are determined by actual value management.

Tab. 478: Legend for determining the target, setpoint and actual values diagram

The monitoring result is output as follows:
– as status signal
– as directional lock when software and hardware end positions are exceeded
– as diagnostic message with parameterisable error response (in the event of an error)

Diagnostic messages can be disabled if necessary.

Overview

Code	Motion monitoring function		Detailed information
TR	Target Window Reached		➔ 5.2 Target Window Reached
TRX		Position	
TRV		Speed	
TRT		Torque	
FE	Following error		➔ 5.3 Following error
FEX		Position	
FEV		Speed	
FEA		Acceleration	
TM	Target area monitoring		➔ 5.4 Target area monitoring
TMX		Position	
TMV		Speed	
TMT		Torque	
HL	Hardware limit switch reached		➔ 5.5 Hardware limit switch reached
HLP		positive	
HLN		negative	
SL	Software end position reached		➔ 5.6 Software end position reached
SLP		positive	
SLN		negative	
ST	Standstill monitoring		➔ 5.7 Standstill monitoring
STX		Position/speed	
STV		Speed	
LS	Stop reached		➔ 5.8 Stop reached
STL	Stroke limit reached		➔ 5.9 Stroke limit reached
STLP		positive	
STLN		negative	
VM	Speed monitoring		➔ 5.10 Speed monitoring (spinning protection)
PB	Reverse feed monitoring		➔ 5.11 Pushback monitoring
RDX	Remaining distance monitoring		➔ 5.12 Remaining distance monitoring
MC	Trajectory completed		➔ 5.13 Trajectory completed
REFS	Reference switch activated		➔ 5.14.1 Reference switch activated
TUR	Torque utilisation exceeded		Status display
FSPR	Fixed stop reached		
ACC	Drive accelerated		
DEC	Drive decelerated		

Tab. 479: Overview of motion monitoring functions

Status word (Px.460)

The status of every motion monitoring function is provided in a status word within a bit, e.g. to continue commands based on the "Target reached" signal.
If a bit is set (1), the result for the associated motion monitoring function is "true".

The status word can be displayed via the Px.460 parameter.

Status word bit assignment[1]		
Bit	Code	Name
0	TRX	Target window reaches position
1	TRV	Target window reaches speed
2	TRT	Target window reaches torque
3	FEX	Position following error
4	FEV	Speed following error
5	–	Reserved
6	TMX	Position target area monitoring
7	TMV	Speed target area monitoring
8	TMT	Torque target area monitoring
9	–	Reserved
10	FEA	Acceleration following error
11	–	Reserved
12	HLP	Hardware limit switch reached positive
13	HLN	Hardware limit switch reached negative
14	SLP	Software end position reached positive
15	SLN	Software end position reached negative
16	STX	Standstill monitoring position/speed
17	STV	Standstill monitoring speed
18	LS	Stop reached
19	STLP	Stroke limit reached positive
20	STLN	Stroke limit reached negative
21	VM	Speed monitoring
22	PB	Reverse feed monitoring
23	RDX	Remaining distance monitoring
24	MC	Trajectory completed
25	REFS	Reference switch activated
26	TUR	Torque utilisation exceeded
27	FSPR	Fixed stop reached
28	ACC	Drive accelerated
29	DEC	Drive decelerated
30 … 31	–	Reserved

1) Assignment identical to configuration word

Tab. 480: Bit allocation status word

Configuration word (Px.461)

Diagnostic messages (e.g. following error) that are not required in certain operating situations can be disabled via the configuration word. The configuration word is a bitmask. If the bit for the associated motion monitoring function is set (1), the associated motion monitoring function may issue a diagnostic message and activate limits (e.g. directional lock). Without a diagnostic message, the bit is of no significance to the motion monitoring functions. The configuration word is defined by the Motion Sequence Control (MSC) component as a function of the motion command and the parameterisation of the position set and is transferred as part of the command.

Configuration word bit assignment[1]		
Bit	Code	Name
0	TRX	Target window reaches position
1	TRV	Target window reaches speed
2	TRT	Target window reaches torque
3	FEX	Position following error
4	FEV	Speed following error
5	–	Reserved
6	TMX	Position target area monitoring
7	TMV	Speed target area monitoring
8	TMT	Torque target area monitoring
9	–	Reserved
10	FEA	Acceleration following error
11	–	Reserved
12	HLP	Hardware limit switch reached positive
13	HLN	Hardware limit switch reached negative
14	SLP	Software end position reached positive
15	SLN	Software end position reached negative
16	STX	Standstill monitoring position/speed
17	STV	Standstill monitoring speed
18	LS	Stop reached
19	STLP	Stroke limit reached positive
20	STLN	Stroke limit reached negative
21	VM	Speed monitoring
22	PB	Reverse feed monitoring
23	RDX	Remaining distance monitoring
24	MC	Trajectory completed
25	REFS	Reference switch activated
26	TUR	Torque utilisation exceeded
27	FSPR	Fixed stop reached
28	ACC	Drive accelerated
29	DEC	Drive decelerated
30 … 31	–	reserved

1) Assignment identical to status word

Tab. 481: Configuration word bit assignment

Message types

Message type	**Description**
Status messages	Signal relating to an event or state to advance the internal state machine.
Diagnostic messages	Message relating to a malfunction or error, in part with parameterisable error responses. – Ignore – Info – Warning – Stop category 0 – Stop category 1 – Stop category 2

Tab. 482: Message types

Parameters

ID Px.	Parameter	Description	
460	Movement monitoring status	Status of movement monitoring	
		Access	read/–
		Update	effective immediately
		Unit	–
461	Configuration word movement monitoring	Configuration word for the movement monitoring	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 483: Parameters

5.1.1 CiA 402

Objects for status word and configuration word

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
460	0x2166.01	Movement monitoring status	UDINT
461	0x2166.02	Configuration word movement monitoring	UDINT

Tab. 484: Objects

5.1.2 PROFIdrive

PNUs for status word and configuration word

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
460	11144.0	Movement monitoring status	UDINT
461	11145.0	Configuration word movement monitoring	UDINT

Tab. 485: PNUs

5.2 Target Window Reached

Target reached TRx

The function indicates whether the target value has been reached following the start of a command. Various target values are monitored simultaneously with a comparator during this process depending on the operating mode. Each comparator is defined by a monitoring window and the damping time.
The cushioning time is set with the same parameter in all operating modes.

Timing

Status signal	TR...
Initial state of TRX, TRV, TRT signals	= 1
The signal is set under the following conditions: – The difference (current actual value - target value) is within the monitoring window – AND this condition is fulfilled for at least the specified damping time. The signal remains set until a new command is started. For positioning commands with a final velocity that is not equal to 0, the signal is set if the target position is reached and the final velocity remains in the monitoring window for the duration of the damping time.	0→ 1
The signal is reset under the following conditions: – A command is started. If the command has already been executed and it is restarted, all of the corresponding signals are reset and then set again for at least one cycle of the servo drive (typically 1 ms).	1→0

Tab. 486: Status signals - target window reached (depending on the operating mode)

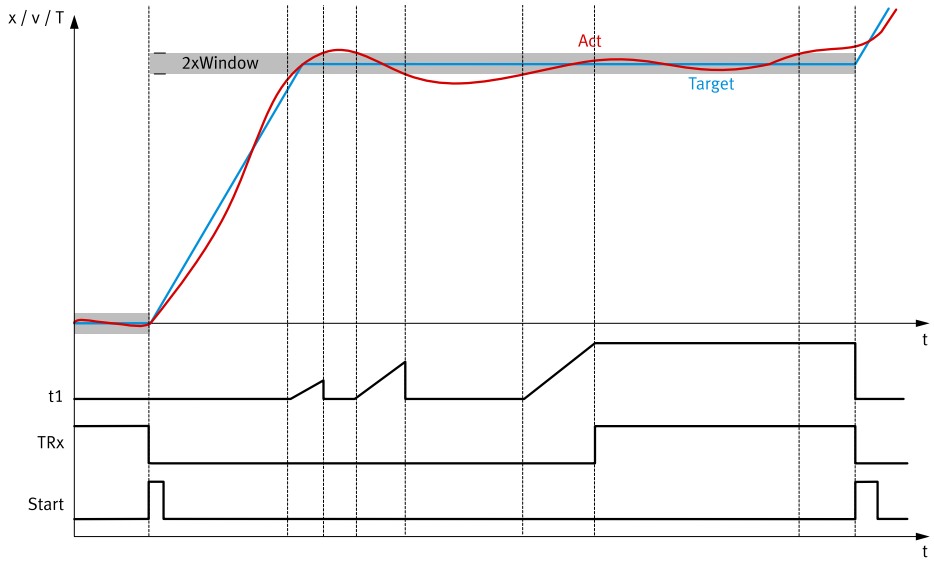


Fig. 74: Timing diagram: target window reached (example)

Name	Description
x/v/T	Position, speed and torque motion quantities
t1	Cushioning time
TRx	Diagnostic message
Start	Start motion command
Window	Monitoring window
Act	Actual variable
Target	Target value

Tab. 487: Legend for timing diagram for target window reached

Parameters and diagnostic messages

ID Px.	Parameter	Description	
468	Damping time target reached	Specifies the damping time for the target position, velocity and torque. The signal is set if the actual value for the specified duration is in the monitoring window. The signal remains set if the actual value moves outside the monitoring window during the specified duration. The damping time is re-evaluated when the value returns to the window.	
		Access	read/write
		Update	effective immediately
		Unit	s
469	Monitoring window target position	Specifies the monitoring window for the target position. The monitoring window is set symmetrically to the target value (window width = 2x parameter).	
		Access	read/write
		Update	effective immediately
		Unit	user defined
4610	Monitoring window target velocity	Specifies the monitoring window for the target velocity. The monitoring window is set symmetrically to the target value (window width = 2x parameter).	
		Access	read/write
		Update	effective immediately
		Unit	user defined
4611	Monitoring window target torque	Specifies the monitoring window for the target torque. The monitoring window is set symmetrically to the target value (window width = 2x parameter).	
		Access	read/write

ID Px.	Parameter	Description	
4611	Monitoring window target torque	Update	effective immediately
		Unit	Nm

Tab. 488: Parameters - target window reached

ID Dx.	Name	Description
07 | 02 | 00121 (117571705)	Target position reached	Target position reached
07 | 02 | 00122 (117571706)	Target velocity reached	Target velocity reached
07 | 02 | 00123 (117571707)	Target torque reached	Target torque reached

Tab. 489: Diagnostic messages - target window reached

5.2.1 CiA 402

Objects - Target Window Reached

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
468	0x6068.00	Damping time target reached	UINT
469	0x6067.00	Monitoring window target position	UDINT
4610	0x606D.00	Monitoring window target velocity	UINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
468	0x2166.09	Damping time target reached	REAL
469	0x2166.0A	Monitoring window target position	REAL
4610	0x2166.0B	Monitoring window target velocity	REAL
4611	0x2166.0C	Monitoring window target torque	REAL

Tab. 490: Objects

5.2.2 PROFIdrive

PNUs of Target Window Reached

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
468	11152.0	Damping time target reached	REAL
469	11153.0	Monitoring window target position	REAL
4610	11565.0	Monitoring window target velocity	REAL
4611	11566.0	Monitoring window target torque	REAL

Tab. 491: PNUs

5.3 Following error

Following error FEx

The difference between the setpoint value and actual value is monitored by the following error monitor. The position and speed are monitored simultaneously with a comparator during this process. The comparator is defined by a monitoring window and a cushioning time. Following error monitoring is active as long as the target has not been reached (target reached = FALSE). Target area monitoring is then active ➔ 5.4 Target area monitoring

Parameters and diagnostic messages

ID Px.	Parameter	Description	
462	Damping time position: following error	Specifies the damping time for the position following error. The signal is set if the position difference for the specified duration is outside the monitoring window. If the position difference is within the monitoring window, the required damping time re-starts when the difference is outside the window again.	
		Access	read/write
		Update	effective immediately
		Unit	s
463	Monitoring window position: following error	Specifies the monitoring window for the position following error. The monitoring window is set symmetrically to the setpoint value pattern (window width = 2x parameter).	
		Access	read/write
		Update	effective immediately
		Unit	user defined
464	Monitoring window velocity: following error	Specifies the monitoring window for the velocity following error. The monitoring window is set symmetrically to the setpoint value pattern (window width = 2x parameter).	
		Access	read/write
		Update	effective immediately
		Unit	user defined
4682	Actual position: following error	Specifies the actual position following error.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
4683	Actual velocity: following error	Specifies the actual velocity following error.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
4690	Damping time velocity: following error	Specifies the damping time for the velocity following error. The signal is set if the velocity difference for the specified duration is outside the monitoring window. If the velocity difference is within the monitoring window, the required damping time re-starts when the difference is outside the window again.	
		Access	read/write
		Update	effective immediately
		Unit	s
101731	Settling time Following error Acceleration	Specifies the settling time for the tracking error monitoring. If the acceleration difference is outside the monitoring window for the specified duration, the signal is set. If the acceleration difference is within the monitoring window, the required settling time restarts when the signal exits again.	
		Access	read/write
		Update	effective immediately
		Unit	s
101735	Monitoring window Following error acceleration	Specifies the monitoring window for the acceleration difference. The monitoring window is set symmetrically to the setpoint value curve (window width = 2x parameter).	
		Access	read/write
		Update	effective immediately
		Unit	user defined
101737	Following error acceleration	Displays the current tracking error of the acceleration.	
		Access	read/–

ID Px.	Parameter	Description	
101737	Following error acceleration	Update	effective immediately
		Unit	user defined

Tab. 492: Parameters - following error

ID Dx.	Name	Description
07 | 02 | 00126 (117571710)	Position: following error	Position: following error
07 | 02 | 00127 (117571711)	Velocity: following error	Velocity: following error

Tab. 493: Diagnostic messages - following error

Timing

Status signal	FE...
Initial state of FEX, FEV signals	= 0
The signal is set under the following conditions: – The difference (current actual value - continuously determined setpoint value) is outside the window – AND this condition is fulfilled for at least the specified time.	0→1
The signal is reset under the following conditions: – The difference (current actual value - continuously determined setpoint value) is within the window – OR the target has been reached (target reached = TRUE).	1→0

Tab. 494: Status signals - following error

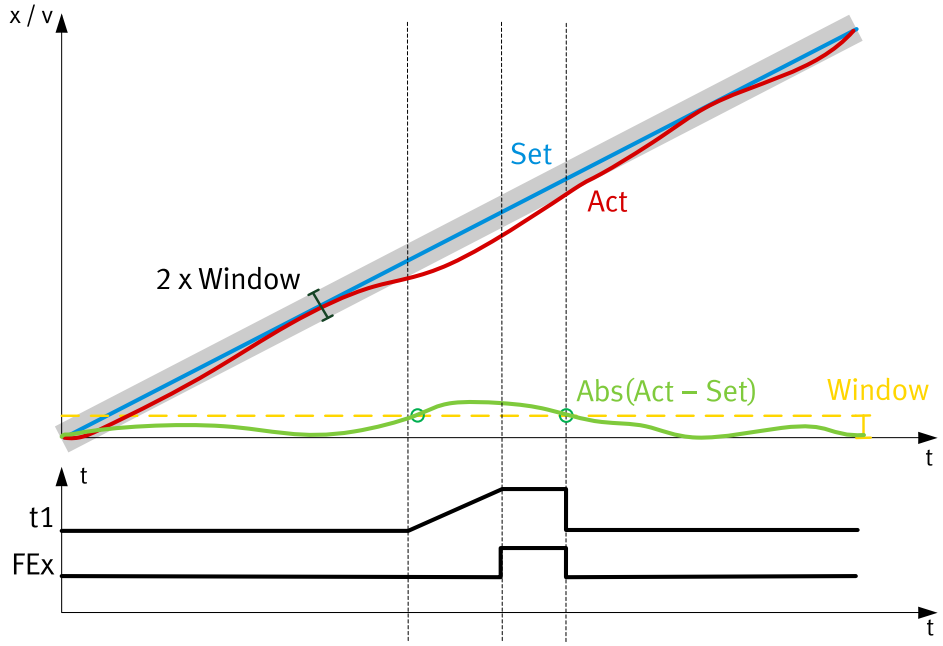


Fig. 75: Timing diagram: following error

Name	Description
x/v	Position and velocity motion variables
t1	Cushioning time
FEx	Diagnostic message
Window	Monitoring window
Act	Actual variable
Set	Setpoint variable

Tab. 495: Legend for timing diagram: following error

5.3.1 CiA 402

Objects following error

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
462	0x6066.00	Damping time position: following error	UINT
463	0x6065.00	Monitoring window position: following error	UDINT
464	0x60F8.00	Monitoring window velocity: following error	DINT
4682	0x60F4.00	Actual position: following error	DINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
462	0x2166.03	Damping time position: following error	UDINT
463	0x2166.04	Monitoring window position: following error	REAL
464	0x2166.05	Monitoring window velocity: following error	REAL
4682	0x2166.42	Actual position: following error	REAL
4683	0x2166.43	Actual velocity: following error	REAL
4690	0x2166.4A	Damping time velocity: following error	REAL
101731	0x2166.5D	Settling time Following error Acceleration	REAL
101735	0x2166.5E	Monitoring window Following error acceleration	REAL
101737	0x2166.5F	Following error acceleration	REAL

Tab. 496: Objects

5.3.2 PROFIdrive

PNUs of following error

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
462	11146.0	Damping time position: following error	REAL
463	11147.0	Monitoring window position: following error	REAL
464	11148.0	Monitoring window velocity: following error	REAL
4682	11624.0	Actual position: following error	REAL
4683	11625.0	Actual velocity: following error	REAL
4690	11632.0	Damping time velocity: following error	REAL
101731	12860.0	Settling time Following error Acceleration	REAL
101735	12862.0	Monitoring window Following error acceleration	REAL
101737	12863.0	Following error acceleration	REAL

Tab. 497: PNUs

5.4 Target area monitoring

Target monitor TMx

The function monitors the movement of the drive after reaching the target window (target reached = TRUE). Depending on the operating mode, the position, speed or torque are monitored during this process. The target area monitoring of a positioning command with a final speed is identical to the target area monitoring of a speed command.

Timing

Status signal	TM...
Initial state	= 0
The signal is reset under the following conditions: – A new command is started – OR the difference (current actual value - target value) is outside the window.	1→0
The signal is set under the following conditions: – The associated target has been reached (target reached = TRUE) – OR the difference (current actual value - target value) is within the window AND this condition is fulfilled for at least the specified time.	0→1

Tab. 498: Status signals - target area monitoring

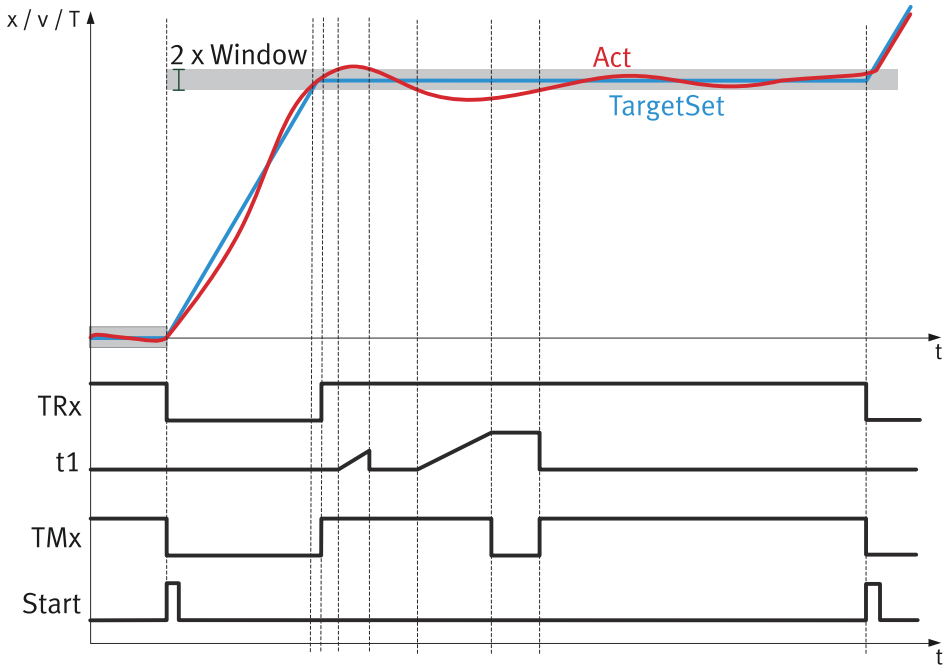


Fig. 76: Timing diagram: target area monitoring (example)

Name	Description
x/v/T	Position, speed and torque motion quantities
TRx	Target reached
t1	Cushioning time
TMx	Diagnostic message
Start	Start motion command
Window	Monitoring window
Act	Actual variable
TargetSet	Target value

Tab. 499: Legend for timing diagram target area monitoring

Parameters and diagnostic messages

ID Px.	Parameter	Description	
4665	Damping time target range	Specifies the damping time for target area monitoring (movement to a fixed stop). Minimum duration that the threshold value can be exceeded before a message is generated. The damping time is restarted if the actual value is below the threshold value or if the prefix for the specified setpoint value changes during the evaluation of the damping time.	
		Access	read/write
		Update	effective immediately
		Unit	s

ID Px.	Parameter	Description	
4666	Monitoring window target position	Specifies the monitoring window for the target position. The monitoring window is set symmetrically to the target variable (window width = 2x parameter).	
		Access	read/write
		Update	effective immediately
		Unit	user defined
4667	Monitoring window velocity	Specifies the monitoring window for the target velocity. The monitoring window is set symmetrically to the target value (window width = 2x parameter).	
		Access	read/write
		Update	effective immediately
		Unit	user defined
4668	Monitoring window torque	Specifies the monitoring window for the target torque. The monitoring window is set symmetrically to the target value (window width = 2x parameter).	
		Access	read/write
		Update	effective immediately
		Unit	Nm

Tab. 500: Parameters - target area monitoring

ID Dx.	Name	Description
07 | 02 | 00129 (117571713)	Out of target range	Drive has left the target range

Tab. 501: Diagnostic messages - target area monitoring

5.4.1 CiA 402

Objects - Target area monitoring

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
4665	0x2166.35	Damping time target range	REAL
4666	0x2166.36	Monitoring window target position	REAL
4667	0x2166.37	Monitoring window velocity	REAL
4668	0x2166.38	Monitoring window torque	REAL

Tab. 502: Objects

5.4.2 PROFIdrive

PNUs of target area monitoring

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4665	11611.0	Damping time target range	REAL
4666	11612.0	Monitoring window target position	REAL
4667	11613.0	Monitoring window velocity	REAL
4668	11614.0	Monitoring window torque	REAL

Tab. 503: PNUs

5.5 Hardware limit switch reached

HW limit switch reached HL

The positioning area is limited via a hardware limit switch for each limit position. The drive must be positioned between the limit positions when the power supply is switched on.

A digital input for the positive or negative limit switch is assigned via the commissioning software. Rewiring the digital inputs is not necessary and can be changed via the configuration.
The monitoring function includes:
– Status evaluation of the limit switches
– Configuration check
– Limit switch monitoring
– Inverting and debouncing of the digital input signals
– Detection of overrunning the limit switches
The hardware limit switch monitoring can be activated and deactivated via parameter Px.101116. If monitoring is deactivated, this also has an effect on the corresponding homing methods.

Application

– Protect the drive from damage:
  An error message is triggered, and the corresponding error response is initiated if the hardware limit switch is reached or overrun. The current direction of movement is blocked. Another command in the blocked direction will not be executed. The lock is removed, if the drive initiates the limit switch again when reaching the valid area.
– Record sequencing during record linking:
  The record sequencing function can be implemented during record linking for applications that do not need protecting against overrunning the end position. The error response is parameterised as a message for this purpose.
– Monitoring the direction of movement during reference run to a reference point.
– Use as reference point for a homing run method.

Timing

Status signal	HL...
Initial state of HLP, HLN signals	= 0
The signal is set under the following conditions: – HLP: if the switch is activated OR if the actual position is greater than the position saved when the limit switch was triggered – HLN: if the switch is activated OR if the actual position is less than the position saved when the limit switch was triggered If the HLP signal is set, the directional lock is activated in a positive direction. If the HLN signal is set, the directional lock is activated in a negative direction. A configuration error is displayed if both switches are activated.	0→1
The signal is reset under the following conditions: – HLP: if the switch is not activated AND if the actual position is less than the position saved when the limit switch was triggered – HLN: if the switch is not activated AND if the actual position is greater than the position saved when the limit switch was triggered	1→0

Tab. 504: Status signals - hardware limit switch reached

Parameters and diagnostic messages

ID Px.	Parameter	Description	
101100	Configure negative hardware limit switch	Specifies the configuration of the negative hardware limit switch: 0: deactivated, 1: normally open, 2: normally closed	
		Access	read/write
		Update	reinitialization
		Unit	–
101101	Configure positive hardware limit switch	Specifies the configuration of the positive hardware limit switch: 0: deactivated, 1: normally open, 2: normally closed	

ID Px.	Parameter	Description	
101101	Configure positive hardware limit switch	Access	read/write
		Update	reinitialization
		Unit	–
101112	Negative hardware limit switch detected	Specifies whether the negative hardware limit switch is active.	
		Access	read/–
		Update	effective immediately
		Unit	–
101113	Positive hardware limit switch detected	Specifies whether the positive hardware limit switch is active.	
		Access	read/–
		Update	effective immediately
		Unit	–
101114	Negative limit switch position detected	Specifies the position where the negative limit switch was detected.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
101115	Positive limit switch position detected	Specifies the position where the positive limit switch was detected.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
101116	Activation of hardware limit switch monitoring	Specifies whether the hardware limit switch monitoring is active or inactive.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 505: Parameters - hardware limit switch reached

ID Dx.	Name	Description
07 | 01 | 00114 (117506162)	Negative hardware limit switch reached	Negative hardware limit switch reached
07 | 01 | 00115 (117506163)	Positive hardware limit switch reached	Positive hardware limit switch reached
07 | 01 | 00116 (117506164)	Limitation by negative hardware limit switch	Limitation of direction of movement owing to negative hardware limit switch
07 | 01 | 00117 (117506165)	Limitation by positive hardware limit switch	Limitation of direction of movement owing to positive hardware limit switch
07 | 01 | 00118 (117506166)	Error: both hardware limit switches activated	Error: both hardware limit switches activated

Tab. 506: Diagnostic messages - hardware limit switch reached

5.5.1 CiA 402

Objects - hardware limit switch reached

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
101100	0x2189.01	Configure negative hardware limit switch	UDINT
101101	0x2189.02	Configure positive hardware limit switch	UDINT
101112	0x2189.0D	Negative hardware limit switch detected	USINT
101113	0x2189.0E	Positive hardware limit switch detected	USINT
101114	0x2189.0F	Negative limit switch position detected	LINT

Parameter	Index.Subindex	Name	Data type
101115	0x2189.10	Positive limit switch position detected	LINT
101116	0x2189.11	Activation of hardware limit switch monitoring	USINT

Tab. 507: Objects

5.5.2 PROFIdrive

PNUs of hardware limit switch reached

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
101100	11930.0	Configure negative hardware limit switch	UDINT
101101	11931.0	Configure positive hardware limit switch	UDINT
101112	11942.0	Negative hardware limit switch detected	BOOL
101113	11943.0	Positive hardware limit switch detected	BOOL
101114	11944.0	Negative limit switch position detected	LINT
101115	11945.0	Positive limit switch position detected	LINT
101116	11946.0	Activation of hardware limit switch monitoring	BOOL

Tab. 508: PNUs

5.6 Software end position reached

SW limit reached SL

Monitoring of the software end positions controls the traversing range of the drive.
The monitoring function includes:
- Status evaluation of the SLN/SLP software end positions
- Configuration check
- End position monitoring (optionally with automatic braking)

The end position configuration is invalid if the negative end position is greater or equal to the positive end position.
The configuration check is only completed if end position monitoring is activated (default).



The software end positions relate to the axis zero point. A valid homing must therefore be completed. The homing can also be completed if the drive is outside the end positions.

Application

- Protect the drive from damage:
  Status SLP or SLN is set when the end position is exceeded. The status is reset as soon as the drive reaches the valid range again.
- Protect the drive from damage:
  - End position monitoring without automatic braking:
    An error message is triggered if the end position is reached or exceeded. The drive is stopped depending on the set error response. The current direction of movement is blocked. Another command in the blocked direction will not be executed. The block is removed when the drive reaches the valid area again.
  - End position monitoring with automatic braking:
    Due to the current distance and speed, exceeding the end position can be prevented by braking in time in record, interpolation and jog mode. The dynamic deceleration and jerk values from the stop ramp parameters are used for the projection.

The stop ramp parameters should be higher than the values resulting from the setpoint specification. Otherwise, the positioning record is aborted before the target position is reached.
A message is triggered, and the parameterised error response is initiated, so that a standstill can be achieved before the end position, if possible. The current direction of movement is blocked. Another command in the blocked direction will not be executed. The block is removed when the drive reaches the valid area again.

Timing

Status signal	SL...
Initial state of SLN/SLP signals	= 0
The signal is set under the following conditions: – SLN: If the actual position is lower than the parameterised negative end position – SLP: If the actual position is greater than the parameterised positive end position – SLN/SLP, if automatic braking is triggered	0→1
The signal is reset under the following conditions: – SLN: If the actual position is greater than the parameterised negative end position – SLP: If the actual position is lower than the parameterised positive end position	1→0

Tab. 509: Status signals - Software end position reached

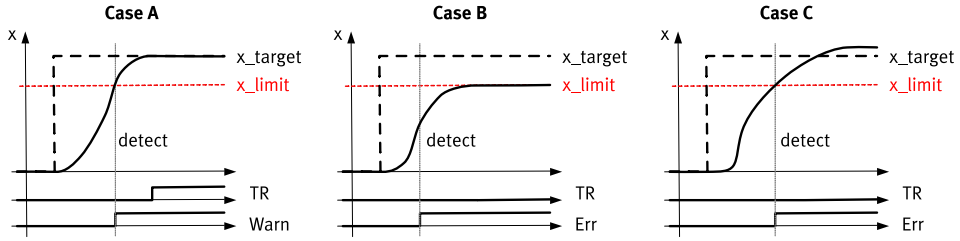


Fig. 77: Timing diagram: software end position reached

Name	Description
Case A	Target position over x_limit without error reaction
Case B	Target position over x_limit with error reaction and automatic braking to x_limit
Case C	Target position over x_limit and overruning of x_limit with error reaction, e.g. category 0 stop
x	Position motion quantity
x_target	Target position
x_limit	End position
TR	Target reached
Warn	Warning message
Err	Error message

Tab. 510: Legend for timing graph

Parameters and diagnostic messages

ID Px.	Parameter	Description	
4628	Software limit positions active	Specifies whether software limit position monitoring should be activated. 0: inactive 1: active	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
4629	Negative software limit position	Specifies the limit value of the negative software limit position. The value of the negative software limit position must be lower than the value of the positive software limit position.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
4630	Positive software limit position	Specifies the limit value of the positive software limit position. The value of the positive software limit position must be greater than the value of the negative software limit position.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
4631	Activation of automatic stop ramp software limit position	Specifies whether the automatic stop ramp should be activated before exceeding the software limit position. (Automatic) braking is initiated as part of the error response. Braking is not initiated if no error response is parameterised (warning). 0: inactive 1: active	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 511: Parameters - software end position reached

ID Dx.	Name	Description
07 | 01 | 00109 (117506157)	Negative software limit position	Negative software limit position reached
07 | 01 | 00110 (117506158)	Positive software limit position	Positive software limit position reached
07 | 01 | 00111 (117506159)	Limitation negative direction	Limitation of direction of movement owing to negative software limit position
07 | 01 | 00112 (117506160)	Limitation positive direction	Limitation of direction of movement owing to positive software limit position
07 | 01 | 00113 (117506161)	Parameterisation of software limit positions	Parameterisation of software limit positions invalid

Tab. 512: Diagnostic messages - software end position reached

5.6.1 CiA 402

Objects - software end position reached

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
4629	0x607D.01	Negative software limit position	DINT
4630	0x607D.02	Positive software limit position	DINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
4628	0x2166.1D	Software limit positions active	USINT
4629	0x2166.1E	Negative software limit position	LINT
4630	0x2166.1F	Positive software limit position	LINT
4631	0x2166.20	Activation of automatic stop ramp software limit position	USINT

Tab. 513: Objects

5.6.2 PROFIdrive

PNUs of software limit position reached

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4628	11583.0	Software limit positions active	BOOL
4629	11584.0	Negative software limit position	LINT
4630	11585.0	Positive software limit position	LINT
4631	11586.0	Activation of automatic stop ramp software limit position	BOOL

Tab. 514: PNUs

5.7 Standstill monitoring

Standstill monitor STx

The monitoring function indicates that the drive is not moving or that the drive is only moving minimally at a speed that is the lower than the parameterised threshold value. Despite a standstill message being set, the drive can still move at a threshold value that is not equal to 0. Any drifting is prevented by additional position monitors.

Timing

Status signal	ST...
Position monitoring	**STX**
Initial state STX	= 0
The signal is set under the following conditions: – STV = 1 – AND the value (standstill position - actual position) is within the positioning window. The standstill position is the sampled actual position at the time of the rising edge of STV (0→1).	0→1
The STX signal is reset under the following conditions: – STV = 0 – OR the value (standstill position - actual position) is outside the positioning window.	1→0
Speed monitoring	**STV**
Initial state STV	= 0
The STV signal is set under the following conditions: – The actual speed value falls below the threshold value – AND the value falls below the threshold value for longer than the damping time.	0→1
The STV signal is reset under the following condition: – The actual speed value exceeds the threshold value.	1→0

Tab. 515: Status signals - standstill monitoring

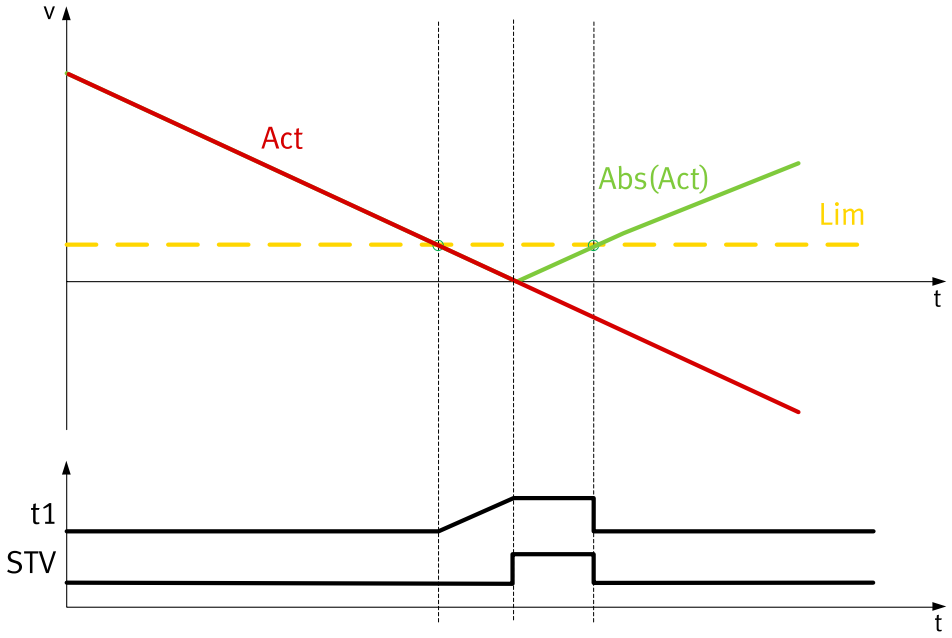


Fig. 78: Timing diagram: standstill monitoring

Name	Description
v	Speed motion quantity
t1	Cushioning time
STV	Diagnostic message
Act	Actual velocity
Lim	Threshold value

Tab. 516: Legend for timing diagram: standstill monitoring

Parameters and diagnostic messages

ID Px.	Parameter	Description	
465	Standstill damping time	Specifies the damping time of standstill monitoring. If the actual velocity value falls below the threshold value and if it exceeds the threshold during the damping time, the damping time is re-started once it falls below the threshold again.	
		Access	read/write
		Update	effective immediately
		Unit	s
466	Monitoring window velocity standstill monitoring	Specifies the monitoring window for velocity standstill monitoring (maximum permissible velocity at a standstill). A standstill indicates that the actual velocity of the drive is below the parameterised threshold value.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
467	Monitoring window position standstill	Specifies the monitoring window for position standstill monitoring to prevent drifting at a threshold value that is not equal to 0. The monitoring window is set symmetrically to the standstill position (window width = 2x parameter). The standstill position is determined by the positive edge of the STV signal.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 517: Parameters - standstill monitoring

ID Dx.	Name	Description
07 | 02 | 00124 (117571708)	Standstill reached	Standstill reached
07 | 02 | 00125 (117571709)	Standstill reached and in standstill window	Standstill reached and in standstill window

Tab. 518: Diagnostic messages - Standstill monitoring

5.7.1 CiA 402

Objects - Standstill monitoring

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
465	0x6070.00	Standstill damping time	UINT
466	0x606F.00	Monitoring window velocity standstill monitoring	UINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
465	0x2166.06	Standstill damping time	REAL
466	0x2166.07	Monitoring window velocity standstill monitoring	REAL
467	0x2166.08	Monitoring window position standstill	REAL

Tab. 519: Objects

5.7.2 PROFIdrive

Standstill monitoring PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
465	11149.0	Standstill damping time	REAL
466	11150.0	Monitoring window velocity standstill monitoring	REAL
467	11151.0	Monitoring window position standstill	REAL

Tab. 520: PNUs

5.8 Stop reached

Limit stop LS

The monitoring function combines standstill monitoring (STV) and current monitoring for the stop detection. The actual current and velocity values are monitored cyclically to ensure that the defined limits are reached.

Timing

Status signal	LS
Stop detection	
Initial state LS	= 0
The LS signal is set under the following conditions: – The actual current value exceeds the threshold value – AND STV = 1 – AND both conditions are set to be longer than the damping time.	0→1
The LS signal is reset under the following conditions: – The actual current value falls below the threshold value. – OR STV = 0	1→0

Tab. 521: Status signals - stop reached

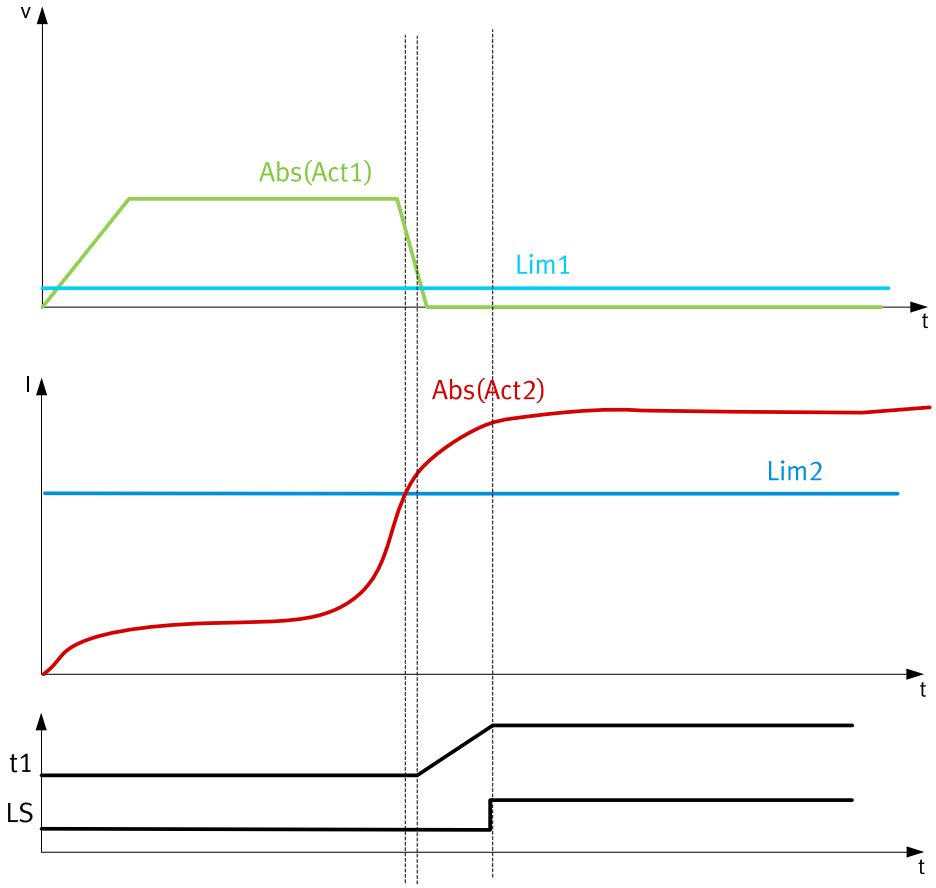


Fig. 79: Timing diagram: stop reached

Name	Description
v	Speed motion quantity
I	Active current
t1	Cushioning time
LS	Diagnostic message
Act1	Actual velocity
Act2	Actual active current
Lim1	STV
Lim2	Stop detection limit value

Tab. 522: Legend for timing diagram: stop reached

Parameters and diagnostic messages

ID Px.	Parameter	Description	
4626	Stop detection limit value	Specifies the percentage threshold value for the current limit. The value is relative to the actual parameterisation of the nominal current.	
		Access	read/write
		Update	effective immediately
		Unit	–
4627	Damping time limit detection	Specifies the response delay when both conditions are met. If the current threshold is parameterised at more than 100%, the damping time must be set to lower than I^2t for the standstill (typically 50...200ms) to ensure that the detection is triggered. The damping time starts when both limit value monitors are valid. The damping time is reset if just one of the limit value monitors is invalid.	
		Access	read/write

ID Px.	Parameter	Description	
4627	Damping time limit detection	Update	effective immediately
		Unit	s

Tab. 523: Parameters - stop reached

5.8.1 CiA 402

Objects - Stop reached

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
4626	0x2166.1B	Stop detection limit value	REAL
4627	0x2166.1C	Damping time limit detection	REAL

Tab. 524: Objects

5.8.2 PROFIdrive

Stop reached PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4626	11581.0	Stop detection limit value	REAL
4627	11582.0	Damping time limit detection	REAL

Tab. 525: PNUs

5.9 Stroke limit reached

Stroke limit reached STL

The monitoring function includes:
- Status evaluation of the stroke limits
- Configuration check
- Monitoring of the completed, relative movement
- Automatic braking (optional)

In contrast to software limit position monitoring, stroke limit monitoring is only available for speed and power operation.
The stroke limit is activated and parameterized separately via the relevant command during direct or record operation ("Command with stroke limit monitoring"). Referencing is not necessary. The parameterized, relative monitoring window is applied to the current position when a new command is started. The stroke limit configuration is invalid if the negative stroke limit is greater or equal to the positive stroke limit.

Application

- Stroke limit monitoring without automatic braking:
  An error message is triggered if the stroke limit is reached or exceeded. The drive is stopped with the parameterised error response. The error message can only be acknowledged once the stop ramp has expired.
- Stroke limit monitoring with automatic braking:
  Due to the current distance and speed, exceeding the stroke limit can be prevented by braking in time. The dynamic acceleration and jerk values from the stop ramp parameters are used for the projection.
  An error message is triggered, and the drive is decelerated with the parameterised error response, so that it comes to a standstill before the stroke limit, if possible. The error message can only be acknowledged once the stop ramp has expired.

Timing

Status signal	STL...
Initial state of STLN/STLP signals	= 0
If stroke limit monitoring is activated for the command, the signal is set under the following conditions: – STLN: If the actual position is lower than the parameterised negative stroke limit – STLP: If the actual position is greater than the parameterised positive stroke limit – STLN/STLP, if automatic braking is triggered	0→1
The signal is reset when a new command is started.	1→0

Tab. 526: Status signals - stroke limit reached

Parameters and diagnostic messages

ID Px.	Parameter	Description	
10368	Default value negative stroke limit	Specifies the negative stroke limit. The negative stroke limit must be lower than the positive stroke limit.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
10369	Default value positive stroke limit	Specifies the positive stroke limit. The positive stroke limit must be greater than the negative stroke limit.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
4675	Activation of automatic stop ramp stroke limit	Specifies whether automatic braking should be activated. If automatic braking is active, the drive is decelerated so that it stops before the stroke limit, if possible. If automatic braking is deactivated, the drive is only stopped once it reaches the stroke limit. 0: inactive 1: active	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 527: Parameters - stroke limit reached

ID Dx.	Name	Description
07 | 01 | 00119 (117506167)	Negative stroke limit reached	Negative stroke limit reached
07 | 01 | 00120 (117506168)	Positive stroke limit reached	Positive stroke limit reached

Tab. 528: Diagnostic messages - stroke limit reached

5.9.1 CiA 402

Objects - Stroke limit reached

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
10368	0x2190.08	Default value negative stroke limit	LINT
10369	0x2190.09	Default value positive stroke limit	LINT
4675	0x2166.3D	Activation of automatic stop ramp stroke limit	USINT

Tab. 529: Objects

5.9.2 PROFIdrive

Stroke limit reached PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
10368	11819.0	Default value negative stroke limit	LINT
10369	11820.0	Default value positive stroke limit	LINT
4675	11619.0	Activation of automatic stop ramp stroke limit	BOOL

Tab. 530: PNUs

5.10 Speed monitoring (spinning protection)

Speed monitor VM The monitoring function detects excessive speed and prevents the drive from spinning by a category 0 stop. The function ensures that the parameterised speed threshold value is not exceeded.

Timing

Status signal	VM
Initial state VM	= 0
The signal is set under the following conditions: – the threshold value (speed) is reached	0→1
The signal is reset under the following conditions: – the value falls below the threshold value (speed)	1→0

Tab. 531: Status signals - speed monitoring

Parameters and diagnostic messages

Px.	Parameter	Description	
4660	Maximum velocity	Specifies the amount of the maximum velovity. If the parameterised velocity value is exceeded, an error response is triggered.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 532: Parameters - speed monitoring

ID Dx.	Name	Description
07 | 02 | 00128 (117571712)	Velocity too high	RPM monitoring reports velocity too high

Tab. 533: Diagnostic messages - speed monitoring

5.10.1 CiA 402

Objects - Speed monitoring

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
4660	0x2166.30	Maximum velocity	REAL

Tab. 534: Objects

5.10.2 PROFIdrive

Speed monitoring PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4660	11606.0	Maximum velocity	REAL

Tab. 535: PNUs

5.11 Pushback monitoring

PB push back

The monitoring function checks the movement of the drive as a function of the specified effective direction of the torque. The torque setpoint value may at most trigger an aligned movement. A reverse movement is only permissible below the parameterised speed threshold value. If the torque setpoint value = 0, movements in both directions are only permitted below the parameterised threshold value.

Timing

Status signal	PB
Initial state	= 0
The signal is set under the following conditions: **Target torque ≠ 0:** – The actual speed value exceeds the threshold value for longer than the cushioning time – AND the drive moves in the opposite direction to the torque. **Target torque = 0:** – The actual speed value exceeds the threshold value for longer than the cushioning time.	0→1
The signal is reset under the following conditions: – The setting logic is inverted.	1→0

Tab. 536: Status signals - Pushback monitoring

Parameters and diagnostic messages

ID Px.	Parameter	Description	
4663	Monitoring window pushback	Specifies the monitoring window for pushback monitoring. Threshold value for monitoring the actual velocity (direction of movement) in relation to the effective direction of the torque (setpoint value).	
		Access	read/write
		Update	effective immediately
		Unit	user defined
4664	Damping time pushback	Specifies the damping time for pushback monitoring. Minimum duration that the threshold value can be exceeded before a message is generated. The damping time is restarted if the actual velocity is below the threshold value or if the prefix for the specified setpoint value (torque) changes during the evaluation of the damping time.	
		Access	read/write
		Update	effective immediately
		Unit	s

Tab. 537: Parameters - pushback monitoring

ID Dx.	Name	Description
07 | 02 | 00130 (117571714)	Reverse feed monitoring	Reverse feed monitoring reports error

Tab. 538: Diagnostic messages - pushback monitoring

5.11.1 CiA 402

Objects - Pushback monitoring

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
4663	0x2166.33	Monitoring window pushback	REAL
4664	0x2166.34	Damping time pushback	REAL

Tab. 539: Objects

5.11.2 PROFIdrive

Pushback monitoring PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4663	11609.0	Monitoring window pushback	REAL
4664	11610.0	Damping time pushback	REAL

Tab. 540: PNUs

5.12 Remaining distance monitoring

Remain distance monitor RDX The monitoring function indicates that the remaining path determined during the ongoing positioning command is below the specified limit value.

Timing

Status signal	RD...
Initial state	= 0
The RD signal is set under the following condition: – The difference (command target value / current actual value) falls below the limit value.	0→1
The RD signal is reset under the following condition: – The setting logic is inverted.	1→0

Tab. 541: Status signals - remaining distance monitoring

Parameters and diagnostic messages

ID Px.	Parameter	Description	
4685	Limit value remaining distance monitoring	Specifies the limit value of the remaining distance to be monitored.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 542: Parameters - remaining distance monitoring

ID Dx.	Name	Description
07 | 02 | 00131 (117571715)	Residual distance too low	Residual distance too low

Tab. 543: Diagnostic messages - remaining distance monitoring

5.12.1 CiA 402

Objects - Remaining distance monitoring

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
4685	0x2166.69	Remaining distance monitoring critical limit	SINT64

Tab. 544: Objects

5.12.2 PROFIdrive

Remaining distance monitoring PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4685	11627.0	Limit value remaining distance monitoring	LINT

Tab. 545: PNUs

5.13 Trajectory completed

Motion complete MC The monitoring function indicates that a trajectory (movement) has been completed.

Timing

Status signal	MC
Initial state	= 0
The signal is set under the following conditions: – The trajectory is completed.	0→1
The signal is reset under the following conditions: – A new command is started.	1→0

Tab. 546: Status signals - trajectory completed

Diagnostic messages

ID Dx.	Name	Description
07 | 02 | 00132 (117571716)	Trajectory completed	Trajectory completed (setpoint value reached)

Tab. 547: Diagnostic messages - trajectory completed

5.14 Reference switch activated

5.14.1 Function

Reference switch REFS The monitoring function signals if the reference switch is occupied.

Timing

Status signal	REFS
Initial state	= 0
The signal is set under the following conditions: – The configuration of the reference switch is not equal to 0 – AND the status of the reference switch is active.	0→1
The signal is reset under the following conditions: – The configuration of the reference switch = 0 – OR the status of the reference switch is inactive.	1→0

Tab. 548: Status signals - reference switch

Parameters and diagnostic messages

ID Px.	Parameter	Description	
101200	Reference switch configuration	Specifies the configuration of the reference switch. 0: deactivated 1: N/O contact 2: N/C contact	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
101201	Reference switch status	Specifies whether the reference switch is active. 0: inactive 1: active	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 549: Parameters - reference switch

Diagnostic messages No specific diagnostic messages are allocated to the function.

5.14.2 CiA 402

Objects - reference switch

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
101200	0x218A.01	Reference switch configuration	UDINT
101201	0x218A.02	Reference switch status	USINT

Tab. 550: Objects

5.14.3 PROFIdrive

Reference switch PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
101200	11947.0	Reference switch configuration	UDINT
101201	11948.0	Reference switch status	BOOL

Tab. 551: PNUs

6 Closed-loop control

6.1 Cascade controller

6.1.1 Function

The movement of the drive system is regulated by the cascade controller. The basic structure of the cascade controller consists of a position controller, a velocity controller and a current regulator. The active control loop of the cascade controller depends on the selected operating mode. The input variables of the individual control loops are regulated to the setpoints. The actual values are formed from the encoder data and the measured current. Control response can be improved with a pilot control. Limitations for the current and velocity controllers can also be activated. Aside from the active control parameter set, 3 additional control parameter sets are available for the parameterisation of the cascade controller.

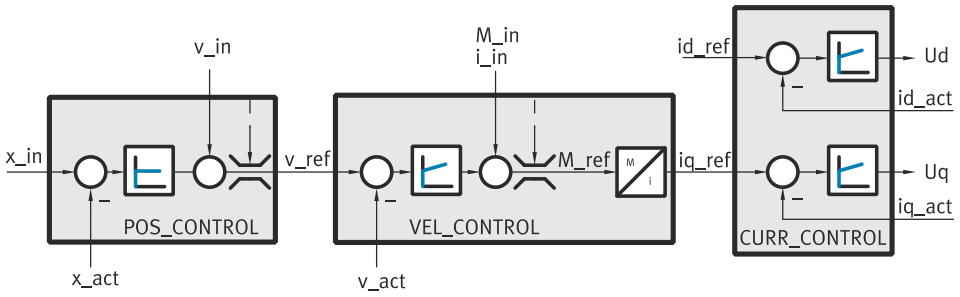


Fig. 80: Block diagram of cascade controller

Name	Parameter	ID Px.
i_in	Setpoint current The current value is used as a pilot control value for the current regulator. The resulting setpoint value is dependent on the parameterised upstream variables of the pilot control ➔ 6.3 Pilot control (closed-loop control setpoint values). The relationship i_in = M_in/(torque constant x gear ratio) is between i_in and M_in.	95
id_act	Actual reactive current value	813
id_ref	Setpoint value reactive current	87
iq_act	Actual active current value	814
iq_ref	Setpoint value active current	86
M_in	Setpoint torque The torque setpoint value is used as a pilot control value for the current regulator and refers to the output side (motor + gear unit). The resulting setpoint value is dependent on the parameterised upstream variables of the pilot control ➔ 6.3 Pilot control (closed-loop control setpoint values).	94
M_ref	Setpoint value torque	2220
v_act	Actual velocity value encoder channel 1	1210
v_in	Setpoint velocity The velocity setpoint value is used as a pilot control value for the velocity regulator ➔ 6.3 Pilot control (closed-loop control setpoint values).	91
v_ref	Setpoint value velocity controller	2216
x_act	Actual position value encoder channel 1	128
x_in	Setpoint position	90

Tab. 552: Legend for the block diagram of cascade controller

6.1.2 Position controller

The position controller is designed as P-closed-loop controller that calculates the speed specification for the secondary speed control circuit from the control difference (setpoint position - actual position). A dead zone element suppresses all control differences with the value "0" if it lies within the parameterised symmetrical dead zone. The P-element generates the setpoint speed from the control difference and position controller amplification factor. This can be asymmetrically limited via the minimum and maximum correction speed. At active speed feed forward control (default setting) "Setpoint speed" and "speed feed forward control" values are added and output as speed specification to the secondary speed controller. The speed controller setpoint value can be asymmetrically limited via the resulting lower and upper limit value speed. If the setpoint value reaches the limit, this can be requested via a status.

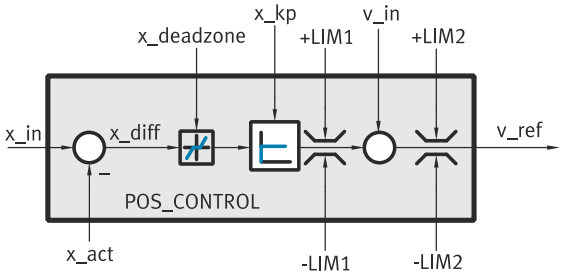


Fig. 81: Position controller block diagram

Name	Parameter	ID Px.
x_act	Actual position value encoder channel 1	128
x_deadzone	Dead zone position controller	221
x_diff	Position control error	2217
x_in	Setpoint position	90
x_kp	Position controller amplification gain	220
v_in	Setpoint velocity The speed setpoint value is used as a pilot control value for the speed controller ➔ 6.3 Pilot control (closed-loop control setpoint values).	91
v_ref	Setpoint value velocity controller	2216
–LIM1	Minimum correction velocity	222
+LIM1	Maximum correction velocity	223
–LIM2	Resulting lower limit value velocity (closed loop controller) This limit value is an output value of the limiter for the setpoint speed➔ Fig. 85.	6100
+LIM2	Resulting upper limit value velocity (closed loop controller) This limit value is an output value of the limiter for the setpoint speed➔ Fig. 85.	6101

Tab. 553: Legend for the block diagram of the position controller

Parameters and diagnostic messages

ID Px.	Parameter	Description	
220	Position controller amplification gain	Specifies the amplification gain for the P-element in the position controller.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
221	Dead zone position controller	Specifies the value (relative to the zero point) of the dead zone in the position controller. If the control deviation value is in the range of the dead zone, the value "0" is output on the output of the element.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
222	Minimum correction velocity	Specifies the limit value "Minimum correction velocity" for the velocity limitation on the output of the P-element in the position controller.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
223	Maximum correction velocity	Specifies the limit value "Maximum correction velocity" for the velocity limitation on the output of the P-element in the position controller.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
2216	Setpoint value velocity controller	Specifies the setpoint velocity for the velocity controller at the output of the position controller including the feed forward control value for the velocity.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
2217	Position control error	Specifies the control difference of input variables "Feed forward control output position" and "Actual position" on the output of the setpoint-actual comparator in the position controller.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
6100	Resulting lower limit value velocity (closed loop controller)	Specifies the limit value "Lower limit value of velocity" for velocity limitation.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
6101	Resulting upper limit value velocity (closed loop controller)	Specifies the limit value "Upper limit value of velocity" for velocity limitation.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
52675	Velocity limitation active	Specifies the monitoring status of "Velocity limitation is active" for the setpoint value for the velocity controller in the position controller.	
		Access	read/–
		Update	effective immediately
		Unit	–
526794	Filter time constant controller limitation	Specifies the filter time constant for reaching a limit in the velocity or current control circuit	
		Access	read/write
		Update	effective immediately
		Unit	s

Tab. 554: Parameters

ID Dx.	Name	Description
07 | 03 | 00135 (117637255)	Limit for velocity or current active	A limit for the velocity or current is active

Tab. 555: Diagnostic messages

6.1.2.1 CiA 402

Position controller objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
220	0x215B.01	Position controller amplification gain	REAL
221	0x215B.02	Dead zone position controller	LINT
222	0x215B.03	Minimum correction velocity	REAL
223	0x215B.04	Maximum correction velocity	REAL
2216	0x215B.08	Setpoint value velocity controller	REAL
2217	0x215B.09	Position control error	LINT
6100	0x2168.08	Resulting lower limit value velocity (closed loop controller)	REAL
6101	0x2168.09	Resulting upper limit value velocity (closed loop controller)	REAL
52675	0x2152.09	Velocity limitation active	USINT
526794	0x2152.0D	Filter time constant controller limitation	REAL

Tab. 556: Objects

6.1.2.2 PROFIdrive

Position controller PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
220	11080.0	Position controller amplification gain	REAL
221	11081.0	Dead zone position controller	LINT
222	11082.0	Minimum correction velocity	REAL
223	11083.0	Maximum correction velocity	REAL
2216	11412.0	Setpoint value velocity controller	REAL
2217	11413.0	Position control error	LINT
6100	11640.0	Resulting lower limit value velocity (closed loop controller)	REAL
6101	11641.0	Resulting upper limit value velocity (closed loop controller)	REAL
52675	11889.0	Velocity limitation active	BOOL
526794	12165.0	Filter time constant controller limitation	REAL

Tab. 557: PNUs

6.1.3 Speed controller

The speed controller is designed as a PI closed-loop controller (with anti-windup function) which calculates the torque specifications for the secondary current control circuit from the control difference (setpoint speed - actual speed). At active torque pilot control (default setting) the "Setpoint torque" and "Torque pilot control" values are added and output to the secondary current regulator as torque specification. The torque setpoint value can be asymmetrically limited via the minimum and maximum torque. A torque current converter converts the torque setpoint value into an active current setpoint value by means of the torque constant and the gear unit factor. If the setpoint value reaches the limit, this can be requested via a status. Another limit symmetrically limits the torque setpoint value for use with the CiA 402 protocol.

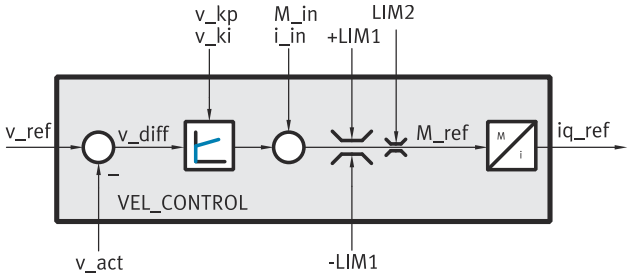


Fig. 82: Block diagram of speed controller

Name	Parameter	ID Px.
i_in	Setpoint current The current value is used as a pilot control value for the current regulator. The resulting setpoint value is dependent on the parameterised upstream variables of the pilot control ➔ 6.3 Pilot control (closed-loop control setpoint values). Between i_in and M_in, there is the relationship i_in = M_in/(torque constant x gear unit factor).	95
iq_ref	Setpoint value active current	86
M_in	Setpoint torque The setpoint value torque is used as a pilot control value for the speed controller. The resulting setpoint value is dependent on the parameterised upstream variables of the pilot control ➔ 6.3 Pilot control (closed-loop control setpoint values).	94
M_ref	Setpoint value torque	2220
v_kp	Velocity controller amplification gain	224
v_ki	Velocity controller integration constant	225
v_act	Actual velocity value encoder channel 1	1210
v_diff	Velocity control error	2215
v_ref	Setpoint value velocity controller	2216
–LIM1	Minimum torque This limit value is an output value of the limiter for the torque ➔ 6.2.3 Torque limitation.	2218
+LIM1	Maximum torque This limit value is an output value of the limiter for the torque ➔ 6.2.3 Torque limitation.	2219
LIM2	Maximum torque symmetrical	526796

Tab. 558: Legend for the block diagram of the speed controller

Recommendation: before changing controller parameters, check the signal of the encoder. If required, optimize signal noises using a suitable filter time constant.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
224	Velocity controller amplification gain	Specifies the amplification gain for the PI-element in the velocity controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
225	Velocity controller integration constant	Specifies the integration constant for the PI-element in the velocity controller.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
1210	Actual velocity value encoder channel 1	Specifies the velocity measured by the primary encoder.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
2215	Velocity control error	Specifies the control difference of input variables "Velocity controller setpoint value" and "Actual value of velocity transducer interface 1" on the output of the setpoint-actual comparator in the velocity controller.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
2216	Setpoint value velocity controller	Specifies the setpoint velocity for the velocity controller at the output of the position controller including the feed forward control value for the velocity.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
2218	Minimum torque	Specifies the minimum torque for torque limitation.	
		Access	read/–
		Update	effective immediately
		Unit	Nm
2219	Maximum torque	Specifies the maximum torque for torque limitation.	
		Access	read/–
		Update	effective immediately
		Unit	Nm
2220	Setpoint value torque	Specifies the torque setpoint for the current controller in the velocity controller.	
		Access	read/–
		Update	effective immediately
		Unit	Nm
52676	Current limitation active	Specifies the monitoring status of "Current limitation is active" for the setpoint value of the active current in the velocity controller.	
		Access	read/–
		Update	effective immediately
		Unit	–
526796	Maximum torque symmetrical	Specifies the limit value "maximum torque" for the symmetrical torque limitation at the output of the velocity controller.	
		Access	read/write
		Update	effective immediately
		Unit	Nm

Tab. 559: Parameters

ID Dx.	Name	Description
06 | 02 | 00086 (100794454)	Sign limits	The target torque and the velocity limit are uncorrelated.

Tab. 560: Diagnostic messages

6.1.3.1 CiA 402

Speed controller objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
1210	0x606C.00	Actual velocity value encoder channel 1	DINT
526796	0x6072.00	Maximum torque symmetrical	UINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
224	0x215B.05	Velocity controller amplification gain	REAL
225	0x215B.06	Velocity controller integration constant	REAL
1210	0x2155.0B	Actual velocity value encoder channel 1	REAL
2215	0x215B.07	Velocity control error	REAL
2216	0x215B.08	Setpoint value velocity controller	REAL
2218	0x215B.0A	Minimum torque	REAL
2219	0x215B.0B	Maximum torque	REAL
2220	0x215B.0C	Setpoint value torque	REAL
52676	0x2152.0A	Current limitation active	USINT
526796	0x2168.17	Maximum torque symmetrical	REAL

Tab. 561: Objects

6.1.3.2 PROFIdrive

Speed controller PNUs

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value encoder channel 1	INT
Px.	**Manufacturer-specific parameters**		
224	11084.0	Velocity controller amplification gain	REAL
225	11085.0	Velocity controller integration constant	REAL
1210	11311.0	Actual velocity value encoder channel 1	REAL
2215	11411.0	Velocity control error	REAL
2216	11412.0	Setpoint value velocity controller	REAL
2218	11414.0	Minimum torque	REAL
2219	11415.0	Maximum torque	REAL
2220	11416.0	Setpoint value torque	REAL
52676	11890.0	Current limitation active	BOOL
526796	12166.0	Maximum torque symmetrical	REAL

Tab. 562: PNUs

6.1.4 Current regulator

The current regulator consists of an active current regulator and a reactive current regulator which specify the voltage setpoint values for the secondary power output stages.

The CMMT-ST plug-in synchronises the parameters of active current regulator and reactive current regulator if the parameter Px.819 is set (default setting) and controller parameters are calculated by the plug-in. For example, the calculation can be initiated on the ‘Closed Loop’ panel.

Active current regulator: The active current regulator is designed as a PI controller (with anti-windup functions), which uses the control difference (Setpoint value active current – Actual active current value) to calculate the voltage specification U_{q_ref} for the secondary voltage transformation.

Reactive current regulator: The reactive current regulator is designed as a PI controller (with anti-windup functions), which uses the control difference (Setpoint value reactive current – Actual reactive current value) to calculate the voltage specification U_{d_ref} for the secondary voltage transformation.

Voltage limitation: The voltages U_{q_ref} and U_{d_ref} are evaluated jointly. The voltage phasor calculated from U_{q_ref} and U_{d_ref} is limited to the maximum output voltage. The status of the applicable limitation for U_{q_ref} and U_{d_ref} can be queried.

Voltage transformation: The voltage transformation generates the setpoint specifications for the secondary power output stage from the "voltage setpoint value" input variables. This prioritises the voltage U_d as default against voltage U_q.

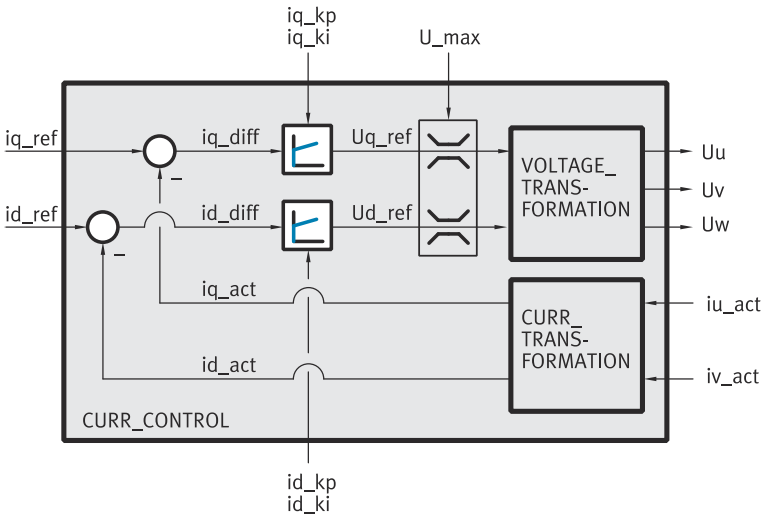


Fig. 83: Block diagram of current regulator

Name	Parameters	ID Px.
id_act	Actual reactive current value	813
id_diff	Reactive current control error	824
id_ki	Current controller integration constant (reactive current)	81
id_kp	Current controller amplification gain (reactive current)	80
id_ref	Setpoint value reactive current	87
iq_act	Actual active current value	814
iq_diff	Active current control error	825
iq_ki	Current controller integration constant (active current)	83
iq_kp	Current controller amplification gain (active current)	82
iq_ref	Setpoint value active current	86
iu_act	Actual phase U current value	39
iv_act	Actual phase V current value	310
Ud_ref	Setpoint value voltage Ud	84
Uq_ref	Setpoint value voltage Uq	85
U_max	Maximum output voltage	88
Uu	Setpoint value motor voltage phase U	–

Name	Parameters	ID Px.
Uv	Setpoint value motor voltage phase V	–
Uw	Setpoint value motor voltage phase W	–

Tab. 563: Legend for the block diagram of the current regulator

Parameters and diagnostic Messages

ID Px.	Parameter	Description	
39	Actual phase U current value	Specifies the actual value of the phase U current.	
		Access	read/–
		Update	effective immediately
		Unit	A
80	Current controller amplification gain (reactive current)	Specifies the amplification gain for the P-element in the reactive current controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
81	Current controller integration constant (reactive current)	Specifies the integration constant for the I-element in the reactive current controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
82	Current controller amplification gain (active current)	Specifies the amplification gain for the P-element in the effective current controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
83	Current controller integration constant (active current)	Specifies the integration constant for the I-element in the effective current controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
84	Setpoint value voltage Ud	Specifies the setpoint voltage Ud at the output of the reactive current controller.	
		Access	read/–
		Update	effective immediately
		Unit	V
85	Setpoint value voltage Uq	Specifies the setpoint voltage Uq at the output of the active current controller.	
		Access	read/–
		Update	effective immediately
		Unit	V
86	Setpoint value active current	Specifies the active current setpoint for the current controller.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
87	Setpoint value reactive current	Specifies the reactive current setpoint for the current controller.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
88	Maximum output voltage	Specifies the limit value "Maximum output voltage" for the outputs of the PI-elements (reactive current/active current) in the current controller.	
		Access	read/–
		Update	effective immediately
		Unit	V

ID Px.	Parameter	Description	
310	Actual phase V current value	Specifies the actual value of the phase V current.	
		Access	read/–
		Update	effective immediately
		Unit	A
813	Actual reactive current value	Specifies the actual reactive current at the output of the current transformation.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
814	Actual active current value	Specifies the actual active current at the output of the current transformation.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
819	Control parameter equalisation for active and reactive current controllers	The plug-in synchronises the parameters of the active current controller and reactive current controller if the parameter is set. – 0: inactive; for the calculation of the regulator parameters, the plug-in only calculates the active current regulator. The reactive current regulator remains unaffected. – 1: active; for the calculation of the regulator parameters, the plug-in synchronises the parameters for the active current and the reactive current	
		Access	read/write
		Update	effective immediately
		Unit	–
824	Reactive current control error	Specifies the control difference of input variables "Reactive current setpoint value" and "Actual value of reactive current" on the output of the setpoint-actual comparator in the current controller.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
825	Active current control error	Specifies the control difference of input variables "Active current setpoint value" and "Actual value of active current" on the output of the setpoint-actual comparator in the current controller.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
1206	Length motor cable	Specifies the length of the motor cable. The length of the motor cable is required for close loop.	
		Access	read/write
		Update	reinitialization
		Unit	mCable
1208	Cable cross section	Specifies the cable cross-section in mm². The cable cross-section is required for controller sizing.	
		Access	read/write
		Update	reinitialization
		Unit	mm²
52679	Voltage limitation filter time constant	Specifies the filter time constant for reaching the voltage limit.	
		Access	read/write
		Update	effective immediately
		Unit	s
52680	Voltage limitation Ud active	Specifies the monitoring status of "Voltage limitation Ud active" for the voltage Ud setpoint value in the current controller.	
		Access	read/–

ID Px.	Parameter	Description	
52680	Voltage limitation Ud active	Update	effective immediately
		Unit	–
52681	Voltage limitation Uq active	Specifies the monitoring status of "Voltage limitation Uq active" for the voltage Uq setpoint value in the current controller.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 564: Parameter

ID Dx.	Name	Description
07 | 03 | 00134 (117637254)	Voltage limitation active	Voltage limitation active

Tab. 565: Diagnostic messages

6.1.4.1 CiA 402

Current regulator objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
814	0x6078.00	Actual active current value	INT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
39	0x2151.0A	Actual phase U current value	REAL
80	0x2153.01	Current controller amplification gain (reactive current)	REAL
81	0x2153.02	Current controller integration constant (reactive current)	REAL
82	0x2153.03	Current controller amplification gain (active current)	REAL
83	0x2153.04	Current controller integration constant (active current)	REAL
84	0x2153.05	Setpoint value voltage Ud	REAL
85	0x2153.06	Setpoint value voltage Uq	REAL
86	0x2153.07	Setpoint value active current	REAL
87	0x2153.08	Setpoint value reactive current	REAL
88	0x2153.09	Maximum output voltage	REAL
310	0x2151.0B	Actual phase V current value	REAL
813	0x2153.0E	Actual reactive current value	REAL
814	0x2153.0F	Actual active current value	REAL
819	0x2153.14	Control parameter equalisation for active and reactive current controllers	USINT
824	0x2153.15	Reactive current control error	REAL
825	0x2153.16	Active current control error	REAL
1206	0x217F.07	Length motor cable	REAL
1208	0x217F.09	Cable cross section	REAL
52679	0x2151.0C	Voltage limitation filter time constant	REAL
52680	0x2151.0D	Voltage limitation Ud active	USINT
52681	0x2151.0E	Voltage limitation Uq active	USINT

Tab. 566: Objects

6.1.4.2 PROFIdrive

Current regulator PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
39	11021.0	Actual phase U current value	REAL
80	11035.0	Current controller amplification gain (reactive current)	REAL
81	11036.0	Current controller integration constant (reactive current)	REAL
82	11037.0	Current controller amplification gain (active current)	REAL
83	11038.0	Current controller integration constant (active current)	REAL
84	11039.0	Setpoint value voltage Ud	REAL
85	11040.0	Setpoint value voltage Uq	REAL
86	11041.0	Setpoint value active current	REAL
87	11042.0	Setpoint value reactive current	REAL
88	11043.0	Maximum output voltage	REAL
310	11113.0	Actual phase V current value	REAL
813	11189.0	Actual reactive current value	REAL
814	11190.0	Actual active current value	REAL
819	11195.0	Control parameter equalisation for active and reactive current controllers	BOOL
824	11200.0	Reactive current control error	REAL
825	11201.0	Active current control error	REAL
1206	11308.0	Length motor cable	REAL
1208	11310.0	Cable cross section	REAL
52679	11893.0	Voltage limitation filter time constant	REAL
52680	11894.0	Voltage limitation Ud active	BOOL
52681	11895.0	Voltage limitation Uq active	BOOL

Tab. 567: PNUs

6.1.5 Control parameter sets

Aside from the active control parameter set, 3 additional control parameter sets are available for the parameterisation of the cascade controller. A control parameter set contains all control parameters for position and speed controllers and current regulators, the total inertia for the torque feed forward control and the filter time constant for the actual speed value filter. When a control parameter set is changed, the total inertia and the speed filter are also changed.
The individual control parameter sets can be activated via the record table or the device profile. The switch over duration into another control parameter set can be influenced by the transition time. There is a linear interpolation of all values during the switch over.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
44	Change closed loop parameter set status	Specifies the status of the activated closed loop parameter set in the change closed loop parameter set.	
		Access	read/–
		Update	effective immediately
		Unit	–
226	Position controller amplification gain	Specifies the amplification gain in the parameter sets for the P-element in the position controller.	

ID Px.	Parameter	Description	
226	Position controller amplification gain	Access	read/write
		Update	effective immediately
		Unit	–
2210	Velocity controller amplification gain	Specifies the amplification gain in the parameter sets for the PI-element in the velocity controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
2211	Velocity controller integration constant	Specifies the integration constant in the parameter sets for the PI-element in the velocity controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
2223	Current controller amplification gain (active current)	Specifies the amplification gain "Active current" in the parameter sets for the PI-element in the current controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
2224	Integration constant current controller (active current)	Specifies the integration constant "Active current" in the parameter sets for the PI-element in the current controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
2225	Current controller amplification gain (reactive current)	Specifies the amplification gain "Reactive current" in the parameter sets for the PI-element in the current controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
2227	Total inertia	Specifies the total inertia torque of the drive train (axis, gear unit, motor, load). A value input by the user is overwritten with the total of all inertias from the configured drive train, including the load, by calculation of the control parameters.	
		Access	read/write
		Update	effective immediately
		Unit	kgm²
2228	Velocity filter time constant	Specifies the filter time constant for the actual velocity value filter for the parameter sets.	
		Access	read/write
		Update	effective immediately
		Unit	s

Tab. 568: Parameters

Diagnostic messages No specific diagnostic messages are allocated to the function.

6.1.5.1 CiA 402

Objects - control parameter sets

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
44	0x2156.01	Change closed loop parameter set status	USINT
226	0x2227.01 ... 03	Position controller amplification gain	REAL
2210	0x2228.01 ... 03	Velocity controller amplification gain	REAL

Parameter	Index.Subindex	Name	Data type
2211	0x2229.01 ... 03	Velocity controller integration constant	REAL
2223	0x222A.01 ... 03	Current controller amplification gain (active current)	REAL
2224	0x222B.01 ... 03	Integration constant current controller (active current)	REAL
2225	0x222C.01 ... 03	Current controller amplification gain (reactive current)	REAL
2227	0x222E.01 ... 03	Total inertia	REAL
2228	0x222F.01 ... 03	Velocity filter time constant	REAL

Tab. 569: Objects

Controlling the controller parameter set switchover

Object 0x2001.01: starting the controller parameter set switchover

The start of the controller parameter set switchover is controlled via the object:

Bit[1)]	Description
0→1	Controller parameter set switchover started at parameterised

1) signal status: 0→1 = rising edge

Tab. 570: Starting the controller parameter set switchover

Monitoring controller parameter set switchover

Object 0x2001.02: status of the controller parameter set switchover

The status of the controller parameter set switchover is issued via the object:

Bit[1)]	Description
0	Controller parameter set switchover not active
1	Controller parameter set switchover active

1) Signal status: 0 = low; 1 = high

Tab. 571: Status of the controller parameter set switchover

Object 0x2001.05: return value of device access

The status of the device access is issued via the object:

Bit[1)]	Description
0	Device access successful
1	Device access was aborted with an internal error

1) Signal status: 0 = low; 1 = high

Tab. 572: Return value of device access

6.1.5.2 PROFIdrive

Control parameter sets PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
44	11026.0	Change closed loop parameter set status	BOOL
226	11086.0 ... 2	Position controller amplification gain	REAL
2210	11409.0 ... 2	Velocity controller amplification gain	REAL
2211	11410.0 ... 2	Velocity controller integration constant	REAL
2223	11419.0 ... 2	Current controller amplification gain (active current)	REAL
2224	11420.0 ... 2	Integration constant current controller (active current)	REAL
2225	11421.0 ... 2	Current controller amplification gain (reactive current)	REAL
2227	11423.0 ... 2	Total inertia	REAL
2228	11424.0 ... 2	Velocity filter time constant	REAL

Tab. 573: PNUs

6.2 Limitations

6.2.1 Application limitations

The setpoint specifications for the trajectory generator are restricted by the application limitations, which are specified by the active record table, profile operating mode (positioning, speed or force/torque), jogging or homing.
During the test, the variables of movement "speed (v), acceleration (a), deceleration (d) and torque (M)" are compared with the specified limitations (jerk is not limited). If all setpoint values lie within the specified limitations, the trajectory generator calculates the path course for the specified setpoint values. If the setpoint values lie outside the limitations, the setpoint values are limited to the specific value and a corrected trajectory is calculated.
The motion variables can be asymmetrically limited via the minimum and maximum. If a position order is executed with final speed, the final speed is also limited. If one of the setpoint values reaches the limit, it can be queried via a status.
The parameter speed override Px.1309 can be used to influence the parameterised target speed in the range of 0 ... 200%. The value for the speed override can be selected in the range from 0 ... 2. The scaling for 100% corresponds to the value 1. The setting affects the following motion types:
– Position sets
– Jogging
– Homing
– Target value specification
The speed override for devices with the PROFIdrive drive profile is set in the range of 0 ... 200 by the Px.11280611 parameter. The standardisation for 100% corresponds to the value 0x4000 ➔ 12.4.8.23 Velocity Override (OVERRIDE).

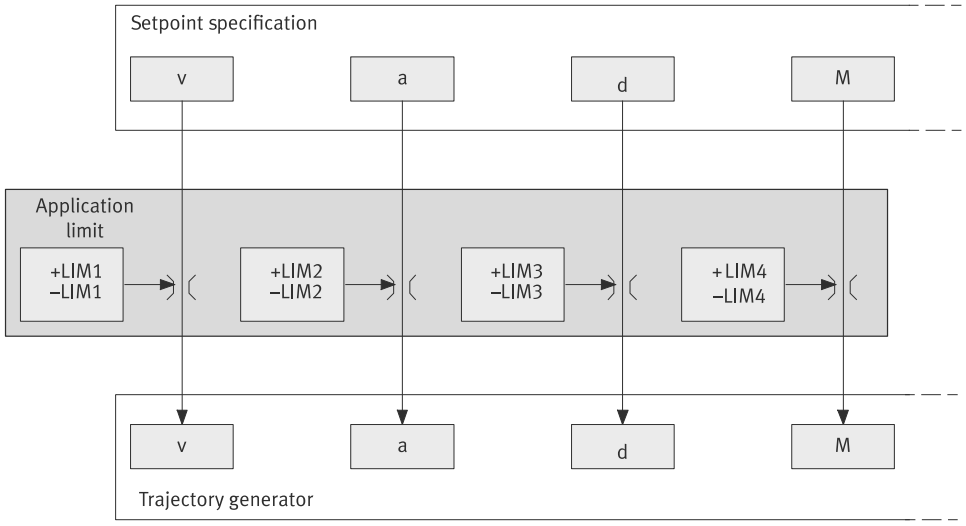


Fig. 84: Structure of the application limit

Name	Parameter	ID Px.
+LIM1	Limit value velocity limit positive and negative direction of movement	1304
–LIM1	Limit value velocity limit negative direction of movement	1310
+LIM2	Upper limit value acceleration limitation	1305
–LIM2	Lower limit value acceleration limitation	1311
+LIM3	Upper limit value deceleration limitation	1306
–LIM3	Lower limit value deceleration limit	1312

Name	Parameter	ID Px.
+LIM4	Upper limit torque limitation	1307
–LIM4	Lower limit torque limitation	1308

Tab. 574: Legend of the block diagram for the application limitation

Limit values of the speed limiting (+LIM1/–LIM1):
- The limiting is effective for all position, speed and torque commands (PP, PV, PT mode). The limit also applies to all tasks that are, e.g., part of homing, jogging or zero-angle detection.
- The positive value must be ≥ 0 and applies to all movements in the positive direction.
- The negative value must be ≤ 0 and applies to all movements in the negative direction.

Limit values of the acceleration limitation (+LIM2/–LIM2)
- The limitation is effective for all position and speed commands (PP, PV mode). The limit also applies to all tasks that are, e.g., part of homing, jogging or zero-angle detection.
- The maximum and minimum value must be ≥ 0.
- The maximum value must be greater than the minimum values.
- The violation of the condition is not checked until the limit values are actively used. In the event of an error, the limitation is ineffective and a diagnostic message is triggered.

Limit values of the deceleration limitation (+LIM3/–LIM3):
- The limitation is effective for all position and speed commands (PP, PV mode). The limit also applies to all tasks that are, e.g., part of homing, jogging or zero-angle detection.
- The maximum and minimum value must be greater than = 0.
- The maximum value must be greater than the minimum value.
- The violation of the condition is not checked until the limit values are actively used. In the event of an error, the limitation is ineffective and a diagnostic message is triggered.

Limit values of the torque limitation (+LIM4/–LIM4):
- The limitation is only effective for torque commands (PT mode). The limit also applies to all tasks that are, e.g., part of homing, jogging or zero-angle detection.
- The positive value must be ≥ 0 and applies to all movements in the positive direction.
- The negative value must be ≤ 0 and applies to all movements in the negative direction.

Parameters and diagnostic Messages

ID Px.	Parameter	Description	
1301	Velocity limitation status	Display the status of the velocity limitation for the application limitation.	
		Access	read/–
		Update	effective immediately
		Unit	–
1302	Acceleration limitation status	Specifies the status of the acceleration limitation for the application limitation.	
		Access	read/–
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
1303	Torque limitation status	Specifies the status of the torque limitation for the application limitation.	
		Access	read/–
		Update	effective immediately
		Unit	–
1304	Limit value velocity limit positive and negative direction of movement	Specifies the velocity limit value for the positive direction of movement in the application limitation.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1305	Upper limit value acceleration limitation	Specifies the upper limit value for the acceleration limitation in the application limitation. The limitation must be greater than 0 and greater than Px.1311.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1306	Upper limit value deceleration limitation	Specifies the upper limit value for the deceleration limitation in the application limitation. The limitation must be greater than 0 and greater than Px.1312.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1307	Upper limit torque limitation	Specifies the upper limit value for the torque limitation in the application limitation.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
1308	Lower limit torque limitation	Specifies the lower limit value for the torque limitation in the application limitation.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
1309	Velocity override	Specifies the velocity override in positioning and velocity mode. The override can be set in the range from 0 ... 2. The normalization for 100 % corresponds to the value of 1.	
		Access	read/write
		Update	effective immediately
		Unit	–
1310	Limit value velocity limit negative direction of movement	Specifies the velocity limit value for the negative direction of movement in the application limitation.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1311	Lower limit value acceleration limitation	Specifies the lower limit value for the acceleration limitation in the application limitation. The limitation must be greater than 0 and less than Px.1305.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1312	Lower limit value deceleration limit	Specifies the lower limit value for the deceleration limitation in the application limitation. The limitation must be greater than 0 and less than Px.1306.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

ID Px.	Parameter	Description	
11280611	Velocity override	Specifies the velocity override in positioning and velocity mode. The override can be set in the range 0 ... 200 %. The scaling for 100 % corresponds to the value of 0x4000.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 575: Parameters

Diagnostic messages No specific diagnostic messages are allocated to the function.

6.2.1.1 CiA 402

Application limitation objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
1304	0x607F.00	Limit value velocity limit positive and negative direction of movement	UDINT
1305	0x60C5.00	Upper limit value acceleration limitation	UDINT
1306	0x60C6.00	Upper limit value deceleration limitation	UDINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1301	0x2183.01	Velocity limitation status	USINT
1302	0x2183.02	Acceleration limitation status	USINT
1303	0x2183.03	Torque limitation status	USINT
1304	0x2183.04	Limit value velocity limit positive and negative direction of movement	REAL
1305	0x2183.05	Upper limit value acceleration limitation	REAL
1306	0x2183.06	Upper limit value deceleration limitation	REAL
1307	0x2183.07	Upper limit torque limitation	REAL
1308	0x2183.08	Lower limit torque limitation	REAL
1309	0x2183.09	Velocity override	REAL
1310	0x2183.0C	Limit value velocity limit negative direction of movement	REAL
1311	0x2183.0D	Lower limit value acceleration limitation	REAL
1312	0x2183.0E	Lower limit value deceleration limit	REAL

Tab. 576: Objects

6.2.1.2 PROFIdrive

Application limitation PNUs

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280611	205.0	Velocity override ➔ 12.4.8.23 Velocity Override (OVERRIDE)	INT
Px.	**Manufacturer-specific parameters**		
1301	11331.0	Velocity limitation status	BOOL
1302	11332.0	Acceleration limitation status	BOOL
1303	11333.0	Torque limitation status	BOOL
1304	11334.0	Limit value velocity limit positive and negative direction of movement	REAL
1305	11335.0	Upper limit value acceleration limitation	REAL
1306	11336.0	Upper limit value deceleration limitation	REAL
1307	11337.0	Upper limit torque limitation	REAL
1308	11338.0	Lower limit torque limitation	REAL

Parameter	PNU	Name	Data type
1309	12482.0	Velocity override	REAL
1310	12644.0	Limit value velocity limit negative direction of movement	REAL
1311	12645.0	Lower limit value acceleration limitation	REAL
1312	12646.0	Lower limit value deceleration limit	REAL
11280611	12534.0	Velocity override ➔ 12.4.8.23 Velocity Override (OVERRIDE)	INT

Tab. 577: PNUs

6.2.2 Control limitation

The cascade controller has the following limitations:
– Limiter for the setpoint speed
– Limiter for the setpoint torque and the setpoint active current
The limit values for the 2 limiters consist of static and dynamic data.

Data	Description
Dynamic data	Data consisting of the specifications of the user and the data from the I²t monitoring The data can be adjusted by the user at any time.
Static data	Data composed of the configuration of the drive system, the size of the servo drive and the motor. The data can only be changed by changing the configuration.

Tab. 578: Static and dynamic data

Limiter for setpoint speed

The lower and upper speed limit value (v_in1, v_in 2) specified by the user is compared with the limit value for the speed of the drive system determined from the static data ➔ Fig. 85.
The resulting lower limit value of the speed (–LIM2) is the higher limit value in each case.
The resulting upper limit value of the speed (+ LIM2) is the lower limit value in each case.
The resulting limit values (–LIM2, + LIM2) limit the output value of the position controller including the speed feed forward control ➔ Fig. 81.

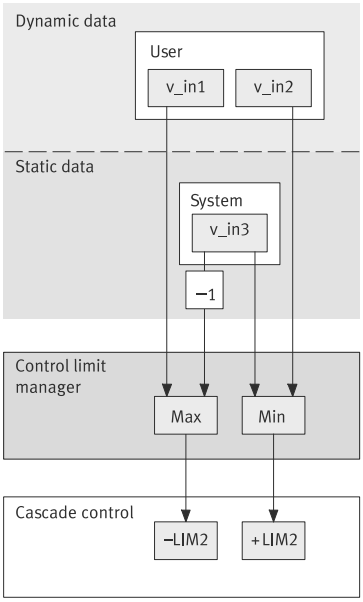


Fig. 85: Limiter for the setpoint speed

Name	Parameter	ID Px.
v_in1	Lower limit value velocity (closed loop controller)	850
v_in2	Upper limit value velocity (closed loop controller)	851
v_in3	Maximum motor velocity Specifies the static limit value Maximum velocity of the motor in relation to the output side with gearbox.	382
–LIM2	Resulting lower limit value velocity (closed loop controller)	6100
+LIM2	Resulting upper limit value velocity (closed loop controller)	6101

Tab. 579: Legend for the block diagram limiter for setpoint speed

Limiter for setpoint torque and setpoint active current

The lower and upper limit value of the torque (M_in1, M_in2) specified by the user is compared with the limit values of the drive system determined from the static data (M_in3, M_in4) ➔ Fig. 86.
The resulting lower limit value of the torque (-M) is the highest value in every case.
The resulting upper limit value of the torque (+ M) is the lowest value in each case.
The lower and upper limit value of the active current (iq_in1, iq_in2) specified by the user is compared with the dynamic data of the I^2T monitoring and the minimum and maximum currents of the drive system resulting from the static data.
The resulting lower limit value of the active current (–iq) is the highest value in each case.
The resulting upper limit value of the active current (+ iq) is the lowest value in each case.
The resulting values (-M, + M, –iq, + iq) are input values for the torque limiter ➔ Fig. 87.

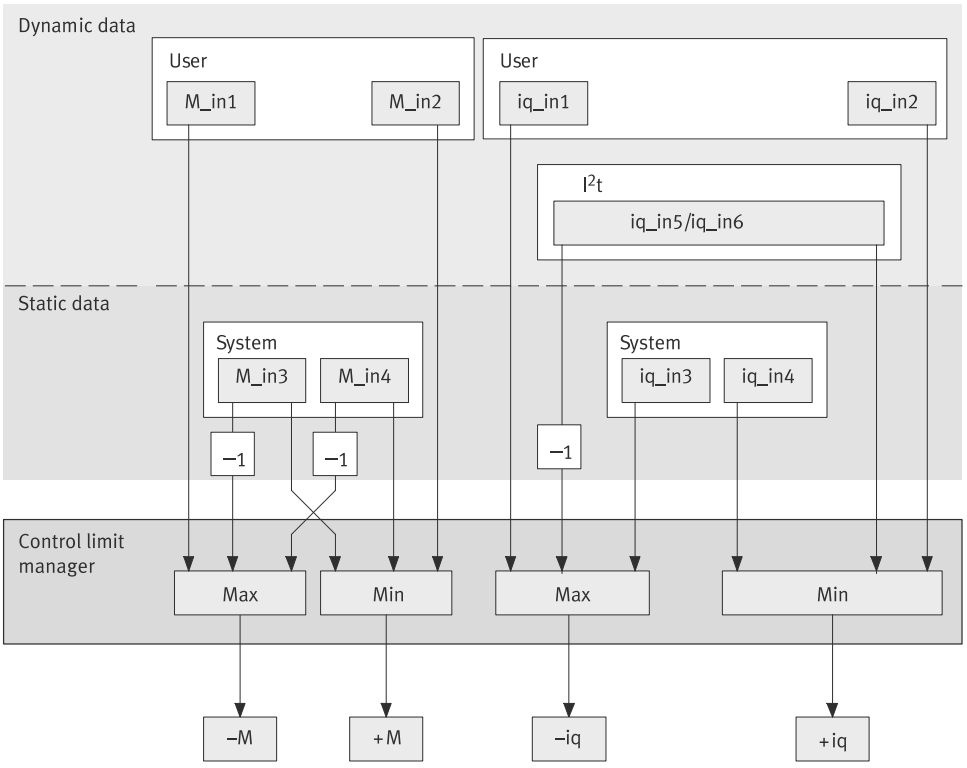


Fig. 86: Limiter for the setpoint torque and the setpoint active current

Name	Parameter	ID Px.
M_in1	Lower limit value torque (closed loop controller)	852
M_in2	Upper limit value torque (closed loop controller)	853

Name	Parameter	ID Px.
M_in3	Maximum motor torque/servo drive Specifies the maximum torque from the minimum values of the motor and servo drive controller relative to the output side with gearbox.	381
M_in4	Resulting maximum driving torque of the axis ➔ 6.2.3 Torque limitation, section ➔ Inertia compensation.	–
–M	Resulting lower limit value torque (closed loop controller)	6104
+M	Resulting upper limit value torque (closed loop controller)	6105
iq_in1	Lower limit value active current (closed loop controller)	854
iq_in2	Upper limit value active current (closed loop controller)	855
iq_in3	Resulting minimum current Specifies the static limit value "Minimum current" created from the minimum of the maximum values of the motor or servo drive with negative signs.	625
iq_in4	Resulting maximum current Specifies the static limit value "Maximum current" created from the minimum of the maximum values of the motor or servo drive.	624
iq_in5	When the limit value is reached, the current of the motor is limited to the resulting nominal current (ID Px.621).	–
iq_in6	When the limit value is reached, the current of the power output stage is limited to the resulting nominal current (ID Px.623).	–
–iq	Resulting lower limit value active current (closed loop controller)	6108
+iq	Resulting upper limit value active current (closed loop controller)	6109

Tab. 580: Legend for the block diagram limiter for setpoint torque and setpoint active current

Parameters and diagnostic messages

ID Px.	Parameter	Description	
381	Maximum motor torque/servo drive	Specifies the maximum torque from the minimum values of the motor and servo drive controller relative to the output side with gearbox.	
		Access	read/–
		Update	effective immediately
		Unit	Nm
382	Maximum motor velocity	Specifies the static limit value Maximum velocity of the motor in relation to the output side with gearbox.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
624	Resulting maximum current	Specifies the static limit value "Maximum current" created from the minimum of the maximum values of the motor or servo drive.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
625	Resulting minimum current	Specifies the static limit value "Minimum current" created from the minimum of the maximum values of the motor or servo drive with negative signs.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
850	Lower limit value velocity (closed loop controller)	Specifies the dynamic limit value "Lower limit value of velocity" specified by the user.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
851	Upper limit value velocity (closed loop controller)	Specifies the dynamic limit value "Upper limit value of velocity" specified by the user.	
		Access	read/write

ID Px.	Parameter	Description	
851	Upper limit value velocity (closed loop controller)	Update	effective immediately
		Unit	user defined
852	Lower limit value torque (closed loop controller)	Specifies the dynamic limit value "Lower limit value of the torque" specified by the user.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
853	Upper limit value torque (closed loop controller)	Specifies the dynamic limit value "Upper limit value of the torque" specified by the user.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
854	Lower limit value active current (closed loop controller)	Specifies the dynamic limit value "Lower limit value of the active current" specified by the user.	
		Access	read/write
		Update	effective immediately
		Unit	Arms
855	Upper limit value active current (closed loop controller)	Specifies the dynamic limit value "Upper limit value of the active current" specified by the user.	
		Access	read/write
		Update	effective immediately
		Unit	Arms
1199	Maximum driving torque axis	Specifies the maximum driving torque of the axis.	
		Access	read/write
		Update	reinitialization
		Unit	Nm
6100	Resulting lower limit value velocity (closed loop controller)	Specifies the limit value "Lower limit value of velocity" for velocity limitation.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
6101	Resulting upper limit value velocity (closed loop controller)	Specifies the limit value "Upper limit value of velocity" for velocity limitation.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
6104	Resulting lower limit value torque (closed loop controller)	Specifies the resulting minimum torque for torque limitation.	
		Access	read/–
		Update	effective immediately
		Unit	Nm
6105	Resulting upper limit value torque (closed loop controller)	Specifies the resulting maximum torque for torque limitation.	
		Access	read/–
		Update	effective immediately
		Unit	Nm
6108	Resulting lower limit value active current (closed loop controller)	Specifies the limit value "Lower limit value of the active current". (Conversion to the output-side torque is an internal calculation)	
		Access	read/–
		Update	effective immediately
		Unit	Arms
6109	Resulting upper limit value active current (closed loop controller)	Specifies the limit value "Upper limit value of the active current". (Conversion to the output-side torque is an internal calculation)	

ID Px.	Parameter	Description	
6109	Resulting upper limit value active current (closed loop controller)	Access	read/–
		Update	effective immediately
		Unit	Arms

Tab. 581: Parameters

ID Dx.	Name	Description
06 | 02 | 00087 (100794455)	Velocity control limitation invalid	Velocity control limitation invalid
06 | 02 | 00088 (100794456)	Torque control limitation invalid	Torque control limitation invalid
06 | 02 | 00089 (100794457)	Current control limitation invalid	Current control limitation invalid
06 | 02 | 00090 (100794458)	Maximum peak current control limitation invalid	Maximum peak current control limitation invalid

Tab. 582: Diagnostic messages

6.2.2.1 CiA 402

Control limitation objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
852	0x60E1.00	Lower limit value torque (closed loop controller)	UINT
853	0x60E0.00	Upper limit value torque (closed loop controller)	UINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
381	0x2169.01	Maximum motor torque/servo drive	REAL
382	0x2169.02	Maximum motor velocity	REAL
624	0x2169.07	Resulting maximum current	REAL
625	0x2169.08	Resulting minimum current	REAL
850	0x2168.01	Lower limit value velocity (closed loop controller)	REAL
851	0x2168.02	Upper limit value velocity (closed loop controller)	REAL
852	0x2168.03	Lower limit value torque (closed loop controller)	REAL
853	0x2168.04	Upper limit value torque (closed loop controller)	REAL
854	0x2168.05	Lower limit value active current (closed loop controller)	REAL
855	0x2168.06	Upper limit value active current (closed loop controller)	REAL
1199	0x217E.09	Maximum driving torque axis	REAL
6100	0x2168.08	Resulting lower limit value velocity (closed loop controller)	REAL
6101	0x2168.09	Resulting upper limit value velocity (closed loop controller)	REAL
6104	0x2168.0C	Resulting lower limit value torque (closed loop controller)	REAL
6105	0x2168.0D	Resulting upper limit value torque (closed loop controller)	REAL
6108	0x2168.10	Resulting lower limit value active current (closed loop controller)	REAL
6109	0x2168.11	Resulting upper limit value active current (closed loop controller)	REAL

Tab. 583: Objects

6.2.2.2 PROFIdrive

Control limitation PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
381	11122.0	Maximum motor torque/servo drive	REAL
382	11123.0	Maximum motor velocity	REAL

Parameter	PNU	Name	Data type
624	11163.0	Resulting maximum current	REAL
625	11164.0	Resulting minimum current	REAL
850	11212.0	Lower limit value velocity (closed loop controller)	REAL
851	11213.0	Upper limit value velocity (closed loop controller)	REAL
852	11214.0	Lower limit value torque (closed loop controller)	REAL
853	11215.0	Upper limit value torque (closed loop controller)	REAL
854	11216.0	Lower limit value active current (closed loop controller)	REAL
855	11217.0	Upper limit value active current (closed loop controller)	REAL
1199	11301.0	Maximum driving torque axis	REAL
6100	11640.0	Resulting lower limit value velocity (closed loop controller)	REAL
6101	11641.0	Resulting upper limit value velocity (closed loop controller)	REAL
6104	11644.0	Resulting lower limit value torque (closed loop controller)	REAL
6105	11645.0	Resulting upper limit value torque (closed loop controller)	REAL
6108	11648.0	Resulting lower limit value active current (closed loop controller)	REAL
6109	11649.0	Resulting upper limit value active current (closed loop controller)	REAL

Tab. 584: PNUs

6.2.3 Torque limitation

The torque limitation restricts the torque related to the drive output shaft end directly at the output of the speed controller. For drive systems with gear unit the shaft end of the gear unit output is on the drive output side.
Current limitation values from the configuration of the servo drive, the motor and the specifications of the user are converted internally to a resulting torque based on the shaft end on the drive output side ➔ Fig. 87.
The input values -M, + M, –iq, + iq are the output values of the limiter for setpoint torque and setpoint active current ➔ Fig. 86.
The resulting limit values (–LIM1, + LIM1) limit the output value (iq_ref) of the speed controller, including the torque pilot controller ➔ Fig. 82.

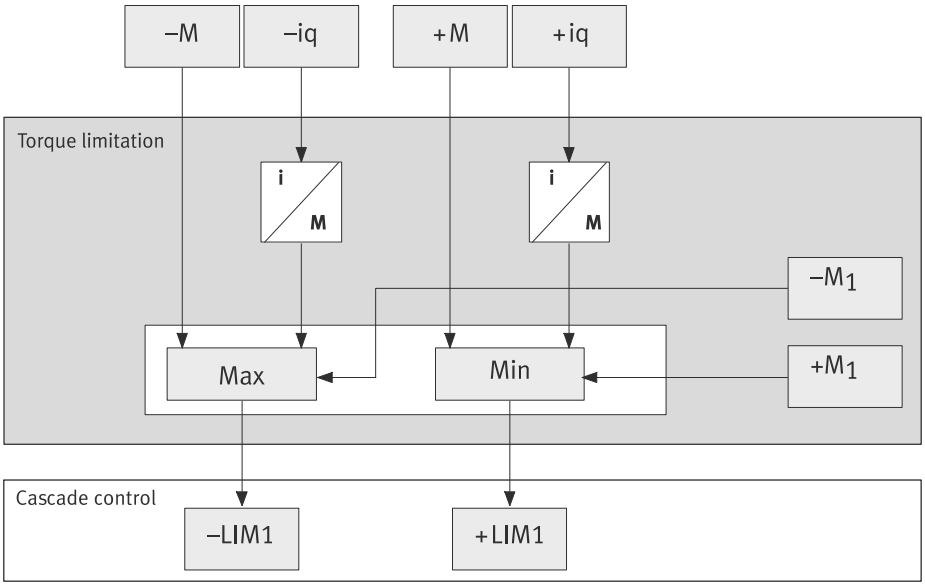


Fig. 87: Torque limiter structure

Name	Parameters	ID Px.
–iq	Resulting lower limit value active current (closed loop controller)	6108
+iq	Resulting upper limit value active current (closed loop controller)	6109

Name	Parameters	ID Px.
–M	Resulting lower limit value torque (closed loop controller)	6104
+M	Resulting upper limit value torque (closed loop controller)	6105
$-M_1$	Resulting limit value from the reactive current reduction, which also acts on the torque limitation ➔ 7.4.1 Field weakening	–
$+M_2$		
–LIM1	Minimum torque, acts in the cascade controller This value is additionally limited by Px.526796, Maximum torque symmetrical.	2218
+LIM1	Maximum torque This value is additionally limited by Px.526796, Maximum torque symmetrical.	2219

Tab. 585: Legend for the block diagram of the torque limiter

The resulting limit values iq are the result of the control limitation ➔ 6.2.2 Control limitation.
The minimum torque LIM1- and the maximum torque LIM1 + affect the output of the speed controller ➔ 6.1.3 Speed controller.

Inertia compensation

The inertia of motor, gear unit and coupling reduce the effective torque at the output side shaft end. Therefore, the specified value for the torque limitation is not fully available for acceleration of the load. This can be compensated by the following parameters:
– Inertia Gear (Px.124321)
– Inertia coupling (Px.124322)
– Dynamic losses (Px.124323)
– Selection of dynamic torque boost (Px.102223)
The resulting limit values + M_in4 and –M_in4 consist of the static limit value of the axis Px.1199 and the dynamic losses Px.124323 and the compensation of motor, gear unit and coupling inertia. The resulting limit values + M_in4 and –M_in4 act on the control limitation ➔ Fig. 86.
The inertia for the gear unit is a function of the motor shaft. If there are multiple gear units in the drive train, the total inertia must be calculated.
Example: 2 gear units installed one behind the other. Gear unit 1 is installed on the motor and gear unit 2 is installed on gear unit 1. Gear unit 1 has a ratio of i_1 and an input inertia of J_1. Gear unit 2 has a ratio i_2 and an input inertia of J_2.
$J_{total} = (J_2 \times i_1^2) + J_1$
With 3 gear units the formula is:
$J_{total} = ((J_3 \times i_2^2 + J_2) \times i_1^2) + J_1$

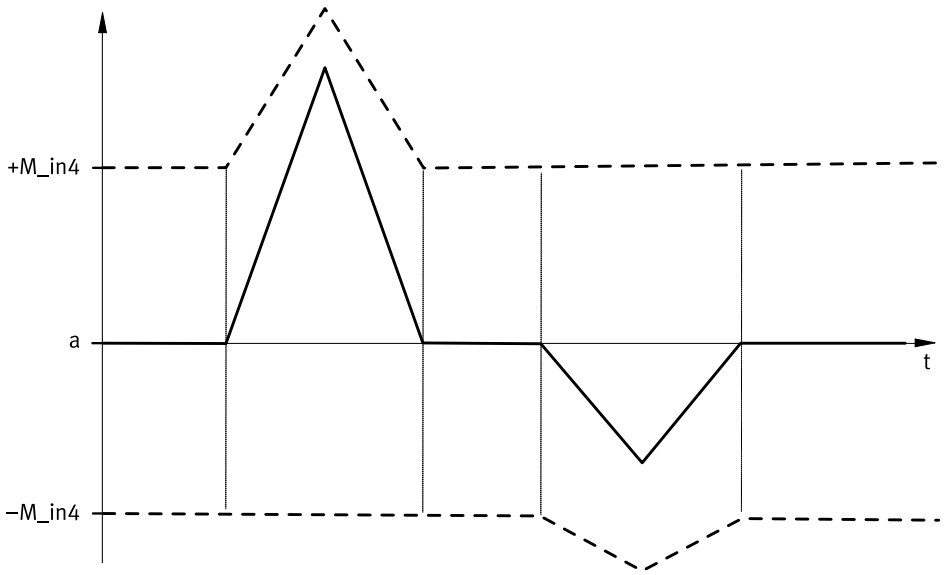


Fig. 88: Inertia compensation

Name	Description
a	Acceleration in user units
M_in4	resulting maximum driving torque of the axis (Px.1199 + Px.124323 * total gear ratio + inertia * acceleration)

Tab. 586: Legend

Selection of dynamic torque boost

The dynamic torque increase can be influenced with the parameter Px.102223 "Selection of dynamic torque boost", see also ➔ 6.2.2 Control limitation, ➔ Fig. 86.

Values:

- 0: None: it is calculated without boost.
- 1: Axis limitation: the Px.1199 parameter is increased, then the input is calculated with the modified value.
- 2: All limitations: the input is calculated and the result is derived from that.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
87	Setpoint value reactive current	Specifies the reactive current setpoint for the current controller.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
856	Limit value total current (closed loop controller)	Specifies the limit value of the total current for the servo drive.	
		Access	read/write
		Update	effective immediately
		Unit	Arms
2218	Minimum torque	Specifies the minimum torque for torque limitation.	
		Access	read/–
		Update	effective immediately
		Unit	Nm
2219	Maximum torque	Specifies the maximum torque for torque limitation.	
		Access	read/–
		Update	effective immediately
		Unit	Nm

ID Px.	Parameter	Description	
6104	Resulting lower limit value torque (closed loop controller)	Specifies the resulting minimum torque for torque limitation.	
		Access	read/–
		Update	effective immediately
		Unit	Nm
6105	Resulting upper limit value torque (closed loop controller)	Specifies the resulting maximum torque for torque limitation.	
		Access	read/–
		Update	effective immediately
		Unit	Nm
6108	Resulting lower limit value active current (closed loop controller)	Specifies the limit value "Lower limit value of the active current". (Conversion to the output-side torque is an internal calculation)	
		Access	read/–
		Update	effective immediately
		Unit	Arms
6109	Resulting upper limit value active current (closed loop controller)	Specifies the limit value "Upper limit value of the active current". (Conversion to the output-side torque is an internal calculation)	
		Access	read/–
		Update	effective immediately
		Unit	Arms
6112	Resulting upper limit value total current (closed loop controller)	Specifies the limit value of the total current.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
124321	Inertia Gear	Specifies the total inertia of all gears in the drive train. The value is required for raising the torque limitation during the acceleration and deceleration phase. The inertia for the gear unit refers to the motor shaft. If there are several gear units in the drive train, the total inertia must be calculated on the drive side.	
		Access	read/write
		Update	reinitialization
		Unit	kgm²
124322	Inertia coupling	Specifies the inertia of the clutch in the drive train. The value is required for increasing the torque limitation during the acceleration and deceleration phase.	
		Access	read/write
		Update	reinitialization
		Unit	kgm²
124323	Dynamic losses	Specifies the friction losses in Nm related to the motor side (gearbox input). The value raises the torque limit permanently to compensate for these losses.	
		Access	read/write
		Update	reinitialization
		Unit	Nm
102223	Selection of dynamic torque boost	Specifies to which torque limit the dynamic boost is applied.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 587: Parameters

Diagnostic messages No specific diagnostic messages are allocated to the function.

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Torque limitation objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
87	0x2153.08	Setpoint value reactive current	REAL
856	0x2168.07	Limit value total current (closed loop controller)	REAL
2218	0x215B.0A	Minimum torque	REAL
2219	0x215B.0B	Maximum torque	REAL
6104	0x2168.0C	Resulting lower limit value torque (closed loop controller)	REAL
6105	0x2168.0D	Resulting upper limit value torque (closed loop controller)	REAL
6108	0x2168.10	Resulting lower limit value active current (closed loop controller)	REAL
6109	0x2168.11	Resulting upper limit value active current (closed loop controller)	REAL
6112	0x2168.14	Resulting upper limit value total current (closed loop controller)	REAL
124321	0x2182.0F	Inertia Gear	REAL
124322	0x217F.0A	Inertia coupling	REAL
124323	0x217E.0B	Dynamic losses	REAL
102223	0x2168.1B	Selection of dynamic torque boost	USINT

Tab. 588: Objects

6.2.3.2 PROFIdrive

Torque limitation PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
87	11042.0	Setpoint value reactive current	REAL
856	11218.0	Limit value total current (closed loop controller)	REAL
2218	11414.0	Minimum torque	REAL
2219	11415.0	Maximum torque	REAL
6104	11644.0	Resulting lower limit value torque (closed loop controller)	REAL
6105	11645.0	Resulting upper limit value torque (closed loop controller)	REAL
6108	11648.0	Resulting lower limit value active current (closed loop controller)	REAL
6109	11649.0	Resulting upper limit value active current (closed loop controller)	REAL
6112	11652.0	Resulting upper limit value total current (closed loop controller)	REAL
124321	12448.0	Inertia Gear	REAL
124322	12449.0	Inertia coupling	REAL
124323	12450.0	Dynamic losses	REAL
102223	13073.0	Selection of dynamic torque boost	USINT

Tab. 589: PNUs

6.3 Pilot control (closed-loop control setpoint values)

6.3.1 Setpoint value connection

The pilot control (FFC feed forward control) creates the setpoint values for the cascade controller, e.g. from
– the time derivations of the set values
– a constant value (offset)
This ensures that the positioning response of the drive is greatly improved, e.g. a reduction of the following error or improved run-in response to the target position.

The input variables for the pilot control are directly connected to the output variable or are adjusted using a mathematical operation:

– Output variables with the same physical meaning are added within the pilot control component. The added value can additionally be influenced by a weighting factor (gain).
– Every mathematical operation with the input variables v (speed) and a (acceleration) has a deceleration element of the first order connected in series. An inactive time element is connected in series for the position.

A constant value can be stipulated for the weight force compensation.

The following pilot control values are valid for the various operating modes of the cascade controller. The pilot control also acts in the interpolating operating modes via fieldbus.

Input variable	Output variable	Pilot control	Operating mode[1]		
			P	V	T
v	v	Speed (default)	•	–	–
a	M	Torque (inertia)	•	•	–
v	M	Torque (friction)	•	•	–
–	M	Torque (constant value)	•	•	•

1) P = positioning mode, V = speed mode, T = torque mode

Tab. 590: Pilot control

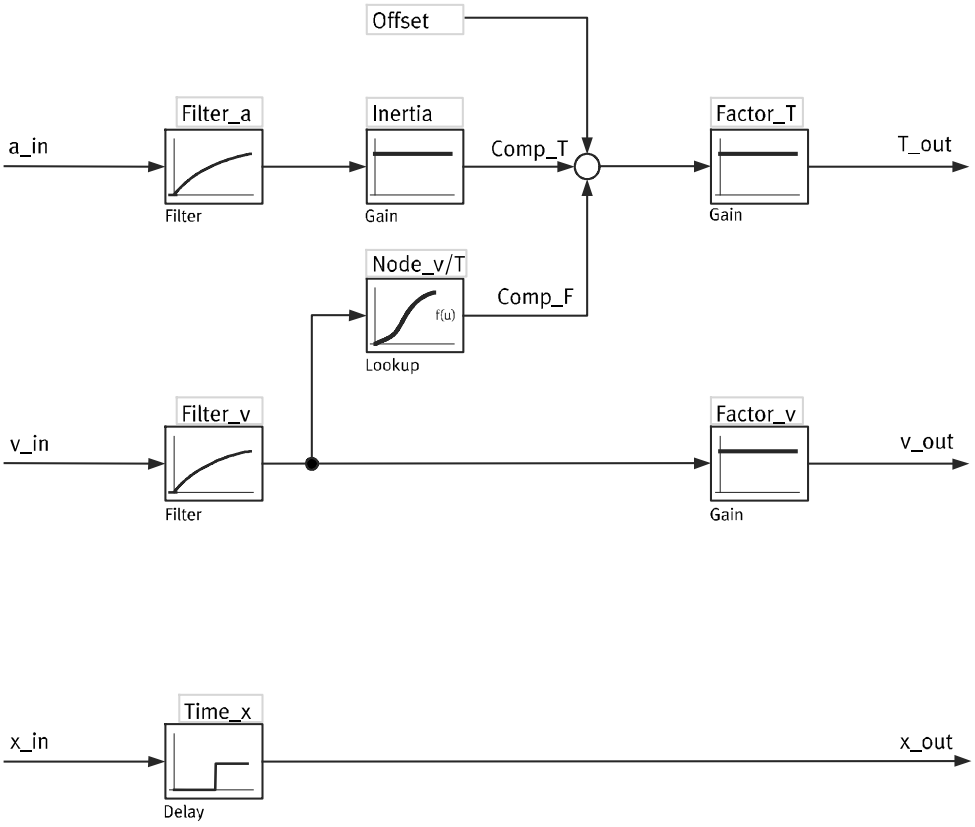


Fig. 89: Pilot control

Name	Description	ID Px.
x_in, v_in, a_in	Position, speed and acceleration setpoint values as input variables of the pilot control	
	Setpoint management output position	290
	Setpoint management output velocity	291
	Setpoint management output acceleration	292

Name	Description	ID Px.
x_out, v_out, T_out	Setpoint values for the cascade controller	
	Setpoint position	90
	Setpoint velocity	91
	Setpoint torque	94
t_x <- time_x	Inactive time position setpoint value (integer multiple of the device-specific scanning time of the closed-loop controller)	957
t_v <- filter_v	Time constant velocity setpoint value filter	958
t_a <- filter_a	Time constant acceleration setpoint value filter	959
Factor_v	Amplification gain velocity feed forward control	967
Factor_T	Amplification gain torque feed forward control	968
Offset	Offset torque	969
Inertia	Total inertia	973
Comp_F	Setpoint value friction compensation The parameter can be used, for example, to assess the component of the feed forward control from the friction compensation by means of measured data recording (trace).	974
Comp_T	Setpoint value inertia compensation The parameter can be used, for example, to assess the component of the feed forward control from the inertia compensation by means of measured data recording (trace).	975
Node_v	Support point velocity [rad/s]	976
Node_T	Support point torque [Nm]	977

Tab. 591: Legend for the pilot control block diagram

Certain parameters of the pilot control are not entered in user units but, e.g. in Nm or rad/s and their derivations. The user unit is automatically converted to rad/s by the device.
The inertia for the inertia compensation is stipulated in kgm² (Px.973) and the support points of the table for the friction compensation Node_T (Px.976) in Nm and Node_v in rad/s (Px.977).

Parameters

ID Px.	Parameter	Description	
90	Setpoint position	Position output from feed forward control as setpoint value for the closed-loop controller	
		Access	read/–
		Update	effective immediately
		Unit	user defined
91	Setpoint velocity	Velocity output from feed forward control as setpoint value for the closed-loop controller	
		Access	read/–
		Update	effective immediately
		Unit	user defined
92	Setpoint acceleration	Acceleration output from feed forward control as setpoint value for the closed-loop controller	
		Access	read/–
		Update	effective immediately
		Unit	user defined
93	Setpoint jerk	Jerk output from feed forward control as setpoint value for the closed-loop controller	
		Access	read/–
		Update	effective immediately
		Unit	user defined
94	Setpoint torque	Torque output from feed forward control as setpoint value for the closed-loop controller	
		Access	read/–

ID Px.	Parameter	Description	
94	Setpoint torque	Update	effective immediately
		Unit	Nm
95	Setpoint current	Current output from feed forward control	
		Access	read/–
		Update	effective immediately
		Unit	Arms
957	Inactive time position setpoint value	Specifies the dead time of the position setpoint in integer samples of the position control loop.	
		Access	read/write
		Update	effective immediately
		Unit	–
958	Time constant velocity setpoint value filter	Time constant velocity setpoint value filter	
		Access	read/write
		Update	effective immediately
		Unit	s
959	Time constant acceleration setpoint value filter	Time constant acceleration setpoint value filter	
		Access	read/write
		Update	effective immediately
		Unit	s
967	Amplification gain velocity feed forward control	Amplification gain velocity feed forward control	
		Access	read/write
		Update	effective immediately
		Unit	–
968	Amplification gain torque feed forward control	Amplification gain torque feed forward control	
		Access	read/write
		Update	effective immediately
		Unit	–
969	Offset torque	Specifies the offset for a torque. For vertically mounted axes, it is recommended to specify a determined value for the loads used for weight compensation. The value can be determined by teaching.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
973	Total inertia	Specifies the total inertia torque of the drive train (axis, gear unit, motor, load). A value input by the user is overwritten with the total of all inertias from the configured drive train, including the load, by calculation of the control parameters.	
		Access	read/write
		Update	effective immediately
		Unit	kgm²
974	Setpoint value friction compensation	The parameter can be used, for example, to assess the component of the feed forward control from the friction compensation by means of measured data recording (trace).	
		Access	read/–
		Update	effective immediately
		Unit	Nm
975	Setpoint value inertia compensation	The parameter can be used, for example, to assess the component of the feed forward control from the inertia compensation by means of measured data recording (trace).	
		Access	read/–
		Update	effective immediately

ID Px.	Parameter	Description	
975	Setpoint value inertia compensation	Unit	Nm
976	Support point velocity [rad/s]	Maximum of 16 support points via Index 0 ... 15. Velocity [rad/s] of the drive train (axis, gear unit, motor, load) based on the gear unit output.	
		Access	read/write
		Update	effective immediately
		Unit	–
977	Support point torque [Nm]	Maximum of 16 support points via Index 0 ... 15. Torque [Nm] of the drive train (axis, gear unit, motor, load) based on the gear unit output.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
978	Number of support points	Number of support points for which the look-up table friction compensation is to be used.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 592: Parameters

6.3.2 Inertia and friction compensation

For the inertia compensation it is multiplied with the setpoint acceleration. The value for the inertia is the total inertia of the drive system. If the switchover is carried out on a different control parameter set, the applicable inertia is also superimposed from the control parameter set.
The friction is compensated via a look-up table. In the table torque is plotted via support points via angular velocity. Linear interpolation is applied between the support points. The input variable is always the angular velocity independent of the selected user unit. The output variable is the torque. If the input variable is larger or smaller than the last value of the support point of the angular velocity, the last value of the torque support point is used as output variable.
The use of an offset can, for example, be practical for a vertical mounting position of an axis.
The output variables for the velocity and torque feed forward control can be weighted via separate factors.

Example for inertia compensation

A torque can be feed forward-controlled depending on the total inertia in the drive system with the inertia compensation. The torque is composed of the total inertia multiplied by the velocity set value.

Example of the drive system:

- EMMS-ST-57-M-SEB-G2
- EMGA-60-P-G3-SST-57
- ELGR-TB-55-1000-0H
- Load mass 5 kg

Excerpt from datasheet ELGR axis:

Mass moments of inertia		
Size		55
J_O	[kg mm²]	360
J_H per metre stroke	[kg mm²/m]	1.88

Mass moments of inertia		
Size		55
J_L per kg payload	[kg mm²/kg]	205.21
J_W for additional slide	[kg mm²]	301.92

Tab. 593: Mass moments of inertia for ELGR axis

Mass moment of inertia J_A of the entire axis:
$J_A = J_O + K * J_W + J_H$ x working stroke [m] + $J_L * m_{payload}$ [kg]
K = number of the additional slides

Excerpt from datasheet EMMS-ST motor:

Technical data			
Size			57-M
Motor			
...			
Total output moment of inertia			
	without brake	[kgcm²]	0.48
	with brake	[kgcm²]	0.50
...			

Tab. 594: Technical data of the EMMS-ST motor

Calculation of total inertia Px.973:

$J_{Total} = J_{ELGR} + J_{EMMS-ST} * i^2 = 3.6$ kgcm² + 0.0188 kgcm² / m * 1 m + 2.0521 kgcm² / kg * 5 kg + 0.5 kgcm² * 3² = 18.3793 kgcm² = 0.00183793 kgm²
(i = gear ratio)

Calculation of torque:

$M = J_{total} * \alpha$
(α = angular acceleration)

Example for friction compensation

There is the option of feed forward control of a velocity-dependent torque, for which a look-up table is available. The torque is composed of the support points of the look-up table depending on the angular velocity.

Example of the drive system:

- EMMS-ST-57-M-SEB-G2
- ELGR-TB-55-1000-0H
- Load mass 5 kg
- Maximum velocity v_{max} = 3 m/s
- Feed 0.09 m
- Cohesive friction M_{stic} = 0.2 Nm
- Velocity-dependent friction M_v = 0.005 Nm * s/rad

Calculation of torque:

$M = M_{stic} + M_v * \omega$
(ω = angular velocity)

Interpolation point	Velocity [rad/s]		Interpolation point	Torque [Nm]
P1.976.0.0	–209.4395		P1.977.0.0	–1.2472
P1.976.0.1	–34.9066		P1.977.0.1	–0.3745
P1.976.0.2	–6.9813		P1.977.0.2	–0.2349
P1.976.0.3	–3.4907		P1.977.0.3	–0.2175
P1.976.0.4	–0.6981		P1.977.0.4	–0.2035
P1.976.0.5	–0.3491		P1.977.0.5	–0.2017
P1.976.0.6	–0.0698		P1.977.0.6	–0.2003
P1.976.0.7	0		P1.977.0.7	0

Interpolation point	Velocity [rad/s]		Interpolation point	Torque [Nm]
P1.976.0.8	0.0698		P1.977.0.8	0.2003
P1.976.0.9	0.3491		P1.977.0.9	0.2017
P1.976.0.10	0.6981		P1.977.0.10	0.2035
P1.976.0.11	3.4907		P1.977.0.11	0.2175
P1.976.0.12	6.9813		P1.977.0.12	0.2349
P1.976.0.13	34.9066		P1.977.0.13	0.3745
P1.976.0.14	209.4395		P1.977.0.14	1.2472

Tab. 595: Look-up table

Parameters	Value
P1.978.0.0	15

Tab. 596: Number of support points

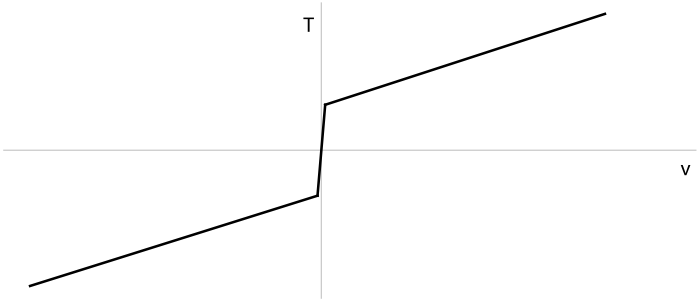


Fig. 90: View of look-up table

6.3.3 Torque pilot control torque via position

The servo drive has a torque pilot control via position. A torque is specified as a pilot value for the current regulator based on a position.

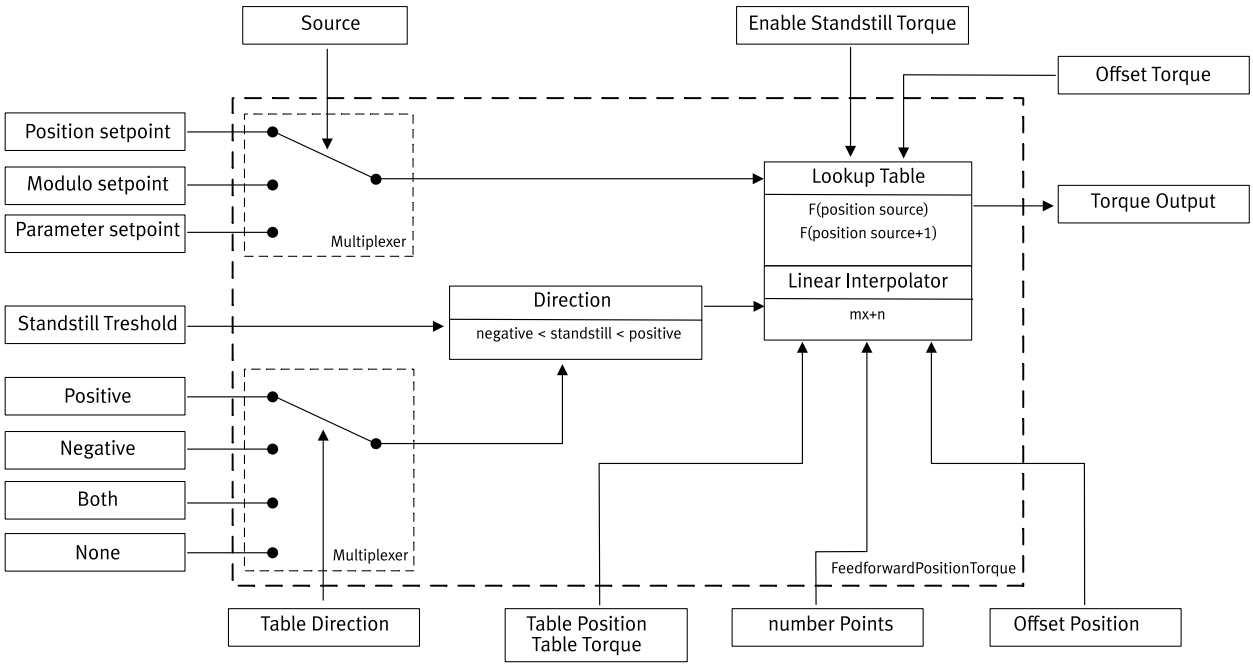


Fig. 91: Torque pilot control torque via position

Table

The torque via position is described by two tables that contain the position/torque pair. Torque Px.102644, position Px.102645.

- The table requires at least two entries to define the lower/upper limit of the application range and a maximum of 64 entries.
- The table requires a number of entries that must be set corresponding to the filled values. Px.102646.
- Table values must always be filled from the first entry.
- Table position values that are duplicated in the table are ignored and the pair of the first occurrence is used.
- Static torque ranges can be specified by constant torque values within a specific range.
- The actual torque between two positions is a linear interpolation.
- If the position value is outside the lower or upper position values from the table, 0 is output.

Setpoint selector

A Px.102643 reference source is required for referencing a torque from the lookup table.

Source	Description	Behaviour
Setpoint position	The position setpoint is used as the current setpoint value.	The table torque can be described as an absolute position and is only referenced to this position.
Setpoint position modulo	The modulo position value is used as the current setpoint value.	The torque table can be described by modulo positions and repeats infinitely between the modulo positions.
Parameter Px.102649	The position value is used by a specified parameter as the current setpoint value.	The Torque Manual Position value is used and can be updated via the external fieldbus, manually or as specified by the customer.

Tab. 597: Setpoint selector

Direction

The table requires a direction property to describe the torque value according to the direction of motion. The meaning of the direction is defined in the "Dimension Reference System" specification.

Direction	Description	Behaviour
Positive	The torque via position table is only used for movement in the positive direction.	A torque value is used for the positive direction of movement. In the negative direction the output value = 0.
Negative	The torque via position table is only used for movement in the negative direction.	A torque value is used for the negative direction of movement. In the positive direction the output value = 0.
Both	The torque via position table is used for both directions of motion.	The torque values should be described as a reference in the positive direction of motion. In the negative direction the torque value is multiplied by -1, which results in an inverted value for the pilot control.
Standstill	The table is only applied at standstill if the speed is within the standstill threshold.	During standstill phases the torque is applied as it corresponds to the table definition at the position.

Tab. 598: Direction

Torque at standstill direction

This function also allows the specification of a torque exclusively in standstill situations. A value from the table is output if the current speed is below the symmetrical standstill detection limit Px.101149, the parameter Px.101097 is activated and standstill is selected as the direction.

If the standstill detection limit value Px.101149 is deactivated, the output of the pilot control torque via position = 0.

Output value

The value resulting from the calculation of the resulting torque as a function of position can be influenced by an offset for the torque Px.102648 or an offset for the position Px.102647.

Parameters and diagnostic Messages

ID Px.	Parameter	Description	
101082	Activation Torque/Position	Activates the torque pre-control torque over position.	
		Access	read/write
		Update	effective immediately
		Unit	–
101089	Torque/Position	Display whether torque pre-control torque over position is active.	
		Access	read/–
		Update	effective immediately
		Unit	–
101097	Activation torque at standstill	Activates the output of a torque even below the limit value Standstill Px.101149.	
		Access	read/write
		Update	effective immediately
		Unit	–
101131	Output Torque/Position	Displays the output value of the Torque via position table.	
		Access	read/–
		Update	effective immediately
		Unit	Nm
101149	Limit value standstill detection	Specifies the limit value for the standstill detection. If the value falls below the limit value and the function is activated via Px.101149, a torque is also output. Otherwise, no torque is output.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
102642	Direction Torque/Position	Specifies the direction for which the torque over position feedforward control is active.	
		Access	read/write
		Update	effective immediately
		Unit	–
102643	Setpoint Selector Torque/Position	Specifies the source from which the torque over position feedforward control uses the position as a reference.	
		Access	read/write
		Update	effective immediately
		Unit	–
102644	Torque table	Specifies the table for the torque that is used for torque over position feedforward control. The number of entries must be the same as in parameter Px.102645 and the number must be specified in parameter Px.102646. Array 0 … 63	
		Access	read/write
		Update	effective immediately
		Unit	Nm

ID Px.	Parameter	Description	
102645	Position table	Specifies the table for the position that is used for torque over position feedforward control. The position values must be specified in ascending order. The number of entries must be the same as in parameter Px.102645 and the number must be specified in parameter Px.102646. Array 0 ... 63	
		Access	read/write
		Update	effective immediately
		Unit	user defined
102646	Number of table elements	Specifies the number of entries for the torque and position table.	
		Access	read/write
		Update	effective immediately
		Unit	–
102647	Offset Position Torque/Position	Specifies the offset for the position of the torque over position feedforward control.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
102648	Offset Torque Torque/Position	Specifies the offset for the torque of the torque over position feedforward control.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
102649	Source Parameter Torque/Position	Specifies the position value as the source for the torque over position feedforward control.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 599: Parameter

Diagnostic messages No specific diagnostic messages are allocated to the function.

6.3.3.1 CiA 402

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific parameters**		
101082	0x2439.01	Activation Torque/Position	USINT
101089	0x2439.02	Torque/Position	USINT
101097	0x2439.04	Activation torque at standstill	USINT
101131	0x2439.05	Output Torque/Position	REAL
101149	0x2439.06	Limit value standstill detection	REAL
102642	0x2439.07	Direction Torque/Position	USINT
102643	0x2439.08	Setpoint Selector Torque/Position	USINT
102644	0x22F3.01 ... 40	Torque table	REAL
102645	0x22F4.01 ... 40	Position table	LINT
102646	0x2439.09	Number of table elements	UDINT
102647	0x2439.0A	Offset Position Torque/Position	LINT
102648	0x2439.0B	Offset Torque Torque/Position	REAL
102649	0x2439.0C	Source Parameter Torque/Position	LINT

Tab. 600: Objects

6.3.3.2 PROFIdrive

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
101082	13185.0	Activation Torque/Position	BOOL
101089	13186.0	Torque/Position	BOOL
101097	13188.0	Activation torque at standstill	BOOL
101131	13189.0	Output Torque/Position	REAL
101149	13190.0	Limit value standstill detection	REAL
102642	13193.0	Direction Torque/Position	USINT
102643	13194.0	Setpoint Selector Torque/Position	USINT
102644	13195.0 ... 63	Torque table	REAL
102645	13196.0 ... 63	Position table	LINT
102646	13197.0	Number of table elements	UDINT
102647	13198.0	Offset Position Torque/Position	LINT
102648	13199.0	Offset Torque Torque/Position	REAL
102649	13200.0	Source Parameter Torque/Position	LINT

Tab. 601: PNUs

6.3.4 CiA 402

Pilot control objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
90	0x6062.00	Setpoint position	DINT
91	0x606B.00	Setpoint velocity	DINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
90	0x2154.01	Setpoint position	LINT
91	0x2154.02	Setpoint velocity	REAL
92	0x2154.03	Setpoint acceleration	REAL
93	0x2154.04	Setpoint jerk	REAL
94	0x2154.05	Setpoint torque	REAL
95	0x2154.06	Setpoint current	REAL
957	0x2154.07	Inactive time position setpoint value	UDINT
958	0x2154.08	Time constant velocity setpoint value filter	REAL
959	0x2154.09	Time constant acceleration setpoint value filter	REAL
967	0x2154.0A	Amplification gain velocity feed forward control	REAL
968	0x2154.0B	Amplification gain torque feed forward control	REAL
969	0x2154.0C	Offset torque	REAL
973	0x2154.0D	Total inertia	REAL
974	0x2154.0E	Setpoint value friction compensation	REAL
975	0x2154.0F	Setpoint value inertia compensation	REAL
976	0x2225.01 ... 10	Support point velocity [rad/s]	REAL
977	0x2226.01 ... 10	Support point torque [Nm]	REAL
978	0x2154.10	Number of support points	UDINT

Tab. 602: Objects

6.3.5 PROFIdrive

Pilot control PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
90	11045.0	Setpoint position	LINT
91	11046.0	Setpoint velocity	REAL
92	11047.0	Setpoint acceleration	REAL
93	11048.0	Setpoint jerk	REAL
94	11049.0	Setpoint torque	REAL
95	11050.0	Setpoint current	REAL
957	11246.0	Inactive time position setpoint value	UDINT
958	11247.0	Time constant velocity setpoint value filter	REAL
959	11248.0	Time constant acceleration setpoint value filter	REAL
967	11249.0	Amplification gain velocity feed forward control	REAL
968	11250.0	Amplification gain torque feed forward control	REAL
969	11251.0	Offset torque	REAL
973	11252.0	Total inertia	REAL
974	11253.0	Setpoint value friction compensation	REAL
975	11254.0	Setpoint value inertia compensation	REAL
976	11255.0 ... 15	Support point velocity [rad/s]	REAL
977	11256.0 ... 15	Support point torque [Nm]	REAL
978	11257.0	Number of support points	UDINT

Tab. 603: PNUs

6.4 Vibration suppression

6.4.1 Introduction

Every mechanical system has its own natural frequencies, e.g. a drive system in combination with a machine frame. If such a mechanical system with natural frequencies is excited, such as by the position signal of a control or specification of a setpoint value, the system will vibrate. The vibrations can no longer be suppressed by the control or are even amplified.
The device offers the following options for avoiding these excitation frequencies in the control signal or setpoint value:
– Blocking filter ➔ 6.4.2.1 Notch filter
– Input shaping ➔ 6.4.3.1 Input shaping

6.4.2 Notch filter

6.4.2.1 Function

The notch filter is located between the speed controller and the current regulator (position signal). Since the notch filter is thus in the control loop and has an effect, its use has a strong influence on the design of the closed-loop control and the stability of the control. Notch filters should therefore be used with caution.
A notch filter should be used where a specific interference frequency influences the drive system. A notch filter should be used, for example, if a specific rotational speed causes the drive system to produce high-frequency vibrations in the position signal that cannot be suppressed by the rotational speed control.

High-frequency vibrations that cannot be suppressed by the control are vibrations above the bandwidth of the closed-loop controller (approx. > 200 Hz).
If high-frequency interference frequencies in the position signal are caused by a specific rotational speed, the interference frequencies can be detected by a data recording (trace) of the setpoint active current and the setpoint rotational speed when passing through a speed ramp.
The notch filters are connected in series. The number of implemented notch filters is device-specific. The characteristics of the filter can be parameterised and are determined by the filter frequency and filter bandwidth.

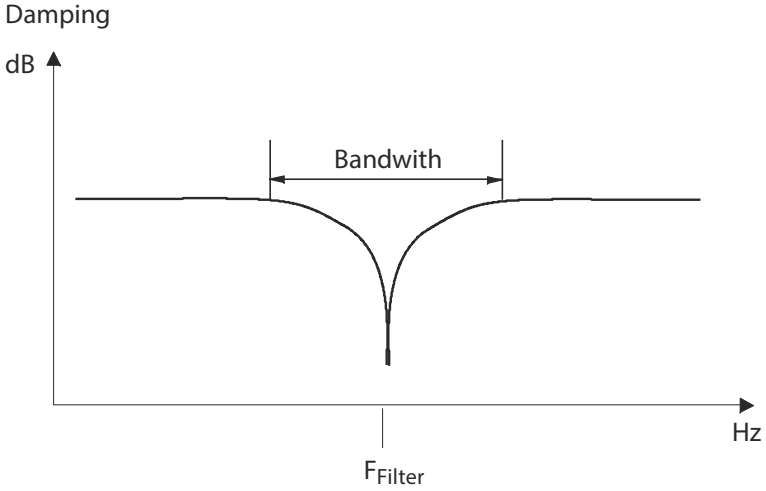


Fig. 92: Filter bandwidth and filter frequency

Name	Description	ID Px.
Bandwith	Band width of notch filter	49
Damping	Cushioning	–
F_{Filter}	Filter frequency notch filter	40

Tab. 604: Legend for the filter bandwidth and filter frequency diagram

Parameters and diagnostic Messages

Parameter allocation:
- Index 0: blocking filter 1
- Index 1: blocking filter 2
- Index 2: blocking filter 3

ID Px.	Parameter	Description	
40	Filter frequency notch filter	Fixes the filter frequency of the notch filter.	
		Access	read/write
		Update	effective immediately
		Unit	Hz
49	Band width of notch filter	Fixes the filter band width of the notch filter.	
		Access	read/write
		Update	effective immediately
		Unit	Hz
50	Notch filter output active current	Specifies the filtered setpoint value of the active current.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
51	Activation of notch filter	Fixes whether the notch filter is active or inactive. – 1: active – 0: inactive	

ID Px.	Parameter	Description	
51	Activation of notch filter	Access	read/write
		Update	effective immediately
		Unit	–
52	Setpoint value active current unfiltered	Specifies the unfiltered setpoint value of the active current.	
		Access	read/–
		Update	effective immediately
		Unit	Arms

Tab. 605: Parameter

ID Dx.	Name	Description
06 | 00 | 00082 (100663378)	Notch filter frequency invalid	The parameterisation of the notch filter frequency is invalid

Tab. 606: Diagnostic messages

6.4.2.2 CiA 402

Notch filter objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
40	0x2221.01 ... 03	Filter frequency notch filter	REAL
49	0x2222.01 ... 03	Band width of notch filter	REAL
50	0x2223.01 ... 03	Notch filter output active current	REAL
51	0x2224.01 ... 03	Activation of notch filter	USINT
52	0x2152.06	Setpoint value active current unfiltered	REAL

Tab. 607: Objects

6.4.2.3 PROFIdrive

Notch filter PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
40	11022.0 ... 2	Filter frequency notch filter	REAL
49	11031.0 ... 2	Band width of notch filter	REAL
50	11032.0 ... 2	Notch filter output active current	REAL
51	11033.0 ... 2	Activation of notch filter	BOOL
52	11034.0	Setpoint value active current unfiltered	REAL

Tab. 608: PNUs

6.4.3 Input shaping

6.4.3.1 Function

Input shaping is a control strategy for compensation of natural frequencies in mechanical systems in a natural frequency range of 2 ... 100 Hz that are excited by dynamic motion processes.
The input shaping is located in the setpoint value channel and therefore has no influence on the design of the closed-loop controller and the stability of the closed-loop control. The required track is modified to ensure that as far as possible the natural frequencies of the system are not excited.
The modification of the trajectory is located in the setpoint specification and is only effective in the Position mode profile. 2 frequencies are available for elimination of the mechanical natural frequencies.

Modification of the setpoint trajectory results in a longer positioning time in the first step, but this can possibly be compensated by higher jerk and acceleration values.
If the setpoint value specification causes a low-frequency mechanical vibration in the machine frame when a drive system moves, the natural frequency can be detected as follows:
- If there are vibrations in actual values, the natural frequency can be detected by recording measurement data of the actual speed or the actual active current during the run-in behaviour to the target position (trace).
- If there are no vibrations in actual values, the natural frequency can be detected with suitable measuring equipment, e.g. with an acceleration sensor on the drive load or the machine frame subject to vibration.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
144316	Damping	Specifies the damping of the drive system for vibration suppression.	
		Access	read/write
		Update	effective immediately
		Unit	–
144317	Natural frequency	Specifies the natural frequency of the drive system for vibration suppression.	
		Access	read/write
		Update	effective immediately
		Unit	Hz
144318	Activation of vibration suppression	Specifies whether vibration suppression should be active.	
		Access	read/write
		Update	effective immediately
		Unit	–
144319	Vibration suppression active	Display whether vibration suppression is active.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 609: Parameters

6.4.3.2 CiA 402

Input shaping objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
144316	0x2281.01 ... 02	Damping	REAL
144317	0x2282.01 ... 02	Natural frequency	REAL
144318	0x2283.01 ... 02	Activation of vibration suppression	USINT
144319	0x2284.01 ... 02	Vibration suppression active	USINT

Tab. 610: Objects

6.4.3.3 PROFIdrive

Input shaping PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
144316	12451.0 ... 1	Damping	REAL
144317	12452.0 ... 1	Natural frequency	REAL
144318	12453.0 ... 1	Activation of vibration suppression	BOOL
144319	12454.0 ... 1	Vibration suppression active	BOOL

Tab. 611: PNUs

6.5 Auto-tuning

6.5.1 Function

Auto-tuning can be used to determine the control parameters for position and speed controllers. It is based on a current regulator that has already been designed and suitable start parameters for position controllers and speed controllers, as well as the amplitude of the excitation signal. The start parameters are determined automatically based the drive configuration. Measurements are necessary as basis for the layout. The number of measurements can be adjusted. The measurements can be carried out during the standstill or during a movement command.

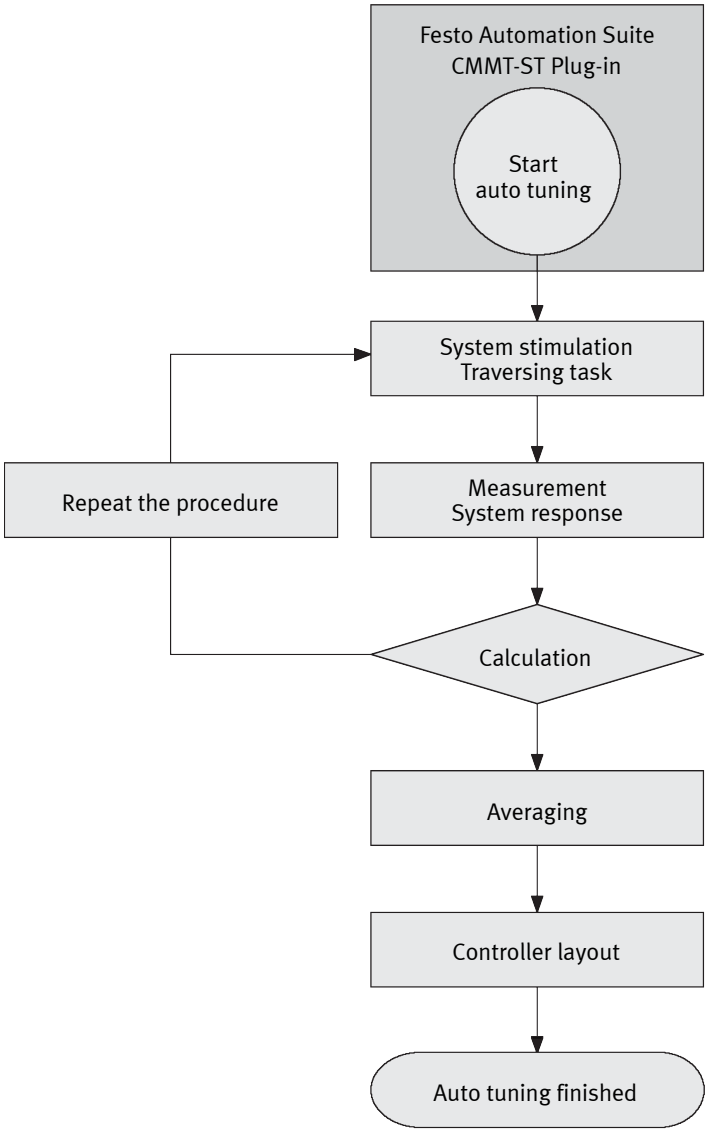


Fig. 93: Auto-tuning

Precondition for auto-tuning

The following conditions must be fulfilled before the start of auto-tuning:
- The plug-in is connected to the device
- The plug-in has the master control
- Controller enable is activated

Parameterisation of auto-tuning

The following parameters are defined by the plug-in before the start of auto-tuning:

Servo drive start values:
- Start value position controller amplification gain
- Start value speed controller amplification gain
- Start value speed controller integration constant
- Filter time constant speed controller

Mean value calculation:
- Number of identifications for averaging

The use of the default setting "8 identification cycles" is recommended for averaging.

System excitation:
- Amplification gain noise signal generator

Drive movement (option):

- Drive is moving during identification (activate)
- Movement stroke during the identification
- Maximum speed during the identification
- Maximum acceleration during the identification
- Maximum deceleration during the identification
- Maximum jerk during the identification

Recommendation: for drives with high friction (e.g. plain-bearing guide) activate "Move drive ..." parameter.

With the 1st identification cycle the axis moves in the positive direction up to the target of the movement stroke. At the 2nd identification cycle the axis moves back again to the starting point. The movement is repeated with each further double cycle.

- Plan a sufficient movement distance.

Controlling auto-tuning

NOTICE

In case of vertically installed axes a sagging of the load is possible at the start of auto tuning.

- Keep the range of movement of the connected actuators unobstructed.

Monitoring auto-tuning

The current status is displayed in the status data during auto-tuning.
The new values "Results of tuning" are displayed in the plug-in after the auto-tuning.
A test run can be carried out with the determined values or the values can applied directly in the controller data as active control parameters.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
860	Status auto tuning	Specifies the status of auto tuning. – 0: inactive – 1: test run – 2: start measurement – 3: measurement active – 4: FFT calculation active – 5: FFT calculation finished – 6: controller calculation active – 7: controller calculation finished – 8: error, stroke too short – 9: auto-tuning aborted – 10: error, invalid controller parameters	
		Access	read/–
		Update	effective immediately
		Unit	–
8601	Result of position controller amplification gain	Specifies the results of auto tuning for the amplification gain in the position controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
8602	Result of velocity controller integration constant	Specifies the result of auto tuning for the integration constant of the velocity controller.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
8603	Result of velocity controller amplification gain	Specifies the result of auto tuning for the amplification gain of the velocity controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
8611	Start value position controller amplification gain	Specifies the start value of auto tuning for the amplification gain of the position controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
8612	Start value velocity controller amplification gain	Specifies the start value of auto tuning for the amplification gain of the velocity controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
8613	Start value velocity controller integration constant	Specifies the start value of auto tuning for the integration constant of the velocity controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
8614	Filter time constant velocity controller	Specifies the filter time constant of the velocity controller for the layout of the controller parameters.	
		Access	read/write
		Update	effective immediately
		Unit	s
8615	Filter time constant noise signal generator	Specifies the filter time constant of the noise signal generator.	
		Access	read/write
		Update	effective immediately
		Unit	s
8616	Noise signal generator amplification gain	Specifies the amplification gain of the noise signal generator.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
8617	Signal selection noise signal generator	Specifies the signal selection of the noise signal generator. 1 uniform noise and 2 normally distributed noise	
		Access	read/write
		Update	effective immediately
		Unit	–
8618	Time delay noise signal for the start identification	Specifies the time delay noise signal for the start of the identification.	
		Access	read/write
		Update	effective immediately
		Unit	s
8619	Identification with movement	Specifies the activation for the drive moving during the identification.	
		Access	read/write
		Update	effective immediately
		Unit	–
8620	Number of identifications for averaging	Specifies the number of identifications for averaging.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
8621	Maximum movement stroke during the identification	Specifies the movement stroke during the identification.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
8622	Maximum velocity during the identification	Specifies the maximum velocity during the identification.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
8623	Maximum acceleration during the identification	Specifies the maximum acceleration during the identification.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
8624	Maximum deceleration during the identification	Specifies the maximum deceleration during the identification.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
8625	Maximum jerk during the identification	Specifies the maximum jerk during the identification.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 612: Parameters

ID Dx.	Name	Description
13 | 02 | 00217 218235097	Auto tuning aborted	Auto tuning aborted
13 | 02 | 00218 218235098	Auto tuning movement insufficient or synchronous phase too short	Auto tuning movement insufficient
13 | 02 | 00219 218235099	Auto tuning controller parameters invalid	The Auto tuning function could not identify any controller parameters
13 | 02 | 00220 (218235100)	Transmission of auto tuning measured values failed	Transmission of auto tuning measured values failed

Tab. 613: Diagnostic messages

6.5.1.1 CiA 402

Auto-tuning objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
860	0x2173.01	Status auto tuning	USINT
8601	0x2173.02	Result of position controller amplification gain	REAL
8602	0x2173.03	Result of velocity controller integration constant	REAL
8603	0x2173.04	Result of velocity controller amplification gain	REAL
8611	0x2174.01	Start value position controller amplification gain	REAL
8612	0x2174.02	Start value velocity controller amplification gain	REAL
8613	0x2174.03	Start value velocity controller integration constant	REAL
8614	0x2174.04	Filter time constant velocity controller	REAL
8615	0x2171.01	Filter time constant noise signal generator	REAL
8616	0x2171.02	Noise signal generator amplification gain	REAL
8617	0x2171.03	Signal selection noise signal generator	USINT

Parameter	Index.Subindex	Name	Data type
8618	0x2174.05	Time delay noise signal for the start identification	REAL
8619	0x2174.06	Identification with movement	USINT
8620	0x2174.07	Number of identifications for averaging	USINT
8621	0x2174.08	Maximum movement stroke during the identification	LINT
8622	0x2174.09	Maximum velocity during the identification	REAL
8623	0x2174.0A	Maximum acceleration during the identification	REAL
8624	0x2174.0B	Maximum deceleration during the identification	REAL
8625	0x2174.0C	Maximum jerk during the identification	REAL

Tab. 614: Objects

6.5.1.2 PROFIdrive

Auto-tuning PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
860	11219.0	Status auto tuning	USINT
8601	11748.0	Result of position controller amplification gain	REAL
8602	11749.0	Result of velocity controller integration constant	REAL
8603	11750.0	Result of velocity controller amplification gain	REAL
8611	11753.0	Start value position controller amplification gain	REAL
8612	11754.0	Start value velocity controller amplification gain	REAL
8613	11755.0	Start value velocity controller integration constant	REAL
8614	11756.0	Filter time constant velocity controller	REAL
8615	11757.0	Filter time constant noise signal generator	REAL
8616	11758.0	Noise signal generator amplification gain	REAL
8617	11759.0	Signal selection noise signal generator	USINT
8618	11760.0	Time delay noise signal for the start identification	REAL
8619	11761.0	Identification with movement	BOOL
8620	11762.0	Number of identifications for averaging	USINT
8621	11763.0	Maximum movement stroke during the identification	LINT
8622	11764.0	Maximum velocity during the identification	REAL
8623	11765.0	Maximum acceleration during the identification	REAL
8624	11766.0	Maximum deceleration during the identification	REAL
8625	11767.0	Maximum jerk during the identification	REAL

Tab. 615: PNUs

6.5.2 Test run

The test run can be used to test the behaviour of the drive system with the new results of the tuning.
In the test run the drive is moved in the specified stroke range according to the number of validation movements (single stroke path).

A test run can no longer be performed after the parameters have been imported.

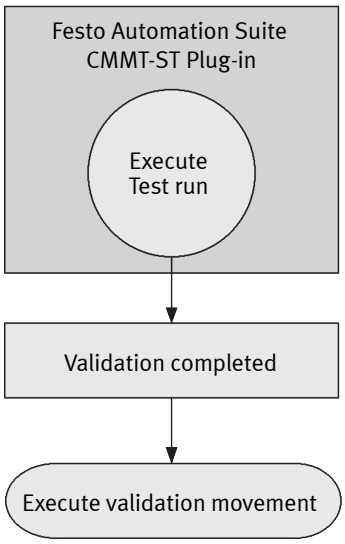


Fig. 94: Test run procedure

Parameterisation of test run

Before the test run the following values are to be adjusted in the parameters of the plug-in:
- Number of validation motions
- Movement stroke during validation movement
- Maximum speed during validation motion
- Maximum acceleration during validation motion
- Maximum deceleration during validation motion
- Maximum jerk during validation movement

The parameters resulting from auto-tuning can be changed manually, and a test run can optionally be started with the parameters.

Controlling a test run

The test run is started via the plug-in of the Festo Automation Suite.
If the controller parameters have not been optimally set, unusual noises could occur in the test run. In this case, stop the test run, perform the auto-tuning again or adjust the controller parameters manually.

Monitoring the test run

The current status is displayed in the status data during the test run.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
8630	Number of validation movements	Specifies the number of validation movements. A validation movement is defined as one outward and one return movement.	
		Access	read/write
		Update	effective immediately
		Unit	–
8631	Movement stroke during validation movement	Specifies the relative movement stroke during the validation movement.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
8632	Maximum velocity during validation movement	Specifies the maximum velocity during the validation movement.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
8633	Maximum acceleration during validation movement	Specifies the maximum acceleration during the validation movement.	

ID Px.	Parameter	Description	
8633	Maximum acceleration during validation movement	Access	read/write
		Update	effective immediately
		Unit	user defined
8634	Maximum deceleration during validation movement	Specifies the maximum deceleration during the validation movement.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
8635	Maximum jerk during validation movement	Specifies the maximum jerk during the validation movement.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 616: Parameters

ID Dx.	Name	Description
13 | 02 | 00220 (218235100)	Transmission of auto tuning measured values failed	Transmission of auto tuning measured values failed

Tab. 617: Diagnostic messages

6.5.2.1 CiA 402

Test run objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
8630	0x2174.0D	Number of validation movements	USINT
8631	0x2174.0E	Movement stroke during validation movement	LINT
8632	0x2174.0F	Maximum velocity during validation movement	REAL
8633	0x2174.10	Maximum acceleration during validation movement	REAL
8634	0x2174.11	Maximum deceleration during validation movement	REAL
8635	0x2174.12	Maximum jerk during validation movement	REAL

Tab. 618: Objects

6.5.2.2 PROFIdrive

Test run PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
8630	11768.0	Number of validation movements	USINT
8631	11769.0	Movement stroke during validation movement	LINT
8632	11770.0	Maximum velocity during validation movement	REAL
8633	11771.0	Maximum acceleration during validation movement	REAL
8634	11772.0	Maximum deceleration during validation movement	REAL
8635	11773.0	Maximum jerk during validation movement	REAL

Tab. 619: PNUs

7 Technology functions

7.1 Position trigger (cam controller)

7.1.1 Function

The position trigger function generates trigger signals at the trigger output (TRG) when parameterised positions (x1, x2) are reached. The position switch and rotor position switch, for example, can be simulated using this function.

Activating position trigger

The position trigger can be activated:
– via the record table ➔ 4.5 Task via record selection.
– automatically during the device start-up ➔ Px.101547.
If the position trigger is activated via the record table, the update mode can be used to specify the time at which the setting becomes active.
– "Immediately" update mode activates the setting immediately.
– "At modulo transition" update mode activates the setting at the next transition of the modulo limit (machine cycle).
This activation imports the parameterised values (Px.112700 ... Px.112712) as currently valid parameters (Px.112713 ... Px.112725).
Example: the value of the parameter Px.112700 (Position trigger mode) is imported as value for the parameter Px.112713 (current mode position trigger).
The desired trigger output must be parameterised for the function (parameters Px.11303 and Px.11304). The origin (source ...) of the positions can be selected (e.g. primary encoder). Positions (x1, x2) can be freely defined within the modulo limits (+Mod, –Mod).
Multiple switching points per trigger output can be configured within the modulo range with the index of the relevant parameters. Various modes are available for the function (➔ Tab. 623 Possible modes of the position trigger function). The switching duration (t1, t2) of the trigger output can, for example, be parameterised or be dependent on the defined switching limit values (x1, x2).

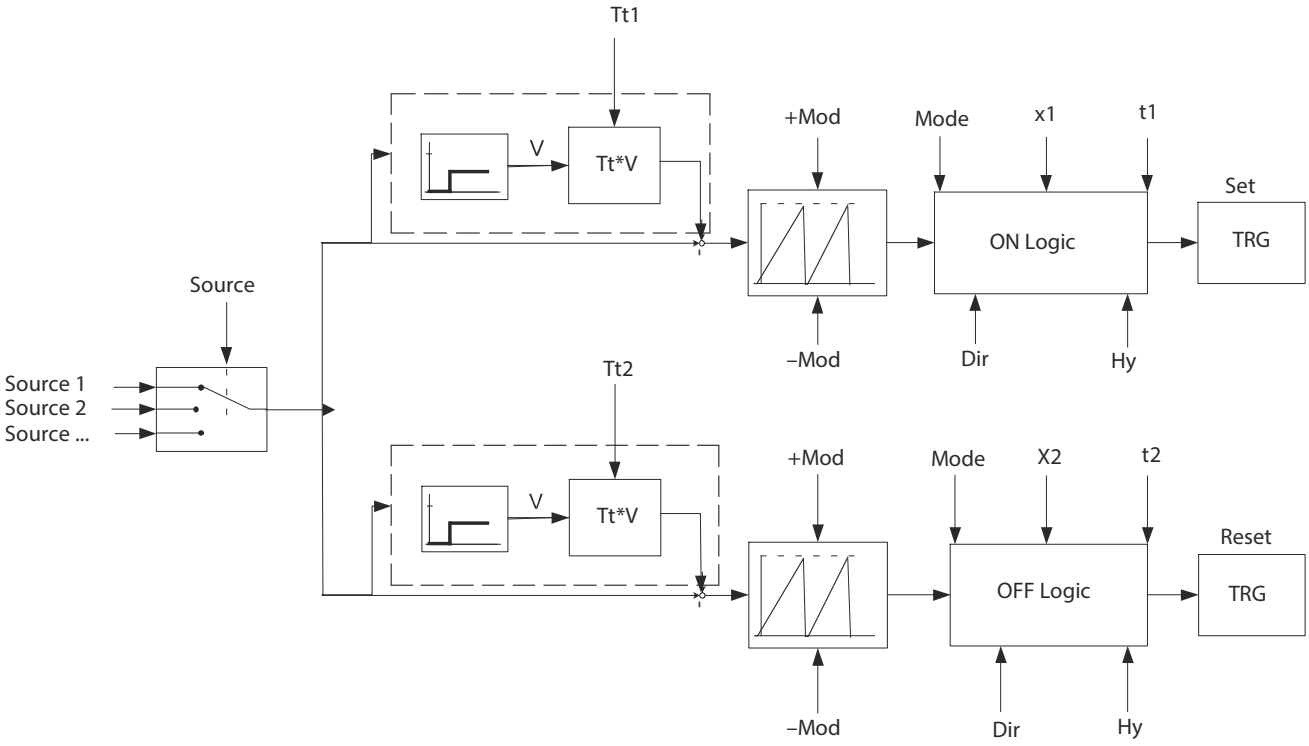


Fig. 95: Block diagram position trigger

Name	Description	ID Px.
Source 1, 2, ...	Source of the position, e.g. primary encoder, secondary encoder; the possible sources depend on the device or firmware.	–
Source	Selection: Position trigger source	112701
Tt1	Inactive time compensation of first switching point	112704
Tt2	Inactive time compensation of second switching point	112705
+Mod	Upper limit value modulo	112702
–Mod	Lower limit value modulo	112703
Mode	Position trigger mode	112700
ON Logic	Switch-on logic	–
OFF Logic	Switch-off logic	–
Dir	Selection of switching function (negative/positive direction)	112708
Hy	Hysteresis	112706
x1	First switching point	112710
x2	Second switching point	112711
t1, t2	Switching time (manual)	112707
	Switching time (automatic)	112712
TRG	Trigger output of device (TRG...)	–

Tab. 620: Legend for the position trigger block diagram

Timing

Source

Setpoints and actual values of the encoder are available as source depending on the device design.
To enable reliable switching even at very low velocities and short switching points, the position can be filtered with parameter Px.112740 and the speed with parameter Px.112738.

Hysteresis

The hysteresis suppresses undesired switching procedures around the switching point during fluctuations. The hysteresis refers to the switching point, including the offset due to the delay compensation.
An example is shown in the diagram below. All additional timing diagrams do not depict the hysteresis.

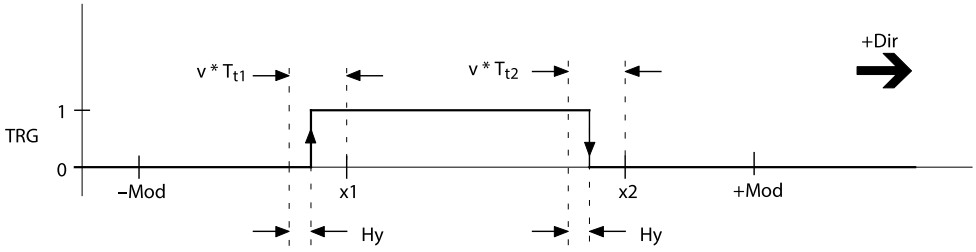


Fig. 96: Timing diagram: hysteresis (example: positive direction)

Examples of signal curves

Signal curve depending on the switching function, delay compensation and hysteresis in automatic mode (6) – examples

a) Positive direction

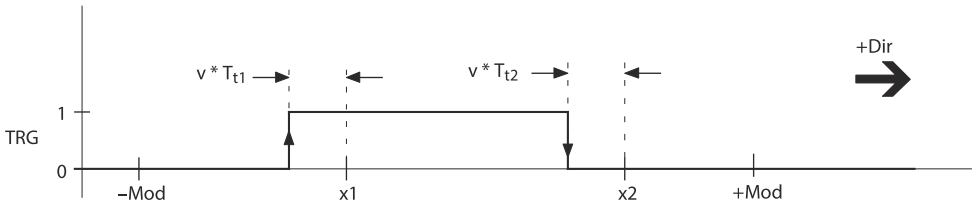


Fig. 97: Timing diagram: positive direction

b) Negative direction

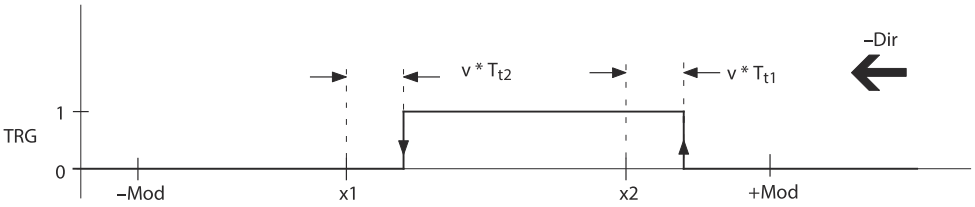


Fig. 98: Timing diagram: negative direction

c) Negative/positive direction

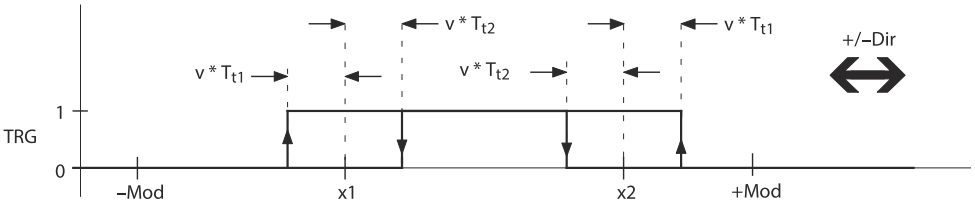


Fig. 99: Timing diagram: negative/positive direction

Example of time-controlled signal curve

Signal curve depending on switching function, delay compensation and hysteresis in automatic mode (6) with the switching characteristic time-controlled On (2), positive direction

After switching point x1 is reached, the trigger output for the duration of the parameterised switch-on time is activated. The switching time t1 always refers to the switching point x1, independent of the direction of movement.

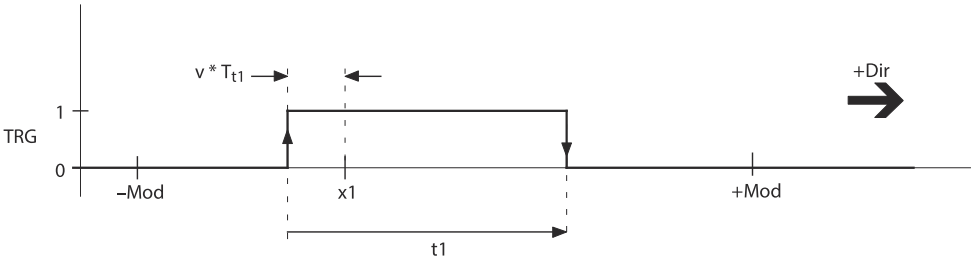


Fig. 100: Timing diagram: mode 4 (switch-on time) - example: positive direction

If the status of the trigger output is “high” when the next “switch-on point” is reached, the new switching point is ignored. The new switching points are accepted only if no switching point is currently active. The switching duration is not extended.

Name	Description	ID Px.
TRG	Trigger output	–
Tt1	Inactive time compensation of first switching point	112704
Tt2	Inactive time compensation of second switching point	112705
+Mod	Upper limit value modulo	112702
–Mod	Lower limit value modulo	112703
Hy	Hysteresis	112706
x1	First switching point	112710
t1	Switching time (automatic)	112712
x2	Second switching point	112711

Tab. 621: Legend for the figures above

Parameters and diagnostic messages

The number of available position triggers depends on the product version. Every position trigger is organised in its own instance.
– Instance 0: parameter for position trigger 0
– Instance 1: parameter for position trigger 1
– ...
Depending on the device design, multiple position switches can be parameterised within a position trigger. The parameterisation of the position switches of a position trigger is not checked for overlapping or contradictory switching functions. Overlapping or contradictory switching points are ignored.

ID Px.	Parameter	Description	
101547	Activation Position trigger Device start	Activates the position trigger configuration when the device is restarted.	
		Access	read/write
		Update	effective immediately
		Unit	–
112700	Position trigger mode	Specifies the mode of the Position Trigger function. For detailed information ➔ Tab. 623 Possible modes of the position trigger function.	
		Access	read/write
		Update	effective immediately
		Unit	–
112701	Position trigger source	Specifies the source of the measured values. This means: 0: primary encoder 1: secondary encoder (device-specific) 2: setpoint position	
		Access	read/write
		Update	effective immediately
		Unit	–
112702	Upper limit value modulo	Specifies the upper limit value for the modulo calculation. When the upper limit value is exceeded, the position jumps to the lower limit value.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
112703	Lower limit value modulo	Specifies the lower limit value for the modulo calculation. When the lower limit value is undershot, the position jumps to the upper limit value.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
112704	Inactive time compensation of first switching point	Specifies the inactive time compensation for the signal change for the first switching point. With this parameter, switch-on delays of external components can be compensated.	
		Access	read/write
		Update	effective immediately
		Unit	s
112705	Inactive time compensation of second switching point	Specifies the inactive time compensation for the signal change for the second switching point. With this parameter, switch-on delays of external components can be compensated.	
		Access	read/write
		Update	effective immediately
		Unit	s
112706	Hysteresis	Through the determination of the hysteresis range, undesired switching procedures are suppressed around the switching point during fluctuations.	
		Access	read/write

ID Px.	Parameter	Description	
112706	Hysteresis	Update	effective immediately
		Unit	user defined
112707	Switching time (manual)	Specifies the switching time for time-based manual switching (mode 4/5).	
		Access	read/write
		Update	effective immediately
		Unit	s
112708	Selection of switching function	Specifies the direction of movement at which the position switch shall activate. – 0: Negative/positive direction – 1: Positive direction – 2: Negative direction Multiple positions can be parameterised within the defined modulo range depending on the product design. Index 0: position switch 1 Index 1: position switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/write
		Update	effective immediately
		Unit	–
112709	Selection of switching characteristics	Specifies the switching behaviour of the position switch. For the On to Off switching function, the switching points are specified in parameters Px.112710 and Px.112711. The time for the time-controlled switching behaviour is specified via parameter Px.112712. – 0: Inactive – 1: Position switch On/Off – 2: Position switch ON, time-controlled – 3: Position switch OFF, time-controlled Multiple positions can be parameterised within the defined modulo range depending on the product design. Index 0: position switch 1 Index 1: position switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/write
		Update	effective immediately
		Unit	–
112710	First switching point	Specifies the first switching point at which the position switch should be active. Index 0: position switch 1 Index 1: position switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/write
		Update	effective immediately
		Unit	user defined
112711	Second switching point	Specifies the second switching point at which the position switch should be active. Index 0: position switch 1 Index 1: position switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/write
		Update	effective immediately
		Unit	user defined

ID Px.	Parameter	Description	
112712	Switching time (automatic)	Specifies the time for which position trigger is active. The specified time refers to the switching point X1, independent of the direction of movement. The switching time always refers to the switching point x1, regardless of the direction of movement. Index 0: position switch 1 Index 1: position switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/write
		Update	effective immediately
		Unit	s
112713	Actual Position Trigger mode	Specifies the actual mode of the Position Trigger function.	
		Access	read/–
		Update	effective immediately
		Unit	–
112714	Actual Position Trigger source	Specifies the actual source of the position values of the Position Trigger. This means: – 0: primary encoder (commutation encoder) – 1: secondary encoder – 2: ... (depending on the product design)	
		Access	read/–
		Update	effective immediately
		Unit	–
112715	Actual upper limit value modulo	Specifies the actual determined upper limit value for the modulo calculation.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112716	Actual lower limit value modulo	Specifies the actual determined lower limit value for the modulo calculation.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112717	Actual inactive time first switching point	Specifies the actual delay compensation of the first switching point for the switch-on process.	
		Access	read/–
		Update	effective immediately
		Unit	s
112718	Actual inactive time second switching point	Specifies the actual delay compensation of the second switching point for the switch-on process.	
		Access	read/–
		Update	effective immediately
		Unit	s
112719	Actual hysteresis	Specifies the actual hysteresis. In the hysteresis range, switching procedures are suppressed around the switching point during fluctuations.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112720	Actual switching time (manual)	Specifies the actual switch-on time for mode 4.	
		Access	read/–
		Update	effective immediately
		Unit	s

ID Px.	Parameter	Description	
112721	Actual selection of switching function	Specifies the actual direction of movement at which the position switch activates. – 0: Negative/positive direction – 1: Positive direction – 2: Negative direction Index 0: position switch 1 Index 1: position switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/–
		Update	effective immediately
		Unit	–
112722	Actual selection of switching characteristics	Specifies the actual switching behaviour of the position switch. This means: – 0: Inactive – 1: Position switch On/Off – 2: Position switch ON, time-controlled – 3: Position switch OFF, time-controlled Index 0: position switch 1 Index 1: position switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/–
		Update	effective immediately
		Unit	––
112723	Actual first switching point	Specifies the actual first switching point at which the position switch is inactive. Index 0: position switch 1 Index 1: position switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112724	Actual second switching point	Specifies the actual second switching point at which the position switch is inactive. Index 0: position switch 1 Index 1: position switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112725	Actual switching time (automatic)	Specifies the actual switching time for time-based switching. Index 0: position switch 1 Index 1: position switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/–
		Update	effective immediately
		Unit	ss
112726	Modulo position for the logic (ON)	Specifies the actual runtime-compensated module position for the logic (On).	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112727	Modulo position for the logic (OFF)	Specifies the actual runtime-compensated module position for the logic (Off).	
		Access	read/–

ID Px.	Parameter	Description	
112727	Modulo position for the logic (OFF)	Update	effective immediately
		Unit	user defined
112728	Position switch status ON/OFF	Specifies the status of the trigger output.	
		Access	read/––
		Update	effective immediately
		Unit	–
112729	Status modulo limit reached	Flag that indicates that modulo limits have been reached. The signal duration amounts to 1 ms.	
		Access	read/–
		Update	effective immediately
		Unit	–
112730	Status active position switch	Specifies which position switch is active.	
		Access	read/–
		Update	effective immediately
		Unit	–
112732	Offset modulo position	Offset of the modulo position	
		Access	read/write
		Update	effective immediately
		Unit	user defined
112733	Initialisation modulo	Default value for the reference position	
		Access	read/write
		Update	effective immediately
		Unit	user defined
112734	Actual offset modulo position	Specifies the actual used offset of the modulo position.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112735	Counter modulo cycles	Counter for the modulo cycles	
		Access	read/–
		Update	effective immediately
		Unit	–
112736	Modulo hysteresis	Hysteresis for the modulo position for secure detection during a modulo run	
		Access	read/write
		Update	effective immediately
		Unit	user defined
112737	Actual modulo hysteresis	Specifies the actual used hysteresis for the modulo position for secure detection during a modulo run.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112738	Filter time constant velocity filter	Specifies the filter time constant of the velocity filter. The filter time constant prevents or attenuates a signal noise of the encoder signal.	
		Access	read/write
		Update	effective immediately
		Unit	s
112740	Filter time constant Position filter	Specifies the filter time constant of the position filter. The filter time constant prevents or attenuates a signal noise of the encoder signal.	

ID Px.	Parameter	Description	
112740	Filter time constant Position filter	Access	read/write
		Update	effective immediately
		Unit	s
101017	Threshold value velocity look-ahead	Specifies the threshold value for the velocity look-ahead, from which the runtime for the position triggers is compensated. With travel at slow speeds it may be necessary to reduce the threshold value accordingly.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 622: Parameters

Position trigger parameter mode (Px.112700)		
Value	Meaning	Description
0	Inactive	Position trigger function is inactive
1	ON (manual)	The trigger output is activated when the position trigger function is activated. The trigger output can therefore be activated manually for test purposes.
2	OFF (manual)	The trigger output is deactivated when the position trigger function is activated. The trigger output can therefore be deactivated manually for test purposes.
3	Force last status	The status present at the current time is permanently retained.
4	Switch-on time (manual)	Activation for the duration of the parameterised switching time (Px.112707).
5	Switch-off time (manual)	Deactivation for the duration of the parameterised switching time (Px.112707).
6	Automatic	The switching status of the trigger output is controlled automatically. The switching points depend on the parameterisation of the individual positions.
7	Set modulo position	Sets the modulo position to the value saved in the Px.112733 parameter.
8	Reset modulo position	Resets the modulo position set by the "Set modulo position" function.

Tab. 623: Possible modes of the position trigger function

Diagnostic messages No specific diagnostic messages are allocated to the function.

7.1.2 CiA 402

Position trigger objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
101547	0x2192.3B ... 3C	Activation Position trigger Device start	USINT
112700	0x2192.01 ... 02	Position trigger mode	UINT
112701	0x2192.03 ... 04	Position trigger source	UINT
112702	0x2192.05 ... 06	Upper limit value modulo	LINT
112703	0x2192.07 ... 08	Lower limit value modulo	LINT
112704	0x2192.09 ... 0A	Inactive time compensation of first switching point	REAL
112705	0x2192.0B ... 0C	Inactive time compensation of second switching point	REAL
112706	0x2192.0D ... 0E	Hysteresis	LINT
112707	0x2192.0F ... 10	Switching time (manual)	REAL
112708	0x226F.01 ... 08	Selection of switching function	UINT
112709	0x2270.01 ... 08	Selection of switching characteristics	UINT
112710	0x2271.01 ... 08	First switching point	LINT
112711	0x2272.01 ... 08	Second switching point	LINT
112712	0x2273.01 ... 08	Switching time (automatic)	REAL
112713	0x2192.11 ... 12	Actual Position Trigger mode	UINT
112714	0x2192.13 ... 14	Actual Position Trigger source	UINT

Parameter	Index.Subindex	Name	Data type
112715	0x2192.15 … 16	Actual upper limit value modulo	LINT
112716	0x2192.17 … 18	Actual lower limit value modulo	LINT
112717	0x2192.19 … 1A	Actual inactive time first switching point	REAL
112718	0x2192.1B … 1C	Actual inactive time second switching point	REAL
112719	0x2192.1D … 1E	Actual hysteresis	LINT
112720	0x2192.1F … 20	Actual switching time (manual)	REAL
112721	0x2274.01 … 08	Actual selection of switching function	UINT
112722	0x2275.01 … 08	Actual selection of switching characteristics	UINT
112723	0x2276.01 … 08	Actual first switching point	LINT
112724	0x2277.01 … 08	Actual second switching point	LINT
112725	0x2278.01 … 08	Actual switching time (automatic)	REAL
112726	0x2192.21 … 22	Modulo position for the logic (ON)	LINT
112727	0x2192.23 … 24	Modulo position for the logic (OFF)	LINT
112728	0x2192.25 … 26	Position switch status ON/OFF	USINT
112729	0x2192.27 … 28	Status modulo limit reached	USINT
112730	0x2192.29 … 2A	Status active position switch	USINT
112732	0x2192.2D … 2E	Offset modulo position	LINT
112733	0x2192.2F … 30	Initialisation modulo	LINT
112734	0x2192.31 … 32	Actual offset modulo position	LINT
112735	0x2192.33 … 34	Counter modulo cycles	UDINT
112736	0x2192.35 … 36	Modulo hysteresis	LINT
112737	0x2192.37 … 38	Actual modulo hysteresis	LINT
112738	0x21AD.01 … 02	Filter time constant velocity filter	REAL
112740	0x21AD.05 … 06	Filter time constant Position filter	REAL
101017	0x2192.39 … 3A	Threshold value velocity look-ahead	REAL

Tab. 624: Objects

7.1.3 PROFIdrive

PNUs position trigger

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
101547	12857.0	Activation Position trigger Device start	BOOL
112700	11960.0	Position trigger mode	UINT
112701	11962.0	Position trigger source	UINT
112702	11964.0	Upper limit value modulo	LINT
112703	11966.0	Lower limit value modulo	LINT
112704	11968.0	Inactive time compensation of first switching point	REAL
112705	11970.0	Inactive time compensation of second switching point	REAL
112706	11972.0	Hysteresis	LINT
112707	11974.0	Switching time (manual)	REAL
112708	11976.0 … 3	Selection of switching function	UINT
112709	11978.0 … 3	Selection of switching characteristics	UINT
112710	11980.0 … 3	First switching point	LINT
112711	11982.0 … 3	Second switching point	LINT
112712	11984.0 … 3	Switching time (automatic)	REAL
112713	11986.0	Actual Position Trigger mode	UINT

Parameter	PNU	Name	Data type
112714	11988.0	Actual Position Trigger source	UINT
112715	11990.0	Actual upper limit value modulo	LINT
112716	11992.0	Actual lower limit value modulo	LINT
112717	11994.0	Actual inactive time first switching point	REAL
112718	11996.0	Actual inactive time second switching point	REAL
112719	11998.0	Actual hysteresis	LINT
112720	12000.0	Actual switching time (manual)	REAL
112721	12002.0 ... 3	Actual selection of switching function	UINT
112722	12004.0 ... 3	Actual selection of switching characteristics	UINT
112723	12006.0 ... 3	Actual first switching point	LINT
112724	12008.0 ... 3	Actual second switching point	LINT
112725	12010.0 ... 3	Actual switching time (automatic)	REAL
112726	12012.0	Modulo position for the logic (ON)	LINT
112727	12014.0	Modulo position for the logic (OFF)	LINT
112728	12016.0	Position switch status ON/OFF	BOOL
112729	12018.0	Status modulo limit reached	BOOL
112730	12020.0	Status active position switch	USINT
112732	12024.0	Offset modulo position	LINT
112733	12026.0	Initialisation modulo	LINT
112734	12028.0	Actual offset modulo position	LINT
112735	12030.0	Counter modulo cycles	UDINT
112736	12032.0	Modulo hysteresis	LINT
112737	12034.0	Actual modulo hysteresis	LINT
112738	12651.0	Filter time constant velocity filter	REAL
112740	12653.0	Filter time constant Position filter	REAL
101017	12726.0	Threshold value velocity look-ahead	REAL

Tab. 625: PNUs

7.2 Position detection (touch probe)

7.2.1 Function

The device enables precise detection of current positions during processing of tasks. During the process the position detection function is initiated by the trigger signals at a trigger input (CAP input). This requires the corresponding input to be activated for the touch probe function. The signal edge of the trigger event is parameterisable (edge). The typical internal signal running times of the trigger signals are compensated by the firmware of the device. The positions can therefore be detected with high precision.
The origin (Source ...) of the positions can be selected (e.g. primary encoder).
The modulo limit values can be freely parameterised within the positioning range (+Mod/–Mod).
The touch probe function provides various modes ➔ Tab. 630 Possible modes of the touch probe function. For example, the position can be detected once or cyclically. Within the modulo range, the range in which trigger signals shall be accepted can also be limited (+LIM/–LIM).
The detected position and detection time are saved in one parameter each (X_out, T_out). The parameters can be evaluated during the record selection mode and read out through the device provide is necessary.

If a CiA 402 specific mode is executed, the acquired position is provided without module over-calculation (mode 8 or 9, current value of source ➔ Tab. 630 Possible modes of the touch probe function).

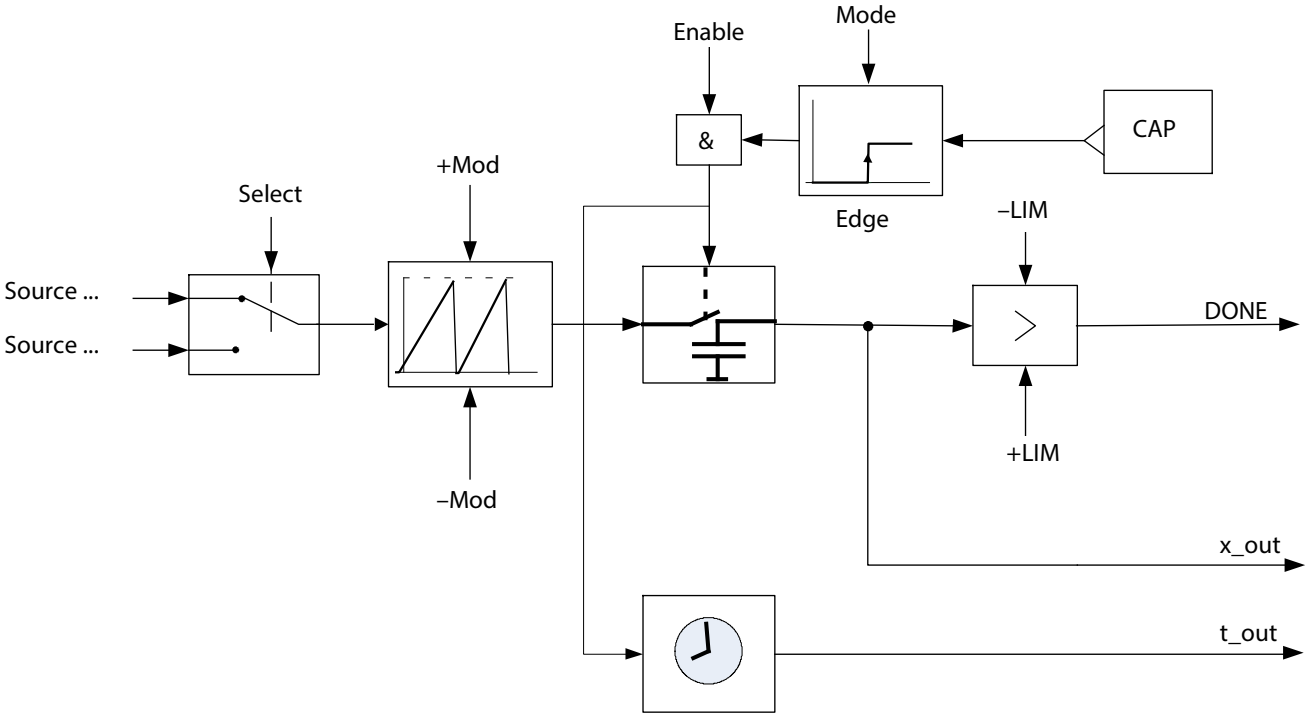


Fig. 101: Touch probe block diagram

Name	Description	ID Px.
Source ...	Source of the position, e.g. primary encoder, secondary encoder; the possible sources depend on the device design	–
Mode	Touch probe mode	113000
Select	Touch probe source	113001
+Mod	Upper limit value modulo	113003
–Mod	Lower limit value modulo	113004
Enable	Activation/deactivation of the touch probe function using the record table or device profile	–
Edge	Selection trigger event	113002
CAP	Trigger input CAPx	–
–LIM	Lower limit value trigger event	113005
+LIM	Upper limit value trigger event	113006
DONE	Trigger event initiated	113016
x_out	Touch probe position	113014
t_out	Time stamp touch probe position	113015

Tab. 626: Legend for the touch probe block diagram (example)

Timing

The timing diagram shows an example of position detection in mode 2 (once with window). Trigger signals outside the window are not accepted.

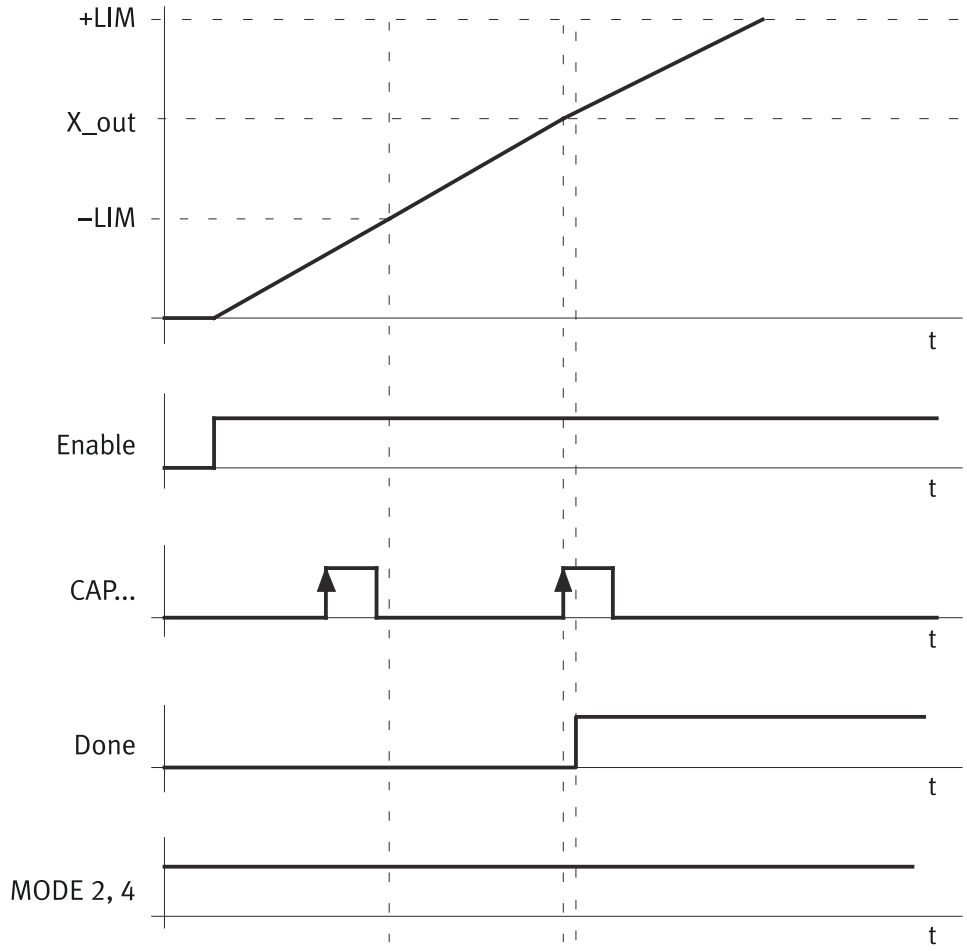


Fig. 102: Touch probe timing diagram (example of “Once with window” touch probe mode)

Name	Description	ID Px.
+LIM	Upper limit value trigger eventUpper limit value trigger event	113006
–LIM	Lower limit value trigger eventLower limit value trigger event	113005
X_out	Touch probe position	113014
Enable	Activation/deactivation of the touch probe function using the record table or device profile	–
CAP	Trigger input CAPx	–
DONE	Trigger event initiated	113016
MODE 2, 4	Touch probe mode, Mode 2 or Mode 4 (with window)	113000

Tab. 627: Legend for the touch probe timing (example) figure

Example: touch probe cyclically via record table

If the touch probe function is active, a relative motion command can be triggered (positioning relative to the touch probe position). Record sequences can be implemented by using the “Touch probe valid” comparator (18).
Requirement: position sensing (touch probe) is parameterised (Px.113000 ... Px.113006).
The table below describes an example of a record table:

Record	Record characteristics	Comment
1	– Record type: ‘Additional’, ‘Touch probe (28)’ – Parameters of the record type: ‘mode’: ‘cyclic (3)’, ‘instance x’: 0 or 1.	Activate touch probe (cyclic)
	– Record sequencing with ‘Execution completed’ condition, target record 2.	continue to the next record

Record	Record characteristics	Comment
2	– Record type ‘Additional’, ‘Flow control (10)’	The record does not perform an action (wait for condition).
	– Record sequencing with the ‘Touch probe detected’ condition, target record 3.	continue if the touch probe position has been detected
3	– Record type: ‘Motion task’, ‘Position (5)’ – Type: ‘positioning relative to touch probe position instance ...’	Relative motion command to the touch probe position
	– Record sequencing with the ‘Execution completed’ condition, target record 2.	continue to record the next position

Tab. 628: Record table: cyclic touch probe (example)

Parameters

The parameters of the available trigger outputs are organised into various instances:
– Instance 0: trigger input CAP0
– Instance ...: trigger input CAP... (depending on the product design)
The touch probe function can be activated using the record table. This activation allows the parameterised values (Px.113000 through Px.113006) to be imported as currently valid parameters (Px.113007 ... Px.113013).

ID Px.	Parameter	Description	
113000	Touch probe mode	Specifies the mode of the touch probe function. The specified mode is effective on activation of the touch probe function. For detailed information ➔ Tab. 630 Possible modes of the touch probe function.	
		Access	read/write
		Update	effective immediately
		Unit	–
113001	Touch probe source	Specifies the source of the measured values. This means: – 0: primary encoder – 1: secondary encoder (device-specific) – 2: ... (depending on the product design)	
		Access	read/write
		Update	effective immediately
		Unit	–
113002	Selection trigger event	Specifies the type of signal edge with which the measurement shall be triggered. This means: – 0: inactive – 1: positive edge – 2: negative edge – 3: positive or negative edge	
		Access	read/write
		Update	effective immediately
		Unit	–
113003	Upper limit value modulo	Specifies the upper limit value for the modulo calculation. When the upper limit value is exceeded, the position jumps to the lower limit value.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
113004	Lower limit value modulo	Specifies the lower limit value for the modulo calculation. When the lower limit value is undershot, the position jumps to the upper limit value.	
		Access	read/write
		Update	effective immediately

ID Px.	Parameter	Description	
113004	Lower limit value modulo	Unit	user defined
113005	Lower limit value trigger event	Specifies the lower limit for trigger signals within the modulo range. Trigger signals at positions below the limit are ignored. Only relevant in the following modes: once with window and cyclic with window	
		Access	read/write
		Update	effective immediately
		Unit	user defined
113006	Upper limit value trigger event	Specifies the upper limit for trigger signals within the modulo range. Trigger signals at positions above the limit are ignored. Only relevant in the following modes: once with window and cyclic with window	
		Access	read/write
		Update	effective immediately
		Unit	user defined
113007	Actual touch probe mode	Specifies the actual mode of the touch probe function. Possible modes ➔ Tab. 630 Possible modes of the touch probe function.	
		Access	read/–
		Update	effective immediately
		Unit	–
113008	Actual touch probe source	Specifies the actual sources of the measured values. This means: – 0: primary encoder (commutation encoder) – 1: secondary encoder – 2: ... (depending on the product design)	
		Access	read/–
		Update	effective immediately
		Unit	–
113009	Actual selection trigger event	Specifies the actual defined signal edge of the trigger event. This means: – 0: inactive – 1: positive edge – 2: negative edge 3: positive or negative edge	
		Access	read/–
		Update	effective immediately
		Unit	–
113010	Actual upper limit value modulo	Specifies the actual determined upper limit value for the modulo calculation.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113011	Actual lower limit value modulo	Specifies the actual determined lower limit value for the modulo calculation.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113012	Actual lower limit value trigger event	Specifies the lower limit for trigger signals within the modulo range. Trigger signals at positions below the limit are ignored.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113013	Actual upper limit value trigger event	Specifies the upper limit for trigger signals within the modulo range. Trigger signals at positions above the limit are ignored.	
		Access	read/–

ID Px.	Parameter	Description	
113013	Actual upper limit value trigger event	Update	effective immediately
		Unit	user defined
113014	Touch probe position	Specifies the position of the last measurement.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113015	Time stamp touch probe position	Specifies the time of the last measurement based on the system time of the device.	
		Access	read/–
		Update	effective immediately
		Unit	–
113016	Trigger event initiated	Display whether the trigger signal was triggered within the specified range. With cyclic acquisition, the signal is set up to the transition of the modulo limit and is reset at the transition. This means: – 0: no valid trigger signal – 1: valid trigger signal was triggered	
		Access	read/–
		Update	effective immediately
		Unit	–
113017	Trigger event NOT initiated	Specifies whether a trigger signal has been triggered within the defined range if the module limit is exceeded. 1 means that the trigger signal has not been triggered	
		Access	read/–
		Update	effective immediately
		Unit	–
113018	Trigger events counter triggered	Specifies the number of valid measurements. The parameter value increases at every valid measurement.	
		Access	read/–
		Update	effective immediately
		Unit	–
113019	Trigger events counter NOT triggered	Specifies the number of invalid measurements. The parameter value increases at every invalid measurement.	
		Access	read/–
		Update	effective immediately
		Unit	–
113020	Counter modulo cycles	Specifies how often the modulo limits have been exceeded.	
		Access	read/–
		Update	effective immediately
		Unit	–
113021	Status touch probe input	Specifies the status of the CAPx input. This means: – 0: low level – 1: high level	
		Access	read/–
		Update	effective immediately
		Unit	–
113022	Status modulo limit reached	Flag that indicates that modulo limits have been exceeded. The signal duration amounts to 1 ms.	
		Access	read/–
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
113023	Modulo position	Modulo of the reference position	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113024	Offset modulo position	Offset of the modulo position	
		Access	read/write
		Update	effective immediately
		Unit	user defined
113025	Initialisation modulo	Default value for the reference position	
		Access	read/write
		Update	effective immediately
		Unit	user defined
113026	Actual offset modulo position	Specifies the actual used offset of the modulo position.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113027	Time stamp touch probe position positive CiA402	Time stamp for the last recorded touch probe position positive edge CiA402	
		Access	read/–
		Update	effective immediately
		Unit	–
113028	Time stamp touch probe position negative CiA402	Time stamp for the last recorded touch probe position negative edge CiA402	
		Access	read/–
		Update	effective immediately
		Unit	–
113029	Touch probe position positive CiA402	Position detected by touch probe positive edge CiA402. The captured position refers to the actual value of the source without considering the modulo setting.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113030	Touch probe position negative CiA402	Position detected by touch probe negative edge CiA402. The captured position refers to the actual value of the source without considering the modulo setting.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113031	Counter initiated trigger events positive edge CiA402	Counter of initiated trigger events for the positive edge CiA402	
		Access	read/–
		Update	effective immediately
		Unit	–
113032	Counter initiated trigger events negative edge CiA402	Counter of initiated trigger events for the negative edge CiA402	
		Access	read/–
		Update	effective immediately
		Unit	–
113033	Touch probe status CiA402	Touch probe status CiA402	
		Access	read/–
		Update	effective immediately
		Unit	–
113034	Modulo hysteresis	Hysteresis for the modulo position for secure detection during a modulo run	

ID Px.	Parameter	Description	
113034	Modulo hysteresis	Access	read/write
		Update	effective immediately
		Unit	user defined
113035	Actual modulo hysteresis	Specifies the actual used hysteresis for the modulo position for secure detection during a modulo run.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113036	Delay time	Specifies the delay time during which the digital input signal is delayed	
		Access	read/write
		Update	effective immediately
		Unit	s
113037	Actual delay time	Specifies the actual used delay time during which the digital input signal is delayed	
		Access	read/–
		Update	effective immediately
		Unit	s

Tab. 629: Parameters

Touch probe mode parameters (Px.113000 and Px.113007)		
Value	Mode	Description
0	Inactive	The position detection is inactive.
1	Once	one-time position detection without limiting the trigger range; after the measurement has been performed, the function is deactivated automatically.
2	Once with window	one-time position detection with limitation of the trigger range; trigger signals outside of the window are ignored. After the measurement has been performed, the function is deactivated automatically.
3	Cyclic	cyclic position detection: the next time a valid trigger signal is received, the current measured value is overwritten. The position value is always overwritten cyclically. The validity can be evaluated through Px.113016.
4	Cyclic with window	cyclic position detection with limitation to one window: the next time a valid trigger signal is received, the current measured value is overwritten.
7	Set modulo position	Setting the modulo position.
8	Once via CiA402	Behaviour as in mode 1, but differentiation of the result according to the trigger event (separate parameters for positive and negative trigger edge). The captured position refers to the current value of the source without considering the modulo setting.
9	Cyclic via CiA402	Behaviour as in mode 3, but differentiation of the result according to the trigger event (separate parameters for positive and negative trigger edge). The captured position refers to the current value of the source without considering the modulo setting.
10	Reset modulo position	Resetting the modulo position.

Tab. 630: Possible modes of the touch probe function

Lower and upper limit value of trigger event

The valid trigger range depends on the size ratio of both limit values (➔ Fig. 103).

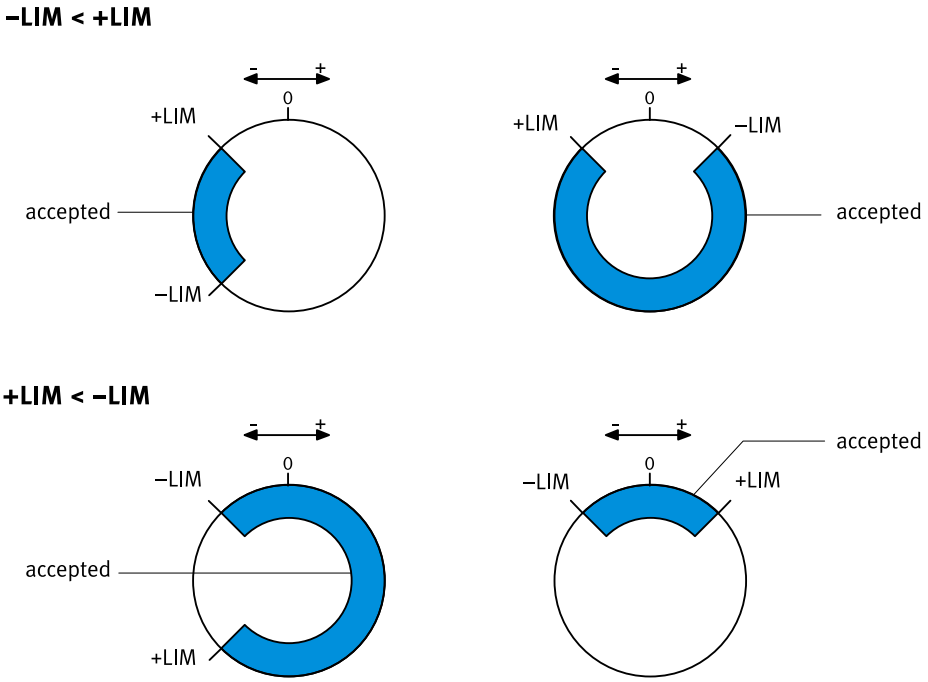


Fig. 103: Diagram of trigger ranges (example)

Name	Description	ID Px.
accepted	Valid trigger range	–
–LIM	Lower limit value trigger event	113005
+LIM	Upper limit value trigger event	113006

Tab. 631: Legend for the diagram of trigger ranges (example)

Diagnostic messages No specific diagnostic messages are allocated to the function.

7.2.2 CiA 402

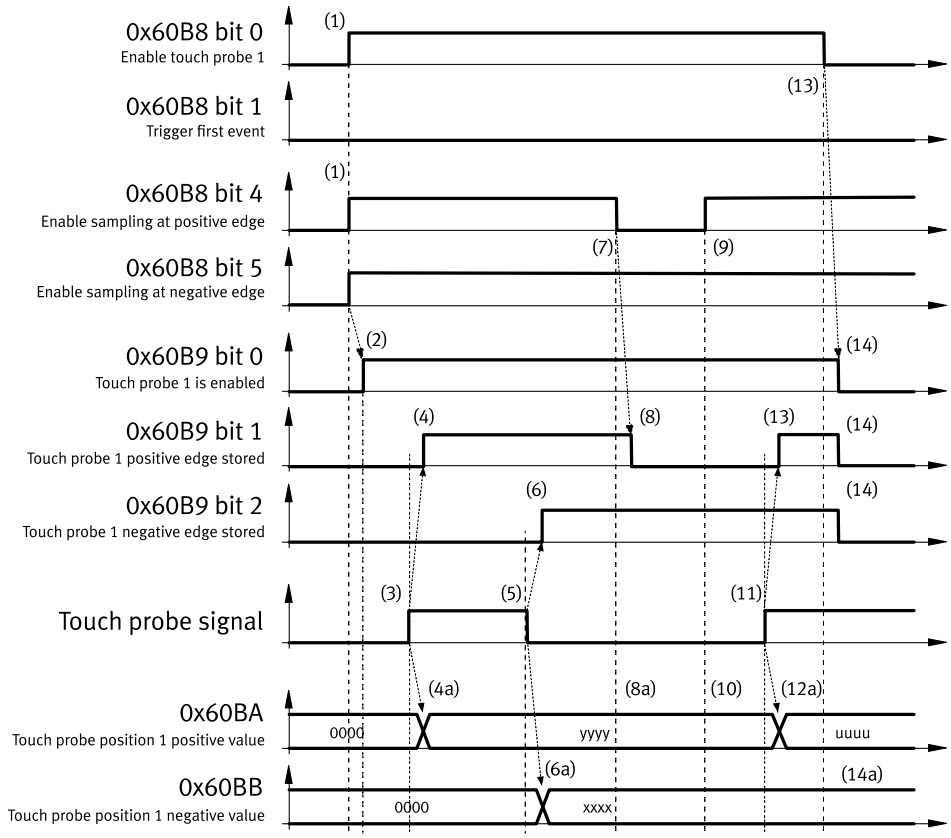


Fig. 104: Touch probe timing diagram via CiA 402

No.	Touch probe behaviour	
(1)	0x60B8, bit 0 = 1	Enable touch probe 1
	0x60B8, bit 1 = 0	Trigger first event (1 = continous)
	0x60B8, bit 4, 5	Configure and enable touch probe 1 positive and negative edge
(2)	→ 0x60B9, bit 0 = 1	Status "Touch probe 1 enabled" is set
(3)	External touch probe signal has positive edge	
(4)	→ 0x60B9, bit 1 = 1	Status "Touch probe 1 positve edge stored" is set
(4a)	→ 0x60BA	Touch probe position 1 positive value is stored
(5)	External touch probe signal has negative edge	
(6)	→ 0x60B9, bit 2 = 1	Status "Touch probe 1 negative edge stored" is set
(6a)	→ 0x60BB	Touch probe position 1 negative value is stored
(7)	0x60B8, bit 4 = 0	Sample positive edge is disabled
(8)	→ 0x60B9, bit 0 = 0	Status "Touch probe 1 positve edge stored" is reset
(8a)	0x60BA	Touch probe position 1 positive value is not changed
(9)	0x60B8, bit 4 = 1	Sample positive edge is enabled
(10)	→ 0x60BA	Touch probe position 1 positive value is not changed
(11)	External touch probe signal has positive edge	
(12)	→ 0x60B9, bit 1 = 1	Status "Touch probe 1 positve edge stored" is set
(12a)	→ 0x60BA	Touch probe position 1 positive value is stored
(13)	0x60B8, bit 0 = 0	Touch probe 1 is disabled
(14)	→ 0x60B9, bit 0, 1, 2 = 0	Status bits are reset
(14a)	→ 0x60BA, 0x60BB	Touch probe position 1 positive/negative value are not changed

Tab. 632: Legend for touch probe timing diagram via CiA 402

With objects 0x60B8 and 0x60B9 the second instance starts with bit 8 (e. g. 0x60B8: bit 8 = 1; Enable touch probe 2; bit 9 = 0; Trigger first event).

Object 0x60B8 Object 0x60B8 enables configuration of the touch probe function.

Bit	Value	Description
0	0	Switch 0 off touch probe 1
	1	Enable touch probe 1
1	0	Trigger first event
	1	continous
3, 2	00	Trigger with touch probe 1 input (fix)
4	0	Switch off sampling at positive edge of touch probe 1
	1	Enable sampling at positive edge of touch probe 1
5	0	Switch off sampling at negative edge of touch probe 1
	1	Enable sampling at negative edge of touch probe 1
6, 7	–	reserved
8	0	Switch off touch probe 2
	1	Enable touch probe 2
9	0	Trigger first event
	1	continous
11, 10	00	Trigger with touch probe 2 input (fix)
12	0	Switch off sampling at positive edge of touch probe 2
	1	Enable sampling at positive edge of touch probe 2
13	0	Switch off sampling at negative edge of touch probe 2
	1	Enable sampling at negative edge of touch probe 2
14, 15	–	reserved

Tab. 633: Value definition of the object 0x60B8

Object 0x60B9 Object 0x60B9 returns the status of the touch probe function.

Bit	Value	Description
0	0	Touch probe 1 is switched off
	1	Touch probe 1 is enabled
1	0	Touch probe 1 no positive edge value stored
	1	Touch probe 1 positive edge position stored
2	0	Touch probe 1 no negative edge value stored
	1	Touch probe 1 negative edge position stored
3 to 7	0	reserved
8	0	Touch probe 2 is Switched off
	1	Touch probe 2 is enabled
9	0	Touch probe 2 no positive edge value stored
	1	Touch probe 2 positive edge position stored
10	0	Touch probe 2 no negative edge value stored
	1	Touch probe 2 negative edge position stored
11 to 15	0	reserved

Tab. 634: Value definition of the object 0x60B9

Position sensing objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
1128060	0x60B8.00	Touch probe function CiA402	UINT
1128061	0x60B9.00	Touch probe status as per CiA402	UINT
113027	0x60D1.00	Time stamp touch probe position positive CiA402	UDINT
113028	0x60D2.00	Time stamp touch probe position negative CiA402	UDINT
113029	0x60BA.00	Touch probe position positive CiA402	DINT
113030	0x60BB.00	Touch probe position negative CiA402	DINT
113031	0x60D5.00	Counter initiated trigger events positive edge CiA402	UINT
113032	0x60D6.00	Counter initiated trigger events negative edge CiA402	UINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1128060	0x2195.06	Touch probe function CiA402	UINT
1128061	0x2195.07	Touch probe status as per CiA402	UINT
113000	0x2193.01 ... 02	Touch probe mode	UINT
113001	0x2193.03 ... 04	Touch probe source	UINT
113002	0x2193.05 ... 06	Selection trigger event	UINT
113003	0x2193.07 ... 08	Upper limit value modulo	LINT
113004	0x2193.09 ... 0A	Lower limit value modulo	LINT
113005	0x2193.0B ... 0C	Lower limit value trigger event	LINT
113006	0x2193.0D ... 0E	Upper limit value trigger event	LINT
113007	0x2193.0F ... 10	Actual touch probe mode	UINT
113008	0x2193.11 ... 12	Actual touch probe source	UINT
113009	0x2193.13 ... 14	Actual selection trigger event	UINT
113010	0x2193.15 ... 16	Actual upper limit value modulo	LINT
113011	0x2193.17 ... 18	Actual lower limit value modulo	LINT
113012	0x2193.19 ... 1A	Actual lower limit value trigger event	LINT
113013	0x2193.1B ... 1C	Actual upper limit value trigger event	LINT
113014	0x2193.1D ... 1E	Touch probe position	LINT
113015	0x2193.1F ... 20	Time stamp touch probe position	ULINT
113016	0x2193.21 ... 22	Trigger event initiated	USINT
113017	0x2193.23 ... 24	Trigger event NOT initiated	USINT
113018	0x2193.25 ... 26	Trigger events counter triggered	UDINT
113019	0x2193.27 ... 28	Trigger events counter NOT triggered	UDINT
113020	0x2193.29 ... 2A	Counter modulo cycles	UDINT
113021	0x2193.2B ... 2C	Status touch probe input	USINT
113022	0x2193.2D ... 2E	Status modulo limit reached	USINT
113023	0x2193.2F ... 30	Modulo position	LINT
113024	0x2193.31 ... 32	Offset modulo position	LINT
113025	0x2193.33 ... 34	Initialisation modulo	LINT
113026	0x2193.35 ... 36	Actual offset modulo position	LINT
113027	0x2193.37 ... 38	Time stamp touch probe position positive CiA402	ULINT
113028	0x2193.39 ... 3A	Time stamp touch probe position negative CiA402	ULINT
113029	0x2193.3B ... 3C	Touch probe position positive CiA402	LINT
113030	0x2193.3D ... 3E	Touch probe position negative CiA402	LINT
113031	0x2193.3F ... 40	Counter initiated trigger events positive edge CiA402	UDINT
113032	0x2193.41 ... 42	Counter initiated trigger events negative edge CiA402	UDINT

Parameter	Index.Subindex	Name	Data type
113033	0x2193.43 ... 44	Touch probe status CiA402	UINT
113034	0x2193.45 ... 46	Modulo hysteresis	LINT
113035	0x2193.47 ... 48	Actual modulo hysteresis	LINT
113036	0x2193.49 ... 4A	Delay time	REAL
113037	0x2193.4B ... 4C	Actual delay time	REAL

Tab. 635: Objects

7.2.3 PROFIdrive

Position sensing PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
113000	12037.0	Touch probe mode	UINT
113001	12039.0	Touch probe source	UINT
113002	12041.0	Selection trigger event	UINT
113003	12043.0	Upper limit value modulo	LINT
113004	12045.0	Lower limit value modulo	LINT
113005	12047.0	Lower limit value trigger event	LINT
113006	12049.0	Upper limit value trigger event	LINT
113007	12051.0	Actual touch probe mode	UINT
113008	12053.0	Actual touch probe source	UINT
113009	12055.0	Actual selection trigger event	UINT
113010	12057.0	Actual upper limit value modulo	LINT
113011	12059.0	Actual lower limit value modulo	LINT
113012	12061.0	Actual lower limit value trigger event	LINT
113013	12063.0	Actual upper limit value trigger event	LINT
113014	12065.0	Touch probe position	LINT
113015	12067.0	Time stamp touch probe position	ULINT
113016	12069.0	Trigger event initiated	BOOL
113017	12071.0	Trigger event NOT initiated	BOOL
113018	12073.0	Trigger events counter triggered	UDINT
113019	12075.0	Trigger events counter NOT triggered	UDINT
113020	12077.0	Counter modulo cycles	UDINT
113021	12079.0	Status touch probe input	BOOL
113022	12081.0	Status modulo limit reached	BOOL
113023	12083.0	Modulo position	LINT
113024	12085.0	Offset modulo position	LINT
113025	12087.0	Initialisation modulo	LINT
113026	12089.0	Actual offset modulo position	LINT
113027	12091.0	Time stamp touch probe position positive CiA402	ULINT
113028	12093.0	Time stamp touch probe position negative CiA402	ULINT
113029	12095.0	Touch probe position positive CiA402	LINT
113030	12097.0	Touch probe position negative CiA402	LINT
113031	12099.0	Counter initiated trigger events positive edge CiA402	UDINT
113032	12101.0	Counter initiated trigger events negative edge CiA402	UDINT
113033	12103.0	Touch probe status CiA402	UINT
113034	12105.0	Modulo hysteresis	LINT

Parameter	PNU	Name	Data type
113035	12107.0	Actual modulo hysteresis	LINT
113036	12109.0	Delay time	REAL
113037	12111.0	Actual delay time	REAL

Tab. 636: PNUs

7.3 Open-loop operation

7.3.1 Function

Function

In open-loop operation the motor is controlled with constant currents. This type of control is particularly suited for reducing vibration at low rotational speeds.
In closed-loop operation the servo drive controls the motor current and tries to compensate for deviations as closely as possible depending on the closed-loop parameterisation.
Open-loop operation is possible with and without an encoder. If an encoder is used, the device can switch automatically between closed-loop operation and open-loop operation. If closed-loop operation is requested without the presence of a valid commutation angle in the current data record, an error message is output.
The following modes of open-loop operation are supported:

Modes	Description
Open-loop operation without encoder	The motor is controlled with constant currents only. If functions require an encoder or closed-loop operation, they are rejected with an error message. Deviations cannot be detected. – Motion monitoring functions are inactive. – Force mode is not supported. – Homing methods that require an encoder are not supported (homing methods with zero pulse detection). – Homing methods that require force mode are not supported (homing methods with stop detection).
Open-loop operation with encoder	The motor is operated in open-loop or closed-loop operation with constant currents depending on the function call. Deviations can be detected. – Motion monitoring functions are supported as configured. – If functions require closed-loop operation, they are automatically run in closed-loop operation. If force mode is requested, it is automatically run in closed-loop operation. – All homing methods can be triggered. Homing methods with stop detection are automatically run in closed-loop operation.
Automatic operation	If the speed falls below the parameterised target speed (Px.4008), the servo drive automatically switches to open-loop operation. If the parameterised target speed is exceeded, the servo drive switches back to closed-loop operation. Motion monitoring functions are supported as configured. – Motion monitoring functions are supported as configured. – If functions require closed-loop operation, they are automatically run in closed-loop operation. If force mode is requested, it is automatically run in closed-loop operation.

Tab. 637: Modes of open-loop operation

Parameters and diagnostic messages

If parameter Px.4001.0.0 is deactivated, the desired operating mode can be defined with parameter Px.4005 when the device is started. The operating mode can then be changed during operation with parameter Px4006.0.0. The active operating mode is displayed by parameter Px4007.0.0.

If controlled operation is to take place without an encoder, even though the motor has an encoder, the parameter "Activation of open loop operation" Px.4001.0.0 must be set to activated and the mode for the commutation-angle detection must be set to deactivated (Px.668.0.0).
The holding current of the motor can be reduced in open-loop operation after standstill detection. The current reduction can be switched on and off with the Px.4026 parameter. The deceleration time and the magnitude of the current reduction can be specified by parameterisation.

ID Px.	Parameter	Description	
270	Setpoint value reactive current	Setpoint value of the reactive current	
		Access	read/write
		Update	effective immediately
		Unit	Arms
662	Time current increase	Specifies the time duration of the current rise ramp for the commutation-angle detection.	
		Access	read/write
		Update	effective immediately
		Unit	s
4001	Activation of open loop operation	Activates the open loop operation	
		Access	read/write
		Update	reinitialization
		Unit	–
4004	Active control structure	Displays the active control structure	
		Access	read/–
		Update	effective immediately
		Unit	–
4005	Selection of mode of operation open loop/closed loop	Specifies the mode of operation for the open loop or closed loop operation used when starting the device.	
		Access	read/write
		Update	effective immediately
		Unit	–
4006	Selection of mode of operation	Displays the active operating mode selection for open loop or closed loop operation. This means: 0: Automatic operation 1: Open loop operation 2: closed loop operation	
		Access	read/write
		Update	effective immediately
		Unit	–
4007	Active mode of operation	Displays the active mode of operation for the open-loop or closed-loop operation This means: 0: Automatic operation 1: Open loop operation 2: closed loop operation	
		Access	read/–
		Update	effective immediately
		Unit	–
4008	Velocity switching threshold	Specifies the switching threshold from which velocity can be automatically switched from open-loop operation to closed-loop operation.	
		Access	read/write
		Update	effective immediately

ID Px.	Parameter	Description	
4008	Velocity switching threshold	Unit	user defined
4010	Current rise time	Specifies the time with which mode of operation is open loop and switched to closed-loop in automatic mode.	
		Access	read/write
		Update	effective immediately
		Unit	s
4026	Current reduction activation	Activates the current reduction after detection of standstill	
		Access	read/write
		Update	effective immediately
		Unit	–
4027	Current reduction delay time	Specifies the delay time with which current reduction is effective after reaching standstill detection.	
		Access	read/write
		Update	effective immediately
		Unit	s
4028	Current reduction scaling factor	Specifies the scaling factor for current reduction based on the nominal current	
		Access	read/write
		Update	effective immediately
		Unit	–
6694	Factor current setpoint value	Specifies the factor for the current setpoint used for the commutation angle determination.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 638: Parameters

ID Dx.	Name	Description
06 | 02 | 00273 (100794641)	Change of control structure not permissible	The change of the control structure is not permissible
06 | 02 | 00274 (100794642)	Motion command not permissible	The motion command is not permissible in open-loop operation
06 | 02 | 00275 (100794643)	Change to closed loop operation not permissible	Change to closed loop operation not permissible because the commutation angle is not valid

Tab. 639: Diagnostic messages

7.3.2 CiA 402

Open-loop operation objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
270	0x219C.02	Setpoint value reactive current	REAL
662	0x219C.03	Time current increase	REAL
4001	0x219C.04	Activation of open loop operation	USINT
4004	0x219C.07	Active control structure	UDINT
4005	0x219C.08	Selection of mode of operation open loop/closed loop	UDINT
4006	0x219C.09	Selection of mode of operation	UDINT
4007	0x219C.0A	Active mode of operation	UDINT
4008	0x219C.0B	Velocity switching threshold	REAL
4010	0x219C.0D	Current rise time	REAL
4026	0x219C.15	Current reduction activation	USINT

Parameter	Index.Subindex	Name	Data type
4027	0x219C.16	Current reduction delay time	REAL
4028	0x219C.17	Current reduction scaling factor	REAL
6694	0x219C.14	Factor current setpoint value	REAL

Tab. 640: Objects

7.3.3 PROFIdrive

Open-loop operation PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
270	11094.0	Setpoint value reactive current	REAL
662	11179.0	Time current increase	REAL
4001	11542.0	Activation of open loop operation	BOOL
4004	11545.0	Active control structure	UDINT
4005	11546.0	Selection of mode of operation open loop/closed loop	UDINT
4006	11547.0	Selection of mode of operation	UDINT
4007	11548.0	Active mode of operation	UDINT
4008	11549.0	Velocity switching threshold	REAL
4010	11551.0	Current rise time	REAL
4026	11558.0	Current reduction activation	BOOL
4027	11559.0	Current reduction delay time	REAL
4028	11560.0	Current reduction scaling factor	REAL
6694	11685.0	Factor current setpoint value	REAL

Tab. 641: PNUs

7.4 Field weakening

7.4.1 Function

Synchronous motors can only be operated up to a specific rotational speed. If the induced motor voltage reaches the level of the DC link voltage, the torque rapidly decreases.
The objective of field weakening is to reach higher rotational speeds. In field weakening the motor negative field voltage is reduced by a negative reactive current. This means that the motor can also be operated above the maximum speed. The negative reactive current must be limited for some motors.
The reactive current is automatically determined and impressed depending on the operating status. Impressing the reactive current reduces the available active current.

When switched off, voltages greater than the supply voltage can be present at the motor terminals in an unfavourable operating status.

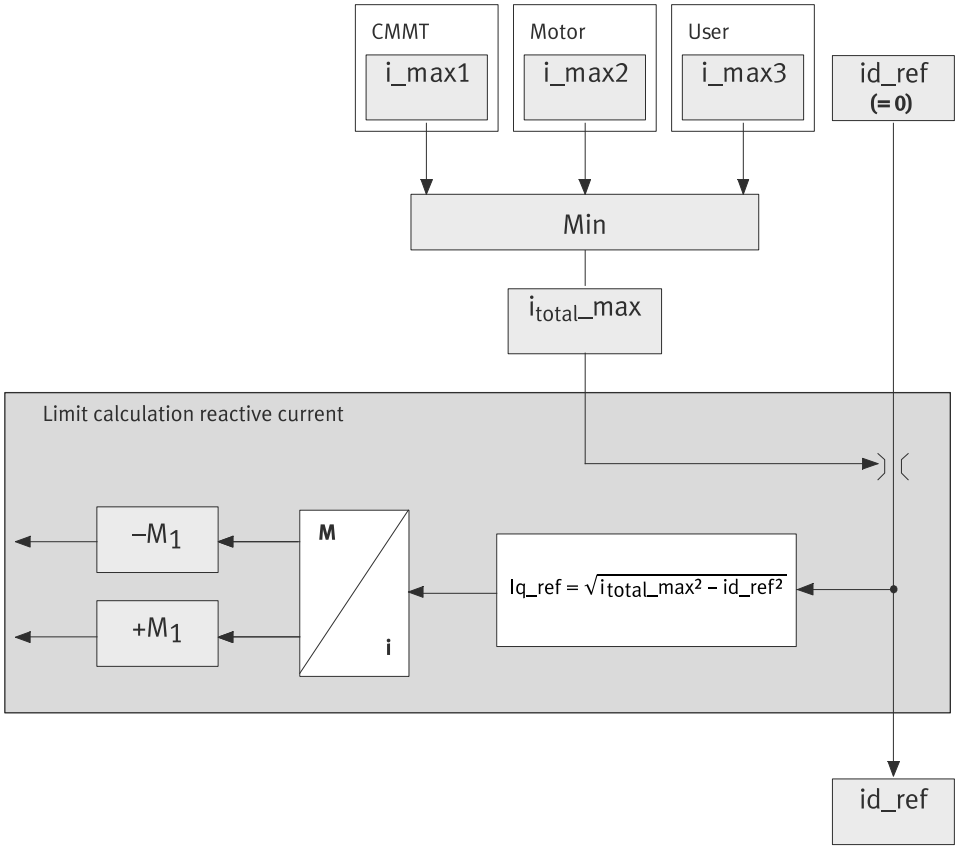


Fig. 105: Limit value calculation reactive current

Name	Parameter	ID Px.
i_max1	Maximum current servo drive	622
i_max2	Maximum current motor	620
i_max3	Limit value total current (closed loop controller)	856
id_ref	Setpoint value reactive current	87
i_{total}_max	Resulting upper limit value total current (closed loop controller)	6112
$-M_1$	Resulting limit value from the reactive current reduction, which also acts on the torque limitation ➔ 6.2.3 Torque limitation	–
$+M_2$		

Tab. 642: Legend for the figure “Limit value calculation for reactive current”

Parameters and diagnostic messages

ID Px.	Parameter	Description	
102201	Activation of field weakening	Specifies whether the field weakening is active or inactive.	
		Access	read/write
		Update	reinitialization
		Unit	–
102202	Field weakening status	Displays whether the field weakening is active or inactive.	
		Access	read/–
		Update	effective immediately
		Unit	–
7123	Maximum rpm (user defined)	Specifies the maximum permissible velocity of the motor used -> data sheet of the motor.	
		Access	read/write
		Update	reinitialization
		Unit	rpm

ID Px.	Parameter	Description	
71370	Fieldweakening: Active max. rotary speed	Displays the active maximum rotational speed for fieldweakening	
		Access	read/–
		Update	effective immediately
		Unit	user defined
71371	Fieldweakening: max. rotary speed (user defined)	Specifies the maximum rotational speed for fieldweakening	
		Access	read/write
		Update	reinitialization
		Unit	rpm

Tab. 643: Parameters

7.4.2 CiA 402

Field weakening objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
102201	0x219F.01	Activation of field weakening	USINT
102202	0x219F.02	Field weakening status	USINT
7123	0x216C.06	Maximum rpm (user defined)	REAL
71370	0x2162.23	Fieldweakening: Active max. rotary speed	REAL
71371	0x216C.1A	Fieldweakening: max. rotary speed (user defined)	REAL

Tab. 644: Objects

7.4.3 PROFIdrive

Field weakening PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
102201	11949.0	Activation of field weakening	BOOL
102202	11950.0	Field weakening status	BOOL
7123	11694.0	Maximum rpm (user defined)	REAL
71370	13256.0	Fieldweakening: Active max. rotary speed	REAL
71371	13260.0	Fieldweakening: max. rotary speed (user defined)	REAL

Tab. 645: PNUs

7.5 Modulo operation

7.5.1 Function

Modulo mode simplifies the implementation of intermittent endless movements, e.g. the operation of rotary indexing tables and conveyors. The modulo mode is only used in the positioning mode (PP) (profile position mode PP).
The modulo range is described by a minimum value and a maximum value (Lower limit value modulo and Upper limit value modulo parameter). If a setpoint value is specified that lies outside the defined modulo range, only the remaining distance resulting from the modulo division is traversed.
The actual position provided by the real-time Ethernet interface is always a position that is within the defined modulo limits. During active modulo operation the Px.113104 parameter is automatically returned to the controller as actual position.
If a multi-turn absolute encoder is used, the travelled revolutions are stored so the correct modulo position can be determined when the device is switched on again.

Activate/deactivate modulo

Modulo mode can be activated and deactivated via block selection or via the drive profile of the relevant fieldbus.
Activation via drive profile:
- The modulo mode becomes active if one of the two limit values of the modulo range is set to non-zero via the drive profile. Details on activation via the drive ➔ 7.5.2 CiA 402 and ➔ 7.5.3 PROFIdrive.
- The modulo mode becomes inactive when both limit values of the modulo range are set to zero via the drive profile.
- To change parameters after the modulo mode has been activated, the modulo mode must first be deactivated and then reactivated. For example, this applies for changing the modulo limit or the offset of the modulo.

Activation via record table or via the method calls (device services) of the respective drive profile:
- The applicable mode is activated or deactivated via the record table or the corresponding method call.
- The lower and upper modulo limit values are specified via parameters Px.113102 and Px.113113. Changed limit values are only applied after a new call of a modulo function (record table or the corresponding method call).
- Automatic activation during device start-up ➔ Px.101551.

Zero point offset

Through the two parameters Offset modulo position Px.113110 and Initialisation modulo position Px.113111, a zero point offset of the actual position can be carried out. The values of both parameters are independent of each other and add up to a total value for the offset.
- A user-defined offset for a zero point offset can be specified via the Offset modulo position Px.113110 parameter. The offset is imported by activating a modulo mode.
  Example: the actual position is 90° and the parameter Px.113110 is written to -90°. After a modulo mode is called, the actual position is 0°.
- The Initialisation modulo position Px.113111 parameter can be set and reset by the record table or the corresponding method call of the device service (example ➔ Tab. 646 Modulo operation modes with absolute position specification).

Basics

When modulo mode is active, you can switch between the "Position Mode PP" profile and the "Speed Mode PV" profile without deactivating modulo mode.
Any absolute and relative setpoint specifications are permitted in the "Position Mode PP" profile. A modulo calculation is applied to the setpoint value and the remainder is traversed as a function of the mode.
If the "Set modulo position" mode is activated via the record table or the method call, the resulting modulo position is set to the lower modulo limit value at the current actual position and the value of the zero point offset is stored in parameter Px.113111.
The modulo limit values and the modulo mode remain unaffected and refer to the new modulo position. Through the "Reset modulo position" mode, the offset in parameter Px.113111 is set to 0.



If modulo mode is activated via the drive profile, the modulo position is reported as the actual value. However, with the drive profile (PROFIdrive, drive profile via EtherNet/IP and Modbus TCP, CiA 402) this only happens after the first movement command.

Influence of the user unit and the factor group on the accuracy

The user unit and the factor group have a major influence on the positioning accuracy and the position drift for relative motion commands. Since all setpoint values refer to the output, gear units, even with uneven divider ratios, do not result in position drift.

User unit

The defined user unit, e.g. degree (°) or rev, is converted to a 64-bit position value. To achieve permanent, correct positioning without position drift, it is recommended that the user unit be selected so that it executes integer user unit steps, e.g. with degree as the user unit.
Examples
Target 60° mechanical motion at the output with the degree as user unit:
– A setpoint specification of 60° results in the internal value 60000000. There is no danger of rounding errors.
Target 60° mechanical motion at the output with the rev as user unit:
– A setpoint specification of 1/6 results in the value 0.166666666666666666 and internally the value 166666666. This leads to rounding errors.

Factor group

The factor group is used to specify the resolution with which setpoint values are transferred from a controller to the servo drive. This inevitably results in rounding errors. With absolute positioning, the rounding errors do not add up. However, if relative positioning is carried out continuously, the rounding errors accumulate. If the factor group cannot be selected in combination with the setpoint values so that there are no rounding errors, it is recommended to work with the position orders provided by the "absolute" or "relative" record table.

Tolerance window

For example, minor position differences after switching on the device with multi-turn position encoders or after homing to obtain the same number of turns or motion make it possible to parameterise a tolerance window with Px.102100. The tolerance window within the window may result in movements against the assigned direction.
Example:
– Mode: only positive
– Modulo limits: 0 ... 360°
– Motion command: 90°

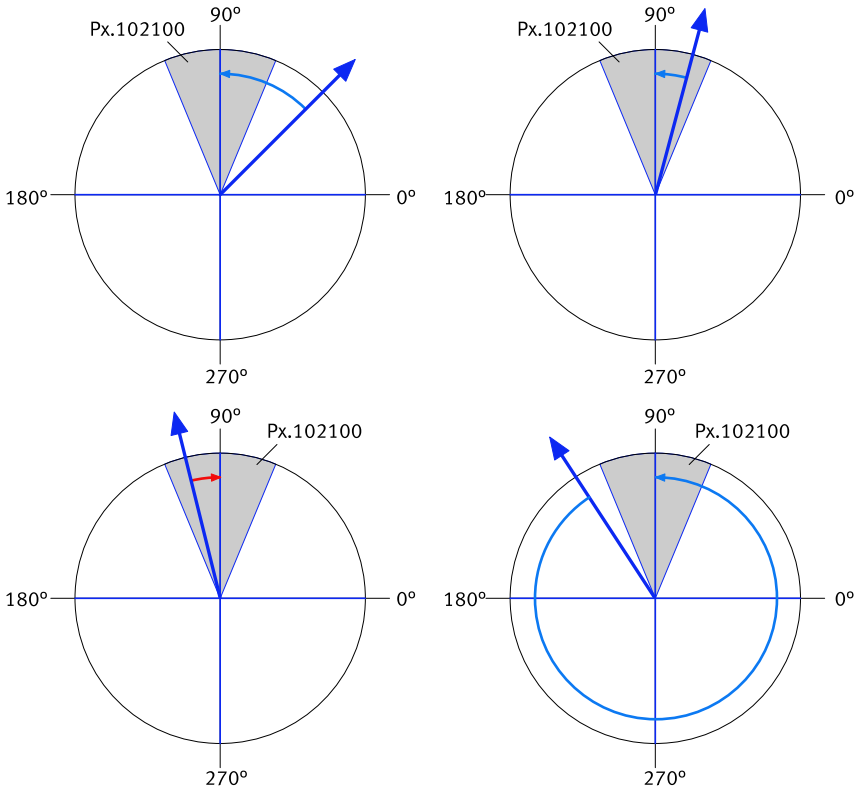


Fig. 106: Effect of the modulo tolerance window - modulo target position 90° in positive direction

The behaviour can be activated compatible with firmware V33 with the Px.102137 parameter.

Modulo modes

The actual position refers to the value that is returned to the controller as an actual value via the relevant drive profile.

Modulo operation with absolute position specification		
Modulo modes	Description	Example
Shortest path	The drive moves over the shortest path to the target position resulting from the modulo division. The modulo limits are not considered.	Specification: – Modulo range: 0 ... 360° – The drive is stationary at 340° and the absolute setpoint specification is 420°. Reaction: – The drive moves 80° in the positive direction of motion beyond the modulo limit of360°. – Actual position: 60°
Shortest path with turns	The drive travels the shortest path to the target position and takes the number of revolutions into account. The modulo limits are not considered.	Specification: – Modulo range: 0 ... 360° – The drive is stationary at 90° and the absolute setpoint specification is 820°. Reaction: – The drive travels in the positive direction of movement 2 times over the modulo limits from 360° to 820°. – Actual position: 100°

Modulo operation with absolute position specification		
Modulo modes	Description	Example
Within the modulo limits	The drive moves the shortest way to the target position resulting from the modulo division. The modulo limits are taken into account.	Specification: – Modulo range: 0 ... 360° – The drive is stationary at 340° and the absolute setpoint specification is 420°. Reaction: – The drive moves 280° in the negative direction of motion and does not move beyond a modulo limit of 360°. – Actual position: 60°
Only positive path	The drive moves to the target position in positive direction.	Specification: – Modulo range: 0 ... 360° – The drive is stationary at 340° and the absolute setpoint specification is 680°. Reaction: – The drive moves in positive direction 340°. – Actual position: 320°
Only positive path with turns	The drive travels to the target position in a positive direction and takes the number of rotations into account.	Specification: – Modulo range: 0... 360° – The drive is stationary at 10° and the absolute setpoint specification is 360°. Reaction: – The drive travels in the positive direction of movement 1 times over the modulo limits from 360° to 720°. – Actual position: 0°
Only negative path	The drive moves to the target position in negative direction.	Specification: – Modulo range: 0 ... 360° – The drive is stationary at 340° and the absolute setpoint specification is 350°. Reaction: – The drive moves in negative direction of motion 350°. – Actual position: 350°
Only negative path with turns	The drive travels to the target position in the negative direction and takes the number of rotations into account.	Specification: – Modulo range: 0... 360° – The drive is stationary at 90° and the absolute setpoint specification is 820°. Reaction: – The drive moves in the negative direction of motion 3 times over the modulo limits from 360° to –980°. – Actual position: 100°

Modulo operation with absolute position specification		
Modulo modes	Description	Example
Set modulo position	Zero point offset of the actual position: – Sets the actual position to the lower modulo limit value. – Value of the zero point offset is stored in parameter Px.113111.	Specification: – Shortest path mode – Modulo range: 0... 360° – The drive is stationary at 450° – Actual position: 90° – "Set modulo position" is executed. – Actual position: 0° – absolute setpoint specification 420° Reaction: – The drive moves 60° in the positive direction of motion and stops at 510° – Parameter Px.113111 = –90° – Actual position: 60°
Reset modulo position	Zero point offset of the actual position: – Reset resets a previous offset of the modulo value with the Set modulo position function. – Value of the zero point offset is reset to 0 in parameter Px.113111.	Specification: – Modulo range: 0... 360° – Parameter Px.113111 = –90° – Actual position: 90° – "Reset modulo position" is executed. Reaction: – Drive does not move. – Parameter Px.113111 = 0° – Actual position is set to 180°.

Tab. 646: Modulo operation modes with absolute position specification

Modulo operation with relative position specification		
Modulo modes	Description	Example
Shortest path	The drive moves over the shortest path to the target position resulting from the modulo division. The modulo limits are not considered.	Specification: – Modulo range: 0°... 360° – The drive is set to 90° and the relative setpoint specification is 460°. Reaction: – The drive moves in positive direction 100°. – Actual position: 190°
Shortest path with turns	The drive travels the shortest path to the target position and takes the number of revolutions into account. The modulo limits are not considered.	Specification: – Modulo range: 0°... 360° – The drive is set to 90° and the relative setpoint specification is 460°. Reaction: – The drive moves once in the positive direction of motion over the modulo limit of 360° to 550°. – Actual position: 190°
Only positive path	The drive moves to the target position in positive direction.	Specification: – Modulo range: 0°... 360° – The drive is set to 90° and the relative setpoint specification is 440°. Reaction: – The drive moves in positive direction 80°. – Actual position: 170°
Only positive path with turns	The drive travels to the target position in a positive direction and takes the number of rotations into account.	Specification: – Modulo range: 0... 360° – The drive is set to 90° and the relative setpoint specification is 440°. Reaction: – The drive travels in the positive direction of movement 1 times over the modulo limits from 360° to 530°. – Actual position: 170°

Modulo operation with relative position specification		
Modulo modes	Description	Example
Only negative path	The drive moves to the target position in negative direction.	Specification: – Modulo range: 0°... 360° – The drive is set to –90° and the relative set-point specification is –440°. Reaction: – The drive moves in negative direction of motion –80°. – Actual position: 190°
Only negative path with turns	The drive travels to the target position in the negative direction and takes the number of rotations into account.	Specification: – Modulo range: 0... 360° – The drive is set to –90° and the relative set-point specification is –370°. Reaction: – The drive moves once in the negative direction of motion over the modulo limits from 360° to –460°. – Actual position: 260°

Tab. 647: Modes of modulo operation with relative position specification

Monitoring functions

The monitoring functions marked with a dot are effective in modulo mode:

Motion monitoring function status word			
Bit	Code	Name	Effective
0	TRX	Target window reaches position	•
1	TRV	Target window reaches speed	•
2	TRT	Target window reaches torque	–
3	FEX	Position following error	•
4	FEV	Speed following error	•
5	–	Reserved	–
6	TMX	Position target area monitoring	•
7	TMV	Speed target area monitoring	•
8	TMT	Torque target area monitoring	–
9...11	–	Reserved	–
12	HLP	Hardware limit switch reached positive	•
13	HLN	Hardware limit switch reached negative	•
14	SLP	Software end position reached positive	•
15	SLN	Software end position reached negative	•
16	STX	Standstill monitoring position/speed	•
17	STV	Standstill monitoring speed	•
18	LS	Stop reached	•
19	STLP	Stroke limit reached positive	–
20	STLN	Stroke limit reached negative	–
21	VM	Speed monitoring	•
22	PB	Reverse feed monitoring	–
23	RDX	Remaining distance monitoring	–
24	MC	Trajectory completed	•
25	REFS	Reference switch activated	•
26	TUR	Torque utilisation exceeded	–
27	FSPR	Fixed stop reached	–
28	ACC	Drive accelerated	•

Motion monitoring function status word			
Bit	Code	Name	Effective
29	DEC	Drive decelerated	•
30... 31	–	Reserved	–

Tab. 648: Motion monitoring function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Parameters and diagnostic Messages

ID Px.	Parameter	Description	
101551	Activation Modulo device start	Activates the modulo configuration when the device is restarted.	
		Access	read/write
		Update	effective immediately
		Unit	–
113102	Lower limit value modulo	Lower limit value of the modulo function	
		Access	read/write
		Update	effective immediately
		Unit	user defined
113103	Setpoint value modulo	Setpoint value based on the modulo limits	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113104	Actual value modulo	Actual value based on the modulo limits	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113105	Actual mode modulo	Specifies the actual used setting of the modulo function.	
		Access	read/–
		Update	effective immediately
		Unit	–
113106	Actual upper limit value modulo	Specifies the actual used upper limit value of the modulo function.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113107	Actual lower limit value modulo	Specifies the actual used lower limit value of the modulo function.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113108	Counter modulo cycles	Counter for the modulo cycles	
		Access	read/–
		Update	effective immediately
		Unit	–
113109	Modulo overflow status	Specifies the status for exceeding the modulo limit.	
		Access	read/–
		Update	effective immediately
		Unit	–
113110	Offset modulo position	Specifies the offset that results in a user-defined zero point offset of the actual position.	
		Access	read/write

ID Px.	Parameter	Description	
113110	Offset modulo position	Update	effective immediately
		Unit	user defined
113111	Initialisation modulo position	The parameter is set by the method "Set Initialization Modulo" and "Reset Initialization Modulo" are set or reset. The parameter results in a zero point offset of the actual position.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
113112	Actual offset modulo position	Specifies the actual used offset of the zero point offset from Px.113110.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113113	Upper limit value modulo	Specifies the upper limit value for the modulo calculation. When the upper limit value is exceeded, the position jumps to the lower limit value.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
102100	Tolerance window modulo	Specifies the tolerance window for modulo with turns.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
102137	Activation compatibility V33	Activates compatibility to FW version V33 regarding shortest path with turns.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 649: Parameters

Diagnostic messages

No specific diagnostic messages are allocated to the function.

7.5.2 CiA 402

There are two options for activating the modulo mode via drive profile CiA 402:
– with the Position Option Code
– with the record table or with device services/methods
Modulo is activated via CiA 402, in which one of the modulo limit values is not equal to 0: Px113102 and Px113113.

Activating modulo with the Position Option Code

The Position Option Code 0x60F2 (Px.88817) defines how to proceed in the direct setpoint specification. The modulo mode can be selected with bits 6 and 7. The 0x607B.01 (Px.113102) and 0x607B.02 (Px.113113) objects define the lower or the upper modulo limit value.
These bits determine the direction of rotation in "Profile Position" mode.

Bit 7	Bit 6	Definition
0	0	Normal positioning
0	1	Positioning only in negative direction
1	0	Positioning only in positive direction
1	1	Positioning with the shortest path to the target position

Tab. 650: Modulo mode

The "shortest path within the modulo limit" variant can be activated instead of "shortest path" via the parameter Px.88818 or the manufacturer-specific object 0x216F.16.

Activating modulo with the record table or with device services/methods

The relevant modulo is activated or deactivated via the record table or device service/method 0x2008.1 … 4. The limit values for the lower and upper modulo limit are specified via parameters Px.113102 and Px.113113 and activated by activating a modulo mode. Motion commands that are subsequently executed via the record table are executed with the activated modulo mode.
If, after activation of the modulo mode, a motion command is issued via the CiA 402 direct positioning via the record table, the procedure is followed by the modulo mode, which is specified by the position option code 0x60F2 ➔ Tab. 650 Modulo mode.

Modulo objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA402: The factor group is effective.**		
113102	0x607B.01	Lower limit value modulo	DINT
113104	0x6064.00	Actual value modulo	DINT
113113	0x607B.02	Upper limit value modulo	DINT
88817	0x60F2.00	Positioning option code CiA402	UINT
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
88817	0x216F.0C	Positioning option code CiA402	UINT
88818	0x216F.16	Extended Modulo mode This parameter can be used to extend modulo operation by the following mode: – Shortest path within the modulo boundary	USINT
101551	0x2197.0F	Activation Modulo device start	USINT
113102	0x2197.03	Lower limit value modulo	LINT
113103	0x2197.04	Setpoint value modulo	LINT
113104	0x2197.05	Actual value modulo	LINT
113105	0x2197.06	Actual mode modulo	UINT
113106	0x2197.07	Actual upper limit value modulo	LINT
113107	0x2197.08	Actual lower limit value modulo	LINT
113108	0x2197.09	Counter modulo cycles	UDINT
113109	0x2197.0A	Modulo overflow status	USINT
113110	0x2197.0B	Offset modulo position	LINT
113111	0x2197.0C	Initialisation modulo position	LINT
113112	0x2197.0D	Actual offset modulo position	LINT
113113	0x2197.0E	Upper limit value modulo	LINT
102100	0x2197.10	Tolerance window modulo	REAL
102137	0x2197.11	Activation compatibility V33	USINT

Tab. 651: Objects

7.5.3 PROFIdrive

There are two options for activating the modulo mode via the drive profile:
– with the SINA_POS function module
– with the record table or with device services/methods

Activating modulo with the SINA_POS function module (SIEMENS)

Modulo is activated via the drive profile in which one of the modulo limit values is not equal to 0, Px.113102 or Px.113113. The parameters can be preset via the plug-in or changed via PNU 12115.0 and PNU 12637.0. For deactivation, both limit values must be set to 0. If the limit values are changed via the PNUs, modulo is not immediately active and the output-side position is still displayed as the actual position. The modulo becomes active only after the next positioning task and the actual modulo position is displayed as the actual position.
If the parameter set is saved with modulo limit values not equal to 0, the modulo mode is active when the device is restarted and the activated modulo mode is moved with the first motion command.
The mode is selected by the two 'Positive' and 'Negative' inputs on the module:

Mode	'Positive'	'Negative'
1 = shortest path	1	1
	0	0
4 = positive direction	1	0
6 = negative direction	0	1

Tab. 652: Modulo mode

The Px.11280612 or the PNU 12638 parameter can be used to activate the "shortest path within the modulo limit" and positive/negative direction with turns" variants instead of the "shortest path" variant.

Activating modulo with the record table or with device services/methods

The relevant mode is activated or deactivated via the record table or device service/method PNU 10010...10013. The limit values for the lower and upper modulo limit are specified via parameters Px.113102 and Px.113113 and activated by activating a modulo mode. Motion commands that are subsequently executed via the record table are executed with the activated modulo mode.
If a motion command is initiated after activation of the modulo mode by the record table following the SINA_POS function module, the modulo mode that is defined by the 'Positive' and 'Negative' module inputs is traversed ➔ Tab. 652 Modulo mode.

PNUs modulo

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
113104	28.0	Actual value modulo	DINT
Px.	**Manufacturer-specific parameters**		
101551	12859.0	Activation Modulo device start	BOOL
113102	12115.0	Lower limit value modulo	LINT
113103	12116.0	Setpoint value modulo	LINT
113104	12117.0	Actual value modulo	LINT
113105	12118.0	Actual mode modulo	UINT
113106	12119.0	Actual upper limit value modulo	LINT
113107	12120.0	Actual lower limit value modulo	LINT
113108	12121.0	Counter modulo cycles	UDINT
113109	12122.0	Modulo overflow status	BOOL
113110	12123.0	Offset modulo position	LINT
113111	12124.0	Initialisation modulo position	LINT
113112	12125.0	Actual offset modulo position	LINT

Parameter	PNU	Name	Data type
113113	12637.0	Upper limit value modulo	LINT
102100	13070.0	Tolerance window modulo	REAL
102137	13071.0	Activation compatibility V33	BOOL
11280612	12638.0	Extended Modulo mode This parameter can be used to extend modulo operation by the following mode: – Shortest path with modulo boundaries – With turns	USINT

Tab. 653: PNUs

8 Safety signals

8.1 Function

The device continuously monitors the plausibility of its own feedback signals for the STO safety sub-function. The monitoring checks that the feedback signals are available within the tolerance period for triggering the safety sub-function. If the monitoring detects a fault, a message is triggered and the parametrised fault response is initiated. The following feedback signals are monitored:

Feedback signal	Safety sub-function	Control ports
STA	STO (safe torque off acknowledge)	#STO-A, #STO-B

Tab. 654: Feedback signals for safety sub-functions

Detailed information on the safety sub-functions of the product can be found in the Safety sub-function manual ➔ 1.3 Applicable documents.

The status of the feedback signal for the STO safety sub-function can be functionally monitored by parameters.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
392	STO safety status	STO safety status Bit 0: normal status, no internal error. Bit 1: reserved Bit 2: the bit is set if the safety function is requested in the safety module. The bit remains active until the request is reset. Bit 3: the bit is set if the safety function was requested in the safety module and the safe state is reached. Bit 4: an internal error was detected. Bit 5/6: reserved Bit 7: indicates that the drive can be switched on.	
		Access	read/–
		Update	effective immediatelyC
		Unit	–
820	Functional safety status	Status of the functional safety Bit 0: normal status, no internal STO error. Bit 1: reserved Bit 2: the bit is set if an STO safety function is requested in the safety module. The bit remains active until all requests are reset. Bit 3: the bit is set if a STO safety function was requested in the safety module and the safe state is reached. Bit 4: an internal STO error was detected. Bit 5/6: reserved Bit 7: indicates that the drive can be switched on.	
		Access	read/–
		Update	effective immediately
		Unit	–
950	SFB error status	Display what feedback signal was not received on time in case of fault. The following allocation applies: Bit 0: STA feedback signal This means: – 0: no error – 1: fault in time monitoring All other bits have the value 0.	
		Access	read/–

ID Px.	Parameter	Description	
950	SFB error status	Update	effective immediately
		Unit	–
951	Feedback signals	Display the status of the feedback signals. The following allocation applies: Signals as they are pending at the pin: – Bit 0: STA feedback signal Signals after filtering: – Bit 16: STA feedback signal This means: – 0: low signal – 1: high signal	
		Access	read/–
		Update	effective immediately
		Unit	–
952	STA hysteresis time	Display the tolerance time for the STA feedback signal.	
		Access	read/–
		Update	effective immediately
		Unit	s

Tab. 655: Parameters

ID Dx.	Name	Description
09 | 00 | 00146 (150995090)	Safety function requested	Safety function requested
09 | 00 | 00147 (150995091)	Plausibility check of safety feedback signals	Error during plausibility check of safety feedback signals
09 | 01 | 00148 (151060628)	STO: Discrepancy time exceeded	Discrepancy time for #STO-A/B exceeded
09 | 01 | 00149 (151060629)	Plausibility check #STO-A/B	Plausibility check of #STO-A/B input
09 | 01 | 00150 (151060630)	Sequence monitoring #STO-A/B	Sequence monitoring, #STO-A/B inputs

Tab. 656: Diagnostic messages

8.2 CiA 402

Objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
392	0x2164.03	STO safety status	UDINT
820	0x2170.01	Functional safety status	UDINT
950	0x2178.01	SFB error status	UDINT
951	0x2178.02	Feedback signals	UDINT
952	0x2178.03	STA hysteresis time	REAL

Tab. 657: Objects

8.3 PROFIdrive

Safety signal PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
392	11126.0	STO safety status	UDINT
820	11196.0	Functional safety status	UDINT

Parameter	PNU	Name	Data type
950	11239.0	SFB error status	UDINT
951	11240.0	Feedback signals	UDINT
952	11241.0	STA hysteresis time	REAL

Tab. 658: PNUs

9 Diagnostics and fault clearance

9.1 Diagnostics options

The servo drive provides comprehensive diagnostics options.
The status LEDs of the device display the current status information.
The Festo Automation Suite plug-in provides access to diagnostic messages in plain text format.
The web server displays the diagnostic messages as short text.
Fieldbus-specific diagnostic functions are available via the fieldbus.
The device saves all of the messages in the volatile message directory. The device also has a non-volatile error memory. Messages, for which the history should be traceable at a later date, are recorded in the error memory. The classification of errors ensures that the response to the error by the device can be adjusted to individual requirements. The device provides the trace function to analyse errors and for optimisation purposes. The trace function can, for example, be used to simultaneously record various measuring data for a diagnostic event.

Diagnostics options	Brief description
On-site via LEDs	The LEDs, for example, display the following: – Device status – Status of the power supply – Status of the device interfaces – Status of the safety equipment More information ➔ 9.5 Diagnostics via LED.
Diagnostics via the commissioning software	The Festo Automation Suite plug-in offers the following functions, e.g.: – Access to the message directory (current messages) – Access to the error history (message history) – Error acknowledgement – Error classification to categorise diagnostic events – Recording measuring data (trace function)
Diagnostics via web server	The web server offers the following functions, e.g.: – Access to the message directory (current messages) – Access to the error history (message history) – Error acknowledgement
Diagnostics via fieldbus – Request diagnostic status – Fieldbus-specific diagnostic functions	Special diagnostic functions and communication services are available, depending on the fieldbus used.

Tab. 659: Diagnostics options

9.2 Classification of Diagnostic Events

If a diagnostic event occurs, the device issues a message and reacts according to the parameterized severity of the diagnostic event.
The firmware, for example, cyclically monitors the temperature of the power unit in the device. If a limit value is overrun, the firmware initially triggers the "High temperature in power unit" warning and then triggers the "Power unit overtemperature" error message when the next limit value is overrun.
Further reactions to a diagnostic event are dependent on the severity of the diagnostic event. For many of the messages, the severity of a diagnostic event can be specified within certain limits by parameterising the classification.
The following levels are available:
– Error, stop category 0
– Error, stop category 1
– Error, stop category 2

- Warning
- Information
- Ignore
- Invalid, Internal

The parameter Px.102935 (object 0x603F, PNU 4668) contains the most serious active diagnostic message of the "Error" category (value 64 or higher). Associated CiA error code, see ➔ 11.9.3.2 Error finite state machine. Associated PROFINET error code see ➔ 12.3.6 Diagnostics via PROFINET.

Classification (level)	Value	Severity	Reactions
Error, stop category 0	4096	Error with high degree of severity and execution of a general and a specific error response	Stop category 0 General response – As with stop category 2. Specific error response of category 0 – The output stage is switched off immediately after the error has occurred. In the case of drives with a brake, the brake is actuated. Without a brake, the drive coasts to a stop.
Error, stop category 1	256	Error with high degree of severity and execution of a general and a specific error response	Stop category 1 General error response – As with stop category 2. Specific error response of category 1 – The drive is decelerated using the defined stop ramp as soon as the error occurs. When the drive is at a standstill, the brake engages and the closed-loop controller is switched off upon expiry of the deceleration delay. The drive is switched off directly at standstill without the brake.
Error, stop category 2	64	Error with high degree of severity and execution of a general and a specific error response	Stop category 2 General error response – Generation of the message and entry in the message directory – The device switches to the error status. – Status LED indicates the error (flashing red). – The normally open contact RDY-C1/2 is opened (ready = open). Specific error response of category 2 – The drive is decelerated using the parameterised stop ramp as soon as the error occurs. – When the drive has reached velocity 0, the closed-loop controller maintains the drive at the position achieved upon completion of the stop ramp.
Warning	16	Diagnostic event with medium degree of severity to inform about impending error states	– Generation of the message and entry in the message directory – The status LED indicates the warning. – No change to the operating status. – No change to the ready signal.
Information	4	Diagnostic event with low degree of severity	– Generation of the message and entry in the message directory; the event has no further influence.
Ignore	2	Diagnostic event of minor importance	– Generation of the message and entry in the message directory; the event has no further influence.
Internal	1	Category present for compatibility reasons. Do not use	– As with "ignore" level.
Invalid	0		

Tab. 660: Error levels

9.3 Diagnostics status

The device determines the diagnostic status from the severity of the active messages. The diagnostic status is a bit mask that represents the severity of all of the triggered messages in the device. The following can be determined by requesting the diagnostic status:

– If active messages are pending (diagnostic status parameter > 0)
– If errors are pending (diagnostic status parameter ≥ 64)
– levels of severity (e. g. diagnostic status ≥ 4096 corresponds to stop category 0)

Diagnostics status			
Bit	Value	Description	Priority
1	2	1 = Ignore	Lowest
2	4	1 = information	...
4	16	1 = Warning	
Error limit			
6	64	1 = Error stop category 2	
8	256	1 = Error stop category 1	
12	4096	1 = Error stop category 0	Highest

Tab. 661: Diagnostics status

The diagnostic status parameter can be requested via the device profile of the fieldbus being used.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
300	Diagnostic device status	Diagnostic status of the device	
		Access	read/–
		Update	effective immediately
		Unit	–
112819	Error active	Displays whether an error is pending	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 662: Parameters

Diagnostic messages No specific diagnostic messages are allocated to the function.

9.3.1 CiA 402

Diagnostic status objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
300	0x210D.01	Diagnostic device status	UINT
112819	0x218E.09	Error active	USINT

Tab. 663: Objects

9.3.2 PROFIdrive

Diagnostic status PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
300	2081.0	Diagnostic device status	UINT
112819	12036.0	Error active	BOOL

Tab. 664: PNUs

9.4 Servo drive messages

9.4.1 Status of messages

Messages can have the following statuses:

Status	Description
Active	The triggering diagnostic event is still active.
Cancelled	The triggering diagnostic event is no longer active. The message was therefore cancelled internally.
Acknowledged	The triggering diagnostic event is no longer active. The message was therefore cancelled internally. The message was then acknowledged by an external command or an external signal.

Tab. 665: Status of messages

The messages remain active as long as the diagnostic event is active (e. g. high temperature of power unit). Once the diagnostic event is no longer active, the message is cancelled by the firmware and can be acknowledged. The acknowledgement resets the error response of the device again (e. g. LED display). The device switches to the error status when errors occur. The error status remains active until all of the errors have been cancelled by the firmware and have then been acknowledged by an external command or an external signal. The error status is quit again once all of the error messages have been acknowledged.

9.4.2 Structure of messages

Messages for diagnostic events consistently contain the following key features:

Characteristics	Brief description
Message ID	unique identification of the diagnostic event
Name	Brief description of the diagnostic event
Status	Status of the message: – active = diagnostic event is pending – cancelled = diagnostic event is no longer pending – acknowledged = the cancelled message has been acknowledged
Classification	Level of the message, corresponding to severity level: – Ignore – Information – Warning – Error stop category 0, 1 or 2
Time stamp	Time of occurrence of a diagnostic event in operating hours. Display: <days>.<hours>:<minutes>:<seconds>.<milliseconds>

Tab. 666: Structure of messages

Complete list of all diagnostic messages ➔ 9.4.6 Diagnostic messages with information for fault clearance.

Structure of the message ID

The message ID consists of:
– System- (D0...) or axis ID (D1...)
– 1- or 3-part diagnostic number, derived from the main error group, error subgroup and error number

➔ Main/sub-groups of the message ID

– Instance for identifying the affected component

Message ID						Description
[1]	[2]	[3]	[4]	[5]	[6]	**System message "Over-current monitoring"**
D	0.	16842763			0	1-part diagnostic number
D	0.	01	01	00011.	0	3-part diagnostic number, e.g. – Main group = 01 ➔ current – Sub-group = 01 ➔ I²t – Error number = 00011 ➔ overcurrent error

Tab. 667: Example of message ID Over-current monitoring

D	System/axis	ID diagnostic number			Instance	
		Main group	Subgroup	Number		
.	.	.	.	.	[6] ➔	Identifier of the affected component with similar components. Example: Position Capture 1 and Position Capture 2
.	.	.	.	.		
.	.	.	.	.		
.	.	.	.	.		
.	.	.	.	.		
.	.	.	.	[5] ➔	ID error number	
.	.	.	.			
.	.	.	[4] ➔	Sub-group as a function of the main group, e.g. logic supply, DC link supply		
.	.	.				
.	.	[3] ➔	Main group of the error, e.g. current, voltage, temperature error			
.	.					
.	[2] ➔	Identification of the system or axis: 0 = system x = number of the related axis (1 = axis 1, 2 = axis 2, ...)				
.						
.						
[1] ➔	Identification D = Diagnostics					

Tab. 668: Message ID Dx ...

Representation of the diagnostic number

The diagnostic number is optionally displayed in 2 variants:
- 1-part = 1 resulting number from main group, sub-group and error number
- 3 parts = 3 individual numbers for main group, sub-group and error number
  This representation is used e.g. in the plug-in.

The variants are determined via the hexadecimal/decimal conversion. Proceed as follows to determine the 1-part diagnostic number:

1. Combine main group, sub-group and error number byte by byte as a hexadecimal 4-byte value:
   Main group = byte 4
   Sub-group = byte 3
   Error number = byte 2 and 1
2. Convert the resulting hexadecimal 4-byte number into a decimal number.
   This results in the 1-part diagnostic number.

Main group	Subgroup	Error number	Comment
Byte 4	Byte 3	Byte 2 ... 1	
02	02	00031	3-part diagnostic number, decimal
Conversion of dec ➔ hex			
0x 02	0x 02	0x 00 1F	Individual values, hexadecimal
Grouping			
0x 02 02 00 1F			Grouping of the individual values (4-byte number), hexadecimal
Conversion hex ➔ dec			
33685535			1-part diagnostic number, decimal

Tab. 669: Display variants of the diagnostic number (example)

If the device profile only allows 16 bits, only the ID error number [5] is transferred ➔ Tab. 667 Example of message ID Over-current monitoring.

The 1-part diagnostic number of the currently most serious diagnostic event can be read out via the following parameters:

Type of error	Parameters	CiA object	PNU
System-related or axis-related errors (error only, no warning or info)	Px.102935	0x210D.08 (internal diagnostic number 32 bits)	4668.0
	–	0x603F.00 (emergency code 16 bits)	–
System-related errors (error, warning and info)	Instance 0: Px.315.0.0	0x2145.0B (internal diagnostic number 32 bits)	3376.0
Axis-related errors (error, warning and info)	Instance 1: Px.315.1.0	0x2145.0C (internal diagnostic number 32 bits)	3377.0

Tab. 670: Severest Diagnosis ID

Main/sub-groups of the message ID

Main group		Subgroup	
01	Current	01	Short circuit
		02	I²t
		03	Braking resistor
02	Voltage	01	Supply
		02	DC link circuit
		03	Principal voltage
		04	Encoder supply
03	Temperature	01	Device
		02	Output stage
		03	Motor
05	Motion	01	Homing
		02	Motion control
		03	Interpolation
06	Configuration/parameterisation	00	No allocation
		02	Critical limits
		05	Parameter set
07	Monitoring	01	Limitations
		02	Motion monitoring
		03	Critical limits
		04	Zero angle detection
		05	Analogue setpoint specification
		11	Friction
08	Communication	00	No allocation
		03	PROFINET
		04	EtherCAT®
		06	EtherNet
		09	PROFIdrive
		12	CiA 402
		13	EtherNet/IP
		14	MP
09	Safety engineering	00	No allocation
		01	STO

Main group		Subgroup	
10	Internal hardware	01	Module error
11	Software	00	No allocation
		01	Exception
		02	Task
		03	File system
		04	Firmware update
		05	Device configuration
		06	LibRTE
		07	Warm start
		08	Version management
12	Maintenance	01	Operating time
13	Various	01	Diagnostics
		02	Auto-tuning
17	Security (data)	01	User login
18	Encoder	00	No allocation
		03	Quadrature (incremental encoder)
		05	BiSS C
		07	PROFIdrive

Tab. 671: Main and sub-groups of the message ID

9.4.3 Message directory

All messages are stored in the volatile message directory of the device. The sequence of the entries is determined by the time when they occurred and the severity. The message directory is sorted as follows:

– Severity in descending order (messages with a higher degree of severity come first)
– Time stamp in ascending order (older messages come first)

The plug-in in the ‘Diagnosis’ context offers access to the message directory, ‘Device State’ diagnostics panel.

9.4.4 Error memory

Messages, for which the history should be traceable at a later date, are recorded in the error memory. These are usually error messages. The plug-in can be used to specify whether warnings should also be logged on the ‘Error Classification’ panel. The recording of other select messages can also be set ➔ 9.4.6 Diagnostic messages with information for fault clearance.

The error memory is designed as a non-volatile ring memory. The relevant messages are written consecutively to the ring memory. Whenever the ring memory is full, the oldest message is overwritten when a new message arrives (FIFO principle).

The error memory can be accessed via:

– The plug-in
– The web server

The sequence of the entries is determined by the time at which they occurred. The latest message is in first position of the error memory, ready to be read out.

9.4.5 Acknowledging messages and errors

Acknowledging messages initiates the following:

– All cancelled messages switch to the "acknowledged" status ➔ 9.4.1 Status of messages.
– All active messages remain active (cannot be acknowledged).
– If acknowledged successfully, the reaction of the corresponding message is retracted (e. g. status LED off).
– The error status is closed again if all of the errors have been acknowledged successfully.

If messages remain active, the cause must first be eliminated so that they can be cancelled internally. Only cancelled messages can be acknowledged.

Serious errors cannot be acknowledged. In this case, the error status may be able to be closed by switching the device on again (power OFF/ON). If the serious error immediately occurs again, please contact Festo Service team (service required).

Information on troubleshooting ➔ 9.4.6 Diagnostic messages with information for fault clearance.

Messages and errors are acknowledged via:
– The digital input CTRL-EN (falling edge)
– The device profile of the fieldbus in use
– The plug-in
– The web server

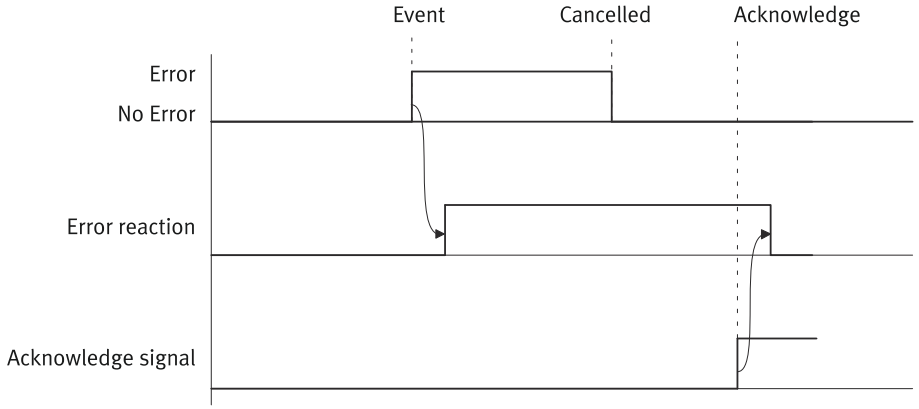


Fig. 107: Acknowledgement

Name	Description
Error/No error	Errors/no errors
Error reaction	Reaction of the device
Acknowledge signal	Signal or command for acknowledgment (when acknowledging with the digital input CTRL-EN, a falling edge is required.)
Event	Diagnostic event, e.g. error
Cancelled	Message cancelled internally
Acknowledge	Acknowledgement

Tab. 672: Legend for acknowledgement timing diagram

9.4.6 Diagnostic messages with information for fault clearance

Structure of reference list for the diagnostic messages

The reference list for the diagnostic messages is structured as follows:

ID Dx.	Message	Description		
01 | 02 | 00012 (16908300) [1]	I²t monitoring: motor warning limit [2]	I²t monitoring: motor warning limit		[3]
		Remedy	– Reduce dynamic response of tasks – Motor/mechanics blocked or stiff?	[4]
		Classification	Default: Warning (16)	[5]
			Can be parameterised: Px.6319 Value list: Warning (16) Information (4) Ignore (2)	[6]
		Error memory	Default: Save (1)	[7]
			Can be parameterised: Px.6320	[8]

Tab. 673: Sample diagnostic message

Cell	Content/description
[1]	Diagnostic number in grouped overview. Followed by the diagnostic number in brackets in the ungrouped overview.
[2]	Name of the message
[3]	Description of the diagnostic event
[4]	Remedy: remedial measures
[5]	Classification: default error response (factory setting)
[6]	Specification of whether classification can be parameterised: – no: error response cannot be parameterised – Parameter ID Px... = error response can be parameterised Value list: list of error responses that can be parameterised
[7]	Error memory: default setting of whether message is added to the error memory
[8]	Specification of whether addition to the error memory can be parameterised: – Can be parameterised: no = addition cannot be parameterised – Parameter ID Px... = addition can be parameterized The value list always applies: – Do not save (0) – Save (1)

Tab. 674: Legend for sample diagnostic message

The following reference list for the diagnostic messages is sorted by the ID in the grouped overview.

ID Dx.	Message	Description	
01 | 01 | 00010 (16842762)	Short circuit motor phases/ braking resistor	Short circuit motor phases/braking resistor	
		Remedy	– Check wiring and rectify short circuit
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
01 | 01 | 00011 (16842763)	Over-current monitoring	Error on over-current monitoring	
		Remedy	– Check wiring of motor phases (short circuit?) – Check wiring of braking resistor (short circuit?) – Check commutation angle
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no

ID Dx.	Message	Description	
01 | 02 | 00012 (16908300)	I²t monitoring: motor warning limit	I²t monitoring: motor warning limit	
		Remedy	– Reduce dynamics of movement orders – Check holding brake – Motor/mechanism blocked or stiff?
		Classification	Default: Warning (16)
			Can be parameterised: Px.6319, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.6320
01 | 02 | 00013 (16908301)	I²t monitoring: motor error limit	I²t monitoring: motor error limit	
		Remedy	– Motor/mechanics blocked or stiff? – Motor undersized? – Power dimensioning Check drive package – Check holding brake
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.6321, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.6322
01 | 02 | 00014 (16908302)	I²t monitoring: output stage warning limit	I²t monitoring: output stage warning limit	
		Remedy	– Motor/mechanics blocked or stiff? – Servo drive undersized? – Power dimensioning Check drive package – Check holding brake
		Classification	Default: Warning (16)
			Can be parameterised: Px.6323, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.6324
01 | 02 | 00015 (16908303)	I²t monitoring: output stage error limit	I²t monitoring: output stage error limit	
		Remedy	– Motor/mechanics blocked or stiff? – Servo drive undersized? – Power dimensioning Check drive package – Check holding brake
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.6325, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.6326

ID Dx.	Message	Description	
01 | 02 | 00016 (16908304)	I²t monitoring: output stage v0 warning limit	I²t monitoring: output stage in standstill warning limit	
		Remedy	– Reduce set current / set torque – Reduce downtime – Allow movement >5 Hz electrical rotational frequency
		Classification	Default: Warning (16)
			Can be parameterised: Px.6327, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.6328
01 | 02 | 00017 (16908305)	I²t monitoring: output stage v0 error limit	I²t monitoring: output stage in standstill error limit	
		Remedy	– Reduce set current / set torque – Reduce downtime – Allow movement >5 Hz electrical rotational frequency
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.6329, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.6330
01 | 02 | 00018 (16908306)	Parameterisation I²t: motor monitoring invalid	Parameterisation I²t: motor monitoring invalid	
		Remedy	– Check parameterization for I²t limit value (Px.7144) – Nominal current (Px.7117) and maximum current (Px.7120) of the Motor plausible?
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
01 | 02 | 00258 (16908546)	I²t monitoring: motor model warning limit	I²t monitoring: motor model warning limit	
		Remedy	– Reduce dynamics of movement orders – Check holding brake – Motor/mechanism blocked or stiff?
		Classification	Default: Warning (16)
			Can be parameterised: Px.63019, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.63020
01 | 02 | 00259 (16908547)	I²t monitoring: motor model error limit	I²t monitoring: motor model error limit	
		Remedy	– Reduce dynamics of movement orders – Check holding brake – Motor/mechanism blocked or stiff?
		Classification	Default: Stop category 1 (256)

ID Dx.	Message	Description	
01 | 02 | 00259 (16908547)	I^2t monitoring: motor model error limit	Classification	Can be parameterised: Px.63021, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.63022
01 | 03 | 00019 (16973843)	Warning: pulse energy monitoring, braking resistor	Warning: pulse energy monitoring, braking resistor	
		Remedy	– Reduce deceleration dynamics – Use braking resistor with higher pulse energy
		Classification	Default: Warning (16)
			Can be parameterised: Px.6513, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.6514
01 | 03 | 00020 (16973844)	Error: pulse energy monitoring, braking resistor	Error: pulse energy monitoring, braking resistor	
		Remedy	– Reduce deceleration dynamics – Use braking resistor with higher pulse energy
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.6515, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.6516
01 | 03 | 00021 (16973845)	Parameterisation braking resistor pulse energy	Parameterization Pulse energy monitoring Braking resistor outside the valid range	
		Remedy	– Check parameterization of external braking resistor P0.6512
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.6517, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: no
01 | 03 | 00773 (16974597)	Parameterisation braking resistor pulse energy	Parameterization Pulse energy monitoring Braking resistor Resistance value outside the valid range	
		Remedy	– Parameterization of external braking resistor Check resistance value P0.6510
		Classification	Default: Stop category 1 (256)

ID Dx.	Message	Description	
01 | 03 | 00773 (16974597)	Parameterisation braking resistor pulse energy	Classification	Can be parameterised: Px.102676, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: no
01 | 03 | 00774 (16974598)	Parameterisation braking resistor pulse energy	Parameterization Pulse energy monitoring Braking resistor Nominal power outside the valid range	
		Remedy	– Parameterization of external braking resistor Check rated power P0.6511
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.102688, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: no
02 | 01 | 00022 (33619990)	Undervoltage in logic supply 24V	Undervoltage in logic supply 24V	
		Remedy	– Check power supply. – Restart device
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
02 | 01 | 00023 (33619991)	Overvoltage in logic supply 24V	Overvoltage in logic supply 24V	
		Remedy	– Check power supply.
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
02 | 01 | 00024 (33619992)	Undervoltage in logic supply 5V	Undervoltage in logic supply 5V internal	
		Remedy	– Check power supply.
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
02 | 01 | 00025 (33619993)	Overvoltage in logic supply 5V	Overvoltage in logic supply 5V internal	
		Remedy	– Check power supply.
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
02 | 01 | 00026 (33619994)	Undervoltage in logic supply 3.3V	Undervoltage in logic supply 3.3V internal	
		Remedy	– Check power supply.

ID Dx.	Message	Description	
02 | 01 | 00026 (33619994)	Undervoltage in logic supply 3.3V	Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
02 | 01 | 00027 (33619995)	Overvoltage in logic supply 3.3V internal	Overvoltage in logic supply 3.3V internal	
		Remedy	– Check power supply.
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
02 | 01 | 00472 (33620440)	Voltage error microprocessor	A supply voltage of the microprocessor has violated the value range.	
		Remedy	– Restart device – Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
02 | 02 | 00030 (33685534)	Overvoltage in DC link	Overvoltage in DC link	
		Remedy	– Check braking resistor dimensioning, value too high – Reduce deceleration dynamics – Check limit value for DC link switch-off (P0.4812)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
02 | 02 | 00031 (33685535)	Undervoltage in DC link	Undervoltage in DC link	
		Remedy	– Check power supply – Couple DC links, if technically permissible – Check DC link voltage (measure) – Check undervoltage monitoring (threshold value) (P0.4814)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.487, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.488
02 | 02 | 00032 (33685536)	DC link warning threshold reached	DC link warning threshold reached	
		Remedy	– None (info only)
		Classification	Default: Warning (16)
			Can be parameterised: Px.489, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.4890
02 | 03 | 00038 (33751078)	Undervoltage in load voltage	Undervoltage in load voltage	

ID Dx.	Message	Description	
02 | 03 | 00038 (33751078)	Undervoltage in load voltage	Remedy	– Check power supply – Power failure detection correctly parameterized (P0.493)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.519, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.5180
02 | 03 | 00039 (33751079)	Overvoltage in load voltage	Overvoltage in load voltage	
		Remedy	– Check power supply – Power failure detection correctly parameterized (P0.494)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.517, value list: – Stop category 1 (256) – Warning (16)
		Error memory	Default: Save (1)
			Can be parameterised: no
02 | 03 | 00251 (33751291)	Limit value of energy recovery exceeded	The limit value for the energy recovery has been exceeded	
		Remedy	– Check power supply – Check parameters for the switch-off threshold (P0.10185)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
03 | 01 | 00044 (50397228)	Warning threshold: Insufficient temperature in device	Warning threshold: Insufficient temperature in device	
		Remedy	– Check ambient conditions – Check parameterization warning threshold (P0.9312)
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.933
03 | 01 | 00045 (50397229)	Temperature in device too low	Temperature in device too low	
		Remedy	– Check ambient conditions – Check parameterization of switch-off threshold (P0.9313)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
03 | 01 | 00046 (50397230)	Warning threshold: Device overtemperature	Warning threshold: Device overtemperature	
		Remedy	– Check parameterization warning threshold (P0.9310) – Unit fan defective? – Device overloaded? – Check installation conditions, filter of control cabinet fan dirty? – Check drive dimensioning (possible overload in continuous operation)
		Classification	Default: Warning (16)
			Can be parameterised: no

ID Dx.	Message	Description	
03 | 01 | 00046 (50397230)	Warning threshold: Device overtemperature	Error memory	Default: Save (1)
			Can be parameterised: Px.937
03 | 01 | 00047 (50397231)	Device overtemperature	Device overtemperature	
		Remedy	– Check parameterization warning threshold (P0.9311) – Unit fan defective? – Device overloaded? – Check installation conditions, filter of control cabinet fan dirty? – Check drive dimensioning (possible overload in continuous operation)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
03 | 02 | 00048 (50462768)	Warning threshold: Insufficient temperature in power unit	Warning threshold: Insufficient temperature in power unit	
		Remedy	– Check ambient conditions – Check parameterization warning threshold (P0.9316)
		Classification	Default: Warning (16)
			Can be parameterised: Px.922, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.923
03 | 02 | 00049 (50462769)	Insufficient temperature in power unit	Insufficient temperature in output stage	
		Remedy	– Check ambient conditions – Check parameterization of switch-off threshold (P0.9317)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
03 | 02 | 00050 (50462770)	Warning threshold: Power unit overtemperature	Warning threshold: Power unit overtemperature	
		Remedy	– Check parameterization warning threshold (P0.9314) – Unit fan defective? – Device overloaded? – Check installation conditions, filter of control cabinet fan dirty? – Check drive dimensioning (possible overload in continuous operation)
		Classification	Default: Warning (16)
			Can be parameterised: Px.926, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.927
03 | 02 | 00051 (50462771)	Power unit overtemperature	Power unit overtemperature	
		Remedy	– Check parameterization warning threshold (P0.9315) – Unit fan defective? – Device overloaded? – Check installation conditions, filter of control cabinet fan dirty? – Check drive dimensioning (possible overload in continuous operation)
		Classification	Default: Stop category 1 (256)

ID Dx.	Message	Description	
03 | 02 | 00051 (50462771)	Power unit overtemperature	Classification	Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
03 | 03 | 00052 (50528308)	Warning threshold: Insufficient temperature in motor	Warning threshold: Insufficient temperature in motor	
		Remedy	– Check ambient conditions – Check parameterization warning threshold (Px.945)
		Classification	Default: Warning (16)
			Can be parameterised: Px.9413, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.9414
03 | 03 | 00053 (50528309)	Insufficient temperature in motor	Insufficient temperature in motor	
		Remedy	– Check ambient conditions – Check parameterization of switch-off threshold (Px.947)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.9415, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.9416
03 | 03 | 00054 (50528310)	Warning threshold: Motor overtemperature	Warning threshold: Motor overtemperature	
		Remedy	– Motor overloaded – Sensor defective or incorrectly parameterized? – Cable break? – Parameterization current controller, check current limit values – Check parameter adjustment of the sensor or the sensor characteristic curve – Device defective
		Classification	Default: Warning (16)
			Can be parameterised: Px.9417, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.9418
03 | 03 | 00055 (50528311)	Motor overtemperature	Motor overtemperature	
		Remedy	– Motor overloaded – Sensor defective or incorrectly parameterized? – Cable break? – Parameterization current controller, check current limit values – Check parameter adjustment of the sensor or the sensor characteristic curve – Device defective
		Classification	Default: Stop category 1 (256)

ID Dx.	Message	Description	
03 | 03 | 00055 (50528311)	Motor overtemperature	Classification	Can be parameterised: Px.9419, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.9420
05 | 01 | 00056 (83951672)	Configuration of homing run invalid	Parameterisation of homing run invalid	
		Remedy	– Move to hardware limit switch (limit switch configured) – Set the position encoder interface (Px.122) and the referencing encoder interface(Px.101733) to the same encoder interface when referencing all encoders(Px.1214) not active
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.8450, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64)
		Error memory	Default: Save (1)
			Can be parameterised: Px.8451
05 | 01 | 00057 (83951673)	Homing: Timeout	Homing: Timeout	
		Remedy	– Check timeout for homing (Px.842) – At end stop: Check parameters for standstill window (Px.8415) and limit monitoring (Px8414) – At stop: Check parameters for standstill window (Px.4627) and limit monitoring (Px4626) – Increase dynamic values for homing
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.8452, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64)
		Error memory	Default: Save (1)
			Can be parameterised: Px.8453
05 | 01 | 00058 (83951674)	Homing: Search path exceeded	Homing: Search path exceeded	
		Remedy	– Check arrangement slide to limit switch / end stop – Parameterization search path (Px.8412, Px.8413)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.8454, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64)
		Error memory	Default: Save (1)
			Can be parameterised: Px.8455
05 | 01 | 00619 (83952235)	Unsupported homing method	In the active controller operating mode, the requested homing method is not supported.	
		Remedy	– Use different homing method (xxx)
		Classification	Default: Stop category 1 (256)

ID Dx.	Message	Description	
05 | 01 | 00619 (83952235)	Unsupported homing method	Classification	Can be parameterised: Px.101348, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2) – Internal (1) – Invalid (0)
		Error memory	Default: Save (1)
			Can be parameterised: Px.101344
05 | 02 | 00059 (84017211)	Positioning command invalid	Command invalid	
		Remedy	– Check parameterization motion task or record
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00060 (84017212)	Motion task not known	Unknown motion task pending	
		Remedy	– Check order, record number or step-on condition
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00061 (84017213)	Task ignored controller enable failed	Task could not be executed as the drive control is missing	
		Remedy	– Set release CTRL-EN – Controller enable via fieldbus missing
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00062 (84017214)	Task ignored as safety function requested	Task could not be executed as a safety function is requested	
		Remedy	– Check inputs of safety function for correct logic level
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00064 (84017216)	Task ignored as DC link coupling not ready	Task could not be executed as no DC link voltage is present or this has not yet been detected	
		Remedy	– Check mains voltage for present – Check the DC voltage when the DC Power supply Is activated – Check braking resistor for presence, if required
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00065 (84017217)	Task ignored as device not ready	The motion task was rejected in the actual status	
		Remedy	– Control enable missing – Cancel current movement order with a stop – Wait for MC for the current movement order
		Classification	Default: Warning (16)

ID Dx.	Message	Description	
05 | 02 | 00065 (84017217)	Task ignored as device not ready	Classification	Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.1733
05 | 02 | 00066 (84017218)	Task ignored as encoder not ready	Task could not be executed as the encoder is not ready	
		Remedy	– Check encoder cable – Check voltage supply for the encoder
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00067 (84017219)	Task ignored as referencing missing	Task could not be executed as the drive is not referenced	
		Remedy	– Reference drive
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00068 (84017220)	Task ignored as reinitialisation is required	Task could not be executed as a reinitialisation is required due to a parameter change	
		Remedy	– Performing Reinitialization
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00069 (84017221)	Task ignored as restart is required	Task could not be executed as a restart is required due to a parameter change	
		Remedy	– Save configuration and restart the device
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00071 (84017223)	Trajectory generator error	An error occurred in the trajectory generator when calculating a movement profile	
		Remedy	– Check parameterization order or block (complete? unrealistic values?)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.30127, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64)
		Error memory	Default: Save (1)
			Can be parameterised: Px.30128
05 | 02 | 00072 (84017224)	Invalid position preset of trajectory generator	The position specified for the trajectory generator is invalid	
		Remedy	– Change position specification to the valid range, see documentation
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00073 (84017225)	Invalid velocity value of trajectory generator	The velocity specified for the trajectory generator is invalid	
		Remedy	– Change speed default to the valid range, see documentation

ID Dx.	Message	Description	
05 | 02 | 00073 (84017225)	Invalid velocity value of trajectory generator	Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00074 (84017226)	Invalid acceleration value of trajectory generator	The acceleration specified for the trajectory generator is invalid	
		Remedy	– Change deceleration setting to the valid range, see documentation
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00075 (84017227)	Invalid deceleration value of trajectory generator	The deceleration specified for the trajectory generator is invalid	
		Remedy	– Change acceleration default to the valid range, see documentation
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00076 (84017228)	Invalid jerk value of trajectory generator	The jerk specified for the trajectory generator is invalid	
		Remedy	– Change jerk setting to the valid range, see documentation
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00077 (84017229)	Trajectory generator error	An error occurred in the trajectory generator when calculating a movement profile	
		Remedy	– Adjust dynamic values for the movement order
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00078 (84017230)	Stop ramp: Timeout	Stop ramp: Timeout	
		Remedy	– Check parameterization of standstill monitoring (Px.4610, Px.468)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00079 (84017231)	Torque increase ramp invalid	The torque increase ramp is invalid	
		Remedy	– Change parameters for the torque rise ramp to the valid range
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.1130225, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.1130226

ID Dx.	Message	Description	
05 | 02 | 00080 (84017232)	Simultaneous negative/positive directional lock	Simultaneous negative/positive directional lock	
		Remedy	– Check HW limit switch logic
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00278 (84017430)	Task ignored because directional lock active	Task could not be executed because a directional lock is active	
		Remedy	– Observe further diagnostic messages and eliminate the cause of the directional lock – Carry out movement into the valid work area.
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00279 (84017431)	Fixed stop not detected	Fixed stop was not detected	
		Remedy	– Check if workpiece Is in front of the target position
		Classification	Default: Information (4)
			Can be parameterised: Px.4647, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.4648
05 | 02 | 00280 (84017432)	Monitoring window of fixed stop left	Monitoring window of fixed stop left	
		Remedy	– Check if workpiece was not lost
		Classification	Default: Information (4)
			Can be parameterised: Px.4649, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.4650
05 | 02 | 00282 (84017434)	Encoder not ready	Selected encoder not ready for brake test	
		Remedy	– Check whether selection of encoder interface valid – Check whether encoder errors are present
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.103136, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.103137

ID Dx.	Message	Description	
05 | 02 | 00283 (84017435)	Brake test failed	Brake test failed	
		Remedy	– Check brake wear – Check monitoring window stroke (Px.103117.x.0)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.103138, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.103139
05 | 02 | 00284 (84017436)	Torque failed brake test	Torque for brake test cannot be built up	
		Remedy	– Check brake wear – Check Torque monitoring window (Px103118.x.0)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.103140, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.103141
05 | 02 | 00364 (84017516)	Profile velocity = 0	The preset profile velocity is 0. The drive does not move and does not reach its target position.	
		Remedy	– Check profile speed (record table / direct operation) – Check speed override (Px.1309, Px.11280611) – Check application limitation (Px.1304, Px.1310)
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
05 | 02 | 00431 (84017583)	Invalid limit value Application limitation	At least one limit value (Px.1304 ... Px.1312) is outside its validity range	
		Remedy	– Check values for limitations (min value < max value)?
		Classification	Default: Stop category 2 (64)
			Can be parameterised: Px.53, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2) – Internal (1) – Invalid (0)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.18
05 | 02 | 00432 (84017584)	Motion job error due to firmware update	A motion job cannot be executed because a firmware update is in progress.	
		Remedy	– Wait until firmware update Is completed
		Classification	Default: Stop category 1 (256)

ID Dx.	Message	Description	
05 | 02 | 00432 (84017584)	Motion job error due to firmware update	Classification	Can be parameterised: Px.143, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64)
		Error memory	Default: Save (1)
			Can be parameterised: Px.139
05 | 03 | 00639 (84083327)	Number of interpolation points exceeded	The number of interpolation points for the fine interpolator was exceeded, the fine interpolator extrapolated.	
		Remedy	– None
		Classification	Default: Information (4)
			Can be parameterised: Px.101573, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.101571
06 | 00 | 00070 (100663366)	Invalid record table parameter	A record table parameter is invalid	
		Remedy	– Check record table parameters
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.1852, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64)
		Error memory	Default: Save (1)
			Can be parameterised: Px.1853
06 | 00 | 00081 (100663377)	Controller operating mode invalid	The operating mode of the controller (position, velocity, force, stop) does not match the parameterisation	
		Remedy	– Check the parameterization of the controller (Px.4001, Px.4005, Px.40069
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 00 | 00082 (100663378)	Notch filter frequency invalid	The parameterisation of the notch filter frequency is invalid	
		Remedy	– Check parameterization notch filter frequency, notch filter frequency is greater than half the sampling frequency (Px.40.0.x)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 00 | 00083 (100663379)	Record table incorrect	Record table incorrect	
		Remedy	– Check motion record number
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.1850, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64)
		Error memory	Default: Save (1)

ID Dx.	Message	Description	
06 | 00 | 00083 (100663379)	Record table incorrect	Error memory	Can be parameterised: Px.1851
06 | 00 | 00084 (100663380)	Parameterisation switching frequency	Parameterisation of switching frequency invalid	
		Remedy	– Check parameter set, matches the device? – Check parameterization PWM frequency (P0.670)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 00 | 00085 (100663381)	Digital I/O configuration invalid	The configuration of the digital inputs or outputs is invalid	
		Remedy	– Check configuration of the digital I/O for double function assignment
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 00 | 00248 (100663544)	Motor type is not supported	The parameterised motor type (servo, stepper etc.) is not supported	
		Remedy	– See documentation whether motor is actually supported – Check motor configuration data (Px.71432)
		Classification	Default: Stop category 2 (64)
			Can be parameterised: Px.71429, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.71433
06 | 00 | 00252 (100663548)	Incorrect parameterisation of reactive current braking	The start and end voltages for reactive current braking are incompatible	
		Remedy	– Check parameterization reactive current braking (Px.102108, Px.102109)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 00 | 00313 (100663609)	Invalid parameterization variable message function	The variable message function is incorrectly parameterized.	
		Remedy	– Check input parameters for data trigger (Px.1174201 … 1174207)
		Classification	Default: Warning (16)
			Can be parameterised: Px.1174230, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.1174231
06 | 00 | 00826 (100664122)	Invalid gearbox configuration	The combination of numerator and denominator results in an invalid gearbox configuration	

ID Dx.	Message	Description	
06 | 00 | 00826 (100664122)	Invalid gearbox configuration	Remedy	– Gear factor numerator or denominator large 14 bits? – Feed constant numerator or denominator large 17 bits? – Gear factor greater than 1:1000?
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.102876
06 | 02 | 00086 (100794454)	Sign limits	The target torque and the velocity limit are uncorrelated.	
		Remedy	– Check torque and current limitations, signs and limitations must match (symmetrical?)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 02 | 00087 (100794455)	Velocity control limitation invalid	Velocity control limitation invalid	
		Remedy	– Check configuration of control limitation (Px.850, Px.851)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 02 | 00088 (100794456)	Torque control limitation invalid	Torque control limitation invalid	
		Remedy	– Check configuration of control limitation (Px.852, Px.853)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: Px.6106, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64)
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 02 | 00089 (100794457)	Current control limitation invalid	Current control limitation invalid	
		Remedy	– Check configuration of control limitation (Px.854, Px.855)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.6110, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64)
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 02 | 00090 (100794458)	Maximum peak current control limitation invalid	Maximum peak current control limitation invalid	
		Remedy	– Check configuration of control limitation (Px.856)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 02 | 00091 (100794459)	Parameterisation of currents	Parameterisation of nominal current/maximum peak current of motor invalid	
		Remedy	– Check parameterization for rated current (Px.7117) and maximum current (Px.7120) (consistency)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no

ID Dx.	Message	Description	
06 | 02 | 00091 (100794459)	Parameterisation of currents	Error memory	Default: Save (1)
			Can be parameterised: no
06 | 02 | 00273 (100794641)	Change of control structure not permissible	The change of the control structure is not permissible	
		Remedy	– Wait until current movement order is completed – Check movement order
		Classification	Default: Warning (16)
			Can be parameterised: Px.4020, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.4021
06 | 02 | 00274 (100794642)	Motion command not permissible	The motion command is not permissible in open-loop operation	
		Remedy	– Check movement order
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 02 | 00275 (100794643)	Change to closed loop operation not permissible	Change to closed loop operation not permissible because the commutation angle is not valid	
		Remedy	– Perform commutation angle determination
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 02 | 00559 (100794927)	Input frequency A/B signals too high	The maximum input frequency for the A/B signals has been exceeded	
		Remedy	– Reduce motor velocity, Number of increments should be even, execute Reinit
		Classification	Default: Warning (16)
			Can be parameterised: Px.101127, value list: – Warning (16) – Information (4)
		Error memory	Default: Save (1)
			Can be parameterised: Px.101125
06 | 05 | 00097 (100991073)	Parameter set not found	Parameter set not found	
		Remedy	– Check selection of parameter set
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 05 | 00098 (100991074)	Parameter set invalid	Parameter set invalid	
		Remedy	– Overwrite (save) parameter set
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no

ID Dx.	Message	Description	
06 | 05 | 00099 (100991075)	Parameter set incompatible	Parameter set incompatible	
		Remedy	– Delete parameter set – Overwrite (save) parameter set
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 05 | 00102 (100991078)	Transmission error in parameter set	Transmission error in parameter set	
		Remedy	– Repeat transmission – Check connection
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.5711
06 | 05 | 00103 (100991079)	Parameter set: store failed	Parameter set: store failed	
		Remedy	– Repeat saving – Service case
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.5713
06 | 05 | 00104 (100991080)	Parameter set: delete failed	Parameter set: delete failed	
		Remedy	– Parameter set available? – Repeat deletion – Service case
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.5715
06 | 05 | 00105 (100991081)	Factory parameter not found	A factory parameter was not found	
		Remedy	– None (info only)
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.5727
06 | 05 | 00106 (100991082)	Factory parameter set invalid	The factory parameter set is invalid	
		Remedy	– None (info only)
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.5723
06 | 05 | 00107 (100991083)	Factory parameter set not found	The factory parameter set was not found	
		Remedy	– None (info only)
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.5721

ID Dx.	Message	Description	
06 | 05 | 00108 (100991084)	Factory parameter set incompatible	The factory parameter set is incompatible	
		Remedy	– None (info only)
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.5725
06 | 05 | 00290 (100991266)	Parameter set with older version	Parameter set was created with an older firmware version	
		Remedy	– Save parameter set again
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.5781
06 | 05 | 00291 (100991267)	Parameter set with newer version	Parameter set was created with a newer firmware version	
		Remedy	– Save parameter set again
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.5783
06 | 05 | 00620 (100991596)	Parameter set stored CRC1 0..63	Parameter set stored. Return CRC1 0..63	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 05 | 00621 (100991597)	Parameter set stored CRC1 64..127	Parameter set stored. Return CRC1 64..127	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 05 | 00624 (100991600)	Parameter not found Px.y.-.-	Parameter not found. Return parameters System/Axis and ID	
		Remedy	– Delete parameter set – Overwrite (save) parameter set
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 05 | 00625 (100991601)	Parameter not found P-.-.x.y	Parameter not found. Return parameters instance and index	
		Remedy	– Delete parameter set – Overwrite (save) parameter set
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 05 | 00626 (100991602)	Parameter not writable Px.y.-.-	Parameter not writable. Return parameters System/Axis and ID	
		Remedy	– Delete parameter set – Overwrite (save) parameter set

ID Dx.	Message	Description	
06 | 05 | 00626 (100991602)	Parameter not writable Px.y.-.-	Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.5709
06 | 05 | 00627 (100991603)	Parameter not writable P-.-.x.y	Parameter not writable. Return parameters instance and index	
		Remedy	– Delete parameter set – Overwrite (save) parameter set
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.5709
06 | 05 | 00810 (100991786)	Safety Parameter set saved by User:	Parameter set saved by:	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
06 | 05 | 00816 (100991792)	Factory parameter set activated	Factory parameter set activated	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
07 | 01 | 00109 (117506157)	Negative software limit position	Negative software limit position reached	
		Remedy	– Check movement trajectory (close to end stop)? – Check values for software end positions (Px.4629, Px.4630) – Check whether automatic braking is active (Px.4631) – Parameters of stop ramp (Px.12101, Px.12111) lower than trajectory parameters, increase stop ramp parameters
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.4632, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.4633
07 | 01 | 00110 (117506158)	Positive software limit position	Positive software limit position reached	
		Remedy	– Check movement trajectory (close to end position)? – Check values for software end positions (Px.4630) – Check whether automatic braking is active (Px.4631) – Parameters of stop ramp (Px.12101, Px.12111) lower than trajectory parameters, increase stop ramp parameters
		Classification	Default: Stop category 1 (256)

ID Dx.	Message	Description	
07 | 01 | 00110 (117506158)	Positive software limit position	Classification	Can be parameterised: Px.4634, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.4635
07 | 01 | 00111 (117506159)	Limitation negative direction	Limitation of direction of movement owing to negative software limit position	
		Remedy	– Check movement order
		Classification	Default: Warning (16)
			Can be parameterised: Px.4636, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.4637
07 | 01 | 00112 (117506160)	Limitation positive direction	Limitation of direction of movement owing to positive software limit position	
		Remedy	– Check movement order
		Classification	Default: Warning (16)
			Can be parameterised: Px.4638, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.4639
07 | 01 | 00113 (117506161)	Parameterisation of software limit positions	Parameterisation of software limit positions invalid	
		Remedy	– Check values for software end positions (consistency, negative Px.4629 < positive end position Px4630)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
07 | 01 | 00114 (117506162)	Negative hardware limit switch reached	Negative hardware limit switch reached	
		Remedy	– Check movement order
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.101102, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.101103
07 | 01 | 00115 (117506163)	Positive hardware limit switch reached	Positive hardware limit switch reached	
		Remedy	– Check movement order
		Classification	Default: Stop category 1 (256)

ID Dx.	Message	Description	
07 | 01 | 00115 (117506163)	Positive hardware limit switch reached	Classification	Can be parameterised: Px.101106, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.101107
07 | 01 | 00116 (117506164)	Limitation by negative hardware limit switch	Limitation of direction of movement owing to negative hardware limit switch	
		Remedy	– Check movement order
		Classification	Default: Warning (16)
			Can be parameterised: Px.101104, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.101105
07 | 01 | 00117 (117506165)	Limitation by positive hardware limit switch	Limitation of direction of movement owing to positive hardware limit switch	
		Remedy	– Check movement order
		Classification	Default: Warning (16)
			Can be parameterised: Px.101108, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.101109
07 | 01 | 00118 (117506166)	Error: both hardware limit switches activated	Error: both hardware limit switches activated	
		Remedy	– Check parameterization – Check Wiring – Device restart
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.101110, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.101111
07 | 01 | 00119 (117506167)	Negative stroke limit reached	Negative stroke limit reached	
		Remedy	– Check movement order – Check parameterization stroke limit (Px.10368)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.4676, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)

ID Dx.	Message	Description	
07 | 01 | 00119 (117506167)	Negative stroke limit reached	Error memory	Can be parameterised: Px.4677
07 | 01 | 00120 (117506168)	Positive stroke limit reached	Positive stroke limit reached	
		Remedy	– Check movement order – Check parameterization stroke limit (Px.10369)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.4678, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.4679
07 | 02 | 00121 (117571705)	Target position reached	Target position reached	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: Px.4612, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.4613
07 | 02 | 00122 (117571706)	Target velocity reached	Target velocity reached	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: Px.4614, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.4615
07 | 02 | 00123 (117571707)	Target torque reached	Target torque reached	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: Px.4616, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.4617
07 | 02 | 00124 (117571708)	Standstill reached	Standstill reached	
		Remedy	– None (info only)

ID Dx.	Message	Description	
07 | 02 | 00124 (117571708)	Standstill reached	Classification	Default: Information (4)
			Can be parameterised: Px.4618, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.4619
07 | 02 | 00125 (117571709)	Standstill reached and in standstill window	Standstill reached and in standstill window	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: Px.4620, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.4621
07 | 02 | 00126 (117571710)	Position: following error	Position: following error	
		Remedy	– Investigate causes of contouring errors (Trace) – Reduce dynamic values – Check error window (Px.463)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.4622, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.4623
07 | 02 | 00127 (117571711)	Velocity: following error	Velocity: following error	
		Remedy	– Investigate causes of contouring errors (Trace) – Reduce dynamic values – Check error window (Px.464)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.4624, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.4625
07 | 02 | 00128 (117571712)	Velocity too high	RPM monitoring reports velocity too high	
		Remedy	– Check maximum velocity configuration (Px.4660) – Reduce set velocity – Check offset angle, perform commutation angle determination

ID Dx.	Message	Description	
07 | 02 | 00128 (117571712)	Velocity too high	Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.4661, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: no
07 | 02 | 00129 (117571713)	Out of target range	Drive has left the target range	
		Remedy	– Check target range window and settling time (Px.4665 … Px.4667) – Monitoring makes sense for application? Possibly deactivate monitoring (Px.4669)
		Classification	Default: Warning (16)
			Can be parameterised: Px.4669, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.4670
07 | 02 | 00130 (117571714)	Reverse feed monitoring	Reverse feed monitoring reports error	
		Remedy	– Check parameterization (Px.4663, Px.4664) – Monitoring makes sense for application? Possibly deactivate monitoring (Px.4671)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: Px.4671, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.4672
07 | 02 | 00131 (117571715)	Residual distance too low	Residual distance too low	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: Px.4686, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.4687
07 | 02 | 00132 (117571716)	Trajectory completed	Trajectory completed (setpoint value reached)	
		Remedy	– None (info only)
		Classification	Default: Information (4)

ID Dx.	Message	Description	
07 | 02 | 00132 (117571716)	Trajectory completed	Classification	Can be parameterised: Px.4691, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.4692
07 | 02 | 00133 (117571717)	Position difference encoder 1 to encoder 2 too large	The position difference encoder 1 to encoder 2 too large	
		Remedy	– Calibrate feed constant encoder 1 to encoder 2, see documentation – Check error threshold (Px.4642, Px.4643) – Check encoder cable
		Classification	Default: Ignore (2)
			Can be parameterised: no
		Error memory	Default: Do not save (0)
			Can be parameterised: no
07 | 02 | 00634 (117572218)	Velocity difference encoder 1 to encoder 2 too large	The velocity difference encoder 1 to encoder 2 too large	
		Remedy	– Set velocity filter – Check error threshold – Check encoder line
		Classification	Default: Internal (1)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
07 | 02 | 00658 (117572242)	Acceleration following error	Acceleration following error	
		Remedy	– Investigate causes of contouring errors (Trace) – Reduce dynamic values – Check error window (Px.101735) – Check phase sequence – Check direction of rotation of encoder
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: Px.101753, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2) – Internal (1) – Invalid (0)
		Error memory	Default: Save (1)
			Can be parameterised: Px.101750
07 | 03 | 00134 (117637254)	Voltage limitation active	Voltage limitation active	
		Remedy	– Reduce velocity – Reduce torque
		Classification	Default: Information (4)

ID Dx.	Message	Description	
07 | 03 | 00134 (117637254)	Voltage limitation active	Classification	Can be parameterised: Px.52682, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.52683
07 | 03 | 00135 (117637255)	Limit for velocity or current active	A limit for the velocity or current is active	
		Remedy	– Reduce dynamic values for the motion task – Check parameters for velocity limitation (Px.850, Px.851) – Check parameters for current limitation (Px.854 ... Px.856)
		Classification	Default: Information (4)
			Can be parameterised: Px.52677, value list: – Warning (16) – Information (4) – Invalid (0)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.52678
07 | 04 | 00136 (117702792)	Commutation finding failed	Commutation finding failed	
		Remedy	– Check encoder (valid values / connected) – For vertical axes with load: reduce load mass – Enlarge monitoring window (Px.6693) – Reduce step size (Px.664) – Reduce dynamic values (Px.669, Px.6691, Px.6692)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
07 | 04 | 00137 (117702793)	Commutation finding direction error	An error has occurred during the commutation angle search, the direction of rotation of the motor does not correlate with the position from the encoder.	
		Remedy	– Motor shaft freewheeling? – Increase current injection for commutation angle finding (Px.270) – Axle jammed? – Adjust dynamic values for commutation angle finding (Px.669, Px.6691, Px.6692) – Check whether the direction of rotation of the encoder (P0.1171.0.0) and that of the motor (Px.1172) match.
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
07 | 05 | 00138 (117768330)	Analog setpoint specification limit exceeded	Limits for analog setpoint specification exceeded	
		Remedy	– Check limit values (Px.998, Px.999) – Check scaling (Px.995)
		Classification	Default: Warning (16)

ID Dx.	Message	Description	
07 | 05 | 00138 (117768330)	Analog setpoint specification limit exceeded	Classification	Can be parameterised: Px.9913, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.9914
07 | 11 | 00765 (118162173)	Calculation mass/friction value estimate not completed	Calculation mass/friction value estimate not completed	
		Remedy	– Increase pause time between movements
		Classification	Default: Warning (16)
			Can be parameterised: Px.102548, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.102544
08 | 00 | 00139 (134217867)	Fieldbus not supported	Fieldbus not supported	
		Remedy	– Installing a suitable FW-Package for the device
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
08 | 00 | 00140 (134217868)	Failure of fieldbus synchronisation signal	Failure of fieldbus synchronisation signal	
		Remedy	– Check wiring – Check PLC configuration
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.801, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.802
08 | 00 | 00243 (134217971)	Invalid cycle time	Cycle time is not an integral multiple of 1 ms	
		Remedy	– Check the cycle time is an integer multiple of 1 ms
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
08 | 03 | 00141 (134414477)	Invalid process data	The process data is invalid	
		Remedy	– Check mapping of process data
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)

ID Dx.	Message	Description	
08 | 03 | 00141 (134414477)	Invalid process data	Error memory	Can be parameterised: no
08 | 03 | 00373 (134414709)	Failure of synchronization signal Fieldbus	The maximum number of failed synchronization signals was exceeded.	
		Remedy	– Check wiring – Check PLC configuration
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.54545, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.54546
08 | 03 | 00391 (134414727)	Process data communication failed	PROFINET process data communication failed	
		Remedy	– Check communication (connector, master) etc...
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
08 | 03 | 00617 (134414953)	Incompatible device configuration PROFINET IRT	Incompatible device configuration in the control for PROFINET IRT	
		Remedy	– Select MP device in GSDML (CMMT-...-...-MP instead of CMMT-... V1)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.101296, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2) – Internal (1) – Invalid (0)
		Error memory	Default: Save (1)
			Can be parameterised: Px.101291
08 | 04 | 00142 (134480014)	EtherCAT process data invalid	Parameterisation of process data invalid	
		Remedy	– Check parameterization EtherCAT communication
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
08 | 04 | 00143 (134480015)	EtherCAT process data communication failed	EtherCAT process data communication failed	
		Remedy	– Check communication EtherCAT (connector, master) etc...
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
08 | 04 | 00281 (134480153)	Process data not received at Sync time	Process data not received at Sync time. Changes in classification are not permanently saved	

ID Dx.	Message	Description	
08 | 04 | 00281 (134480153)	Process data not received at Sync time	Remedy	– Check connection between process data and Sync time in the controller
		Classification	Default: Warning (16)
			Can be parameterised: Px.758, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2) – Internal (1) – Invalid (0)
		Error memory	Default: Save (1)
			Can be parameterised: Px.759
08 | 06 | 00637 (134611581)	Incorrect IP address settings	No valid IP addresses setting	
		Remedy	– Change IP address to a valid value
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.101561
08 | 09 | 00144 (134807696)	Required application class not supported	The required application class is not supported	
		Remedy	– Only request the application class supported by the device (see documentation)
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.11280111
08 | 09 | 00145 (134807697)	Telegram not supported	The required telegram is not supported	
		Remedy	– request Only the telegrams supported by the device (see documentation)
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.11280203
08 | 09 | 00288 (134807840)	PROFIdrive test error message 1	PROFIdrive test error message 1	
		Remedy	– Cancel error test message via PNU
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
08 | 09 | 00289 (134807841)	PROFIdrive test error message 2	PROFIdrive test error message 2	
		Remedy	– Cancel error test message via PNU
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
08 | 09 | 00294 (134807846)	PLC Control is not set	The PLC Control bit is not set	
		Remedy	– Set PLC control bit (STW1.Bit10)
		Classification	Default: Stop category 0 (4096)

ID Dx.	Message	Description	
08 | 09 | 00294 (134807846)	PLC Control is not set	Classification	Can be parameterised: Px.11280117, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.11280118
08 | 09 | 00299 (134807851)	Error Sign of Life	The number of failed Sign of Life signals was exceeded.	
		Remedy	– Check PROFINET communication – Check whether the life sign is sent correctly by the controller (e.g. create trace with STW2.12 ... STW2.15 and trigger signal ZSW1.3). – Check the permissible failure rate of the telegrams (PNU 925). – Check bus or controller for utilization.
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
08 | 09 | 00382 (134807934)	Invalid configuration Extended process data	The extended process data is configured invalid.	
		Remedy	– Check mapping of the extended process data
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.424201, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.424202
08 | 12 | 00250 (135004410)	Invalid mode of operation	An invalid mode of operation was requested	
		Remedy	– Check requested CiA402 operating mode
		Classification	Default: Stop category 2 (64)
			Can be parameterised: Px.12236, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.12237
08 | 12 | 00272 (135004432)	Resolution of position factorgroup invalid	The resolution of the position factorgroup is invalid	
		Remedy	– Adjust parameterization position factor group (Px.7841 ... Px.7844)
		Classification	Default: Warning (16)

ID Dx.	Message	Description	
08 | 12 | 00272 (135004432)	Resolution of position factorgroup invalid	Classification	Can be parameterised: Px.45, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2) – Internal (1) – Invalid (0)
		Error memory	Default: Save (1)
			Can be parameterised: Px.46
08 | 13 | 00001 (135069697)	The requested telegram is not supported	The requested telegram is not supported	
		Remedy	– Request Only the telegrams supported by the device (see documentation)
		Classification	Default: Warning (16)
			Can be parameterised: Px.144, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2) – Internal (1) – Invalid (0)
		Error memory	Default: Save (1)
			Can be parameterised: Px.141
08 | 13 | 00394 (135070090)	Invalid process data	The process data is invalid	
		Remedy	– New configuration of the EtherNet/IP interface (see documentation)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
08 | 14 | 00544 (135135776)	Error communication RTE	Error in the communication to the RTE module.	
		Remedy	– Update Firmware – Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
08 | 14 | 00747 (135135979)	Error intern communication RTE	Error in the communication to the RTE module.	
		Remedy	– Contact Festo service
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
09 | 00 | 00146 (150995090)	Safety function requested	Safety function requested	
		Remedy	– None (info only)
		Classification	Default: Information (4)

ID Dx.	Message	Description	
09 | 00 | 00146 (150995090)	Safety function requested	Classification	Can be parameterised: Px.821, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Do not save (0)
			Can be parameterised: Px.822
09 | 00 | 00147 (150995091)	Plausibility check of safety feedback signals	Error during plausibility check of safety feedback signals	
		Remedy	– Restart device – Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
09 | 01 | 00148 (151060628)	STO: Discrepancy time exceeded	Discrepancy time for #STO-A/B exceeded	
		Remedy	– Timing Check input signals STO – Configuration Check discrepancy time (Px.391)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
09 | 01 | 00149 (151060629)	Plausibility check #STO-A/B	Plausibility check of #STO-A/B input	
		Remedy	– Restart device – Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
09 | 01 | 00150 (151060630)	Sequence monitoring #STO-A/B	Sequence monitoring, #STO-A/B inputs	
		Remedy	– Timing and sequence Check input signals STO
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
09 | 02 | 00151 (151126167)	Plausibility check #SBC-A/B	Plausibility check of #SBC-A/B input effective	
		Remedy	– Check holding brake output for short circuit – Restart device – Service case
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
09 | 02 | 00152 (151126168)	SBC: Discrepancy time exceeded	Discrepancy time for #SBC-A/B exceeded	
		Remedy	– Timing Check input signals SBC – Configuration Check discrepancy time (Px.437)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)

ID Dx.	Message	Description	
09 | 02 | 00152 (151126168)	SBC: Discrepancy time exceeded	Error memory	Can be parameterised: no
10 | 00 | 00827 (167772987)	Invalid device parameter	One or more device parameters are out of range	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
10 | 01 | 00156 (167837852)	Common error power output stage	Error power output stage	
		Remedy	– Restart device – Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 00 | 00689 (184550065)	System starts	System starts	
		Remedy	– None
		Classification	Default: Information (4)
			Can be parameterised: Px.101992, value list: – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.101990
11 | 01 | 00161 (184615073)	Overflow diagnostic register	Overflow in diagnostic register, actual messages not acknowledged	
		Remedy	– Acknowledge messages – Remedy causes for currently pending messages
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 01 | 00162 (184615074)	Overflow buffer diagnostic register	Overflow buffer in diagnostic register, actual messages not acknowledged	
		Remedy	– Acknowledge messages – Remedy causes for currently pending messages
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 01 | 00163 (184615075)	User unit error	An error has occurred when changing the user unit	
		Remedy	– Perform reinitialization again
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.11590
11 | 02 | 00164 (184680612)	Process runtime exceeded	Process runtime exceeded	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)

ID Dx.	Message	Description	
11 | 02 | 00164 (184680612)	Process runtime exceeded	Error memory	Can be parameterised: no
11 | 02 | 00165 (184680613)	Timeout process level 0	Timeout has occurred in process level 0	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 02 | 00166 (184680614)	Timeout process level 1	Timeout has occurred in process level 1	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 02 | 00167 (184680615)	Timeout process level 2	Timeout has occurred in process level 2	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 02 | 00168 (184680616)	Timeout process level 3	Timeout has occurred in process level 3	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 02 | 00169 (184680617)	Timeout process level 4	Timeout has occurred in process level 4	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 02 | 00170 (184680618)	Timeout process level 5	Timeout has occurred in process level 5	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 02 | 00171 (184680619)	Timeout process level 6	Timeout has occurred in process level 6	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 02 | 00172 (184680620)	Timeout process level 7	Timeout has occurred in process level 7	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)

ID Dx.	Message	Description	
11 | 02 | 00172 (184680620)	Timeout process level 7	Classification	Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 03 | 00173 (184746157)	File system faulty	File system faulty	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 03 | 00174 (184746158)	File: user file (backup) invalid	The user file backup file is invalid	
		Remedy	– Restart device – Service case
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 03 | 00175 (184746159)	Creation of user file (backup) not possible	The creation of a backup file for the user file has failed	
		Remedy	– Restart device – Service case
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 03 | 00176 (184746160)	CRC error in user file	A CRC error was detected in the user file	
		Remedy	– Restart device – Contact support
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 03 | 00177 (184746161)	File: user file invalid	The user file is invalid	
		Remedy	– Restart device – Service case
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 03 | 00178 (184746162)	New user file has been created	A new user file has been generated	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 03 | 00179 (184746163)	Writing to user file not possible	It was not possible to write to the user file	
		Remedy	– Restart device – Service case
		Classification	Default: Information (4)
			Can be parameterised: no

ID Dx.	Message	Description	
11 | 03 | 00179 (184746163)	Writing to user file not possible	Error memory	Default: Save (1)
			Can be parameterised: no
11 | 03 | 00180 (184746164)	Unknown user file error	An unknown error was triggered for the user file	
		Remedy	– Restart device – Service case
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 04 | 00181 (184811701)	Writing of firmware failed	Writing of firmware failed	
		Remedy	– Repeat transfer of firmware package.
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.9601
11 | 04 | 00182 (184811702)	Reading of firmware failed	Reading of firmware failed	
		Remedy	– Repeat transfer of firmware package.
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.9603
11 | 04 | 00183 (184811703)	Firmware invalid	Firmware invalid	
		Remedy	– Repeat transfer of firmware package.
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.9605
11 | 04 | 00184 (184811704)	Firmware incompatible	Firmware incompatible	
		Remedy	– Version Check hardware and firmware version – Repeat transfer of firmware package
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.9607
11 | 04 | 00185 (184811705)	Firmware save location invalid	Firmware save location invalid	
		Remedy	– Restart device – Service case
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.9609
11 | 04 | 00186 (184811706)	Firmware save location empty	Firmware save location empty	
		Remedy	– Restart device – Service case
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)

ID Dx.	Message	Description	
11 | 04 | 00186 (184811706)	Firmware save location empty	Error memory	Can be parameterised: Px.9611
11 | 04 | 00187 (184811707)	Firmware update not allowed	Firmware update not allowed	
		Remedy	– Power stage switched off
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.9613
11 | 04 | 00188 (184811708)	Firmware package in use	Firmware package in use	
		Remedy	– Repeat transfer of firmware package.
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.9615
11 | 04 | 00189 (184811709)	System error during firmware update	System error occurred during firmware update	
		Remedy	– Repeat transfer of firmware package – Service case
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 04 | 00190 (184811710)	Firmware update failed	Firmware update failed	
		Remedy	– Repeat transfer of firmware package – Service case
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 05 | 00191 (184877247)	Calibration data incorrect: Safety	Calibration data incorrect: Safety	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 05 | 00192 (184877248)	Device data incorrect	Device data incorrect	
		Remedy	– Repeat transfer of firmware package – Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 05 | 00193 (184877249)	Device data incorrect: control unit	Device data incorrect: control unit	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no

ID Dx.	Message	Description	
11 | 05 | 00194 (184877250)	Device data incorrect: communication unit	Device data incorrect: communication unit	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 05 | 00195 (184877251)	Device data incorrect: Safety	Device data incorrect: Safety	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 05 | 00196 (184877252)	Calibration data incorrect: control unit	Calibration data incorrect: control unit	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 05 | 00197 (184877253)	Calibration data incorrect: power unit	Calibration data incorrect: power unit	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 05 | 00198 (184877254)	Device data incorrect: power unit	Device data incorrect: power unit	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 05 | 00200 (184877256)	Current sensor calibration invalid	Current sensor calibration invalid	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 05 | 00201 (184877257)	Device not configured	Device not configured	
		Remedy	– Restart device – Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 05 | 00202 (184877258)	Store device failed	Store device failed	
		Remedy	– Restart device – Service case
		Classification	Default: Warning (16)

ID Dx.	Message	Description	
11 | 05 | 00202 (184877258)	Store device failed	Classification	Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.5719
11 | 07 | 00204 (185008332)	Device initialisation failed	The initialisation of the device has failed	
		Remedy	– Check other diagnosis notifications. – Reset device to factory defaults.
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 07 | 00205 (185008333)	Task ignored as reinitialisation not possible	Requested reinitialisation could not be executed	
		Remedy	– Reset controller enable
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.10328
11 | 07 | 00271 (185008399)	Reinitialisation failed	The reinitialisation failed	
		Remedy	– Check other diagnosis notifications. – Reset device to factory defaults.
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
11 | 08 | 00206 (185073870)	Hardware does not correspond to expected revision/certification status	Hardware does not correspond to expected revision/certification status	
		Remedy	– Service case
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Do not save (0)
			Can be parameterised: no
11 | 08 | 00207 (185073871)	Hardware does not correspond to expected compatibility status	Hardware does not correspond to expected compatibility state	
		Remedy	– Service case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
12 | 01 | 00208 (201392336)	Maximum mileage value reached	Maximum value for the mileage is reached	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
12 | 01 | 00209 (201392337)	Mileage warning threshold reached	Threshold value 1 (default: warning threshold) for the mileage is reached	
		Remedy	– None (info only)
		Classification	Default: Warning (16)
			Can be parameterised: Px.1419, value list: – Warning (16) – Information (4) – Ignore (2)

ID Dx.	Message	Description	
12 | 01 | 00209 (201392337)	Mileage warning threshold reached	Error memory	Default: Save (1)
			Can be parameterised: Px.14110
12 | 01 | 00210 (201392338)	Mileage error threshold reached	Threshold value 2 (default: error threshold) for the mileage is reached	
		Remedy	– None (info only)
		Classification	Default: Warning (16)
			Can be parameterised: Px.14113, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.14114
12 | 01 | 00211 (201392339)	Maximum load change value reached	The maximum value for the load change is reached	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
12 | 01 | 00212 (201392340)	Load change warning threshold reached	Threshold value 1 (default: warning threshold) for the load change is reached	
		Remedy	– None (info only)
		Classification	Default: Warning (16)
			Can be parameterised: Px.1429, value list: – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.14210
12 | 01 | 00213 (201392341)	Load change error threshold reached	Threshold value 2 (default: error threshold) for the load change is reached	
		Remedy	– None (info only)
		Classification	Default: Warning (16)
			Can be parameterised: Px.14213, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.14214
12 | 01 | 00440 (201392568)	Maximum write cycles reached	Maximum write cycles of file storage reached	
		Remedy	– Service case
		Classification	Default: Information (4)

ID Dx.	Message	Description	
12 | 01 | 00440 (201392568)	Maximum write cycles reached	Classification	Can be parameterised: Px.205, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2) – Internal (1) – Invalid (0)
		Error memory	Default: Save (1)
			Can be parameterised: Px.203
13 | 01 | 00214 (218169558)	Message acknowledgment	Message acknowledgment completed	
		Remedy	– None (info only)
		Classification	Default: Internal (1)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
13 | 01 | 00215 (218169559)	Diagnostics log file has invalid format	Diagnostic memory invalid	
		Remedy	– None
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.100505
13 | 01 | 00216 (218169560)	Loss of messages from diagnostics log	Loss of messages from diagnostics log	
		Remedy	– None
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Do not save (0)
			Can be parameterised: no
13 | 02 | 00217 (218235097)	Auto tuning aborted	Auto tuning aborted	
		Remedy	– Check whether further error messages are present and correct their cause – Start Autotuning again
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
13 | 02 | 00218 (218235098)	Auto tuning movement insufficient or synchronous phase too short	Auto tuning movement insufficient	
		Remedy	– Check the position of the carriage. Too close to the end positions? – Check move distance of move set (Px.8621) – Check the acceleration and braking ramps, if necessary increase the maximum acceleration and deceleration for autotuning, so that the acceleration and braking phases are shorter (Px.8620 … Px.8625)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
13 | 02 | 00219 (218235099)	Auto tuning controller parameters invalid	The Auto tuning function could not identify any controller parameters	

ID Dx.	Message	Description	
13 | 02 | 00219 (218235099)	Auto tuning controller parameters invalid	Remedy	– Restart autotuning with modified parameter noise intensity (Px.8616) – Start autotuning with movement (Px.8619) – Evaluate frequency response analysis
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
13 | 02 | 00220 (218235100)	Transmission of auto tuning measured values failed	Transmission of auto tuning measured values failed	
		Remedy	– Check if connection exists – Restart transmission – Start Autotuning again
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: Px.8605
17 | 01 | 00226 (285278434)	Login error	An error occurred during user login	
		Remedy	– Reset to factory settings (hard-reset, including user files)
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
17 | 01 | 00439 (285278647)	Too many invalid login attempts	Too many invalid login attempts	
		Remedy	– Restart device and try again
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
17 | 01 | 00628 (285278836)	Login completed	Login to access the device at a specific authorisation level has been completed.	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
17 | 01 | 00629 (285278837)	Logout completed	Logout of the device at a specific authorisation level has been completed.	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
17 | 01 | 00817 (285279025)	Login failed attempt	Login failed attempt	
		Remedy	– None (info only)
		Classification	Default: Information (4)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 00 | 00092 (301989980)	Motor change detected, commutation angle invalid	Motor change detected, commutation angle invalid	
		Remedy	– Run commutation angle finding and homing and save

ID Dx.	Message	Description	
18 | 00 | 00092 (301989980)	Motor change detected, commutation angle invalid	Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 00 | 00093 (301989981)	Motor change detected, zero point offset invalid	Motor change detected, zero point offset invalid	
		Remedy	– Perform homing and save parameter set
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 00 | 00094 (301989982)	Commutation angle in encoder invalid	Commutation angle in encoder invalid	
		Remedy	– Perform commutation angle determination
		Classification	Default: Invalid (0)
			Can be parameterised: no
		Error memory	Default: Do not save (0)
			Can be parameterised: no
18 | 00 | 00095 (301989983)	Encoder type plate invalid	Encoder type plate invalid	
		Remedy	– Service case
		Classification	Default: Invalid (0)
			Can be parameterised: no
		Error memory	Default: Do not save (0)
			Can be parameterised: no
18 | 00 | 00096 (301989984)	Encoder type plate (user defined) invalid	Encoder type plate (user defined) invalid	
		Remedy	– Reconfigure using the commissioning tool
		Classification	Default: Invalid (0)
			Can be parameterised: no
		Error memory	Default: Do not save (0)
			Can be parameterised: no
18 | 00 | 00227 (301990115)	Encoder identification reports incorrect encoder type	Encoder identification reports incorrect encoder type	
		Remedy	– Check configuration
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 00 | 00318 (301990206)	Status transition error	The requested state transition is not supported.	
		Remedy	– Remove PROFIdrive command from control sequence
		Classification	Default: Stop category 2 (64)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 00 | 00686 (301990574)	Linearisation table invalid	Linearisation table invalid	
		Remedy	– None
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no

ID Dx.	Message	Description	
18 | 00 | 00688 (301990576)	Cogging compensation invalid	Cogging compensation invalid	
		Remedy	– Restart device
		Classification	Default: Stop category 1 (256)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 00 | 00693 (301990581)	Error when recording the cogging table	Error when recording the cogging table	
		Remedy	– Repeat identification drive
		Classification	Default: Warning (16)
			Can be parameterised: Px.102019, value list: – Warning (16) – Information (4) – Ignore (2) – Internal (1) – Invalid (0)
		Error memory	Default: Save (1)
			Can be parameterised: Px.102017
18 | 01 | 00771 (302056195)	Incompatible motor change	Incompatible motor change	
		Remedy	– Match NOC code (Px.32410) with connected motor
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 03 | 00235 (302186731)	Incremental encoder analysis invalid	Common error quadrature encoder	
		Remedy	– Check encoder cable – Adjust detection thresholds P10053/P10054 – Restart the device
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 03 | 00301 (302186797)	Number of increments between two zero pulses invalid	Wrong zero pulse or incorrect number of increments per revolution	
		Remedy	– Check encoder cable – Restart the device
		Classification	Default: Warning (16)
			Can be parameterised: Px.10061, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2)
		Error memory	Default: Save (1)
			Can be parameterised: Px.10060
18 | 03 | 00434 (302186930)	Invalid encoder resolution	The product of resolution Px.10040 and evaluation Px.10043 is larger than the value range of 16 bit.	
		Remedy	– Check parameterization. P0.10040 must be smaller than 65536.
		Classification	Default: Stop category 1 (256)

ID Dx.	Message	Description	
18 | 03 | 00434 (302186930)	Invalid encoder resolution	Classification	Can be parameterised: Px.181, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4) – Ignore (2) – Internal (1) – Invalid (0)
		Error memory	Default: Save (1)
			Can be parameterised: Px.179
18 | 05 | 00239 (302317807)	BiSS-C encoder analysis invalid	Check the wiring of the encoder and the position resolution of the BiSS-C protocol.	
		Remedy	– Check encoder cable – Restart the device
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 05 | 00633 (302318201)	BiSS-C Timeout communication	The actual baud rate is too low for the encoder resolution	
		Remedy	– Increase baud rate value
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 05 | 00812 (302318380)	BiSS-C encoder error	BiSS-C encoder error	
		Remedy	– Check surounding conditions of motor/encoder – unplug and plug the encoder – sevice case
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: Px.102791, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16)
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 05 | 00813 (302318381)	BiSS-C encoder warning	BiSS-C encoder warning	
		Remedy	– Check surounding conditions of motor/encoder – unplug and plug the encoder
		Classification	Default: Warning (16)
			Can be parameterised: Px.102793, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4)
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 05 | 00839 (302318407)	BiSS-C common notification	BiSS-C common notification	
		Remedy	– None (info only)
		Classification	Default: Information (4)

ID Dx.	Message	Description	
18 | 05 | 00839 (302318407)	BiSS-C common notification	Classification	Can be parameterised: Px.102916, value list: – Stop category 0 (4096) – Stop category 1 (256) – Stop category 2 (64) – Warning (16) – Information (4)
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 07 | 00365 (302449005)	Invalid request Gn_STW1.4...7	Invalid request for the control word Gn_STW1.4...7, bits reserved.	
		Remedy	– Control word Check PROFIdrive encoder
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 07 | 00366 (302449006)	Function not supported Gn_STW1	An unsupported function in the control word Gn_STW1 is requested.	
		Remedy	– Control word Check PROFIdrive encoder
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 07 | 00367 (302449007)	Axis parking not possible	Axis Parking Request cannot be executed because the axis is moving.	
		Remedy	– Withdraw controller enable before parking
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 07 | 00368 (302449008)	Error reference marks search	Error when searching for the reference marks, because the requested function is not completely configured.	
		Remedy	– Control word Check PROFIdrive encoder
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 07 | 00369 (302449009)	Error Read Position Reference mark	Error when reading the position of the reference mark because the function is not completely configured.	
		Remedy	– Control word Check PROFIdrive encoder
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 07 | 00370 (302449010)	Error measuring on the fly	Error when measuring the reference mark on the fly, because the function is not completely configured.	
		Remedy	– Control word Check PROFIdrive encoder
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 07 | 00371 (302449011)	Error Read Position Measure on the fly	Error when reading the position Measure on the fly of the reference mark, because the function is not completely configured.	

ID Dx.	Message	Description	
18 | 07 | 00371 (302449011)	Error Read Position Measure on the fly	Remedy	– Control word Check PROFIdrive encoder
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no
18 | 07 | 00372 (302449012)	Error Transfer absolute position to Gn_XIST2	Error when transferring the absolute position to Gn_XIST2.	
		Remedy	– Check PROFIdrive encoder control word – Use of absolute encoder
		Classification	Default: Warning (16)
			Can be parameterised: no
		Error memory	Default: Save (1)
			Can be parameterised: no

Tab. 675: Diagnostic messages

9.5 Diagnostics via LED

9.5.1 Device status displays

LED	Designation	Brief description
✓	Status LED	Indicates the general device status
⏻	Power LED	Indicates the status of the power supply
🧍	Safety LED	Indicates the status of the safety equipment
🔄	Application status LED	Indicates the identification sequence and is reserved for future extensions

Tab. 676: Device status LEDs (status, power, safety and application status LEDs)

LED test

After the device is switched on, it runs through an initialisation phase. During the initialisation phase, the device performs an LED test. During the LED test, the 4 device status LEDs are activated simultaneously. The 4 device status LEDs are yellow for a short time.

✓ Status LED, display of the device status

LED	Meaning
 fast red flashing	Unexpected exception error. – Restart device – Service case
 flashing red	An error is pending.
 Flashing orange	The servo drive is currently performing a firmware update.
 flashing yellow	A warning is pending.
 yellow light	The servo drive is in the initialisation phase.
 flashing green	The servo drive is ready, and the power stage is switched off (Ready).
 green light	The power stage and the closed-loop controller are enabled.

Tab. 677: Status LED

Power LED, status of the power supply

LED	Meaning
 yellow light	The logic power supply is present, but the load voltage supply is not present or is currently being measured.
 green light	The load voltage supply and the logic power supply are present.

Tab. 678: Power LED

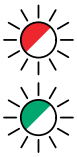
Safety LED, functional status of the safety engineering

Malfunctions of the safety sub-function are detected and displayed in the functional device. The following are detected:
– Safety sub-function STO requested via 1 channel (discrepancy monitoring)
– Plausibility check of STO channel switch-off
Malfunctions are externally reported by the functional part, including via the additional communication interfaces (bus, commissioning software).

LED	Meaning
 flashing red	Error in the safety part or a safety condition has been violated.
 yellow light	The safety sub-function has been requested and is active.
 green light	Ready, a safety sub-function has not been requested.

Tab. 679: Safety LED

Application status

LED	Meaning
 flashes alternately between red, yellow and green	Identification sequence active (for optical identification of the device in a network), which can be activated via the parameterisation software
 Flashing red and green	Activation of factory parameter set
 flashing yellow	Reserved for future extensions
 yellow light	
 flashing green	
 green light	

Tab. 680: Application status LED

Special function of the start program (bootloader) during firmware updates

When the bootloader starts the update procedure, the status LED flashes yellow at half-second intervals. The power LED, safety LED and application status LED remain off.

If an error occurs during a firmware update, the status LED flashes red at one-second intervals. The frequency of flashing corresponds to the error number specified in the following table. After flashing, there is a pause of 3 s. Then the procedure repeats.

Error number	Description
1	The start program has detected a CRC error in the firmware after switching on.
2	The start program has detected a CRC error in the firmware update package after switching on.
3	The start program has detected another fatal error that prevents the device from being started.

Tab. 681: Error messages of the start program (bootloader)

9.5.2 Interface status [X18]

CMMT-...-MP: LEDs on [X18]; connection status of the Ethernet interface

LED	Meaning (top LED)
off	Interface is deactivated.
green light	Interface is activated.
flashing green	Communication activity.

Tab. 682: Top LED at [X18]

LED	Meaning (bottom LED)
off	reserved

Tab. 683: Bottom LED at [X18]

CMMT-...-EC/EP/PN: LEDs on [X18]; connection status of the Ethernet interface

LED	Meaning (top LED)
off	Interface is deactivated.
green light	Interface is activated.

Tab. 684: Top LED at [X18]

LED	Meaning (bottom LED)
off	no communication activity
flashing yellow	Communication activity detected.

Tab. 685: Bottom LED at [X18]

9.5.3 Device and interface status, EtherCAT

Together with the 2 LEDs on the top, the Run LED and the Error LED on the front display the bus/network status.

EtherCAT, LED RN or Run; operating status

LED	Meaning	Remedy
off	The device is in the Init status (initialisation).	–
flashing green	The device is in the pre-operational status.	–

LED	Meaning	Remedy
 flashing green[1)]	The device is in the safe-operational status.	–
 green light	The device is in the operational status (normal operating status).	–

1) Single flash: short single flash (1x flash, pause, 1x flash, etc.)

Tab. 686: LED RN or Run

EtherCAT, LED ER or Error; error status

LED	Meaning	Remedy
 off	no error	–
 flashing red	invalid configuration, general configuration error, a status change specified by the master is not possible.	Eliminate configuration error.
 flashing red[1)]	Local error, the slave device application has independently changed the EtherCAT status. This can have the following causes: – A host watchdog time-out has occurred. – Synchronisation error, the device switches automatically to the safe-operational status.	–
 flashing red[2)]	A process data watchdog time-out has occurred.	–

1) Single flash: short single flash (1x flash, pause, 1x flash, etc.)
2) Double flash: short double flash (2x flash, pause, 2x flash, etc.)

Tab. 687: LED ER or Error

EtherCAT, LINK/ ACTIVITY LED; connection status at XF1 IN and XF2 OUT

LED	Meaning	Remedy
 off	no network connection	Check network connection.
 flickers green (approx. 10 Hz)	Data traffic activity (traffic).	–
 green light	Network connection is OK (link).	–

Tab. 688: LED at XF1 IN and XF2 OUT

9.5.4 Device and interface status, PROFINET

Together with the 4 LEDs on the top, the NF LED on the front displays the bus/ network status.
In the case of devices with multi-protocol CMMT-AS-...-MP, the SF LED indicates common errors for PROFINET communication.

CMMT-...-MP: PROFINET, LED NF; bus error

LED	Meaning	Remedy
off	no error	–
flashes red (2 Hz)	Network error: – no data transfer – no configuration	Check network configuration and network connection.
red light	Network error: – no physical connection to the network	Check network connection.

Tab. 689: LED NF with the CMMT-...-MP

CMMT-...-MP: PROFINET, LED SF; common error

LED	Meaning	Remedy
off	no error	–
flashing red (1 Hz, 3 s)	DCP signal service is triggered via the bus (Discovery and basic Configuration Protocol).	–
red light	– At least one station in the network is no longer available for data exchange. – With active PROFIdrive diagnostics (Activate diagnostics): device error of the servo drive	Check devices in the network. Check whether devices in the network are required for operation of the system.

Tab. 690: LED SF with the CMMT-...-MP

CMMT-...-PN: PROFINET, LED NF; bus error

LED	Meaning	Remedy
off	no error	–
flashes red (2 Hz)	Network error: – no data transfer – no configuration – no network connection or network connection is malfunctioning	Check network configuration and network connection.

Tab. 691: LED NF with the CMMT -...- PN

PROFINET, LEDs at XF1 IN and XF2 OUT; connection status, data traffic

LED	Meaning of the green LED	Remedy
off	no network connection	Check network connection.
green light	Network connection is OK (link).	–

Tab. 692: Green LED at XF1 IN and XF2 OUT

LED	Meaning of the yellow LED	Remedy
off	no data traffic	–
flashing yellow	Data traffic activity (traffic).	–

Tab. 693: Yellow LED at XF1 IN and XF2 OUT

9.5.5 Device and interface status, EtherNet/IP

Together with the 4 LEDs on the top (Link/Activity), the MS LED and NS LED on the front display the bus/network status.

EtherNet/IP, MS LED; module status

LED	Meaning	Remedy
 off	No logic voltage supply.	Check logic voltage supply.
 flashing green	Device is not configured.	Perform configuration.
 green light	normal operating status	–
 flashing red/green	Device is performing a self-test.	–
 flashing red	rectifiable error, possibly a configuration error	Check configuration.
 red light	error cannot be rectified	Contact Festo Service ➔ www.festo.com.

Tab. 694: MS LED

EtherNet/IP, NS LED; network status

LED	Meaning	Remedy
 off	The device is switched off or has no IP address.	Switch on device or check IP address.
 flashing green	The device has an IP address but no CIP connection. It may be that the device is not assigned to a master/scanner.	Eliminate configuration error.
 green light	Normal operating status. The device is online and has a CIP connection.	–
 flashing red/green	Device is performing a self-test.	–
 flashing red	One or more I/O connections are in the time-out status.	Check the physical connection to the master/scanner.
 red light	The IP address of the device has already been assigned.	Check and correct IP addresses in the network.

Tab. 695: NS LED

EtherNet/IP, LED at XF1 IN and XF2 OUT; connection status, data traffic

LED	Meaning of the green LED	Remedy
 off	no network connection	Check network connection.
 green light	Network connection is OK (link).	–

Tab. 696: Green LED at XF1 IN and XF2 OUT

LED	Meaning of the yellow LED	Remedy
 off	no data traffic	–
 flickers yellow	Data traffic activity.	–

Tab. 697: Yellow LED at XF1 IN and XF2 OUT

9.6 Recording measuring data (trace)

Recording measuring data is a proven means of helping with the diagnostics.
The device firmware supports the recording of all of the data in the parameters directory of the device. Different measuring data can be recorded simultaneously. The device firmware supplies several channels for this purpose. The number of available channels and amount of data to be recorded is dependent on the firmware and software being used. The plug-in, for example, enables the configuration of measuring data and display of 8 channels.
In addition to selecting the measured values, the sampling interval, trigger signal, trigger event and trigger type can be configured. The measuring data configuration is saved in the parameter directory of the device by saving the parameter set. The device then waits for a trigger event and records the data independently. After a connection has been established with the plug-in, it is possible to read out the data (button in the title bar of the working section of the 'Trace Display' panel in the 'Diagnosis' context).
The implemented configuration applies equally to all channels. A distinction is made between the following trigger types:

Trigger types	Description
Data trigger	Trigger type that can use all of the data in the parameter directory of the device as a trigger signal. For example, a data trigger on the "Setpoint value speed controller" parameter can start creating a record when the calculated setpoint value exceeds a certain value.
Diagnostics trigger	Trigger type that can use a diagnostic event as a trigger signal thus enabling data before and after a diagnostic event to be recorded. Often, only the time just before and just after the error has occurred is important for the diagnostics.

Tab. 698: Trigger types

After a recording has started, the measuring data are recorded in the trace memory (ring memory). When the trigger event occurs, the measuring data are not retained on the device upon expiry of the recording. The data are lost when a new recording is started and when the power supply is switched off.

Parameters

ID Px.	Parameter	Description	
5500	Trace channel	Specifies whether the channel is activated or not. If the channel is activated, the assigned measured value is permanently recorded in the ring memory after the recording has been started. The array ID is used for the channel assignment. This means: – 1 = channel activated – 0 = channel not activated 5500.0.0: channel 0 ... 5500.0.n: channel n	
		Access	read/write
		Update	effective immediately
		Unit	–
5501	Axis ID trace data	Specifies the axis ID of the signal that should be recorded. The array ID is used for the channel assignment. 5501.0.0: channel 0 ... 5501.0.n: channel n	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
5502	Data ID trace data	Specifies the data ID of the signal to be recorded. The array ID is used for the channel assignment. 5502.0.0: channel 0 ... 5502.0.n: channel n	
		Access	read/write
		Update	effective immediately
		Unit	–
5503	Data instance ID trace data	Contains the instance number of the signal to be recorded. The array ID is used for the channel assignment. 5503.0.0: channel 0 ... 5503.0.n: channel n	
		Access	read/write
		Update	effective immediately
		Unit	–
5504	Array ID trace data	Contains the array ID of the signal to be recorded. The array ID is used for the channel assignment. 5504.0.0: channel 0 ... 5504.0.n: channel n	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 699: Parameters

Example

The following measured values of axis 1 should be recorded at the same time:

- Storage option: DC link voltage too low following power failure (P1.4682.0.0) on channel 0
- Actual position value encoder channel 1 (P1.128.0.0) on channel 1

Parameter settings (example)		
Parameters	Value	Comment
Axis ID trace data selection: axis 1		
P0.5501.0.0	1	Channel 0: axis ID of the parameter P**1**.4682.0.0
P0.5501.0.1	1	Channel 1: axis ID of the parameter P**1**.128.0.0
Data ID trace data selection		
P0.5502.0.0	4682	Channel 0: number of the parameter "Actual position: following error P1.**4682**.0.0
P0.5502.0.1	128	Channel 1: number of the parameter "Actual position value encoder channel 1" P1.**128**.0.0
Data instance ID trace data selection		
P0.5503.0.0	0	Channel 0: instance of P1.4682.**0**.0 parameter
P0.5503.0.1	0	Channel 1: instance of P1.128.**0**.0 parameter
Array ID trace data selection		
5504.0.0	0	Channel 0: array ID = index of the P1.4682.0.**0** parameter
5504.0.1	0	Channel 1: array ID = index of the P1.128.0.**0** parameter
Selection of the trace channels		
5500.0.0	1	Activate trace channel 0
5500.0.1	1	Activate trace channel 1

Tab. 700: Parameter settings (example)

Trace and trigger configuration parameters

ID Px.	Parameter	Description	
341	Trigger type	Specifies the trigger type. This means: – 0 = after start, immediate recording without trigger – 1 = data trigger (parameter as trigger signal) – 2 = diagnostic trigger (diagnostic event as trigger signal)	
		Access	read/write
		Update	effective immediately
		Unit	–
556	Data trace status	Specifies the status of the measuring data recording. This means: – 0 = recording inactive (idle) – 1 = recording active, wait for trigger signal – 2 = recording started	
		Access	read/–
		Update	effective immediately
		Unit	–
557	Trace delay	Specifies the lead and follow-up time relating to the trigger event (specified in samples) A positive value (pre-trigger) refers to a lead time during which measured values before the trigger event are recorded in the trace memory. A negative value (post-trigger) refers to follow-up time during which measured values after the trigger event are recorded in the trace memory.	
		Access	read/write
		Update	effective immediately
		Unit	–
558	Recording length	Number of samples per channel. The value is calculated based on the duration and resolution and applies to all of the channels.	
		Access	read/write
		Update	effective immediately
		Unit	–
559	Down sampling factor	Factor for influencing the sampling interval. With a factor of 2, for example, only every 2nd sample is recorded. Sampling interval = downsampling factor (Px.559) * Basic sampling interval per sample in [µs] (Px.5517)	
		Access	read/write
		Update	effective immediately
		Unit	–
5516	Maximum recording length	Specifies the maximum recording capacity of the trace memory in bytes.	
		Access	read/–
		Update	effective immediately
		Unit	–
5517	Basic sampling interval	Sampling interval in [s]. The sampling frequency depends on the device. The frequency of the CMMT-AS is 16 Khz. This results in a sampling interval of 62.5 µs (1/16000 s). The frequency of the CMMT-ST is 20 KHz. This results in a sampling interval of 50 µs (1/20000 s).	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 701: Parameters

Example of trace and trigger configuration

The recording should be started via a data trigger. The recording should start 0.5 s before the trigger signal (pre-trigger). Only every second measured value should be recorded in the trace memory.

Parameter settings (example)		
Parameters	Value	Comment
Trigger type selection		
P0.341.0.0	1	1 = data trigger
Trace delay selection (recording delay in the samples)		
P0.557.0.0	5000	Number of samples before the trigger (5000 * 0.0001 s = 0.5 s)
Down sampling factor selection		
P0.559.0.0	2	Sampling interval should be 100 µs (2 * base time per sample)

Tab. 702: Parameter settings (example)

Parameters for configuring the trigger event for data triggers

ID Px.	Parameter	Description	
6000	Axis ID data trigger	Specifies the axis ID of the trigger signal. 0 = system 1 = axis 1 ... n = axis n	
		Access	read/write
		Update	effective immediately
		Unit	–
6001	Data ID data trigger	Specifies the data ID of the trigger signal.	
		Access	read/write
		Update	effective immediately
		Unit	–
6002	Data instance ID data trigger	Specifies the data instance ID of the trigger signal.	
		Access	read/write
		Update	effective immediately
		Unit	–
6003	Array ID data trigger	Specifies the array ID of the trigger signal.	
		Access	read/write
		Update	effective immediately
		Unit	–
6004	Trigger event	Specifies the trigger event. The following is possible: – 0 = falling edge (signal changes from 1 to 0); for numerical trigger signals, exceeding the threshold value in a negative direction will initiate the trigger. – 1 = rising edge (signal changes from 0 to 1); for numerical trigger signals, exceeding the threshold value in a positive direction will initiate the trigger. – 2 = any edge (any signal change); for numerical trigger signals, exceeding the threshold value in any direction will initiate the trigger. – 3 = value change (any signal change or value change); at the start of a recording, the value of the signal for the trigger condition is stored. The Trigger level forms a symmetrical monitoring window around the stored value. If the signal for the trigger condition leaves the monitoring window, it is triggered by the value change. – 4 = comparison (value is the same)	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
60012	Trigger level	Specifies the trigger level value. The value is applied as the active trigger level at the start of the recording (Px.6013).	
		Access	read/write
		Update	effective immediately
		Unit	–
60013	Bit mask data trigger	Bit mask for data trigger AND link	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 703: Parameters

Example of data trigger, threshold value exceeded

The recording should be started when the value of the following parameter exceeds 0.5 user units:

– Setpoint value velocity controller (ID P1.2216.0.0)

Parameter settings (example)		
Parameters	Value	Value
Axis ID data trigger selection		
P0.6000.0.0	1	Axis ID of the parameter P**1**.2216.0.0
Data ID data trigger selection		
P0.6001.0.0	2216	Number of the "Setpoint value velocity controller" parameter P1.**2216**.0.0 as trigger signal
Data instance ID data trigger selection		
P0.6002.0.0	0	Instance of the parameter P1.2216.**0**.0
Array ID data trigger selection		
P0.6003.0.0	0	Array ID = index of P1.2216.0.**0** parameter
Trigger event selection		
P0.6004.0.0	1	1 = rising edge (exceeding the threshold value in a positive direction)
Trigger level selection		
P0.60012.0.0	0.5	Threshold value = 0.5 user units
Bit mask data trigger		
P0.60013.0.0	0xFFFFFFFFFFFFFFFF	Delete bit mask

Tab. 704: Parameter settings (example)

Example: bit mask data trigger

The recording is to be started when the motion monitor reports that the trajectory calculation has been completed (Motion complete). The Motion complete status (MC) is signalled via bit 24 of the motion monitoring status word (parameter P1.460).
– Motion complete (ID P1.460.0.0, bit 24)

Parameter settings (example)		
Parameters	Value	Value
Axis ID data trigger selection		
P0.6000.0.0	1	1 = axis 1 Axis ID of the parameter P**1**.460.0.0
Data ID data trigger selection		
P0.6001.0.0	460	Number of the "Status of movement monitoring" parameter P1.**460**.0.0 as trigger signal
Data instance ID data trigger selection		
P0.6002.0.0	0	Instance of the parameter P1.460.**0**.0
Array ID data trigger selection		
P0.6003.0.0	0	Array ID = index of P1.460.0.**0** parameter
Trigger event selection		
P0.6004.0.0	1	1 = rising edge (exceeding the threshold value in a positive direction)
Trigger level selection		
P0.60012.0.0	1	Threshold value = 1
Bit mask data trigger		
P0.60013.0.0	16777216	16777216 (Bit 24 = 1) ... 0001 0000 0000 0000 0000 0000 0000

Tab. 705: Parameter settings (example)

Parameters for configuring the trigger event for diagnostic triggers

ID Px.	Parameter	Description	
103100	Axis ID diagnostic trace	Specifies the axis ID of the diagnostic event. 0 = system 1 = axis 1 ... n = axis n	
		Access	read/write
		Update	effective immediately
		Unit	–
103101	Diagnostics ID diagnostic trace	Specifies the diagnostics ID of the diagnostic event.	
		Access	read/write
		Update	effective immediately
		Unit	–
103102	Data instance ID diagnostic trace	Specifies the data instance ID of the diagnostic event.	
		Access	read/write
		Update	effective immediately
		Unit	–
103103	Actual axis ID diagnostic trace	Specifies the actual axis ID of the current recording.	
		Access	read/–
		Update	effective immediately
		Unit	–
103104	Actual diagnostics ID diagnostic trace	Specifies the actual diagnostics ID of the current recording.	
		Access	read/–

ID Px.	Parameter	Description	
103104	Actual diagnostics ID diagnostic trace	Update	effective immediately
		Unit	–
103105	Actual data instance ID diagnostic trace	Specifies the actual data instance ID of the current recording.	
		Access	read/–
		Update	effective immediately
		Unit	–
103106	Diagnostics trigger	Specifies the trigger event. The following is possible: – 0 = trigger the message – 1 = reset the message – 2 = trigger or reset the message	
		Access	read/write
		Update	effective immediately
		Unit	–
103107	Actual diagnostics trigger	Specifies the actual used diagnostics trigger. The following is possible: – 0 = trigger the message – 1 = reset the message – 2 = trigger or reset the message	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 706: Parameters

Diagnostics trigger example

The recording should be started when the following diagnostic event occurs for axis 1:

– Position: following error (D1.117571710.0)

Parameter settings (example)		
Parameters	Value	Value
Axis ID diagnostic trace selection		
P0.103100.0.0	1	1 = axis 1 Axis ID diagnostic event D**1**.117571710.0
Diagnostics ID diagnostic trace selection		
P0.103101.0.0	117571710	Number of diagnostic event "Position: following error" D1.**117571710**.0
Data instance ID diagnostic trace selection		
P0.103102.0.0	0	Instance of diagnostic D1.117571710.**0**
Diagnostics trigger selection		
P0.103106.0.0	0	0 = trigger the message

Tab. 707: Parameter settings (example)

Diagnostic messages

No specific diagnostic messages are allocated to the function.

9.6.1 CiA 402

Channel configuration objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
5500	0x2207.01 ... 08	Trace channel	USINT
5501	0x2208.01 ... 08	Axis ID trace data	UINT
5502	0x2209.01 ... 08	Data ID trace data	UDINT

Parameter	Index.Subindex	Name	Data type
5503	0x220A.01 ... 08	Data instance ID trace data	UINT
5504	0x220B.01 ... 08	Array ID trace data	UINT

Tab. 708: Objects

Trace and trigger configuration objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
341	0x210F.02	Trigger type	UDINT
556	0x2117.01	Data trace status	UDINT
557	0x2117.02	Trace delay	DINT
558	0x2117.03	Recording length	UDINT
559	0x2117.04	Down sampling factor	UDINT
5516	0x2117.08	Maximum recording length	UDINT
5517	0x2117.09	Basic sampling interval	REAL

Tab. 709: Objects

Objects for configuring the trigger event for data triggers

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
6000	0x211B.01	Axis ID data trigger	UINT
6001	0x211B.02	Data ID data trigger	UDINT
6002	0x211B.03	Data instance ID data trigger	UINT
6003	0x211B.04	Array ID data trigger	UINT
6004	0x211B.05	Trigger event	UDINT
60012	0x211B.0C	Trigger level	LINT
60013	0x211B.0D	Bit mask data trigger	ULINT

Tab. 710: Objects

Objects for configuring the trigger event for diagnostic triggers

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
103100	0x2142.01	Axis ID diagnostic trace	UINT
103101	0x2142.02	Diagnostics ID diagnostic trace	UDINT
103102	0x2142.03	Data instance ID diagnostic trace	UINT
103103	0x2142.04	Actual axis ID diagnostic trace	UINT
103104	0x2142.05	Actual diagnostics ID diagnostic trace	UDINT
103105	0x2142.06	Actual data instance ID diagnostic trace	UINT
103106	0x2142.07	Diagnostics trigger	UDINT
103107	0x2142.08	Actual diagnostics trigger	UDINT

Tab. 711: Objects

9.6.2 PROFIdrive

Channel configuration PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
5500	2578.0 ... 7	Trace channel	BOOL
5501	2579.0 ... 7	Axis ID trace data	UINT

Parameter	PNU	Name	Data type
5502	2580.0 ... 7	Data ID trace data	UDINT
5503	2581.0 ... 7	Data instance ID trace data	UINT
5504	2582.0 ... 7	Array ID trace data	UINT

Tab. 712: PNUs

Trace and trigger configuration PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
341	2114.0	Trigger type	UDINT
556	2173.0	Data trace status	UDINT
557	2174.0	Trace delay	DINT
558	2175.0	Recording length	UDINT
559	2176.0	Down sampling factor	UDINT
5516	2591.0	Maximum recording length	UDINT
5517	2592.0	Basic sampling interval	REAL

Tab. 713: PNUs

PNUs for configuring the trigger event for data triggers

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
6000	2646.0	Axis ID data trigger	UINT
6001	2647.0	Data ID data trigger	UDINT
6002	2648.0	Data instance ID data trigger	UINT
6003	2649.0	Array ID data trigger	UINT
6004	2650.0	Trigger event	UDINT
60012	3071.0	Trigger level	LINT
60013	3072.0	Bit mask data trigger	ULINT

Tab. 714: PNUs

PNUs for configuring the trigger event for diagnostic triggers

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
103100	3140.0	Axis ID diagnostic trace	UINT
103101	3141.0	Diagnostics ID diagnostic trace	UDINT
103102	3142.0	Data instance ID diagnostic trace	UINT
103103	3143.0	Actual axis ID diagnostic trace	UINT
103104	3144.0	Actual diagnostics ID diagnostic trace	UDINT
103105	3145.0	Actual data instance ID diagnostic trace	UINT
103106	3146.0	Diagnostics trigger	UDINT
103107	3147.0	Actual diagnostics trigger	UDINT

Tab. 715: PNUs

9.7 Condition monitoring

9.7.1 Overview of condition monitoring

The condition monitoring function records the following data of the servo drive and axis over the entire service life:

– Drive service life
– Drive load change
– Number of servo drive operating hours

The data are recorded with separate counters and stored as a remanent value approx. every 15 minutes. When the device is switched on again, the last stored values are restored and recording is continued.

9.7.2 Mileage counter

The mileage counter records the distance completed by the connected axis. The unwanted recording of small positioning differences is suppressed by a hysteresis function (random noise). Two threshold values can be specified per parameterisation. A diagnostic message is issued if they are exceeded. The reaction of the servo drive when the threshold value is exceeded can be influenced by specifying the error category.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
1411	Mileage 1	Specifies the actual mileage of the corresponding axis.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1417	Mileage warning threshold	Specifies the first threshold value when the device should generate the first configured message. Warning threshold is deactivated at 0.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
14111	Mileage error threshold	Specifies the second threshold value when the device should generate the second configured message. Error threshold is deactivated at 0.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 716: Parameters

ID Dx.	Name	Description
12 | 01 | 00208 (201392336)	Maximum mileage value reached	Maximum value for the mileage is reached
12 | 01 | 00209 (201392337)	Mileage warning threshold reached	Threshold value 1 (default: warning threshold) for the mileage is reached
12 | 01 | 00210 (201392338)	Mileage error threshold reached	Threshold value 2 (default: error threshold) for the mileage is reached

Tab. 717: Diagnostic messages

Example

The mileage counter should be reset to 0 and the following threshold values should be parameterised:
– Warning threshold for mileage recording of axis 1: 90000000 user units
– Error threshold for mileage recording of axis 1: 100000000 user units

Parameter settings (example)		
Parameters	Value	Comment
Live performance		
P1.1411.0.0	0	Service life of axis 1 in user units
Warning threshold for mileage recording		
P1.1417.0.0	90000000	Warning service life threshold axis 1
Error threshold for mileage recording		
P1.14111.0.0	100000000	Error service life threshold axis 1

Tab. 718: Parameter settings (example)

9.7.2.1 CiA 402

Mileage counter objects

Parameter	Index.Subindex	Name	Data type
ID Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1411	0x2184.01	Mileage 1	LINT
1417	0x2184.05	Mileage warning threshold	LINT
14111	0x2184.08	Mileage error threshold	LINT

Tab. 719: Objects

9.7.2.2 PROFIdrive

Mileage counter PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1411	11339.0	Mileage 1	LINT
1417	11343.0	Mileage warning threshold	LINT
14111	11844.0	Mileage error threshold	LINT

Tab. 720: PNUs

9.7.3 Load change counter

The load change counter records how many reversing backlashes the drive completes. The unwanted recording of small positioning differences is suppressed by a hysteresis function (random noise). Two threshold values can be specified per parameterisation. A diagnostic message is issued if they are exceeded. The reaction of the servo drive when the threshold value is exceeded can be influenced by specifying the error category.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
1421	Load change counter 1	Specifies the actual number of load changes for the corresponding axis.	
		Access	read/write
		Update	effective immediately
		Unit	–
1427	Warning threshold load change counter	Specifies the first threshold value when the device should generate the first configured message.	
		Access	read/write
		Update	effective immediately
		Unit	–
14211	Error threshold load change counter	Specifies the second threshold value when the device should generate the second configured message.	

ID Px.	Parameter	Description	
14211	Error threshold load change counter	Access	read/write
		Update	effective immediately
		Unit	–

Tab. 721: Parameters

ID Dx.	Name	Description
12 | 01 | 00211 (201392339)	Maximum load change value reached	The maximum value for the load change is reached
12 | 01 | 00212 (201392340)	Load change warning threshold reached	Threshold value 1 (default: warning threshold) for the load change is reached
12 | 01 | 00213 (201392341)	Load change error threshold reached	Threshold value 2 (default: error threshold) for the load change is reached

Tab. 722: Diagnostic messages

Example

The load change counter should be reset to 0 and the following threshold values should be parameterised:
- Warning threshold for the load change counter of axis 1: 4500000 user units
- Error threshold for the load change counter of axis 1: 90000000 user units

Parameter settings (example)		
Parameters	Value	Comment
Load change		
P1.1421.0.0	0	Reset axis load change to 0
Warning threshold for the load change counter		
P1.1427.0.0	4500000	Load change warning threshold of axis 1
Error threshold for the load change counter		
P1.14211.0.0	90000000	Load change error threshold of axis 1

Tab. 723: Parameter settings (example)

9.7.3.1 CiA 402

Load change counter objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1421	0x2185.01	Load change counter 1	LINT
1427	0x2185.05	Warning threshold load change counter	LINT
14211	0x2185.08	Error threshold load change counter	LINT

Tab. 724: Objects

9.7.3.2 PROFIdrive

Load change counter PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1421	11345.0	Load change counter 1	LINT
1427	11349.0	Warning threshold load change counter	LINT
14211	11848.0	Error threshold load change counter	LINT

Tab. 725: PNUs

9.7.4 Operating hour counter

The operating hour counter records the time for which the 24 V logic supply of the servo drive was switched on.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
1423	Operating hour counter	Specifies the number servo drive operating hours.	
		Access	read/–
		Update	effective immediately
		Unit	s

Tab. 726: Parameters

Example

The operating hours counter should be read.

Parameter settings (example)		
Parameters	Value	Comment
Operating hour counter		
P0.1423.0.0	...	Number of servo drive operating hours

Tab. 727: Parameter settings (example)

Diagnostic messages No specific diagnostic messages are allocated to the function.

9.7.4.1 CiA 402

Operating hour counter objects

Parameter	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
1423	0x2133.02	Operating hour counter	REAL

Tab. 728: Objects

9.7.4.2 PROFIdrive

Operating hour counter PNUs

Parameter	PNU	Name	Data type
Px.	Manufacturer-specific parameters		
1423	2318.0	Operating hour counter	REAL

Tab. 729: PNUs

10 Web server

10.1 Function

A web server is integrated into the device. The web server provides access to a dynamic English-language website for the device. If access via web server is to be disabled, the web server can be deactivated with the Px.11280051 parameter. The website of the web server enables, for example, the following:
- Setting the IP configuration
- Diagnostics of servo drive
- Transfer of parameter files and firmware (upload and download)

Prerequisites for online connection with the web server

- The power supply of the device is switched on.
- The IP configuration of the device including subnet mask is set correctly.
- Device and PC are connected at the Ethernet interface (direct connection or connection over a network).

IP address of the device

In the factory setting, the device has the following IP address:
- 192.168.0.1

If the IP configuration of the device has been changed, the current IP address can be determined with the CMMT plug-in.

Opening web server

1. Open an internet browser.
2. Enter the IP address of the device into the address line of the browser.
   ⇨ The device's website is displayed.

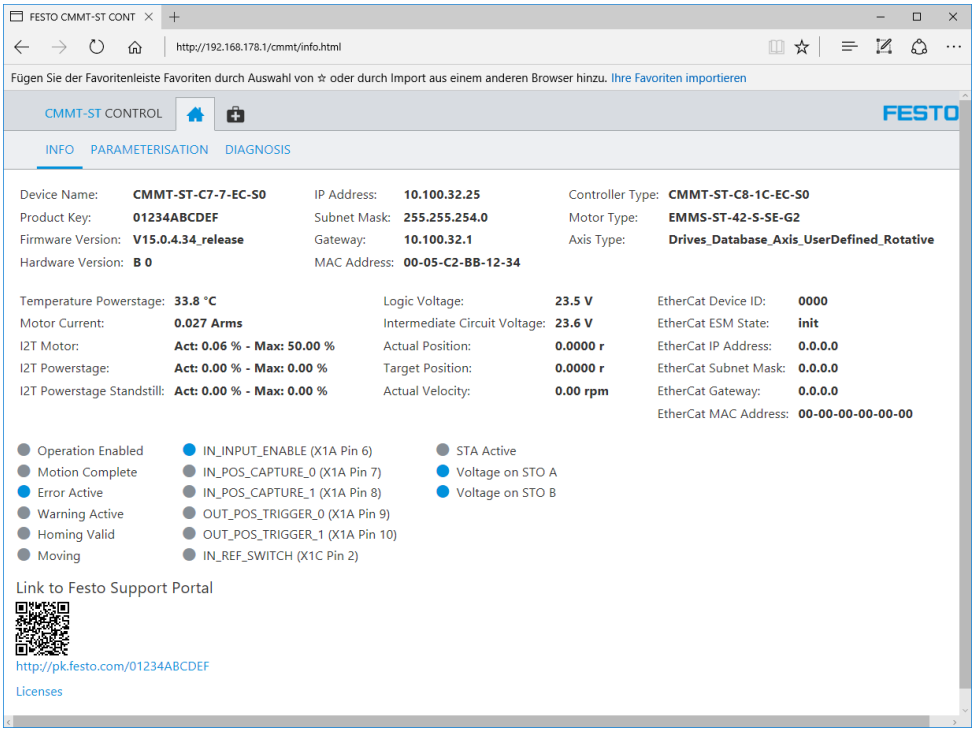


Fig. 108: Website of the web server

The website of the web server has the following register:

register	Description
Info	**Shows the following information:** – Status information of the device (e.g. order reference and hardware version) – dynamic measured values (e.g. temperature of the output stage, level of the logic voltage supply, current position of the drive) – Signal statuses of digital inputs and outputs, active signals are marked with a blue dot. Inactive signals are marked with a grey dot.
Parameterisation	**Offers the following commands:** – Commands to set the IP configuration – Activation of identification sequence (for visual identification of the device in a network) – Firmware upload and download – Upload and download of parameter sets – Reset of all parameters to factory settings
Diagnosis	**Enables the diagnostics of the servo drive** – Access to the error history – Display of current messages from the device – Acknowledgement of all cancelled messages

Tab. 730: Register of the website of the web server

Parameters

ID Px.	Parameter	Description	
11280051	Web server activation	Activation of the web server – 0: inactive – 1: active	
		Access	read/write
		Update	restart
		Unit	–

Tab. 731: Parameters

10.2 CiA 402

Web server objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
11280051	0x21A4.01	Web server activation	USINT

Tab. 732: Objects

10.3 PROFIdrive

Web server PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
11280051	3371.0	Web server activation	BOOL

Tab. 733: PNUs

11 EtherCAT

11.1 General

This part of the documentation describes the implemented standards and the communications of the device in an EtherCAT network. It is intended for people who are already familiar with the bus protocol.
EtherCAT (Ethernet for Controller and Automation Technology) is a standard developed by the "EtherCAT Technology Group (ETG)" association. Numerous device manufacturers are members of this user organisation. EtherCAT is an open, real-time-capable Ethernet technology that has been standardised by the International Electrotechnical Commission (IEC).

Downloads

A configuration file is available in the firmware package and as a separate file on the Internet ➔ www.festo.com/sp.

Festo provides function blocks and application notes to facilitate the commissioning of the device with controllers from various manufacturers ➔ www.festo.com/sp, Downloads → Software and Expert knowledge.

11.2 ETG standards

The following specifications, among others, can be obtained from this user organisation:
– ETG.1000.5: EtherCAT Application Layer Services Definition
– ETG.1000.6: EtherCAT Application Layer Protocol Specification
– ETG.1020:EtherCAT Protocol Enhancements
– ETG.1300:EtherCAT Indicator and Labeling Specification
– ETG.2000:EtherCAT Slave Information Specification
– ETG.2200:EtherCAT Slave Implementation Guide
– ETG.6010:EtherCAT Implementation Directive for CiA402 Drive Profile

User organisation:

Additional information on the "EtherCAT Technology Group (ETG)" user organisation ➔ www.ethercat.org.

EtherCAT implementation

The EtherCAT implementation is based on the following standards:

ETG Draft Standard		Version	Issue
1000.6	EtherCAT Application Layer Protocol Specification S (R)	V1.0.3	2013-01-03
6010	EtherCAT Implementation Directive for CiA402 Drive Profile D (R)	V1.1.0	2014-11-19

Tab. 734: EtherCAT implementation

11.3 EtherCAT communication

11.3.1 Overview of EtherCAT communication and synchronisation

The graph shows the EtherCAT communication and synchronisation of the device with other network devices (e.g. controller (Controller) and Clock Master) and the advanced "CANopen over EtherCAT (CoE)" and "Ethernet over EtherCAT (EoE)" protocols.

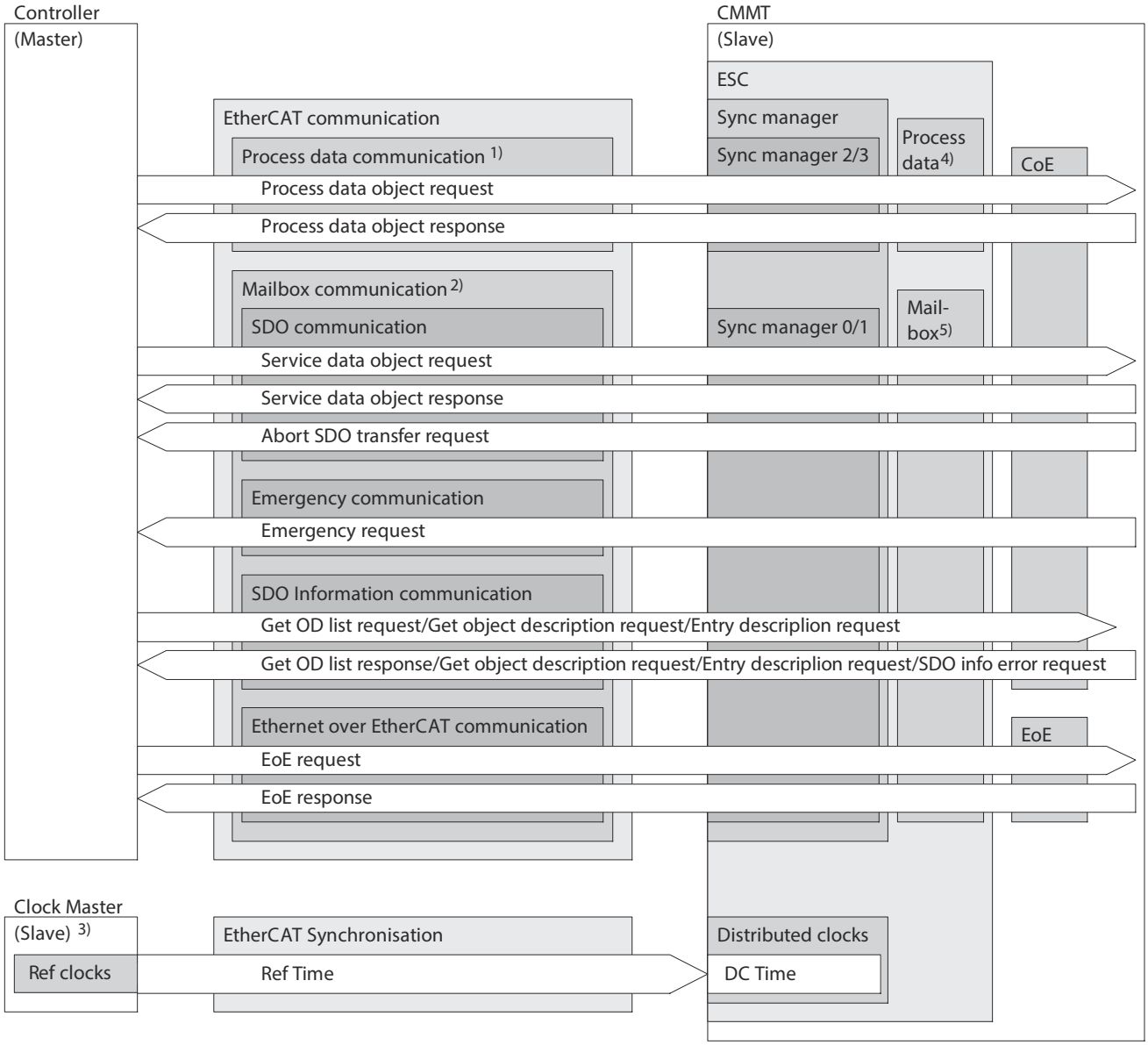


Fig. 109: Overview of EtherCAT communication and synchronisation

1) cyclical transmission
2) acyclic transmission
3) first DC-capable slave in the EtherCAT network
4) internal memory for process data
5) internal memory for mailbox data

Detailed information on EtherCAT communication and synchronisation:

- EtherCAT bus ➔ Chapter 11.3.2
- EtherCAT Slave Controller ESC ➔ Chapter 11.3.3
- Protocol (CoE/EoE) ➔ Chapter 11.3.4
- Sync Manager (Sync manager) ➔ Chapter 11.5
  - Sync manager communication (Sync manager communication) ➔ Chapter 11.5.2
  - Sync manager synchronisation ➔ Chapter 11.5.3
- Distributed Clocks DC ➔ Chapter 11.6
- Process data communication (Process data communication) ➔ Chapter 11.8
  - Process data mapping ➔ Chapter 11.8.2

- Mailbox communication (Mailbox communication) ➔ Chapter 11.9
  - SDO communication (SDO communication) ➔ Chapter 11.9.2
  - Emergency communication (Emergency communication)) ➔ Chapter 11.9.3
  - SDO information communication (SDO information communication): the device supports the transmission of "Get OD list/Get object description/Entry description/SDO info error" in the SDO information communication.
  - Ethernet over EtherCAT communication (Ethernet over EtherCAT communication) ➔ Chapter 11.9.4
  - File access over EtherCAT ➔ Chapter 11.9.5

11.3.2 EtherCAT bus

Topology The device can be integrated into an EtherCAT network string with ring, star or line topology.

Ports The device is integrated into an EtherCAT network by the following connections:
- Port XF1 IN: EtherCAT input
- Port XF2 IN: EtherCAT output

Termination The EtherCAT Slave Controller (ESC) monitors the two EtherCAT ports (XF1 IN/XF2 OUT) of the device. An open XF2 OUT port is automatically closed by the EtherCAT Slave Controller via the loopback function.

Wiring For additional information see the manual for the description, assembly and installation of the servo drive ➔ 1.3 Applicable documents.

11.3.3 EtherCAT Slave Controller ESC

Der EtherCAT Slave Controller ESC ESC forms the central communication unit for the device for the exchange of data between the control unit and the EtherCAT devices. The Distributed Clock DC function is used by the EtherCAT Slave Controller to control the cyclical synchronous processing and transmission of process data.

11.3.4 Protocol

The device supports the following protocols for exchanging data:

Protocol	Description
CANopen over EtherCAT CoE	Data transfer in accordance with CANopen, CiA301
Ethernet over EtherCAT EoE	Data transfer in accordance with IEEE 802.3
File access over EtherCAT	File transfer according to ETG specification

Tab. 735: Overview: protocol

Byte format With EtherCAT, the 16-bit values (word) and the 32-bit values (double word) are presented as follows:

Byte format	Data type	Byte order[1)]			
Little endian	Word (0xCDEF)	(LSB)	(MSB)	–	–
		0xEF	0xCD	–	–
	Double word (0x89ABCDEF)	(LSB)	...		(MSB)
		0xEF	0xCD	0xAB	0x89

1) LSB: least significant byte, MSB: most significant byte

Tab. 736: Byte order

Layout of the Ethernet and EtherCAT frame The graph shows the layout of the Ethernet and EtherCAT frame with the embedded "CANopen over EtherCAT (CoE)" and "Ethernet over EtherCAT (EoE)" protocols.

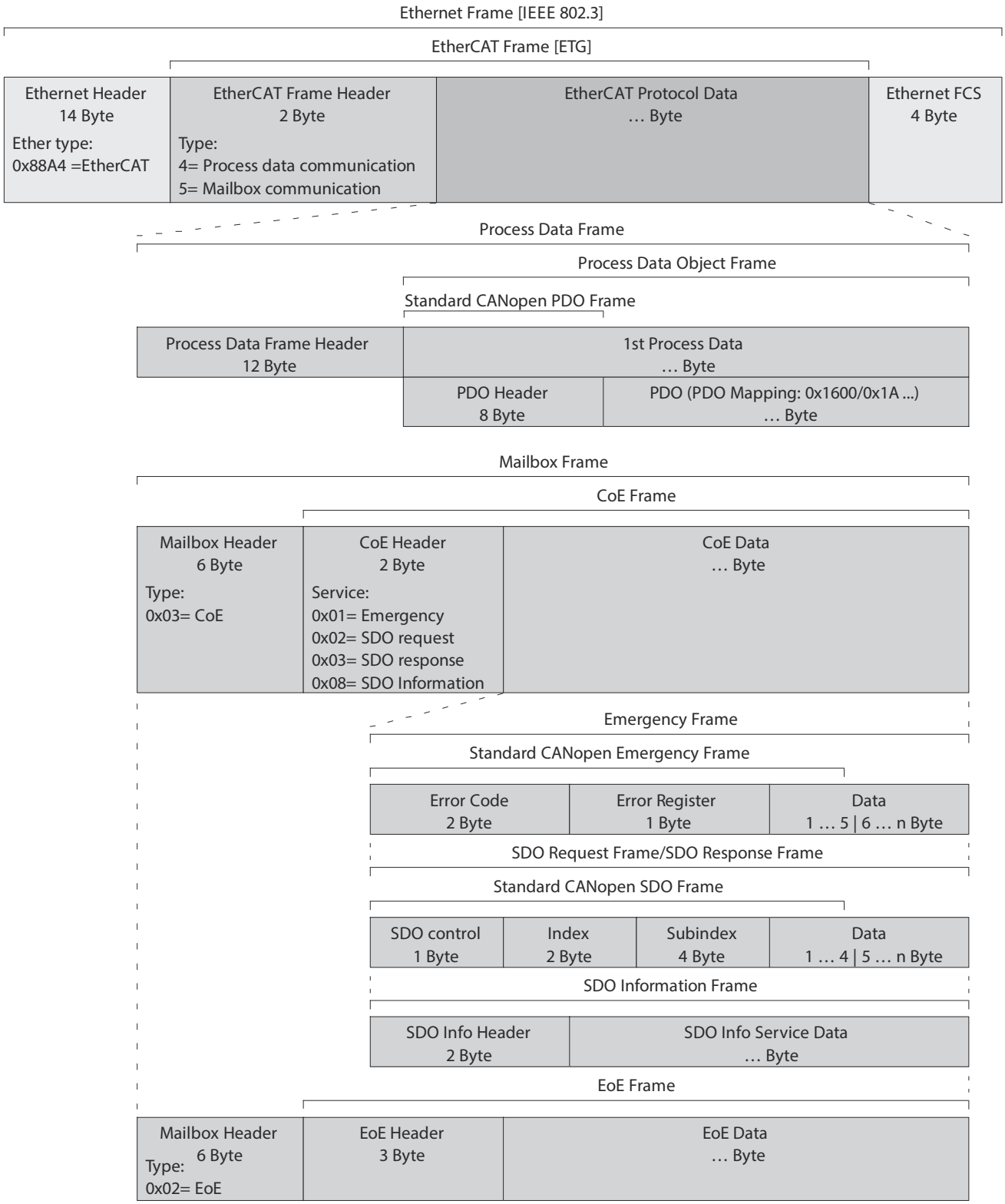


Fig. 110: Layout of the Ethernet and EtherCAT frame

11.4 EtherCAT final state machine

The EtherCAT final state machine contains all statuses needed to establish device communication in an EtherCAT network. After a restart (Power ON or Reset), the device is initialised by the controller (Master). In the following sequence, communication is established for mailbox data and process data. The activation of

communication enables data to be exchanged between the device and the other network devices. All status transitions are controlled by the commands from the higher-order controller. The device does not perform autonomous status changes. The graph shows all statuses and status transitions of the EtherCAT finite state machine.

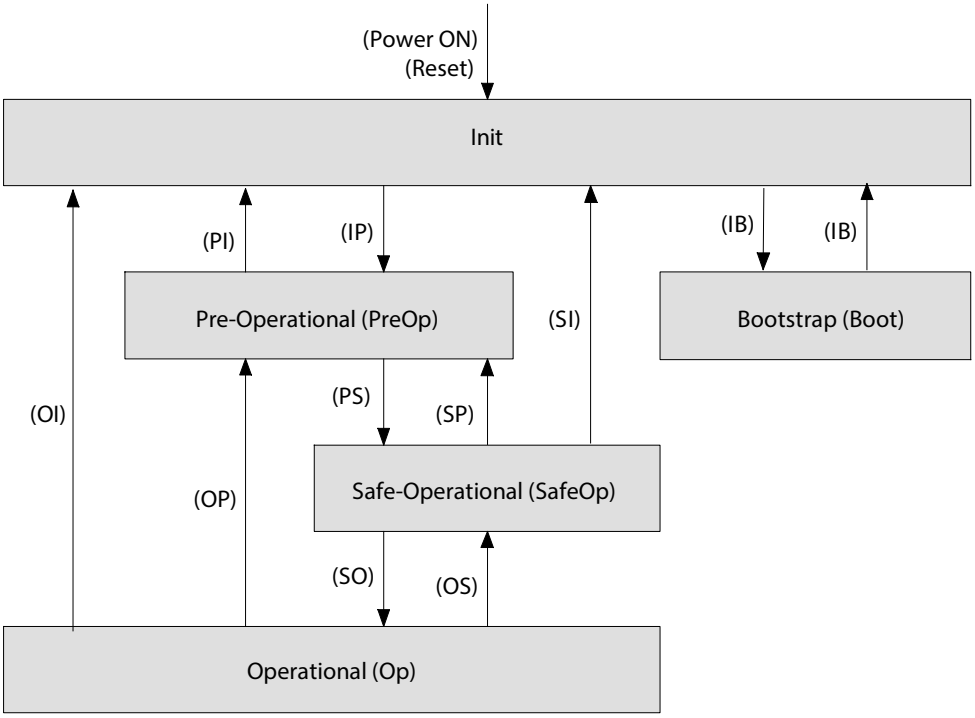


Fig. 111: EtherCAT final state machine

The table describes all statuses of the EtherCAT final state machine.

Status	Status
Init	– Status after Power ON or Reset. – acyclical mailbox communication (SDO) is not possible. – cyclical process data communication (PDO) is not possible. – the controller initialises Sync Manager channels 0 and 1 for mailbox communication.
Pre-Operational (PreOp)	– acyclical mailbox communication (SDO) is possible. – cyclical process data communication (PDO) is not possible. – the controller initialises Sync Manager 2 and 3 and PDO mapping for process data communication.
Safe-Operational (SafeOp)	– acyclical mailbox communication (SDO) is possible. – cyclical process data communication (PDO) is possible. – the controller does not transmit setpoint values to the device (RxPDO). The device is in a safe condition. – the device transmits current actual values to the controller (TxPDO).
Operational (Op)	– acyclical mailbox communication (SDO) is possible. – cyclical process data communication (PDO) is possible. – the controller does not transmit new setpoint values to the device (RxPDO). The setpoint values are processed by the device. – the device transmits current actual values to the controller (TxPDO).
Bootstrap (Boot)	Supported in conjunction with FoE for activating the transferred files.

Tab. 737: Statuses of the EtherCAT final state machine

The table describes all status transitions of the EtherCAT final state machine.

Status transition	Status
Power ON/RESET	The device was switched on, or a Reset was triggered. The device initialises itself and switches directly into the "Init" status.
IP (Init → PreOp)	Mailbox communication (SDO) is started. The controller reads the device information from the EtherCAT Slave Controller (ESC) and configures: – Station address – Sync Manager register for mailbox communication
PI (PreOp → Init)	Mailbox communication (PDO) is stopped.
PS (PreOp → SafeOp)	Process data communication (PDO) is started. The controller configures: – Sync Manager register for process data communication – PDO mapping and Distributed Clocks (DC)
SP (SafeOp → PreOp)	Process data communication (PDO) is stopped.
SO (SafeOp → Op)	The controller transmits valid output data.
OS (Op → SafeOp)	The controller actively requests a change to the "Safe-Operational (SafeOp)" status. The device triggers a diagnostic message in accordance with the configured response.
OP (Op → PreOp)	Process data communication (PDO) is stopped.
SI (SafeOp → Init)	Mailbox communication (PDO) is stopped. Process data communication (PDO) is stopped.
OI (Op → Init)	Mailbox communication (PDO) is stopped. Process data communication (PDO) is stopped.
IB (Init → Boot)	Supported in conjunction with FoE for activating the transferred files.
BI (Boot → Init)	Supported in conjunction with FoE for activating the transferred files.

Tab. 738: Status transitions of the EtherCAT finite state machine

11.5 Sync Manager

11.5.1 Overview of sync manager

The sync manager supports the following functions:
– Sync manager communication (network communication) ➔ 11.5.2 Sync manager communication
– Synchronisation (network synchronisation) ➔ 11.5.3 Synchronisation

11.5.2 Sync manager communication

The sync manager controls the mailbox and process data communication to the other network devices (e.g. controller).
The following table describes the fixed assignment of communication type and transmission type to the sync manager.

Sync Manager	Communication type	Transmission type
0	Mailbox communication	Receive service data objects SDO
1		Transmit service data objects SDO
2	Process data communication	Receive process data objects RxPDO
3		Transmit process data objects TxPDO

Tab. 739: Communication type

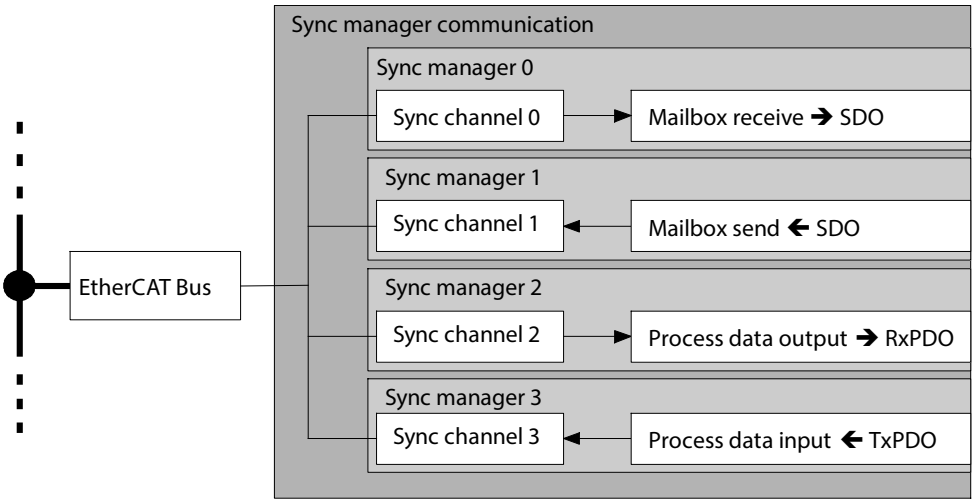


Fig. 112: Parameters and diagnostic Messages

Parameters and diagnostic Messages

ID Px.	Parameter	Description	
750	Sync manager communication type EtherCAT	Display the communication types of the synchronisation manager for the EtherCAT communication.	
		Access	read/write
		Update	effective immediately
		Unit	–
770	Sync manager x number of assigned PDOs EtherCAT	Specifies the number of assigned PDOs in the synchronisation managers 2/3 of the EtherCAT communication.	
		Access	read/write
		Update	effective immediately
		Unit	–
771	PDO mapping object index of assigned PDO EtherCAT	Specifies the PDO Mapping object index of the assigned PDO of the EtherCAT communication	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 740: Parameter

ID Dx.	Name	Description
08 | 04 | 00142 (134480014)	EtherCAT process data invalid	Parameterisation of process data invalid
08 | 04 | 00143 (134480015)	EtherCAT process data communication failed	EtherCAT process data communication failed

Tab. 741: Diagnostic messages

11.5.2.1 CiA 402

Sync manager objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA301: Communication profile**		
750.0.0 … 4	0x1C00.00 … 04	Sync manager communication type EtherCAT	UINT8
770.0.0	0x1C12.00	Sync manager x number of assigned PDOs EtherCAT	UINT8
770.1.0	0x1C13.00	Sync manager x number of assigned PDOs EtherCAT	UINT8
771.0.0	0x1C12.01	PDO mapping object index of assigned PDO EtherCAT	UINT16
771.1.0 … 2	0x1C13.01 … 03	PDO mapping object index of assigned PDO EtherCAT	UINT16

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
750	0x2213.01 ... 05	Sync manager communication type EtherCAT	USINT
770	0x2124.01 ... 02	Sync manager x number of assigned PDOs EtherCAT	USINT
771	0x2215.01 ... 06	PDO mapping object index of assigned PDO EtherCAT	UINT

Tab. 742: Objects

11.5.3 Synchronisation

Transmission and processing of cyclical process data is specified by the synchronisation. The synchronisation is controlled by the Distributed Clocks DC ➔ 11.6 Distributed clocks DC (Distributed Clocks).

The device supports the following synchronisation mode:

– Free Run (no synchronisation)

– Sync (synchronisation with DC Sync 0 event)

EtherCAT DC timing

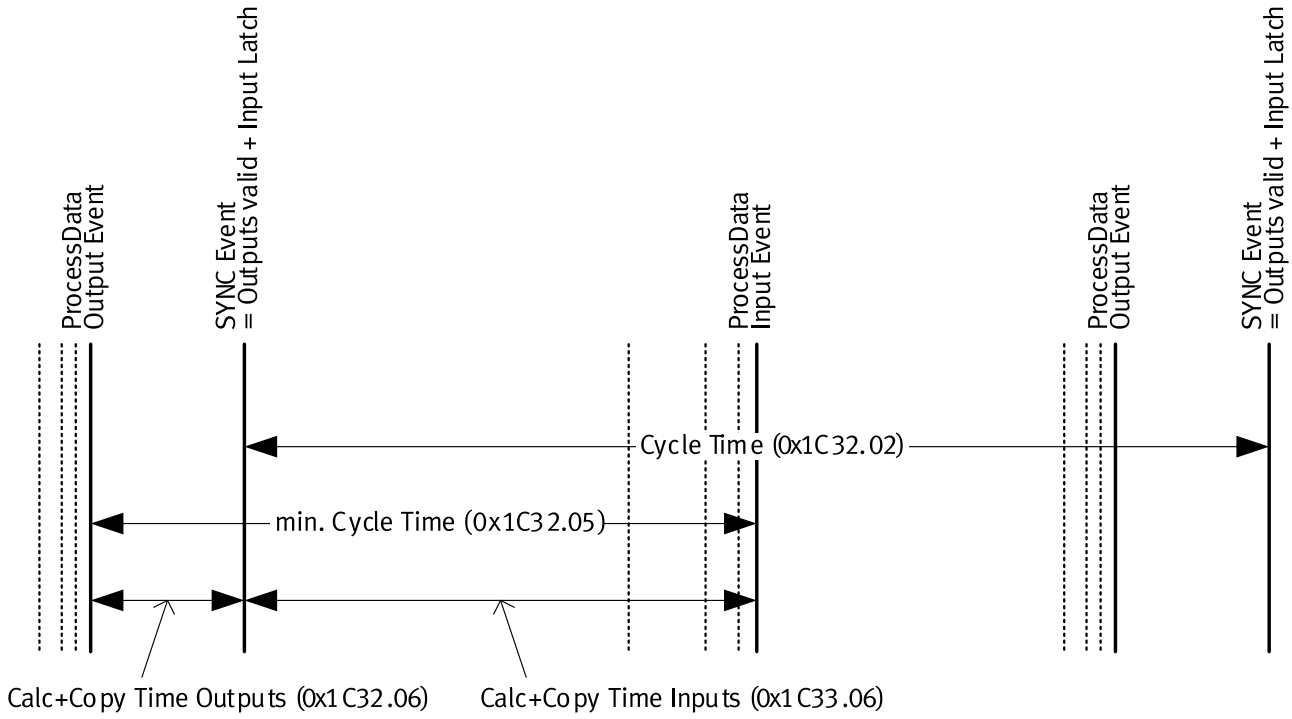


Fig. 113: EtherCAT DC timing

Parameters and diagnostic Messages

ID Px.	Parameter	Description	
1050	Synchronisation mode	Specifies the synchronisation mode. – 0: FreeRun – 1: Sync with process data – 2: DC Sync0	
		Access	read/write
		Update	effective immediately
		Unit	–
1051	Synchronisation process repetition time	Specifies the cycle time [s] for the synchronisation processes. – Sync with process data: cycle time of the master – DC Sync0: time between two sync 0 events (Value range: 1,000,000 – 20,000,000 ns in 1,000,000 ns steps)	
		Access	read/write

ID Px.	Parameter	Description	
1051	Synchronisation process repetition time	Update	effective immediately
		Unit	–
1053	Sync mode supported	Specifies the supported synchronisation mode. – Bit 0 = 1: free run is supported – Bit 1 = 1: Sync with process data is supported – Bit 2-4 = 001: DC Sync0 is supported – Bit 5-15 = reserved	
		Access	read/–
		Update	effective immediately
		Unit	–
1054	Sync Minimum Cycle Time	Specifies the minimum cycle time [ns] (fixed value: 1,000,000 ns).	
		Access	read/–
		Update	effective immediately
		Unit	–
1055	Sync Calc And Copy Time	Specifies the minimum time [ns] between frame and SYNC0 event in Sync synchronisation mode.	
		Access	read/–
		Update	effective immediately
		Unit	–
1056	Sync Get Cycle Time	Specifies the status of the "local cycle time DC Sync0" measurement and the reset of the error counter. – Bit 0: – = 0: the measurement of the local cycle time is stopped. – = 1: the measurement of the local cycle time is restarted and measured again. – Bit 1: – = 0: - – = 1: error counter is reset – Bit 2-15: reserved The value is only up to date in the CiA object via EtherCAT, not during access to the parameter Px.1056 via the plug-in.	
		Access	read/write
		Update	effective immediately
		Unit	–
1057	Sync Delay Time	Specifies the maximum time [ns] between Sync 0 event and issue of the output in Sync synchronisation mode. The value is fixed = 0	
		Access	read/–
		Update	effective immediately
		Unit	–
1058	Sync0 Cycle Time	Specifies the time [ns] between two Sync 0 events in Sync synchronisation mode.	
		Access	read/write
		Update	effective immediately
		Unit	–
1059	Sync SM Event Missed	Specifies the number of failed SM2 events in the Operational status in the Sync synchronisation mode. The value is only up to date in the CiA object via EtherCAT, not during access to the parameter Px.1059 via the plug-in.	
		Access	read/–
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
1060	Sync cycle time too small	Specifies the number of cycle time violations in the Operational status (cycle was not finished on time or the following cycle started too early). The value is only up to date in the CiA object via EtherCAT, not during access to the parameter Px.1060 via the plug-in.	
		Access	read/–
		Update	effective immediately
		Unit	–
1061	Sync Error	Specifies the faulty synchronisation of the last cycle in Sync synchronisation mode. The value is only up to date in the CiA object via EtherCAT, not during access to the parameter Px.1061 via the plug-in.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 743: Parameter

ID Dx.	Name	Description
08 | 00 | 00140 (134217868)	Failure of fieldbus synchronisation signal	Failure of fieldbus synchronisation signal
08 | 00 | 00243 (134217971)	Invalid cycle time	Cycle time is not an integral multiple of 1 ms

Tab. 744: Diagnostic messages

11.5.3.1 CiA 402

Synchronisation objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA301: Communication profile**		
1050.0.0	0x1C32.01	Synchronisation mode	UINT16
1050.0.0	0x1C33.01	Synchronisation mode	UINT16
1051.0.0	0x1C32.02	Synchronisation process repetition time	UINT32
1051.0.0	0x1C33.02	Synchronisation process repetition time	UINT32
1053.0.0	0x1C32.04	Sync mode supported	UINT16
1053.0.0	0x1C33.04	Sync mode supported	UINT16
1054.0.0	0x1C32.05	Sync Minimum Cycle Time	UINT32
1054.0.0	0x1C33.05	Sync Minimum Cycle Time	UINT32
1055.0.0	0x1C32.06	Sync Calc And Copy Time	UINT32
1055.0.0	0x1C33.06	Sync Calc And Copy Time	UINT32
1056.0.0	0x1C32.08	Sync Get Cycle Time	UINT16
1056.0.0	0x1C33.08	Sync Get Cycle Time	UINT16
1057.0.0	0x1C32.09	Sync Delay Time	UINT32
1057.0.0	0x1C33.09	Sync Delay Time	UINT32
1058.0.0	0x1C32.0A	Sync0 Cycle Time	UINT32
1058.0.0	0x1C33.0A	Sync0 Cycle Time	UINT32
1059.0.0	0x1C32.0B	Sync SM Event Missed	UINT16
1059.0.0	0x1C33.0B	Sync SM Event Missed	UINT16
1060.0.0	0x1C32.0C	Sync cycle time too small	UINT16
1060.0.0	0x1C33.0C	Sync cycle time too small	UINT16
1061.0.0	0x1C32.20	Sync Error	BOOL
1061.0.0	0x1C33.20	Sync Error	BOOL

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
1050	0x212E.01	Synchronisation mode	UINT
1051	0x212E.02	Synchronisation process repetition time	REAL
1053	0x212E.04	Sync mode supported	UINT
1054	0x212E.05	Sync Minimum Cycle Time	REAL
1055	0x212E.06	Sync Calc And Copy Time	REAL
1056	0x212E.07	Sync Get Cycle Time	UINT
1057	0x212E.08	Sync Delay Time	REAL
1058	0x212E.09	Sync0 Cycle Time	REAL
1059	0x212E.0A	Sync SM Event Missed	UINT
1060	0x212E.0B	Sync cycle time too small	UINT
1061	0x212E.0C	Sync Error	USINT

Tab. 745: Objects

11.6 Distributed clocks DC (Distributed Clocks)

All real-time clocks in the EtherCAT Slave Controller ESC of all DC-capable network devices of an EtherCAT network array can be synchronised by the mechanism of the distributed clocks DC. The first DC-capable slave in the EtherCAT network by default controls the task of Clock Master with reference clock (Ref Clock). At cyclical intervals, master transmits a synchronisation datagram in which the Clock Master writes the current reference time (Ref Time) to the reference clock. All subsequent slaves read out this value. The EtherCAT Slave Controller ASC calculates the time from the reference time (Ref Time) and the DC time from the run-time (Offset) calculated by the controller.

The DC distributed clocks are continuously synchronised with every subsequent synchronisation datagram. Cyclic synchronous processes can be executed via the Distributed Clocks DC (e.g. chronologically synchronous import of setpoint value from the process data or cyclical synchronous operation of multiple axes). Transmission and processing of cyclical process data is controlled by the Sync Manager synchronisation ➔ 11.5.3 Synchronisation.

In the IP status transition (Init ➔ PreOp) all Distributed Clocks DC in an EtherCAT network are configured by the controller. In the status transitions (PreOp ➔ SafeOp) the DC synchronisation is established in an EtherCAT network. Then the Clock Slave are restored to the Operational status (Op).

The graph shows the DC-topology and synchronisation of the EtherCAT network.

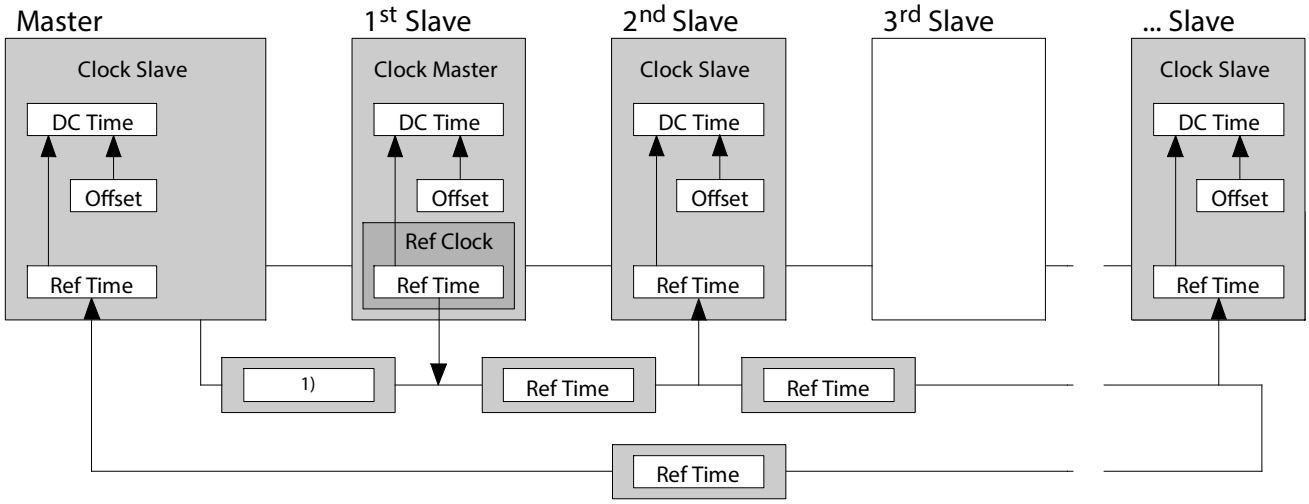


Fig. 114: DC-topology and synchronisation of the EtherCAT network

11.7 CiA 402 finite state machine

11.7.1 Overview of the CiA 402 finite state machine

After switching on, the servo drive automatically changes to the "Not ready to switch on" state.

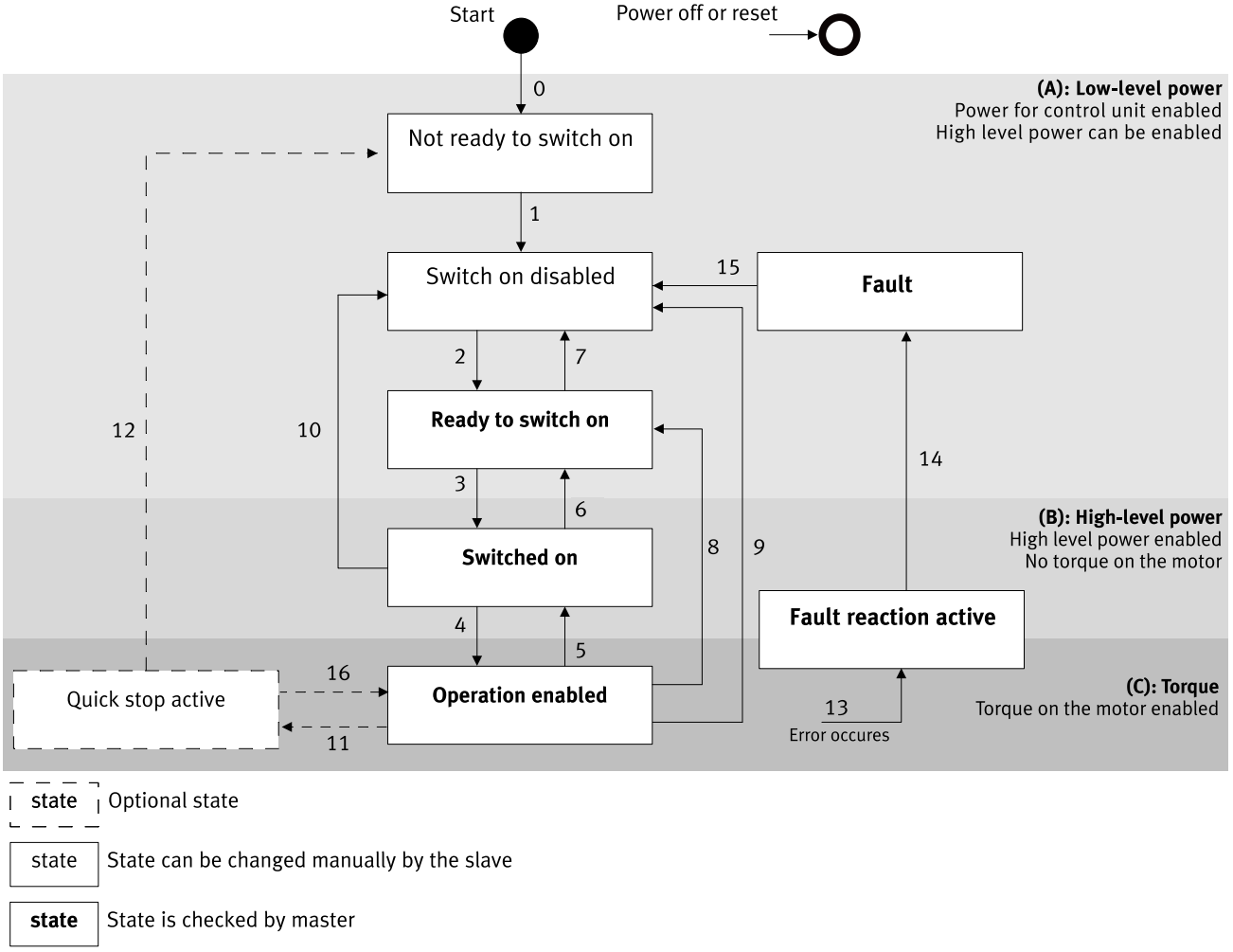


Fig. 115: CiA 402 finite state machine of the servo drive

The states shown in bold in the diagram are stable states of the servo drive and are changed and queried by a higher-level controller.

The states shown in the diagram in normal font can also be changed by the servo drive itself.
Transitions 3 and 4 can only be triggered by the higher-level controller via the control word. These two transitions can be triggered via a single command by simultaneously setting bits 0, 1 and 3 in the control word together in one step.

Commands, state coding and transitions

Command	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	Transition
Shutdown	0	x	1	1	0	2,6,8
Switch on	0	0	1	1	1	3
Switch on + enable operation	0	1	1	1	1	3 + 4[1)]
Disable voltage	0	x	x	0	x	7,9,10,12
Quick stop	0	x	0	1	x	7,10,11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4.16
Fault reset	0→1	x	x	x	x	15
0→1 = rising edge; x = arbitrary						

1) Automatic transition to the "Operation enabled" state after execution of the functionality in the "Switched On" state.

Tab. 746: Control word commands

Status transitions

Transition	Event	Action
0	Automatic transition after switching on or resetting the application	The self-test and the initialisation of the servo drive are carried out.
1	Automatic transition	Communication can be activated.
2	Shutdown command from the higher-level controller or local signal	none
3	Switch on command received from the higher-level controller or local signal	The load voltage supply should be switched on, if possible.
4	Enable operation command received from the higher-level controller or local signal	The drive function is activated and all internal setpoint values are deleted.
5	Disable operation command received from the higher-level controller or local signal	The drive function is deactivated.
6	Shutdown command received from the higher-level controller or local signal	The load voltage supply can be switched off if possible.
7	Quick stop or disable voltage command from the higher-level controller or local signal	none
8	Shutdown command from the higher-level controller or local signal	The drive function is deactivated. The load voltage supply can be switched off if possible.
9	Disable voltage command from the higher-level controller or local signal	The drive function is deactivated. The load voltage supply can be switched off if possible.
10	Disable voltage or quick stop command from the higher-level controller or local signal	The load voltage supply can be switched off if possible.
11	Quick stop command from the higher-level controller or local signal	Quick stop is executed.
12	Disable voltage command from the higher-level controller or local signal	The drive function is deactivated. The load voltage supply can be switched off if possible.
13	Error (see also IEC 61800-7-301)	The configured error reaction is executed.
14	Automatic transition	The drive function is deactivated. The load voltage supply can be switched off if possible.

Transition	Event	Action
15	Fault reset command from the higher-level controller or local signal	The error state is reset if there is no active error at the servo drive. After leaving the error state, the error reset bit in the control word should be deleted by the higher-level controller.
16	Enable operation command from the higher-level controller	The drive function is deactivated.

Tab. 747: Transitions

Coding of the status word

Status word	Status of the servo drive
xxxx xxxx x0xx 0000	Not ready to switch on
xxxx xxxx x1xx 0000	Switch on disabled
xxxx xxxx x01x 0001	Ready to switch on
xxxx xxxx x01x 0011	Switched on
xxxx xxxx x01x 0111	Operation enabled
xxxx xxxx x00x 0111	Quick stop active
xxxx xxxx x0xx 1111	Fault reaction active
xxxx xxxx x0xx 1000	Fault

Tab. 748: Coding

11.7.2 Control word (object 0x6040)

The control word can be used to modify the current status of the device and to trigger a specific action directly (e.g. start of homing). The functions of the bits depend on the operating mode and are described in the relevant section.

Bit	Meaning	Comment
0	Switch on	Controller of the status transitions These bits are evaluated together.
1	Enable Voltage	
2	Quick stop	
3	Enable operation	
4	Operation mode specific	PP: new setpoint HM: Homing operation start PJ: Jog positive RT: new record
5	Operation mode specific	PP: Change set immediately PJ: Jog negative
6	Operation mode specific	PP: abs/rel
7	Fault reset	
8	Halt	PJ: shall be ignored CSP: shall be ignored CSV: shall be ignored CST: shall be ignored other modes: halt with actual deceleration
9	Operation mode specific	PP: see ➔ Tab. 750 Response 0x6040, Bit 9
10	reserved	reserved
11	Jog with slow velocity only	PJ: If set, jogging is done with velocity 1 only
12	Jog with fast velocity only	PJ: If set, jogging is done with velocity 2 only
13	Manufacturer specific	reserved
14	Manufacturer specific	reserved
15	Manufacturer specific	reserved

Tab. 749: Overview of the bit allocation of the control word (object 0x6040)

Bit 9	Bit 5	Bit 4	Description
0	0	0 → 1	The positioning process is completed (target reached) before the next positioning process is started.
x	1	0 → 1	The next positioning process will start immediately.
1	0	0 → 1	The positioning process is continued with the current profile until the current setpoint position is reached, then the next positioning process is immediately started.

Tab. 750: Response 0x6040, Bit 9

11.7.3 Status words (objects 0x6041)

The status word returns status information on the current status of the device. The functions of the bits depend on the operating mode and are described in the relevant section.

Bit	Meaning	Comment
0	Ready to switch on	Status of the CiA 402 state machine These bits are evaluated together.
1	Switched on	
2	Operation enabled	
3	Fault	
4	Voltage enabled	DC link voltage present and in the valid range
5	Quick stop	Bit 5 = 0 if quick stop is run.
6	Switch on disabled	Status of the CiA 402 state machine
7	Warning	One or more messages with the warning severity level are pending.
8	Manufacturer specific: drive is moving	Drive moves
9	Remote	Bit 9 = 1 if the control word (0x6040) is executed. Master control for CiA402 is present.
10	Operation mode specific	PP: Target reached PV: Target reached PT: Target reached HM: Target reached PJ: Target reached RT: Record sequence done
11	Internal limit active	One or more of the internal limits is overrun. This prevents the target/setpoint values from being fully reached. The result is a general status, list of limitations ➔ Tab. 752 Limits for 0x6041, general status bit 11.
12	Operation mode specific	CSP: Drive follows the command value CSV: Drive follows the command value CST: Drive follows the command value PP: Setpoint acknowledge PV: Speed HM: Homing attained PJ: jog with velocity 1 (slow) RT: New record acknowledge
13	Operation mode specific	CSP: Following error PP: Following error PV: Max slippage error HM: Homing error PJ: jog with velocity 2 (fast) RT: Single record done
14	Manufacturer specific	reserved
15	Manufacturer specific	drive is referenced

Tab. 751: Overview of the bit allocation of the status word (object 0x6041)

Limits for 0x6041, general status bit 11		
Limitation	Parameters	Comment
Controller limits		
Speed limitation active OR Maximum correction speed limitation active	Px.52675	Status can become active or inactive during a movement operation
Current limitation active	Px.52676	
Voltage limits		
Ud active voltage limitation	Px.52680	–
Uq active voltage limitation	Px.52681	
Application limitations		
Speed limiting	Px.1301	The status indicates whether the current motion command was limited. Bit 11 remains TRUE until the motion command is completed.
Acceleration limitation	Px.1302	
Torque limitation	Px.1303	
Directional motion block		
Status of directional motion block	Px.10353	The status indicates that one or both directions are blocked for setpoint specifications
Motion monitoring		
Software end position positive active	460p x 14 SLP	–
Software end position negative active	460p x 15 SLN	
Hardware end position positive active	460p x 12 HLP	
Hardware end position negative active	460p x 13 HLN	
Stroke limitation positive active	460p x 19p STLP	
Stroke limitation negative active	Px.460 bit 20 STLN	

Tab. 752: Limits for 0x6041, general status bit 11

11.7.4 Mode-specific status and control bits

The following table shows an overview of the specific bits in the respective operating modes.

Control word	**Operating mode**								
	1, 0	3	4	6	8	9	10	–3	–20
	PP	PV	PT	HM	CSP	CSV	CST	PJ	RT
Bit 4	New setpoint	–	–	Homing operation start	–	–	–	Jog positive	New record
Bit 5	Change set immediately	–	–	–	–	–	–	Jog negative	Change set immediately
Bit 6	0: Absolute 1: Relative	–	–	–	–	–	–	–	–
Bit 11	–	–	–	–	–	–	–	Jog with Velocity 1	–
Bit 12	–	–	–	–	–	–	–	Jog with Velocity 2	–

Tab. 753: Operating-mode-specific control bits

Status word	Operating mode								
	1, 0	3	4	6	8	9	10	–3	–20
	PP	PV	PT	HM	CSP	CSV	CST	PJ	RT
Bit 10	Target Reached	Target Reached	Target Reached	Target Reached	–	–	–	Target Reached	Record sequence done
Bit 12	Set point acknowledge	Speed = 0	–	Homing attained	Drive follows command value	Drive follows command value	Drive follows command value	Velocity 1 jog	New record acknowledge
Bit 13	Following error	Max slippage error	–	Homing error	Following error	–	–	Velocity 2 jog	Single record done
Bit 14	–	–	In Torque	–	–	–	–	–	–

Tab. 754: Operating-mode-specific status bits

11.7.5 Torque switching

Torque values in servo drives are by default referenced to the values at the gear unit output shaft (including gear ratio). This deviates from the CiA 402 specification.

According to the CiA 402 specification, the torque at the motor shaft (without gear unit) is expressed as a percentage of the nominal torque.

The Px.1128062 parameter allows the torque values involved to be referenced to the gear unit output shaft instead of the motor shaft (TRUE value = motor shaft). Changing the parameter requires reinitialisation.

- 0x6071: target torque (Target torque CiA402)
- 0x6072: maximum torque (Maximum torque symmetrical)
- 0x60E0: critical limit of positive torque (Upper limit value torque (closed loop controller))
- 0x60E1: critical limit of negative torque (Lower limit value torque (closed loop controller))
- 0x6074: torque requirement (Setpoint generator output torque)
- 0x6077: torque actual value (Actual torque value gear shaft)
- 0x60B2: torque offset (Torque offset CiA402)

Torque parameter switching

ID Px.	Parameter	Description	
128062	Torque on motor side	Displays the torque on the motor side.	
		Access	read/write
		Update	reinitialization
		Unit	–

Tab. 755: Parameters

Parameter	Index.Subindex	Name	Data type
128062	0x2195.08	Torque on motor side	USINT

Tab. 756: Objects

Parameter	Index.Subindex	Name	Data type
128062	13235.0	Torque on motor side	BOOL

Tab. 757: PNUs

11.8 Process data communication

11.8.1 Overview of process data communication

The process data communication (Process data communication) is used to exchange process data (e.g. setpoint values and actual values) cyclically between the device and the network devices (e.g. controller (Controller)). With every process data frame that is run through the output process data (Process data output) are read from the frame and the input process data (Process data input) are written to the frame. In the device the controller for process data communication is assigned permanently to Sync Managers 2 and 3 for transmission of mapped process data objects (PDO) (Process data objects). Max. 16 output/input objects (Sub: 0x01 ... ...0x10) with 64 bytes user data each can be assigned to the process data objects (RxPDO/TxPDO).
Process data communication is active from the "Safe Operational" status. The device transmits the current actual values (TxPDO) to the controller from this status. After the "Operational" status is reached, incoming setpoint values (RxPDO) are processed and executed by the device.
Synchronisation of the device can be controlled by the Distributed Clocks DC
➔ 11.6 Distributed clocks DC (Distributed Clocks).

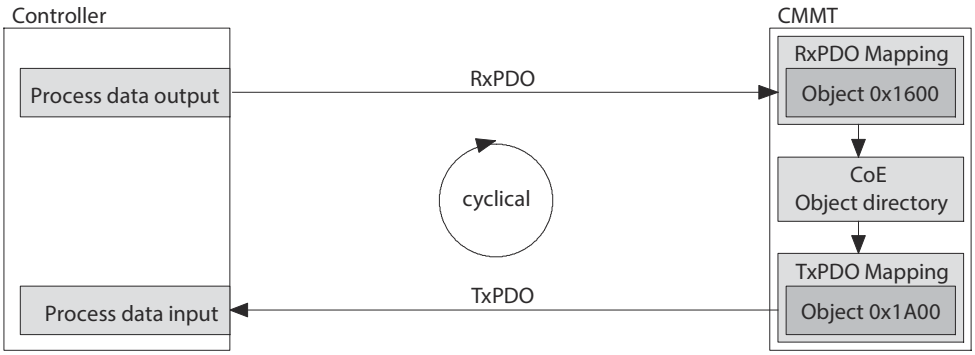


Fig. 116: Access procedure via process data objects PDO

PDO mapping can be used to create application-specific output and input data sets for data exchange.

11.8.2 PDO mapping

11.8.2.1 Function: RxPDO1 mapping

The graph shows the default setting (factory setting) for the 1st receive PDO mapping RxPDO1 in object 0x1600.

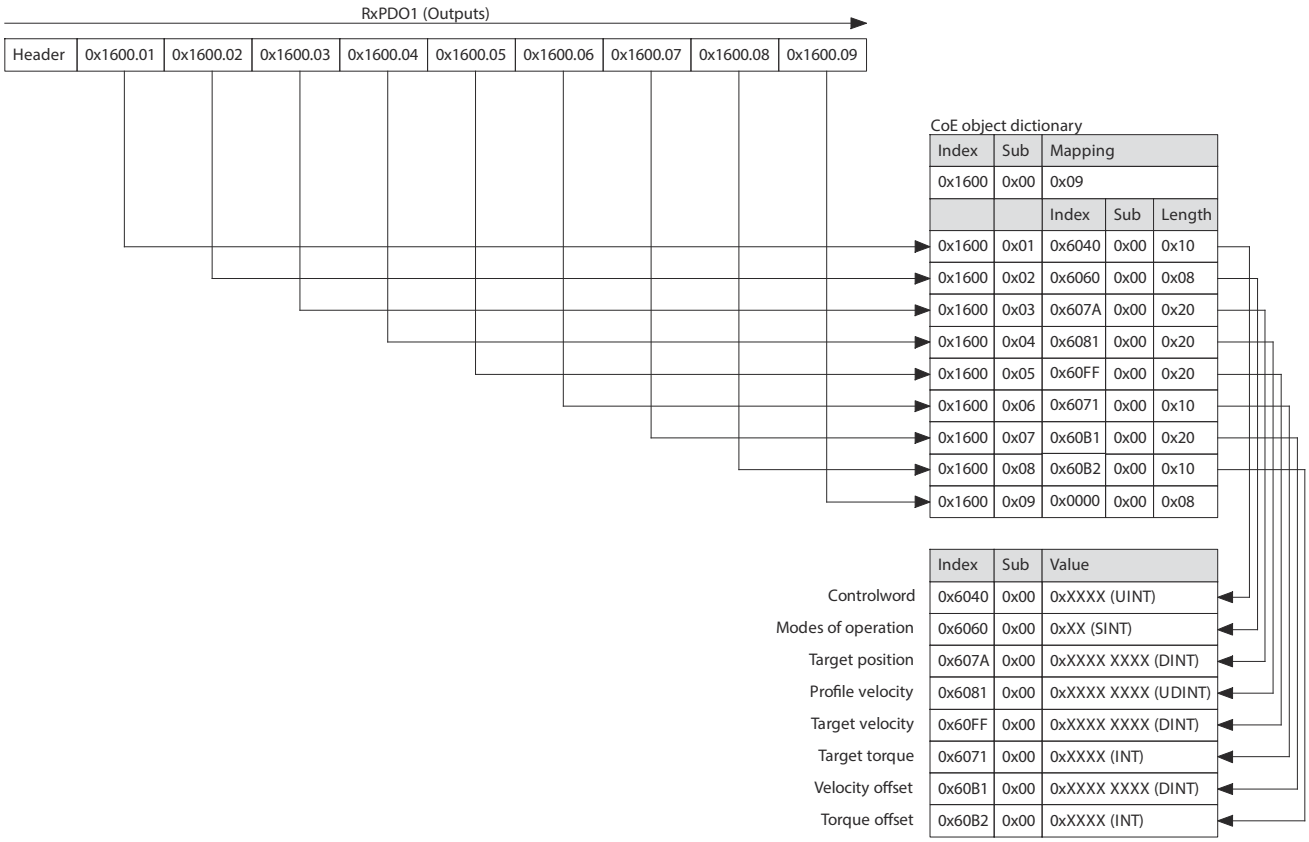


Fig. 117: Overview: default RxPDO1 mapping

Configuring object 0x1600

The following steps are required for parameterisation of object 0x1600 (only if the "complete access" function is not enabled):

- Set the device to the "Pre-Operational (PreOp)" status.
- Set the subindex 0x00 to value 0.
- Configure the subindex 0x01 ... 0x10.
- Set the subindex 0x00 to the value of the assigned PDOs.
- Set the device to the "Safe-Operational (SafeOp) and Operational (Op)" status.

11.8.2.2 Function: TxPDO1 mapping, axis 1

The graph shows the default setting (factory setting) for the 1st send PDO mapping TxPDO1 in object 0x1A00.

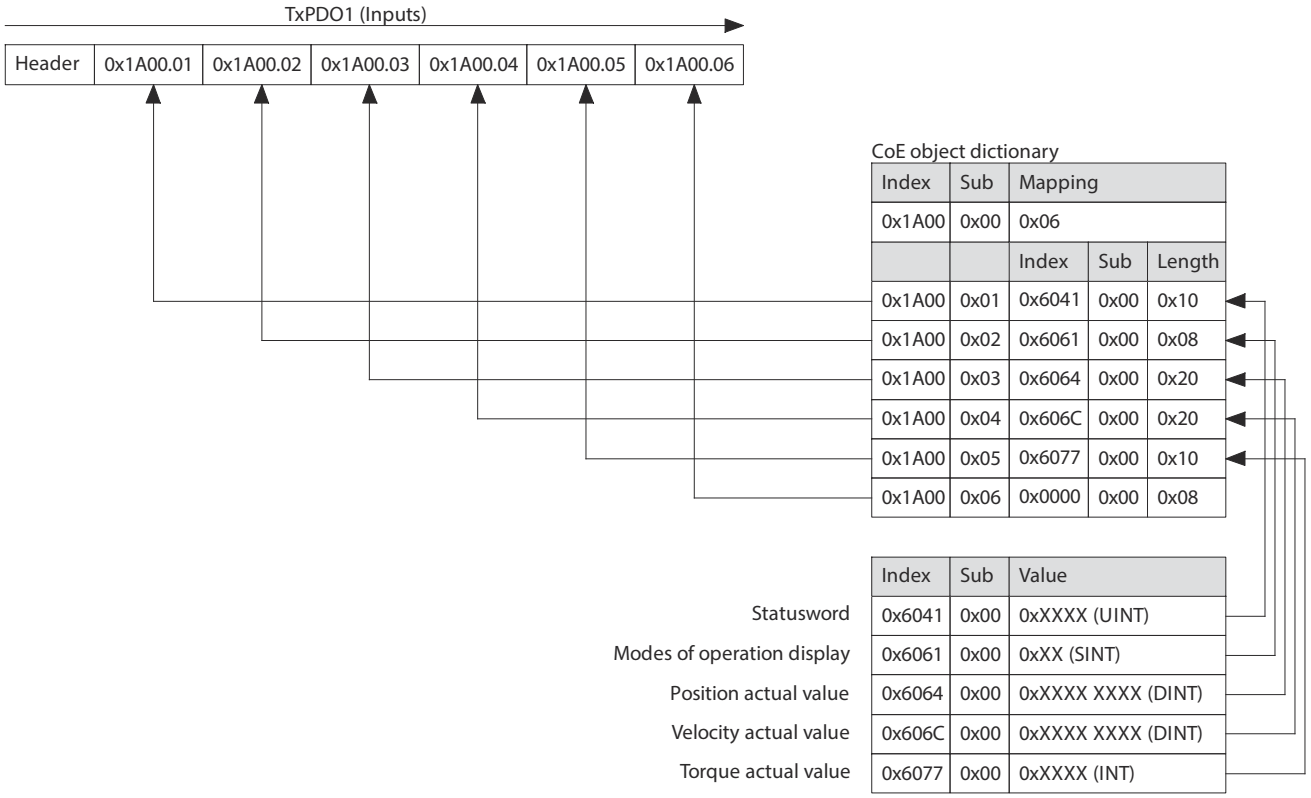


Fig. 118: Overview: default TxPDO1 mapping

Configuring object 0x1A00

The following steps are required for parameterisation of object 0x1A00 (only if the "complete access" function is not enabled):

- Set the device to the "Pre-Operational (PreOp)" status.
- Set the subindex 0x00 to value 0.
- Configure the subindex 0x01 ... 0x10.
- Set the subindex 0x00 to the value of the assigned PDOs.
- Set the device to the "Safe-Operational (SafeOp) and Operational (Op)" status.

11.8.2.3 Function: TxPDO2 mapping, EtherCAT, diagnostic history

The graph shows the fixed setting for the 2rd send PDO mapping TxPDO2 in object 0x1AF0.

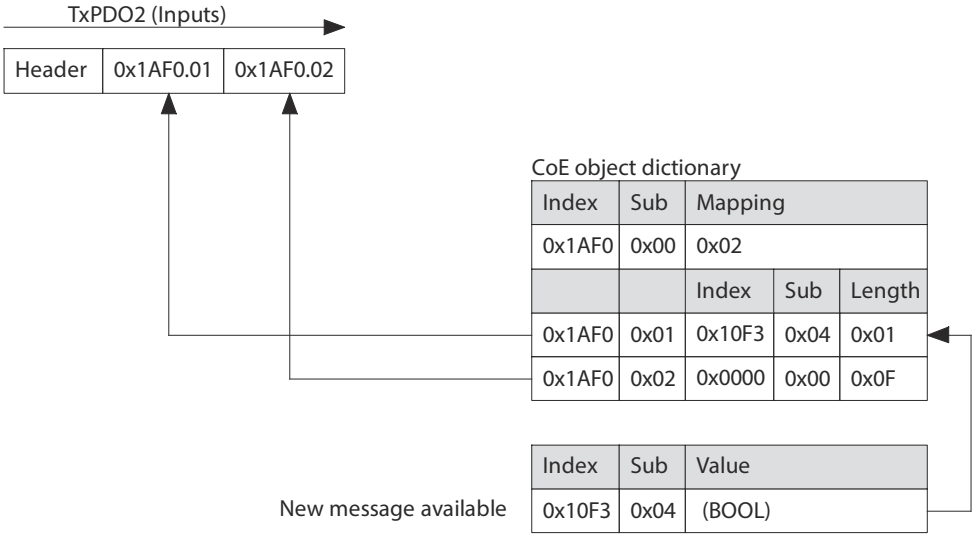


Fig. 119: Overview: default TxPDO2 mapping

11.8.2.4 Function: TxPDO3 mapping, EtherCAT, DC time stamp

The graph shows the fixed setting for the 3rd send PDO mapping TxPDO3 in object 0x1AF1.

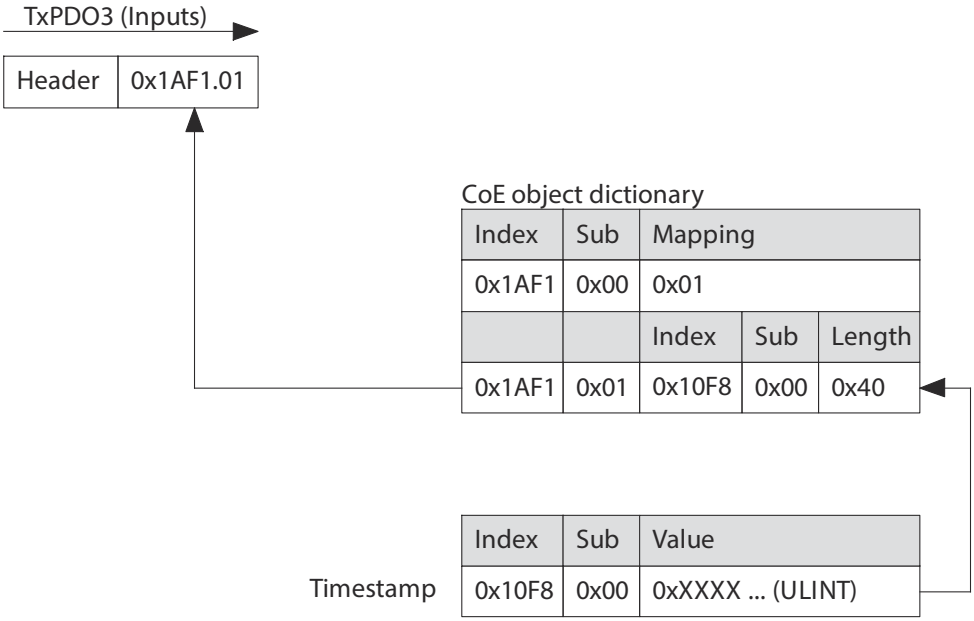


Fig. 120: Overview: default TxPDO3 mapping

11.8.2.5 Parameters and diagnostic Messages

ID Px.	Parameters	Description	
760	Receive PDO number of objects EtherCAT	Specifies the number of objects in the RxPDO.	
		Access	read/write
		Update	effective immediately
		Unit	–
761	Receive PDO Mapped Objects EtherCAT	Specifies the mapping of objects in the RxPDO ➔ 11.8 Process data communication	
		Access	read/write
		Update	effective immediately
		Unit	–
880	Transmit PDO number of objects EtherCAT	Specifies the number of objects in the TxPDO. – 1A00: TxPDO1 mapping, axis 1 – 1AF0: TxPDO2 mapping, EtherCAT, diagnostic history – 1AF1: TxPDO3 mapping, EtherCAT, DC time stamp	
		Access	read/write
		Update	effective immediately
		Unit	–
881	Transmit PDO mapped objects EtherCAT	Specifies the mapping of objects in the TxPDO. – 1A00: TxPDO1 mapping, axis 1 ➔ 11.8 Process data communication. – 1AF0: TxPDO2 mapping, EtherCAT, diagnostic history ➔ 11.8 Process data communication. – 1AF1: TxPDO3 mapping, EtherCAT, DC time stamp ➔ 11.8 Process data communication.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 758: Parameters

Diagnostic messages No specific diagnostic messages are allocated to the function.

11.8.2.6 CiA 402

PDO mapping objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA301: Communication profile**		
760.0.0	0x1600.00	Receive PDO number of objects EtherCAT	UINT8
761.0.0 ... 15	0x1600.01 ... 10	Receive PDO Mapped Objects EtherCAT	UINT32
880.0.0	0x1A00.00	Transmit PDO number of objects EtherCAT	UINT8
880.1.0	0x1AF0.00	Transmit PDO number of objects EtherCAT	UINT8
880.2.0	0x1AF1.00	Transmit PDO number of objects EtherCAT	UINT8
881.0.0 ... 15	0x1A00.01 ... 10	Transmit PDO mapped objects EtherCAT	UINT32
881.1.0	0x1AF0.01 ... 02	Transmit PDO mapped objects EtherCAT	UINT32
881.2.0	0x1AF1.01	Transmit PDO mapped objects EtherCAT	UINT32
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
760	0x2123.01	Receive PDO number of objects EtherCAT	USINT
761	0x2214.01 ... 10	Receive PDO Mapped Objects EtherCAT	UDINT
880	0x2126.01 ... 03	Transmit PDO number of objects EtherCAT	USINT
881	0x2216.01 ... 10	Transmit PDO mapped objects EtherCAT	UDINT

Tab. 759: Objects

11.9 Mailbox communication

11.9.1 Overview of mailbox communication

The mailbox communication (Mailbox communication) is used to exchange service data (e.g. parameter values) or error messages acyclically between the higher-level controller and the device. In the device the controller for mailbox communication is assigned permanently to Sync Managers 0 and 1 for transmission of service data objects (SDO) (Service data objects), emergency messages and SDO information.

Mailbox communication is enabled from the "Pre-Operational" status.

Mailbox communication supports the following communication services:

- Via CANopen over EtherCAT (CoE)
  - SDO communication (acyclic transmission of service data objects) ➔ 11.9.2 SDO communication
    The "Complete Access" function is supported.
  - Emergency communication (event-controlled transmission of emergency error messages (Error codes)) ➔ 11.9.3 Emergency communication
  - SDO information communication (acyclic transmission of object data) ➔ 11.9.2.1 SDO communication
- Via Ethernet over EtherCAT (EoE)
  - Ethernet communication (acyclic transmission of service data objects via EtherCAT over Ethernet EoE) ➔ 11.9.4 Ethernet over EtherCAT communication (EoE)

11.9.2 SDO communication

11.9.2.1 Overview of SDO communication

SDO communication supports the following SDO services:
- SDO read command (SDO upload/Upload SDO): acyclic reading of parameter data ➔ 11.9.2.3 SDO read command (SDO upload/Upload SDO)
- SDO write command (SDO download/Download SDO): acyclic writing to parameter data ➔ 11.9.2.2 SDO write command (SDO download/Download SDO)
- SDO error transmission: event-controlled transmission of SDO error code ➔ 11.9.2.4 SDO error message (Abort SDO transfer request)

11.9.2.2 SDO write command (SDO download/Download SDO)

The SDO write command (SDO write command) enables the controller (Controller) to access the CoE object directory CoE OD in the device acyclically to write the data of an object (Value). After processing the write command, the device sends an acknowledgment (Acknowledgment) to the controller.

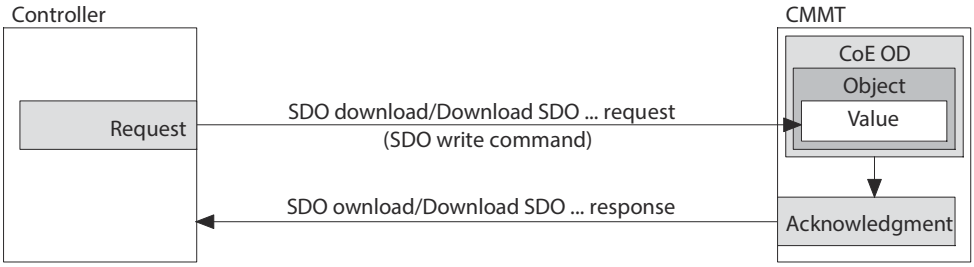


Fig. 121: Write access to object data

The SDO service supports the following SDO write commands:

SDO service	Description
SDO download expedited request	Write command request for 1 ... 4 bytes user data
SDO download expedited response	Write command acknowledgement with 1 ... 4 bytes user data
SDO download normal request	Write command request for 5 ... 1,406 bytes user data
SDO download normal response	Write command acknowledgement with 5 ... 1,406 bytes user data
Download SDO segmented request	Write command request for 1,407 ... n bytes user data
Download SDO segmented response	Write command acknowledgement with 1,407 ... n bytes user data

Tab. 760: Supported SDO read commands

The controller may not send the next request (request) until the acknowledgement of the write command (download ... response) has been received by the controller.

The request of the write command (download ... request) must not include any object that is mapped in the "Receive PDO Mapping (0x1600)" object. The alternating transfer of process data objects PDO and service data objects SDO would overwrite the data of the object (Value) in an undefined chronological order.

11.9.2.3 SDO read command (SDO upload/Upload SDO)

The SDO read command (SDO read command) enables the controller (Controller) to access the CoE object directory CoE OD in the device acyclically to read the data of an object (Value). After processing the read command, the device sends a response (Answer) to the controller with the requested data.

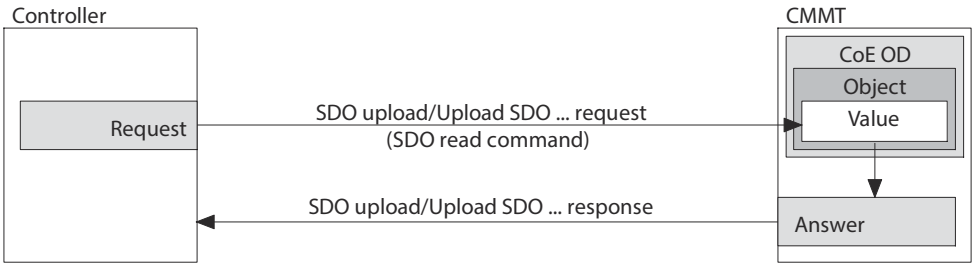


Fig. 122: Read access to object data

The SDO service supports the following SDO write commands:

SDO service	Description
SDO upload expedited request	Read command request for 1 ... 4 bytes user data
SDO upload expedited response	Read command response with 1 ... 4 bytes user data
SDO upload normal request	Read command request for 5 ... 1,406 bytes user data
SDO upload normal response	Read command response with 5 ... 1,406 bytes user data
Upload SDO segmented request	Read command request for 1,407 ... n bytes user data
Upload SDO segmented response	Read command response 1,407 ... n bytes user data

Tab. 761: Supported SDO read commands

The controller must not send the next request (request) until the response of the read command (upload ... response) has been received by the controller.

11.9.2.4 SDO error message (Abort SDO transfer request)

In the case of an error (SDO Error) when reading, writing or transmitting the SDO the device responds with a SDO error message (Abort SDO transfer request). The cause of error is transmitted as an abort code (Abort codes) in the data (Data) of the error message to the controller (Controller).

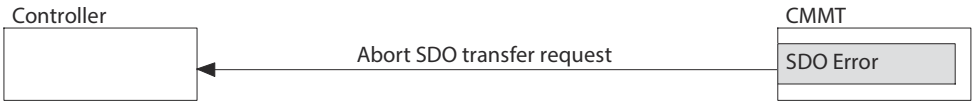


Fig. 123: Transmit error message

Example: A write command is transmitted to the object "Statusword (0x6041h)" that only has read access. The abort code "0x06 01 00 02" is returned in the error message.

SDO abort codes (SDO abort codes) The following table describes all the SDO abort codes for SDO communication:

Abort code F3 F2 F1 F0	Description
0x05 03 00 00	Protocol error: toggle bit was not revised with segmented SDO transfer.
0x05 04 00 00	SDO protocol time violation
0x05 04 00 01	Protocol error: client/server command specifier invalid or unknown
0x05 04 00 05	outside the memory range
0x06 01 00 00	Access type is not supported
0x06 01 00 01	Read access to an object that can only be written

Abort code F3 F2 F1 F0	Description
0x06 01 00 02	Write access to an object that can only be read
0x06 01 00 03	Subindex cannot be written to, subindex 0 must be 0 for write access
0x06 01 00 04	SDO complete access is not supported for objects with variable length, e.g. with ENUM object types
0x06 01 00 05	Length of object exceeds size of mailbox
0x06 01 00 06	Object is assigned to RxPDO, SDO download is blocked
0x06 02 00 00	The addressed object does not exist in the object directory.
0x06 04 00 41	The object must not be entered into a PDO (e.g. ro object in RPDO).
0x06 04 00 42	The length of the objects entered in the PDO exceeds the PDO length
0x06 04 00 43	General parameter error
0x06 04 00 47	Overflow of an internal variable/general error
0x06 06 00 00	Access faulty due to a hardware problem
0x06 07 00 10	Protocol error: length of the service parameter does not agree.
0x06 07 00 12	Protocol error: length of the service parameter is too large.
0x06 07 00 13	Protocol error: length of the service parameter is too small.
0x06 09 00 11	The addressed subindex does not exist.
0x06 09 00 30	Value range for parameters was exceeded (only for write access)
0x06 09 00 31	Parameter value is too big
0x06 09 00 32	Parameter value is too small
0x06 09 00 36	Maximum value is smaller than the minimum value
0x08 00 00 00	General error
0x08 00 00 20	Data cannot be transmitted to the device or saved
0x08 00 00 21	Data cannot be transmitted to the device or saved due to absence of master control
0x08 00 00 22	Data cannot be transmitted to the device or saved due to the current status of the device
0x08 00 00 23	Dynamic generation of the object directory failed, or no object directory is available

Tab. 762: SDO abort codes

11.9.3 Emergency communication

The device monitors the function of internal modules (e.g. output stage). Whenever an error occurs, the configured error reaction is initiated, and the corresponding emergency message is transmitted to the controller.
The device also sends an emergency message when an error acknowledgement has been executed.

Parameters and diagnostic Messages

ID Px.	Parameter	Description	
7602	Error register CiA402	Display the error code in accordance with the error register (CiA402).	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 763: Parameter

Diagnostic messages No specific diagnostic messages are allocated to the function.

11.9.3.1 CiA 402

Emergency communication objects

Parameter	Index.Subindex	Name	Data type
Px.	**CiA301: Communication profile**		
7602.0.0	0x1001.00	Error register CiA402	UINT8
Px.	**Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.**		
7602	0x2196.01	Error register CiA402	USINT

Tab. 764: Objects

11.9.3.2 Error finite state machine

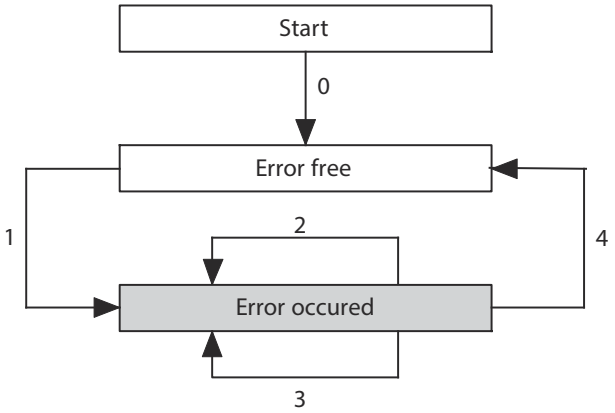


Fig. 124: Diagram: error finite state machine

The following status transitions are possible:

No.	Cause	Description
0	Initialisation completed	There is no error.
1	Error occurs	No error is present, and a new error occurs. An emergency message is transmitted with the error code of the new error.
2	Error acknowledgement not successful	An error acknowledgement was executed but not all causes of the error are remedied ➔ 9.4.5 Acknowledging messages and errors.
3	New error occurs	An error is present, and a new error occurs. An emergency message is transmitted with the error code of the new error.
4	Error acknowledgement successful	All causes of error are remedied, and an error acknowledgement was executed ➔ 9.4 Servo drive messages. The emergency message is transmitted with the error code 0x0000 (No error/Error reset).

Tab. 765: Error status transitions

Error messages (Error codes)

The following table lists all error messages that can occur in EtherCAT operation.

For additional information on the error messages (e.g. error response, cause and measures) ➔ 9.4.6 Diagnostic messages with information for fault clearance.

Error code E0 E1	Name	Error register Bit	Festo Automation Suite ID Dx.
0x2081	Current	0x03	01 | 02 | 00016, 01 | 02 | 00017, 01 | 02 | 00018, 01 | 02 | 00258, 01 | 02 | 00259, 01 | 03 | 00019, 01 | 03 | 00020, 01 | 03 | 00021
0x2230	Current	0x03	01 | 01 | 00010
0x2340	Current	0x03	01 | 01 | 00011
0x2350	Current	0x03	01 | 02 | 00013, 01 | 02 | 00015
0x2351	Current	0x03	01 | 02 | 00012, 01 | 02 | 00014

Error code E0 E1	Name	Error register Bit	Festo Automation Suite ID Dx.
0x2380	Leakage current detected	0x81	01 | 00 | 00840
0x3082	Voltage	0x05	02 | 01 | 00022, 02 | 01 | 00023, 02 | 01 | 00028, 02 | 01 | 00029, 02 | 01 | 00472, 02 | 02 | 00034, 02 | 02 | 00035, 02 | 02 | 00286, 02 | 02 | 00287, 02 | 03 | 00251, 02 | 04 | 00042, 02 | 04 | 00043, 07 | 05 | 00772
0x3110	Voltage	0x05	02 | 03 | 00039
0x3120	Voltage	0x05	02 | 03 | 00036, 02 | 03 | 00037, 02 | 03 | 00038
0x3130	Voltage	0x05	02 | 03 | 00040
0x3140	Voltage	0x05	02 | 03 | 00041
0x3220	Voltage	0x05	02 | 02 | 00033
0x4083	Temperature	0x09	03 | 01 | 00045, 03 | 01 | 00047, 03 | 02 | 00049, 03 | 02 | 00051
0x4210	Temperature	0x09	03 | 01 | 00046
0x4220	Temperature	0x09	03 | 01 | 00044
0x4310	Temperature	0x09	03 | 03 | 00054, 03 | 03 | 00055
0x4320	Temperature	0x09	03 | 03 | 00052, 03 | 03 | 00053
0x4410	Temperature	0x09	03 | 02 | 00050
0x4420	Temperature	0x09	03 | 02 | 00048
0x508A	Device Hardware	0x21	08 | 14 | 00747, 09 | 05 | 00009, 10 | 01 | 00153, 10 | 01 | 00154, 10 | 01 | 00155, 10 | 01 | 00156, 10 | 01 | 00157, 10 | 01 | 00158, 10 | 01 | 00199, 10 | 01 | 00249, 10 | 01 | 00713, 10 | 01 | 00714, 13 | 00 | 00474, 13 | 00 | 00475, 13 | 00 | 00476
0x5110	Voltage	0x05	02 | 01 | 00024, 02 | 01 | 00025, 02 | 01 | 00026, 02 | 01 | 00027
0x5120	Voltage	0x05	02 | 02 | 00030, 02 | 02 | 00031, 02 | 02 | 00032
0x608B	Device Software	0x21	11 | 00 | 00689, 11 | 01 | 00159, 11 | 01 | 00160, 11 | 01 | 00161, 11 | 01 | 00162, 11 | 01 | 00163, 11 | 01 | 00244, 11 | 02 | 00164, 11 | 02 | 00165, 11 | 02 | 00166, 11 | 02 | 00167, 11 | 02 | 00168, 11 | 02 | 00169, 11 | 02 | 00170, 11 | 02 | 00171, 11 | 02 | 00172, 11 | 03 | 00173, 11 | 03 | 00174, 11 | 03 | 00175, 11 | 03 | 00176, 11 | 03 | 00177, 11 | 03 | 00178, 11 | 03 | 00179, 11 | 03 | 00180, 11 | 04 | 00181, 11 | 04 | 00182, 11 | 04 | 00183, 11 | 04 | 00184, 11 | 04 | 00185, 11 | 04 | 00186, 11 | 04 | 00187, 11 | 04 | 00188, 11 | 04 | 00189, 11 | 04 | 00190, 11 | 05 | 00191, 11 | 05 | 00192, 11 | 05 | 00193, 11 | 05 | 00194, 11 | 05 | 00195, 11 | 05 | 00196, 11 | 05 | 00197, 11 | 05 | 00198, 11 | 05 | 00200, 11 | 05 | 00201, 11 | 05 | 00202, 11 | 06 | 00203, 11 | 06 | 00285, 11 | 06 | 00300, 11 | 07 | 00204, 11 | 07 | 00205, 11 | 07 | 00271, 11 | 08 | 00206, 11 | 08 | 00207
0x6310	Device Software - Data Set	0x81	06 | 05 | 00097, 06 | 05 | 00102, 06 | 05 | 00103, 06 | 05 | 00104, 06 | 05 | 00105, 06 | 05 | 00106, 06 | 05 | 00107, 06 | 05 | 00624, 06 | 05 | 00625
0x6320	Device Software - Data Set	0x81	06 | 05 | 00098, 06 | 05 | 00099, 06 | 05 | 00290, 06 | 05 | 00291, 06 | 05 | 00626, 06 | 05 | 00627
0x6386	Device Software - Data Set	0x81	06 | 00 | 00070, 06 | 00 | 00081, 06 | 00 | 00082, 06 | 00 | 00083, 06 | 00 | 00084, 06 | 00 | 00085, 06 | 00 | 00248, 06 | 00 | 00252, 06 | 00 | 00313, 06 | 00 | 00545, 06 | 02 | 00086, 06 | 02 | 00087, 06 | 02 | 00088, 06 | 02 | 00089, 06 | 02 | 00090, 06 | 02 | 00091, 06 | 02 | 00273, 06 | 02 | 00274, 06 | 02 | 00275, 06 | 02 | 00559, 06 | 05 | 00100, 06 | 05 | 00101, 06 | 05 | 00108, 06 | 05 | 00620, 06 | 05 | 00621, 06 | 05 | 00810, 06 | 05 | 00816, 13 | 01 | 00779
0x7110	Current	0x03	01 | 03 | 00702, 01 | 03 | 00773, 01 | 03 | 00774
0x7120	Additional Modules	0x21	18 | 00 | 00093
0x7122	Monitoring	0x81	07 | 04 | 00136, 07 | 04 | 00137, 18 | 00 | 00092, 18 | 00 | 00094

Error code E0 E1	Name	Error register Bit	Festo Automation Suite ID Dx.
0x7300	Additional Modules	0x21	18 | 00 | 00095, 18 | 00 | 00096, 18 | 00 | 00227, 18 | 00 | 00318, 18 | 00 | 00686, 18 | 00 | 00688, 18 | 00 | 00693, 18 | 01 | 00228, 18 | 01 | 00229, 18 | 01 | 00771, 18 | 02 | 00230, 18 | 02 | 00231, 18 | 02 | 00232, 18 | 02 | 00233, 18 | 02 | 00234, 18 | 02 | 00276, 18 | 03 | 00235, 18 | 03 | 00301, 18 | 03 | 00434, 18 | 04 | 00236, 18 | 04 | 00237, 18 | 04 | 00238, 18 | 04 | 00253, 18 | 05 | 00239, 18 | 05 | 00633, 18 | 05 | 00812, 18 | 05 | 00813, 18 | 05 | 00839, 18 | 06 | 00240, 18 | 06 | 00241, 18 | 06 | 00242, 18 | 06 | 00277, 18 | 07 | 00365, 18 | 07 | 00366, 18 | 07 | 00367, 18 | 07 | 00369, 18 | 07 | 00370, 18 | 07 | 00371, 18 | 07 | 00372
0x7500	Monitoring - Communication	0x11	08 | 00 | 00139, 08 | 00 | 00140, 08 | 00 | 00243, 08 | 06 | 00637, 08 | 14 | 00544
0x8087	Monitoring	0x81	06 | 00 | 00826, 07 | 01 | 00109, 07 | 01 | 00110, 07 | 01 | 00111, 07 | 01 | 00112, 07 | 01 | 00113, 07 | 01 | 00114, 07 | 01 | 00115, 07 | 01 | 00116, 07 | 01 | 00117, 07 | 01 | 00118, 07 | 01 | 00119, 07 | 01 | 00120, 07 | 02 | 00124, 07 | 02 | 00125, 07 | 02 | 00129, 07 | 02 | 00130, 07 | 02 | 00131, 07 | 02 | 00132, 07 | 03 | 00134, 07 | 03 | 00135, 07 | 05 | 00138, 07 | 11 | 00765, 09 | 03 | 00818, 09 | 03 | 00819, 09 | 03 | 00820, 09 | 03 | 00821, 10 | 00 | 00827
0x8088	Power threshold exceeded	0x81	07 | 00 | 00255
0x8188	Monitoring - Communication	0x11	08 | 03 | 00373, 08 | 03 | 00617, 08 | 04 | 00143, 08 | 04 | 00246, 08 | 04 | 00247, 08 | 09 | 00144, 08 | 09 | 00145, 08 | 09 | 00288, 08 | 09 | 00289, 08 | 09 | 00294, 08 | 09 | 00299, 08 | 12 | 00250, 08 | 12 | 00272, 08 | 13 | 00001, 08 | 13 | 00394, 08 | 13 | 00395
0x8300	Monitoring	0x81	07 | 02 | 00123
0x8311	Monitoring	0x81	07 | 02 | 00128
0x8400	Monitoring	0x81	07 | 02 | 00122, 07 | 02 | 00127, 07 | 02 | 00634
0x8500	Monitoring	0x81	07 | 02 | 00121, 07 | 02 | 00133
0x8611	Monitoring	0x81	07 | 02 | 00126, 07 | 02 | 00658
0x8613	Additional Modules	0x21	18 | 07 | 00368
0x8900	Monitoring - Communication	0x11	08 | 03 | 00141, 08 | 03 | 00391, 08 | 04 | 00142, 08 | 04 | 00281, 08 | 09 | 00382
0x9090	External Error	0x21	16 | 01 | 00221, 16 | 01 | 00222, 16 | 01 | 00223
0xF085	Additional Function	0x81	05 | 01 | 00056, 05 | 01 | 00057, 05 | 01 | 00058, 05 | 01 | 00619, 05 | 02 | 00059, 05 | 02 | 00060, 05 | 02 | 00061, 05 | 02 | 00062, 05 | 02 | 00063, 05 | 02 | 00064, 05 | 02 | 00065, 05 | 02 | 00066, 05 | 02 | 00067, 05 | 02 | 00068, 05 | 02 | 00069, 05 | 02 | 00071, 05 | 02 | 00072, 05 | 02 | 00073, 05 | 02 | 00074, 05 | 02 | 00075, 05 | 02 | 00076, 05 | 02 | 00077, 05 | 02 | 00078, 05 | 02 | 00079, 05 | 02 | 00080, 05 | 02 | 00245, 05 | 02 | 00278, 05 | 02 | 00279, 05 | 02 | 00280, 05 | 02 | 00282, 05 | 02 | 00283, 05 | 02 | 00284, 05 | 02 | 00364, 05 | 02 | 00396, 05 | 02 | 00397, 05 | 02 | 00431, 05 | 02 | 00432, 05 | 03 | 00639

Error code E0 E1	Name	Error register Bit	Festo Automation Suite ID Dx.
0xF089	Additional Function	0x21	09 | 00 | 00002, 09 | 00 | 00003, 09 | 00 | 00146, 09 | 00 | 00147, 09 | 00 | 00469, 09 | 00 | 00470, 09 | 00 | 00531, 09 | 00 | 00532, 09 | 00 | 00536, 09 | 00 | 00537, 09 | 00 | 00538, 09 | 00 | 00539, 09 | 00 | 00540, 09 | 00 | 00541, 09 | 00 | 00546, 09 | 00 | 00550, 09 | 00 | 00551, 09 | 00 | 00552, 09 | 00 | 00553, 09 | 00 | 00554, 09 | 00 | 00555, 09 | 00 | 00556, 09 | 00 | 00557, 09 | 00 | 00558, 09 | 00 | 00592, 09 | 00 | 00593, 09 | 00 | 00600, 09 | 00 | 00601, 09 | 00 | 00606, 09 | 00 | 00607, 09 | 00 | 00608, 09 | 00 | 00609, 09 | 00 | 00610, 09 | 00 | 00611, 09 | 00 | 00612, 09 | 00 | 00613, 09 | 00 | 00614, 09 | 00 | 00615, 09 | 00 | 00622, 09 | 00 | 00623, 09 | 00 | 00630, 09 | 00 | 00635, 09 | 00 | 00636, 09 | 00 | 00640, 09 | 00 | 00641, 09 | 00 | 00642, 09 | 00 | 00643, 09 | 00 | 00644, 09 | 00 | 00645, 09 | 00 | 00646, 09 | 00 | 00647, 09 | 00 | 00648, 09 | 00 | 00649, 09 | 00 | 00650, 09 | 00 | 00651, 09 | 00 | 00677, 09 | 00 | 00678, 09 | 00 | 00679, 09 | 00 | 00680, 09 | 00 | 00681, 09 | 00 | 00682, 09 | 00 | 00683, 09 | 00 | 00684, 09 | 00 | 00687, 09 | 00 | 00806, 09 | 00 | 00807, 09 | 00 | 00808, 09 | 00 | 00809, 09 | 00 | 00811, 09 | 01 | 00148, 09 | 01 | 00149, 09 | 01 | 00150, 09 | 01 | 00659, 09 | 01 | 00660, 09 | 01 | 00661, 09 | 01 | 00662, 09 | 01 | 00663, 09 | 01 | 00664, 09 | 01 | 00665, 09 | 01 | 00666, 09 | 01 | 00667, 09 | 01 | 00668, 09 | 01 | 00669, 09 | 01 | 00670, 09 | 02 | 00151, 09 | 02 | 00152, 09 | 02 | 00766, 09 | 02 | 00767, 09 | 03 | 00442, 09 | 03 | 00443, 09 | 03 | 00444, 09 | 03 | 00445, 09 | 03 | 00602, 09 | 03 | 00603, 09 | 03 | 00698, 09 | 03 | 00699, 09 | 03 | 00700, 09 | 03 | 00701, 09 | 04 | 00446, 09 | 04 | 00447, 09 | 04 | 00448, 09 | 04 | 00449, 09 | 04 | 00527, 09 | 04 | 00528, 09 | 04 | 00542, 09 | 04 | 00543, 09 | 05 | 00453, 09 | 05 | 00454, 09 | 05 | 00455, 09 | 05 | 00456, 09 | 05 | 00473, 09 | 05 | 00512, 09 | 05 | 00513, 09 | 05 | 00514, 09 | 05 | 00515, 09 | 05 | 00516, 09 | 05 | 00517, 09 | 05 | 00518, 09 | 05 | 00519, 09 | 05 | 00520, 09 | 05 | 00521, 09 | 05 | 00522, 09 | 05 | 00523, 09 | 05 | 00525, 09 | 05 | 00526, 09 | 06 | 00457, 09 | 06 | 00458, 09 | 06 | 00459, 09 | 06 | 00460, 09 | 06 | 00461, 09 | 06 | 00462, 09 | 06 | 00463, 09 | 06 | 00464, 09 | 06 | 00594, 09 | 06 | 00595, 09 | 06 | 00596, 09 | 06 | 00597, 09 | 06 | 00598, 09 | 06 | 00599, 09 | 08 | 00768, 09 | 08 | 00769, 09 | 09 | 00671, 09 | 09 | 00672, 09 | 09 | 00673, 09 | 09 | 00674, 09 | 09 | 00675, 09 | 09 | 00676, 09 | 10 | 00727, 09 | 10 | 00728, 09 | 10 | 00729, 09 | 10 | 00730, 09 | 11 | 00731, 09 | 11 | 00732, 09 | 11 | 00733, 09 | 11 | 00734, 09 | 11 | 00735, 09 | 11 | 00736, 09 | 11 | 00814, 09 | 11 | 00815, 09 | 12 | 00737, 09 | 12 | 00738, 09 | 12 | 00739, 09 | 12 | 00740, 09 | 12 | 00741, 09 | 12 | 00742, 09 | 12 | 00743, 09 | 12 | 00744, 09 | 12 | 00745, 09 | 12 | 00746
0xF08C	Additional Function	0x81	12 | 01 | 00208, 12 | 01 | 00209, 12 | 01 | 00210, 12 | 01 | 00211, 12 | 01 | 00212, 12 | 01 | 00213, 12 | 01 | 00440
0xF091	Additional Functions	0x21	17 | 01 | 00224, 17 | 01 | 00225, 17 | 01 | 00226, 17 | 01 | 00439, 17 | 01 | 00628, 17 | 01 | 00629, 17 | 01 | 00817
0xFF8D	Device specific	0x81	13 | 01 | 00214, 13 | 01 | 00215, 13 | 01 | 00216, 13 | 02 | 00217, 13 | 02 | 00218, 13 | 02 | 00219, 13 | 02 | 00220

Tab. 766: Emergency error messages

11.9.4 Ethernet over EtherCAT communication (EoE)

The device supports Ethernet communication within mailbox communication via the EtherCAT interfaces. The Ethernet data are transmitted via the Ethernet over EtherCAT protocol (EoE). The real-time properties of the EtherCAT network are not affected by this. If the controller (master) has a separate Ethernet port, this port can be used to connect a PC with the Festo Automation Suite. The data of the Festo Automation Suite are incorporated in the Ethernet frame and are tunnelled

between controller and device for transmission via EtherCAT communication. The IP address of the device must be configured in the controller to enable the Ethernet data to be routed to the device.

Communication via the Ethernet over EtherCAT EoE protocol runs parallel to the acyclic SDO communication and cyclical process data communication in EtherCAT.

The graph illustrates Ethernet communication between a PC and the device via the "Ethernet over EtherCAT EoE" protocol.

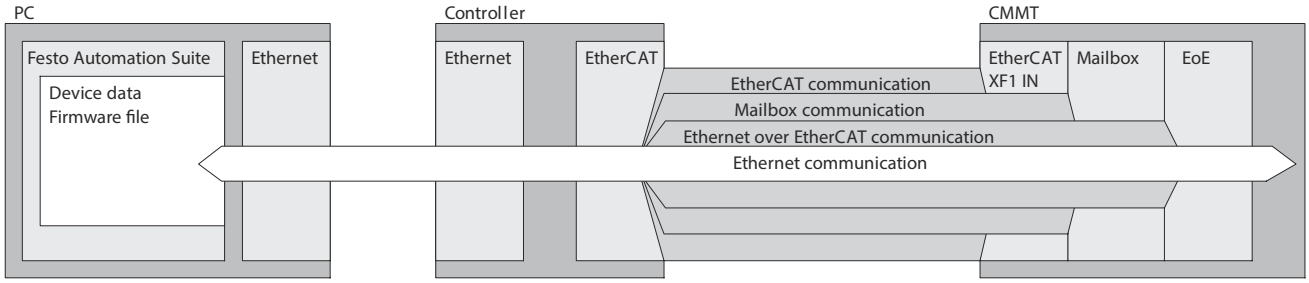


Fig. 125: Communication via the "Ethernet over EtherCAT EoE" protocol

11.9.5 File Access over EtherCAT (FoE)

FoE is a protocol based on TFTP that allows the transfer of any files.
FoE specifications are contained in the following ETG documents:
– ETG.1000.5: EtherCAT Application Layer Services Definition
– ETG.1000.6: EtherCAT Application Layer Protocol Specification
The file transfer via FoE works in all states of the EtherCAT finite state machine, except in the Init state. The actual firmware update or the loading of the parameter set with a previously transferred firmware or a parameter set is carried out with the state transition from Bootstrap to Init.
The download via FoE allows any file format. Only the subsequent check will determine whether the file is valid for the device.
The device supports the download of firmware files and parameter sets. This check is not based on the file name or file extension because the file name is not always fully used for transfer by the software tools on the control side. Therefore, the header of the file in the device is checked for file compatibility.
The download of a file via FoE starts with the following information:
– File name (without directory, depending on the controller also without file extension); the string length is limited by the FoE mailbox size.
– Password (UINT32) (0: password not used; 1 ... 0xFFFFFFFF: password); the password is ignored because the password is not sufficient for current and future security requirements.

Time of file evaluation

The file header is checked with the first received telegram to avoid having to store invalid files in the file system. Invalid files are acknowledged with an error.

Upload

S = {"param1", "param2", "param3", "param4", "firmware"}
Default case: if a file name is used that does not contain a substring of S, an upload of the currently selected parameter slot (parameter slot 0) is called.
Using a filename containing a substring of S will result in the upload of the corresponding file.

Download

P = {"param1", "param2", "param3", "param4"}

Firmware package

Any naming.

The actual firmware update is executed with the change of state from Bootstrap to Init the EtherCAT finite state machine.

Parameter package

Default case: using a file name that does not contain a substring of P (see "Download") results in a download to the currently selected parameter location (parameter location 0).
Using a filename that contains a substring of P will trigger a download to the corresponding file.
The parameter package is loaded with the change of state from Bootstrap to Init of the EtherCAT finite state machine.

11.10 Objects reference list

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
CiA301: communication profile					
0x1000.00	Device type CiA402	UDINT	rw	–	P0.7601.0.0
0x1001.00	Error register CiA402	USINT	rw	–	P0.7602.0.0
0x1008.00	Device name CiA402	STRING(32)	rw	–	P0.7603.0.0 ... 31
0x1009.00	Hardware version CiA402	STRING(6)	rw	–	P0.7604.0.0 ... 5
0x100A.00	Software version CiA402	STRING(32)	rw	–	P0.7605.0.0 ... 31
0x1018.01	Vendor ID	UDINT	rw	–	P0.7607.0.0
0x1018.02	Product code	UDINT	rw	–	P0.7608.0.0
0x1018.03	Revision number	UDINT	rw	–	P0.7609.0.0
0x1018.04	Serial number	UDINT	ro	–	P0.246.0.0
0x1C32.01	Synchronisation mode	UINT	rw	–	P0.1050.0.0
0x1C32.02	Synchronisation process repetition time	UDINT	rw	–	P0.1051.0.0
0x1C32.04	Sync mode supported	UINT	ro	–	P0.1053.0.0
0x1C32.05	Sync Minimum Cycle Time	UDINT	ro	–	P0.1054.0.0
0x1C32.06	Sync Calc And Copy Time	UDINT	ro	–	P0.1055.0.0
0x1C32.09	Sync Delay Time	UDINT	ro	–	P0.1057.0.0
0x1C32.0B	Sync SM Event Missed	UINT	ro	–	P0.1059.0.0
0x1C32.0C	Sync cycle time too small	UINT	ro	–	P0.1060.0.0
0x1C32.0D	Error counter Sync 0	UINT	ro	–	P0.1064.0.0
0x1C32.20	Sync Error	BOOL	ro	–	P0.1061.0.0
0x1C33.01	Synchronisation mode	UINT	rw	–	P0.1050.0.0
0x1C33.02	Synchronisation process repetition time	UDINT	rw	–	P0.1051.0.0
0x1C33.04	Sync mode supported	UINT	ro	–	P0.1053.0.0
0x1C33.05	Sync Minimum Cycle Time	UDINT	ro	–	P0.1054.0.0
0x1C33.06	Calc and copy time	UDINT	ro	–	P0.1062.0.0
0x1C33.0B	Sync SM Event Missed	UINT	ro	–	P0.1059.0.0
0x1C33.0C	Sync cycle time too small	UINT	ro	–	P0.1060.0.0
0x1C33.0D	Error counter Sync 0	UINT	ro	–	P0.1064.0.0
0x1C33.20	Sync Error	BOOL	ro	–	P0.1061.0.0
0x1600.00	Receive PDO number of objects EtherCAT	USINT	rw	–	P0.760.0.0
0x1600.01 ... 10	Receive PDO Mapped Objects EtherCAT	UDINT	rw	–	P0.761.0.0 ... 15
0x1A00.00	Transmit PDO number of objects EtherCAT	USINT	rw	–	P0.880.0.0
0x1A00.01 ... 10	Transmit PDO mapped objects EtherCAT	UDINT	rw	–	P0.881.0.0 ... 15

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x1AF0.00	Transmit PDO number of objects EtherCAT	USINT	rw	–	P0.880.1.0
0x1AF0.01 ... 02	Transmit PDO mapped objects EtherCAT	UDINT	rw	–	P0.881.1.0 ... 15
0x1AF1.00	Transmit PDO number of objects EtherCAT	USINT	rw	–	P0.880.2.0
0x1AF1.01	Transmit PDO mapped objects EtherCAT	UDINT	rw	–	P0.881.2.0 ... 15
0x1C00.00 ... 04	Sync manager communication type EtherCAT	USINT	rw	–	P0.750.0.0 ... 4
0x1C12.00	Sync manager x number of assigned PDOs EtherCAT	USINT	rw	–	P0.770.0.0
0x1C12.01	PDO mapping object index of assigned PDO EtherCAT	UINT	rw	–	P0.771.0.0 ... 2
0x1C13.00	Sync manager x number of assigned PDOs EtherCAT	USINT	rw	–	P0.770.1.0
0x1C13.01 ... 03	PDO mapping object index of assigned PDO EtherCAT	UINT	rw	–	P0.771.1.0 ... 2
0x10F1.01	Local error reaction	UDINT	rw	–	P0.43543.0.0
0x10F1.02	Sync error counter limit	UINT	rw	–	P0.43544.0.0
0x10F3.01	Maximum messages	USINT	rw	–	P0.43545.0.0
0x10F3.02	Newest message	USINT	rw	–	P0.43546.0.0
0x10F3.03	Newest ack message	USINT	rw	–	P0.43547.0.0
0x10F3.04	New message available	BOOL	rw	Tx	P0.43548.0.0
0x10F3.05	Flags	UINT	rw	–	P0.43549.0.0
0x10F8.00	Timestamp object	ULINT	rw	Tx	P0.43550.0.0
CiA402: the factor group is effective.					
0x603F.00	Severest Diagnosis ID	UINT	ro	Tx	P0.102935.0.0
0x6040.00	Control word CiA402	UINT	rw	Rx	P1.730.0.0
0x6041.00	Status word CiA402	UINT	ro	Tx	P1.731.0.0
0x6060.00	Modes of operation CiA402	SINT	rw	Rx	P1.12234.0.0
0x6061.00	Modes of operation display CiA402	SINT	ro	Tx	P1.12235.0.0
0x6064.00	Actual value modulo	DINT	ro	Tx	P1.113104.0.0
0x606C.00	Actual velocity value encoder channel 1	DINT	ro	Tx	P1.1210.0.0
0x6071.00	Target torque CiA402	INT	rw	Rx	P1.526795.0.0
0x6072.00	Maximum torque symmetrical	UINT	rw	Rx	P1.526796.0.0
0x6073.00	Limit value total current (closed loop controller)	UINT	rw	Rx	P1.856.0.0
0x6074.00	Setpoint generator output torque	INT	ro	Tx	P1.3014.0.0
0x6075.00	Actual nominal current	UDINT	rw	–	P1.7118.0.0
0x6076.00	Resulting nominal torque	UDINT	ro	–	P1.7139.0.0
0x6077.00	Actual torque value gear shaft	INT	ro	Tx	P1.151.0.0
0x6078.00	Actual active current value	INT	ro	Tx	P1.814.0.0
0x6079.00	Actual value DC link voltage	UDINT	ro	Tx	P0.480.0.0
0x607A.00	Target position CiA402	DINT	rw	Rx	P1.8130.0.0
0x60C1.01	Target position CiA402	DINT	rw	Rx	P1.8130.0.0
0x607C.00	Axis zero point offset	DINT	rw	Rx	P1.8416.0.0
0x6081.00	Profile velocity CiA402	UDINT	rw	Rx	P1.8131.0.0
0x6082.00	End velocity CiA402	UDINT	rw	Rx	P1.8132.0.0
0x6083.00	Profile acceleration CiA402	UDINT	rw	Rx	P1.8133.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x6084.00	Profile deceleration CiA402	UDINT	rw	Rx	P1.8134.0.0
0x6085.00	Quick stop deceleration CiA402	UDINT	rw	Rx	P1.8135.0.0
0x6087.00	Torque slope CiA402	UDINT	rw	Rx	P1.526799.0.0
0x6098.00	Referencing method	SINT	rw	Rx	P1.8417.0.0
0x6099.01	Search for reference mark setpoint velocity	UDINT	rw	Rx	P1.843.0.0
0x6099.02	Setpoint reference mark creeping velocity	UDINT	rw	Rx	P1.846.0.0
0x609A.00	Search for reference mark setpoint acceleration	UDINT	rw	Rx	P1.844.0.0
0x60A4.01	Profile jerk CiA402	UDINT	rw	Rx	P1.8136.0.0
0x60A8.00	SI unit position CiA402	UDINT	rw	–	P1.7860.0.0
0x60A9.00	SI unit and velocity CiA402	UDINT	rw	–	P1.7861.0.0
0x60AA.00	SI unit acceleration CiA402	UDINT	rw	–	P1.7862.0.0
0x60AB.00	SI unit and jerk CiA402	UDINT	rw	–	P1.7863.0.0
0x60B1.00	Velocity offset CiA402	DINT	rw	Rx	P1.8138.0.0
0x60B2.00	Torque offset CiA402	INT	rw	Rx	P1.8111.0.0
0x60E0.00	Upper limit value torque (closed loop controller)	UINT	rw	Rx	P1.853.0.0
0x60E1.00	Lower limit value torque (closed loop controller)	UINT	rw	Rx	P1.852.0.0
0x60F2.00	Positioning option code CiA402	UINT	rw	Rx	P1.88817.0.0
0x60FD.00	Digital inputs CiA402	UDINT	ro	Tx	P1.1128052.0.0
0x60FE.01	Digital outputs CiA402	UDINT	rw	Rx	P1.1128054.0.0
0x60FE.02	Bit mask digital outputs CiA402	UDINT	rw	Rx	P1.1128055.0.0
0x60FF.00	Target velocity CiA402	DINT	rw	Rx	P1.8137.0.0
0x6402.00	Motor type CiA402	UINT	rw	–	P1.1128057.0.0
0x6403.00	Actual order code motor	STRING(32)	ro	–	P1.7188.0.0 ... 31
0x6502.00	Supported drive modes CiA402	UDINT	ro	Tx	P1.734.0.0
0x6503.00	Device name	STRING(128)	rw	–	P0.902.0.0 ... 127
0x6505.00	URL address	STRING(20)	rw	–	P0.11280052.0.0 ... 19
0x6062.00	Setpoint position	DINT	ro	Tx	P1.90.0.0
0x6065.00	Monitoring window position: following error	UDINT	rw	Rx	P1.463.0.0
0x6066.00	Damping time position: following error	UINT	rw	Rx	P1.462.0.0
0x6067.00	Monitoring window target position	UDINT	rw	Rx	P1.469.0.0
0x6068.00	Damping time target reached	UINT	rw	Rx	P1.468.0.0
0x60F4.00	Actual position: following error	DINT	ro	Tx	P1.4682.0.0
0x607B.01	Lower limit value modulo	DINT	rw	Rx	P1.113102.0.0
0x607B.02	Upper limit value modulo	DINT	rw	Rx	P1.113113.0.0
0x607D.01	Negative software limit position	DINT	rw	Rx	P1.4629.0.0
0x607D.02	Positive software limit position	DINT	rw	Rx	P1.4630.0.0
0x607E.00	Reversing direction of motion	USINT	rw	Rx	P1.1170.0.0
0x606B.00	Setpoint velocity	DINT	ro	Tx	P1.91.0.0
0x606D.00	Monitoring window target velocity	UINT	rw	Rx	P1.4610.0.0
0x606E.00	Damping time target reached	UINT	rw	Rx	P1.468.0.0
0x606F.00	Monitoring window velocity standstill monitoring	UINT	rw	Rx	P1.466.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x6070.00	Standstill damping time	UINT	rw	Rx	P1.465.0.0
0x60F8.00	Monitoring window velocity: following error	DINT	rw	Rx	P1.464.0.0
0x607F.00	Limit value velocity limit positive and negative direction of movement	UDINT	rw	Rx	P1.1304.0.0
0x6080.00	Maximum rpm (user defined)	UDINT	rw	Rx	P1.7123.0.0
0x60C5.00	Upper limit value acceleration limitation	UDINT	rw	Rx	P1.1305.0.0
0x60C6.00	Upper limit value deceleration limitation	UDINT	rw	Rx	P1.1306.0.0
0x60E3.01 ... 11	Supported homing methods CiA402	SINT	ro	–	P1.8119.0.0 ... 16
0x60E4.01	Actual position value encoder channel 1	DINT	ro	Tx	P1.128.0.0
0x60E5.01	Actual velocity value encoder channel 1	DINT	ro	Tx	P1.1210.0.0
0x60E8.01	Total conversion factor gear unit numerator	UDINT	rw	Rx	P1.1242.0.0
0x60ED.01	Total conversion factor gear unit denominator	UDINT	rw	Rx	P1.1243.0.0
0x60E9.01	Feed constant numerator	UDINT	rw	Rx	P1.1194.0.0
0x60EE.01	Feed constant denominator	UDINT	rw	Rx	P1.1195.0.0
0x67FE.00	CiA402 version	UDINT	ro	–	P1.1128056.0.0
0x60B8.00	Touch probe function CiA402	UINT	rw	Rx	P1.1128060.0.0
0x60B9.00	Touch probe status CiA402	UINT	ro	Tx	P1.1128061.0.0
0x60D1.00	Time stamp touch probe position positive CiA402	UDINT	ro	Tx	P1.113027.0.0
0x60D2.00	Time stamp touch probe position negative CiA402	UDINT	ro	Tx	P1.113028.0.0
0x60D5.00	Counter initiated trigger events positive edge CiA402	UINT	ro	Tx	P1.113031.0.0
0x60D6.00	Counter initiated trigger events negative edge CiA402	UINT	ro	Tx	P1.113032.0.0
0x60BA.00	Touch probe position positive CiA402	DINT	ro	Tx	P1.113029.0.0
0x60BB.00	Touch probe position negative CiA402	DINT	ro	Tx	P1.113030.0.0
0x60D3.00	Time stamp touch probe position positive CiA402	UDINT	ro	Tx	P1.113027.1.0
0x60D4.00	Time stamp touch probe position negative CiA402	UDINT	ro	Tx	P1.113028.1.0
0x60D7.00	Counter initiated trigger events positive edge CiA402	UINT	ro	Tx	P1.113031.1.0
0x60D8.00	Counter initiated trigger events negative edge CiA402	UINT	ro	Tx	P1.113032.1.0
0x60BC.00	Touch probe position positive CiA402	DINT	ro	Tx	P1.113029.1.0
0x60BD.00	Touch probe position negative CiA402	DINT	ro	Tx	P1.113030.1.0
Manufacturer-specific objects: the user or basic unit defined for the parameter is effective.					
0x2100.01	Activate keep-alive-signal	USINT	rw	Rx	P0.12008.0.0
0x2100.02	Keep-alive-signal wait time	UDINT	rw	Rx	P0.12009.0.0
0x2100.03	Keep-alive-signal repeat time	UDINT	rw	Rx	P0.12010.0.0
0x2100.04	Maximum number of repetitions	UDINT	rw	Rx	P0.12011.0.0
0x2103.01	Order number	UDINT	ro	Tx	P0.70.0.0
0x2103.02	Order code	STRING(50)	ro	Tx	P0.71.0.0 ... 49
0x2103.03	Major version servo drive	STRING(2)	ro	Tx	P0.73.0.0 ... 1
0x2103.04	Serial number	STRING(5)	ro	Tx	P0.79.0.0 ... 4
0x2103.05	Control unit data set ID	UDINT	ro	Tx	P0.269.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2103.06	Minor version servo drive	UINT	ro	Tx	P0.739.0.0
0x2103.07	Compatibility index servo drive	UINT	ro	Tx	P0.748.0.0
0x2103.08	Test number	STRING(9)	ro	Tx	P0.790.0.0 ... 8
0x2103.09	Product key	STRING(15)	ro	Tx	P0.791.0.0 ... 14
0x2103.0A	Major version device data set	STRING(2)	ro	Tx	P0.2213.0.0 ... 1
0x2103.0B	Minor version device data set	UINT	ro	Tx	P0.2214.0.0
0x2103.19	Compatibility index firmware	STRING(100)	ro	Tx	P0.5773.0.0 ... 99
0x2103.1E	URL address	STRING(20)	rw	Rx	P0.11280052.0.0 ... 19
0x2103.1F	Revision	STRING(10)	ro	Tx	P0.72.0.0 ... 9
0x2103.20	Order code product	STRING(50)	ro	Tx	P0.701.0.0 ... 49
0x2103.21	Expected ITAC number Power unit	STRING(15)	ro	Tx	P0.16000.0.0 ... 14
0x2103.22	Expected ITAC number safety unit	STRING(15)	ro	Tx	P0.16001.0.0 ... 14
0x2103.23	Database ID Braking resistor	UDINT	rw	Rx	P0.101529.0.0
0x2103.24	Order code Braking resistor	STRING(37)	rw	Rx	P0.101530.0.0 ... 36
0x2105.1C	Scaled value analog input sine track 1	REAL	ro	Tx	P0.1190.0.0
0x2105.23	Scaled value analog input cosine track 1	REAL	ro	Tx	P0.111200.0.0
0x2106.01	Product key	STRING(15)	ro	Tx	P0.710.0.0 ... 14
0x2106.03	Order code	STRING(32)	ro	Tx	P0.711.0.0 ... 31
0x2106.05	Material number	UDINT	ro	Tx	P0.712.0.0
0x2106.07	Serial number	STRING(20)	ro	Tx	P0.713.0.0 ... 19
0x2106.09	Pole pairs	UDINT	ro	Tx	P0.717.0.0
0x2106.0B	Motor inertia	REAL	ro	Tx	P0.7110.0.0
0x2106.0D	Phase sequence	USINT	ro	Tx	P0.7113.0.0
0x2106.0F	Nominal current	REAL	ro	Tx	P0.7116.0.0
0x2106.11	Maximum current	REAL	ro	Tx	P0.7119.0.0
0x2106.13	Maximum rpm	REAL	ro	Tx	P0.7122.0.0
0x2106.15	Nominal rotary velocity	REAL	ro	Tx	P0.7125.0.0
0x2106.17	Winding inductance	REAL	ro	Tx	P0.7128.0.0
0x2106.19	Winding resistance	REAL	ro	Tx	P0.7131.0.0
0x2106.1B	Torque constant	REAL	ro	Tx	P0.7134.0.0
0x2106.1D	Time constant I^2t	REAL	ro	Tx	P0.7143.0.0
0x2106.1F	Winding temperature	REAL	ro	Tx	P0.7146.0.0
0x2106.21	Nominal motor voltage	REAL	ro	Tx	P0.7149.0.0
0x2106.23	Major version hardware	STRING(2)	ro	Tx	P0.7150.0.0 ... 1
0x2106.25	Minor version hardware	UINT	ro	Tx	P0.7151.0.0
0x2106.27	Temperature sensor	UDINT	ro	Tx	P0.7152.0.0
0x2106.29	Holding brake	USINT	ro	Tx	P0.7158.0.0
0x2106.2B	Switch-on delay holding brake 1	REAL	ro	Tx	P0.7161.0.0
0x2106.2D	Switch-off delay holding brake 1	REAL	ro	Tx	P0.7164.0.0
0x2106.2F	Continuous current	REAL	ro	Tx	P0.7181.0.0
0x2106.31	Encoder data set ID	UDINT	ro	Tx	P0.7183.0.0
0x2106.33	Major version motor data set	STRING(2)	ro	Tx	P0.7186.0.0 ... 1
0x2106.35	Minor version motor data set	UINT	ro	Tx	P0.7187.0.0
0x2106.37	Lq inductance	REAL	ro	Tx	P0.7428.0.0
0x2106.39	Ld inductance	REAL	ro	Tx	P0.7429.0.0
0x2106.3B	Motor type	USINT	ro	Tx	P0.7430.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2106.3D	Denominator pole pairs	UDINT	ro	Tx	P0.7171.0.0
0x2106.43	Fieldweakening: Max. rotary speed	REAL	ro	Tx	P0.7137.0.0
0x2106.45	Pitch length	REAL	ro	Tx	P0.7443.0.0
0x2106.47	Nominal velocity linear	REAL	ro	Tx	P0.7444.0.0
0x2106.49	Maximum velocity linear	REAL	ro	Tx	P0.7445.0.0
0x2106.4B	Maximum velocity fieldweakening linear	REAL	ro	Tx	P0.7446.0.0
0x2106.4D	Force constant linear	REAL	ro	Tx	P0.7447.0.0
0x2106.4F	Slide weight linear	REAL	ro	Tx	P0.7448.0.0
0x2107.01	Status LED	UINT	ro	Tx	P0.160.0.0
0x2107.02	Power LED	UINT	ro	Tx	P0.161.0.0
0x2107.03	Safety LED	UINT	ro	Tx	P0.162.0.0
0x2107.04	Application LED	UINT	ro	Tx	P0.163.0.0
0x2108.01	Debug variable index 0	REAL	rw	Rx	P0.190.0.0
0x2108.02	Debug variable index 1	REAL	rw	Rx	P0.191.0.0
0x2108.03	Debug variable index 2	REAL	rw	Rx	P0.192.0.0
0x2108.04	Debug variable index 3	REAL	rw	Rx	P0.193.0.0
0x2108.05	Debug variable index 4	REAL	rw	Rx	P0.194.0.0
0x2108.06	Debug variable index 5	REAL	rw	Rx	P0.195.0.0
0x2108.07	Debug variable index 6	REAL	rw	Rx	P0.196.0.0
0x2108.08	Debug variable index 7	REAL	rw	Rx	P0.197.0.0
0x2108.09	Debug variable index 8	REAL	rw	Rx	P0.198.0.0
0x2108.0A	Debug variable index 9	REAL	rw	Rx	P0.199.0.0
0x210A.07	Serial number	UDINT	ro	Tx	P0.246.0.0
0x210A.08	Major version communication data set	STRING(2)	ro	Tx	P0.2204.0.0 ... 1
0x210A.09	Minor version communication data set	UINT	ro	Tx	P0.2205.0.0
0x210A.0C	Major Version RTE	UINT	ro	Tx	P0.100686.0.0
0x210A.0D	Minor Version RTE	UINT	ro	Tx	P0.100690.0.0
0x210A.0E	Build Version RTE	UINT	ro	Tx	P0.100691.0.0
0x210A.0F	Revision Version RTE	UINT	ro	Tx	P0.100692.0.0
0x210A.10	Version String RTE	STRING(63)	ro	Tx	P0.100693.0.0 ... 62
0x210B.01	Material number control unit	UDINT	ro	Tx	P0.250.0.0
0x210B.02	Order code control unit	STRING(50)	ro	Tx	P0.251.0.0 ... 49
0x210B.03	Major version control unit	STRING(2)	ro	Tx	P0.253.0.0 ... 1
0x210B.04	Compatibility index control unit	UINT	ro	Tx	P0.254.0.0
0x210B.0A	Serial number control unit	STRING(9)	ro	Tx	P0.266.0.0 ... 8
0x210B.0C	Major version control unit data set	STRING(2)	ro	Tx	P0.2208.0.0 ... 1
0x210B.0D	Minor version control unit data set	UINT	ro	Tx	P0.2209.0.0
0x210B.0E	Minor version control unit	UINT	ro	Tx	P0.2212.0.0
0x210D.01	Diagnostic device status	UINT	ro	Tx	P0.300.0.0
0x210D.02	Maximum number of components in the message buffer	UDINT	ro	Tx	P0.303.0.0
0x210D.03	Actual number of components in the message buffer	UDINT	ro	Tx	P0.304.0.0
0x210D.08	Severest Diagnosis ID	UDINT	ro	Tx	P0.102935.0.0
0x210F.01	Trace type	UDINT	ro	Tx	P0.340.0.0
0x210F.02	Trigger type	UDINT	rw	Rx	P0.341.0.0
0x210F.03	Actual trace status	UDINT	ro	Tx	P0.3400.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x210F.04	Actual trigger status	UDINT	ro	Tx	P0.3401.0.0
0x210F.05	Actual trace type code	UDINT	ro	Tx	P0.3402.0.0
0x2110.01	Actual time without synchronisation	LINT	ro	Tx	P0.7534.0.0
0x2110.02	Actual time with synchronisation	LINT	ro	Tx	P0.7535.0.0
0x2110.03	Synced trace: Synchronised	USINT	ro	Tx	P0.102898.0.0
0x2114.01	Actual value DC link voltage	REAL	ro	Tx	P0.480.0.0
0x2114.06	Diagnostic category: Undervoltage in DC link	UINT	rw	Rx	P0.487.0.0
0x2114.07	Storage option: Undervoltage in DC link	USINT	rw	Rx	P0.488.0.0
0x2114.08	Diagnostic category	UINT	rw	Rx	P0.489.0.0
0x2114.0A	Warning threshold DC link voltage	REAL	rw	Rx	P0.4811.0.0
0x2114.0B	Switch-on threshold brake chopper	REAL	rw	Rx	P0.4812.0.0
0x2114.0C	Upper limit value DC link voltage	REAL	rw	Rx	P0.4813.0.0
0x2114.0D	Lower limit value DC link voltage	REAL	rw	Rx	P0.4814.0.0
0x2114.10	Brake chopper threshold actual value	REAL	ro	Tx	P0.4817.0.0
0x2114.15	Storage option: DC link warning threshold reached	USINT	rw	Rx	P0.4890.0.0
0x2114.18	Actual warning threshold DC link voltage	REAL	ro	Tx	P0.56799.0.0
0x2114.19	Actual upper limit value DC link voltage	REAL	ro	Tx	P0.56800.0.0
0x2114.1A	Actual lower limit value DC link voltage	REAL	ro	Tx	P0.56801.0.0
0x2114.1B	Actual switch-on threshold brake chopper	REAL	ro	Tx	P0.56802.0.0
0x2114.20	Activate automatic detection Switching threshold brake chopper	USINT	rw	Rx	P0.48012.0.0
0x2114.21	Offset switching threshold brake chopper	REAL	rw	Rx	P0.48013.0.0
0x2115.02	Load voltage root mean square value	REAL	ro	Tx	P0.491.0.0
0x2115.04	Lower load voltage limit value	REAL	rw	Rx	P0.493.0.0
0x2115.05	Upper load voltage limit value	REAL	rw	Rx	P0.494.0.0
0x2115.0B	Diagnostic category: Overvoltage in load voltage	UINT	rw	Rx	P0.517.0.0
0x2115.0D	Diagnostic category: Undervoltage in load voltage	UINT	rw	Rx	P0.519.0.0
0x2115.16	Storage option: Undervoltage in load voltage	USINT	rw	Rx	P0.5180.0.0
0x2115.19	Actual lower limit value load voltage	REAL	ro	Tx	P0.28151.0.0
0x2115.1A	Actual upper limit value load voltage	REAL	ro	Tx	P0.28152.0.0
0x2116.01	Supply voltage 24 V logic	REAL	ro	Tx	P0.520.0.0
0x2117.01	Data trace status	UDINT	ro	Tx	P0.556.0.0
0x2117.02	Trace delay	DINT	rw	Rx	P0.557.0.0
0x2117.03	Recording length	UDINT	rw	Rx	P0.558.0.0
0x2117.04	Down sampling factor	UDINT	rw	Rx	P0.559.0.0
0x2117.05	Actual pre-trigger	DINT	ro	Tx	P0.5513.0.0
0x2117.06	Actual recording length	UDINT	ro	Tx	P0.5514.0.0
0x2117.07	Actual downsampling factor	UDINT	ro	Tx	P0.5515.0.0
0x2117.08	Maximum recording length	UDINT	ro	Tx	P0.5516.0.0
0x2117.09	Basic sampling interval	REAL	ro	Tx	P0.5517.0.0
0x2117.0A	Timestamp End trace	LINT	ro	Tx	P0.5518.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2117.0B	Synced trace: end timestamp	ULINT	ro	Tx	P0.102894.0.0
0x2117.0C	Synced trace: trigger event timestamp	ULINT	ro	Tx	P0.102895.0.0
0x2117.0D	Synced trace: Enable	USINT	rw	Rx	P0.102896.0.0
0x2117.0E	Synced trace: Enabled	USINT	ro	Tx	P0.102897.0.0
0x2119.01	Number of parameter sets	UDINT	ro	Tx	P0.571.0.0
0x2119.0B	Storage option: Parameter not writable	USINT	rw	Rx	P0.5709.0.0
0x2119.0D	Storage option: Transmission error in parameter set	USINT	rw	Rx	P0.5711.0.0
0x2119.0F	Storage option: Parameter set: store failed	USINT	rw	Rx	P0.5713.0.0
0x2119.11	Storage option: Parameter set: delete failed	USINT	rw	Rx	P0.5715.0.0
0x2119.15	Storage option: Store device failed	USINT	rw	Rx	P0.5719.0.0
0x2119.17	Storage option: Factory parameter set not found	USINT	rw	Rx	P0.5721.0.0
0x2119.19	Storage option: Factory parameter set invalid	USINT	rw	Rx	P0.5723.0.0
0x2119.1B	Storage option: Factory parameter set incompatible	USINT	rw	Rx	P0.5725.0.0
0x2119.1D	Storage option: Factory parameter not found	USINT	rw	Rx	P0.5727.0.0
0x2119.1E	Parameter set status	UDINT	ro	Tx	P0.5728.0.0
0x2119.1F	Start-up parameter set	DINT	rw	Rx	P0.5729.0.0
0x2119.20	Active parameter set	DINT	ro	Tx	P0.5730.0.0
0x2119.22	Storage option: Parameter set with older version	USINT	rw	Rx	P0.5781.0.0
0x2119.24	Storage option: Parameter set with newer version	USINT	rw	Rx	P0.5783.0.0
0x2119.25	Storage option: Maximum write cycles reached	USINT	rw	Rx	P0.203.0.0
0x2119.26	Diagnostic category: Maximum write cycles reached	UINT	rw	Rx	P0.205.0.0
0x2119.27	Enabled Memory access EEProm	USINT	rw	Rx	P0.100025.0.0
0x2119.28	Number of memory access EEProm	UDINT	ro	Tx	P0.100026.0.0
0x2119.29	Switching threshold Diagnostic message	UDINT	rw	Rx	P0.100027.0.0
0x2119.2A	Maximum write accesses	UDINT	ro	Tx	P0.666.0.0
0x2119.2C	Diagnostic category: Parameter set stored CRC1	UINT	ro	Tx	P0.100811.0.0
0x2119.2E	Diagnostic category: Safety parameter set saved by user	UINT	ro	Tx	P0.102756.0.0
0x2119.2F	Parameter set Hash	UDINT	ro	Tx	P0.102764.0.0
0x2119.31	Diagnostic category: Factory parameter set activated	UINT	ro	Tx	P0.102816.0.0
0x2119.33	Diagnostic category: Invalid device parameter	UINT	ro	Tx	P0.102883.0.0
0x211B.01	Axis ID data trigger	UINT	rw	Rx	P0.6000.0.0
0x211B.02	Data ID data trigger	UDINT	rw	Rx	P0.6001.0.0
0x211B.03	Data instance ID data trigger	UINT	rw	Rx	P0.6002.0.0
0x211B.04	Array ID data trigger	UINT	rw	Rx	P0.6003.0.0
0x211B.05	Trigger event	UDINT	rw	Rx	P0.6004.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x211B.06	Actual axis ID data trigger	UINT	ro	Tx	P0.6006.0.0
0x211B.07	Actual data ID data trigger	UDINT	ro	Tx	P0.6007.0.0
0x211B.08	Actual data instance ID data trigger	UINT	ro	Tx	P0.6008.0.0
0x211B.09	Actual array ID data trigger	UINT	ro	Tx	P0.6009.0.0
0x211B.0A	Actual data trigger type	UDINT	ro	Tx	P0.6010.0.0
0x211B.0B	Actual trigger threshold	LINT	ro	Tx	P0.6013.0.0
0x211B.0C	Trigger level	LINT	rw	Rx	P0.60012.0.0
0x211B.0D	Bit mask data trigger	ULINT	rw	Rx	P0.60013.0.0
0x211B.0E	Active trigger bitmask	ULINT	ro	Tx	P0.102902.0.0
0x211D.01	Scaling factor start value pulse energy monitoring braking resistor	REAL	ro	Tx	P0.650.0.0
0x211D.02	Limit value pulse energy monitoring braking resistor	REAL	ro	Tx	P0.651.0.0
0x211D.03	Scaling factor maximum value after switching on	REAL	ro	Tx	P0.652.0.0
0x211D.04	Actual value pulse energy monitoring braking resistor	REAL	ro	Tx	P0.653.0.0
0x211D.05	Actual value pulse energy monitoring braking resistor (standardised)	REAL	ro	Tx	P0.654.0.0
0x211D.06	Scaling factor warning limit pulse energy monitoring braking resistor	REAL	rw	Rx	P0.655.0.0
0x211D.07	Actual value power dissipation braking resistor	REAL	ro	Tx	P0.656.0.0
0x211D.09	Activate of external braking resistor	USINT	rw	Rx	P0.658.0.0
0x211D.0A	Status selected braking resistor	USINT	ro	Tx	P0.659.0.0
0x211D.0D	Resistance value external braking resistor	REAL	rw	Rx	P0.6510.0.0
0x211D.0E	Nominal value of the power dissipation external braking resistor	REAL	rw	Rx	P0.6511.0.0
0x211D.0F	Limit value pulse energy monitoring external braking resistor	REAL	rw	Rx	P0.6512.0.0
0x211D.10	Diagnostic category: Warning: pulse energy monitoring, braking resistor	UINT	rw	Rx	P0.6513.0.0
0x211D.11	Storage option: Warning: pulse energy monitoring, braking resistor	USINT	rw	Rx	P0.6514.0.0
0x211D.12	Diagnostic category: Error: pulse energy monitoring, braking resistor	UINT	rw	Rx	P0.6515.0.0
0x211D.13	Storage option: Error: pulse energy monitoring, braking resistor	USINT	rw	Rx	P0.6516.0.0
0x211D.14	Diagnostic category: Parameterisation braking resistor	UINT	rw	Rx	P0.6517.0.0
0x211D.17	Diagnostic category: Parameterisation braking resistor pulse energy	UINT	rw	Rx	P0.102676.0.0
0x211D.19	Diagnostic category: Parameterisation braking resistor pulse energy	UINT	rw	Rx	P0.102688.0.0
0x211E.01	PWM frequency selection	UDINT	rw	Rx	P0.670.0.0
0x2120.01	EtherCAT state machine state (ESM)	UDINT	ro	Tx	P0.720.0.0
0x2122.01	Sync manager 0 PDO assignment EtherCAT	USINT	ro	Tx	P0.751.0.0
0x2122.02	Sync manager 1 PDO assignment EtherCAT	USINT	ro	Tx	P0.752.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2122.0D	Diagnostic category: Process data not received at Sync time	UINT	rw	Rx	P0.758.0.0
0x2122.0E	Storage option: Process data not received at Sync time	USINT	rw	Rx	P0.759.0.0
0x2122.0F	Counter Process data loss	UDINT	ro	Tx	P0.1770.0.0
0x2123.01	Receive PDO number of objects EtherCAT	USINT	rw	Rx	P0.760.0.0
0x2124.01 ... 02	Sync manager x number of assigned PDOs EtherCAT	USINT	rw	Rx	P0.770.0.0
0x2125.02	Diagnostic category: Failure of fieldbus synchronisation signal	UINT	rw	Rx	P0.801.0.0
0x2125.03	Storage option: Failure of fieldbus synchronisation signal	USINT	rw	Rx	P0.802.0.0
0x2125.07	Sync trigger detected	USINT	ro	Tx	P0.20812.0.0
0x2125.08	PLL locked	USINT	ro	Tx	P0.20813.0.0
0x2125.09	PLL error	REAL	ro	Tx	P0.526783.0.0
0x2125.0A	PLL output	REAL	ro	Tx	P0.526784.0.0
0x2125.0B	PLL Sync Timeout	REAL	rw	Rx	P0.526785.0.0
0x2125.0C	Status synchronization	UDINT	ro	Tx	P0.102476.0.0
0x2126.01 ... 03	Transmit PDO number of objects EtherCAT	USINT	rw	Rx	P0.880.0.0
0x2127.01	Project name	STRING(41)	rw	Rx	P0.900.0.0 ... 40
0x2127.02	Project description	STRING(161)	rw	Rx	P0.901.0.0 ... 160
0x2127.03	Device name	STRING(128)	rw	Rx	P0.902.0.0 ... 127
0x2127.04	Device description	STRING(161)	rw	Rx	P0.903.0.0 ... 160
0x2128.01	Temperature power output stage	REAL	ro	Tx	P0.920.0.0
0x2128.02	Temperature status power output stage	DINT	ro	Tx	P0.921.0.0
0x2128.03	Diagnostic category: Warning threshold: Insufficient temperature in power unit	UINT	rw	Rx	P0.922.0.0
0x2128.04	Storage option: Warning threshold: Insufficient temperature in power unit	USINT	rw	Rx	P0.923.0.0
0x2128.07	Diagnostic category: Warning threshold: Power unit overtemperature	UINT	rw	Rx	P0.926.0.0
0x2128.08	Storage option: Warning threshold: Power unit overtemperature	USINT	rw	Rx	P0.927.0.0
0x2128.0E	Storage option: Warning threshold: Insufficient temperature in device	USINT	rw	Rx	P0.933.0.0
0x2128.12	Storage option: Warning threshold: Device overtemperature	USINT	rw	Rx	P0.937.0.0
0x2128.19	Upper limit value warning threshold power output stage temperature	REAL	rw	Rx	P0.9314.0.0
0x2128.1A	Upper limit value power output stage temperature	REAL	rw	Rx	P0.9315.0.0
0x2128.1B	Lower limit value warning threshold power output stage temperature	REAL	rw	Rx	P0.9316.0.0
0x2128.1C	Lower limit value power output stage temperature	REAL	rw	Rx	P0.9317.0.0
0x2128.21	Actual upper limit value warning threshold power output stage temperature	REAL	ro	Tx	P0.9322.0.0
0x2128.22	Actual upper limit value power output stage temperature	REAL	ro	Tx	P0.9323.0.0

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0x2128.23	Actual lower limit value warning threshold power output stage temperature	REAL	ro	Tx	P0.9324.0.0
0x2128.24	Actual lower limit value power output stage temperature	REAL	ro	Tx	P0.9325.0.0
0x2129.01	Firmware version	STRING(30)	ro	Tx	P0.960.0.0 ... 29
0x2129.02	Major Version Firmware	UDINT	ro	Tx	P0.961.0.0
0x2129.03	Minor Version Firmware	UDINT	ro	Tx	P0.962.0.0
0x2129.04	Patch Version Firmware	UDINT	ro	Tx	P0.963.0.0
0x2129.05	Build Version Firmware	UDINT	ro	Tx	P0.964.0.0
0x2129.06	Firmware status	UDINT	ro	Tx	P0.965.0.0
0x2129.07	Actual firmware slot	UDINT	ro	Tx	P0.966.0.0
0x2129.08	Firmware package version	STRING(30)	ro	Tx	P0.9550.0.0 ... 29
0x2129.09	Major version firmware package	UDINT	ro	Tx	P0.9560.0.0
0x2129.0A	Minor version firmware package	UDINT	ro	Tx	P0.9570.0.0
0x2129.0B	Patch version firmware package	UDINT	ro	Tx	P0.9580.0.0
0x2129.0C	Build version firmware package	UDINT	ro	Tx	P0.9590.0.0
0x2129.0E	Storage option: Writing of firmware failed	USINT	rw	Rx	P0.9601.0.0
0x2129.10	Storage option: Reading of firmware failed	USINT	rw	Rx	P0.9603.0.0
0x2129.12	Storage option: Firmware invalid	USINT	rw	Rx	P0.9605.0.0
0x2129.14	Storage option: Firmware incompatible	USINT	rw	Rx	P0.9607.0.0
0x2129.16	Storage option: Firmware save location invalid	USINT	rw	Rx	P0.9609.0.0
0x2129.18	Storage option: Firmware save location empty	USINT	rw	Rx	P0.9611.0.0
0x2129.1A	Storage option: Firmware update not allowed	USINT	rw	Rx	P0.9613.0.0
0x2129.1C	Storage option: Firmware package in use	USINT	rw	Rx	P0.9615.0.0
0x2129.22	Hash firmware package	STRING(20)	ro	Tx	P0.9595.0.0 ... 19
0x2129.23	Number of update jobs	INT	ro	Tx	P0.100023.0.0
0x2129.24	Active update job	INT	ro	Tx	P0.100024.0.0
0x2129.25	Total number of bytes written Flash	DINT	ro	Tx	P0.100028.0.0
0x2129.26	Number of bytes written Flash	DINT	ro	Tx	P0.100029.0.0
0x212E.01	Synchronisation mode	UINT	rw	Rx	P0.1050.0.0
0x212E.02	Synchronisation process repetition time	REAL	rw	Rx	P0.1051.0.0
0x212E.04	Sync mode supported	UINT	ro	Tx	P0.1053.0.0
0x212E.05	Sync Minimum Cycle Time	REAL	ro	Tx	P0.1054.0.0
0x212E.06	Sync Calc And Copy Time	REAL	ro	Tx	P0.1055.0.0
0x212E.07	Sync Get Cycle Time	UINT	rw	Rx	P0.1056.0.0
0x212E.08	Sync Delay Time	REAL	ro	Tx	P0.1057.0.0
0x212E.09	Sync0 Cycle Time	REAL	rw	Rx	P0.1058.0.0
0x212E.0A	Sync SM Event Missed	UINT	ro	Tx	P0.1059.0.0
0x212E.0B	Sync cycle time too small	UINT	ro	Tx	P0.1060.0.0
0x212E.0C	Sync Error	USINT	ro	Tx	P0.1061.0.0
0x212E.0D	Calc and copy time	REAL	ro	Tx	P0.1062.0.0
0x212E.0E	Maximum delay time	REAL	ro	Tx	P0.1063.0.0

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0x212E.0F	Error counter Sync 0	UINT	ro	Tx	P0.1064.0.0
0x212F.0A	Digital input X1A.7	UDINT	rw	Rx	P0.11201.0.0
0x212F.0B	Digital input X1A.8	UDINT	rw	Rx	P0.11202.0.0
0x212F.0C	Digital output X1A.9	UDINT	rw	Rx	P0.11203.0.0
0x212F.0D	Digital output X1A.10	UDINT	rw	Rx	P0.11204.0.0
0x212F.0E	Digital input X1C.2	UDINT	rw	Rx	P0.11205.0.0
0x212F.0F	Status word Object 0x60FE	UINT	rw	Rx	P0.11310.0.0
0x2130.1F	Commutation angle from user configuration	LINT	rw	Rx	P0.3219.0.0
0x2130.21	Actual commutation angle	LINT	ro	Tx	P0.3220.0.0
0x2130.23	Zero point offset from encoder memory	LINT	rw	Rx	P0.3221.0.0
0x2130.25	Zero point offset from user configuration	LINT	rw	Rx	P0.3223.0.0
0x2130.27	Actual zero point offset	LINT	ro	Tx	P0.3224.0.0
0x2130.29	Encoder referencing is valid	USINT	ro	Tx	P0.3225.0.0
0x2130.2B	Referencing in user configuration is valid	USINT	rw	Rx	P0.3226.0.0
0x2130.2D	Actual referencing is valid	USINT	ro	Tx	P0.3227.0.0
0x2130.2F	Valid commutation angle from encoder memory	USINT	ro	Tx	P0.3228.0.0
0x2130.31	Valid commutation angle from user configuration	USINT	ro	Tx	P0.3229.0.0
0x2130.33	Actual commutation angle valid	USINT	ro	Tx	P0.3230.0.0
0x2130.39	Electrical angular frequency filtered	REAL	ro	Tx	P0.3234.0.0
0x2130.3D	Activate compatible motor change	USINT	rw	Rx	P0.3236.0.0
0x2130.3F	Encoder permanently homed	USINT	rw	Rx	P0.3237.0.0
0x2130.41	Material number motor reference configuration	UDINT	rw	Rx	P0.3238.0.0
0x2130.43	Serial number motor reference configuration	STRING(13)	rw	Rx	P0.3239.0.0 ... 12
0x2130.45	Product key motor reference configuration	STRING(15)	rw	Rx	P0.3240.0.0 ... 14
0x2130.59	Activation automatic encoder detection	USINT	rw	Rx	P0.3250.0.0
0x2130.5B	Selection gear ratio group	USINT	rw	Rx	P0.3251.0.0
0x2130.5D	Standardised encoder position	LINT	ro	Tx	P0.11600.0.0
0x2130.5F	Absolute position in user units	LINT	ro	Tx	P0.11601.0.0
0x2130.61	Actual Velocity in user units	REAL	ro	Tx	P0.11602.0.0
0x2130.63	Filtered velocity in user units	REAL	ro	Tx	P0.11603.0.0
0x2130.65	Electrical angle	UDINT	ro	Tx	P0.11604.0.0
0x2130.67	Electrical angular frequency	REAL	ro	Tx	P0.11605.0.0
0x2130.6D	Commutation angle from encoder memory	LINT	rw	Rx	P0.11608.0.0
0x2130.7B	Actual position	LINT	ro	Tx	P0.11615.0.0
0x2130.7D	Encoder selection	UDINT	rw	Rx	P0.11616.0.0
0x2130.7F	Active encoder	UDINT	ro	Tx	P0.11617.0.0
0x2130.81	Velocity filter filter time constant	REAL	rw	Rx	P0.11618.0.0
0x2130.91	Activation commutation angle transfer (CMMP type plate)	USINT	rw	Rx	P0.11626.0.0
0x2130.93	Actual acceleration value unfiltered	REAL	ro	Tx	P0.71500.0.0
0x2130.95	Actual acceleration value filtered	REAL	ro	Tx	P0.71501.0.0

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0x2130.97	Filter time constant acceleration filter	REAL	rw	Rx	P0.71502.0.0
0x2130.E8	NOC motor reference configuration	STRING(32)	rw	Rx	P0.32410.0.0 ... 31
0x2130.F7	Encoder resolution	REAL	rw	Rx	P0.102903.0.0
0x2130.FA	Enable linear measurement	USINT	rw	Rx	P0.102908.0.0
0x2133.02	Operating hour counter	REAL	ro	Tx	P0.1423.0.0
0x2133.03	Operating hours counter UINT	UDINT	ro	Tx	P0.14231.0.0
0x2136.01	EtherCAT explicit device ID	UINT	rw	Rx	P0.7600.0.0
0x2136.02	Device type CiA402	UDINT	rw	Rx	P0.7601.0.0
0x2136.04	Device name CiA402	STRING(32)	rw	Rx	P0.7603.0.0 ... 31
0x2136.05	Hardware version CiA402	STRING(6)	rw	Rx	P0.7604.0.0 ... 5
0x2136.06	Software version CiA402	STRING(32)	rw	Rx	P0.7605.0.0 ... 31
0x2136.08	Vendor ID	UDINT	rw	Rx	P0.7607.0.0
0x2136.09	Product code	UDINT	rw	Rx	P0.7608.0.0
0x2136.0A	Revision number	UDINT	rw	Rx	P0.7609.0.0
0x2136.0B	Activation Legacy Mode Station Alias	USINT	rw	Rx	P0.7610.0.0
0x2138.01	Encoder resolution	UINT	rw	Rx	P0.10040.0.0
0x2138.04	Raw value position	UINT	ro	Tx	P0.10041.0.0
0x2138.07	Raw value number of revolutions	INT	ro	Tx	P0.10042.0.0
0x2138.10	Supply voltage encoder	REAL	rw	Rx	P0.10046.0.0
0x2138.13	Encoder supply voltage monitoring window	REAL	rw	Rx	P0.10049.0.0
0x2138.19	Filter time constant quadrature evaluation	UDINT	rw	Rx	P0.10051.0.0
0x2138.1F	Lower limit value encoder monitoring voltage	REAL	rw	Rx	P0.10053.0.0
0x2138.22	Maximum transverse mode voltage	REAL	rw	Rx	P0.10054.0.0
0x2138.34	Activation inversion zero pulse	USINT	rw	Rx	P0.10045.0.0
0x2138.35	Zero pulse monitoring window	UINT	rw	Rx	P0.10047.0.0
0x2138.36	Storage option: Number of increments between two zero pulses invalid	USINT	rw	Rx	P0.10060.0.0
0x2138.37	Diagnostic category: Number of increments between two zero pulses invalid	UINT	rw	Rx	P0.10061.0.0
0x2138.40	Storage option: Invalid encoder resolution	USINT	rw	Rx	P0.179.0.0
0x2138.43	Diagnostic category: Invalid encoder resolution	UINT	rw	Rx	P0.181.0.0
0x2138.46	Activation multi-turn	USINT	rw	Rx	P0.100556.0.0
0x2138.49	Storage option: Input frequency A/B signals too high	USINT	rw	Rx	P0.101125.0.0
0x2138.4C	Diagnostic category: Input frequency A/B signals too high	UINT	rw	Rx	P0.101127.0.0
0x2138.4F	Activation of extended encoder resolution	USINT	rw	Rx	P0.101502.0.0
0x2138.52	Extended encoder resolution	UDINT	rw	Rx	P0.101503.0.0
0x2139.02	Message counter	UDINT	ro	Tx	P0.100501.0.0
0x2139.03	Actual file pointer	UDINT	ro	Tx	P0.100502.0.0
0x2139.04	Actual file size	UDINT	ro	Tx	P0.100503.0.0
0x2139.06	Storage option: Diagnostics log file has invalid format	USINT	rw	Rx	P0.100505.0.0

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0x2139.08	Storage option: Loss of messages from diagnostics log	USINT	ro	Tx	P0.100509.0.0
0x2139.09	Actual indicator in the message buffer	UDINT	ro	Tx	P0.100510.0.0
0x213D.01	Device interface X1A status	UDINT	ro	Tx	P0.10151.0.0
0x213D.02	Device interface X1C status	UDINT	ro	Tx	P0.10152.0.0
0x213D.03	Internal interface status	UDINT	ro	Tx	P0.10153.0.0
0x213D.04	Device interface X1B status	UDINT	ro	Tx	P0.10154.0.0
0x213F.01	DC link recovery deactivation	REAL	ro	Tx	P0.10181.0.0
0x213F.02	DC link recovery status	USINT	ro	Tx	P0.10182.0.0
0x213F.03	DC link recovery	USINT	rw	Rx	P0.10183.0.0
0x213F.04	Activate automatic voltage determination	USINT	rw	Rx	P0.10184.0.0
0x213F.05	Switch-off threshold power feedback	REAL	rw	Rx	P0.10185.0.0
0x213F.06	Scaling factor offset of voltage calculation	REAL	rw	Rx	P0.10186.0.0
0x2141.01	Exception Count	UDINT	ro	Tx	P0.10300.0.0
0x2141.02	Exception Type	UDINT	ro	Tx	P0.10301.0.0
0x2141.04	Error Code	UDINT	ro	Tx	P0.10303.0.0
0x2141.06	Reg R14ex	UDINT	ro	Tx	P0.10305.0.0
0x2141.12	State OS	UDINT	ro	Tx	P0.100257.0.0
0x2141.13	Reg DFSR	UDINT	ro	Tx	P0.100265.0.0
0x2141.14	Reg IFSR	UDINT	ro	Tx	P0.100273.0.0
0x2141.17	Reg DFAR	UDINT	ro	Tx	P0.101133.0.0
0x2141.18	Reg IFAR	UDINT	ro	Tx	P0.101134.0.0
0x2141.19	Reg VBAR	UDINT	ro	Tx	P0.101135.0.0
0x2141.1A	Reg ISR	UDINT	ro	Tx	P0.101137.0.0
0x2141.1B	Active Task ID	UDINT	ro	Tx	P0.101139.0.0
0x2141.1C	Active Task Stack Fill Level	UDINT	ro	Tx	P0.101140.0.0
0x2141.1D	Active Task Stack Size	UDINT	ro	Tx	P0.101141.0.0
0x2141.1E	Actual Task Id	UDINT	ro	Tx	P0.101142.0.0
0x2141.1F	Actual Task Stack Fill Level	UDINT	ro	Tx	P0.101144.0.0
0x2141.20	Actual Task Stack Size	UDINT	ro	Tx	P0.101145.0.0
0x2141.21	Heap used	UDINT	ro	Tx	P0.101146.0.0
0x2141.22	Heap size	UDINT	ro	Tx	P0.101147.0.0
0x2141.23	Reg R14 last	UDINT	ro	Tx	P0.101492.0.0
0x2141.24	Reg R13 sp	UDINT	ro	Tx	P0.101494.0.0
0x2142.01	Axis ID diagnostic trace	UINT	rw	Rx	P0.103100.0.0
0x2142.02	Diagnostics ID diagnostic trace	UDINT	rw	Rx	P0.103101.0.0
0x2142.03	Data instance ID diagnostic trace	UINT	rw	Rx	P0.103102.0.0
0x2142.04	Actual axis ID diagnostic trace	UINT	ro	Tx	P0.103103.0.0
0x2142.05	Actual diagnostics ID diagnostic trace	UDINT	ro	Tx	P0.103104.0.0
0x2142.06	Actual data instance ID diagnostic trace	UINT	ro	Tx	P0.103105.0.0
0x2142.07	Diagnostics trigger	UDINT	rw	Rx	P0.103106.0.0
0x2142.08	Actual diagnostics trigger	UDINT	ro	Tx	P0.103107.0.0
0x2143.01	Status ReInit	UDINT	ro	Tx	P0.10321.0.0
0x2143.02	Status ReInit requested	USINT	ro	Tx	P0.10322.0.0
0x2143.03	Status ReInit active	USINT	ro	Tx	P0.10323.0.0

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0x2143.04	Status ReInit device restart	USINT	ro	Tx	P0.10324.0.0
0x2143.08	Storage option: Task ignored as reiniti-alisation not possible	USINT	rw	Rx	P0.10328.0.0
0x2143.09	Number ReInit requests	UDINT	ro	Tx	P0.10329.0.0
0x2143.0A	Number activated ReInit	UDINT	ro	Tx	P0.10330.0.0
0x2143.0B	ID reintialisation	UDINT	ro	Tx	P0.11280019.0.0
0x2143.0E	Storage option: System starts	USINT	rw	Rx	P0.101990.0.0
0x2143.0F	Diagnostic category: System starts	UINT	rw	Rx	P0.101992.0.0
0x2145.01 ... 02	Diagnostic axis status	UINT	ro	Tx	P0.301.0.0
0x2145.03 ... 04	Diagnostic response axis	UINT	ro	Tx	P0.302.0.0
0x2145.09 ... 0A	Number diagnostics acknowledgements	UDINT	ro	Tx	P0.103401.0.0
0x2145.0B ... 0C	Actually most serious error	UDINT	ro	Tx	P0.315.0.0
0x214C.03	Test user 10	USINT	rw	Rx	P0.9303.0.0
0x214C.04	Test user 20	USINT	rw	Rx	P0.9304.0.0
0x214C.05	Test user 30	USINT	rw	Rx	P0.9305.0.0
0x214C.06	Test user 40	USINT	no access	Rx	P0.9306.0.0
0x214C.07	Test user 50	USINT	no access	Rx	P0.9307.0.0
0x214C.0D	Activation Identification code	USINT	ro	Tx	P0.102760.0.0
0x214D.01 ... 02	Activate DHCP	USINT	rw	Rx	P0.12000.0.0
0x214D.03 ... 04	IP address	UDINT	rw	Rx	P0.12001.0.0
0x214D.05 ... 06	Subnet mask	UDINT	rw	Rx	P0.12002.0.0
0x214D.07 ... 08	Gateway address	UDINT	rw	Rx	P0.12003.0.0
0x214D.09 ... 0A	Active IP address	UDINT	ro	Tx	P0.12004.0.0
0x214D.0B ... 0C	Active subnet mask	UDINT	ro	Tx	P0.12005.0.0
0x214D.0D ... 0E	Active gateway address	UDINT	ro	Tx	P0.12006.0.0
0x214D.0F ... 10	Storage option: Incorrect IP address set-tings	USINT	rw	Rx	P0.101561.0.0
0x214F.01	Major version bootloader	UDINT	ro	Tx	P0.1130121.0.0
0x214F.02	Minor version bootloader	UDINT	ro	Tx	P0.1130122.0.0
0x214F.03	Patch version bootloader	UDINT	ro	Tx	P0.1130123.0.0
0x214F.04	Build version bootloader	UDINT	ro	Tx	P0.1130124.0.0
0x214F.05	Version bootloader	STRING(32)	ro	Tx	P0.1130125.0.0 ... 31
0x214F.08	Major Version APPloader	UDINT	ro	Tx	P0.100680.0.0
0x214F.09	Minor Version APPloader	UDINT	ro	Tx	P0.100681.0.0
0x214F.0A	Patch Version APPloader	UDINT	ro	Tx	P0.100682.0.0
0x214F.0B	Build Version APPloader	UDINT	ro	Tx	P0.100683.0.0
0x214F.0C	Version String APPloader	STRING(32)	ro	Tx	P0.100684.0.0 ... 31
0x214F.0D	Timestamp APPloader	STRING(48)	ro	Tx	P0.100685.0.0 ... 47
0x214F.0E	User Build APPloader	STRING(32)	ro	Tx	P0.100689.0.0 ... 31
0x2150.01	Switch-on delay holding brake 1	REAL	ro	Tx	P1.20.0.0
0x2150.02	Switch-off delay holding brake 1	REAL	ro	Tx	P1.21.0.0
0x2150.05	Status holding brake 1	UDINT	ro	Tx	P1.24.0.0
0x2150.07	Status holding brakes 1 and 2	UDINT	ro	Tx	P1.26.0.0
0x2150.09	Selection of holding brake	UDINT	ro	Tx	P1.29.0.0
0x2150.0A	Activation STO+SBC	USINT	rw	Rx	P1.102558.0.0
0x2151.0A	Actual phase U current value	REAL	ro	Tx	P1.39.0.0
0x2151.0B	Actual phase V current value	REAL	ro	Tx	P1.310.0.0

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0x2151.0C	Voltage limitation filter time constant	REAL	rw	Rx	P1.52679.0.0
0x2151.0D	Voltage limitation Ud active	USINT	ro	Tx	P1.52680.0.0
0x2151.0E	Voltage limitation Uq active	USINT	ro	Tx	P1.52681.0.0
0x2151.0F	Diagnostic category: Voltage limitation active	UINT	rw	Rx	P1.52682.0.0
0x2151.10	Storage option: Voltage limitation active	USINT	rw	Rx	P1.52683.0.0
0x2152.02	Controller operating status	UDINT	ro	Tx	P1.42.0.0
0x2152.06	Setpoint value active current unfiltered	REAL	ro	Tx	P1.52.0.0
0x2152.09	Velocity limitation active	USINT	ro	Tx	P1.52675.0.0
0x2152.0A	Current limitation active	USINT	ro	Tx	P1.52676.0.0
0x2152.0B	Diagnostic category: Limit for velocity or current active	UINT	rw	Rx	P1.52677.0.0
0x2152.0C	Storage option: Limit for velocity or current active	USINT	rw	Rx	P1.52678.0.0
0x2152.0D	Filter time constant controller limitation	REAL	rw	Rx	P1.526794.0.0
0x2153.01	Current controller amplification gain (reactive current)	REAL	rw	Rx	P1.80.0.0
0x2153.02	Current controller integration constant (reactive current)	REAL	rw	Rx	P1.81.0.0
0x2153.03	Current controller amplification gain (active current)	REAL	rw	Rx	P1.82.0.0
0x2153.04	Current controller integration constant (active current)	REAL	rw	Rx	P1.83.0.0
0x2153.05	Setpoint value voltage Ud	REAL	ro	Tx	P1.84.0.0
0x2153.06	Setpoint value voltage Uq	REAL	ro	Tx	P1.85.0.0
0x2153.07	Setpoint value active current	REAL	ro	Tx	P1.86.0.0
0x2153.08	Setpoint value reactive current	REAL	ro	Tx	P1.87.0.0
0x2153.09	Maximum output voltage	REAL	ro	Tx	P1.88.0.0
0x2153.0A	Actual Clarke-Transformation Ia current value	REAL	ro	Tx	P1.89.0.0
0x2153.0B	Actual Clarke-Transformation Ib current value	REAL	ro	Tx	P1.810.0.0
0x2153.0E	Actual reactive current value	REAL	ro	Tx	P1.813.0.0
0x2153.0F	Actual active current value	REAL	ro	Tx	P1.814.0.0
0x2153.14	Control parameter equalisation for active and reactive current controllers	USINT	rw	Rx	P1.819.0.0
0x2153.15	Reactive current control error	REAL	ro	Tx	P1.824.0.0
0x2153.16	Active current control error	REAL	ro	Tx	P1.825.0.0
0x2154.01	Setpoint position	LINT	ro	Tx	P1.90.0.0
0x2154.02	Setpoint velocity	REAL	ro	Tx	P1.91.0.0
0x2154.03	Setpoint acceleration	REAL	ro	Tx	P1.92.0.0
0x2154.04	Setpoint jerk	REAL	ro	Tx	P1.93.0.0
0x2154.05	Setpoint torque	REAL	ro	Tx	P1.94.0.0
0x2154.06	Setpoint current	REAL	ro	Tx	P1.95.0.0
0x2154.07	Inactive time position setpoint value	UDINT	rw	Rx	P1.957.0.0
0x2154.08	Time constant velocity setpoint value filter	REAL	rw	Rx	P1.958.0.0
0x2154.09	Time constant acceleration setpoint value filter	REAL	rw	Rx	P1.959.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2154.0A	Amplification gain velocity feed forward control	REAL	rw	Rx	P1.967.0.0
0x2154.0B	Amplification gain torque feed forward control	REAL	rw	Rx	P1.968.0.0
0x2154.0C	Offset torque	REAL	rw	Rx	P1.969.0.0
0x2154.0D	Total inertia	REAL	rw	Rx	P1.973.0.0
0x2154.0E	Setpoint value friction compensation	REAL	ro	Tx	P1.974.0.0
0x2154.0F	Setpoint value inertia compensation	REAL	ro	Tx	P1.975.0.0
0x2154.10	Number of support points	UDINT	rw	Rx	P1.978.0.0
0x2154.13	Gain factor Torque/Position	REAL	rw	Rx	P1.102641.0.0
0x2155.03	Selection encoder channel 1 position	UDINT	ro	Tx	P1.122.0.0
0x2155.09	Actual position value encoder channel 1	LINT	ro	Tx	P1.128.0.0
0x2155.0B	Actual velocity value encoder channel 1	REAL	ro	Tx	P1.1210.0.0
0x2155.0D	Electrical angle	UDINT	ro	Tx	P1.1212.0.0
0x2155.0E	Electrical angular frequency	REAL	ro	Tx	P1.1213.0.0
0x2155.11	Reference Encoder interface	UDINT	rw	Rx	P1.101733.0.0
0x2156.01	Change closed loop parameter set status	USINT	ro	Tx	P1.44.0.0
0x2157.01	Actual torque value motor shaft	REAL	ro	Tx	P1.150.0.0
0x2157.02	Actual torque value gear shaft	REAL	ro	Tx	P1.151.0.0
0x2157.03	Actual force	REAL	ro	Tx	P1.101362.0.0
0x2157.04	Filter time constant torque/force	REAL	rw	Rx	P1.101374.0.0
0x2157.05	Threshold value sensor switching	REAL	rw	Rx	P1.102085.0.0
0x2157.06	Hysteresis sensor switching	REAL	rw	Rx	P1.102089.0.0
0x2157.07	Actual value selector torque control	UDINT	rw	Rx	P1.102097.0.0
0x2157.08	Actual value parameter	REAL	rw	Rx	P1.102098.0.0
0x2158.01	Motion Manager status	UDINT	ro	Tx	P1.171.0.0
0x2158.02	Active motion task	UDINT	ro	Tx	P1.172.0.0
0x2158.03	Active motion task status	UDINT	ro	Tx	P1.173.0.0
0x2158.0F	Storage option: Task ignored as device not ready	USINT	rw	Rx	P1.1733.0.0
0x2158.18	Storage option: Motion job error due to firmware update	USINT	rw	Rx	P1.139.0.0
0x2158.19	Diagnostic category: Motion job error due to firmware update	UINT	rw	Rx	P1.143.0.0
0x2159.01	Actual record table index	DINT	ro	Tx	P1.1837.0.0
0x2159.02	Maximum number record links	UDINT	ro	Tx	P1.1839.0.0
0x2159.03	Activate Event table	USINT	rw	Rx	P1.1840.0.0
0x2159.04	Status of record table	UDINT	ro	Tx	P1.1846.0.0
0x2159.05	Diagnostic category: Record table incorrect	UINT	rw	Rx	P1.1850.0.0
0x2159.06	Storage option: Record table incorrect	USINT	rw	Rx	P1.1851.0.0
0x2159.07	Diagnostic category: Invalid record table parameter	UINT	rw	Rx	P1.1852.0.0
0x2159.08	Storage option: Invalid record table parameter	USINT	rw	Rx	P1.1853.0.0
0x2159.09	Record table status	DINT	ro	Tx	P1.526797.0.0
0x2159.0A	Activation background mode	USINT	rw	Rx	P1.1130224.0.0
0x215B.01	Position controller amplification gain	REAL	rw	Rx	P1.220.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x215B.02	Dead zone position controller	LINT	rw	Rx	P1.221.0.0
0x215B.03	Minimum correction velocity	REAL	rw	Rx	P1.222.0.0
0x215B.04	Maximum correction velocity	REAL	rw	Rx	P1.223.0.0
0x215B.05	Velocity controller amplification gain	REAL	rw	Rx	P1.224.0.0
0x215B.06	Velocity controller integration constant	REAL	rw	Rx	P1.225.0.0
0x215B.07	Velocity control error	REAL	ro	Tx	P1.2215.0.0
0x215B.08	Setpoint value velocity controller	REAL	ro	Tx	P1.2216.0.0
0x215B.09	Position control error	LINT	ro	Tx	P1.2217.0.0
0x215B.0A	Minimum torque	REAL	ro	Tx	P1.2218.0.0
0x215B.0B	Maximum torque	REAL	ro	Tx	P1.2219.0.0
0x215B.0C	Setpoint value torque	REAL	ro	Tx	P1.2220.0.0
0x215B.0F	Selection voltage limitation prioritisation	UDINT	rw	Rx	P1.526772.0.0
0x215B.10	Actual gain factor	REAL	rw	Rx	P1.101989.0.0
0x215B.11	Actual integration constant	REAL	rw	Rx	P1.101991.0.0
0x215B.12	Gain factor torque control	REAL	rw	Rx	P1.102040.0.0
0x215B.13	Integration constant torque control	REAL	rw	Rx	P1.102042.0.0
0x215D.02	Selection voltage limitation prioritisation	UDINT	rw	Rx	P1.526773.0.0
0x215E.0B	Power unit dataset major version	STRING(2)	ro	Tx	P1.2800.0.0 ... 1
0x215E.0C	Minor version power unit dataset	UINT	ro	Tx	P1.2801.0.0
0x215E.13	Lower limit value minimum DC link voltage	REAL	ro	Tx	P1.2818.0.0
0x215E.14	Upper limit value minimum DC link voltage	REAL	ro	Tx	P1.2819.0.0
0x215E.1B	Potential difference brake chopper ON	REAL	ro	Tx	P1.2829.0.0
0x215E.1C	Hysteresis brake chopper ON/OFF	REAL	ro	Tx	P1.2830.0.0
0x215E.21	Lower limit value resistance value external braking resistor	REAL	ro	Tx	P1.2835.0.0
0x215E.22	Upper limit value resistance value external braking resistor	REAL	ro	Tx	P1.2836.0.0
0x215E.23	Nominal power external braking resistor	REAL	ro	Tx	P1.2837.0.0
0x215E.24	Maximum pulse energy external braking resistor	REAL	ro	Tx	P1.2838.0.0
0x215E.25	Upper limit value power output stage temperature	REAL	ro	Tx	P1.2850.0.0
0x215E.26	Lower limit value power output stage temperature	REAL	ro	Tx	P1.2851.0.0
0x215E.27	Upper limit value servo drive temperature	REAL	ro	Tx	P1.2852.0.0
0x215E.28	Lower limit value servo drive temperature	REAL	ro	Tx	P1.2853.0.0
0x215E.46	Upper limit value minimum load voltage	REAL	ro	Tx	P1.28120.0.0
0x215E.47	Lower limit value minimum load voltage	REAL	ro	Tx	P1.28121.0.0
0x215E.48	Upper limit value maximum load voltage	REAL	ro	Tx	P1.28130.0.0
0x215E.49	Lower limit value maximum load voltage	REAL	ro	Tx	P1.28131.0.0
0x215E.4A	Lower limit value maximum DC link voltage	REAL	ro	Tx	P1.28180.0.0
0x215E.4B	Upper limit value maximum DC link voltage	REAL	ro	Tx	P1.28181.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x215E.4C	Upper limit value warning threshold maximum DC link voltage	REAL	ro	Tx	P1.28200.0.0
0x215E.4D	Lower limit value warning threshold maximum DC link voltage	REAL	ro	Tx	P1.28201.0.0
0x215E.51	Upper limit value brake chopper ON	REAL	ro	Tx	P1.28280.0.0
0x215E.52	Lower limit value brake chopper ON	REAL	ro	Tx	P1.28281.0.0
0x215F.01	Setpoint management output position	LINT	ro	Tx	P1.290.0.0
0x215F.02	Setpoint management output velocity	REAL	ro	Tx	P1.291.0.0
0x215F.03	Setpoint management output acceleration	REAL	ro	Tx	P1.292.0.0
0x215F.04	Setpoint management output jerk	REAL	ro	Tx	P1.293.0.0
0x215F.05	Setpoint management output torque	REAL	ro	Tx	P1.294.0.0
0x215F.06	Setpoint management output current	REAL	ro	Tx	P1.295.0.0
0x215F.07	Setpoint management control structure	UDINT	ro	Tx	P1.296.0.0
0x215F.08	Setpoint management controller operating status	UDINT	ro	Tx	P1.297.0.0
0x2162.01	Use of user specific motor data	USINT	rw	Rx	P1.14.0.0
0x2162.02	Actual pole pairs	UDINT	ro	Tx	P1.719.0.0
0x2162.03	Actual motor inertia	REAL	ro	Tx	P1.7112.0.0
0x2162.04	Actual phase sequence	USINT	ro	Tx	P1.7115.0.0
0x2162.05	Actual nominal current	REAL	rw	Rx	P1.7118.0.0
0x2162.06	Actual maximum current	REAL	ro	Tx	P1.7121.0.0
0x2162.07	Actual maximum velocity	REAL	ro	Tx	P1.7124.0.0
0x2162.08	Actual nominal velocity	REAL	ro	Tx	P1.7127.0.0
0x2162.09	Actual winding inductance	REAL	ro	Tx	P1.7130.0.0
0x2162.0A	Actual winding resistance	REAL	ro	Tx	P1.7133.0.0
0x2162.0B	Actual torque constant	REAL	ro	Tx	P1.7136.0.0
0x2162.0C	Resulting nominal torque	REAL	ro	Tx	P1.7139.0.0
0x2162.0D	Resulting maximum torque	REAL	ro	Tx	P1.7142.0.0
0x2162.0E	Actual time constant I^2t	REAL	ro	Tx	P1.7145.0.0
0x2162.0F	Actual winding temperature	REAL	ro	Tx	P1.7148.0.0
0x2162.10	Actual temperature sensor motor	UDINT	ro	Tx	P1.7154.0.0
0x2162.11	Holding brake	USINT	ro	Tx	P1.7160.0.0
0x2162.12	Actual switch-on delay holding brake 1	REAL	ro	Tx	P1.7163.0.0
0x2162.13	Actual switch-off delay holding brake 1	REAL	ro	Tx	P1.7166.0.0
0x2162.14	Actual order code motor	STRING(32)	ro	Tx	P1.7188.0.0 ... 31
0x2162.15	Actual database ID motor	UDINT	ro	Tx	P1.7189.0.0
0x2162.16	Actual nominal motor voltage	REAL	ro	Tx	P1.71422.0.0
0x2162.17	Actual continuous current	REAL	ro	Tx	P1.71425.0.0
0x2162.18	Actual Lq inductance	REAL	ro	Tx	P1.71426.0.0
0x2162.19	Actual Ld inductance	REAL	ro	Tx	P1.71427.0.0
0x2162.1A	Actual motor type	USINT	ro	Tx	P1.71428.0.0
0x2162.1B	Diagnostic category: Motor type is not supported	UINT	rw	Rx	P1.71429.0.0
0x2162.1C	Storage option: Motor type is not supported	USINT	rw	Rx	P1.71433.0.0
0x2162.1D	Active denominator Pole pairs	UDINT	ro	Tx	P1.7191.0.0
0x2162.1E	Activation virtual drive	USINT	rw	Rx	P1.71434.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2162.1F	Activate virtual encoder	USINT	rw	Rx	P1.102034.0.0
0x2162.20	K1 factor	REAL	rw	Rx	P1.102224.0.0
0x2162.21	K2 factor	REAL	rw	Rx	P1.102225.0.0
0x2162.22	Tk factor	REAL	rw	Rx	P1.102226.0.0
0x2162.23	Fieldweakening: Active max. rotary speed	REAL	ro	Tx	P1.71370.0.0
0x2162.24	Raw value voltage ZK 600V	REAL	ro	Tx	P1.102704.0.0
0x2162.25	Force constant (active value)	REAL	ro	Tx	P1.102927.0.0
0x2162.26	Slide weight linear	REAL	ro	Tx	P1.102929.0.0
0x2164.01	STO hysteresis time	REAL	rw	Rx	P1.390.0.0
0x2164.02	STO discrepancy time	REAL	rw	Rx	P1.391.0.0
0x2164.03	STO safety status	UDINT	ro	Tx	P1.392.0.0
0x2164.04	STO error status	UDINT	ro	Tx	P1.393.0.0
0x2164.05	STO signal status	UDINT	ro	Tx	P1.394.0.0
0x2166.01	Movement monitoring status	UDINT	ro	Tx	P1.460.0.0
0x2166.02	Configuration word movement monitoring	UDINT	ro	Tx	P1.461.0.0
0x2166.03	Damping time position: following error	REAL	rw	Rx	P1.462.0.0
0x2166.04	Monitoring window position: following error	REAL	rw	Rx	P1.463.0.0
0x2166.05	Monitoring window velocity: following error	REAL	rw	Rx	P1.464.0.0
0x2166.06	Standstill damping time	REAL	rw	Rx	P1.465.0.0
0x2166.07	Monitoring window velocity standstill monitoring	REAL	rw	Rx	P1.466.0.0
0x2166.08	Monitoring window position standstill	REAL	rw	Rx	P1.467.0.0
0x2166.09	Damping time target reached	REAL	rw	Rx	P1.468.0.0
0x2166.0A	Monitoring window target position	REAL	rw	Rx	P1.469.0.0
0x2166.0B	Monitoring window target velocity	REAL	rw	Rx	P1.4610.0.0
0x2166.0C	Monitoring window target torque	REAL	rw	Rx	P1.4611.0.0
0x2166.0D	Diagnostic category: Target position reached	UINT	rw	Rx	P1.4612.0.0
0x2166.0E	Storage option: Target position reached	USINT	rw	Rx	P1.4613.0.0
0x2166.0F	Diagnostic category: Target velocity reached	UINT	rw	Rx	P1.4614.0.0
0x2166.10	Storage option: Target velocity reached	USINT	rw	Rx	P1.4615.0.0
0x2166.11	Diagnostic category: Target torque reached	UINT	rw	Rx	P1.4616.0.0
0x2166.12	Storage option: Target torque reached	USINT	rw	Rx	P1.4617.0.0
0x2166.13	Diagnostic category: Standstill reached	UINT	rw	Rx	P1.4618.0.0
0x2166.14	Storage option: Standstill reached	USINT	rw	Rx	P1.4619.0.0
0x2166.15	Diagnostic category: Standstill reached and in standstill window	UINT	rw	Rx	P1.4620.0.0
0x2166.16	Storage option: Standstill reached and in standstill window	USINT	rw	Rx	P1.4621.0.0
0x2166.17	Diagnostic category: Position: following error	UINT	rw	Rx	P1.4622.0.0
0x2166.18	Storage option: Position: following error	USINT	rw	Rx	P1.4623.0.0
0x2166.19	Diagnostic category: Velocity: following error	UINT	rw	Rx	P1.4624.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2166.1A	Storage option: Velocity: following error	USINT	rw	Rx	P1.4625.0.0
0x2166.1B	Stop detection limit value	REAL	rw	Rx	P1.4626.0.0
0x2166.1C	Damping time limit detection	REAL	rw	Rx	P1.4627.0.0
0x2166.1D	Software limit positions active	USINT	rw	Rx	P1.4628.0.0
0x2166.1E	Negative software limit position	LINT	rw	Rx	P1.4629.0.0
0x2166.1F	Positive software limit position	LINT	rw	Rx	P1.4630.0.0
0x2166.20	Activation of automatic stop ramp software limit position	USINT	rw	Rx	P1.4631.0.0
0x2166.21	Diagnostic category: Negative software limit position	UINT	rw	Rx	P1.4632.0.0
0x2166.22	Storage option: Negative software limit position	USINT	rw	Rx	P1.4633.0.0
0x2166.23	Diagnostic category: Positive software limit position	UINT	rw	Rx	P1.4634.0.0
0x2166.24	Storage option: Positive software limit position	USINT	rw	Rx	P1.4635.0.0
0x2166.25	Diagnostic category: Limitation negative direction	UINT	rw	Rx	P1.4636.0.0
0x2166.26	Storage option: Limitation negative direction	USINT	rw	Rx	P1.4637.0.0
0x2166.27	Diagnostic category: Limitation positive direction	UINT	rw	Rx	P1.4638.0.0
0x2166.28	Storage option: Limitation positive direction	USINT	rw	Rx	P1.4639.0.0
0x2166.30	Maximum velocity	REAL	rw	Rx	P1.4660.0.0
0x2166.31	Diagnostic category: Velocity too high	UINT	rw	Rx	P1.4661.0.0
0x2166.33	Monitoring window pushback	REAL	rw	Rx	P1.4663.0.0
0x2166.34	Damping time pushback	REAL	rw	Rx	P1.4664.0.0
0x2166.35	Damping time target range	REAL	rw	Rx	P1.4665.0.0
0x2166.36	Monitoring window target position	REAL	rw	Rx	P1.4666.0.0
0x2166.37	Monitoring window velocity	REAL	rw	Rx	P1.4667.0.0
0x2166.38	Monitoring window torque	REAL	rw	Rx	P1.4668.0.0
0x2166.39	Diagnostic category: Out of target range	UINT	rw	Rx	P1.4669.0.0
0x2166.3A	Storage option: Out of target range	USINT	rw	Rx	P1.4670.0.0
0x2166.3B	Diagnostic category: Reverse feed monitoring	UINT	rw	Rx	P1.4671.0.0
0x2166.3C	Storage option: Reverse feed monitoring	USINT	rw	Rx	P1.4672.0.0
0x2166.3D	Activation of automatic stop ramp stroke limit	USINT	rw	Rx	P1.4675.0.0
0x2166.3E	Diagnostic category: Negative stroke limit reached	UINT	rw	Rx	P1.4676.0.0
0x2166.3F	Storage option: Negative stroke limit reached	USINT	rw	Rx	P1.4677.0.0
0x2166.40	Diagnostic category: Positive stroke limit reached	UINT	rw	Rx	P1.4678.0.0
0x2166.41	Storage option: Positive stroke limit reached	USINT	rw	Rx	P1.4679.0.0
0x2166.42	Actual position: following error	REAL	ro	Tx	P1.4682.0.0
0x2166.43	Actual velocity: following error	REAL	ro	Tx	P1.4683.0.0
0x2166.44	Actual stroke value	LINT	ro	Tx	P1.4684.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2166.45	Limit value remaining distance monitoring	LINT	rw	Rx	P1.4685.0.0
0x2166.46	Diagnostic category: Residual distance too low	UINT	rw	Rx	P1.4686.0.0
0x2166.47	Storage option: Residual distance too low	USINT	rw	Rx	P1.4687.0.0
0x2166.48	Bit mask movement monitoring	UDINT	rw	Rx	P1.4688.0.0
0x2166.49	Movement monitoring (masked)	UDINT	ro	Tx	P1.4689.0.0
0x2166.4A	Damping time velocity: following error	REAL	rw	Rx	P1.4690.0.0
0x2166.4B	Diagnostic category: Trajectory completed	UINT	rw	Rx	P1.4691.0.0
0x2166.4C	Storage option: Trajectory completed	USINT	rw	Rx	P1.4692.0.0
0x2166.4D	Diagnostic category: Fixed stop not detected	UINT	rw	Rx	P1.4647.0.0
0x2166.4E	Storage option: Fixed stop not detected	USINT	rw	Rx	P1.4648.0.0
0x2166.4F	Diagnostic category: Monitoring window of fixed stop left	UINT	rw	Rx	P1.4649.0.0
0x2166.50	Storage option: Monitoring window of fixed stop left	USINT	rw	Rx	P1.4650.0.0
0x2166.51	Fixed stop detection damping time	REAL	rw	Rx	P1.4693.0.0
0x2166.52	Limit value following error	REAL	rw	Rx	P1.4694.0.0
0x2166.53	Stroke limit positive for detection of a fixed stop	LINT	rw	Rx	P1.11280408.0.0
0x2166.54	Stroke limit negative for detection of a fixed stop	LINT	rw	Rx	P1.11280409.0.0
0x2166.55	Threshold value torque utilization reached	REAL	rw	Rx	P1.11280410.0.0
0x2166.56	Torque utilization monitoring window	REAL	rw	Rx	P1.11280411.0.0
0x2166.57	Damping time torque utilization	REAL	rw	Rx	P1.11280412.0.0
0x2166.5D	Settling time Following error Acceleration	REAL	rw	Rx	P1.101731.0.0
0x2166.5E	Monitoring window Following error acceleration	REAL	rw	Rx	P1.101735.0.0
0x2166.5F	Following error acceleration	REAL	ro	Tx	P1.101737.0.0
0x2166.60	Storage option: Following error acceleration	USINT	rw	Rx	P1.101750.0.0
0x2166.61	Diagnostic category: Following error acceleration	UINT	rw	Rx	P1.101753.0.0
0x2167.01	Device control status	UDINT	ro	Tx	P1.530.0.0
0x2168.01	Lower limit value velocity (closed loop controller)	REAL	rw	Rx	P1.850.0.0
0x2168.02	Upper limit value velocity (closed loop controller)	REAL	rw	Rx	P1.851.0.0
0x2168.03	Lower limit value torque (closed loop controller)	REAL	rw	Rx	P1.852.0.0
0x2168.04	Upper limit value torque (closed loop controller)	REAL	rw	Rx	P1.853.0.0
0x2168.05	Lower limit value active current (closed loop controller)	REAL	rw	Rx	P1.854.0.0
0x2168.06	Upper limit value active current (closed loop controller)	REAL	rw	Rx	P1.855.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2168.07	Limit value total current (closed loop controller)	REAL	rw	Rx	P1.856.0.0
0x2168.08	Resulting lower limit value velocity (closed loop controller)	REAL	ro	Tx	P1.6100.0.0
0x2168.09	Resulting upper limit value velocity (closed loop controller)	REAL	ro	Tx	P1.6101.0.0
0x2168.0C	Resulting lower limit value torque (closed loop controller)	REAL	ro	Tx	P1.6104.0.0
0x2168.0D	Resulting upper limit value torque (closed loop controller)	REAL	ro	Tx	P1.6105.0.0
0x2168.0E	Diagnostic category: Torque control limitation invalid	UINT	rw	Rx	P1.6106.0.0
0x2168.10	Resulting lower limit value active current (closed loop controller)	REAL	ro	Tx	P1.6108.0.0
0x2168.11	Resulting upper limit value active current (closed loop controller)	REAL	ro	Tx	P1.6109.0.0
0x2168.12	Diagnostic category: Current control limitation invalid	UINT	rw	Rx	P1.6110.0.0
0x2168.14	Resulting upper limit value total current (closed loop controller)	REAL	ro	Tx	P1.6112.0.0
0x2168.17	Maximum torque symmetrical	REAL	rw	Rx	P1.526796.0.0
0x2168.18	Clamping torque	REAL	rw	Rx	P1.526801.0.0
0x2168.19	Clamping torque offset	REAL	rw	Rx	P1.11280407.0.0
0x2168.1A	Activation torque/current limitation	USINT	rw	Rx	P1.101033.0.0
0x2168.1B	Selection of dynamic torque boost	USINT	rw	Rx	P1.102223.0.0
0x2169.01	Maximum motor torque/servo drive	REAL	ro	Tx	P1.381.0.0
0x2169.02	Maximum motor velocity	REAL	ro	Tx	P1.382.0.0
0x2169.03	Maximum current motor	REAL	ro	Tx	P1.620.0.0
0x2169.04	Motor nominal current	REAL	ro	Tx	P1.621.0.0
0x2169.05	Maximum current servo drive	REAL	ro	Tx	P1.622.0.0
0x2169.06	Nominal current servo drive	REAL	ro	Tx	P1.623.0.0
0x2169.07	Resulting maximum current	REAL	ro	Tx	P1.624.0.0
0x2169.08	Resulting minimum current	REAL	ro	Tx	P1.625.0.0
0x2169.09	Resulting nominal current	REAL	ro	Tx	P1.626.0.0
0x216A.01	Scaling factor start value I^2t monitoring motor	REAL	rw	Rx	P1.631.0.0
0x216A.02	Limit value I^2t monitoring motor	REAL	ro	Tx	P1.632.0.0
0x216A.03	Scaling factor maximum value after switching on	REAL	ro	Tx	P1.633.0.0
0x216A.04	Actual value I^2t monitoring motor	REAL	ro	Tx	P1.634.0.0
0x216A.05	Scaling factor warning limit I^2t monitoring motor	REAL	rw	Rx	P1.635.0.0
0x216A.06	Maximum I^2t time	REAL	ro	Tx	P1.636.0.0
0x216A.07	Scaling factor start value I^2t monitoring power output stage	REAL	ro	Tx	P1.637.0.0
0x216A.08	Limit value I^2t monitoring power output stage	REAL	ro	Tx	P1.638.0.0
0x216A.09	Scaling factor maximum value after switching on	REAL	ro	Tx	P1.639.0.0
0x216A.0A	Actual value I^2t monitoring power output stage	REAL	ro	Tx	P1.6310.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x216A.0B	Scaling factor warning limit I²t monitoring power output stage	REAL	rw	Rx	P1.6311.0.0
0x216A.0C	Scaling factor start value I²t monitoring power output stage at standstill	REAL	ro	Tx	P1.6313.0.0
0x216A.0D	Limit value I²t monitoring power output stage at standstill	REAL	ro	Tx	P1.6314.0.0
0x216A.0E	Scaling factor maximum value after drive at standstill	REAL	ro	Tx	P1.6315.0.0
0x216A.0F	Actual value I²t monitoring power output stage at standstill	REAL	ro	Tx	P1.6316.0.0
0x216A.10	Scaling factor warning limit I²t monitoring drive at standstill	REAL	rw	Rx	P1.6317.0.0
0x216A.11	Diagnostic category: I²t monitoring: motor warning limit	UINT	rw	Rx	P1.6319.0.0
0x216A.12	Storage option: I²t monitoring: motor warning limit	USINT	rw	Rx	P1.6320.0.0
0x216A.13	Diagnostic category: I²t monitoring: motor error limit	UINT	rw	Rx	P1.6321.0.0
0x216A.14	Storage option: I²t monitoring: motor error limit	USINT	rw	Rx	P1.6322.0.0
0x216A.15	Diagnostic category: I²t monitoring: output stage warning limit	UINT	rw	Rx	P1.6323.0.0
0x216A.16	Storage option: I²t monitoring: output stage warning limit	USINT	rw	Rx	P1.6324.0.0
0x216A.17	Diagnostic category: I²t monitoring: output stage error limit	UINT	rw	Rx	P1.6325.0.0
0x216A.18	Storage option: I²t monitoring: output stage error limit	USINT	rw	Rx	P1.6326.0.0
0x216A.19	Diagnostic category: I²t monitoring: output stage v0 warning limit	UINT	rw	Rx	P1.6327.0.0
0x216A.1A	Storage option: I²t monitoring: output stage v0 warning limit	USINT	rw	Rx	P1.6328.0.0
0x216A.1B	Diagnostic category: I²t monitoring: output stage v0 error limit	UINT	rw	Rx	P1.6329.0.0
0x216A.1C	Storage option: I²t monitoring: output stage v0 error limit	USINT	rw	Rx	P1.6330.0.0
0x216A.1D	Actual value relative I²t monitoring of motor to limit	REAL	ro	Tx	P1.6331.0.0
0x216A.1E	Actual value relative I²t monitoring of power output stage to limit	REAL	ro	Tx	P1.6332.0.0
0x216A.1F	Actual value relative I²t monitoring of power output stage at standstill to limit	REAL	ro	Tx	P1.6333.0.0
0x216A.20	Actual value I²t monitoring of the total current	REAL	ro	Tx	P1.6334.0.0
0x216A.23	Scaling factor I²t velocity dependent	REAL	rw	Rx	P1.100009.0.0
0x216B.01	Status of state machine commutation finding	UDINT	ro	Tx	P1.660.0.0
0x216B.02	Commutation finding status	UDINT	ro	Tx	P1.661.0.0
0x216B.04	Electrical Increment	REAL	rw	Rx	P1.664.0.0
0x216B.06	Mode	UDINT	rw	Rx	P1.668.0.0
0x216B.07	Velocity	REAL	rw	Rx	P1.669.0.0
0x216B.0A	Acceleration	REAL	rw	Rx	P1.6691.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x216B.0B	Jerk	REAL	rw	Rx	P1.6692.0.0
0x216B.0C	Monitoring window angle	REAL	rw	Rx	P1.6693.0.0
0x216B.10	Commutation-angle detection damping time	REAL	rw	Rx	P1.545454.0.0
0x216B.11	Commutation angle	LINT	rw	Rx	P1.545455.0.0
0x216C.01	Pole pairs (user defined)	UDINT	rw	Rx	P1.718.0.0
0x216C.02	Motor inertia (user defined)	REAL	rw	Rx	P1.7111.0.0
0x216C.03	Phase sequence (user defined)	USINT	rw	Rx	P1.7114.0.0
0x216C.04	Nominal current (user defined)	REAL	rw	Rx	P1.7117.0.0
0x216C.05	Maximum peak current (user defined)	REAL	rw	Rx	P1.7120.0.0
0x216C.06	Maximum rpm (user defined)	REAL	rw	Rx	P1.7123.0.0
0x216C.07	Nominal rotary velocity (user defined)	REAL	rw	Rx	P1.7126.0.0
0x216C.08	Winding inductance (user defined)	REAL	rw	Rx	P1.7129.0.0
0x216C.09	Winding resistance (user defined)	REAL	rw	Rx	P1.7132.0.0
0x216C.0A	Torque constant (user defined)	REAL	rw	Rx	P1.7135.0.0
0x216C.0B	Time constant I^2t (user defined)	REAL	rw	Rx	P1.7144.0.0
0x216C.0C	Winding temperature (user defined)	REAL	rw	Rx	P1.7147.0.0
0x216C.0D	Temperature sensor (user defined)	UDINT	rw	Rx	P1.7153.0.0
0x216C.0E	Holding brake (user defined)	USINT	rw	Rx	P1.7159.0.0
0x216C.0F	Switch-on delay holding brake 1 (user defined)	REAL	rw	Rx	P1.7162.0.0
0x216C.10	Switch-off delay holding brake 1 (user defined)	REAL	rw	Rx	P1.7165.0.0
0x216C.11	Order code motor (user defined)	STRING(32)	rw	Rx	P1.7182.0.0 ... 31
0x216C.12	Database ID motor (user defined)	UDINT	rw	Rx	P1.7184.0.0
0x216C.13	Nominal motor voltage (user defined)	REAL	rw	Rx	P1.71421.0.0
0x216C.14	Continuous current (user defined)	REAL	rw	Rx	P1.71424.0.0
0x216C.15	Lq inductance (user defined)	REAL	rw	Rx	P1.71430.0.0
0x216C.16	Ld inductance (user defined)	REAL	rw	Rx	P1.71431.0.0
0x216C.17	Motor type	USINT	rw	Rx	P1.71432.0.0
0x216C.18	Denominator pole pairs (user-defined)	UDINT	rw	Rx	P1.7185.0.0
0x216C.1A	Fieldweakening: max. rotary speed (user defined)	REAL	rw	Rx	P1.71371.0.0
0x216C.1B	Pitch length (user defined)	REAL	rw	Rx	P1.102901.0.0
0x216C.1C	Rated velocity linear (user defined)	REAL	rw	Rx	P1.102904.0.0
0x216C.1D	Maximum velocity linear (user defined)	REAL	rw	Rx	P1.102905.0.0
0x216C.1E	Maximum velocity fieldweakening linear (user defined)	REAL	rw	Rx	P1.102906.0.0
0x216C.1F	Force constant (user defined)	REAL	rw	Rx	P1.102907.0.0
0x216C.20	Slide weight linear (user defined)	REAL	rw	Rx	P1.102928.0.0
0x216D.01	Control word CiA402	UINT	rw	Rx	P1.730.0.0
0x216D.02	Status word CiA402	UINT	ro	Tx	P1.731.0.0
0x216D.05	Supported drive modes CiA402	UDINT	ro	Tx	P1.734.0.0
0x216D.06	Internal status state machine profile CiA402	UDINT	ro	Tx	P1.735.0.0
0x216D.07	Internal status state machine profile position mode CiA402	UDINT	ro	Tx	P1.736.0.0

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0x216D.08	Internal status state machine profile velocity mode CiA402	UDINT	ro	Tx	P1.737.0.0
0x216D.09	Internal status state machine profile homing CiA402	UDINT	ro	Tx	P1.738.0.0
0x216D.0A	Internal status state machine profile torque mode CiA402	UDINT	ro	Tx	P1.526782.0.0
0x216D.0B	Status record table CiA402	UDINT	ro	Tx	P1.11280055.0.0
0x216D.0C	Modes of operation CiA402	SINT	rw	Rx	P1.12234.0.0
0x216D.0D	Modes of operation display CiA402	SINT	ro	Tx	P1.12235.0.0
0x216D.0E	Diagnostic category: Invalid mode of operation	UINT	rw	Rx	P1.12236.0.0
0x216D.0F	Storage option: Invalid mode of operation	USINT	rw	Rx	P1.12237.0.0
0x216D.10	Modes of operation CiA402	SINT	ro	Tx	P1.12238.0.0
0x216D.11	Modes of operation display CiA402	SINT	ro	Tx	P1.12239.0.0
0x216D.12	Status Interpolation Position	UDINT	ro	Tx	P1.7301.0.0
0x216D.13	Diagnosis V034 Compatible	USINT	rw	Rx	P1.100975.0.0
0x216E.01	User unit position	UINT	rw	Rx	P1.7851.0.0
0x216E.02	User unit velocity	UINT	rw	Rx	P1.7852.0.0
0x216E.03	User unit acceleration	UINT	rw	Rx	P1.7853.0.0
0x216E.04	User unit jerk	UINT	rw	Rx	P1.7854.0.0
0x216E.05	SI unit position CiA402	UDINT	rw	Rx	P1.7860.0.0
0x216E.06	SI unit and velocity CiA402	UDINT	rw	Rx	P1.7861.0.0
0x216E.07	SI unit acceleration CiA402	UDINT	rw	Rx	P1.7862.0.0
0x216E.08	SI unit and jerk CiA402	UDINT	rw	Rx	P1.7863.0.0
0x216E.09	Actual increments per revolution	UDINT	ro	Tx	P1.7864.0.0
0x216E.0A	Selection of next increments per revolution	UDINT	rw	Rx	P1.7865.0.0
0x216E.0B	Actual status Activation increments per revolution	USINT	ro	Tx	P1.7866.0.0
0x216E.0C	Selection of activation of increments per revolution	USINT	rw	Rx	P1.7867.0.0
0x216F.01	Torque offset CiA402	REAL	rw	Rx	P1.8111.0.0
0x216F.02	Number homing methods CiA402	USINT	ro	Tx	P1.8118.0.0
0x216F.03	Target position CiA402	LINT	rw	Rx	P1.8130.0.0
0x216F.04	Profile velocity CiA402	REAL	rw	Rx	P1.8131.0.0
0x216F.05	End velocity CiA402	REAL	rw	Rx	P1.8132.0.0
0x216F.06	Profile acceleration CiA402	REAL	rw	Rx	P1.8133.0.0
0x216F.07	Profile deceleration CiA402	REAL	rw	Rx	P1.8134.0.0
0x216F.08	Quick stop deceleration CiA402	REAL	rw	Rx	P1.8135.0.0
0x216F.09	Profile jerk CiA402	REAL	rw	Rx	P1.8136.0.0
0x216F.0A	Target velocity CiA402	REAL	rw	Rx	P1.8137.0.0
0x216F.0B	Velocity offset CiA402	REAL	rw	Rx	P1.8138.0.0
0x216F.0C	Positioning option code CiA402	UINT	rw	Rx	P1.88817.0.0
0x216F.0D	Target torque CiA402	REAL	rw	Rx	P1.526795.0.0
0x216F.0E	Torque slope CiA402	REAL	rw	Rx	P1.526799.0.0
0x216F.0F	Velocity limitation profile torque mode CiA402	REAL	rw	Rx	P1.526800.0.0
0x216F.10	Positive stroke limitation CiA402	LINT	rw	Rx	P1.526802.0.0

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0x216F.11	Negative stroke limitation CiA402	LINT	rw	Rx	P1.526803.0.0
0x216F.12	Velocity actual value CiA402	LINT	rw	Rx	P1.8140.0.0
0x216F.13	Active CSx mode CiA402	UDINT	ro	Tx	P1.8144.0.0
0x216F.14	Next record table index CiA402	DINT	rw	Rx	P1.11280053.0.0
0x216F.15	Activate stroke limit CiA402	USINT	rw	Rx	P1.526804.0.0
0x216F.16	Extended Modulo mode	USINT	rw	Rx	P1.88818.0.0
0x2170.01	Functional safety status	UDINT	ro	Tx	P1.820.0.0
0x2170.02	Diagnostic category: Safety function requested	UINT	rw	Rx	P1.821.0.0
0x2170.03	Storage option: Safety function requested	USINT	rw	Rx	P1.822.0.0
0x2170.04	Control word Motion Manager	UDINT	ro	Tx	P1.823.0.0
0x2171.01	Filter time constant noise signal generator	REAL	rw	Rx	P1.8615.0.0
0x2171.02	Noise signal generator amplification gain	REAL	rw	Rx	P1.8616.0.0
0x2171.03	Signal selection noise signal generator	USINT	rw	Rx	P1.8617.0.0
0x2172.01	Referencing status	UDINT	ro	Tx	P1.840.0.0
0x2172.02	Move to axis zero point after homing	USINT	rw	Rx	P1.841.0.0
0x2172.03	Homing timeout	REAL	rw	Rx	P1.842.0.0
0x2172.04	Search for reference mark setpoint velocity	REAL	rw	Rx	P1.843.0.0
0x2172.05	Search for reference mark setpoint acceleration	REAL	rw	Rx	P1.844.0.0
0x2172.06	Search for reference mark setpoint jerk	REAL	rw	Rx	P1.845.0.0
0x2172.07	Setpoint reference mark creeping velocity	REAL	rw	Rx	P1.846.0.0
0x2172.08	Setpoint reference mark creeping acceleration	REAL	rw	Rx	P1.847.0.0
0x2172.09	Setpoint reference mark creeping jerk	REAL	rw	Rx	P1.848.0.0
0x2172.0A	Move to axis zero point setpoint velocity	REAL	rw	Rx	P1.849.0.0
0x2172.0B	Move to axis zero point setpoint acceleration	REAL	rw	Rx	P1.8410.0.0
0x2172.0C	Search for move to axis zero point setpoint jerk	REAL	rw	Rx	P1.8411.0.0
0x2172.0D	Maximum search stroke in positive direction	LINT	rw	Rx	P1.8412.0.0
0x2172.0E	Maximum search stroke in negative direction	LINT	rw	Rx	P1.8413.0.0
0x2172.0F	Nominal current limit value scaling factor	REAL	rw	Rx	P1.8414.0.0
0x2172.10	Limit position detection time monitoring window	REAL	rw	Rx	P1.8415.0.0
0x2172.11	Axis zero point offset	LINT	rw	Rx	P1.8416.0.0
0x2172.12	Referencing method	DINT	rw	Rx	P1.8417.0.0
0x2172.13	Status state machine homing	UDINT	ro	Tx	P1.8418.0.0
0x2172.19	Diagnostic category: Configuration of homing run invalid	UINT	rw	Rx	P1.8450.0.0
0x2172.1A	Storage option: Configuration of homing run invalid	USINT	rw	Rx	P1.8451.0.0
0x2172.1B	Diagnostic category: Homing: Timeout	UINT	rw	Rx	P1.8452.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2172.1C	Storage option: Homing: Timeout	USINT	rw	Rx	P1.8453.0.0
0x2172.1D	Diagnostic category: Homing: Search path exceeded	UINT	rw	Rx	P1.8454.0.0
0x2172.1E	Storage option: Homing: Search path exceeded	USINT	rw	Rx	P1.8455.0.0
0x2172.1F	Activation Save zero point offset	USINT	rw	Rx	P1.100548.0.0
0x2172.20	Storage option: Unsupported homing method	USINT	rw	Rx	P1.101344.0.0
0x2172.21	Diagnostic category: Unsupported homing method	UINT	rw	Rx	P1.101348.0.0
0x2172.22	Offset position relative	LINT	rw	Rx	P1.102222.0.0
0x2172.23	Enable working stroke detection	USINT	rw	Rx	P1.102909.0.0
0x2172.24	Working stroke detection method	DINT	rw	Rx	P1.102910.0.0
0x2172.25	Offset software limit to position mark	LINT	rw	Rx	P1.102911.0.0
0x2172.26	Move free offset	LINT	rw	Rx	P1.102912.0.0
0x2172.27	Detected working stroke	LINT	ro	Tx	P1.102913.0.0
0x2173.01	Status auto tuning	USINT	ro	Tx	P1.860.0.0
0x2173.02	Result of position controller amplification gain	REAL	rw	Rx	P1.8601.0.0
0x2173.03	Result of velocity controller integration constant	REAL	rw	Rx	P1.8602.0.0
0x2173.04	Result of velocity controller amplification gain	REAL	rw	Rx	P1.8603.0.0
0x2173.06	Storage option: Transmission of auto tuning measured values failed	USINT	rw	Rx	P1.8605.0.0
0x2174.01	Start value position controller amplification gain	REAL	rw	Rx	P1.8611.0.0
0x2174.02	Start value velocity controller amplification gain	REAL	rw	Rx	P1.8612.0.0
0x2174.03	Start value velocity controller integration constant	REAL	rw	Rx	P1.8613.0.0
0x2174.04	Filter time constant velocity controller	REAL	rw	Rx	P1.8614.0.0
0x2174.05	Time delay noise signal for the start identification	REAL	rw	Rx	P1.8618.0.0
0x2174.06	Identification with movement	USINT	rw	Rx	P1.8619.0.0
0x2174.07	Number of identifications for averaging	USINT	rw	Rx	P1.8620.0.0
0x2174.08	Maximum movement stroke during the identification	LINT	rw	Rx	P1.8621.0.0
0x2174.09	Maximum velocity during the identification	REAL	rw	Rx	P1.8622.0.0
0x2174.0A	Maximum acceleration during the identification	REAL	rw	Rx	P1.8623.0.0
0x2174.0B	Maximum deceleration during the identification	REAL	rw	Rx	P1.8624.0.0
0x2174.0C	Maximum jerk during the identification	REAL	rw	Rx	P1.8625.0.0
0x2174.0D	Number of validation movements	USINT	rw	Rx	P1.8630.0.0
0x2174.0E	Movement stroke during validation movement	LINT	rw	Rx	P1.8631.0.0
0x2174.0F	Maximum velocity during validation movement	REAL	rw	Rx	P1.8632.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2174.10	Maximum acceleration during validation movement	REAL	rw	Rx	P1.8633.0.0
0x2174.11	Maximum deceleration during validation movement	REAL	rw	Rx	P1.8634.0.0
0x2174.12	Maximum jerk during validation movement	REAL	rw	Rx	P1.8635.0.0
0x2176.02	Interpolator output position	LINT	ro	Tx	P1.911.0.0
0x2176.03	Interpolator output velocity	REAL	ro	Tx	P1.912.0.0
0x2176.04	Interpolator output acceleration	REAL	ro	Tx	P1.913.0.0
0x2176.05	Interpolator output jerk	REAL	ro	Tx	P1.914.0.0
0x2176.06	Interpolator output torque	REAL	ro	Tx	P1.915.0.0
0x2176.07	Interpolator output current	REAL	ro	Tx	P1.916.0.0
0x2176.0A	Counter motion task	UDINT	ro	Tx	P1.917.0.0
0x2177.01	Motor temperature	REAL	ro	Tx	P1.940.0.0
0x2177.02	Status motor temperature	DINT	ro	Tx	P1.941.0.0
0x2177.03	Temperature sensor type motor	UDINT	ro	Tx	P1.942.0.0
0x2177.06	Lower limit value warning threshold motor temperature	REAL	rw	Rx	P1.945.0.0
0x2177.07	Hysteresis lower limit value warning threshold motor temperature	REAL	rw	Rx	P1.946.0.0
0x2177.08	Lower limit value motor temperature	REAL	rw	Rx	P1.947.0.0
0x2177.09	Hysteresis lower limit value motor temperature	REAL	rw	Rx	P1.948.0.0
0x2177.0A	Upper limit value warning threshold motor temperature	REAL	rw	Rx	P1.949.0.0
0x2177.0B	Hysteresis upper limit value warning threshold motor temperature	REAL	rw	Rx	P1.9410.0.0
0x2177.0C	Upper limit value motor temperature	REAL	rw	Rx	P1.9411.0.0
0x2177.0D	Hysteresis upper limit value motor temperature	REAL	rw	Rx	P1.9412.0.0
0x2177.0E	Diagnostic category: Warning threshold: Insufficient temperature in motor	UINT	rw	Rx	P1.9413.0.0
0x2177.0F	Storage option: Warning threshold: Insufficient temperature in motor	USINT	rw	Rx	P1.9414.0.0
0x2177.10	Diagnostic category: Insufficient temperature in motor	UINT	rw	Rx	P1.9415.0.0
0x2177.11	Storage option: Insufficient temperature in motor	USINT	rw	Rx	P1.9416.0.0
0x2177.12	Diagnostic category: Warning threshold: Motor overtemperature	UINT	rw	Rx	P1.9417.0.0
0x2177.13	Storage option: Warning threshold: Motor overtemperature	USINT	rw	Rx	P1.9418.0.0
0x2177.14	Diagnostic category: Motor overtemperature	UINT	rw	Rx	P1.9419.0.0
0x2177.15	Storage option: Motor overtemperature	USINT	rw	Rx	P1.9420.0.0
0x2177.16	Active encoder temperature monitoring motor	UDINT	ro	Tx	P1.9421.0.0
0x2178.01	SFB error status	UDINT	ro	Tx	P1.950.0.0
0x2178.02	Feedback signals	UDINT	ro	Tx	P1.951.0.0
0x2178.03	STA hysteresis time	REAL	ro	Tx	P1.952.0.0
0x2179.01	Activation analog input	USINT	rw	Rx	P1.9910.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2179.02	Alternative setpoint value	REAL	rw	Rx	P1.9911.0.0
0x2179.03	Setpoint value analog input	REAL	ro	Tx	P1.9912.0.0
0x2179.04	Diagnostic category: Analog setpoint specification limit exceeded	UINT	rw	Rx	P1.9913.0.0
0x2179.05	Storage option: Analog setpoint specification limit exceeded	USINT	rw	Rx	P1.9914.0.0
0x217A.01	Fine interpolator output position	LINT	ro	Tx	P1.100.0.0
0x217A.02	Fine interpolator output velocity	REAL	ro	Tx	P1.101.0.0
0x217A.03	Fine interpolator output acceleration	REAL	ro	Tx	P1.102.0.0
0x217A.04	Fine interpolator output jerk	REAL	ro	Tx	P1.103.0.0
0x217A.05	Fine interpolator output torque	REAL	ro	Tx	P1.104.0.0
0x217A.06	Fine interpolator output current	REAL	ro	Tx	P1.105.0.0
0x217A.08	Fine interpolator status	UDINT	ro	Tx	P1.107.0.0
0x217A.09	Storage option: Number of interpolation points exceeded	USINT	rw	Rx	P1.101571.0.0
0x217A.0A	Diagnostic category: Number of interpolation points exceeded	UINT	rw	Rx	P1.101573.0.0
0x217B.01	IPO mode position	LINT	ro	Tx	P1.1140.0.0
0x217B.02	IPO mode velocity	REAL	ro	Tx	P1.1141.0.0
0x217B.03	IPO mode acceleration	REAL	ro	Tx	P1.1142.0.0
0x217B.04	IPO mode jerk	REAL	ro	Tx	P1.1143.0.0
0x217B.05	IPO mode torque	REAL	ro	Tx	P1.1144.0.0
0x217B.06	IPO mode current	REAL	ro	Tx	P1.1145.0.0
0x217B.07	IPO mode active	UDINT	ro	Tx	P1.1146.0.0
0x217B.08	Next IPO mode	UDINT	ro	Tx	P1.1147.0.0
0x217B.09	Actual IPO mode	UDINT	ro	Tx	P1.1148.0.0
0x217B.0A	Status next IPO mode	UDINT	ro	Tx	P1.1149.0.0
0x217B.0B	IPO mode (status)	UDINT	ro	Tx	P1.11410.0.0
0x217B.0C	Interpolation step size	UDINT	ro	Tx	P1.11411.0.0
0x217B.0D	Interpolation mode CSP	UDINT	rw	Rx	P1.11412.0.0
0x217B.0E	Interpolation mode CSV	UDINT	rw	Rx	P1.11413.0.0
0x217B.0F	Interpolation mode CST	UDINT	rw	Rx	P1.11414.0.0
0x217B.12	Timing tolerance	DINT	ro	Tx	P1.11417.0.0
0x217B.13	Interpolation step loss counter	DINT	ro	Tx	P1.11418.0.0
0x217B.14	CS IPO delta time	REAL	ro	Tx	P1.102914.0.0
0x217C.01	Actual user unit	UDINT	ro	Tx	P1.1150.0.0
0x217C.02	Selection of next user unit	UDINT	rw	Rx	P1.1151.0.0
0x217C.03	User unit status	UDINT	ro	Tx	P1.1152.0.0
0x217C.04	Actual torque constant	REAL	ro	Tx	P1.1153.0.0
0x217C.05	Actual pole pairs	UDINT	ro	Tx	P1.1154.0.0
0x217C.06	Diagnostic category: User unit error	UINT	ro	Tx	P1.1159.0.0
0x217C.07	Storage option: User unit error	USINT	rw	Rx	P1.11590.0.0
0x217C.08	Storage option: Invalid gearbox configuration	USINT	rw	Rx	P1.102876.0.0
0x217C.09	Diagnostic category: Invalid gearbox configuration	UINT	ro	Tx	P1.102877.0.0
0x217D.01	Reversing direction of motion	USINT	rw	Rx	P1.1170.0.0
0x217D.02	Phase rotation	USINT	rw	Rx	P1.1172.0.0

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0x217D.03	Reversing the direction of rotation validation status	USINT	ro	Tx	P1.1173.0.0
0x217D.04	Validation status of phase rotation	USINT	ro	Tx	P1.1175.0.0
0x217E.01	Database ID of axis	UDINT	rw	Rx	P1.1191.0.0
0x217E.02	Order code Axis	STRING(50)	rw	Rx	P1.1192.0.0 ... 49
0x217E.03	Load weight / load inertia	REAL	rw	Rx	P1.1193.0.0
0x217E.04	Feed constant numerator	UDINT	rw	Rx	P1.1194.0.0
0x217E.05	Feed constant denominator	UDINT	rw	Rx	P1.1195.0.0
0x217E.06	Working stroke	LINT	rw	Rx	P1.1196.0.0
0x217E.07	Design axis	UDINT	rw	Rx	P1.1197.0.0
0x217E.08	Length connecting shaft	REAL	rw	Rx	P1.1198.0.0
0x217E.09	Maximum driving torque axis	REAL	rw	Rx	P1.1199.0.0
0x217E.0A	Unlimited axis	USINT	rw	Rx	P1.2424.0.0
0x217E.0B	Dynamic losses	REAL	rw	Rx	P1.124323.0.0
0x217E.0C	Inertia connecting shaft	REAL	rw	Rx	P1.100835.0.0
0x217E.0D	Mounting position Axis	REAL	rw	Rx	P1.101741.0.0
0x217F.01	Database ID of mounting kit	UDINT	rw	Rx	P1.1200.0.0
0x217F.02	Order code mounting kit	STRING(37)	rw	Rx	P1.1201.0.0 ... 36
0x217F.03	Database ID connecting shaft / coupling	UDINT	rw	Rx	P1.1202.0.0
0x217F.04	Order code connecting shaft / coupling	STRING(37)	rw	Rx	P1.1203.0.0 ... 36
0x217F.05	Database ID cable set	UDINT	rw	Rx	P1.1204.0.0
0x217F.06	Order code cable set	STRING(37)	rw	Rx	P1.1205.0.0 ... 36
0x217F.07	Length motor cable	REAL	rw	Rx	P1.1206.0.0
0x217F.08	Status device configured	USINT	rw	Rx	P1.1207.0.0
0x217F.09	Cable cross section	REAL	rw	Rx	P1.1208.0.0
0x217F.0A	Inertia coupling	REAL	rw	Rx	P1.124322.0.0
0x217F.0B	Mains voltage	REAL	rw	Rx	P1.1209.0.0
0x2180.01	Deceleration Stop ramp	REAL	rw	Rx	P1.12101.0.0
0x2180.02	Jerk Stop ramp	REAL	rw	Rx	P1.12111.0.0
0x2180.03	Stop ramp velocity	REAL	rw	Rx	P1.12112.0.0
0x2181.01	Stop position	LINT	ro	Tx	P1.12201.0.0
0x2181.02	Stop ramp time	REAL	ro	Tx	P1.12202.0.0
0x2181.05	Status Stop ramp	UDINT	ro	Tx	P1.12205.0.0
0x2181.06	Factor extrapolation stop ramp	REAL	rw	Rx	P1.12206.0.0
0x2182.01	Database ID gear unit 1	UDINT	rw	Rx	P1.1230.0.0
0x2182.02	Order code gear unit 1	STRING(37)	rw	Rx	P1.1231.0.0 ... 36
0x2182.03	Conversion factor gear unit 1 numerator	UDINT	rw	Rx	P1.1232.0.0
0x2182.04	Conversion factor gear unit 1 denominator	UDINT	rw	Rx	P1.1233.0.0
0x2182.05	Database ID gear unit 2	UDINT	rw	Rx	P1.1234.0.0
0x2182.06	Order code gear unit 2	STRING(37)	rw	Rx	P1.1235.0.0 ... 36
0x2182.07	Conversion factor gear unit 2 numerator	UDINT	rw	Rx	P1.1236.0.0
0x2182.08	Conversion factor gear unit 2 denominator	UDINT	rw	Rx	P1.1237.0.0
0x2182.09	Database ID gear unit 3	UDINT	rw	Rx	P1.1238.0.0
0x2182.0A	Order code gear unit 3	STRING(37)	rw	Rx	P1.1239.0.0 ... 36
0x2182.0B	Conversion factor gear unit 3 numerator	UDINT	rw	Rx	P1.1240.0.0

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0x2182.0C	Conversion factor gear unit 3 denominator	UDINT	rw	Rx	P1.1241.0.0
0x2182.0D	Total conversion factor gear unit numerator	UDINT	rw	Rx	P1.1242.0.0
0x2182.0E	Total conversion factor gear unit denominator	UDINT	rw	Rx	P1.1243.0.0
0x2182.0F	Inertia Gear	REAL	rw	Rx	P1.124321.0.0
0x2182.10	Conversion factor gear unit 4 numerator	UDINT	rw	Rx	P1.101215.0.0
0x2182.11	Conversion factor gear unit 4 denominator	UDINT	rw	Rx	P1.101216.0.0
0x2182.12	Activation of extended gear ratio	USINT	rw	Rx	P1.101905.0.0
0x2183.01	Velocity limitation status	USINT	ro	Tx	P1.1301.0.0
0x2183.02	Acceleration limitation status	USINT	ro	Tx	P1.1302.0.0
0x2183.03	Torque limitation status	USINT	ro	Tx	P1.1303.0.0
0x2183.04	Limit value velocity limit positive and negative direction of movement	REAL	rw	Rx	P1.1304.0.0
0x2183.05	Upper limit value acceleration limitation	REAL	rw	Rx	P1.1305.0.0
0x2183.06	Upper limit value deceleration limitation	REAL	rw	Rx	P1.1306.0.0
0x2183.07	Upper limit torque limitation	REAL	rw	Rx	P1.1307.0.0
0x2183.08	Lower limit torque limitation	REAL	rw	Rx	P1.1308.0.0
0x2183.09	Velocity override	REAL	rw	Rx	P1.1309.0.0
0x2183.0A	Storage option: Invalid limit value Application limitation	USINT	rw	Rx	P1.18.0.0
0x2183.0B	Diagnostic category: Invalid limit value Application limitation	UINT	rw	Rx	P1.53.0.0
0x2183.0C	Limit value velocity limit negative direction of movement	REAL	rw	Rx	P1.1310.0.0
0x2183.0D	Lower limit value acceleration limitation	REAL	rw	Rx	P1.1311.0.0
0x2183.0E	Lower limit value deceleration limit	REAL	rw	Rx	P1.1312.0.0
0x2183.12	Lower limit value jerk	REAL	rw	Rx	P1.102777.0.0
0x2183.13	Upper limit value jerk	REAL	rw	Rx	P1.102778.0.0
0x2183.14	Jerk limitation status	USINT	ro	Tx	P1.102796.0.0
0x2183.15	Enable analog velocity override input	USINT	rw	Rx	P1.130911.0.0
0x2184.01	Mileage 1	LINT	rw	Rx	P1.1411.0.0
0x2184.05	Mileage warning threshold	LINT	rw	Rx	P1.1417.0.0
0x2184.06	Diagnostic category: Mileage warning threshold reached	UINT	rw	Rx	P1.1419.0.0
0x2184.07	Storage option: Mileage warning threshold reached	USINT	rw	Rx	P1.14110.0.0
0x2184.08	Mileage error threshold	LINT	rw	Rx	P1.14111.0.0
0x2184.09	Diagnostic category: Mileage error threshold reached	UINT	rw	Rx	P1.14113.0.0
0x2184.0A	Storage option: Mileage error threshold reached	USINT	rw	Rx	P1.14114.0.0
0x2184.0B	Mileage 2	LINT	rw	Rx	P1.1414.0.0
0x2185.01	Load change counter 1	LINT	rw	Rx	P1.1421.0.0
0x2185.05	Warning threshold load change counter	LINT	rw	Rx	P1.1427.0.0
0x2185.06	Diagnostic category: Load change warning threshold reached	UINT	rw	Rx	P1.1429.0.0

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0x2185.07	Storage option: Load change warning threshold reached	USINT	rw	Rx	P1.14210.0.0
0x2185.08	Error threshold load change counter	LINT	rw	Rx	P1.14211.0.0
0x2185.09	Diagnostic category: Load change error threshold reached	UINT	rw	Rx	P1.14213.0.0
0x2185.0A	Storage option: Load change error threshold reached	USINT	rw	Rx	P1.14214.0.0
0x2185.0B	Load change counter 2	LINT	rw	Rx	P1.1424.0.0
0x2186.01	Jog duration 1 movement	REAL	rw	Rx	P1.1510.0.0
0x2186.02	Slow jog 1 velocity	REAL	rw	Rx	P1.1511.0.0
0x2186.03	Slow jog 1 acceleration	REAL	rw	Rx	P1.1512.0.0
0x2186.04	Slow jog 1 jerk	REAL	rw	Rx	P1.1513.0.0
0x2186.05	Fast jog 1 velocity	REAL	rw	Rx	P1.1514.0.0
0x2186.06	Fast jog 1 acceleration	REAL	rw	Rx	P1.1515.0.0
0x2186.07	Fast jog 1 jerk	REAL	rw	Rx	P1.1516.0.0
0x2186.08	Jogging state	UDINT	ro	Tx	P1.526917.0.0
0x2186.09	Activation of symmetrical jog	USINT	rw	Rx	P1.214526.0.0
0x2186.0D	Relative position jog 1	LINT	rw	Rx	P1.214530.0.0
0x2186.12	Slow jog 2 velocity	REAL	rw	Rx	P1.214535.0.0
0x2186.13	Slow jog 2 acceleration	REAL	rw	Rx	P1.214536.0.0
0x2186.14	Slow jog 2 jerk	REAL	rw	Rx	P1.214537.0.0
0x2186.15	Relative position jog 2.	LINT	rw	Rx	P1.214538.0.0
0x2186.16	Jog duration 2 movement	REAL	rw	Rx	P1.214539.0.0
0x2186.17	Fast jog 2 velocity	REAL	rw	Rx	P1.214540.0.0
0x2186.18	Fast jog 2 acceleration	REAL	rw	Rx	P1.214541.0.0
0x2186.19	Fast jog 2 jerk	REAL	rw	Rx	P1.214542.0.0
0x2186.1A	Actually used slow jog 1 velocity	REAL	ro	Tx	P1.214543.0.0
0x2186.1B	Actually used slow jog 1 acceleration	REAL	ro	Tx	P1.214544.0.0
0x2186.1C	Actually used slow jog 1 jerk	REAL	ro	Tx	P1.214545.0.0
0x2186.1D	Actually used jog 1 movement duration	REAL	ro	Tx	P1.214546.0.0
0x2186.1E	Actually used fast jog 1 velocity	REAL	ro	Tx	P1.214547.0.0
0x2186.1F	Actually used fast jog 1 acceleration	REAL	ro	Tx	P1.214548.0.0
0x2186.20	Actually used fast jog 1 jerk	REAL	ro	Tx	P1.214549.0.0
0x2186.21	Actually used slow jog 2 velocity	REAL	ro	Tx	P1.214550.0.0
0x2186.22	Actually used slow jog 2 acceleration	REAL	ro	Tx	P1.214551.0.0
0x2186.23	Actually used slow jog 2 jerk	REAL	ro	Tx	P1.214552.0.0
0x2186.24	Actually used jog 2 movement duration	REAL	ro	Tx	P1.214553.0.0
0x2186.25	Actually used fast jog 2 velocity	REAL	ro	Tx	P1.214554.0.0
0x2186.26	Actually used fast jog 2 acceleration	REAL	ro	Tx	P1.214555.0.0
0x2186.27	Actually used fast jog 2 jerk	REAL	ro	Tx	P1.214556.0.0
0x2186.28	Activation symmetrical accelera-tion/deceleration	USINT	rw	Rx	P1.102395.0.0
0x2186.29	Deceleration Jog 1 slow	REAL	rw	Rx	P1.102397.0.0
0x2186.2A	Actual used deceleration Jog 1 slow	REAL	ro	Tx	P1.102399.0.0
0x2186.2B	Deceleration Jog 1 fast	REAL	rw	Rx	P1.102401.0.0
0x2186.2C	Actual used deceleration Jog 1 fast	REAL	ro	Tx	P1.102405.0.0
0x2186.2D	Deceleration Jog 2 slow	REAL	rw	Rx	P1.102407.0.0

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0x2186.2E	Actual used deceleration Jog 2 slow	REAL	ro	Tx	P1.102409.0.0
0x2186.2F	Deceleration Jog 2 fast	REAL	rw	Rx	P1.102413.0.0
0x2186.30	Actual used deceleration Jog 2 fast	REAL	ro	Tx	P1.102415.0.0
0x2188.01	Current ramp	REAL	rw	Rx	P1.1555.0.0
0x2188.02	Conversion factor torque	REAL	rw	Rx	P1.1556.0.0
0x2188.03	Setpoint generator output position	LINT	ro	Tx	P1.3010.0.0
0x2188.04	Setpoint generator output velocity	REAL	ro	Tx	P1.3011.0.0
0x2188.05	Setpoint generator output acceleration	REAL	ro	Tx	P1.3012.0.0
0x2188.06	Setpoint generator output jerk	REAL	ro	Tx	P1.3013.0.0
0x2188.07	Setpoint generator output torque	REAL	ro	Tx	P1.3014.0.0
0x2188.08	Setpoint generator output current	REAL	ro	Tx	P1.3015.0.0
0x2188.09	Setpoint generator input relative target position	LINT	ro	Tx	P1.3016.0.0
0x2188.0A	Setpoint generator input relative target velocity	REAL	ro	Tx	P1.3017.0.0
0x2188.0B	Status setpoint generator	UDINT	ro	Tx	P1.3018.0.0
0x2188.0C	Diagnostic category: Trajectory generator error	UINT	rw	Rx	P1.30127.0.0
0x2188.0D	Storage option: Trajectory generator error	USINT	rw	Rx	P1.30128.0.0
0x2188.0E	Monitoring window factor	REAL	rw	Rx	P1.30129.0.0
0x2188.1D	Diagnostic category: Torque increase ramp invalid	UINT	rw	Rx	P1.1130225.0.0
0x2188.1E	Storage option: Torque increase ramp invalid	USINT	rw	Rx	P1.1130226.0.0
0x2189.01	Configure negative hardware limit switch	UDINT	rw	Rx	P1.101100.0.0
0x2189.02	Configure positive hardware limit switch	UDINT	rw	Rx	P1.101101.0.0
0x2189.03	Diagnostic category: Negative hardware limit switch reached	UINT	rw	Rx	P1.101102.0.0
0x2189.04	Storage option: Negative hardware limit switch reached	USINT	rw	Rx	P1.101103.0.0
0x2189.05	Diagnostic category: Limitation by negative hardware limit switch	UINT	rw	Rx	P1.101104.0.0
0x2189.06	Storage option: Limitation by negative hardware limit switch	USINT	rw	Rx	P1.101105.0.0
0x2189.07	Diagnostic category: Positive hardware limit switch reached	UINT	rw	Rx	P1.101106.0.0
0x2189.08	Storage option: Positive hardware limit switch reached	USINT	rw	Rx	P1.101107.0.0
0x2189.09	Diagnostic category: Limitation by positive hardware limit switch	UINT	rw	Rx	P1.101108.0.0
0x2189.0A	Storage option: Limitation by positive hardware limit switch	USINT	rw	Rx	P1.101109.0.0
0x2189.0B	Diagnostic category: Error: both hardware limit switches activated	UINT	rw	Rx	P1.101110.0.0
0x2189.0C	Storage option: Error: both hardware limit switches activated	USINT	rw	Rx	P1.101111.0.0
0x2189.0D	Negative hardware limit switch detected	USINT	ro	Tx	P1.101112.0.0
0x2189.0E	Positive hardware limit switch detected	USINT	ro	Tx	P1.101113.0.0
0x2189.0F	Negative limit switch position detected	LINT	ro	Tx	P1.101114.0.0

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0x2189.10	Positive limit switch position detected	LINT	ro	Tx	P1.101115.0.0
0x2189.11	Activation of hardware limit switch monitoring	USINT	rw	Rx	P1.101116.0.0
0x218A.01	Reference switch configuration	UDINT	rw	Rx	P1.101200.0.0
0x218A.02	Reference switch status	USINT	ro	Tx	P1.101201.0.0
0x218D.01	Active switch-on threshold reactive current braking	REAL	ro	Tx	P1.102101.0.0
0x218D.02	Active end value reactive current braking	REAL	ro	Tx	P1.102102.0.0
0x218D.03	Status reactive current braking	USINT	ro	Tx	P1.102103.0.0
0x218D.04	Activate reactive current braking	USINT	rw	Rx	P1.102104.0.0
0x218D.05	Maximum reactive current reactive current braking	REAL	ro	Tx	P1.102105.0.0
0x218D.06	Actual value reactive current braking	REAL	ro	Tx	P1.102106.0.0
0x218D.07	Activate automatic voltage determination	USINT	rw	Rx	P1.102107.0.0
0x218D.08	Switch-on threshold reactive current braking	REAL	rw	Rx	P1.102108.0.0
0x218D.09	End value reactive current braking	REAL	rw	Rx	P1.102109.0.0
0x218D.0A	Scaling factor offset of voltage calculation	REAL	rw	Rx	P1.102110.0.0
0x218E.01	Device status IO	UDINT	ro	Tx	P1.10231.0.0
0x218E.02	Controller enable selection	UDINT	rw	Rx	P1.10232.0.0
0x218E.03	Controller enable operating mode	UDINT	rw	Rx	P1.10234.0.0
0x218E.04	Target velocity for controller enable (velocity operation)	REAL	rw	Rx	P1.10235.0.0
0x218E.05	Target torque for controller enable (torque operation)	REAL	rw	Rx	P1.10236.0.0
0x218E.06	Maximum velocity for controller enable (torque operation)	REAL	rw	Rx	P1.10237.0.0
0x218E.07	Index for controller enable	DINT	rw	Rx	P1.10238.0.0
0x218E.08	Torque increase for controller enable	REAL	rw	Rx	P1.11280018.0.0
0x218E.09	Error active	USINT	ro	Tx	P1.112819.0.0
0x218F.01	Request directional lock	DINT	rw	Rx	P1.10351.0.0
0x218F.02	Active directional lock	DINT	ro	Tx	P1.10352.0.0
0x218F.03	Status directional lock	DINT	ro	Tx	P1.10353.0.0
0x2190.01	Default value target position	LINT	rw	Rx	P1.10361.0.0
0x2190.02	Default value maximum velocity	REAL	rw	Rx	P1.10362.0.0
0x2190.03	Default value maximum acceleration	REAL	rw	Rx	P1.10363.0.0
0x2190.04	Default value maximum deceleration	REAL	rw	Rx	P1.10364.0.0
0x2190.05	Default value maximum jerk	REAL	rw	Rx	P1.10365.0.0
0x2190.06	Default value target velocity	REAL	rw	Rx	P1.10366.0.0
0x2190.07	Default value activation stroke limitation	USINT	rw	Rx	P1.10367.0.0
0x2190.08	Default value negative stroke limit	LINT	rw	Rx	P1.10368.0.0
0x2190.09	Default value positive stroke limit	LINT	rw	Rx	P1.10369.0.0
0x2190.0A	Default value target torque	REAL	rw	Rx	P1.10370.0.0
0x2190.0B	Default value Torque rise ramp	REAL	rw	Rx	P1.10371.0.0
0x2191.01	Valid movement monitoring position control	UDINT	rw	Rx	P1.11280020.0.0

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0x2191.02	Valid movement monitoring velocity control	UDINT	rw	Rx	P1.11280021.0.0
0x2191.03	Valid movement monitoring torque regulation	UDINT	rw	Rx	P1.11280022.0.0
0x2191.04	Valid movement monitoring position control analog	UDINT	rw	Rx	P1.11280023.0.0
0x2191.05	Valid movement monitoring velocity control analog	UDINT	rw	Rx	P1.11280024.0.0
0x2191.06	Valid movement monitoring torque control analog	UDINT	rw	Rx	P1.11280025.0.0
0x2191.07	Valid movement monitoring CSP	UDINT	rw	Rx	P1.11280026.0.0
0x2191.08	Valid movement monitoring CSV	UDINT	rw	Rx	P1.11280027.0.0
0x2191.09	Valid movement monitoring CST	UDINT	rw	Rx	P1.11280028.0.0
0x2191.0A	Valid Power Off movement monitoring	UDINT	rw	Rx	P1.11280029.0.0
0x2191.0B	Valid motion monitoring Moving to fixed stop	UDINT	rw	Rx	P1.11280031.0.0
0x2191.0C	Valid motion monitoring AC4 without DSC	UDINT	rw	Rx	P1.11280032.0.0
0x2191.0D	Valid motion monitoring AC4 with DSC	UDINT	rw	Rx	P1.11280033.0.0
0x2191.10	Valid motion monitoring AC5	UDINT	rw	Rx	P1.11280034.0.0
0x2192.01 ... 02	Position trigger mode	UINT	rw	Rx	P1.112700.0.0
0x2192.03 ... 04	Position trigger source	UINT	rw	Rx	P1.112701.0.0
0x2192.05 ... 06	Upper limit value modulo	LINT	rw	Rx	P1.112702.0.0
0x2192.07 ... 08	Lower limit value modulo	LINT	rw	Rx	P1.112703.0.0
0x2192.09 ... 0A	Inactive time compensation of first switching point	REAL	rw	Rx	P1.112704.0.0
0x2192.0B ... 0C	Inactive time compensation of second switching point	REAL	rw	Rx	P1.112705.0.0
0x2192.0D ... 0E	Hysteresis	LINT	rw	Rx	P1.112706.0.0
0x2192.0F ... 10	Switching time (manual)	REAL	rw	Rx	P1.112707.0.0
0x2192.11 ... 12	Actual Position Trigger mode	UINT	ro	Tx	P1.112713.0.0
0x2192.13 ... 14	Actual Position Trigger source	UINT	ro	Tx	P1.112714.0.0
0x2192.15 ... 16	Actual upper limit value modulo	LINT	ro	Tx	P1.112715.0.0
0x2192.17 ... 18	Actual lower limit value modulo	LINT	ro	Tx	P1.112716.0.0
0x2192.19 ... 1A	Actual inactive time first switching point	REAL	ro	Tx	P1.112717.0.0
0x2192.1B ... 1C	Actual inactive time second switching point	REAL	ro	Tx	P1.112718.0.0
0x2192.1D ... 1E	Actual hysteresis	LINT	ro	Tx	P1.112719.0.0
0x2192.1F ... 20	Actual switching time (manual)	REAL	ro	Tx	P1.112720.0.0
0x2192.21 ... 22	Modulo position for the logic (ON)	LINT	ro	Tx	P1.112726.0.0
0x2192.23 ... 24	Modulo position for the logic (OFF)	LINT	ro	Tx	P1.112727.0.0
0x2192.25 ... 26	Position switch status ON/OFF	USINT	ro	Tx	P1.112728.0.0
0x2192.27 ... 28	Status modulo limit reached	USINT	ro	Tx	P1.112729.0.0
0x2192.29 ... 2A	Status active position switch	USINT	ro	Tx	P1.112730.0.0
0x2192.2D ... 2E	Offset modulo position	LINT	rw	Rx	P1.112732.0.0
0x2192.2F ... 30	Initialisation modulo	LINT	rw	Rx	P1.112733.0.0
0x2192.31 ... 32	Actual offset modulo position	LINT	ro	Tx	P1.112734.0.0
0x2192.33 ... 34	Counter modulo cycles	UDINT	ro	Tx	P1.112735.0.0
0x2192.35 ... 36	Modulo hysteresis	LINT	rw	Rx	P1.112736.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2192.37 … 38	Actual modulo hysteresis	LINT	ro	Tx	P1.112737.0.0
0x2192.39 … 3A	Threshold value velocity look-ahead	REAL	rw	Rx	P1.101017.0.0
0x2192.3B … 3C	Activation Position trigger Device start	USINT	rw	Rx	P1.101547.0.0
0x2193.01 … 02	Touch probe mode	UINT	rw	Rx	P1.113000.0.0
0x2193.03 … 04	Touch probe source	UINT	rw	Rx	P1.113001.0.0
0x2193.05 … 06	Selection trigger event	UINT	rw	Rx	P1.113002.0.0
0x2193.07 … 08	Upper limit value modulo	LINT	rw	Rx	P1.113003.0.0
0x2193.09 … 0A	Lower limit value modulo	LINT	rw	Rx	P1.113004.0.0
0x2193.0B … 0C	Lower limit value trigger event	LINT	rw	Rx	P1.113005.0.0
0x2193.0D … 0E	Upper limit value trigger event	LINT	rw	Rx	P1.113006.0.0
0x2193.0F … 10	Actual touch probe mode	UINT	ro	Tx	P1.113007.0.0
0x2193.11 … 12	Actual touch probe source	UINT	ro	Tx	P1.113008.0.0
0x2193.13 … 14	Actual selection trigger event	UINT	ro	Tx	P1.113009.0.0
0x2193.15 … 16	Actual upper limit value modulo	LINT	ro	Tx	P1.113010.0.0
0x2193.17 … 18	Actual lower limit value modulo	LINT	ro	Tx	P1.113011.0.0
0x2193.19 … 1A	Actual lower limit value trigger event	LINT	ro	Tx	P1.113012.0.0
0x2193.1B … 1C	Actual upper limit value trigger event	LINT	ro	Tx	P1.113013.0.0
0x2193.1D … 1E	Touch probe position	LINT	ro	Tx	P1.113014.0.0
0x2193.1F … 20	Time stamp touch probe position	ULINT	ro	Tx	P1.113015.0.0
0x2193.21 … 22	Trigger event initiated	USINT	ro	Tx	P1.113016.0.0
0x2193.23 … 24	Trigger event NOT initiated	USINT	ro	Tx	P1.113017.0.0
0x2193.25 … 26	Trigger events counter triggered	UDINT	ro	Tx	P1.113018.0.0
0x2193.27 … 28	Trigger events counter NOT triggered	UDINT	ro	Tx	P1.113019.0.0
0x2193.29 … 2A	Counter modulo cycles	UDINT	ro	Tx	P1.113020.0.0
0x2193.2B … 2C	Status touch probe input	USINT	ro	Tx	P1.113021.0.0
0x2193.2D … 2E	Status modulo limit reached	USINT	ro	Tx	P1.113022.0.0
0x2193.2F … 30	Modulo position	LINT	ro	Tx	P1.113023.0.0
0x2193.31 … 32	Offset modulo position	LINT	rw	Rx	P1.113024.0.0
0x2193.33 … 34	Initialisation modulo	LINT	rw	Rx	P1.113025.0.0
0x2193.35 … 36	Actual offset modulo position	LINT	ro	Tx	P1.113026.0.0
0x2193.37 … 38	Time stamp touch probe position positive CiA402	ULINT	ro	Tx	P1.113027.0.0
0x2193.39 … 3A	Time stamp touch probe position negative CiA402	ULINT	ro	Tx	P1.113028.0.0
0x2193.3B … 3C	Touch probe position positive CiA402	LINT	ro	Tx	P1.113029.0.0
0x2193.3D … 3E	Touch probe position negative CiA402	LINT	ro	Tx	P1.113030.0.0
0x2193.3F … 40	Counter initiated trigger events positive edge CiA402	UDINT	ro	Tx	P1.113031.0.0
0x2193.41 … 42	Counter initiated trigger events negative edge CiA402	UDINT	ro	Tx	P1.113032.0.0
0x2193.43 … 44	Touch probe status CiA402	UINT	ro	Tx	P1.113033.0.0
0x2193.45 … 46	Modulo hysteresis	LINT	rw	Rx	P1.113034.0.0
0x2193.47 … 48	Actual modulo hysteresis	LINT	ro	Tx	P1.113035.0.0
0x2193.49 … 4A	Delay time	REAL	rw	Rx	P1.113036.0.0
0x2193.4B … 4C	Actual delay time	REAL	ro	Tx	P1.113037.0.0
0x2194.01	Resolution position	SINT	rw	Rx	P1.7841.0.0
0x2194.02	Resolution velocity	SINT	rw	Rx	P1.7842.0.0

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0x2194.03	Resolution acceleration	SINT	rw	Rx	P1.7843.0.0
0x2194.04	Resolution jerk	SINT	rw	Rx	P1.7844.0.0
0x2194.05	Counter overruns 32-bit	DINT	ro	Tx	P1.11.0.0
0x2194.06	Diagnostic category: Resolution of position factorgroup invalid	UINT	rw	Rx	P1.45.0.0
0x2194.07	Storage option: Resolution of position factorgroup invalid	USINT	rw	Rx	P1.46.0.0
0x2195.01	Digital inputs CiA402	UDINT	ro	Tx	P1.1128052.0.0
0x2195.02	Digital outputs CiA402	UDINT	rw	Rx	P1.1128054.0.0
0x2195.03	Bit mask digital outputs CiA402	UDINT	rw	Rx	P1.1128055.0.0
0x2195.04	CiA402 version	UDINT	ro	Tx	P1.1128056.0.0
0x2195.05	Motor type CiA402	UINT	rw	Rx	P1.1128057.0.0
0x2195.06	Touch probe function CiA402	UINT	rw	Rx	P1.1128060.0.0
0x2195.07	Touch probe status CiA402	UINT	ro	Tx	P1.1128061.0.0
0x2195.08	Torque on motor side	USINT	rw	Rx	P1.1128062.0.0
0x2196.01	Error register CiA402	USINT	rw	Rx	P0.7602.0.0
0x2196.02	Local error reaction	UDINT	rw	Rx	P0.43543.0.0
0x2196.03	Sync error counter limit	UINT	rw	Rx	P0.43544.0.0
0x2196.04	Maximum messages	USINT	rw	Rx	P0.43545.0.0
0x2196.05	Newest message	USINT	rw	Rx	P0.43546.0.0
0x2196.06	Newest ack message	USINT	rw	Rx	P0.43547.0.0
0x2196.07	New message available	USINT	rw	Rx	P0.43548.0.0
0x2196.08	Flags	UINT	rw	Rx	P0.43549.0.0
0x2196.09	Timestamp object	ULINT	rw	Rx	P0.43550.0.0
0x2197.01	Requested modulo mode	UINT	rw	Rx	P1.113100.0.0
0x2197.03	Lower limit value modulo	LINT	rw	Rx	P1.113102.0.0
0x2197.04	Setpoint value modulo	LINT	ro	Tx	P1.113103.0.0
0x2197.05	Actual value modulo	LINT	ro	Tx	P1.113104.0.0
0x2197.06	Actual mode modulo	UINT	ro	Tx	P1.113105.0.0
0x2197.07	Actual upper limit value modulo	LINT	ro	Tx	P1.113106.0.0
0x2197.08	Actual lower limit value modulo	LINT	ro	Tx	P1.113107.0.0
0x2197.09	Counter modulo cycles	UDINT	ro	Tx	P1.113108.0.0
0x2197.0A	Modulo overflow status	USINT	ro	Tx	P1.113109.0.0
0x2197.0B	Offset modulo position	LINT	rw	Rx	P1.113110.0.0
0x2197.0C	Initialisation modulo position	LINT	rw	Rx	P1.113111.0.0
0x2197.0D	Actual offset modulo position	LINT	ro	Tx	P1.113112.0.0
0x2197.0E	Upper limit value modulo	LINT	rw	Rx	P1.113113.0.0
0x2197.0F	Activation Modulo device start	USINT	rw	Rx	P1.101551.0.0
0x2197.10	Tolerance window modulo	REAL	rw	Rx	P1.102100.0.0
0x2197.11	Activation compatibility V33	USINT	rw	Rx	P1.102137.0.0
0x2198.09	Master control connection ID	UDINT	ro	Tx	P1.10233999.0.0
0x219A.01	Active connection access	UINT	ro	Tx	P0.12012.0.0
0x219A.02	Maximum connection access	UINT	ro	Tx	P0.12013.0.0
0x219B.01 ... 02	Connection active	USINT	ro	Tx	P0.12014.0.0
0x219B.03 ... 04	Connection ID	UDINT	ro	Tx	P0.12015.0.0
0x219B.05 ... 06	Host IP address	UDINT	ro	Tx	P0.12016.0.0
0x219B.07 ... 08	Port host	UINT	ro	Tx	P0.12017.0.0

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0x219C.02	Setpoint value reactive current	REAL	rw	Rx	P1.270.0.0
0x219C.03	Time current increase	REAL	rw	Rx	P1.662.0.0
0x219C.04	Activation of open loop operation	USINT	rw	Rx	P1.4001.0.0
0x219C.06	Control structure of open loop operation	UDINT	rw	Rx	P1.4003.0.0
0x219C.07	Active control structure	UDINT	ro	Tx	P1.4004.0.0
0x219C.08	Selection of mode of operation open loop/closed loop	UDINT	rw	Rx	P1.4005.0.0
0x219C.09	Selection of mode of operation	UDINT	rw	Rx	P1.4006.0.0
0x219C.0A	Active mode of operation	UDINT	ro	Tx	P1.4007.0.0
0x219C.0B	Velocity switching threshold	REAL	rw	Rx	P1.4008.0.0
0x219C.0D	Current rise time	REAL	rw	Rx	P1.4010.0.0
0x219C.0E	Diagnostic category: Change of control structure not permissible	UINT	rw	Rx	P1.4020.0.0
0x219C.0F	Storage option: Change of control structure not permissible	USINT	rw	Rx	P1.4021.0.0
0x219C.14	Factor current setpoint value	REAL	rw	Rx	P1.6694.0.0
0x219C.15	Current reduction activation	USINT	rw	Rx	P1.4026.0.0
0x219C.16	Current reduction delay time	REAL	rw	Rx	P1.4027.0.0
0x219C.17	Current reduction scaling factor	REAL	rw	Rx	P1.4028.0.0
0x219F.01	Activation of field weakening	USINT	rw	Rx	P1.102201.0.0
0x219F.02	Field weakening status	USINT	ro	Tx	P1.102202.0.0
0x21A0.01	Status brake chopper	USINT	ro	Tx	P0.4801.0.0
0x21A1.01	Activation of variable message function	USINT	rw	Rx	P0.1174200.0.0
0x21A1.02	Axis ID data trigger	UINT	rw	Rx	P0.1174201.0.0
0x21A1.03	Data ID data trigger	UDINT	rw	Rx	P0.1174202.0.0
0x21A1.04	Data instance ID data trigger	UINT	rw	Rx	P0.1174203.0.0
0x21A1.05	Array ID data trigger	UINT	rw	Rx	P0.1174204.0.0
0x21A1.06	Trigger level MELDW.5	LINT	rw	Rx	P0.1174205.0.0
0x21A1.07	Hysteresis of trigger level	LINT	rw	Rx	P0.1174206.0.0
0x21A1.08	Data trigger damping time	REAL	rw	Rx	P0.1174207.0.0
0x21A1.09	Variable message function status	USINT	ro	Tx	P0.1174210.0.0
0x21A1.0A	Actual axis ID data trigger	UINT	ro	Tx	P0.1174211.0.0
0x21A1.0B	Actual data ID data trigger	UDINT	ro	Tx	P0.1174212.0.0
0x21A1.0C	Actual data instance ID data trigger	UINT	ro	Tx	P0.1174213.0.0
0x21A1.0D	Actual array ID data trigger	UINT	ro	Tx	P0.1174214.0.0
0x21A1.0E	Actual trigger level	LINT	ro	Tx	P0.1174215.0.0
0x21A1.0F	Actual hysteresis of trigger level	LINT	ro	Tx	P0.1174216.0.0
0x21A1.10	Actual data trigger damping time	REAL	ro	Tx	P0.1174217.0.0
0x21A1.11	Data trigger status	USINT	ro	Tx	P0.1174220.0.0
0x21A1.12	Diagnostic category: Invalid parameterization variable message function	UINT	rw	Rx	P0.1174230.0.0
0x21A1.13	Storage option: Invalid parameterization variable message function	USINT	rw	Rx	P0.1174231.0.0
0x21A2.01	Resolution single turn	UDINT	rw	Rx	P0.3601.0.0
0x21A2.02	Resolution multi-turn	UDINT	rw	Rx	P0.3602.0.0
0x21A2.03	Single-turn position	UDINT	ro	Tx	P0.3603.0.0
0x21A2.04	Multi-turn numerator	UDINT	ro	Tx	P0.3604.0.0
0x21A2.0C	Baud rate	UDINT	rw	Rx	P0.3612.0.0

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0x21A2.0D	Activation of correction table	USINT	rw	Rx	P0.3613.0.0
0x21A2.0E	Activation read out extended encoder data	USINT	rw	Rx	P0.3618.0.0
0x21A2.15	Encoder serial number	UDINT	ro	Tx	P0.3625.0.0
0x21A2.16	Manufacturer ID BiSS-C	UINT	ro	Tx	P0.3626.0.0
0x21A2.17	Actual encoder ID	ULINT	ro	Tx	P0.3627.0.0
0x21A2.19	Activation automatic detection Protocol Bits	USINT	rw	Rx	P0.36029.0.0
0x21A2.1A	Active singleturn resolution	UDINT	ro	Tx	P0.36030.0.0
0x21A2.1B	Active multi-turn resolution	UDINT	ro	Tx	P0.36031.0.0
0x21A2.1C	Timeout BiSS-C	REAL	rw	Rx	P0.36032.0.0
0x21A2.22	Diagnostic category: BiSS-C encoder error	UINT	rw	Rx	P0.102791.0.0
0x21A2.24	Diagnostic category: BiSS-C encoder warning	UINT	rw	Rx	P0.102793.0.0
0x21A2.27	Diagnostic category: BiSS-C common notifications	UINT	rw	Rx	P0.102916.0.0
0x21A4.01	Web server activation	USINT	rw	Rx	P0.11280051.0.0
0x21A5.01	Scaling factor start value I^2t monitoring motor model	REAL	rw	Rx	P1.6301.0.0
0x21A5.02	Actual value I^2T monitoring motor model	REAL	ro	Tx	P1.6302.0.0
0x21A5.03	Maximum start value I^2t monitoring motor model	REAL	ro	Tx	P1.6303.0.0
0x21A5.04	Scaling factor warning limit I^2t monitoring motor model	REAL	rw	Rx	P1.6305.0.0
0x21A5.06	Diagnostic category: I^2t monitoring: motor model warning limit	UINT	rw	Rx	P1.63019.0.0
0x21A5.07	Storage option: I^2t monitoring: motor model warning limit	USINT	rw	Rx	P1.63020.0.0
0x21A5.08	Diagnostic category: I^2t monitoring: motor model error limit	UINT	rw	Rx	P1.63021.0.0
0x21A5.09	Storage option: I^2t monitoring: motor model error limit	USINT	rw	Rx	P1.63022.0.0
0x21A7.01	Activation current reduction holding brake	USINT	rw	Rx	P1.40001.0.0
0x21A7.02	Delay time	REAL	rw	Rx	P1.40002.0.0
0x21A7.03	Supply voltage holding brake	REAL	rw	Rx	P1.40003.0.0
0x21A7.04	Holding voltage	REAL	rw	Rx	P1.40004.0.0
0x21A8.01	Status FoE	UDINT	ro	Tx	P0.44550.0.0
0x21A8.02	File type FoE	UINT	ro	Tx	P0.44551.0.0
0x21A8.03	Counter FoE	UDINT	ro	Tx	P0.44552.0.0
0x21AA.01	Status	DINT	rw	Rx	P1.103111.0.0
0x21AA.0E	Diagnostic category: Encoder not ready	UINT	rw	Rx	P1.103136.0.0
0x21AA.0F	Storage option: Encoder not ready	USINT	rw	Rx	P1.103137.0.0
0x21AA.10	Diagnostic category: Brake test failed	UINT	rw	Rx	P1.103138.0.0
0x21AA.11	Storage option: Brake test failed	USINT	rw	Rx	P1.103139.0.0
0x21AA.12	Diagnostic category: Torque failed brake test	UINT	rw	Rx	P1.103140.0.0
0x21AA.13	Storage option: Torque failed brake test	USINT	rw	Rx	P1.103141.0.0
0x21AC.01	Testing phase	UINT	rw	Rx	P1.103112.0.0

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0x21AC.03	Torque positive limit value	REAL	rw	Rx	P1.103113.0.0
0x21AC.05	Torque rise ramp Positive limit value	REAL	rw	Rx	P1.103114.0.0
0x21AC.07	Torque negative limit value	REAL	rw	Rx	P1.103115.0.0
0x21AC.09	Torque rise ramp Negative limit value	REAL	rw	Rx	P1.103116.0.0
0x21AC.0B	Monitoring window Position	LINT	rw	Rx	P1.103117.0.0
0x21AC.0D	Torque monitoring window	REAL	rw	Rx	P1.103118.0.0
0x21AC.0F	Holding time Torque	REAL	rw	Rx	P1.103120.0.0
0x21AC.11	Waiting time	REAL	rw	Rx	P1.103121.0.0
0x21AC.13	Test result	UINT	ro	Tx	P1.103122.0.0
0x21AC.15	Selection of encoder interface	UDINT	rw	Rx	P1.103123.0.0
0x21AC.17	Reference point torque	UDINT	rw	Rx	P1.101382.0.0
0x21AD.01 ... 02	Filter time constant velocity filter	REAL	rw	Rx	P1.112738.0.0
0x21AD.03 ... 04	Active filter time constant velocity filter	REAL	ro	Tx	P1.112739.0.0
0x21AD.05 ... 06	Filter time constant Position filter	REAL	rw	Rx	P1.112740.0.0
0x21AD.07 ... 08	Active filter time constant Position filter	REAL	ro	Tx	P1.112741.0.0
0x21AE.01	Sync Time	REAL	rw	Rx	P0.31235.0.0
0x21AE.02	IRT Output time	REAL	rw	Rx	P0.31236.0.0
0x21AE.03	IRT Input time	REAL	rw	Rx	P0.31237.0.0
0x21AE.04	CACF	UINT	rw	Rx	P0.31238.0.0
0x21AF.01	Status PROFINET request	DINT	rw	Rx	P0.54543.0.0
0x21AF.02	Active status PROFINET	DINT	ro	Tx	P0.54544.0.0
0x21AF.03	Diagnostic category: Failure of synchronization signal Fieldbus	UINT	rw	Rx	P0.54545.0.0
0x21AF.04	Storage option: Failure of synchronization signal Fieldbus	USINT	rw	Rx	P0.54546.0.0
0x21B0.01	Name of Station	STRING(241)	ro	Tx	P0.11295001.0.0 ... 240
0x21B0.02	I&M 1 System identification	STRING(33)	rw	Rx	P0.11295002.0.0 ... 32
0x21B0.03	I&M 1 location marking	STRING(23)	rw	Rx	P0.11295003.0.0 ... 22
0x21B0.04	I&M 2 installation date	STRING(17)	rw	Rx	P0.11295004.0.0 ... 16
0x21B0.05	I&M 3 additional name	STRING(55)	rw	Rx	P0.11295005.0.0 ... 54
0x21B1.01	Storage option: Incompatible device configuration PROFINET IRT	USINT	rw	Rx	P0.101291.0.0
0x21B1.02	Diagnostic category: Incompatible device configuration PROFINET IRT	UINT	rw	Rx	P0.101296.0.0
0x21B1.03	Reset device	UINT	rw	Rx	P0.112901.0.0
0x21B1.04	Load factory settings	UINT	rw	Rx	P0.112902.0.0
0x21B1.05	Save the parameter set	UINT	rw	Rx	P0.112903.0.0
0x21B3.01	Storage option: The requested telegram is not supported	USINT	rw	Rx	P0.141.0.0
0x21B3.02	Diagnostic category: The requested telegram is not supported	UINT	rw	Rx	P0.144.0.0
0x21B3.03	Telegram selection	UINT	rw	Rx	P0.3030101.0.0
0x21B3.04	Extended process data (EtherNet/IP)	USINT	rw	Rx	P0.3030104.0.0
0x21B4.01	Maximum number of parameters	UINT	rw	Rx	P0.303101.0.0
0x21B4.02	Multi-parameter access active	USINT	rw	Rx	P0.303102.0.0
0x21B5.01	Status EtherNet/IP	DINT	ro	Tx	P0.303302.0.0
0x21B6.01	RTE Configuration (user defined)	UDINT	rw	Rx	P0.100159.0.0
0x21B6.02	RTE configuration active	UDINT	ro	Tx	P0.100179.0.0

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0x21B6.03	RTE Configuration next	UDINT	ro	Tx	P0.100181.0.0
0x21B6.04	RTE Switches device start	UDINT	ro	Tx	P0.100185.0.0
0x21B6.05	RTE Switches Active	UDINT	ro	Tx	P0.100189.0.0
0x21B9.01	PZD telegram selection	UINT	ro	Tx	P0.11280201.0.0
0x21B9.03	Storage option: Telegram not supported	USINT	rw	Rx	P0.11280203.0.0
0x21B9.04	Extended process data	UINT	ro	Tx	P0.11280204.0.0
0x21B9.05	Active telegram Subslot 5	UINT	ro	Tx	P0.101935.0.0
0x21BA.01	Maximum number of parameters	UINT	ro	Tx	P0.11280801.0.0
0x21BA.02	Multi-parameter access active	USINT	ro	Tx	P0.11280802.0.0
0x21BC.01	Activation PROFINET diagnostics	SINT	rw	Rx	P0.100821.0.0
0x21BD.01	Parameterization authority ID Profile	UDINT	ro	Tx	P0.100046.0.0
0x21BD.02	Parameterization authority ID Connection	UDINT	ro	Tx	P0.100047.0.0
0x21BD.03	Status Parameterization authority	USINT	ro	Tx	P0.100048.0.0
0x21BD.04	Parameterization authority Connection	UDINT	ro	Tx	P0.100072.0.0
0x21BE.01	Status Sign of Life	DINT	ro	Tx	P1.3424.0.0
0x21BE.02	Maximum failure Sign of Life	UINT	rw	Rx	P1.4243.0.0
0x21BE.05	Reduction ratio	UDINT	rw	Rx	P1.4246.0.0
0x21BE.06	Sign of Life Cycle-1	USINT	ro	Tx	P1.4277.0.0
0x21BE.07	Error counter Sign of Life	DINT	ro	Tx	P1.4278.0.0
0x21BE.08	CACF	UINT	rw	Rx	P1.100990.0.0
0x21BF.01	Source sensor 0	UDINT	rw	Rx	P1.101224.0.0
0x21BF.02	Source sensor 1	UDINT	rw	Rx	P1.101252.0.0
0x21C0.01	UINT8	USINT	rw	Rx	P1.66003.0.0
0x21C0.02	UINT16	UINT	rw	Rx	P1.66008.0.0
0x21C0.03	UINT32	UDINT	rw	Rx	P1.66009.0.0
0x21C0.04	INT8	SINT	rw	Rx	P1.66010.0.0
0x21C0.05	INT16	INT	rw	Rx	P1.66012.0.0
0x21C0.06	INT32	DINT	rw	Rx	P1.66013.0.0
0x21C0.07	BOOL	USINT	rw	Rx	P1.66015.0.0
0x21C0.0C	Diagnostic value test 1	UINT	rw	Rx	P1.66061.0.0
0x21C0.0D	Diagnostic value test 2	UINT	rw	Rx	P1.66062.0.0
0x21C1.01	XERR	DINT	rw	Rx	P1.1129990.0.0
0x21C1.02	NSOLL_A/NSOLL_B	REAL	rw	Rx	P1.11280502.0.0
0x21C1.03	Target position MDI	LINT	rw	Rx	P1.11280604.0.0
0x21C1.04	Profile velocity MDI	REAL	rw	Rx	P1.11280605.0.0
0x21C1.05	Acceleration MDI	REAL	rw	Rx	P1.11280606.0.0
0x21C1.06	Deceleration MDI	REAL	rw	Rx	P1.11280607.0.0
0x21C1.07	MDI_TARPOS	DINT	ro	Tx	P1.102038.0.0
0x21C1.08	XSOLL_A	LINT	rw	Rx	P1.11280608.0.0
0x21C2.01	ZSW_AC4	UINT	ro	Tx	P1.11280541.0.0
0x21C2.02	ZSW_AC4.11 Home position set	USINT	ro	Tx	P1.11280542.0.0
0x21C2.03	ZSW_AC4.12 Homing run job activated	USINT	ro	Tx	P1.11280543.0.0
0x21C2.04	ZSW_AC4.13 Homing active	USINT	ro	Tx	P1.11280544.0.0
0x21C3.01	STW_AC4	UINT	rw	Rx	P1.11280540.0.0
0x21C3.02	STW1.11 Start Homing procedure	USINT	rw	Rx	P1.11280550.0.0
0x21C4.01	Parameter List	UINT	ro	Tx	P1.11280001.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x21C4.02	Error message counter PROFIdrive	UINT	ro	Tx	P1.11280003.0.0
0x21C5.01	Diagnostic category: Invalid configuration Extended process data	UINT	rw	Rx	P1.424201.0.0
0x21C5.02	Storage option: Invalid configuration Extended process data	USINT	rw	Rx	P1.424202.0.0
0x21C5.03	Activation Extended process data	USINT	rw	Rx	P1.424203.0.0
0x21C5.04	Extended process data active	USINT	ro	Tx	P1.424213.0.0
0x21C6.01	Number of objects Rx	USINT	ro	Tx	P1.4242101.0.0
0x21C6.02	Number of bytes Rx	USINT	ro	Tx	P1.4242102.0.0
0x21C7.01	Number of objects Tx	USINT	ro	Tx	P1.4242201.0.0
0x21C7.02	Number of bytes Tx	USINT	ro	Tx	P1.4242202.0.0
0x21C8.01	MOMRED	INT	rw	Rx	P1.1126990.0.0
0x21C9.01	KPC	DINT	rw	Rx	P1.1127990.0.0
0x21CA.01	Activation jog 2 phases	USINT	rw	Rx	P1.100010.0.0
0x21CA.02	Operating mode PROFIdrive	UINT	ro	Tx	P1.11280002.0.0
0x21CA.03	Status word MELDW	UINT	ro	Tx	P1.11280046.0.0
0x21CA.04	Status base state machine PROFIdrive	UDINT	ro	Tx	P1.11280102.0.0
0x21CA.05	Actual application class	UDINT	ro	Tx	P1.11280109.0.0
0x21CA.07	Storage option: Required application class not supported	USINT	rw	Rx	P1.11280111.0.0
0x21CA.08	Trigger level MELDW.2	REAL	rw	Rx	P1.11280112.0.0
0x21CA.09	Hysteresis trigger level	REAL	rw	Rx	P1.11280113.0.0
0x21CA.0A	Trigger level MELDW.3	REAL	rw	Rx	P1.11280114.0.0
0x21CA.0B	Hysteresis trigger level	REAL	rw	Rx	P1.11280115.0.0
0x21CA.0C	Activation touch probe Tel. 111	UINT	rw	Rx	P1.11280116.0.0
0x21CA.0D	Diagnostic category: PLC Control is not set	UINT	rw	Rx	P1.11280117.0.0
0x21CA.0E	Storage option: PLC Control is not set	USINT	rw	Rx	P1.11280118.0.0
0x21CB.01	Acceleration	REAL	rw	Rx	P1.11280402.0.0
0x21CB.02	Deceleration	REAL	rw	Rx	P1.11280403.0.0
0x21CB.03	Jerk	REAL	rw	Rx	P1.11280404.0.0
0x21CB.04	Deceleration (system stop)	REAL	rw	Rx	P1.11280405.0.0
0x21CB.05	Jerk (system stop)	REAL	rw	Rx	P1.11280406.0.0
0x21CC.01	Status Application Class 1	UDINT	ro	Tx	P1.11280501.0.0
0x21CC.02	Settling time Direction of rotation detection	REAL	rw	Rx	P1.11280503.0.0
0x21CC.03	Threshold value velocity comparator	REAL	rw	Rx	P1.11280504.0.0
0x21CC.04	Hysteresis threshold value velocity comparator	REAL	rw	Rx	P1.11280505.0.0
0x21CC.05	Switch-on/off delay time velocity comparator	REAL	rw	Rx	P1.11280506.0.0
0x21CD.01	Status Application Class 3	UDINT	ro	Tx	P1.11280601.0.0
0x21CD.03	Velocity override	INT	rw	Rx	P1.11280611.0.0
0x21CD.04	Extended Modulo mode	USINT	rw	Rx	P1.11280612.0.0
0x21CE.01	Base value velocity	REAL	rw	Rx	P1.11280701.0.0
0x21CE.02	Base value acceleration	REAL	rw	Rx	P1.11280702.0.0
0x21CE.03	Base value deceleration	REAL	rw	Rx	P1.11280703.0.0
0x21CE.04	Conversion factor velocity	REAL	ro	Tx	P1.11290701.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x21CF.01	Counter warning messages	UINT	ro	Tx	P1.11280060.0.0
0x21CF.02	Counter error messages	UINT	ro	Tx	P1.11280061.0.0
0x21CF.03	Active error	UINT	ro	Tx	P1.11280062.0.0
0x21CF.04	Active warning	UINT	ro	Tx	P1.11280063.0.0
0x21D0.01	Status Application Class 4	UDINT	ro	Tx	P1.11280531.0.0
0x21D0.02	Velocity comparator time window	REAL	rw	Rx	P1.11280533.0.0
0x21D1.01 ... 02	Encoder n actual position value 2 (Gn_XIST2)	UDINT	ro	Tx	P1.1141990.0.0
0x21D2.01 ... 02	Encoder n actual position value 1 (Gn_XIST1)	UDINT	ro	Tx	P1.1142990.0.0
0x21D2.03 ... 04	Start position homing AC4	LINT	rw	Rx	P1.1142991.0.0
0x21D3.01 ... 02	Gn_ZSW.0 ... 3 Function active	USINT	ro	Tx	P1.1143000.0.0
0x21D3.03 ... 04	Gn_ZSW.4 ... 7 value	USINT	ro	Tx	P1.1143040.0.0
0x21D3.05 ... 06	Gn_ZSW.8 touch probe 0 deflected	USINT	ro	Tx	P1.1143080.0.0
0x21D3.07 ... 08	Gn_ZSW.9 Touch Probe 1 deflected	USINT	ro	Tx	P1.1143090.0.0
0x21D3.09 ... 0A	Gn_ZSW.11 Error acknowledgment active	USINT	ro	Tx	P1.1143110.0.0
0x21D3.0B ... 0C	Gn_ZSW.12 Homing mode active	USINT	ro	Tx	P1.1143120.0.0
0x21D3.0D ... 0E	Gn_ZSW.13 Transmit absolute value cyclically	USINT	ro	Tx	P1.1143130.0.0
0x21D3.0F ... 10	Gn_ZSW.14 Parking sensor active	USINT	ro	Tx	P1.1143140.0.0
0x21D3.13 ... 14	Gn_ZSW.15 sensor error	USINT	ro	Tx	P1.1143150.0.0
0x21D3.15 ... 16	Gn_ZSW	UINT	ro	Tx	P1.1143990.0.0
0x21D4.01 ... 02	Status sensor state machine	DINT	ro	Tx	P1.34234.0.0
0x21D5.01	ZSW1.0 Ready to Switch On	USINT	ro	Tx	P1.1145000.0.0
0x21D5.02	ZSW1.1 Ready To Operate	USINT	ro	Tx	P1.1145010.0.0
0x21D5.03	ZSW1.2 Operation Enabled	USINT	ro	Tx	P1.1145020.0.0
0x21D5.04	ZSW1.3 Fault Present	USINT	ro	Tx	P1.1145030.0.0
0x21D5.05	ZSW1.4 Coast Stop Not Active	USINT	ro	Tx	P1.1145040.0.0
0x21D5.06	ZSW1.5 Quick Stop Not Active	USINT	ro	Tx	P1.1145050.0.0
0x21D5.07	ZSW1.6 Switch On Inhibited	USINT	ro	Tx	P1.1145060.0.0
0x21D5.08	ZSW1.7 Warning Present	USINT	ro	Tx	P1.1145070.0.0
0x21D5.09	ZSW1.8 Velocity Error Within Tolerance Range	USINT	ro	Tx	P1.1145080.0.0
0x21D5.0A	ZSW1.8 Following Error Within Tolerance Range	USINT	ro	Tx	P1.1145081.0.0
0x21D5.0B	ZSW1.9 PLC Control Requested	USINT	ro	Tx	P1.1145090.0.0
0x21D5.0C	ZSW1.10 f or n reached or exceeded	USINT	ro	Tx	P1.1145100.0.0
0x21D5.0D	ZSW1.10 Traverse Task Motion Complete	USINT	ro	Tx	P1.1145101.0.0
0x21D5.0E	ZSW1.11 I, M or P limit not reached	USINT	ro	Tx	P1.1145110.0.0
0x21D5.0F	ZSW1.11 Home Position Set	USINT	ro	Tx	P1.1145111.0.0
0x21D5.10	ZSW1.12 Holding brake open	USINT	ro	Tx	P1.1145120.0.0
0x21D5.11	ZSW1.12 Traversing Task Acknowledgement	USINT	ro	Tx	P1.1145121.0.0
0x21D5.12	ZSW1.13 No warning Overtemperature motor	USINT	ro	Tx	P1.1145130.0.0
0x21D5.13	ZSW1.13 Drive Stopped	USINT	ro	Tx	P1.1145131.0.0
0x21D5.14	ZSW1.14 Motor rotation	USINT	ro	Tx	P1.1145140.0.0

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0x21D5.15	ZSW1.14 Drive Accelerating	USINT	ro	Tx	P1.1145141.0.0
0x21D5.16	ZSW1.15 No warning Overtemperature power unit	USINT	ro	Tx	P1.1145150.0.0
0x21D5.17	ZSW1.15 Drive Decelerating	USINT	ro	Tx	P1.1145151.0.0
0x21D5.18	ZSW1	UINT	ro	Tx	P1.1145990.0.0
0x21D6.01	ZSW2.7 Drive parked	USINT	ro	Tx	P1.1146070.0.0
0x21D6.02	ZSW2.8 Move to fixed stop active	USINT	ro	Tx	P1.1146080.0.0
0x21D6.03	ZSW2.11 Power stage active	USINT	ro	Tx	P1.1146110.0.0
0x21D6.04	ZSW2.12 ... 15 Slave sign of life	USINT	ro	Tx	P1.1146120.0.0
0x21D6.05	ZSW2	UINT	ro	Tx	P1.1146990.0.0
0x21D6.06	ZSW2.5 Holding brake	USINT	ro	Tx	P1.1146090.0.0
0x21D6.07	ZSW2.10 Synchronized active	USINT	ro	Tx	P1.1146091.0.0
0x21D7.01	STW1.0 Power Stage Enable	USINT	ro	Tx	P1.1147000.0.0
0x21D7.02	STW1.1 Coast Stop Disable	USINT	ro	Tx	P1.1147010.0.0
0x21D7.03	STW1.2 Quick Stop Disable	USINT	ro	Tx	P1.1147020.0.0
0x21D7.04	STW1.3 Enable Operation	USINT	ro	Tx	P1.1147030.0.0
0x21D7.05	STW1.4 Enable ramp generator	USINT	ro	Tx	P1.1147040.0.0
0x21D7.06	STW1.4 Reject traversing task	USINT	ro	Tx	P1.1147041.0.0
0x21D7.07	STW1.5 Unfreeze Ramp Generator	USINT	ro	Tx	P1.1147050.0.0
0x21D7.08	STW1.5 Intermediate Stop	USINT	ro	Tx	P1.1147051.0.0
0x21D7.09	STW1.6 Enable setpoint	USINT	ro	Tx	P1.1147060.0.0
0x21D7.0A	STW1.6 Traverse Task Active	USINT	ro	Tx	P1.1147061.0.0
0x21D7.0B	STW1.7 Fault Acknowledge	USINT	ro	Tx	P1.1147070.0.0
0x21D7.0C	STW1.8 Jogging 1	USINT	ro	Tx	P1.1147080.0.0
0x21D7.0D	STW1.9 Jogging 2	USINT	ro	Tx	P1.1147090.0.0
0x21D7.0E	STW1.10 Control by PLC	USINT	ro	Tx	P1.1147100.0.0
0x21D7.0F	STW1.11 Invert setpoint	USINT	ro	Tx	P1.1147110.0.0
0x21D7.10	STW1.11 Start Homing Procedure	USINT	ro	Tx	P1.1147111.0.0
0x21D7.11	STW1.12 Open Holding Brake	USINT	ro	Tx	P1.1147120.0.0
0x21D7.13	STW1.13 Increase the motorized potentiometer setpoint	USINT	ro	Tx	P1.1147130.0.0
0x21D7.14	STW1.13 Start Block Change	USINT	ro	Tx	P1.1147131.0.0
0x21D7.15	STW1.14 Reduce motor potentiometer setpoint	USINT	ro	Tx	P1.1147140.0.0
0x21D7.16	STW1.14 Reserved	USINT	ro	Tx	P1.1147141.0.0
0x21D7.17	STW1.15 Reserved	USINT	ro	Tx	P1.1147150.0.0
0x21D7.18	STW1.15 Reserved	USINT	ro	Tx	P1.1147151.0.0
0x21D7.19	STW1	UINT	rw	Rx	P1.1147990.0.0
0x21D8.01	STW2.7 Drive parking	USINT	ro	Tx	P1.1148070.0.0
0x21D8.02	STW2.8 Traverse to fixed endstop	USINT	ro	Tx	P1.1148080.0.0
0x21D8.03	STW2.11 Motor changeover	USINT	ro	Tx	P1.1148110.0.0
0x21D8.04	STW2.12 ... 15 Master sign of life	USINT	ro	Tx	P1.1148120.0.0
0x21D8.05	STW2	UINT	rw	Rx	P1.1148990.0.0
0x21D8.06	STW2.9 Set referene point	USINT	ro	Tx	P1.1148130.0.0
0x21D9.01 ... 02	Gn_STW.0 ... 3 Request function	USINT	ro	Tx	P1.1149000.0.0
0x21D9.03 ... 04	Gn_STW.4 ... 6 Request command	USINT	ro	Tx	P1.1149040.0.0
0x21D9.05 ... 06	Gn_STW.7 Mode	USINT	ro	Tx	P1.1149070.0.0

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0x21D9.07 ... 08	Gn_STW.11 Home position mode	USINT	ro	Tx	P1.1149110.0.0
0x21D9.09 ... 0A	Gn_STW.12 Trigger mode homing	USINT	ro	Tx	P1.1149120.0.0
0x21D9.0B ... 0C	Gn_STW.13 Request absolute value cyclically	USINT	ro	Tx	P1.1149130.0.0
0x21D9.0D ... 0E	Gn_STW.14 Activate parking sensor	USINT	ro	Tx	P1.1149140.0.0
0x21D9.0F ... 10	Gn_STW.15 Acknowledge sensor error	USINT	ro	Tx	P1.1149150.0.0
0x21D9.11 ... 12	Gn_STW	UINT	rw	Rx	P1.1149990.0.0
0x21D9.13 ... 14	Gn_STW Cycle-1	UINT	ro	Tx	P1.1149991.0.0
0x21DA.05 ... 06	Actual resolution per revolution for Gn_XIST	UDINT	ro	Tx	P1.231544.0.0
0x21DA.07 ... 08	Resolution per revolution for Gn_XIST	UDINT	rw	Rx	P1.231545.0.0
0x21DB.01 ... 02	Actual Error ID	UDINT	ro	Tx	P1.231250.0.0
0x21DC.01	MELDW.0 ramp generator	USINT	ro	Tx	P1.1124900.0.0
0x21DC.02	MELDW.1 torque utilization	USINT	ro	Tx	P1.11249010.0.0
0x21DC.03	MELDW.2 Actual velocity <Threshold1	USINT	ro	Tx	P1.11249020.0.0
0x21DC.04	MELDW.3 Actual velocity = <Threshold2	USINT	ro	Tx	P1.11249030.0.0
0x21DC.05	MELDW.5 Variable reporting function	USINT	ro	Tx	P1.11249050.0.0
0x21DC.06	MELDW.6 No warning Overtemperature motor	USINT	ro	Tx	P1.11249060.0.0
0x21DC.07	MELDW.7 No warning Overtemperature power output stage	USINT	ro	Tx	P1.11249070.0.0
0x21DC.08	MELDW.8 velocity setpoint / actual deviation in tolerance	USINT	ro	Tx	P1.11249080.0.0
0x21DC.09	MELDW.11 Controller enable	USINT	ro	Tx	P1.11249110.0.0
0x21DC.0A	MELDW.12 Ready for operation	USINT	ro	Tx	P1.11249120.0.0
0x21DC.0B	MELDW.13 Power stage active	USINT	ro	Tx	P1.11249130.0.0
0x21DC.0C	MELDW	UINT	ro	Tx	P1.11249990.0.0
0x21DD.01	POS_STW1.0 ... 6 Traversing block selection	USINT	ro	Tx	P1.112411000.0.0
0x21DD.02	POS_STW1.8 Absolute positioning	USINT	ro	Tx	P1.112411080.0.0
0x21DD.03	POS_STW1.9 ... 10 direction selection	UDINT	ro	Tx	P1.112411090.0.0
0x21DD.04	POS_STW1.12 Setpoint transfer	USINT	ro	Tx	P1.112411120.0.0
0x21DD.05	POS_STW1.14 Setting up selected	USINT	ro	Tx	P1.112411140.0.0
0x21DD.06	POS_STW1.15 MDI selection	USINT	ro	Tx	P1.112411150.0.0
0x21DD.07	POS_STW1	UINT	rw	Rx	P1.112411990.0.0
0x21DE.01	POS_ZSW1.0 ... 6 Traversing block bit	USINT	ro	Tx	P1.112412000.0.0
0x21DE.02	POS_ZSW1.8 Negative limit switch active	USINT	ro	Tx	P1.112412080.0.0
0x21DE.03	POS_ZSW1.9 Positive limit switch active	USINT	ro	Tx	P1.112412090.0.0
0x21DE.04	POS_ZSW1.10 Jogging active	USINT	ro	Tx	P1.112412100.0.0
0x21DE.05	POS_ZSW1.11 Reference point approach active	USINT	ro	Tx	P1.112412110.0.0
0x21DE.06	POS_ZSW1.13 Traversing block active	USINT	ro	Tx	P1.112412130.0.0
0x21DE.07	POS_ZSW1.14 Setup active	USINT	ro	Tx	P1.112412140.0.0
0x21DE.08	POS_ZSW1.15 MDI active	USINT	ro	Tx	P1.112412150.0.0
0x21DE.09	POS_ZSW1	UINT	ro	Tx	P1.112412990.0.0
0x21DF.01	POS_ZSW2.0 Tracking mode active	USINT	ro	Tx	P1.112413000.0.0
0x21DF.02	POS_ZSW2.1 Velocity limitation active	USINT	ro	Tx	P1.112413010.0.0

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0x21DF.03	POS_ZSW2.2 Setpoint available	USINT	ro	Tx	P1.112413020.0.0
0x21DF.04	POS_ZSW2.4 Drive moves forward	USINT	ro	Tx	P1.112413040.0.0
0x21DF.05	POS_ZSW2.5 Drive moves backwards	USINT	ro	Tx	P1.112413050.0.0
0x21DF.06	POS_ZSW2.6 Software limit switch minus reached	USINT	ro	Tx	P1.112413060.0.0
0x21DF.07	POS_ZSW2.7 Software limit switch plus reached	USINT	ro	Tx	P1.112413070.0.0
0x21DF.08	POS_ZSW2.8 Position actual value <= position switch 0	USINT	ro	Tx	P1.112413080.0.0
0x21DF.09	POS_ZSW2.9 Position actual value <= position switch 1	USINT	ro	Tx	P1.112413090.0.0
0x21DF.0A	POS_ZSW2.10 Direct output 1 via traversing block	USINT	ro	Tx	P1.112413100.0.0
0x21DF.0B	POS_ZSW2.11 Direct output 2 via traversing block	USINT	ro	Tx	P1.112413110.0.0
0x21DF.0C	POS_ZSW2.12 Fixed stop reached	USINT	ro	Tx	P1.112413120.0.0
0x21DF.0D	POS_ZSW2.13 Fixed stop Clamping torque reached	USINT	ro	Tx	P1.112413130.0.0
0x21DF.0E	POS_ZSW2.14 Move to fixed stop active	USINT	ro	Tx	P1.112413140.0.0
0x21DF.0F	POS_ZSW2.15 Traversing command active	USINT	ro	Tx	P1.112413150.0.0
0x21DF.10	POS_ZSW2	UINT	ro	Tx	P1.112413990.0.0
0x21E0.01	POS_STW2.0 Tracking mode	USINT	ro	Tx	P1.112414000.0.0
0x21E0.02	POS_STW2.1 Set reference point	USINT	ro	Tx	P1.112414010.0.0
0x21E0.03	POS_STW2.5 Jogging incremental active	USINT	ro	Tx	P1.112414050.0.0
0x21E0.04	POS_STW2.10 Selection touch probe	USINT	ro	Tx	P1.112414100.0.0
0x21E0.05	POS_STW2.11 Touch probe edge	USINT	ro	Tx	P1.112414110.0.0
0x21E0.06	POS_STW2.14 Activate software limit switch	USINT	ro	Tx	P1.112414140.0.0
0x21E0.07	POS_STW2.15 Activate hardware limit switch	USINT	ro	Tx	P1.112414150.0.0
0x21E0.08	POS_STW2	UINT	rw	Rx	P1.112414990.0.0
0x21E1.01	SATZANW.0 ... 6 Traversing block selection	USINT	ro	Tx	P1.112415000.0.0
0x21E1.02	SATZANW.15 Activate MDI	USINT	ro	Tx	P1.112415150.0.0
0x21E1.03	SATZANW	UINT	rw	Rx	P1.112415990.0.0
0x21E1.04	SATZANW Cycle-1	UINT	ro	Tx	P1.112415991.0.0
0x21E2.01	AKTSATZ.0 ... 6 Active traversing block	USINT	ro	Tx	P1.112416000.0.0
0x21E2.02	AKTSATZ.15 MDI activated	USINT	ro	Tx	P1.112416150.0.0
0x21E2.03	AKTSATZ	UINT	ro	Tx	P1.112416990.0.0
0x21E3.01	MDI_MOD.0 Positioning	USINT	ro	Tx	P1.112417000.0.0
0x21E3.02	MDI_MOD.1 ... 2 Direction of movement	UDINT	ro	Tx	P1.112417010.0.0
0x21E3.03	MDI_MOD	UINT	rw	Rx	P1.112417990.0.0
0x21E3.04	MDI_MOD Cycle-1	UINT	ro	Tx	P1.112417991.0.0
0x2202.01 ... 02	Temperature sensor characteristic	REAL	ro	–	P0.7155.0.0 ... 1
0x2203.01 ... 06	MAC address	USINT	ro	–	P0.247.0.0 ... 5
0x2204.01 ... 06	MAC address	USINT	ro	–	P0.248.0.0 ... 5
0x2205.01 ... 06	MAC address	USINT	ro	–	P0.249.0.0 ... 5
0x2206.01 ... 06	MAC address	USINT	ro	–	P0.265.0.0 ... 5

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0x2207.01 ... 08	Trace channel	USINT	rw	–	P0.5500.0.0 ... 7
0x2208.01 ... 08	Axis ID trace data	UINT	rw	–	P0.5501.0.0 ... 7
0x2209.01 ... 08	Data ID trace data	UDINT	rw	–	P0.5502.0.0 ... 7
0x220A.01 ... 08	Data instance ID trace data	UINT	rw	–	P0.5503.0.0 ... 7
0x220B.01 ... 08	Array ID trace data	UINT	rw	–	P0.5504.0.0 ... 7
0x220C.01 ... 08	Status Trace channel	USINT	ro	–	P0.5505.0.0 ... 7
0x220D.01 ... 08	Actual axis ID trace data	UINT	ro	–	P0.5506.0.0 ... 7
0x220E.01 ... 08	Actual data ID trace data	UDINT	ro	–	P0.5507.0.0 ... 7
0x220F.01 ... 08	Actual data instance ID trace data	UINT	ro	–	P0.5508.0.0 ... 7
0x2210.01 ... 08	Actual array ID trace data	UINT	ro	–	P0.5509.0.0 ... 7
0x2213.01 ... 05	Sync manager communication type EtherCAT	USINT	rw	–	P0.750.0.0 ... 4
0x2214.01 ... 10	Receive PDO Mapped Objects EtherCAT	UDINT	rw	–	P0.761.0.0 ... 15
0x2215.01 ... 06	PDO mapping object index of assigned PDO EtherCAT	UINT	rw	–	P0.771.0.0 ... 2
0x2216.01 ... 10	Transmit PDO mapped objects EtherCAT	UDINT	rw	–	P0.881.0.0 ... 15
0x221A.01 ... 04	Servo drive initialisation status	UDINT	ro	–	P0.10320.0.0 ... 3
0x2220.01 ... 0C	MAC address	USINT	ro	–	P0.12007.0.0 ... 5
0x2221.01 ... 03	Filter frequency notch filter	REAL	rw	–	P1.40.0.0 ... 2
0x2222.01 ... 03	Band width of notch filter	REAL	rw	–	P1.49.0.0 ... 2
0x2223.01 ... 03	Notch filter output active current	REAL	ro	–	P1.50.0.0 ... 2
0x2224.01 ... 03	Activation of notch filter	USINT	rw	–	P1.51.0.0 ... 2
0x2225.01 ... 10	Support point velocity [rad/s]	REAL	rw	–	P1.976.0.0 ... 15
0x2226.01 ... 10	Support point torque [Nm]	REAL	rw	–	P1.977.0.0 ... 15
0x2227.01 ... 03	Position controller amplification gain	REAL	rw	–	P1.226.0.0 ... 2
0x2228.01 ... 03	Velocity controller amplification gain	REAL	rw	–	P1.2210.0.0 ... 2
0x2229.01 ... 03	Velocity controller integration constant	REAL	rw	–	P1.2211.0.0 ... 2
0x222A.01 ... 03	Current controller amplification gain (active current)	REAL	rw	–	P1.2223.0.0 ... 2
0x222B.01 ... 03	Integration constant current controller (active current)	REAL	rw	–	P1.2224.0.0 ... 2
0x222C.01 ... 03	Current controller amplification gain (reactive current)	REAL	rw	–	P1.2225.0.0 ... 2
0x222D.01 ... 03	Integration constant current controller (reactive current)	REAL	rw	–	P1.2226.0.0 ... 2
0x222E.01 ... 03	Total inertia	REAL	rw	–	P1.2227.0.0 ... 2
0x222F.01 ... 03	Velocity filter time constant	REAL	rw	–	P1.2228.0.0 ... 2
0x2230.01 ... 80	Command record type	UDINT	rw	–	P1.1810.0.0 ... 127
0x2231.01 ... 80	Record number	DINT	rw	–	P1.1811.0.0 ... 127
0x2232.01 ... 80	Record table field 1	LINT	rw	–	P1.1812.0.0 ... 127
0x2233.01 ... 80	Record table field 2	LINT	rw	–	P1.1813.0.0 ... 127
0x2234.01 ... 80	Record table field 3	LINT	rw	–	P1.1814.0.0 ... 127
0x2235.01 ... 80	Record table field 4	LINT	rw	–	P1.1815.0.0 ... 127
0x2236.01 ... 80	Record table field 5	LINT	rw	–	P1.1816.0.0 ... 127
0x2237.01 ... 80	Record table field 6	LINT	rw	–	P1.1817.0.0 ... 127
0x2238.01 ... 80	Record table field 7	LINT	rw	–	P1.1818.0.0 ... 127
0x2239.01 ... 80	Record step enabling type	UDINT	rw	–	P1.1831.0.0 ... 127
0x223A.01 ... 80	Record sequencing record number start	DINT	rw	–	P1.1832.0.0 ... 127

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x223B.01 ... 80	Record sequencing record number target	DINT	rw	–	P1.1833.0.0 ... 127
0x223C.01 ... 80	Record sequencing field time	REAL	rw	–	P1.1834.0.0 ... 127
0x223D.01 ... 80	Record sequencing field 1	LINT	rw	–	P1.1835.0.0 ... 127
0x223E.01 ... 80	Record sequencing field 2	LINT	rw	–	P1.1836.0.0 ... 127
0x223F.01 ... 80	Selection start condition record	UDINT	rw	–	P1.1838.0.0 ... 127
0x2240.01 ... 10	Event type	UDINT	rw	–	P1.1841.0.0 ... 15
0x2241.01 ... 10	Next event target	DINT	rw	–	P1.1842.0.0 ... 15
0x2242.01 ... 10	Next event field time	REAL	rw	–	P1.1843.0.0 ... 15
0x2243.01 ... 10	Next event field 1	LINT	rw	–	P1.1844.0.0 ... 15
0x2244.01 ... 10	Next event field 2	LINT	rw	–	P1.1845.0.0 ... 15
0x2245.01 ... 80	Record sequencing field 3	LINT	rw	–	P1.526778.0.0 ... 127
0x2246.01 ... 10	Next event field 3	LINT	rw	–	P1.526779.0.0 ... 15
0x2247.01 ... 10	Next event field 4	LINT	rw	–	P1.526786.0.0 ... 15
0x2248.01 ... 10	Next event field 5	LINT	rw	–	P1.526787.0.0 ... 15
0x2249.01 ... 10	Next event field 6	LINT	rw	–	P1.526788.0.0 ... 15
0x224A.01 ... 10	Next event field 7	LINT	rw	–	P1.526789.0.0 ... 15
0x224B.01 ... 80	Record sequencing field 4	LINT	rw	–	P1.526790.0.0 ... 127
0x224C.01 ... 80	Record sequencing field 5	LINT	rw	–	P1.526791.0.0 ... 127
0x224D.01 ... 80	Record sequencing field 6	LINT	rw	–	P1.526792.0.0 ... 127
0x224E.01 ... 80	Record sequencing field 7	LINT	rw	–	P1.526793.0.0 ... 127
0x2259.01 ... 05	Status setpoint sources	UDINT	ro	–	P1.298.0.0 ... 4
0x225A.01 ... 02	Actual temperature sensor characteristic motor	REAL	ro	–	P1.7157.0.0 ... 1
0x225B.01 ... 02	Temperature sensor characteristic (user defined)	REAL	rw	–	P1.7156.0.0 ... 1
0x225C.01 ... 11	Supported homing methods CiA402	SINT	ro	–	P1.8119.0.0 ... 16
0x225D.01 ... 03	Bypass	USINT	rw	–	P1.991.0.0 ... 2
0x225E.01 ... 03	First derivation	REAL	rw	–	P1.992.0.0 ... 2
0x225F.01 ... 03	Second derivation	REAL	rw	–	P1.993.0.0 ... 2
0x2260.01 ... 03	Dead zone	REAL	rw	–	P1.994.0.0 ... 2
0x2261.01 ... 03	Scaling factor	REAL	rw	–	P1.995.0.0 ... 2
0x2262.01 ... 03	Offset (analog)	REAL	rw	–	P1.996.0.0 ... 2
0x2263.01 ... 03	Monitoring window safe zero	REAL	rw	–	P1.997.0.0 ... 2
0x2264.01 ... 03	Lower limit value analog input	REAL	rw	–	P1.998.0.0 ... 2
0x2265.01 ... 03	Upper limit value analog input	REAL	rw	–	P1.999.0.0 ... 2
0x2266.01 ... 03	Actual denominator gear unit	REAL	ro	–	P1.1155.0.0 ... 2
0x2267.01 ... 03	Actual numerator gear unit	REAL	ro	–	P1.1156.0.0 ... 2
0x2268.01 ... 03	Actual numerator feed constant	REAL	ro	–	P1.1157.0.0 ... 2
0x2269.01 ... 03	Actual denominator feed constant	REAL	ro	–	P1.1158.0.0 ... 2
0x226E.01 ... 03	Invert encoder signal	USINT	rw	–	P1.1171.0.0 ... 2
0x226F.01 ... 08	Selection of switching function	UINT	rw	–	P1.112708.0.0 ... 3
0x2270.01 ... 08	Selection of switching characteristics	UINT	rw	–	P1.112709.0.0 ... 3
0x2271.01 ... 08	First switching point	LINT	rw	–	P1.112710.0.0 ... 3
0x2272.01 ... 08	Second switching point	LINT	rw	–	P1.112711.0.0 ... 3
0x2273.01 ... 08	Switching time (automatic)	REAL	rw	–	P1.112712.0.0 ... 3
0x2274.01 ... 08	Actual selection of switching function	UINT	ro	–	P1.112721.0.0 ... 3

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0x2275.01 ... 08	Actual selection of switching characteristics	UINT	ro	–	P1.112722.0.0 ... 3
0x2276.01 ... 08	Actual first switching point	LINT	ro	–	P1.112723.0.0 ... 3
0x2277.01 ... 08	Actual second switching point	LINT	ro	–	P1.112724.0.0 ... 3
0x2278.01 ... 08	Actual switching time (automatic)	REAL	ro	–	P1.112725.0.0 ... 3
0x2279.01 ... 20	Transmit PDO mapped objects EtherCAT	UDINT	rw	–	P0.881.1.0 ... 15
0x227B.01 ... 03	Load weight / load inertia	REAL	rw	–	P1.2229.0.0 ... 2
0x227D.01 ... 02	Profile identification number	USINT	ro	–	P1.11280004.0.0 ... 1
0x2281.01 ... 02	Damping	REAL	rw	–	P1.144316.0.0 ... 1
0x2282.01 ... 02	Natural frequency	REAL	rw	–	P1.144317.0.0 ... 1
0x2283.01 ... 02	Activation of vibration suppression	USINT	rw	–	P1.144318.0.0 ... 1
0x2284.01 ... 02	Vibration suppression active	USINT	ro	–	P1.144319.0.0 ... 1
0x228A.01 ... 05	Active telegrams	UINT	ro	–	P0.11280210.0.0 ... 4
0x228B.01 ... 14	SDO 10F3 Diag Array 0	USINT	rw	–	P0.43551.0.0 ... 19
0x228C.01 ... 14	SDO 10F3 Diag Array 1	USINT	rw	–	P0.43552.0.0 ... 19
0x228D.01 ... 14	SDO 10F3 Diag Array 2	USINT	rw	–	P0.43553.0.0 ... 19
0x228E.01 ... 14	SDO 10F3 Diag Array 3	USINT	rw	–	P0.43554.0.0 ... 19
0x228F.01 ... 14	SDO 10F3 Diag Array 4	USINT	rw	–	P0.43555.0.0 ... 19
0x2290.01 ... 14	SDO 10F3 Diag Array 5	USINT	rw	–	P0.43556.0.0 ... 19
0x2291.01 ... 14	SDO 10F3 Diag Array 6	USINT	rw	–	P0.43557.0.0 ... 19
0x2292.01 ... 14	SDO 10F3 Diag Array 7	USINT	rw	–	P0.43558.0.0 ... 19
0x2293.01 ... 14	SDO 10F3 Diag Array 8	USINT	rw	–	P0.43559.0.0 ... 19
0x2294.01 ... 14	SDO 10F3 Diag Array 9	USINT	rw	–	P0.43560.0.0 ... 19
0x2295.01 ... 14	SDO 10F3 Diag Array 10	USINT	rw	–	P0.43561.0.0 ... 19
0x2296.01 ... 14	SDO 10F3 Diag Array 11	USINT	rw	–	P0.43562.0.0 ... 19
0x2297.01 ... 14	SDO 10F3 Diag Array 12	USINT	rw	–	P0.43563.0.0 ... 19
0x2298.01 ... 14	SDO 10F3 Diag Array 13	USINT	rw	–	P0.43564.0.0 ... 19
0x2299.01 ... 14	SDO 10F3 Diag Array 14	USINT	rw	–	P0.43565.0.0 ... 19
0x229A.01 ... 14	SDO 10F3 Diag Array 15	USINT	rw	–	P0.43566.0.0 ... 19
0x229B.01 ... 14	SDO 10F3 Diag Array 16	USINT	rw	–	P0.43567.0.0 ... 19
0x229C.01 ... 14	SDO 10F3 Diag Array 17	USINT	rw	–	P0.43568.0.0 ... 19
0x229D.01 ... 14	SDO 10F3 Diag Array 18	USINT	rw	–	P0.43569.0.0 ... 19
0x229E.01 ... 14	SDO 10F3 Diag Array 19	USINT	rw	–	P0.43570.0.0 ... 19
0x229F.01 ... 08	Drive object data	UINT	ro	–	P1.24124.0.0 ... 7
0x22A0.01 ... 06	Drive unit data	UINT	ro	–	P1.24125.0.0 ... 5
0x22A1.01 ... 02	Assignment controller enable	UINT	ro	–	P1.24126.0.0 ... 1
0x22A2.01 ... 15	Encoder format	UDINT	ro	–	P1.231243.0.0 ... 20
0x22A3.01 ... 05	UINT8 (Array)	USINT	rw	–	P1.66016.0.0 ... 4
0x22A4.01 ... 05	UINT16 (Array)	UINT	rw	–	P1.66017.0.0 ... 4
0x22A5.01 ... 05	UINT32 (Array)	UDINT	rw	–	P1.66018.0.0 ... 4
0x22A6.01 ... 05	INT8 (Array)	SINT	rw	–	P1.66019.0.0 ... 4
0x22A7.01 ... 05	INT16 (Array)	INT	rw	–	P1.66053.0.0 ... 4
0x22A8.01 ... 05	INT32 (Array)	DINT	rw	–	P1.66055.0.0 ... 4
0x22A9.01 ... 05	BOOL (Array)	USINT	rw	–	P1.66056.0.0 ... 4
0x22AA.01 ... 03	Parameter channel description PROFIdrive	UINT	ro	–	P1.11280030.0.0 ... 2
0x22AB.01 ... 08	Axis ID Rx	UINT	rw	–	P1.4242105.0.0 ... 7

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0x22AC.01 ... 08	Data ID Rx	UDINT	rw	–	P1.4242106.0.0 ... 7
0x22AD.01 ... 08	Data instance ID Rx	UINT	rw	–	P1.4242107.0.0 ... 7
0x22AE.01 ... 08	Array ID Rx	UINT	rw	–	P1.4242108.0.0 ... 7
0x22AF.01 ... 08	Actual axis ID Rx	UINT	ro	–	P1.4242115.0.0 ... 7
0x22B0.01 ... 08	Actual data ID Rx	UDINT	ro	–	P1.4242116.0.0 ... 7
0x22B1.01 ... 08	Actual data instance ID Rx	UINT	ro	–	P1.4242117.0.0 ... 7
0x22B2.01 ... 08	Actual array ID Rx	UINT	ro	–	P1.4242118.0.0 ... 7
0x22B3.01 ... 08	Actual data type Rx	UDINT	ro	–	P1.4242119.0.0 ... 7
0x22B4.01 ... 08	Axis ID Tx	UINT	rw	–	P1.4242205.0.0 ... 7
0x22B5.01 ... 08	Data ID Tx	UDINT	rw	–	P1.4242206.0.0 ... 7
0x22B6.01 ... 08	Data instance ID Tx	UINT	rw	–	P1.4242207.0.0 ... 7
0x22B7.01 ... 08	Array ID Tx	UINT	rw	–	P1.4242208.0.0 ... 7
0x22B8.01 ... 08	Actual axis ID Tx	UINT	ro	–	P1.4242215.0.0 ... 7
0x22B9.01 ... 08	Actual data ID Tx	UDINT	ro	–	P1.4242216.0.0 ... 7
0x22BA.01 ... 08	Actual data instance ID Tx	UINT	ro	–	P1.4242217.0.0 ... 7
0x22BB.01 ... 08	Actual array ID Tx	UINT	ro	–	P1.4242218.0.0 ... 7
0x22BC.01 ... 08	Actual data type Tx	UDINT	ro	–	P1.4242219.0.0 ... 7
0x22BD.01 ... 40	Error number	UINT	ro	–	P1.11280040.0.0 ... 63
0x22BE.01 ... 40	Casting time error	UDINT	ro	–	P1.11280041.0.0 ... 63
0x22BF.01 ... 40	Warning number	UINT	ro	–	P1.11280042.0.0 ... 63
0x22C0.01 ... 40	Release time warning	UDINT	ro	–	P1.11280043.0.0 ... 63
0x22CF.01 ... 0A	Debug Variable UINT64	ULINT	rw	–	P0.101711.0.0 ... 9
0x22D0.01 ... 08	Debug Variable SINT64 Position	LINT	rw	–	P0.101713.0.0 ... 7
0x22DF.01 ... 40	Cogging Table Identification	UDINT	ro	–	P1.102008.0.0 ... 63
0x22EB.01 ... 08	Trace channel bitmask	ULINT	rw	–	P0.5520.0.0 ... 7
0x22EC.01 ... 08	Debug U32	UDINT	rw	–	P0.102706.0.0 ... 7
0x22ED.01 ... 08	Debug I32	DINT	rw	–	P0.102708.0.0 ... 7
0x22EE.01 ... 08	Debug U16	UINT	rw	–	P0.102709.0.0 ... 7
0x22EF.01 ... 08	Debug I16	INT	rw	–	P0.102710.0.0 ... 7
0x22F0.01 ... 03	Offset analog input	REAL	rw	–	P1.102673.0.0 ... 2
0x22F3.01 ... 40	Torque table	REAL	rw	–	P1.102644.0.0 ... 63
0x22F4.01 ... 40	Position table	LINT	rw	–	P1.102645.0.0 ... 63
0x22F6.01 ... 08	Aktive trace channel bitmask	ULINT	ro	–	P0.5521.0.0 ... 7
0x2413.01 ... 04	Memory location INT32	DINT	rw	–	P0.101715.0.0
0x2413.05 ... 08	Memory location FLOAT32	REAL	rw	–	P0.101717.0.0
0x241E.01	CiP Sync: Timestamp associated with the position setpoint	UDINT	rw	Rx	P0.303303.0.0
0x241E.02	CiP Sync: Sync interval	REAL	ro	Tx	P0.303305.0.0
0x241E.03	CiP Sync: PTP timestamp (us)	ULINT	ro	Tx	P0.303306.0.0
0x241F.01	Unwind range	LINT	rw	Rx	P1.102964.0.0
0x241F.02	Output setpoint	LINT	ro	Tx	P1.102965.0.0
0x241F.03	Output unwind	LINT	ro	Tx	P1.102966.0.0
0x2420.01	State of application class 5	UDINT	ro	Tx	P1.11280532.0.0
0x2422.01	Encoder linearisation status	UDINT	ro	–	P0.50301.0.0
0x2423.01	Status Cogging Compensation	UDINT	ro	–	P1.101959.0.0
0x2423.05	Actual value cogging table	REAL	ro	–	P1.101967.0.0
0x2424.01	M_ADD	REAL	rw	–	P1.101951.0.0

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0x2424.02	M_LIMIT_NEG	REAL	rw	–	P1.101981.0.0
0x2424.03	M_LIMIT_POS	REAL	rw	–	P1.101985.0.0
0x2424.04	Kp_Adapt	REAL	rw	–	P1.101993.0.0
0x2424.05	Lower limit input value	REAL	rw	–	P1.101994.0.0
0x2424.06	Upper limit input value	REAL	rw	–	P1.101995.0.0
0x2424.07	Lower limit value Output value	REAL	rw	–	P1.101998.0.0
0x2424.08	Upper limit value Output value	REAL	rw	–	P1.102000.0.0
0x2424.09	Mode Gain Calculation	UDINT	rw	–	P1.102002.0.0
0x2425.01	Status Identification Cogging	UDINT	ro	–	P1.102003.0.0
0x2425.02	Normalisation Factor Identification Cogging	REAL	rw	–	P1.102004.0.0
0x2425.03	Offset Identification Cogging	REAL	rw	–	P1.102005.0.0
0x2425.04	Evaluation Identification Cogging	REAL	rw	–	P1.102006.0.0
0x2425.05	Internal Status Identification Cogging	UDINT	ro	–	P1.102007.0.0
0x2425.06	Storage option: Cogging table recording error	USINT	rw	–	P1.102017.0.0
0x2425.07	Diagnosis category: Error in recording the cogging table	UINT	rw	–	P1.102019.0.0
0x242A.01	ModBus TCP timeout	REAL	rw	–	P0.102393.0.0
0x242A.02	Activation EtherNet/IP	USINT	rw	Rx	P0.102726.0.0
0x242B.01	Amplification gain analog input	REAL	rw	–	P0.201.0.0
0x242B.02	Offset analog input	REAL	rw	–	P0.202.0.0
0x242B.03	Scaled value analog input	REAL	ro	–	P0.206.0.0
0x242B.04	Dead zone analog input	REAL	rw	–	P0.102046.0.0
0x242B.05	Filter time constant analog input	REAL	rw	–	P0.102096.0.0
0x242C.01	Activation Save data recording	USINT	rw	–	P0.102260.0.0
0x242C.02	Data recording storage status	UDINT	ro	–	P0.102403.0.0
0x242C.03	Time stamp Data recording storage	LINT	ro	–	P0.102411.0.0
0x242D.01	Activation of mass/friction estimation	USINT	rw	–	P1.102417.0.0
0x242D.02	Maximum velocity	REAL	rw	–	P1.102419.0.0
0x242D.03	Filter time constant velocity	REAL	rw	–	P1.102421.0.0
0x242D.04	Filter time constant Acceleration	REAL	rw	–	P1.102423.0.0
0x242D.05	Static friction Force	REAL	ro	–	P1.102425.0.0
0x242D.06	Filter time constant Torque	REAL	rw	–	P1.102426.0.0
0x242D.07	Basic mass	REAL	rw	–	P1.102427.0.0
0x242D.08	Standstill damping time	REAL	rw	–	P1.102428.0.0
0x242D.09	Monitoring window velocity standstill monitoring	REAL	rw	–	P1.102429.0.0
0x242D.0A	Standstill monitoring status	USINT	ro	–	P1.102431.0.0
0x242D.0B	Velocity dependent friction Force	REAL	ro	–	P1.102432.0.0
0x242D.0C	Total inertia	REAL	ro	–	P1.102433.0.0
0x242D.0D	Total mass	REAL	ro	–	P1.102434.0.0
0x242D.0E	Static friction Torque	REAL	ro	–	P1.102435.0.0
0x242D.0F	Positioning time	REAL	ro	–	P1.102436.0.0
0x242D.10	Load mass	REAL	ro	–	P1.102437.0.0
0x242D.11	Status mass/friction estimation	UDINT	ro	–	P1.102438.0.0
0x242D.12	Velocity dependent friction Torque	REAL	ro	–	P1.102439.0.0

Index.Subindex	Name	Data type	Access	PDO mapping	Parameter
0x242D.13	unused	REAL	rw	–	P1.102441.0.0
0x242D.14	unused	REAL	ro	–	P1.102442.0.0
0x242D.16	Basic inertia	REAL	rw	–	P1.102458.0.0
0x242D.17	Load inertia	REAL	ro	–	P1.102492.0.0
0x242D.18	Storage option: Calculation mass/friction value estimate not completed	USINT	rw	–	P1.102544.0.0
0x242D.19	Diagnostic category: Calculation mass/friction value estimate not completed	UINT	rw	–	P1.102548.0.0
0x2435.01	IO-Profile	UINT	rw	Rx	P0.102886.0.0
0x2436.01	IO-Link telegram selection	UINT	rw	Rx	P0.102889.0.0
0x2437.01	IO-Link device ID	UDINT	ro	Tx	P0.102890.0.0
0x2437.02	IO-Link application tag	STRING(32)	rw	Rx	P0.102891.0.0 ... 31
0x2437.03	IO-Link function tag	STRING(32)	rw	Rx	P0.102892.0.0 ... 31
0x2437.04	IO-Link localisation tag	STRING(32)	rw	Rx	P0.102893.0.0 ... 31
0x2439.01	Activation Torque/Position	USINT	rw	–	P1.101082.0.0
0x2439.02	Torque/Position	USINT	ro	–	P1.101089.0.0
0x2439.04	Activation torque at standstill	USINT	rw	–	P1.101097.0.0
0x2439.05	Output Torque/Position	REAL	ro	–	P1.101131.0.0
0x2439.06	Limit value standstill detection	REAL	rw	–	P1.101149.0.0
0x2439.07	Direction Torque/Position	USINT	rw	–	P1.102642.0.0
0x2439.08	Setpoint Selector Torque/Position	USINT	rw	–	P1.102643.0.0
0x2439.09	Number of table elements	UDINT	rw	–	P1.102646.0.0
0x2439.0A	Offset Position Torque/Position	LINT	rw	–	P1.102647.0.0
0x2439.0B	Offset Torque Torque/Position	REAL	rw	–	P1.102648.0.0
0x2439.0C	Source Parameter Torque/Position	LINT	rw	–	P1.102649.0.0

Tab. 767: Objects reference list

12 PROFINET

12.1 General

The product is intended for operation in a PROFINET IO network. Data are transferred based on Industrial Ethernet following the IEEE 802.3 protocol. Communication is in real-time, using the Real-Time Protocol (RT) or the Isochronous Real-Time Protocol (IRT).

Ports

The product has two equivalent Ethernet interfaces (RJ45) with integrated switch.
– Port 1: XF1 IN
– Port 2: XF2 OUT

Topology

The servo drive can be integrated into a PROFINET network branch with ring (MRP), star or line topology.
The network can be divided into segments using additional switches and routers. This makes it possible to structure and expand the network.

PROFIdrive

PROFIdrive is a modular drive profile for electrical drive devices with PROFIBUS or PROFINET connection.

Downloads

A GSDML file is available in the firmware package and as a separate file on the Internet ➔ www.festo.com/sp.

Festo provides function blocks and application notes to facilitate the commissioning of the device with controllers from various manufacturers ➔ www.festo.com/sp, Downloads→ Software and Expert knowledge.

12.2 Standards

This part of the documentation describes the implemented standards and the communications of the device in a PROFINET network and the PROFIdrive device profile. It is targeted at people who are already familiar with the bus protocol and device profile.

User organisation:

Information on the PROFIBUS user organisation (PNO) ➔ www.profibus.com.

PROFIdrive Implementation:

The PROFIdrive implementation is based on the following standard:

Default	Version	Issue
PROFIdrive Profile Technical Specification forPROFIBUS and PROFINET	4.2	Oct. 2015

Tab. 768: PROFIdrive Implementation

12.3 PROFINET communication

12.3.1 Device description file

A device description file (GSDML file) is used for project engineering in the higher-order controller software. This file contains all the information required for operation using control software (such as SIEMENS TIA Portal or STEP 7). The device description file is available on the Internet ➔ www.festo.com/sp.

12.3.2 Crossover Detection

The product supports crossover detection (auto MDI/MDI-X), which means that there is the option of using patch cables or crossover cables. When using patch cables and crossover cables in the same network, crossover detection must be activated in the higher-order controller.

12.3.3 Identification & Maintenance

The “Identification and Maintenance” (I&M) function serves as an electronic rating plate of the product and offers uniform, manufacturer-independent access to device-specific online information over the network.

12.3.4 Connection parameters

ID Px.	Parameter	Description	
11295001	Name of Station	Displays the PROFINET Name of Station.	
		Access	read/–
		Update	effective immediately
		Unit	–
12004	Active IP address	Active IP address	
		Access	read/–
		Update	effective immediately
		Unit	–
12005	Active subnet mask	Active subnet mask	
		Access	read/–
		Update	effective immediately
		Unit	–
12006	Active gateway address	Active gateway address	
		Access	read/–
		Update	effective immediately
		Unit	–
12007	MAC address	MAC address	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 769: Parameter

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
11295001	3320.0 ... 240	Name of Station	STRING(241)
12004	2999.0	Active IP address	UDINT
12005	3001.0	Active subnet mask	UDINT
12006	3003.0	Active gateway address	UDINT
12007	3005.0 ... 5	MAC address	USINT

Tab. 770: PNUs

12.3.5 Connection characteristics

ID Px.	Parameter	Description	
11280109	Actual application class	Displays the actual application class.	
		Access	read/–
		Update	effective immediately

ID Px.	Parameter	Description	
11280109	Actual application class	Unit	–
11280201	PZD telegram selection	Specifies the setting of the receive and transmit telegram.	
		Access	read/–
		Update	effective immediately
		Unit	–
11280204	Extended process data	Displays which telegram is used for the Extended process data.	
		Access	read/–
		Update	effective immediately
		Unit	–
11280210	Active telegrams	Displays the active telegram for the respective connection.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 771: Parameter

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280201	922.0	PZD telegram selection	UINT
11280204	60104.0	Extended process data	UINT
11280210	60100.0 ... 4	Active telegrams	UINT
Px.	**Manufacturer-specific parameters**		
11280201	3314.0	PZD telegram selection	UINT
11280109	12317.0	Actual application class	UDINT
11280204	3401.0	Extended process data	UINT
11280210	3402.0 ... 4	Active telegrams	UINT

Tab. 772: PNUs

12.3.6 Diagnostics via PROFINET

PROFINET forms the basis for comprehensive diagnostics functions and information over the automation network, e.g. detailed module-related and channel-related status information and error detection in the online mode of the configuration software and in the PLC user program. The PROFIdrive-specific diagnostics over PROFINET can be activated via the "Activate diagnostics" module parameter described in the GSDML in the controller configuration software (e.g. STEP 7 or TiA Portal). PROFINET diagnostics is deactivated on delivery. The PROFIdrive-specific diagnostic codes and the mapping are described in the detailed internal device diagnostics:

Channel error type	Name	Festo Automation Suite ID Dx.
0x40	Mismatch of safety destination address (F_Dest_Add)	09 | 08 | 00478, 09 | 08 | 00748
0x41	Safety destination address not valid (F_Dest_Add)	09 | 08 | 00479, 09 | 08 | 00749
0x42	Safety source address not valid (F_Source_Add)	09 | 08 | 00480, 09 | 08 | 00750
0x43	Safety watchdog time value is 0 ms (F_WD_Time)	09 | 08 | 00481, 09 | 08 | 00751

Channel error type	Name	Festo Automation Suite ID Dx.
0x44	Parameter F_SIL exceeds SIL from specific device application	09 | 08 | 00482, 09 | 08 | 00752
0x45	Parameter F_CRC_Length does not match the generated values	09 | 08 | 00483, 09 | 08 | 00753
0x46	Version of F parameter set incorrect	09 | 08 | 00484, 09 | 08 | 00754
0x47	Data inconsistent in received F-Parameter block (CRC1 error)	09 | 08 | 00485, 09 | 08 | 00755
0x48	Device specific or unspecified diagnosis information, see manual	09 | 08 | 00486, 09 | 08 | 00756
0x49	Save iParameter watchdog time exceeded	09 | 08 | 00487, 09 | 08 | 00757
0x4A	Restore iParameter watchdog time exceeded	09 | 08 | 00488, 09 | 08 | 00758
0x4B	Inconsistent iParameters (iParCRC error)	09 | 08 | 00489, 09 | 08 | 00759
0x4C	F_Block_ID not supported	09 | 08 | 00490, 09 | 08 | 00760
0x4D	Transmission error: data inconsistent (CRC2 error)	09 | 08 | 00491, 09 | 08 | 00761
0x4E	Transmission error: timeout (F_WD_Time or F_WD_Time_2 elapsed)	09 | 08 | 00492, 09 | 08 | 00762
0x4F	Acknowledge needed to enable the channel(s)	09 | 08 | 00493, 09 | 08 | 00763
0x50	BaseID not valid or mismatch of the BaseID	09 | 08 | 00494, 09 | 08 | 00764
0x9000	Microcontroller Hardware or Software	02 | 02 | 00286, 02 | 02 | 00287, 10 | 01 | 00158, 11 | 00 | 00689, 11 | 01 | 00159, 11 | 01 | 00160, 11 | 01 | 00161, 11 | 01 | 00162, 11 | 01 | 00163, 11 | 01 | 00244, 11 | 02 | 00164, 11 | 02 | 00165, 11 | 02 | 00166, 11 | 02 | 00167, 11 | 02 | 00168, 11 | 02 | 00169, 11 | 02 | 00170, 11 | 02 | 00171, 11 | 02 | 00172, 11 | 03 | 00173, 11 | 03 | 00174, 11 | 03 | 00175, 11 | 03 | 00176, 11 | 03 | 00177, 11 | 03 | 00178, 11 | 03 | 00179, 11 | 03 | 00180, 11 | 04 | 00181, 11 | 04 | 00182, 11 | 04 | 00183, 11 | 04 | 00184, 11 | 04 | 00185, 11 | 04 | 00186, 11 | 04 | 00187, 11 | 04 | 00188, 11 | 04 | 00189, 11 | 04 | 00190, 11 | 05 | 00191, 11 | 05 | 00192, 11 | 05 | 00193, 11 | 05 | 00194, 11 | 05 | 00195, 11 | 05 | 00196, 11 | 05 | 00197, 11 | 05 | 00198, 11 | 05 | 00200, 11 | 05 | 00201, 11 | 05 | 00202, 11 | 07 | 00204, 11 | 08 | 00206, 11 | 08 | 00207, 13 | 01 | 00215, 13 | 01 | 00216, 16 | 01 | 00222
0x9001	Mains Supply	02 | 03 | 00036, 02 | 03 | 00037, 02 | 03 | 00038, 02 | 03 | 00039, 02 | 03 | 00040, 02 | 03 | 00041, 02 | 03 | 00251
0x9002	Low Voltage Supply	02 | 01 | 00022, 02 | 01 | 00023, 02 | 01 | 00024, 02 | 01 | 00025, 02 | 01 | 00026, 02 | 01 | 00027, 02 | 01 | 00028, 02 | 01 | 00029, 02 | 01 | 00472
0x9003	DC Link Overvoltage	02 | 02 | 00030, 02 | 02 | 00032
0x9004	Power Electronics	10 | 01 | 00156
0x9005	Overtemperature Electronic Device	01 | 02 | 00014, 01 | 02 | 00015, 01 | 02 | 00016, 01 | 02 | 00017, 03 | 01 | 00046, 03 | 01 | 00047, 03 | 02 | 00050, 03 | 02 | 00051
0x9006	Isolation Fault	01 | 00 | 00840, 01 | 01 | 00010, 01 | 01 | 00011
0x9007	Motor Overload	01 | 02 | 00012, 01 | 02 | 00013, 01 | 02 | 00258, 01 | 02 | 00259, 03 | 03 | 00054, 03 | 03 | 00055

Channel error type	Name	Festo Automation Suite ID Dx.
0x9008	Fieldbus System	08 | 00 | 00139, 08 | 00 | 00140, 08 | 00 | 00243, 08 | 03 | 00141, 08 | 03 | 00373, 08 | 03 | 00391, 08 | 03 | 00617, 08 | 04 | 00142, 08 | 04 | 00143, 08 | 04 | 00246, 08 | 04 | 00247, 08 | 04 | 00281, 08 | 06 | 00637, 08 | 09 | 00288, 08 | 09 | 00289, 08 | 09 | 00294, 08 | 09 | 00299, 08 | 09 | 00382, 08 | 13 | 00001, 08 | 13 | 00394, 08 | 13 | 00395, 11 | 06 | 00285, 11 | 06 | 00300
0x9009	Safety Channel	09 | 00 | 00002, 09 | 00 | 00003, 09 | 00 | 00146, 09 | 00 | 00147, 09 | 00 | 00469, 09 | 00 | 00470, 09 | 00 | 00531, 09 | 00 | 00532, 09 | 00 | 00536, 09 | 00 | 00537, 09 | 00 | 00538, 09 | 00 | 00539, 09 | 00 | 00540, 09 | 00 | 00541, 09 | 00 | 00546, 09 | 00 | 00550, 09 | 00 | 00551, 09 | 00 | 00552, 09 | 00 | 00553, 09 | 00 | 00554, 09 | 00 | 00555, 09 | 00 | 00556, 09 | 00 | 00557, 09 | 00 | 00558, 09 | 00 | 00592, 09 | 00 | 00593, 09 | 00 | 00600, 09 | 00 | 00601, 09 | 00 | 00606, 09 | 00 | 00607, 09 | 00 | 00608, 09 | 00 | 00609, 09 | 00 | 00610, 09 | 00 | 00611, 09 | 00 | 00612, 09 | 00 | 00613, 09 | 00 | 00614, 09 | 00 | 00615, 09 | 00 | 00622, 09 | 00 | 00623, 09 | 00 | 00630, 09 | 00 | 00635, 09 | 00 | 00636, 09 | 00 | 00640, 09 | 00 | 00641, 09 | 00 | 00642, 09 | 00 | 00643, 09 | 00 | 00644, 09 | 00 | 00645, 09 | 00 | 00646, 09 | 00 | 00647, 09 | 00 | 00648, 09 | 00 | 00649, 09 | 00 | 00650, 09 | 00 | 00651, 09 | 00 | 00677, 09 | 00 | 00678, 09 | 00 | 00679, 09 | 00 | 00680, 09 | 00 | 00681, 09 | 00 | 00682, 09 | 00 | 00683, 09 | 00 | 00684, 09 | 00 | 00687, 09 | 00 | 00806, 09 | 00 | 00807, 09 | 00 | 00808, 09 | 00 | 00809, 09 | 00 | 00811, 09 | 01 | 00148, 09 | 01 | 00149, 09 | 01 | 00150, 09 | 01 | 00659, 09 | 01 | 00660, 09 | 01 | 00661, 09 | 01 | 00662, 09 | 01 | 00663, 09 | 01 | 00664, 09 | 01 | 00665, 09 | 01 | 00666, 09 | 01 | 00667, 09 | 01 | 00668, 09 | 01 | 00669, 09 | 01 | 00670, 09 | 02 | 00151, 09 | 02 | 00152, 09 | 02 | 00766, 09 | 02 | 00767, 09 | 03 | 00442, 09 | 03 | 00443, 09 | 03 | 00444, 09 | 03 | 00445, 09 | 03 | 00602, 09 | 03 | 00603, 09 | 03 | 00698, 09 | 03 | 00699, 09 | 03 | 00700, 09 | 03 | 00701, 09 | 04 | 00446, 09 | 04 | 00447, 09 | 04 | 00448, 09 | 04 | 00449, 09 | 04 | 00527, 09 | 04 | 00528, 09 | 04 | 00542, 09 | 04 | 00543, 09 | 05 | 00453, 09 | 05 | 00454, 09 | 05 | 00455, 09 | 05 | 00456, 09 | 05 | 00473, 09 | 05 | 00512, 09 | 05 | 00513, 09 | 05 | 00514, 09 | 05 | 00515, 09 | 05 | 00516, 09 | 05 | 00517, 09 | 05 | 00518, 09 | 05 | 00519, 09 | 05 | 00520, 09 | 05 | 00521, 09 | 05 | 00522, 09 | 05 | 00523, 09 | 05 | 00525, 09 | 05 | 00526, 09 | 06 | 00457, 09 | 06 | 00458, 09 | 06 | 00459, 09 | 06 | 00460, 09 | 06 | 00461, 09 | 06 | 00462, 09 | 06 | 00463, 09 | 06 | 00464, 09 | 06 | 00594, 09 | 06 | 00595, 09 | 06 | 00596, 09 | 06 | 00597, 09 | 06 | 00598, 09 | 06 | 00599, 09 | 08 | 00768, 09 | 08 | 00769, 09 | 09 | 00671, 09 | 09 | 00672, 09 | 09 | 00673, 09 | 09 | 00674, 09 | 09 | 00675, 09 | 09 | 00676, 09 | 10 | 00727, 09 | 10 | 00728, 09 | 10 | 00729, 09 | 10 | 00730, 09 | 11 | 00731, 09 | 11 | 00732, 09 | 11 | 00733, 09 | 11 | 00734, 09 | 11 | 00735, 09 | 11 | 00736, 09 | 12 | 00737, 09 | 12 | 00738, 09 | 12 | 00739, 09 | 12 | 00740, 09 | 12 | 00741, 09 | 12 | 00742, 09 | 12 | 00743, 09 | 12 | 00744, 09 | 12 | 00745, 09 | 12 | 00746
0x900A	Feedback	02 | 04 | 00042, 02 | 04 | 00043, 18 | 00 | 00092, 18 | 00 | 00093, 18 | 00 | 00094, 18 | 00 | 00095, 18 | 00 | 00096, 18 | 00 | 00227, 18 | 00 | 00318, 18 | 01 | 00228, 18 | 01 | 00229, 18 | 02 | 00230, 18 | 02 | 00231, 18 | 02 | 00232, 18 | 02 | 00233, 18 | 02 | 00234, 18 | 02 | 00276, 18 | 03 | 00235, 18 | 03 | 00301, 18 | 03 | 00434, 18 | 04 | 00236, 18 | 04 | 00237, 18 | 04 | 00238, 18 | 04 | 00253, 18 | 05 | 00239, 18 | 05 | 00633, 18 | 05 | 00812, 18 | 05 | 00813, 18 | 05 | 00839, 18 | 06 | 00240, 18 | 06 | 00241, 18 | 06 | 00242, 18 | 06 | 00277, 18 | 07 | 00365, 18 | 07 | 00366, 18 | 07 | 00367, 18 | 07 | 00368, 18 | 07 | 00369, 18 | 07 | 00370, 18 | 07 | 00371, 18 | 07 | 00372
0x900B	Internal Communication	08 | 14 | 00544, 08 | 14 | 00747, 09 | 05 | 00009, 09 | 11 | 00814, 09 | 11 | 00815, 10 | 01 | 00153, 10 | 01 | 00154, 10 | 01 | 00157, 10 | 01 | 00199, 10 | 01 | 00249, 10 | 01 | 00713, 10 | 01 | 00714, 11 | 06 | 00203, 13 | 00 | 00474, 13 | 00 | 00475, 13 | 00 | 00476
0x900C	Infeed	02 | 02 | 00031, 02 | 02 | 00033, 02 | 02 | 00034, 02 | 02 | 00035, 07 | 05 | 00772
0x900D	Brake Resistor	01 | 03 | 00019, 01 | 03 | 00020, 01 | 03 | 00702
0x900F	External	16 | 01 | 00221, 16 | 01 | 00223

Channel error type	Name	Festo Automation Suite ID Dx.
0x9010	Technology	05 | 01 | 00057, 05 | 01 | 00058, 05 | 02 | 00059, 05 | 02 | 00060, 05 | 02 | 00061, 05 | 02 | 00062, 05 | 02 | 00063, 05 | 02 | 00064, 05 | 02 | 00065, 05 | 02 | 00066, 05 | 02 | 00067, 05 | 02 | 00068, 05 | 02 | 00069, 05 | 02 | 00071, 05 | 02 | 00072, 05 | 02 | 00073, 05 | 02 | 00074, 05 | 02 | 00075, 05 | 02 | 00076, 05 | 02 | 00077, 05 | 02 | 00078, 05 | 02 | 00079, 05 | 02 | 00080, 05 | 02 | 00245, 05 | 02 | 00278, 05 | 02 | 00279, 05 | 02 | 00280, 05 | 02 | 00282, 05 | 02 | 00283, 05 | 02 | 00284, 05 | 02 | 00396, 05 | 02 | 00397, 05 | 02 | 00431, 05 | 02 | 00432, 05 | 03 | 00639, 06 | 00 | 00313, 06 | 00 | 00545, 06 | 00 | 00826, 06 | 02 | 00086, 06 | 02 | 00087, 06 | 02 | 00088, 06 | 02 | 00089, 06 | 02 | 00090, 06 | 02 | 00091, 06 | 02 | 00273, 06 | 02 | 00274, 06 | 02 | 00275, 06 | 05 | 00620, 06 | 05 | 00621, 06 | 05 | 00816, 07 | 01 | 00109, 07 | 01 | 00110, 07 | 01 | 00111, 07 | 01 | 00112, 07 | 01 | 00113, 07 | 01 | 00114, 07 | 01 | 00115, 07 | 01 | 00116, 07 | 01 | 00117, 07 | 01 | 00118, 07 | 01 | 00119, 07 | 01 | 00120, 07 | 02 | 00121, 07 | 02 | 00122, 07 | 02 | 00123, 07 | 02 | 00124, 07 | 02 | 00125, 07 | 02 | 00126, 07 | 02 | 00127, 07 | 02 | 00128, 07 | 02 | 00129, 07 | 02 | 00130, 07 | 02 | 00131, 07 | 02 | 00132, 07 | 02 | 00133, 07 | 02 | 00634, 07 | 02 | 00658, 07 | 03 | 00134, 07 | 03 | 00135, 07 | 04 | 00136, 07 | 04 | 00137, 07 | 11 | 00765, 09 | 03 | 00818, 09 | 03 | 00819, 09 | 03 | 00820, 09 | 03 | 00821, 10 | 00 | 00827, 13 | 02 | 00217, 13 | 02 | 00218, 13 | 02 | 00219, 13 | 02 | 00220
0x9011	Engineering	01 | 02 | 00018, 01 | 03 | 00021, 01 | 03 | 00773, 01 | 03 | 00774, 05 | 01 | 00056, 05 | 01 | 00619, 05 | 02 | 00364, 06 | 00 | 00070, 06 | 00 | 00081, 06 | 00 | 00082, 06 | 00 | 00083, 06 | 00 | 00084, 06 | 00 | 00085, 06 | 00 | 00248, 06 | 00 | 00252, 06 | 02 | 00559, 06 | 05 | 00097, 06 | 05 | 00098, 06 | 05 | 00099, 06 | 05 | 00100, 06 | 05 | 00101, 06 | 05 | 00102, 06 | 05 | 00103, 06 | 05 | 00104, 06 | 05 | 00105, 06 | 05 | 00106, 06 | 05 | 00107, 06 | 05 | 00108, 06 | 05 | 00290, 06 | 05 | 00291, 06 | 05 | 00624, 06 | 05 | 00625, 06 | 05 | 00626, 06 | 05 | 00627, 06 | 05 | 00810, 08 | 09 | 00144, 08 | 09 | 00145, 08 | 12 | 00250, 08 | 12 | 00272, 11 | 07 | 00205, 11 | 07 | 00271, 13 | 01 | 00779, 18 | 00 | 00686, 18 | 00 | 00688, 18 | 00 | 00693, 18 | 01 | 00771
0x9012	Other	03 | 01 | 00044, 03 | 01 | 00045, 03 | 02 | 00048, 03 | 02 | 00049, 03 | 03 | 00052, 03 | 03 | 00053, 07 | 00 | 00255, 12 | 01 | 00208, 12 | 01 | 00209, 12 | 01 | 00210, 12 | 01 | 00211, 12 | 01 | 00212, 12 | 01 | 00213, 12 | 01 | 00440, 13 | 01 | 00214, 17 | 01 | 00224, 17 | 01 | 00225, 17 | 01 | 00226, 17 | 01 | 00439, 17 | 01 | 00628, 17 | 01 | 00629, 17 | 01 | 00817
0x9013	Auxiliary Device	07 | 05 | 00138, 10 | 01 | 00155

Tab. 773: PROFINET error codes

12.4 PROFIdrive

12.4.1 General

12.4.1.1 Data types

Standard data types as per IEC 61158-5-10 and profile-specific data types can be used for transmission of data for PROFIdrive drives (parameters and signal of the I/O data telegrams). We recommend the use of profile-specific data types for optimal integration of data in PROFIdrive applications.

Standard data types			Profile-specific data types	
Data type	Identifier		Data type	Identifier
Boolean (BOOL)	1		N2 normalised value (16 bit)	113
Integer8 (SINT)	2		N4 normalised value (32 bit)	114
Integer16 (INT)	3		V2 bit sequence	115
Integer32 (DINT)	4		L2 nibble	116
Integer64 (LINT)	55		R2 reciprocal time constant	117
Unsigned8 (USINT)	5		T2 time constant (16 bit)	118
Unsigned16 (UINT)	6		T4 time constant (32 bit)	119

Standard data types			Profile-specific data types	
Data type	Identifier		Data type	Identifier
Unsigned32 (UDINT)	7		D2 time constant	120
Unsigned64 (ULINT)	56		E2 fixed point value (16 bit)	121
FloatingPoint (REAL)	8		C4 fixed point value (32 bit)	122
FloatingPoint64 (LREAL)	15		X2 normalised value, variable (16 bit)	123
VisibleString(STRING(X))	9		X4 normalised value, variable (32 bit)	124
OctetString	10			
UNICODEString	39			
TimeOfDay (with date indication)	12			
Date	50			
TimeOfDay (without date indication)	52			
TimeDifference (with date indication)	53			
TimeDifference (without date indication)	54			

Tab. 774: Data types

12.4.1.2 Base model

Devices

The PROFIdrive base model, regardless of the communication system, is based on the following three basic components and their relationships with one another:

- Controller
  A controller is an programmable logic controller (PLC) that is assigned to one or more axes of a drive system.
- P device
  A P device is a drive device that is assigned to one or more controllers.
- Supervisor
  For example, a supervisor is an engineering tool that is used to manage data, parameters and diagnostic data from P-devices and controllers.

Functional object

A PROFIdrive device contains one or more functional objects that represent specific functions of the automation system. In the case of P devices the functional object corresponds to a drive object. The drive object represents the actual drive functions, such as a drive axis consisting of motor, output stage, closed-loop control and IO functions.

Communication services

The following communication services are used with PROFIdrive:

- Process data (cyclic data exchange)
  Process data such as setpoint and actual values along with control and status data are transmitted cyclically. Process data are time-critical and must be transmitted under real-time conditions.
- Parameter data (acyclic data exchange)
  Parameter data, such as firmware data or parameters, are transmitted acyclically and only as required.
- Alarms for diagnostic messages

The servo drive sends diagnostic messages to the controller under real-time conditions.

– Time synchronisation data (AC4)

All communication services transmit data in the big-endian format.

12.4.1.3 Drive model

The PROFIdrive drive model defines the architecture of a P device more precisely based on the PROFIdrive base model.

– P device
  A P device contains at least one or more drive units (DU) and can also contain other objects.
– Drive Unit
  A drive unit contains at least one or more drive objects (DO).
– Drive Object
  A drive object is a drive axis.

Potential classes of a P device or a drive unit are derived from it.



Single-Axis
Drive Unit

Fig. 126: PROFIdrive class single axis

12.4.1.4 Application model

Application model

A total of 6 application classes (AC) for different applications is defined with PROFIdrive. The following application classes are supported:

AC	Application class
1	Speed mode (PV)
3	Positioning mode(PP)
4	Central motion control (motion)

Tab. 775: Application classes

12.4.1.5 Finite State Machines

The finite state machines describe the statuses that the drive can have and the required handshake of control and status bits for the status change.

12.4.2 Application classes

12.4.2.1 Basic values and reference values in the application classes

Effectiveness of the dynamic values in the application classes

When a stop ramp is requested via the control word STW1 and when a motion command is requested in application classes 1 and 3, the following dynamic values are used:

ID Px.	Parameters	Effectiveness of the dynamic values in the application classes (AC)						
		STW1.0 AC1/AC3	STW1.2 AC1/AC3	STW1.4 AC1/AC3	STW1.5 AC3	STW1.6 AC1	ModePos AC3	Profile AC1
11280402	Acceleration	–	–	–	–	–	–	✓
11280403	Deceleration	✓	–	–	–	✓	–	✓
11280404	Jerk	✓	–	–	✓	✓	✓	✓
11280405	Deceleration (system stop)	–	–	✓	–	–	–	–
11280406	Jerk (system stop)	–	–	✓	–	–	–	–
12101.0.0	Deceleration Stop ramp	–	✓	–	–	–	–	–
12111.0.0	Jerk Stop ramp	–	✓	–	–	–	–	–
11280702	Base value acceleration	–	–	–	–	–	✓	–
11280703	Base value deceleration	–	–	–	✓	–	✓	–
11280701	Base value velocity	–	–	–	–	–	✓	✓
–	Base value velocity (PLC)	–	–	–	–	–	✓	✓

Tab. 776: Effectiveness of the dynamic values

Parameter

ID Px.	Parameter	Description	
11280701	Base value velocity	Specifies the base value for all Application Classes. The base value in user units (drive side without gearbox) is multiplied by the normalized value in the process data and then results in the internal velocity setpoint. As a recommendation, the base value should be half of the maximum velocity in order to use the full value range 0..200% from the control.	
		Access	read/write
		Update	reinitialization
		Unit	user defined
11280702	Base value acceleration	Specifies the base value for acceleration for the Positioning application class in Tel. 111. The base value is multiplied by the normalized value in the process data and then gives the internal acceleration setpoint.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280703	Base value deceleration	Specifies the base value for deceleration for the Positioning application class in Tel. 111. The base value is multiplied by the normalized value in the process data and then gives the internal deceleration setpoint.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280402	Acceleration	Specifies the acceleration value for the application class AC1.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280403	Deceleration	Specifies the deceleration value for the application class AC1 and AC3.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280404	Jerk	Specifies the value for the jerk for the application class AC1 and AC3.	
		Access	read/write

ID Px.	Parameter	Description	
11280404	Jerk	Update	effective immediately
		Unit	user defined

Tab. 777: Parameter

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
11280701	12345.0	Base value velocity	REAL
11280702	12346.0	Base value acceleration	REAL
11280703	12347.0	Base value deceleration	REAL
11280402	12325.0	Acceleration	REAL
11280403	12326.0	Deceleration	REAL
11280404	12327.0	Jerk	REAL

Tab. 778: PNUs

12.4.2.2 Application Class 1 – Standard Drive (Speed Mode)

In application class 1 the drive is controlled by a main setpoint, e.g. speed setpoint. The speed is controlled completely in the drive. The bus is simply the transmission medium between the automation system and the servo drive. The higher-level controller (PLC) contains all technological functions for the automation task. Process data (setpoint and actual values) are exchanged cyclically. Cyclical synchronous data transfer can be used, but is typically not necessary for this application class.

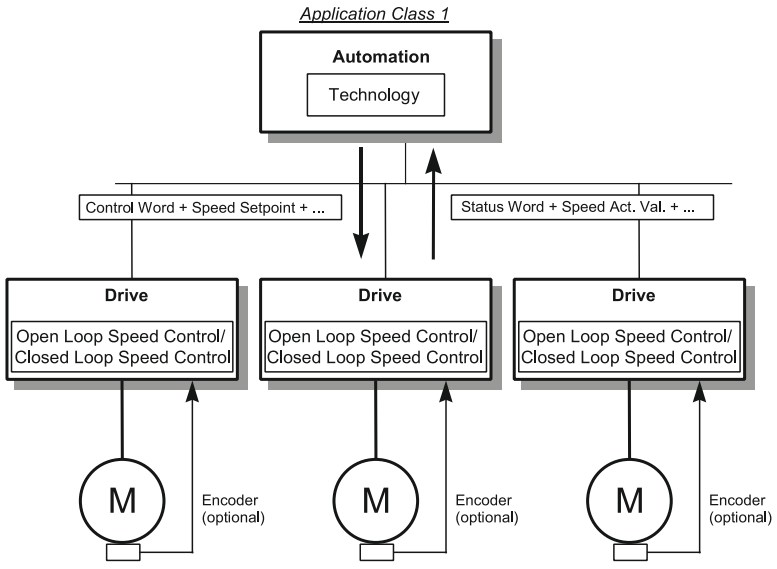


Fig. 127: Application class 1

12.4.2.3 Application Class 3 – Positioning Mode (PtP)

In application class 3 the positioning commands are sent to the drive by the higher-level controller (PLC). The higher-level controller (PLC) only contains the technological functions required for the automation task. The drive itself directly controls the interpolation, positioning and rotational speed and all time-critical control algorithms. Cyclical synchronous operation is only required for complex tracking tasks with multiple axes.

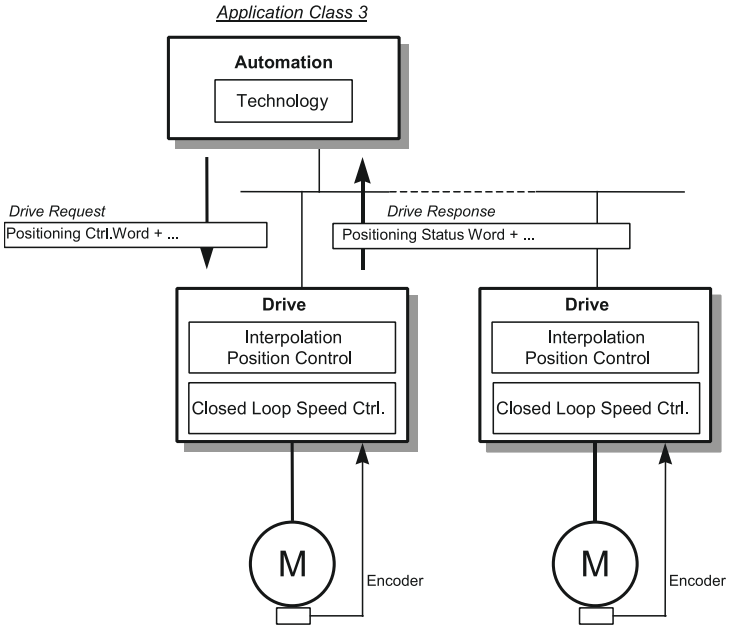


Fig. 128: Application class 3

Sub-mode Record Mode

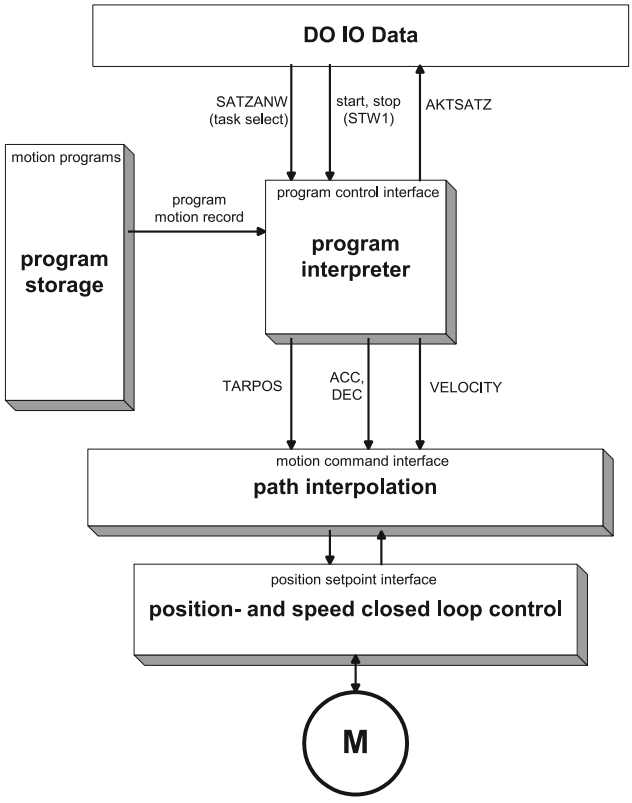


Fig. 129: Record mode

MDI sub-mode/target value specification

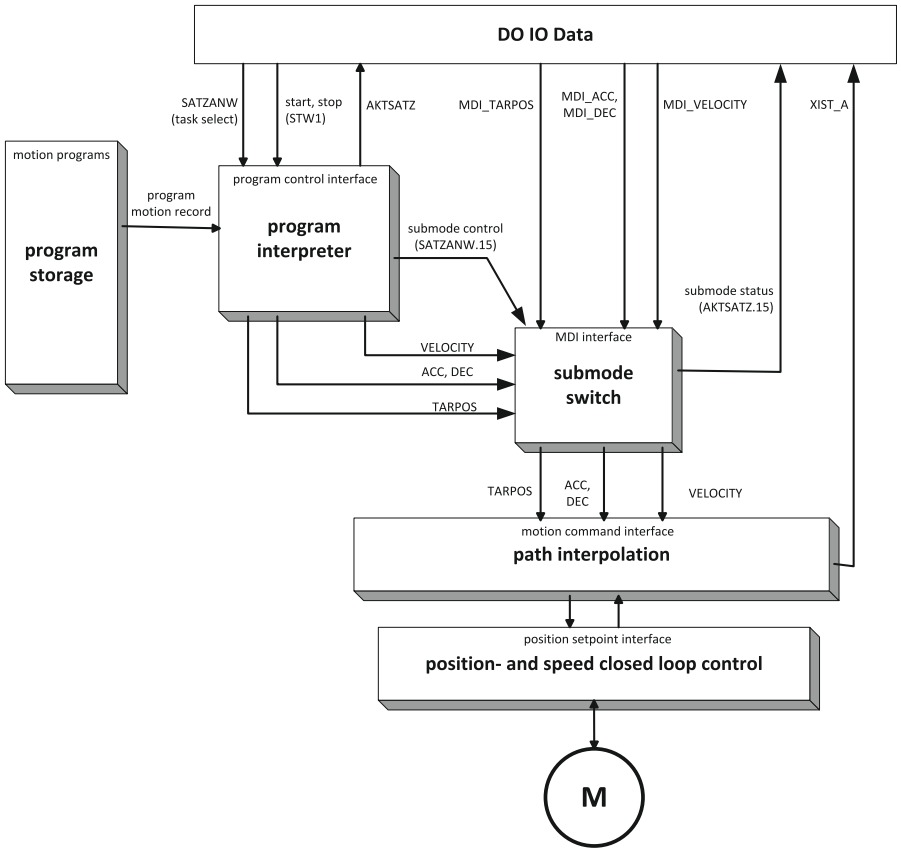


Fig. 130: Target value specification/MDI

12.4.2.4 Application Class 4 - central motion control (Motion)

Application class 4 enables coordinated motion sequences of several drives, as required in robotics applications, for example.

Coordination and movement control are carried out centrally via a higher-level control system. In addition to the technology functions required to control the automation process, the controller also requires functions for interpolation and position control of the drives. The servo drives take over the speed control of the drives.

Speed setpoint values and actual position values are transmitted cyclically via the device profile.

If necessary, the stability and dynamic behaviour of the control can be increased by using the "Dynamic Servo Control" (DSC) functionality. Then the control deviation and the position controller amplification factor KPC are also transmitted in the telegram with the setpoint values. The position controller in the drive can be used with this data. The position-setpoint value interpolation continues to take place in the controller.

Since coordination takes place via the device profile, synchronous operation is required to synchronise the position control in the open-loop controller and the speed control in the servo drives.

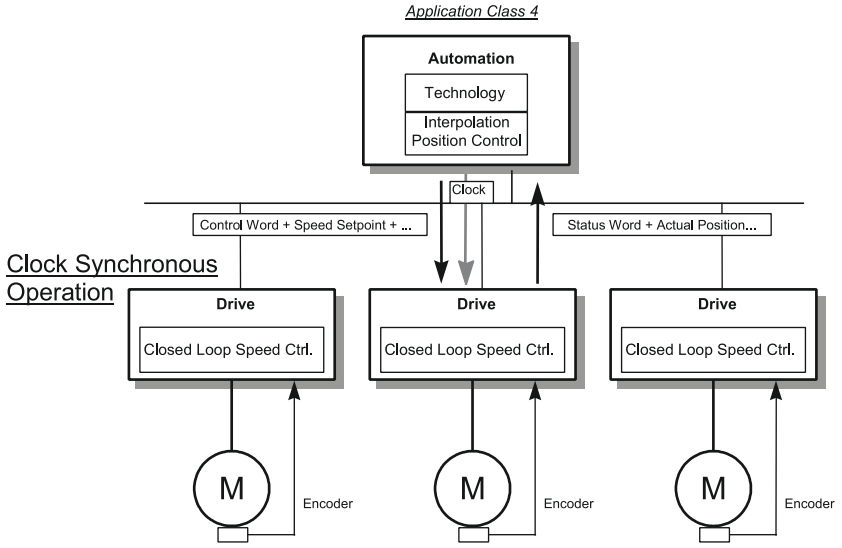


Fig. 131: Application class 4

Basic Controller Structure without DSC

During operation without "Dynamic Servo Control" (DSC), speed setpoint values and actual position values are transmitted cyclically via the device profile. The higher-level control takes over the position control (Position control). The servo drive takes over the rotational speed and current control ((Speed control).
The quality of the control loop depends strongly on the bus cycle time. A bus cycle time that is too long worsens the dynamics of the position control loop (poor control behaviour).

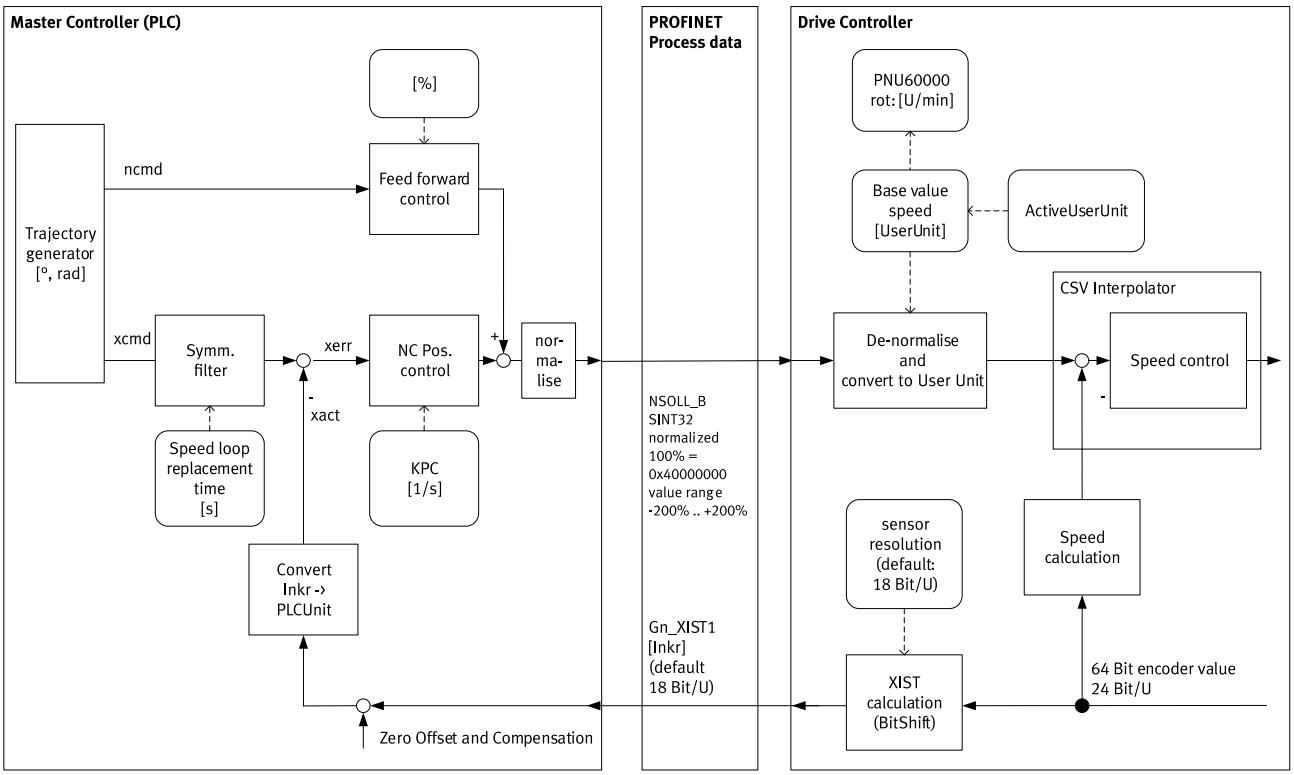


Fig. 132: Basic Controller Structure without DSC

Basic Controller Structure with DSC

Operation with "Dynamic Servo Control" (DSC) significantly increases the dynamic rigidity of the position control loop. In addition to the speed setpoint value and the actual position value, the position controller amplification factor KPC and the position tracking error XERR are also transmitted. Position control takes place in the servo drive. The calculation of the position setpoint value path generator is still carried out in the controller.

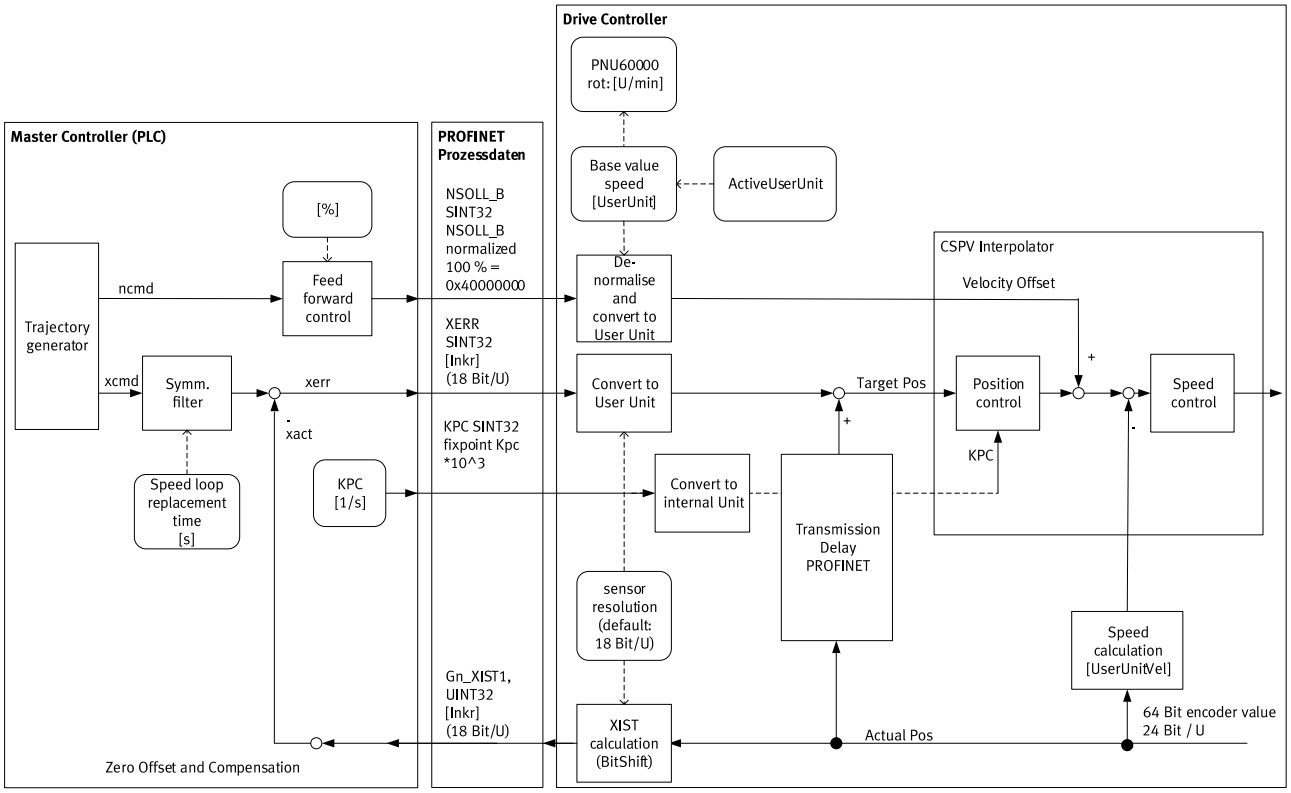


Fig. 133: Basic Controller Structure with DSC

12.4.3 Finite State Machines

12.4.3.1 Basic finite state machine

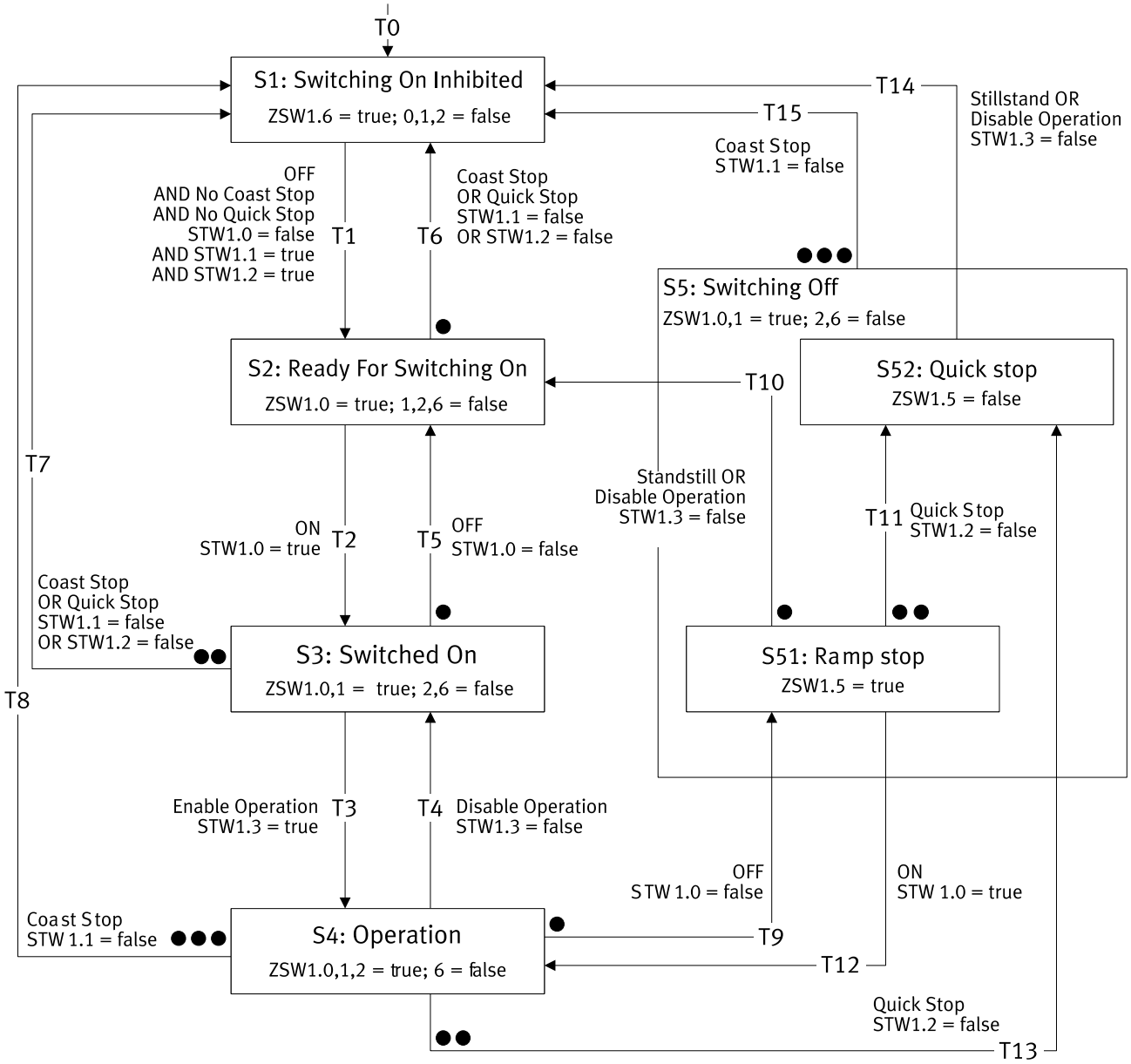


Fig. 134: Basic finite state machine

Multiple transitions are possible from some states. In this case the transitions with assigned priorities are specified in the status diagram. Points are used to identify the priority level. The more points a transition has the higher the priority. A transition with no points has the lowest priority.

No.	condition		Target status
T0	Logic voltage supply present	= 1	S1 Switching On Inhibited

Tab. 779: Transition T0

Status S1 Switching On Inhibited

Name	Description	Status	
S1 Switching On Inhibited	Switch-on lock	ZSW1.0	= 0
		ZSW1.1	= 0
		ZSW1.2	= 0

Name	Description	Status	
S1 Switching On Inhibited	Switch-on lock	ZSW1.6	= 1
		ZSW2.11	= 0

Tab. 780: Status S1

No.	Conditions		Target status
T1	STW1.0 Power Stage Enable	= 0	S2 Ready For Switching On
	AND		
	STW1.1 Coast Stop Disable	= 1	
	AND		
	STW1.2 Quick Stop Disable	= 1	

Tab. 781: Transition from status S1

Status S2 Ready For Switching On

Name	Description	Status	
S2 Ready For Switching On	Ready to be switched on	ZSW1.0	= 1
		ZSW1.1	= 0
		ZSW1.2	= 0
		ZSW1.4	= 1
		ZSW1.5	= 1
		ZSW1.6	= 0
		ZSW2.11	= 0

Tab. 782: Status S2

No.	Conditions		Target status
T2	STW1.0 Power Stage Enable	= 1	S3 Switched On
T6	STW1.1 Coast Stop Disable	= 0	S1 Switching On Inhibited
	OR		
	STW1.2 Quick Stop Disable	= 0	

Tab. 783: Transitions from Status S2

Status S3 Switched On

Name	Description	Status	
S3 Switched On	Ready for operation	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 0
		ZSW1.3	= 0
		ZSW1.4	= 1
		ZSW1.5	= 1
		ZSW1.6	= 0
		ZSW2.11	= 0

Tab. 784: Status S3

No.	Conditions		Target status
T3	STW1.3 Enable Operation	= 1	S4 Operation
T5	STW1.0 Power Stage Enable	= 0	S2 Ready For Switching On
T7	STW1.1 Coast Stop Disable	= 0	S1 Switching On Inhibited
	OR		
	STW1.2 Quick Stop Disable	= 0	

Tab. 785: Transitions from Status S3

Status S4 Operation

Name	Description	Status	
S4 Operation	Operation	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 1
		ZSW1.6	= 0
		ZSW2.11	= 1

Tab. 786: Status S4

No.	Conditions		Target status
T4	STW1.3 Enable Operation	= 0	S3 Switched On
T8	STW1.1 Coast Stop Disable	= 0	S1 Switching On Inhibited
T9	STW1.0 Power Stage Enable	= 0	S51 Ramp stop
T13	STW1.2 Quick Stop Disable	= 0	S52 Quick stop

Tab. 787: Transitions from Status S4

Status S5 Switching off

Name	Description	Status	
S5 Switching off	Switching off	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 0
		ZSW1.6	= 0
		ZSW2.11	= 1

Tab. 788: Status S5

No.	Conditions		Target status
T15	STW1.1 Coast Stop Disable	= 0	S1 Switching On Inhibited

Tab. 789: Transitions from Status S5

Status S51 Ramp stop

Name	Description	Status	
S51 Ramp stop	Switching off	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 0
		ZSW1.5	= 1
		ZSW1.6	= 0
		ZSW2.11	= 1

Tab. 790: Status S51

No.	Conditions		Target status
T10	Standstill detected	–	S2 Ready For Switching On
	OR		
	STW1.3 Enable Operation	= 0	
T11	STW1.2 Quick Stop Disable	= 0	S52 Quick stop
T12	STW1.0 Power Stage Enable	= 1	S4 Operation

Tab. 791: Transitions from Status S51

The "Standstill detected" condition is an internal condition in the process of the stop ramp and is not triggered by the user.

Status S52 Quick stop

Name	Description	Status	
S52 Quick stop	Fast stop	ZSW1.0	= 1
		ZSW1.1	= 1

Name	Description	Status	
S52 Quick stop	Fast stop	ZSW1.2	= 0
		ZSW1.5	= 0
		ZSW1.6	= 0
		ZSW2.10	= 1

Tab. 792: Status S52

The value of the status bit is identical to the S5 Switching off status. The status is not distinguishable from S51 Ramp stop status by the status bit.

No.	Conditions		Target status
T10	Standstill detected	–	S1 Switching On Inhibited
	OR		
	STW1.3 Enable Operation	= 0	

Tab. 793: Transitions from Status S52

The "Standstill detected" condition is an internal condition in the process of the fast stop and is not triggered by the user.

12.4.3.2 Finite State Machine Velocity Mode in Application Class 1

The finite state machine velocity mode is a sub-finite state machine of the status S4 Operation of the basic finite state machine. The same applies to the status messages of the status S4 Operation, they are not executed here.

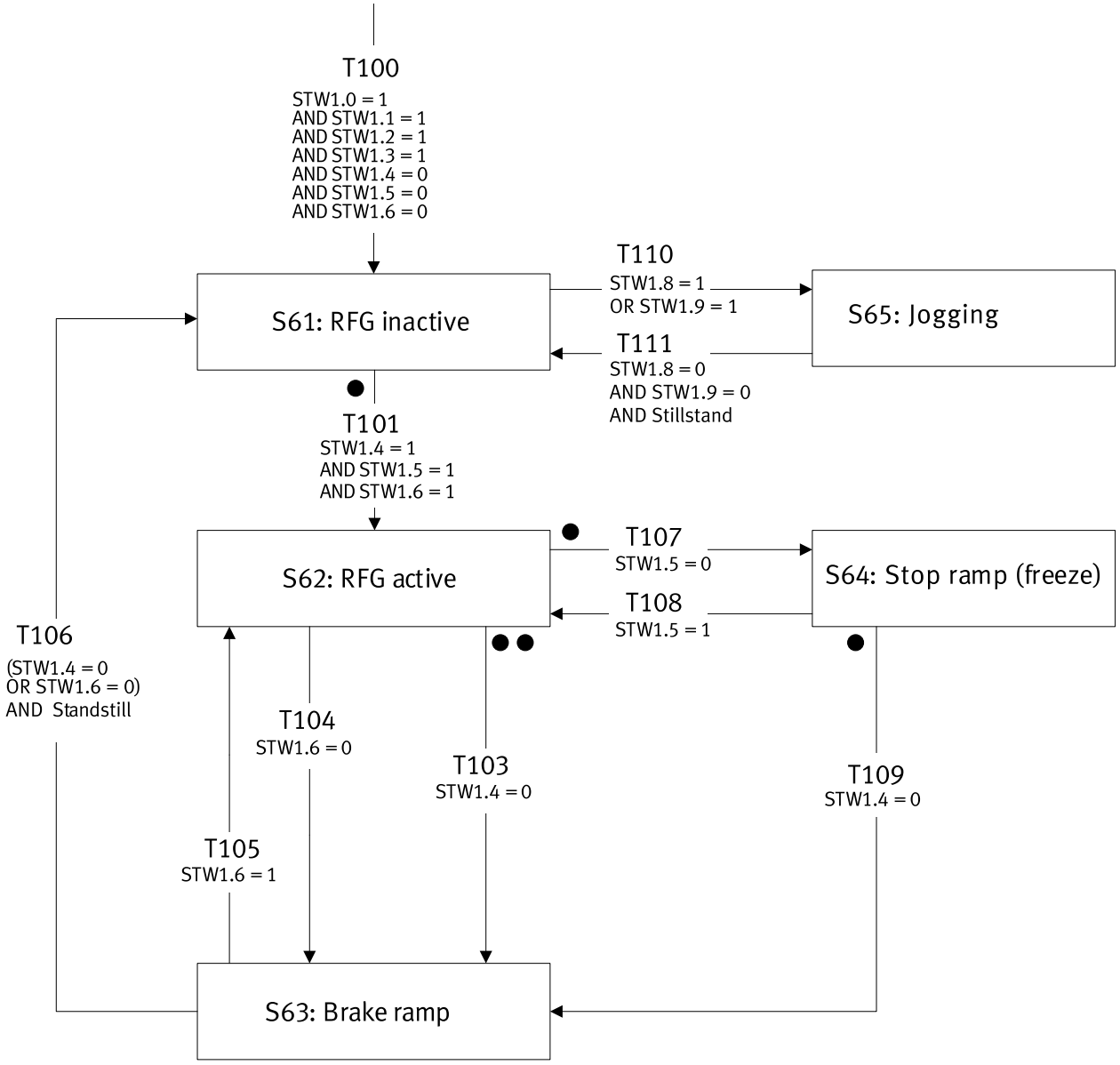


Fig. 135: Finite State Machine Velocity Mode in Application Class 1

Multiple transitions are possible from some states. In this case the transitions with assigned priorities are specified in the status diagram. Points are used to identify the priority level. The more points a transition has the higher the priority. A transition with no points has the lowest priority.

No.	Condition		Target status
T100	STW1.0 Power Stage Enable	= 1	S61 RFG inactive
	STW1.1 Coast Stop Disable	= 1	
	STW1.2 Quick Stop Disable	= 1	
	STW1.3 Enable Operation	= 1	
	STW1.4 Enable ramp generator	= 0	
	STW1.5 Unfreeze Ramp Generator	= 0	
	STW1.6 Enable setpoint	= 0	

Tab. 794: Transition T100

Status S61 RFG inactive

Name	Description	Status	Value
S61 RFG inactive	RFG reset	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 1
		ZSW1.6	= 0

Tab. 795: Status S61

No.	Conditions	Value	Target status
T101	STW1.4 Enable ramp generator	= 1	S62 RFG active
	AND		
	STW1.5 Unfreeze Ramp Generator	= 1	
	AND		
	STW1.6 Enable setpoint	= 1	
T110	STW1.8 Jogging 1	= 1	S65 Jogging AC1
	OR		
	STW1.9 Jogging 2	=1	

Tab. 796: Transitions from Status S61

Status S62 RFG active

Name	Description	Status	Value
S62 RFG active	RFG active	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 1
		ZSW1.6	= 0

Tab. 797: Status S62

No.	Conditions	Value	Target status
T103	STW1.4 Enable ramp generator (system stop)	= 0	S63
T104	STW1.6 Enable setpoint	= 0	S63 Brake ramp
T107	STW1.5 Unfreeze Ramp Generator	= 0	S64 Stop ramp (freeze)

Tab. 798: Transitions from Status S62

Status S63 Brake ramp

Name	Description	Status	Value
S63 Brake ramp	Braking ramp	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 1
		ZSW1.6	= 0

Tab. 799: Status S63

No.	Conditions	Value	Target status
T105	STW1.6 Enable setpoint	= 1	S62 RFG active
T106	STW1.4 Enable ramp generator OR STW1.6 Enable setpoint	= 0 = 0	S61 RFG inactive
	AND		
	Standstill	–	

Tab. 800: Transitions from Status S63

Status S64 Stop ramp (freeze)

Name	Description	Status	Value
S64 Stop ramp (freeze)	Stop ramp	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 1
		ZSW1.6	= 0

Tab. 801: Status S64

No.	Conditions	Value	Target status
T108	STW1.5 Unfreeze Ramp Generator	= 1	S62 RFG active
T109	STW1.4 Enable ramp generator	= 0	S63 Brake ramp

Tab. 802: Transitions from Status S64

Status S65 Jogging AC1

Name	Description	Status	Value
S65 Jogging AC1	Jog Mode	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 1
		ZSW1.6	= 0

Tab. 803: Status S65

No.	Conditions	Value	Target status
T111	STW1.8 Jogging 1	= 0	S61 RFG inactive
	AND		
	STW1.9 Jogging 2	= 0	
	AND		
	Standstill	–	

Tab. 804: Transitions from Status S64

12.4.3.3 Finite State Machine Positioning Mode in Application Class 3

The positioning mode state machine in application class 3 is a substate machine of the S4 Operation status of the basic state machine. The same applies to the status messages of the S4 Operation status.

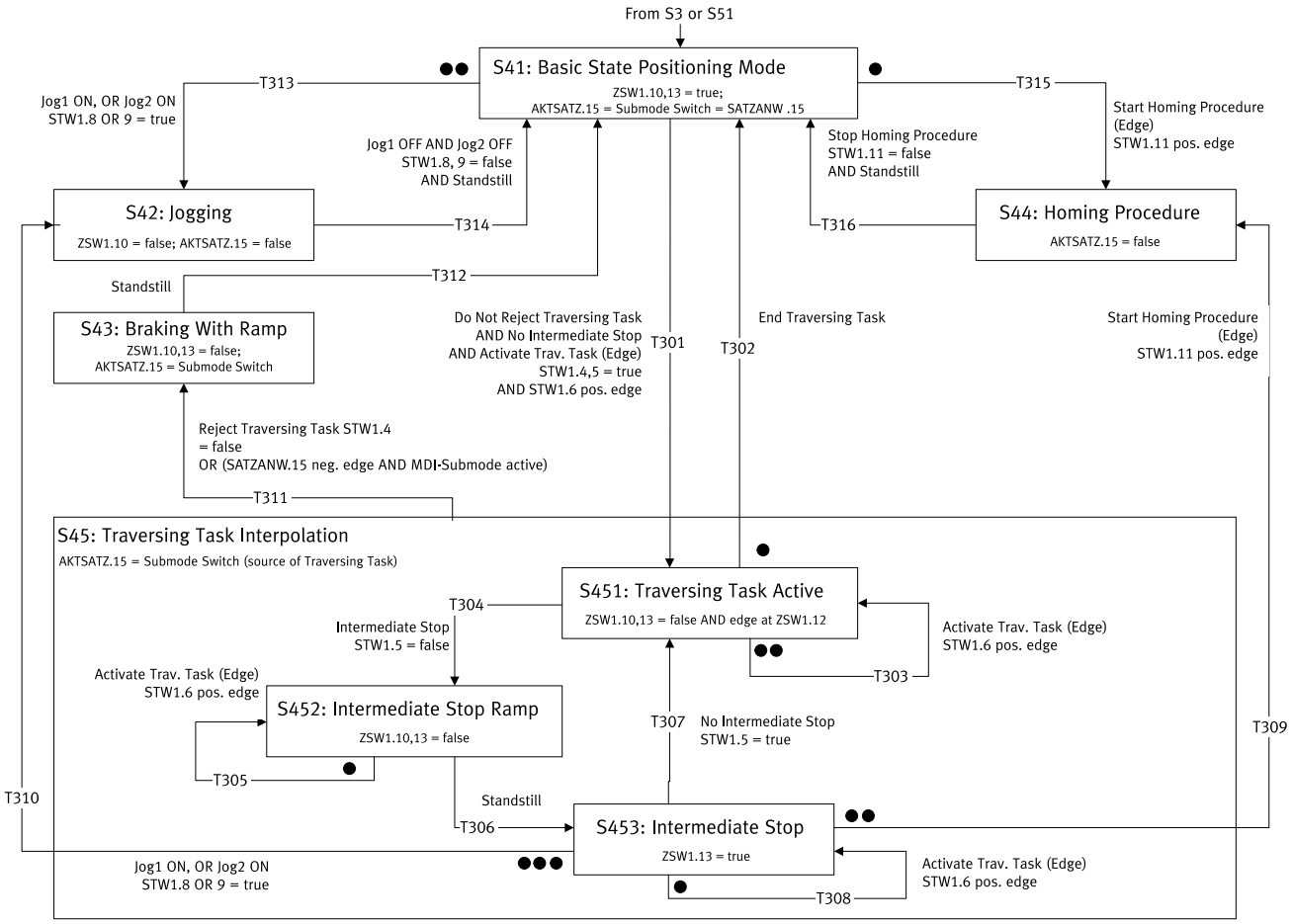


Fig. 136: Finite State Machine Positioning Mode in Application Class 3

Multiple transitions are possible from some states. In this case the transitions with assigned priorities are specified in the status diagram. Points are used to identify the priority level. The more points a transition has the higher the priority. A transition with no points has the lowest priority.
Further information on the basic state machine ➔ 12.4.3.1 Basic finite state machine.

S41 Basic State Positioning Mode status

Name	Description	Status	Value
S41 Basic State Positioning Mode	Basic state positioning mode	ZSW1.10	= 1
		ZSW1.13	= 1
		AKTSATZ, bit 15 = SATZANW, bit 15 (setpoint direct specification switch)	–

Tab. 805: Status S41

A changeover of the MDI selection (SATZANW, bit 15) is only possible in S41 Basic State Positioning Mode status.

No.	Conditions	Value	Target status
T301	STW1.4 Reject traversing task	= 1	S451 Traversing Task Active
	AND		
	STW1.5 Intermediate Stop	= 1	
	AND		
	STW1.6 Traverse Task Active	0→1	
T313	STW1.8 Jogging 1	= 1	S42 Jogging
	OR		

No.	Conditions	Value	Target status
T313	STW1.9 Jogging 2	=1	S42 Jogging
T315	STW1.11 Start Homing Procedure	0→1	S441 Homing Procedure Running

Tab. 806: Transitions from Status S42

T313 has higher priority than T301.
T315 has higher priority than T301.
T313 has higher priority than T315.

S42 Jogging status

Name	Description	Status	Value
S42 Jogging	Jogging	ZSW1.10 Traverse Task Motion Complete	= 0
		ZSW1.13 Drive Stopped	= x
		AKTSATZ bit 15	= 0

Tab. 807: Status S42

AKTSATZ Bit 15 is set to 0 independently of SATZANW bit 15, i.e. also if MDI selection is set (SATZANW.15 = 1).

No.	Conditions	Value	Target status
T314	STW1.8 Jogging 1	= 0	S41 Basic State Positioning Mode
	AND		
	STW1.9 Jogging 2	= 0	
	AND		
	Standstill detected	–	

Tab. 808: Transitions from Status S42

The "Standstill detected" condition is an internal condition and is not triggered by the user.

S43 Braking With Ramp status

Name	Description	Status	Value
S43 Braking With Ramp	Braking ramp	ZSW1.10 Traverse Task Motion Complete	= 0
		ZSW1.13 Drive Stopped	= 0
		AKTSATZ Bit 15 = setpoint specification switch (source for prior setpoint specification)	

Tab. 809: Status S43

No.	Conditions	Value	Target status
T312	Standstill detected	–	S41 Basic State Positioning Mode

Tab. 810: Transitions from Status S43

The "Standstill detected" condition is an internal condition in the process of the braking ramp and is not triggered by the user.

S44 Homing Procedure status

Name	Description	Status	Value
S44 Homing Procedure	Referencing	ZSW1.10 Traverse Task Motion Complete	= x
		ZSW1.11 Home Position Set	= x
		ZSW1.13 Drive Stopped	= x
		AKTSATZ bit 15	= 0

Tab. 811: Status S44

x = value depends on sub-status

No.	Conditions	Value	Target status
T316	STW1.11 Start Homing Procedure	= 0	S41 Basic State Positioning Mode
	AND		
	Standstill detected		

Tab. 812: Transitions from Status S44

The "Standstill detected" condition is an internal condition and is not triggered by the user.

S45 Traversing Task Interpolation status

Name	Description	Status	Value
S45 Traversing Task Interpolation	Traversing task positioning	ZSW1.10 Traverse Task Motion Complete	= x
		ZSW1.12 Traversing Task Acknowledgement	= x
		ZSW1.13 Drive Stopped	= x
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 813: Status S45

x = value depends on sub-status

No.	Conditions	Value	Target status
T311	STW1.4 Reject traversing task	= 0	S43 Braking With Ramp
	OR		
	SATZANW bit 15 AND AKTSATZ bit 15	0→1 = 1	

Tab. 814: Transitions from Status S45

S451 Traversing Task Active status

Name	Description	Status	Value
S451 Traversing Task Active	Positioning task active	ZSW1.10 Traverse Task Motion Complete	= 0
		ZSW1.12 Traversing Task Acknowledgement	0→1
		ZSW1.13 Drive Stopped	= 0
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 815: Status S451

No.	Conditions	Value	Target status
T302	Positioning task complete		S41 Basic State Positioning Mode
T303	STW1.6 Traverse Task Active	0→1	S451 Traversing Task Active
T304	STW1.5 Intermediate Stop	= 0	S452 Intermediate Stop Ramp

Tab. 816: Transitions from Status S451

The "Positioning task complete" condition is an internal condition and is not triggered by the user.
T303 has higher priority than T302.
T303 has higher priority than T304.
T302 has higher priority than T304.

S452 Intermediate Stop Ramp status

Name	Description	Status	Value
S452 Intermediate Stop Ramp	Intermediate stop ramp	ZSW1.10 Traverse Task Motion Complete	= 0
		ZSW1.12 Traversing Task Acknowledgement	= x
		ZSW1.13 Drive Stopped	= 0
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 817: Status S452

No.	Conditions	Value	Target status
T305	STW1.6 Traverse Task Active	0→1	S452 Intermediate Stop Ramp
T306	Standstill detected		S453 Intermediate Stop

Tab. 818: Transitions from Status S452

The "Standstill detected" condition is an internal condition in the process of the intermediate stop ramp and is not triggered by the user.
T305 has higher priority than T306.

S453 Intermediate Stop status

Name	Description	Status	Value
S453 Intermediate Stop	Intermediate stop	ZSW1.10 Traverse Task Motion Complete	= 0
		ZSW1.12 Traversing Task Acknowledgement	= x
		ZSW1.13 Drive Stopped	= 1
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 819: Status S453

No.	Conditions	Value	Target status
T307	STW1.5 Intermediate Stop	1	S451 Traversing Task Active
T308	STW1.6 Traverse Task Active	0→1	S453 Intermediate Stop
T309	STW1.11 Start Homing Procedure	0→1	S441 Homing Procedure Running
T310	STW1.8 Jogging 1	= 1	S42 Jogging
	OR		
	STW1.9 Jogging 2	= 1	

Tab. 820: Transitions from Status S453

T310 has higher priority than T307.
T309 has higher priority than T307.
T308 has higher priority than T307.
T310 has higher priority than T309.

12.4.3.4 Finite State Machine Homing Application Class 3

The finite state machine homing in application class 3 is a sub-finite state machine of the status S44 Homing Procedure of the finite state machine positioning mode.

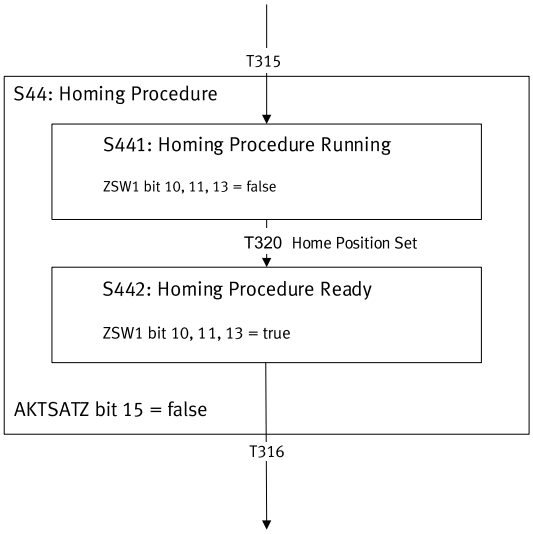


Fig. 137: Finite State Machine Homing Application Class 3

Transition T315 is described in the finite state machine positioning mode and is therefore not considered in detail here.
Transition T316 is described in the finite state machine positioning mode and is therefore not considered in detail here. The transition is possible from every sub-status.

Status S441 Homing Procedure Running

Name	Description	Status	Value
S441 Homing Procedure Running	Homing active	ZSW1.10 Traverse Task Motion Complete	= 0
		ZSW1.11 Home Position Set	= 0
		ZSW1.13 Drive Stopped	= 1

Tab. 821: Status S441

No.	Conditions	Value	Target status
T320	Reference point set	–	S442 Homing Procedure Ready

Tab. 822: Transitions from Status S441

The condition "Homing point set" is an internal condition in the homing process.

Status S442 Homing Procedure Ready

Name	Description	Status	Value
S442 Homing Procedure Ready	Homing complete	ZSW1.10 Traverse Task Motion Complete	= 1
		ZSW1.11 Home Position Set	= 1
		ZSW1.13 Drive Stopped	= 1

Tab. 823: Status S442

12.4.3.5 Finite state machine application class 4

In application class 4 a sub-state machine is never required in the S4 Operation basic state of the basic state machine. Only for the optional jog function via the control bits STW1.8 and STW1.9 (JOG1 and JOG2) are sub-states as in application class 1 necessary.

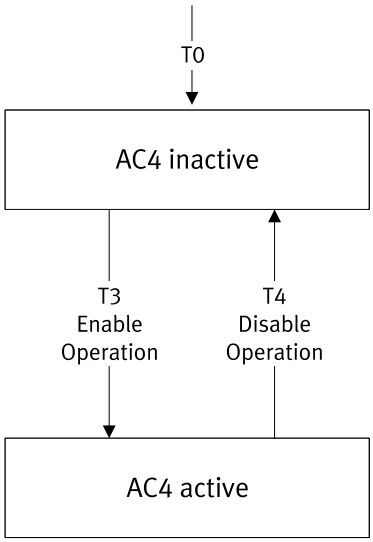


Fig. 138: Finite state machine AC4

12.4.4 Process data

12.4.4.1 Process data signals

Defined signals with associated signal numbers are available for configuration of process data (input/output data).

Signal number/PNU	Signal designation	Abbreviation	Bit length (16/32 bit)	With prefix
Standard telegrams				
1	Control word 1	STW1	16	–
2	Status word 1	ZSW1	16	–
3	Control word 2	STW2	16	–
4	Status word 2	ZSW2	16	–
5	Rotational speed setpoint value A	NSOLL_A	16	•
6	Rotational speed actual value A	NIST_A	16	•
7	Rotational speed setpoint value B	NSOLL_B	32	•
8	Rotational speed actual value B	NIST_B	32	•
9	Control word sensor 1	G1_STW	16	–
10	Status word sensor 1	G1_ZSW	16	–
11	Encoder 1 actual position value 1	G1_XIST1	32	–
12	Encoder 1 actual position value 2	G1_XIST2	32	–
13	Control word sensor 2	G2_STW	16	–
14	Status word sensor 2	G2_ZSW	16	–
15	Encoder 2 actual position value 1	G2_XIST1	32	–
16	Encoder 2 actual position value 2	G2_XIST2	32	–
25	Position deviation	XERR	32	•
26	Position controller amplification factor	KPC	32	•
32	Record selection	SATZANW	16	–
33	Active record	AKTSATZ	16	–
34	Target position MDI	MDI_TARPOS	32	•
35	MDI velocity	MDI_VELOCITY	32	–
36	Acceleration MDI	MDI_ACC	16	–
37	Deceleration MDI	MDI_DEC	16	–

Signal number/PNU	Signal designation	Abbreviation	Bit length (16/32 bit)	With prefix
38	Manual Data Input Mode	MDI_MOD	16	–
Manufacturer-specific telegrams				
28	Actual position value A	XIST_A	32	•
101	Torque reduction	MOMRED	16	•
102	Status word messages	MELDW	16	–
205	Positioning velocity override	OVERRIDE	16	•
220	Positioning control word 1	POS_STW1	16	–
221	Positioning status word 1	POS_ZSW1	16	–
222	Positioning control word 2	POS_STW2	16	–
223	Positioning status word 2	POS_ZSW1	16	–
301	Fault code	FAULT_CODE	16	–
303	Warning code	WARN_CODE	16	–

Tab. 824: Process data signals

12.4.4.2 Process data configuration

The process data (input/output data) can be configured and defined as individual setpoint and actual values. Parameters numbers (PNU) are available for configuration of process data (input/output data).

Parameter	PNU	Name	Data type	Data type
Px.	Profile-specific parameters			
11280201	922.0	PZD telegram selection	ro	UINT

Tab. 825: PNUs for process data configuration

12.4.5 Telegrams

Process data (input/output data) such as setpoint and actual values along with control and status data are transmitted cyclically by telegrams. They are transmitted in the big-endian format. The supported telegrams and their use in the application classes are listed below.

Telegram number	Description	Supported application classes
Standard telegrams		
1	Rotational speed setpoint value 16 bit	AC1
2	Rotational speed setpoint value 32 bit	AC1
3	Rotational speed setpoint value 32 bit with position encoder	AC1 and AC4
5	Rotational speed setpoint value 32 bit with position encoder and DSC (Dynamic Servo Control)	AC4
7	Positioning telegram 7 (single positioning with record selection)	AC3
9	Positioning telegram 9 (single positioning with record selection and direct specification, MDI)	AC3
Manufacturer-specific telegrams		
102	Rotational speed setpoint value 32 bit with position encoder and torque reduction	AC1 and AC4
105	Rotational speed setpoint value 32 bit with position encoder, torque reduction and DSC (Dynamic Servo Control)	AC4
111	Single positioning in the record selection operating mode and direct specification (MDI)	AC3
750	Torque control and Kp adaptation ➔ 12.4.6 Additional torque control telegram	AC4
910	Transmission of additional process data (EPD) ➔ 12.4.7 Additional telegram Extended Process Data	AC1, AC3 and AC4

Tab. 826: Telegrams

AC1 and AC3 enable transmission using RT and IRT. AC4 only allows transmission via IRT.

Telegrams for the single position control operating mode

Telegram						
No.	7		9		111	
Appl. class	3					
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	SATZANW	AKTSATZ	SATZANW	AKTSATZ	POS_STW1	POS_ZSW1
PZD3			STW2	ZSW2	POS_STW2	POS_ZSW2
PZD4			MDI_TARPOS	XIST_A	STW2	ZSW2
PZD5					OVERRIDE	MELDW
PZD6			MDI_VELOCITY		MDI_TARPOS	XIST_A
PZD7						
PZD8			MDI_ACC		MDI_VELOCITY	NIST_B
PZD9			MDI_DEC			
PZD10			MDI_MOD		MDI_ACC	FAULT_CODE
PZD11					MDI_DEC	WARN_CODE
PZD12					reserved	reserved

Tab. 827: Telegrams for position control

Standard telegram 1

Rotational speed setpoint value 16 bit
Supported application classes: AC1

PZD	Setpoint value	Actual value
1	STW1	ZSW1
2	NSOLL_A	NIST_A

Tab. 828: Standard telegram 1

Standard telegram 2

Rotational speed setpoint value 32 bit
Supported application classes: AC1

PZD	Setpoint value	Actual value
1	STW1	ZSW1
2	NSOLL_B	NIST_B
3		
4	STW2	ZSW2

Tab. 829: Standard telegram 2

Standard telegram 3

Rotational speed setpoint value 32 bit with position encoder
Supported application classes: AC1 and AC4

PZD	Setpoint value	Actual value
1	STW1	ZSW1
2	NSOLL_B	NIST_B
3		
4	STW2	ZSW2
5	G1_STW	G1_ZSW
6		G1_XIST1
7		
8		G1_XIST2
9		

Tab. 830: Standard telegram 3

Standard telegram 5

Rotational speed setpoint value 32 bit with position encoder and DSC
Supported application class: AC4

PZD	Setpoint value	Actual value
1	STW1	ZSW1
2	NSOLL_B	NIST_B
3		
4	STW2	ZSW2
5	G1_STW	G1_ZSW
6	XERR	G1_XIST1
7		
8	KPC	G1_XIST2
9		

Tab. 831: Standard telegram 5

Standard telegram 7

Single positioning
Supported application class: AC3

PZD	Setpoint value	Actual value
1	STW1	ZSW1
2	SATZANW	AKTSATZ

Tab. 832: Standard telegram 7

Standard telegram 9

Single positioning (with direct specification, only telegram 9)
Supported application class: AC3

PZD	Setpoint value	Actual value
1	STW1	ZSW1
2	SATZANW	AKTSATZ
3	STW2	ZSW2
4	MDI_TARPOS	XIST_A
5		
6	MDI_VELOCITY	
7		
8	MDI_ACC	
9	MDI_DEC	
10	MDI_MOD	

Tab. 833: Standard telegram 9

Standard telegram 102

Rotational speed setpoint value 32 bit with position encoder and torque reduction
Supported application class: AC1 (RT) and AC4 (RT)

PZD	Setpoint value	Actual value
1	STW1	ZSW1
2	NSOLL_B	NIST_B
3		
4	STW2	ZSW2
5	MOMRED	MELDW
6	G1_STW	G1_ZSW
7		G1_XIST1
8		
9		G1_XIST2
10		

Tab. 834: Standard telegram 102

Standard telegram 111

Single positioning in the operating mode record selection and MDI
Supported application class: AC3

PZD	Setpoint value	Actual value
1	STW1	ZSW1
2	POS_STW1	POS_ZSW1
3	POS_STW2	POS_ZSW2
4	STW2	ZSW2
5	OVERRIDE	MELDW
6	MDI_TARPOS	XIST_A
7		
8	MDI_VELOCITY	NIST_B
9		
10	MDI_ACC	FAULT_CODE
11	MDI_DEC	WARN_CODE
12	reserved	reserved

Tab. 835: Standard telegram 111

12.4.6 Additional torque control telegram

Additional telegram 750 for torque control and Kp adaptation

Telegram 750 is an additional telegram for torque control with the following data:
- The controller sends the additional torque (M_ADD) and the positive and negative torque limits (M_LIMIT_POS, M_LIMIT_NEG) to the servo drive controller.
- The servo drive controller sends the current torque (M_ACT) to the controller.

PZD	Setpoint value	Actual value
1	M_ADD	M_ACT
2	M_LIMIT_POS	–
3	M_LIMIT_NEG	
4	Kp_Adapt	–

Tab. 836: Additional telegram 750

PZD01 = Px.101951
PZD02 = Px.101985
PZD03 = Px.101981
PZD04 = Px.101993
PZD01 : Px.151 (M_ACT)
Telegram 750, including the extension for the speed controller Kp adaptation, is implemented to support the block library for winding applications.
The additional Kp adaptation factor is appended as the 4th process data word in the setpoints.
All torque data are standardised to a base torque.
The base torque is specified for the user in the plug-in on the parameter page for AC4 in parameter P1.381.0.0.
The standardisation is usually scaled with PROFIdrive: 0x4000 = 100% of P1.381.0.0
The Kp adaptation is also transmitted standardised to 100%: 0x4000 = 100% = 1.0f
The Kp adaptation refers to the configured controller parameters of the speed controller. The transmitted percentage value is calculated in the device with the controller parameters and does not change the parameters in the parameter set.
The Px.102002 parameter defines the controller parameter of the speed controller that is adjusted by the Kp adaptation.
- "Inactive" value: Kp adaptation inactive
- "Kp" value: only gain Kp Px.224 → the reset time changes Kp/Ki
- "Kp and Ki" value: Kp Px.224 gain and Ki Px.225 integration constant → the reset time remains constant Kp/Ki

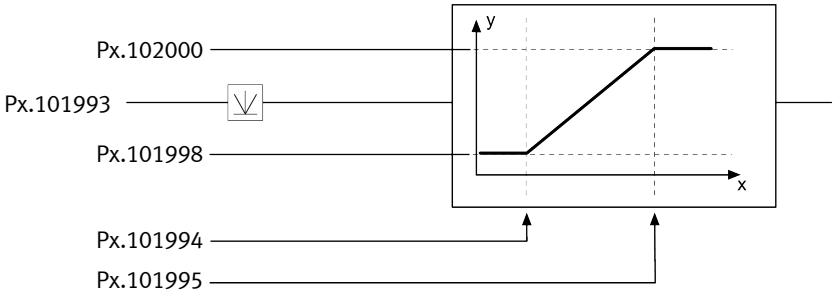


Fig. 139: Kp adaptation

Calculation example

Px.102000 "Upper limit value Output value" = out_max = 2.0

Px.101998 "Lower limit value Output value" = out_min = 0.1
Px.101994 "Lower limit input value" = in_min = 20
Px.101995 "Upper limit input value" = in_max = 100
Px.101993 "Kp_Adapt" = x = 40
Px.101989 "Actual gain factor" = out * Px.224
Px.101991 "Actual integration constant" = out * Px.225
out = (x – in_min) * (out_max – out_min) / (in_max – in_min) + out_min
= (40 – 20) * (2.0 – 0.1) / (100 – 20) + 0.1
= 20 * 1.9 / 80.1 = 0.575

ID Px.	Parameter	Description	
101951	M_ADD	Displays the torque offset sent via the telegram 750.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
101981	M_LIMIT_NEG	Displays the minimum torque sent via the telegram 750.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
101985	M_LIMIT_POS	Displays the maximum torque sent via the telegram 750.	
		Access	read/write
		Update	effective immediately
		Unit	Nm
101989	Actual gain factor	Displays the actual gain factor for the velocity controller sent via the Telegram 750.	
		Access	read/write
		Update	effective immediately
		Unit	–
101993	Kp_Adapt	Displays the input value for the gain factor calculation.	
		Access	read/write
		Update	effective immediately
		Unit	–
101994	Lower limit input value	Specifies the lower limit of the input value for the gain factor calculation.	
		Access	read/write
		Update	effective immediately
		Unit	–
101995	Upper limit input value	Specifies the upper limit of the input value for the gain factor calculation.	
		Access	read/write
		Update	effective immediately
		Unit	–
101998	Lower limit value Output value	Specifies the lower limit of the output value for gain calculation.	
		Access	read/write
		Update	effective immediately
		Unit	–
102000	Reference switch configuration	Specifies the configuration of the reference switch.	
		Access	read/write
		Update	effective immediately
		Unit	–
102002	Mode Gain Calculation	Specifies the mode for the gain factor calculation.	

ID Px.	Parameter	Description	
102002	Mode Gain Calculation	Access	read/write
		Update	effective immediately
		Unit	–

Tab. 837: Torque control parameters

PNUs torque control

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
101951	13023.0	M_ADD	REAL
101981	13034.0	M_LIMIT_NEG	REAL
101985	13035.0	M_LIMIT_POS	REAL
101989	13038.0	Actual gain factor	REAL
101993	13040.0	Kp_Adapt	REAL
101994	13041.0	Lower limit input value	REAL
101995	13042.0	Upper limit input value	REAL
101998	13043.0	Lower limit value Output value	REAL
102000	11947.0	Reference switch configuration	UDINT
102002	13045.0	Mode Gain Calculation	UDINT

Tab. 838: PNUs

12.4.7 Additional telegram Extended Process Data

Additional telegram 910 (Extended Process Data, EPD)

The manufacturer-specific additional telegram 910 is available for transmitting additional process data. The additional telegram can be selected during the process data configuration with the configuration software of the master and becomes active after loading the process data configuration.
The extended process data in the additional telegram can be parameterised with the CMMT-ST plug-in.

Telegram number	Description	Supported application classes
Additional telegram		
910	Transmission of additional process data (EPD)	AC1, AC3 and AC4

Tab. 839: Additional telegram

The additional telegram 910 enables the cyclic transmission of additional parameters. All device parameters of the servo drive can be transferred.
The additional telegram 910 has a fixed length of 32 bytes for each transmission direction in which up to 8 parameters can be transmitted.
Parameters with the "read/write" access right can be sent and received by the servo drive (setpoint value).
Parameters with the "read" access right can only be sent by the servo drive (actual value).

PZD	Setpoint value (Rx data)	Actual value (Tx data)
1	max. 8 parameters (32 bytes)	max. 8 parameters (32 bytes)
2		
3		
4		

PZD	Setpoint value (Rx data)	Actual value (Tx data)
5	max. 8 parameters (32 bytes)	max. 8 parameters (32 bytes)
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

Tab. 840: Additional telegram 910

Parameters for Process Data Configuration

The input/output data of the additional telegram can be configured individually. The following parameters are available for configuration.

ID Px.	Parameter	Description	
4242101	Number of objects Rx	Displays the actual number of objects that mapped for Rx data.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242102	Number of bytes Rx	Displays the actual number of bytes that mapped for Rx data.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242105	Axis ID Rx	Specifies the axis ID of the object to be mapped for the extended process data Rx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242106	Data ID Rx	Specifies the data ID of the object to be mapped for the extended process data Rx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242107	Data instance ID Rx	Specifies the instance number of the object to be mapped for the extended process data Rx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242108	Array ID Rx	Specifies the array ID of the object to be mapped for the extended process data Rx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242115	Actual axis ID Rx	Displays the actual axis ID of the object mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242116	Actual data ID Rx	Displays the actual data ID of the object mapped Rx for the extended process data.	
		Access	read/–

ID Px.	Parameter	Description	
4242116	Actual data ID Rx	Update	effective immediately
		Unit	–
4242117	Actual data instance ID Rx	Displays the actual instance no. of the object mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242118	Actual array ID Rx	Displays the actual array ID of the object mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242119	Actual data type Rx	Displays the data type of the objects mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 841: Parameter (Rx data)

ID Px.	Parameter	Description	
4242201	Number of objects Tx	Displays the actual number of objects that mapped for Tx data.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242202	Number of bytes Tx	Displays the actual number of bytes that mapped for Tx data.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242205	Axis ID Tx	Specifies the axis ID of the object to be mapped for the extended process data Tx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242206	Data ID Tx	Specifies the data ID of the object to be mapped for the extended process data Tx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242207	Data instance ID Tx	Specifies the instance no. of the object to be mapped for the extended process data Tx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242208	Array ID Tx	Specifies the array ID of the object to be mapped for the extended process data Tx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242215	Actual axis ID Tx	Displays the actual axis ID of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242216	Actual data ID Tx	Displays the actual data ID of the object mapped for the extended process data Tx.	
		Access	read/–

ID Px.	Parameter	Description	
4242216	Actual data ID Tx	Update	effective immediately
		Unit	–
4242217	Actual data instance ID Tx	Displays the actual instance number of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242218	Actual array ID Tx	Displays the actual array ID of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242219	Actual data type Tx	Displays the data type of the objects mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 842: Parameter (Tx data)

Extended process data parameters

ID Px.	Parameters	Description	
424213	Extended process data active	Displays with Extended Process Data = 1 that the extended process data is active.	
		Access	read/–
		Update	effective immediately
		Unit	–
11280204	Extended process data	Displays which telegram is used for the Extended process data.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 843: Extended process data parameters

PNUs Rx and Tx data

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4242101	12542.0	Number of objects Rx	USINT
4242102	12543.0	Number of bytes Rx	USINT
4242105	12544.0 ... 7	Axis ID Rx	UINT
4242106	12545.0 ... 7	Data ID Rx	UDINT
4242107	12546.0 ... 7	Data instance ID Rx	UINT
4242108	12547.0 ... 7	Array ID Rx	UINT
4242115	12548.0 ... 7	Actual axis ID Rx	UINT
4242116	12549.0 ... 7	Actual data ID Rx	UDINT
4242117	12550.0 ... 7	Actual data instance ID Rx	UINT
4242118	12551.0 ... 7	Actual array ID Rx	UINT
4242119	12552.0 ... 7	Actual data type Rx	UDINT
4242201	12553.0	Number of objects Tx	USINT
4242202	12554.0	Number of bytes Tx	USINT
4242205	12555.0 ... 7	Axis ID Tx	UINT
4242206	12556.0 ... 7	Data ID Tx	UDINT
4242207	12557.0 ... 7	Data instance ID Tx	UINT
4242208	12558.0 ... 7	Array ID Tx	UINT
4242215	12559.0 ... 7	Actual axis ID Tx	UINT
4242216	12560.0 ... 7	Actual data ID Tx	UDINT

Tab. 844: PNUs

PNUs extended process data

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280204	60104.0	Extended process data	UINT
Px.	**Manufacturer-specific parameters**		
424213	12541.0	Extended process data active	BOOL
11280204	3401.0	Extended process data	UINT

Tab. 845: PNUs

Active telegrams

PNU	Meaning	Access	Data type
Profile-specific parameters			
60100	Shows an overview of the active telegrams. **Array ID = subslot - 1:** – Array 0 = subslot 1, MAP (Module Access Point) – Array 1 = subslot 2, reserved – Array 2 = subslot 3, standard telegram – Array 3 = subslot 4, additional telegram (EPD) – Array 4 .. n = reserved for future additional telegrams **Possible values:** – 1: telegram 1 – 2: telegram 2 – ... – 910 (0x038E): additional telegram (EPD) – 65534 (0xFFFE): no telegram – 65535 (0xFFFF): MAP in subslot 1	ro	UINT array
60104	Indicates whether the additional telegram is active. This parameter is written by the higher-order controller (master). This means: – 65534 (0xFFFE): additional telegram not active – 910 (0x038E): additional telegram 910 is active	rw	UINT

Tab. 846: PNUs

12.4.8 Process data signals in detail

12.4.8.1 Control word 1 (STW1)

Bit	Meaning	
	Speed mode	Positioning mode
0	Output stage enable (ON/OFF, precondition STW1.3 = 1) – 0→1: power output stage enabled (ON) – 0: brake drive to standstill and then deactivate the power output stage (OFF1). If bit STW1.3 is already active, activation of STW1.0 implements a transition to S4 and therefore switches on the output stage. As a rule, however, STW1.0 is active and STW1.3 (output stage enable) is activated.	
1	Drive coast (OFF 2) – 1: no coasting – 0: coasting. Power output stage is deactivated (OFF2). The drive coasts to a stop.	
2	Fast stop (OFF 3) – 1: no fast stop – 0: brake drive to standstill with fast stop and then deactivate the power output stage (OFF3).	
3	Enable operation – 1: enabled – 0: block	
4	Ramp generator enabled – 1: enabled – 0: block	Reject positioning task – 1: inactive – 0: active
5	Start ramp generator – 1: start (precondition STW1.4 = 1) – 0: freeze	Intermediate stop – 1: inactive – 0: active
6	Enable rotational speed setpoint value – 1: enable – 0: block	Activate positioning task – 0→1: active – 0: inactive(no effect)
7	Acknowledge malfunction – 0→1: active – 0: inactive(no effect)	
8	Jogging 1 – 1: active (jogging with the dynamic values of jogging 1) – 0: inactive	

Bit	Meaning	
	Speed mode	Positioning mode
9	Jogging 2 – 1: active (jogging with the dynamic values of jogging 2) – 0: inactive	
10	PLC master control – 1: the higher-order controller requests the master control. The signal must be set if the process data sent are to be applied and effective. – 0: master control not requested	
11	Invert setpoint value – 1: active – 0: inactive	Start homing – 0→1: active – 0: inactive
12	Release holding brake – 1: active – 0: inactive	
13	reserved	Start record change – 0→1: active – 0: inactive
14 ... 15	reserved	reserved

Tab. 847: Control word 1 (STW1)

Significance of General Bits (STW1)

STW1.0 Power Stage Enable (ON/OFF)

Value	Command	Description
0→1	Output stage enable (ON)	If bit STW1.3 is already active, activation of STW1.0 implements a transition to S4 and therefore switches on the output stage. As a rule, however, STW1.0 is active and STW1.3 (output stage enable) is activated.
0	Output stage block (OFF1)	– The drive is braked to standstill and then the power output stage is switched off (OFF1). – The drive switches to the status S2 Ready For Switching On. – If it is coming from the S4 Operation status, it is braked with the ramp generator (S51 Ramp stop). – After standstill is reached the power output stage is switched off.

Tab. 848: STW1.0

Braking with the OFF1 command can be interrupted with the following commands that trigger a higher prioritised stop response:
– Fast stop (OFF3) ➔ bit 2, fast stop
– Block ramp generator or reject positioning task ➔ STW1.4
– Block rotational speed setpoint value or activate positioning task ➔ STW1.6
– Enable power output stage ➔ STW1.0. In this case it switches back to the S4 Operation status.

STW1.1 Coast Stop Disable (OFF 2)

Value	Command	Description
1	No coasting	A coasting command is not pending. The motor can be switched on.
0	Coast (OFF2)	– Power output stage is switched off. – The drive coasts to a stop. – The drive switches to the status S1 Switching On Inhibited.

Tab. 849: STW1.1

STW1.2 Quick Stop Disable (OFF 3)

Value	Command	Description
1	No fast stop	A fast stop command is not pending. The motor can be switched on.
0	Fast stop (OFF3)	– The drive is braked to standstill with fast stop. Then the power output stage is switched off. – The drive switches to the status S1 Switching On Inhibited. – If it is coming from the S4 Operation status, braking with fast stop ramp (status S52 Quick stop).

Tab. 850: STW1.2

– The fast stop command cannot be interrupted (OFF3).
– The fast stop command can interrupt braking with the OFF1 command. In this case, braking is continued to standstill with the fast stop ramp.
– If the block operation command (STW1.3) is applied before reaching standstill, the voltage is disconnected without waiting for standstill and switched to the S1 Switching On Inhibited status.
– The controller is not yet active in the S2 Ready For Switching On and S3 Switched On closed-loop controller is not active. Only the energy is already enabled. Therefore, a fast stop ramp is not generated. It is immediately switched to the S1 Switching On Inhibited status.

STW1.3 Enable Operation

Value	Command	Description
1	Enable operation	If the drive is in the status S3 Switched On: – Switch to status S4 Operation The closed-loop controller is activated. The drive/closed-loop controller is enabled. The setpoint value is only applied after enabling the rotational speed setpoint value (STW1.6) or by activating the positioning task (edge 0→1 on STW1.6) (preconditions STW1.4, STW1.5).
0	Disable operation	– Closed-loop controller is blocked. – The drive coasts to a standstill (without ramp). If it is coming from the S4 Operation coming: – Switch to status S3 Switched On

Tab. 851: STW1.3

The status is changed immediately. Standstill is not required. The setpoint value is specified as follows with a rising edge at STW1.3:
– In velocity mode: the setpoint value is effective immediately depending on control bits bit 4 … bit 6. The setpoint rotational speed affects the closed-loop control; a starting edge or other is not required.
– In positioning mode: setpoint position = current actual position. The current actual position is retained, a new setpoint position is only activated with rising edge at STW1.6 (activate positioning task).

STW1.7 Fault Acknowledge

Value	Command	Description
0→1	Acknowledge malfunction	– With a positive edge the drive attempts to acknowledge pending errors. The reaction depends on the pending messages. If the error reaction caused a shutdown of the output stage, the drive then switches to the status S1 Switching On Inhibited.
0	No effect	–

Tab. 852: STW1.7

STW1.8 Jogging 1

Value	Command	Description
1	Jogging 1 on	Execute jogging 1
0	Jogging 1 off	Stop jogging 1

Tab. 853: STW1.8

STW1.9 Jogging 2

Value	Command	Description
1	Jogging 2 on	Execute jogging 2
0	Jogging 2 off	Stop jogging 2

Tab. 854: STW1.9

STW1.10 Control by PLC

Value	Command	Description
1	Transfer master control	The master control is transferred to the higher-order open-loop control. The output data of the higher-order open-loop control are thus valid.
0	Do not transfer master control	The output data of the open-loop control are invalid. The reaction of the removal of the master control of the higher-order open-loop control depends on the device. Possible reactions include: – With velocity control: retain process data, no status change – With position control: set PLC output data to 0, cancel positioning and block closed-loop controller If the drive is in a status not equal to S1 Switching On Inhibited an error is reported and it switches to the S1 Switching On Inhibited status. If the power output stage is active, it is switched off and the drive coasts to a stop.

Tab. 855: STW1.10

STW1.12 Open Holding Brake

Value	Command	Description
1	Release holding brake	The holding brake is released.
0	Do not release holding brake	The holding brake is not released.

Tab. 856: STW1.12

PNUs for the General Bits (STW1)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1147990	1.0	STW1	UINT
Px.	**Manufacturer-specific parameters**		
1147000	12226.0	STW1.0 Power Stage Enable	BOOL
1147010	12227.0	STW1.1 Coast Stop Disable	BOOL
1147020	12228.0	STW1.2 Quick Stop Disable	BOOL
1147030	12229.0	STW1.3 Enable Operation	BOOL
1147070	12236.0	STW1.7 Fault Acknowledge	BOOL
1147080	12237.0	STW1.8 Jogging 1	BOOL
1147090	12238.0	STW1.9 Jogging 2	BOOL
1147100	12239.0	STW1.10 Control by PLC	BOOL
1147120	12242.0	STW1.12 Open Holding Brake	BOOL
1147990	12250.0	STW1	UINT

Tab. 857: PNUs

Significance of the special bits for velocity mode (STW1)

The commands for velocity mode are also relevant outside the S4 Operation status. This applies particularly to the commands Block ramp generator (STW1.4) and Block setpoint value (STW1.6). These commands interrupt braking in the S51 Ramp stopbecause they trigger a stop reaction with a higher priority.

STW1.4 Enable ramp generator

Value	Command	Description
1	Ramp generator enabled	If enable is possible, the ramp generator is enabled.
0	Block ramp generator	– The output of the ramp generator is set to 0. – The drive remains under power and is braked in accordance with system stop. Additional system stop with separate deceleration and jerk: – Deceleration (system stop): Px.11280405.0.0, PNU 12328.0 – Jerk (system stop): Px.11280406, PNU 12434.0

Tab. 858: STW1.4

STW1.5 Unfreeze Ramp Generator

Value	Command	Description
1	Start ramp generator	The ramp generator is started.
0→1	Freeze ramp generator	The current setpoint value of the ramp generator is frozen with falling edge at the current pending actual value.

Tab. 859: STW1.5

STW1.6 Enable setpoint

Value	Command	Description
1	Enable rotational speed setpoint value	The rotational speed setpoint value is enabled.
0	Block rotational speed setpoint value	The input of the ramp generator is set to 0.

Tab. 860: STW1.6

STW1.11 Invert setpoint

Value	Command	Description
1	Inversion of setpoint value	The setpoint value is inverted.
0	no inversion of setpoint value	The setpoint value is not inverted.

Tab. 861: STW1.11

PNUs of special bits for speed mode (STW1)

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1147040	12230.0	STW1.4 Enable ramp generator	BOOL
1147050	12232.0	STW1.5 Unfreeze Ramp Generator	BOOL
1147060	12234.0	STW1.6 Enable setpoint	BOOL
1147110	12240.0	STW1.11 Invert setpoint	BOOL
1147150	12248.0	STW1.15 Reserved	BOOL

Tab. 862: PNUs

Significance of the special bits for positioning mode (STW1)

The functions defined for positioning mode are relevant only in the S4 Operation status.

STW1.4 Reject traversing task

Value	Command	Description
1	Do not reject positioning task	The current positioning task is not rejected.
0	Reject positioning task	– The current positioning task is rejected. – The drive switches to the status S43 Braking With Ramp and brakes to standstill with system stop. – Then the drive switches to the S41 Basic State Positioning Mode status and remains controlled. – A new positioning task cannot be started.

Tab. 863: STW1.4

STW1.5 Intermediate Stop

Value	Command	Description
1	No intermediate stop	A new positioning task can be executed or an interrupted positioning task can be resumed.
0	Activate intermediate stop	If the drive is in the S451 Traversing Task Active status: – Switch to status S452 Intermediate Stop Ramp – The drive is braked with the deceleration of the current positioning task until standstill, then switches to the S453 Intermediate Stop status and remains controlled. – The current positioning task is not rejected and it can be resumed by setting the STW1.5 bit. If in the status S41 Basic State Positioning Mode: – positioning task cannot be started.

Tab. 864: STW1. 5

STW1.6 Traverse Task Active

Value	Command	Description
0→1	Activate positioning task	The setpoint value is enabled.
0	Do not activate positioning task	No effect

Tab. 865: STW1.6

If the drive is in the S41 Basic State Positioning Mode status and the "Do not reject positioning task" (STW1.4) and "No intermediate stop" (see STW1.5) commands are pending, a positioning task is started with rising edge at STW1.6 (record or direct setpoint value specification).
If the drive is in the S451 Traversing Task Active status, a new positioning task is started with a rising edge. The new positioning task is effective immediately and the currently active positioning task is rejected.
If the drive is in the S452 Intermediate Stop Ramp or S453 Intermediate Stop status, a new positioning task is started with a rising edge at STW1.6.
The setpoint values of the new positioning task are applied immediately. The currently active positioning task is rejected.
In record mode the returned record number switches to the number of the positioning task (AKTSATZ, Bit 0 ... 6).
If there are several start edges in the S452 Intermediate Stop Ramp status or in the S453 Intermediate Stop status, the last started positioning task is executed with the "No intermediate stop" (STW1.5) command (no saving effect).
The command "Activate motion task" is confirmed by a handshake with the status "Acknowledge motion task active".

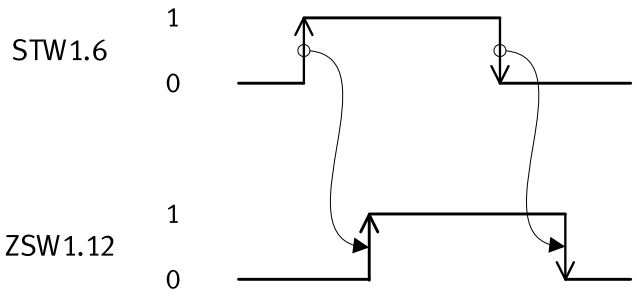


Fig. 140: Activate timing positioning task

The start of another new task before acknowledgement or during ZSW1.12 = 1 is ignored.

STW1.11 Start Homing Procedure

Value	Command	Description
0→1	Start homing	If in the status S41 Basic State Positioning Mode status or the S43 Braking With Ramp: – Homing is started during rising edge.
0	Stop homing	On successful completion of homing (ZSW1.11 = 1, homing point set): – The homing is terminated. – Switch to status S41 Basic State Positioning Mode With active homing: – Homing is interrupted. – The drive is braked to standstill. – Switch to status S41 Basic State Positioning Mode

Tab. 866: STW1.1

STW1.13 Start Block Change

Value	Command	Description
0→1	external record change	The external record change is triggered by a rising edge.
0	No effect	No effect

Tab. 867: STW1.13

PNUs of special bits for positioning mode (STW1)

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1147041	12231.0	STW1.4 Reject traversing task	BOOL
1147051	12233.0	STW1.5 Intermediate Stop	BOOL
1147061	12235.0	STW1.6 Traverse Task Active	BOOL
1147111	12241.0	STW1.11 Start Homing Procedure	BOOL
1147131	12245.0	STW1.13 Start Block Change	BOOL
1147141	12247.0	STW1.14 Reserved	BOOL
1147151	12249.0	STW1.15 Reserved	BOOL

Tab. 868: PNUs

12.4.8.2 Status word 1 (ZSW1)

Bit	Meaning	
	Speed mode	Positioning mode
0	Ready to be switched on – 1: active – 0: inactive	
1	Ready for operation – 1: active – 0: inactive	

Bit	Meaning	
	Speed mode	Positioning mode
2	Operation enabled – 1: active – 0: inactive (blocked)	
3	Malfunction effective – 1: active – 0: inactive	
4	Coasting active – 1: inactive (OFF2 inactive) – 0: active (OFF2 active)	
5	Quick stop active – 1: inactive (OFF3 inactive) – 0: active (OFF3 active)	
6	Switch-on lock active – 1: active – 0: inactive	
7	Warning effective – 1: active – 0: inactive	
8	Rotational speed setpoint/actual deviation within tolerance – 1: in tolerance range – 0: not yet in tolerance range	Position setpoint/actual deviation within tolerance – 1: in tolerance range – 0: not yet in tolerance range
9	Guide required – 1: active – 0: inactive	
10	Speed comparison value reached – 1: active – 0: inactive	Target position reached – 1: active – 0: inactive
11	I, M or P limit not reached – 1: active – 0: inactive	Reference point set – 1: active – 0: inactive
12	Holding brake released – 1: active – 0: inactive	Positioning task activated (acknowledgement) – 0→1: active – 0: inactive
13	No warning of motor overtemperature – 1: motor overtemperature warning not effective – 0: motor overtemperature warning effective	Drive is stationary – 1: active – 0: inactive
14	Motor direction of rotation – 1: actual rotational speed ≥ 0 – 0: actual rotational speed < 0	Axis accelerated – 1: active – 0: inactive
15	no power unit overtemperature warning – 1: warning of thermal overload not effective – 0: warning of thermal overload effective	Drive decelerated – 1: active – 0: inactive

Tab. 869: Status word 1 (ZSW1)

Significance of General Bits (ZSW1)

ZSW1.0 Ready to Switch On

Value	Meaning	Description
1	active (ready to be switched on)	The power supply is switched on. The electronics are initialised. Output stage is active. The drive is in one of the following statuses: – S2 Ready For Switching On – S3 Switched On – S4 Operation – S5 Switching off.
0	inactive (not ready to be switched on)	The drive is in the status S1 Switching On Inhibited.

Tab. 870: ZSW1.0

ZSW1.1 Ready To Operate

Value	Meaning	Description
1	Active (ready for operation)	The output stage is in the ready for operation status. The drive is in one of the following statuses: – S3 Switched On – S4 Operation – S5 Switching off
0	Inactive (not ready for operation)	The Output stage enable command is not pending (STW1.0). The drive is in one of the following statuses: – S1 Switching On Inhibited – S2 Ready For Switching On

Tab. 871: ZSW1.1

ZSW1.2 Operation Enabled

Value	Meaning	Description
1	Active	The output stage is active. The drive follows the pending setpoint value. The drive is in the status S4 Operation.
0	Inactive	The output stage is not active. The drive does not follow the pending setpoint value. The drive is in one of the following statuses: – S1 Switching On Inhibited – S2 Ready For Switching On – S3 Switched On – S5 Switching off

Tab. 872: ZSW1.2

ZSW1.3 Fault Present

Value	Meaning	Description
1	Active	At least one not acknowledged or not acknowledgeable error is pending. The drive is not operational. The error reaction depends on the actual error (see error reaction). The pending errors are in the error memory.
0	Inactive	There are no errors in the error memory.

Tab. 873: ZSW1.3

ZSW1.4 Coast Stop Not Active

Value	Meaning	Description
1	Inactive	The coasting command is inactive.
0	Active (OFF2)	The coasting command is active (OFF2).

Tab. 874: ZSW1.4

ZSW1.5 Quick Stop Not Active

Value	Meaning	Description
1	Inactive	The fast stop command is inactive.
0	Active (OFF3)	The fast stop command is active (OFF3).

Tab. 875: ZSW1.5

ZSW1.6 Switch On Inhibited

Value	Meaning	Description
1	Active	The switch-on lock is active. The drive is in the status S1 Switching On Inhibited. Switching on is only possible with the following command sequence: OFF (OFF1) and no coasting (no OFF2) and no fast stop (no OFF3) and then ON.
0	Inactive	Switching on is possible. The drive is in the status S2 Ready For Switching On, S3 Switched On, S4 Operation or S5 Switching off.

Tab. 876: ZSW1.6

ZSW1.7 Warning Present

Value	Meaning	Description
1	Active	At least one warning is pending. The drive is continuing in operation. Warnings can be acknowledged if the cause is remedied. The pending warnings are in the warning buffer.
0	Inactive	There is no warning in the warning buffer.

Tab. 877: ZSW1.7

ZSW1.9 PLC Control Requested

Value	Meaning	Description
1	Active	The guide is required by the higher-order controller. Condition for use with cycle synchronicity: the drive is synchronous to the automation system.
0	Inactive	Control over the automation system (PLC) is not possible. Control is only possible directly at the device or by a different interface.

Tab. 878: ZSW1.9

PNUs of General Bits (ZSW1)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1145990	2.0	ZSW1	UINT
Px.	**Manufacturer-specific parameters**		
1145990	12220.0	ZSW1	UINT
1145000	12197.0	ZSW1.0 Ready to Switch On	BOOL
1145010	12198.0	ZSW1.1 Ready To Operate	BOOL
1145020	12199.0	ZSW1.2 Operation Enabled	BOOL
1145030	12200.0	ZSW1.3 Fault Present	BOOL
1145040	12201.0	ZSW1.4 Coast Stop Not Active	BOOL
1145050	12202.0	ZSW1.5 Quick Stop Not Active	BOOL
1145060	12203.0	ZSW1.6 Switch On Inhibited	BOOL
1145070	12204.0	ZSW1.7 Warning Present	BOOL
1145090	12207.0	ZSW1.9 PLC Control Requested	BOOL

Tab. 879: PNUs

Significance of the special bits for speed mode (ZSW1)

ZSW1.8 Velocity Error Within Tolerance Range

Value	Meaning	Description
1	in tolerance range	The rotational speed actual value is within a parameterisable tolerance range. A dynamic overshoot or undershoot for time t < t_{max} is acceptable. The tolerance range and the time t_{max} can be parameterised: – Monitoring window velocity: following error: Px.464.0.0, PNU 11148.0 – Damping time velocity: following error: Px.4690.0.0, PNU 11632.0
0	not in tolerance range	The actual rotational speed value is outside a tolerance range.

Tab. 880: ZSW1.8

ZSW1.10 f or n reached or exceeded

Value	Meaning	Description
1	active	The rotational speed comparison value is reached or exceeded. The absolute value is considered: $\|n_{act}\| \geq n_{threshold}$ The comparison value is defined via a threshold value $n_{threshold\ value}$ and a hysteresis n_{hyst}. A switch-on delay time t_{del} can be parameterised during which the rotational speed after falling below $n_{threshold}$ must not fall below the value $n_{threshold}$-n_{hyst}. – Threshold value velocity comparator: Px.11280504, PNU 12435.0 – Hysteresis threshold value velocity comparator: Px.11280505, PNU 12436.0 – Switch-on/off delay time velocity comparator: Px.11280506, PNU 12437.0
0	inactive	Rotational speed comparison value not reached or below setpoint value: $\|n_{act}\| < (n_{threshold} - n_{hyst})$

Tab. 881: ZSW1.10

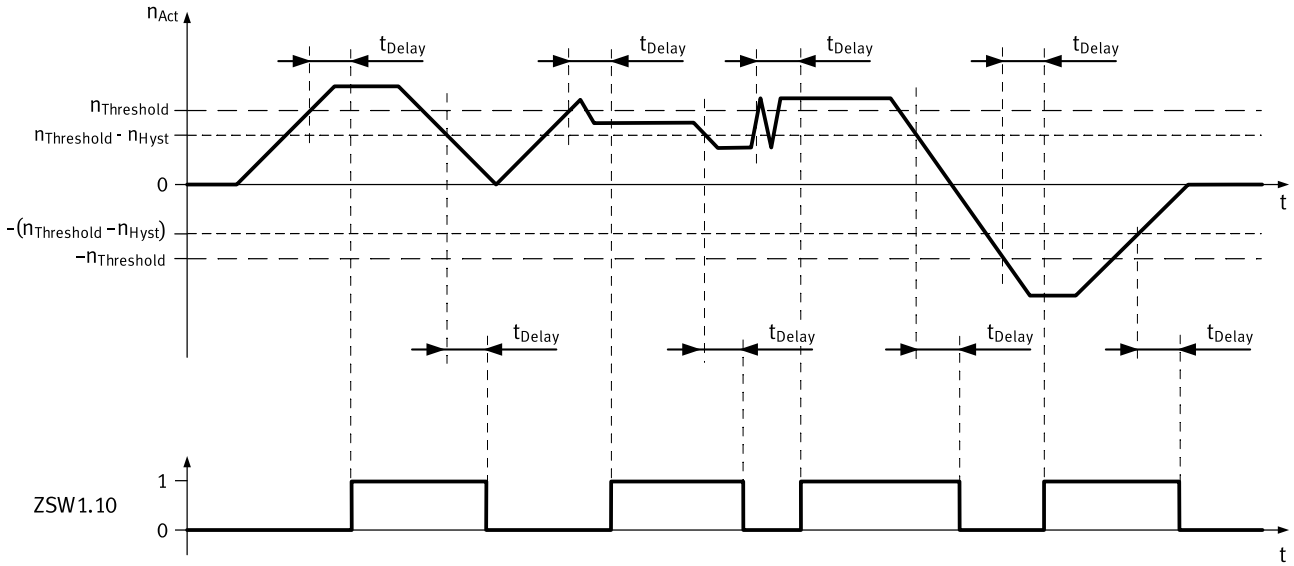


Fig. 141: Rotational speed comparison timing reached

Name	Description	ID Px.
n_{Act}	Actual velocity value encoder channel 1 (rotational speed)	1210
$n_{threshold}$	Threshold value velocity comparator	11280504

Name	Description	ID Px.
n_{hyst}	Hysteresis threshold value velocity comparator	11280505
t_{Delay}	Switch-on/off delay time velocity comparator	11280506

Tab. 882: Legend for rotational speed comparison timing reached

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value encoder channel 1	INT
Px.	**Manufacturer-specific parameters**		
11280504	12435.0	Threshold value velocity comparator	REAL
11280505	12436.0	Hysteresis threshold value velocity comparator	REAL
11280506	12437.0	Switch-on/off delay time velocity comparator	REAL

Tab. 883: PNUs rotational speed comparison timing reached

ZSW1.11 I, M or P limit not reached

Value	Meaning	Description
1	active (not reached)	Indicates that the I, M or P limit has not yet been reached.
0	inactive (reached or exceeded)	Indicates that the I, M or P limit has been reached or exceeded

Tab. 884: ZSW1.11

The motor moves with specified torque and works against the stop when the stop is reached. If the torque limit is reached, the status change is reported by ZSW1.11.

ZSW1.12 Holding brake open

Value	Meaning	Description
1	Active	Shows the "Holding brake opened" status.
0	Inactive	Shows the "Holding brake closed" status.

Tab. 885: ZSW1.12

ZSW1.13 No warning Overtemperature motor

Value	Meaning	Description
1	Motor overtemperature warning not effective	A warning is not output if the defined motor temperature warning threshold is exceeded.
0	Motor overtemperature warning effective	A warning is output if the defined motor temperature warning threshold is exceeded.

Tab. 886: ZSW1.13

ZSW1.14 Motor rotation

Value	Meaning	Description
1	Positive	Actual rotational speed value ≥ 0
0	negative	Actual rotational speed value < 0

Tab. 887: ZSW1.14

ZSW1.15 No warning Overtemperature power unit

Value	Meaning	Description
1	Warning of power unit thermal overload not effective	Shows that a warning or malfunction is not output in case of thermal overload of the power unit.
0	Warning of power unit thermal overload effective	Shows that an appropriate warning or malfunction is output in case of thermal overload of the power unit.

Tab. 888: ZSW1.15

PNUs of special bits for speed mode (ZSW1)

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1145080	12205.0	ZSW1.8 Velocity Error Within Tolerance Range	BOOL
1145100	12208.0	ZSW1.10 f or n reached or exceeded	BOOL
1145110	12210.0	ZSW1.11 I, M or P limit not reached	BOOL
1145120	12212.0	ZSW1.12 Holding brake open	BOOL
1145130	12214.0	ZSW1.13 No warning Overtemperature motor	BOOL
1145140	12216.0	ZSW1.14 Motor rotation	BOOL
1145150	12218.0	ZSW1.15 No warning Overtemperature power unit	BOOL

Tab. 889: PNUs

Significance of the special bits for positioning mode (ZSW1)

ZSW1.8 Following Error Within Tolerance Range

Value	Meaning	Description
1	Following distance within tolerance range	The dynamic comparison of the setpoint position with the actual position is within the tolerance range. The tolerance range can be parameterised: – Damping time position: following error: Px.462.0.0, PNU 11146.0 – Monitoring window position: following error: Px.463.0.0, PNU 11147.0
0	Following distance not yet in tolerance range	The dynamic comparison of the setpoint position with the actual position is not within the parameterised tolerance range.

Tab. 890: ZSW1.8

ZSW1.10 Traverse Task Motion Complete

Value	Meaning	Description
1	active	The actual position value is within the target position window. If the target position window is reached once, the bit remains set until the start of the next task even if the actual position leaves the target position window beforehand. The following can be parameterised: – Damping time target reached: Px.468.0.0, PNU 11152.0 – Monitoring window target position: Px.469.0.0, PNU 11153.0
0	inactive	The actual position value is not within the target position window.

Tab. 891: ZSW1.10

ZSW1.11 Home Position Set

Value	Meaning	Description
1	Active	A homing was run and a valid homing point is set.
0	Inactive	A valid homing point is not set.

Tab. 892: ZSW1.11

ZSW1.12 Traversing Task Acknowledgement (acknowledgment)

Value	Meaning	Description
0→1	Active	With a rising edge the import of a new position task (record or direct setpoint value specification) is acknowledged. The rising edge at ZSW1.12 is the reaction to a rising edge at STW1.6 in in the following statuses: – S41 Basic State Positioning Mode – S451 Traversing Task Active – S452 Intermediate Stop Ramp – S453 Intermediate Stop
0	Inactive	The positioning task acknowledgement is inactive. The status bi is set to 0 if: – STW1.6 = 0, regardless of the current status – the S4 Operation status is left regardless of STW1.6

Tab. 893: ZSW1.12

ZSW1.13 Drive Stopped

Value	Meaning	Description
1	active	The drive is stationary. A prior task is completed or standstill after a braking process is reached (brake ramp, intermediate stop ramp, stop ramp, fast stop). – Standstill damping time: Px.465.0.0, PNU 11149.0 – Monitoring window velocity standstill monitoring: Px.466.0.0, PNU 11150.0 – Damping time target reached: Px.468.0.0, PNU 11152.0 – Monitoring window target position: Px.469.0.0, PNU 11153.0
0	inactive	The drive moves.

Tab. 894: ZSW1.13

Standstill means that the actual rotational speed is less than or equal to a parameterisable threshold value.

$|n_{act}| \leq n_{threshold}$

The signal is effective in all statuses (powered/non-powered).

ZSW1.14 Drive Accelerating

Value	Meaning	Description
1	Active	The axis accelerates. The ramp generator is in the acceleration phase. The signal is not set based on external influences (e.g. malfunction forces acting on the drive).
0	Inactive	The axis does not accelerate. The ramp generator is not in the acceleration phase.

Tab. 895: ZSW1.14

ZSW1.15 Drive Decelerating

Value	Meaning	Description
1	Active	The ramp generator is in the deceleration phase. The drive brakes. The signal is not set based on external influences (e.g. malfunction forces acting on the drive).
0	Inactive	The axis does not decelerate. The ramp generator is not in the deceleration phase.

Tab. 896: ZSW1.15

PNUs of special bits for positioning mode (ZSW1)

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1145081	12206.0	ZSW1.8 Following Error Within Tolerance Range	BOOL
1145101	12209.0	ZSW1.10 Traverse Task Motion Complete	BOOL

Parameter	PNU	Name	Data type
1145111	12211.0	ZSW1.11 Home Position Set	BOOL
1145121	12213.0	ZSW1.12 Traversing Task Acknowledgement	BOOL
1145131	12215.0	ZSW1.13 Drive Stopped	BOOL
1145141	12217.0	ZSW1.14 Drive Accelerating	BOOL
1145151	12219.0	ZSW1.15 Drive Decelerating	BOOL

Tab. 897: PNUs

12.4.8.3 Control word 2 (STW2)

Bit	Meaning
0 … 6	reserved
8	Move to fixed stop – 1: activate move to fixed stop (must be set before reaching the fixed stop). – 1→0: deactivate move to fixed stop
9 … 11	reserved
12	AC4: Master life sign Bit 0
13	AC4: Master life sign Bit 1
14	AC4: Master life sign Bit 2
15	AC4: Master life sign Bit 3

Tab. 898: Control word 2 (STW2)

STW2.8 Traverse to fixed endstop

Value	Command	Description
1	Activate	Move to fixed stop is activated with the command. The signal must be set before reaching the fixed stop.
1→0	Deactivate	Move to the fixed stop is deactivated.

Tab. 899: STW2.8,

For example, with the move to fixed stop command it can be moved to a workpiece with a specified torque to clamp it securely. Detailed information on the function
➔ Move to fixed stop (application class 3).

STW2.12 … 15 Master sign of life

With clock-synchronous IRT transmission in application class 4, the master and slave monitor each other. For each cyclic data exchange, a counter is incremented on both sides and its value is transferred mutually.
The counter of the master life sign is transferred to STW2 (bit 12 … 15). The counter of the slave life sign is transmitted in ZSW 2 (bit 12 … 15) ➔ 12.4.8.4 Status word 2 (ZSW2).

PNUs of control word 2 (STW2)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
1148990	3.0	STW2	UINT
Px.	Manufacturer-specific parameters		
1148080	12254.0	STW2.8 Traverse to fixed endstop	BOOL
1148120	12256.0	STW2.12 … 15 Master sign of life	USINT
1148990	12257.0	STW2	UINT

Tab. 900: PNUs

12.4.8.4 Status word 2 (ZSW2)

Bit	Meaning
0 ... 7	reserved
8	Move to fixed stop – 1: active – 0: inactive
9 ... 10	reserved
11	Output stage active – 1: active – 0: inactive
12	AC4: slave life sign Bit 0
13	AC4: slave life sign Bit 1
14	AC4: slave life sign Bit 2
15	AC4: slave life sign Bit 3

Tab. 901: Status word 2

ZSW2.8 Move to fixed stop active

Value	Meaning	Description
1	Active	This status bit shows that the positioning task "Move to fixed stop" is being executed ➔ Move to fixed stop (application class 3).
0	Inactive	Shows the status "Move to fixed stop is inactive".

Tab. 902: ZSW2.8

ZSW2.11 Power stage active

Value	Meaning	Description
1	Active	Shows that the output stage is enabled (pulses for motor control).
0	Inactive	Shows that the output stage is blocked.

Tab. 903: ZSW2.11

ZSW2.12 ... 15 Slave sign of life

With clock-synchronous IRT transmission in application class 4, the master and slave monitor each other. For each cyclic data exchange, a counter is incremented on both sides and its value is transferred mutually.
The counter of the slave life sign is transmitted in ZSW2 (bit 12 ... 15). The counter of the master life sign is transferred to STW2 (bit 12 ... 15) ➔ 12.4.8.3 Control word 2 (STW2).

PNUs of status word 2 (ZSW2)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
1146990	4.0	ZSW2	UINT
Px.	Manufacturer-specific parameters		
1146080	12222.0	ZSW2.8 Move to fixed stop active	BOOL
1146110	12223.0	ZSW2.11 Power stage active	BOOL
1146120	12224.0	ZSW2.12 ... 15 Slave sign of life	USINT
1146990	12225.0	ZSW2	UINT

Tab. 904: PNUs

12.4.8.5 Rotational speed setpoint value A, B (NSOLL_A, NSOLL_B)

Rotational Speed Set-point Value A (NSOLL_A)

Rotational speed setpoint value A has a 16-bit resolution with sign bit. Bit 15 sets the sign of the setpoint value:

– Bit 15 = 0: positive setpoint value
– Bit 15 = 1: negative setpoint value
The rotational speed is standardised via PNU 60000.
NSOLL_A = 0x4000 or 16384 corresponds to 100 %.

Rotational Speed Setpoint Value B (NSOLL_B)

Rotational speed setpoint value B has a 32-bit resolution with sign bit. Bit 31 sets the sign of the setpoint value:
– Bit 31 = 0: positive setpoint value
– Bit 31 = 1: negative setpoint value
The rotational speed is standardised via PNU 60000.
NSOLL_B = 0x4000 0000 or 1 073 741 824 corresponds to 100 %.

PNUs for rotational speed setpoint value A, B (NSOLL_A, NSOLL_B)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280502	5.0	Target velocity NSOLL_A	Signed16
11280502	7.0	Target velocity NSOLL_B	Signed32
Px.	**Manufacturer-specific parameters**		
11280502	12334.0	NSOLL_A/NSOLL_B	REAL

Tab. 905: PNUs

12.4.8.6 Rotational speed value A, B (NIST_A, NIST_B)

Rotational speed value A (NIST_A)

Rotational speed value A has a 16-bit resolution.
Rotational speed value A is standardised like the setpoint value ➔ 12.4.8.5 Rotational speed setpoint value A, B (NSOLL_A, NSOLL_B).

Rotational speed value B (NIST_B)

Rotational speed value B has a 32-bit resolution.
Rotational speed value B is standardised like the setpoint value ➔ 12.4.8.5 Rotational speed setpoint value A, B (NSOLL_A, NSOLL_B).
NIST_A and NIST_B are mapped to the same parameter (Px.1210).

PNUs for rotational speed value A, B (NIST_A, NIST_B).

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual value of velocity NIST_A	Signed16
	8.0	Actual value of velocity NIST_B	Signed32
Px.	**Manufacturer-specific parameters**		
1210	11311.0	Actual velocity value encoder channel 1	REAL

Tab. 906: PNUs

12.4.8.7 Encoder n actual position value 1 (Gn_XIST1)

Gn_XIST is used to transmit the cyclic actual position value to the higher-level controller.
The device displays actual position values internally in SINT64 format (64 bit).
40 bits are used for multi-turn information (number of revolutions) and 24 bits for single-turn information (pulses per revolution).
All encoder values are internally normalised to 24 bit single-turn information (pulses per revolution) regardless of the encoder resolution.
In telegrams, the actual position values are transmitted in UINT32 format. The number of bits used for multi-turn and single-turn information can be parameterised.

When the preset is active, the device-internal 24 bits are standardised to the following values:
– Single-turn information (pulses per revolution): 18 bits (262144)
– Multiturn information: 14 bits (16383)
Parameter Px.231545 can be used to define the number of bits used for normalising the single-turn information. The remaining bits are used to record the multiturn information. If necessary, overflows must be compensated by the higher-level control system.
The settings used must be consistent with the settings of the higher-level controller.

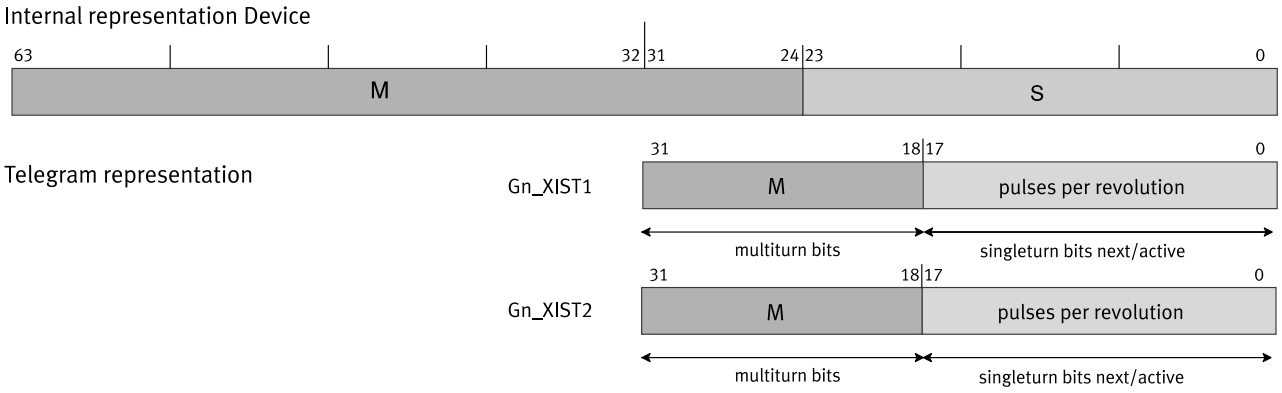


Fig. 142: Display of actual position values (example)

Name	Description
Internal representation device	Internal representation of position values in the device
M	Multiturn information
multi-turn bits	Bits for the representation of the multi-turn values
pulses per revolution	Single-turn information (pulses per revolution)
singleturn bits next/active	Bits for displaying the single-turn values
Telegram representation	Representation of the position values in the telegram

Tab. 907: Legend for Figure "Actual Position Value 1"

Detailed information on the mode of operation of the encoder interface
➔ 12.4.8.11 Status Diagram "Position Feedback Interface".

PNUs encoder n actual position value 1 (Gn_XIST1)

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
231544	12522.0	Actual resolution per revolution for Gn_XIST	UDINT
231545	12524.0	Resolution per revolution for Gn_XIST	UDINT

Tab. 908: PNUs

The device has an instance for each encoder interface. The parameters are allocated to the primary encoder with instance 0 (the commutation encoder is at encoder interface 1).

12.4.8.8 Encoder n actual position value 2 (Gn_XIST2)

Depending on the respective function, different values are entered in Gn_XIST2. The scaling of the position values is carried out analogously to Gn_XIST1 via parameter Px.231545 ➔ 12.4.8.7 Encoder n actual position value 1 (Gn_XIST1).

The following priorities must be observed for the values in Gn_XIST2:

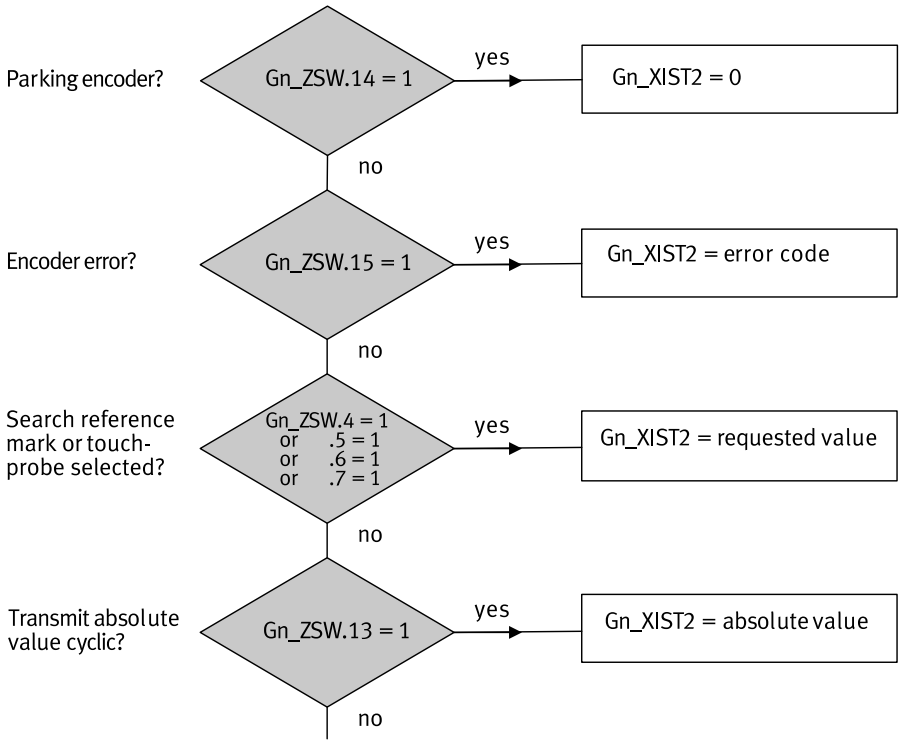


Fig. 143: Priorities for Gn_XIST2 (actual position value 2)

Name	Description
Encoder error?	Is there a sensor error?
Search reference mark or touchprobe selected	Is a reference mark being searched for or is the Touch Probe (flying measurement) function selected?
Transmit absolute value cyclic?	Is the absolute value transmitted cyclically?
Parking encoder?	parking encoder?
Gn_XIST2 = error code	Gn_XIST2 contains the error code.
Gn_XIST2 = request value	Gn_XIST2 contains the requested value.
Gn_XIST2 = absolute value	Gn_XIST2 contains the cyclically transmitted absolute value.

Tab. 909: Legend for figure "Priorities for Gn_XIST2 (Actual Position Value 2)"

Detailed information on the mode of operation of the encoder interface
➔ 12.4.8.11 Status Diagram "Position Feedback Interface".

12.4.8.9 Encoder n control word (Gn_STW)

The encoder status machine is controlled via the encoder control word. The following functions are implemented in the device via the encoder control word and the encoder state machine:

Bit	Meaning
	If Gn_STW.7 = 0; request "Search zero pulse" Value: Function requirement
0	1: Function 1, zero pulse 1
1	1: Function 2, reserved
2	1: Function 3, reserved
3	1: Function 4, reserved

Bit	Meaning
4 … 6	Value: Command – 0: – – 1: Activate function (defined by bit 0 … 3 and 7) – 2: Read value via Gn_XIST2 (defined via bit 0 … 3 and 7) – 3: Abort function (defined via bit 0 … 3 and 7) – 4 … 7: reserved
7	Value: Mode – 0: Request "Search for zero pulse" – 1: reserved
8 … 12	reserved
13	Request absolute value cyclically – 1: Request of an additional cyclic transmission of the absolute actual position in Gn_XIST2
14	Activate encoder parking – 1: Request to switch off the monitoring of the encoder and the actual value measurements in the drive. If the Park encoder function is active, the encoder (or a motor with encoder) can be removed from the machine without having to change the drive configuration or cause an error. If parking of the encoder interface is requested by Gn_STW1.14, all current encoder interface errors are also cleared. Normally the parking of the encoder is not permitted while the drive (S4) is running and leads to an error of the encoder interface (error code 0x0003 in Gn_XIST2).
15	Acknowledge encoder error 1: Request to reset an encoder error (Gn_ZSW.15)

Tab. 910: Control word Gn_STW

Detailed information on the mode of operation of the encoder interface
➔ 12.4.8.11 Status Diagram "Position Feedback Interface".

PNUs encoder n control word (Gn_STW)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1149990	9.0	Gn_STW	UINT
Px.	**Manufacturer-specific parameters**		
1149000	12260.0	Gn_STW.0 … 3 Request function	USINT
1149040	12261.0	Gn_STW.4 … 6 Request command	USINT
1149070	12262.0	Gn_STW.7 Mode	BOOL
1149110	12263.0	Gn_STW.11 Home position mode	BOOL
1149120	12264.0	Gn_STW.12 Trigger mode homing	BOOL
1149130	12265.0	Gn_STW.13 Request absolute value cyclically	BOOL
1149140	12266.0	Gn_STW.14 Activate parking sensor	BOOL
1149150	12267.0	Gn_STW.15 Acknowledge sensor error	BOOL
1149990	12268.0	Gn_STW	UINT
1149991	12269.0	Gn_STW Cycle-1	UINT

Tab. 911: PNUs

12.4.8.10 Encoder n status word (Gn_ZSW)

The encoder status word is used to observe the encoder status machine. The following functions are offered in the device via the encoder status word and the encoder status machine:

Bit	Meaning
0 ... 3	If Gn_STW.7 = 0; request "Search zero pulse" Value: Function – 1: Search zero pulse 1 is active – 2: reserved – 3: reserved – 4: reserved
4 ... 7	If Gn_STW.7 = 0; request "Search zero pulse" Value: Status – 1: Value zero pulse 1 is available – 2: reserved – 3: reserved – 4: reserved
8 ... 9	reserved
10	Fixed 0
11	Acknowledge encoder error – 1: Acknowledge encoder error is executed
12	reserved
13	Absolute value transmitted cyclically – 1: Indicates that the absolute actual position is transferred cyclically in Gn_XIST2. This is only possible if the encoder provides absolute information (displayed in PNU 979.5).
14	Parking encoder active – 1: Feedback "Activate encoder parking" (Gx_STW.14) or display of an invalid value in Gn_XIST1
15	Encoder error – 1: Indicates a sensor device error or an error in the actual value measurement. The corresponding error code is provided in Gn_XIST2. If there is more than one error code, the error code with the highest severity is reported in Gn_XIST2 (most relevant error code). Example: If an overtemperature error occurs first and the encoder signal becomes invalid as a result, Gn_XIST2 first displays the error code 0x0F05 and then 0x0001.

Tab. 912: Encoder n status word (Gn_ZSW)

Detailed information on the mode of operation of the encoder interface
➔ 12.4.8.11 Status Diagram "Position Feedback Interface".

PNUs encoder n status word (Gn_ZSW)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1143990	10.0	Gn_ZSW	UINT
Px.	**Manufacturer-specific parameters**		
1143000	12187.0	Gn_ZSW.0 ... 3 Function active	USINT
1143040	12188.0	Gn_ZSW.4 ... 7 value	USINT
1143080	12189.0	Gn_ZSW.8 touch probe 0 deflected	BOOL
1143090	12190.0	Gn_ZSW.9 Touch Probe 1 deflected	BOOL
1143110	12191.0	Gn_ZSW.11 Error acknowledgment active	BOOL
1143120	12192.0	Gn_ZSW.12 Homing mode active	BOOL
1143130	12193.0	Gn_ZSW.13 Transmit absolute value cyclically	BOOL
1143140	12194.0	Gn_ZSW.14 Parking sensor active	BOOL
1143150	12195.0	Gn_ZSW.15 sensor error	BOOL
1143990	12196.0	Gn_ZSW	UINT

Tab. 913: PNUs

12.4.8.11 Status Diagram "Position Feedback Interface"

Detailed information about the statuses (SD) and transitions (TD) of the status diagram of the position feedback interface can be found in the PROFIdrive ➔ Tab. 768 PROFIdrive Implementation specification.

The statuses SD11, SD10 and SD7 are not supported.

- - - - - - not supported functions: SD11, SD10, SD7

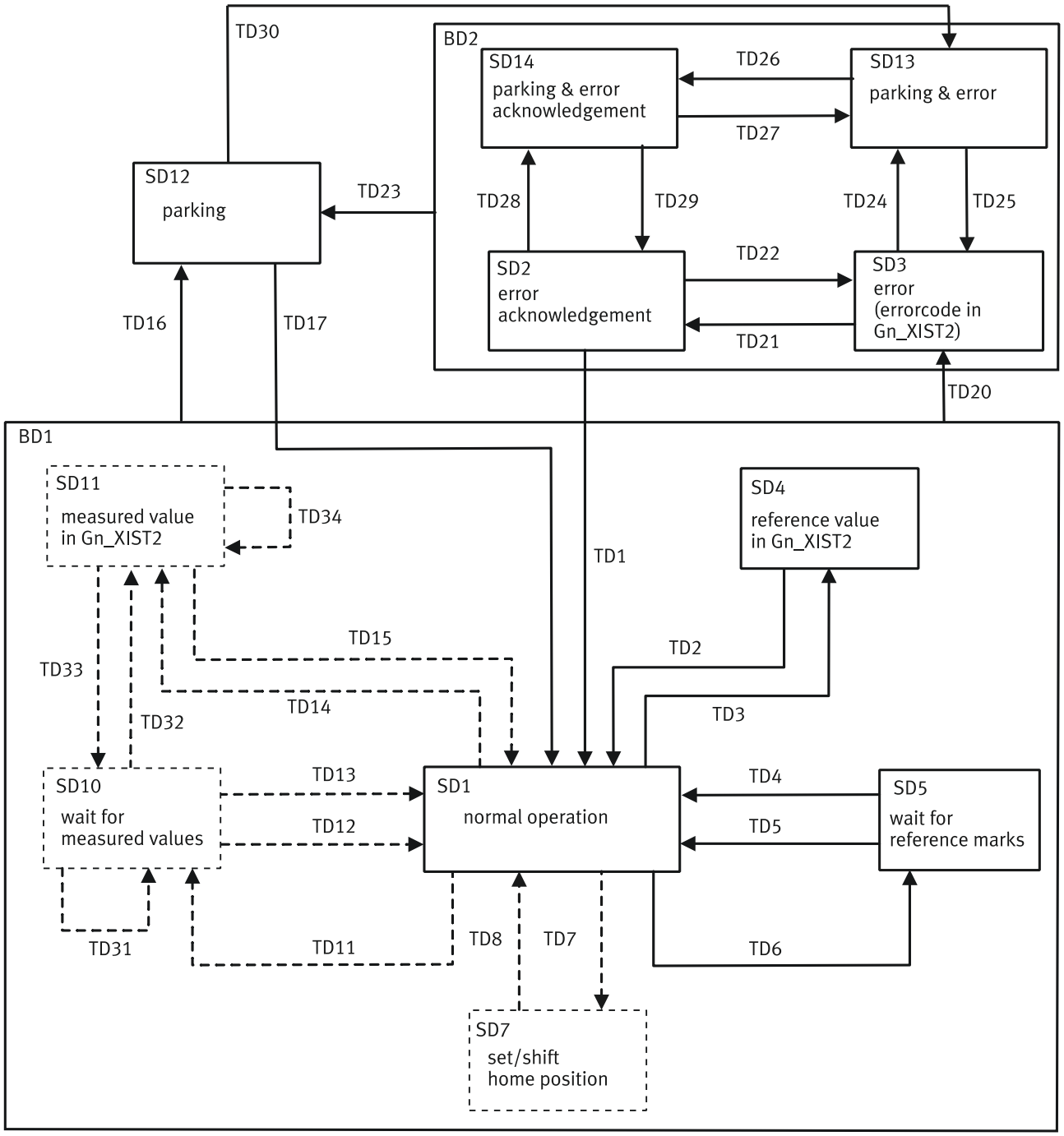


Fig. 144: Status diagram of the position feedback interface

12.4.8.12 Actual position value A (XIST_A)

XIST_A shows the actual position value based on the scaling that is set in the factor group.

PNU actual position value A (XIST_A)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
113104	28.0	XIST_A, parameter name "Actual value modulo"	DINT

Tab. 914: PNUs

12.4.8.13 Position Error (XERR)

The position deviation for Dynamic Servo Control (AC4) is transmitted via this setpoint value (data type SINT32).
The format of XERR is identical to the format of Gn_XIST1 ➔ 12.4.8.7 Encoder n actual position value 1 (Gn_XIST1).

12.4.8.14 Position Controller Amplification Factor (KPC)

The position controller gain factor is transmitted via this setpoint value at Dynamic Servo Control (AC4).
Transmission format: KPC is transmitted in the unit 0.001 1/s (data type SINT32).
Value range: 0 ... 4000.0
Special case: The KPC value = 0 deactivates the position controller in the drive.

12.4.8.15 Record Selection (SATZANW)

Bit	Meaning
0	Record selection bit 0 (2^0)
1	Record selection bit 1 (2^1)
2	Record selection bit 2 (2^2)
3	Record selection bit 3 (2^3)
4	Record selection bit 4 (2^4)
5	Record selection bit 5 (2^5)
6	Record selection bit 6 (2^6)
7 ... 14	reserved
15	MDI selection – 1: activate – 0: deactivate

Tab. 915: SATZANW

SATZANW.0 ... 6 Traversing block selection

Bit	Meaning	Description
0	Record selection bit 0 (2^0)	Record selection record 0 to 127 (binary coded). 128 records can be selected with these 7 bits (record 0 to 127). Record 0 can also be used as a record. Because record 0 is also used as "No record active" as a feedback in the status word, it cannot be detected when it is closed with record 0. If the target value specification (MDI) is active, the record selection is ignored.
1	Record selection bit 1 (2^1)	
2	Record selection bit 2 (2^2)	
3	Record selection bit 3 (2^3)	
4	Record selection bit 4 (2^4)	
5	Record selection bit 5 (2^5)	
6	Record selection bit 6 (2^6)	

Tab. 916: SATZANW, bit 0 ... 6

Example of Signal Processes with Record Execution

In the following example record 2 is started and executed first. Then record 1 is started and executed.

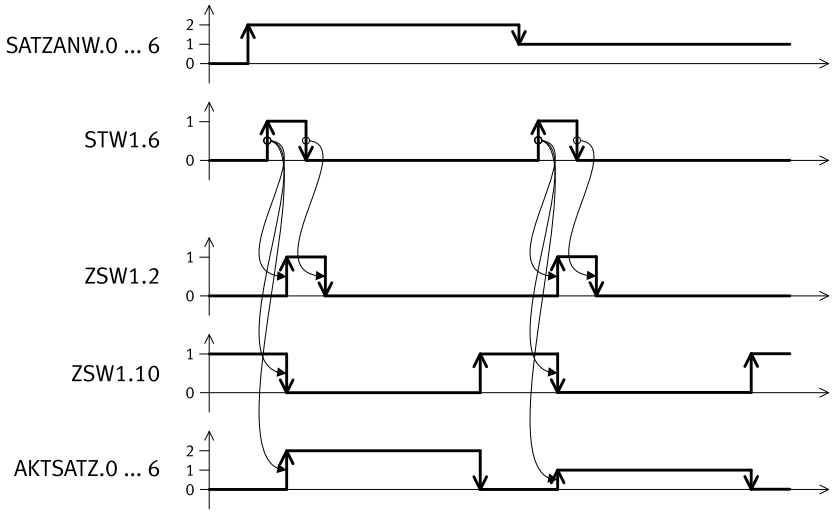


Fig. 145: Record selection timing

SATZANW.15 Activate MDI(Target Value Specification)

The target value specification can only be activated in the S41 Basic State Positioning Mode status.

Value	Command	Description
1	activate	Target value specification is activated. If a task is currently active, it switches first to MDI, if the current task is finished or interrupted and the drive is in the S41 Basic State Positioning Mode status.
0	deactivate	Target value specification is deactivated. If a MDI task is currently active, it switches to the S43 Braking With Ramp status, brakes at maximum deceleration and at standstill switches to the S41 Basic State Positioning Mode status. The current task is rejected.

Tab. 917: SATZANW, bit 15

PNUs of Record Selection (SATZANW)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112415990	32.0	SATZANW	UINT
Px.	Manufacturer-specific parameters		
112415000	12392.0	SATZANW.0 ... 6 Traversing block selection	USINT
112415150	12393.0	SATZANW.15 Activate MDI	BOOL
112415990	12394.0	SATZANW	UINT
112415991	12395.0	SATZANW Cycle-1	UINT

Tab. 918: PNUs

12.4.8.16 Active record (AKTSATY)

Bit	Meaning
0	active position set bit 0 (2^0)
1	active position set bit 1 (2^1)
2	active position set bit 2 (2^2)
3	active position set bit 3 (2^3)
4	active position set bit 4 (2^4)
5	active position set bit 5 (2^5)
6	active position set bit 6 (2^6)

Bit	Meaning
7 … 14	reserved
15	MDI active – 1: active – 0: inactive

Tab. 919: AKTSATZ

AKTSATZ.0 … 6 Active traversing block

Bit	Meaning	Description
0	active position set bit 0 (2^0)	Shows the active position set (0 … 127). A record is active if the drive is in the S45 Traversing Task Interpolation status. If a new task is started during the intermediate stop ramp or during the intermediate stop, the active record switches immediately to the new record number. If MDI is active or no record is currently active, the value 0 is displayed.
1	active position set bit 1 (2^1)	
2	active position set bit 2 (2^2)	
3	active position set bit 3 (2^3)	
4	active position set bit 4 (2^4)	
5	active position set bit 5 (2^5)	
6	active position set bit 6 (2^6)	

Tab. 920: AKTSATZ, bit 0 … 6

Example of Signal Processes with Record Execution

In the following example record 2 is started and executed first. Then record 1 is started and executed.

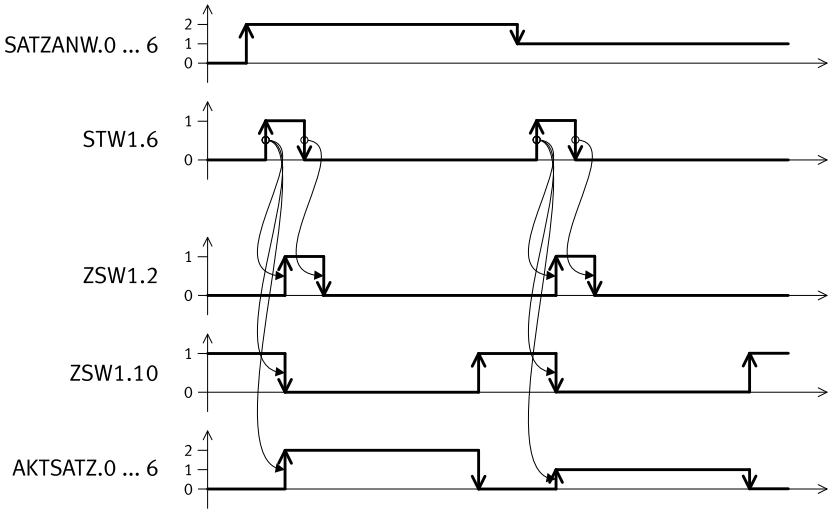


Fig. 146: Record selection timing

AKTSATZ.15 MDI activated (Target Value Specification)

The target value specification can only be activated in the S41 Basic State Positioning Mode status.

Value	Command	Description
1	active	Shows that MDI is active (target value specification). The setpoint values are specified directly by the open-loop controller. If a positioning task is currently being executed, the set-point value was specified directly (drive is in the status S45 Traversing Task Interpolation or S43 Braking With Ramp).
0	inactive	Shows that MDI is inactive. Record mode is active. The record number of a new task is which the setpoint values for the task are saved is taken from bit 0 - 6 (record selection). If a positioning task is currently being executed, the set-point value was specified in record mode and the record number of the active position set is shown in bit 0 - 6 (drive is in the status S45 Traversing Task Interpolation or S43 Braking With Ramp).

Tab. 921: AKTSATZ, bit 15

PNUs active set (ACTSATZ)

Parameters	PNU	Name	Data type
Px.	**Profile-specific parameters**		
112416990	33.0	AKTSATZ	UINT
Px.	**Manufacturer-specific parameters**		
112416000	12396.0	AKTSATZ.0 ... 6 Active traversing block	USINT
112416150	12397.0	AKTSATZ.15 MDI activated	BOOL
112416990	12398.0	AKTSATZ	UINT

Tab. 922: PNUs

12.4.8.17 MDI target position (MDI_TARPOS)

This process datum specifies the position with MDI.
Scaling is analogous to the CiA402 factor group via the following parameter:
– Resolution position: Px.7841, PNU 11724.0
The scalability is limited to the power of 10 ➔ 3.2.4.3 Scaling of internal units for fieldbus ("Factor group").

PNUs of MDI target position (MDI_TARPOS)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280604	34.0	Target position MDI	DINT
Px.	**Manufacturer-specific parameters**		
11280604	12339.0	Target position MDI	LINT

Tab. 923: PNUs

12.4.8.18 MDI velocity (MDI_VELOCITY)

This process data specifies the velocity with MDI.
Scaling is analogous to the CiA402 factor group via the following parameter:
– Resolution velocity: Px.7842, PNU 11725.0
The scalability is limited to the power of 10 ➔ 3.2.4.3 Scaling of internal units for fieldbus ("Factor group").

PNUs of MDI velocity (MDI_VELOCITY)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280605	35.0	Profile velocity MDI	UDINT
Px.	**Manufacturer-specific parameters**		
11280605	12340.0	Profile velocity MDI	REAL

Tab. 924: PNUs

12.4.8.19 MDI acceleration (MDI_ACC)

This process datum specifies the acceleration with MDI records.
Standardisation: 0x4000 (16384) corresponds to 100%. The value is internally limited to 0.1 ... 100%.

PNUs of MDI acceleration (MDI_ACC)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280606	36.0	Acceleration MDI	INT
Px.	**Manufacturer-specific parameters**		
11280606	12341.0	Acceleration MDI	REAL

Tab. 925: PNUs

12.4.8.20 MDI deceleration (MDI_DEC)

This process datum specifies the percentage value for the deceleration override with MDI records.
Standardisation: 0x4000 (16384) corresponds to 100%. The value is internally limited to 0.1 ... 100%.

PNUs of MDI deceleration (MDI_DEC)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280607	37.0	Deceleration MDI	INT
Px.	**Manufacturer-specific parameters**		
11280607	12342.0	Deceleration MDI	REAL

Tab. 926: PNUs

12.4.8.21 Manual Data Input Mode (MDI_MOD)

Bit	Meaning
0	Positioning – 1: absolute – 0: relative
1	Telegram 9, modulo direction selection positive – 1: positive direction Bit 1 and bit 2 identical (0 or 1): shortest path
2	Telegram 9, modulo direction selection negative – 1: negative direction Bit 1 and bit 2 identical (0 or 1): shortest path
3 ... 15	reserved

Tab. 927: MDI_MOD

MDI_MOD.0 Positioning (absolute positioning/relative positioning)

Value	Command	Description
1	Absolute positioning	Absolute positioning is selected.
0	Relative positioning	Relative positioning is selected.

Tab. 928: MDI_MOD, Bit 0

MDI_MOD.1 ... 2 Direction of movement

Value		Description
Bit 2	Bit 1	
0	0	Position absolute on shortest path
0	1	Position absolute in positive direction
1	0	Position absolute in negative direction
1	1	Position absolute on shortest path

Tab. 929: MDI_MOD, bit 1 and 2

PNUs manual data input mode (MDI_MOD)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
112417990	38.0	MDI_MOD	UINT
Px.	**Manufacturer-specific parameters**		
112417000	12399.0	MDI_MOD.0 Positioning	BOOL
112417010	12400.0	MDI_MOD.1 ... 2 Direction of movement	UDINT
112417990	12401.0	MDI_MOD	UINT
112417991	12402.0	MDI_MOD Cycle-1	UINT

Tab. 930: PNUs

12.4.8.22 Status word messages (MELDW)

Bit	Meaning
0	Ramp generator – 1: inactive – 0: active
1	Torque utilisation – 1: < threshold value – 0: > threshold value
2	Actual rotational speed < threshold 1 – 1: value < threshold value – 0: value > threshold value
3	Actual rotational speed ≤ threshold 2 – 1: value < threshold value – 0: value > threshold value
4	reserved
5	Variable message function – 1: threshold value exceeded – 0: below the threshold value or message function not active
6	No warning of motor overtemperature – 1: active (no warning) – 0: inactive (warning active)
7	No warning of power output stage overtemperature – 1: active (no warning) – 0: inactive (warning active)
8	Velocity setpoint/actual deviation within tolerance – 1: active – 0: inactive
9 ... 10	Reserved

Bit	Meaning
11	Controller enable – 1: active – 0: inactive
12	Ready for operation – 1: active – 0: inactive
13	Power stage enable – 1: active – 0: inactive
14 ... 15	Reserved

Tab. 931: Status Word Messages (MELDW)

MELDW.0 ramp generator

Value	Message	Description
1	Inactive	Ramp generator is inactive. Startup phase is complete.
0	Active	Ramp generator active. Startup phase is still active.

Tab. 932: MELDW.0

MELDW.0 shows how far the setpoint value change to a new velocity setpoint value is complete.

MELDW.1 torque utilization

Value	Message	Description
1	< Threshold value	The current torque value is within the torque utilisation monitoring window.
0	> Threshold value	The current torque value is outside the torque utilisation monitoring window.

Tab. 933: MELDW.1

This message can determine an overload of the motor in order to initialise a corresponding reaction (e.g. stop motor or reduce load).
The threshold, the monitoring window and the settling time can be parameterised:
– Threshold value torque utilization reached: Px.11280410, PNU 12332.0
– Torque utilization monitoring window: Px.11280411, PNU 12532
– Damping time torque utilization: Px.11280412, PNU 12533

MELDW.2 Actual velocity <Threshold1

Value	Message	Description
1	Value < specified threshold value	$\|n_{act}\| <$ threshold
0	Value > or equal to specified threshold value	$\|n_{act}\| \geq$ threshold

Tab. 934: MELDW.2

The threshold can be parameterised.
– Trigger level MELDW.2: Px.11280112, PNU 12320.0
– Hysteresis trigger level: Px.11280113, PNU 12321.0

MELDW.3 Actual velocity = <Threshold2

Value	Message	Description
1	Value < specified threshold value	$\|n_{act}\| \leq$ threshold
0	Value > or equal to specified threshold value	$\|n_{act}\| >$ threshold

Tab. 935: MELDW.3

The message is parameterisable and is used for monitoring the rotational speed:
– Trigger level MELDW.3: Px.11280114, PNU12322.0
– Hysteresis trigger level: Px.11280115, PNU 12323.0

MELDW.5 Variable reporting function

Value	Message	Description
1	Threshold value exceeded (Value > threshold value)	The monitored signal of a drive system has exceeded the specified threshold value.
0	Below the threshold value or message function not active (Value ≤ threshold value)	The monitored signal of a drive system is below the specified threshold value or the message function is not active.

Tab. 936: MELDW.5

The function monitors any parameter to check whether it exceeds a threshold value.

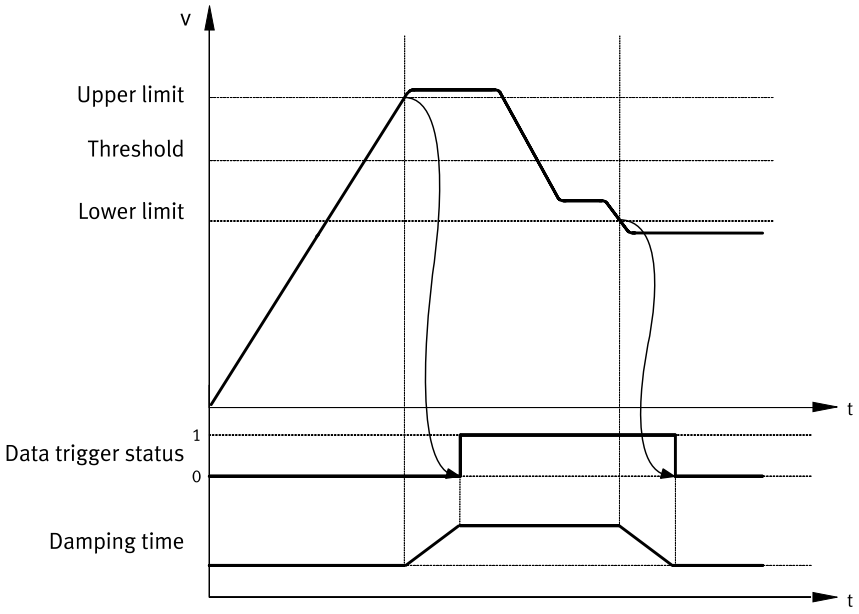


Fig. 147: Variable message function timing (example)

Name	Description	ID Px.
Threshold	Threshold value of the monitored parameter	–
	Trigger level MELDW.5	1174205
	Hysteresis of trigger level	1174206
Upper limit	upper limit value (threshold value + hysteresis)	–
Lower limit	lower limit value (threshold value - hysteresis)	–
Data trigger status	Data trigger status (mapped to MELDW.5)	1174220
Cushioning time	Data trigger damping time	1174207

Tab. 937: Legend for variable message function timing graph

The monitored parameters are specified with the following parameters:
– Axis ID data trigger: P0.1174201.0.0, PNU 3292.0
– Data ID data trigger: P0.1174202.0.0, PNU 3293.0
– Data instance ID data trigger: P0. 1174203.0.0, PNU 3294.0
– Array ID data trigger: P0.1174204, PNU 3295.0
The resolution is specified with the following parameters:
– Trigger level MELDW.5: P0.1174205.0.0, PNU 3296.0
– Hysteresis of trigger level: P0.1174206.0.0, PNU 3297.0
– Data trigger damping time: P0.1174207.0.0, PNU 3298.0
The input values must be specified in the correct format for trigger level and hysteresis (data type of the monitored parameter).
Hysteresis and cushioning times are optional and may be omitted.

On completion of parameterisation the function can be activated with the following parameter:
– Activation of variable message function: P0.1174200.0.0, PNU 3291.0
The specified values are not enabled until the function is activated. The specified values may also be modified without affecting the currently active function.
The status can also be queried with the following parameters in addition to MELDW.5:
– Data trigger status: P0.1174220.0.0, PNU 3307.0

MELDW.6 No warning Overtemperature motor

Value	Message	Description
1	No warning of motor overtemperature	The temperature in the motor is within the permissible range
0	Warning of motor overtemperature	The temperature in the motor is outside the permissible range

Tab. 938: MELDW.6

The bit returns the value 1 so long as the temperature remains within the permissible range (lower warning limit < permissible range < upper warning limit).
The limits are formed by combination of threshold value + hysteresis:
– Lower limit value warning threshold motor temperature: Px.945.0.0, PNU 11234.0
– Hysteresis lower limit value warning threshold motor temperature: Px.946.0.0, PNU 11235.0
– Upper limit value warning threshold motor temperature: Px.949.0.0, PNU 11238.0
– Hysteresis upper limit value warning threshold motor temperature: Px.9410.0.0, PNU 11782.0
A difference between warning and error cannot be distinguished with this bit.
Temperature outside the permissible range means warning and/or error.

MELDW.7 No warning Overtemperature power output stage

Value	Message	Description
1	No warning of thermal overload in power unit	The temperature of the cooling element in the power unit is within the permissible range
0	Warning of thermal overload in power unit	The temperature of the cooling element in the power unit is outside the permissible range

Tab. 939: MELDW.7

The bit returns the value 1 so long as the temperature remains within the permissible range (warning limit < permissible range < upper warning limits).
– Lower limit value warning threshold power output stage temperature: Px.9316.0.0, PNU 2797.0
– Upper limit value warning threshold power output stage temperature: Px.9314.0.0, PNU 2795.0
A difference between warning and error cannot be distinguished with this bit.
Temperature outside the permissible range means warning and/or error.

MELDW.8 velocity setpoint / actual deviation in tolerance

Value	Message	Description
1	active	The rotational speed setpoint/actual deviation as specified is within the tolerance.
0	inactive	The rotational speed setpoint/actual deviation as specified is outside the tolerance.

Tab. 940: MELDW.8

– Monitoring window velocity: following error: Px.464.0.0, PNU 11148.0
– Damping time velocity: following error: Px.4690.0.0, PNU 11632.0

MELDW.11 Controller enable

Value	Message	Description
1	Active	Controller enable reported
0	Inactive	Controller enable not reported

Tab. 941: MELDW.11

MELDW.12 Ready for operation

Value	Message	Description
1	Active	Ready for operation reported
0	Inactive	Ready for operation not reported

Tab. 942: MELDW.12

MELDW.13 Power stage active

Value	Message	Description
1	Active	Output stage active reported
0	Inactive	Output stage not active reported

Tab. 943: MELDW.13

PNUs for status word messages (MELDW)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
11249990	102.0	MELDW	UINT
Px.	Manufacturer-specific parameters		
1174205	3296.0	Trigger level MELDW.5	LINT
11280046	12310.0	Status word MELDW	UINT
11280112	12320.0	Trigger level MELDW.2	REAL
11280114	12322.0	Trigger level MELDW.3	REAL
1124900	12178.0	MELDW.0 ramp generator	BOOL
11249010	12279.0	MELDW.1 torque utilization	BOOL
11249020	12280.0	MELDW.2 Actual velocity <Threshold1	BOOL
11249030	12281.0	MELDW.3 Actual velocity = <Threshold2	BOOL
11249050	12282.0	MELDW.5 Variable reporting function	BOOL
11249060	12283.0	MELDW.6 No warning Overtemperature motor	BOOL
11249070	12284.0	MELDW.7 No warning Overtemperature power output stage	BOOL
11249080	12285.0	MELDW.8 velocity setpoint / actual deviation in tolerance	BOOL
11249110	12286.0	MELDW.11 Controller enable	BOOL
11249120	12287.0	MELDW.12 Ready for operation	BOOL
11249130	12288.0	MELDW.13 Power stage active	BOOL
11249990	12289.0	MELDW	UINT

Tab. 944: PNUs

12.4.8.23 Velocity Override (OVERRIDE)

The process data item OVERRIDE specifies the percentage value for the velocity override for the following movement types in positioning mode of application class 3:
– Positioning records
– Jogging
– Go to Home/Reference
– Homing point specification (MDI)

The velocity setpoint value of these movement types is multiplied by the override factor.
Standardisation: 0x4000 (16384) corresponds to 100%.
Value range according to drive profile: 0 ...0x7FFF (Px.11280611)
Device parameters value range: 0 ... 2 (Px.1309)
Values below this range are interpreted as 0 %.
Values above this range are interpreted as 200 %.

PNUs position speed override (OVERRIDE)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280611	205.0	Velocity override	INT
Px.	**Manufacturer-specific parameters**		
1309	12482.0	Velocity override	REAL
11280611	12534.0	Velocity override	INT

Tab. 945: PNUs

12.4.8.24 Torque reduction (MOMRED)

The process date MOMRED specifies the percentage by which the torque limit is to be reduced. With MOMRED, the maximum permissible torque of the motor or controller (Px.381) can be reduced in the range of 0 ... 100%.
The value 0x4000 corresponds to a reduction of 100%.
The value 0x0000 corresponds to a reduction of 0%.
The symmetrical torque limit (Px.526796) is set according to the following formula:
Px.526796 = Px.381 - Px.381 * Px.1126990 : 0x4000
A reduction of the torque limit is only effective when using telegrams with the control word MOMRED.
MOMRED is only evaluated if STW1.10 is set.

PNUs torque reduction (MOMRED)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
1126990	101.0	MOMRED	INT
Px.	Manufacturer-specific parameters		
381	11122.0	Specifies the maximum torque from the minimum values of the motor and servo drive controller relative to the output side with gearbox.	REAL
526796	12166.0	Maximum torque symmetrical	REAL
1126990	12179.0	MOMRED	INT

Tab. 946: PNUs

12.4.8.25 Positioner control word 1 (POS_STW1)

Bit	Meaning
0	Positioning record selection bit 0 (2^0)
1	Positioning record selection bit 1 (2^1)
2	Positioning record selection bit 2 (2^2)
3	Positioning record selection bit 3 (2^3)
4	Positioning record selection bit 4 (2^4)
5	Positioning record selection bit 5 (2^5)

Bit	Meaning
6	Positioning record selection bit 6 (2^6)
7	reserved
8	absolute positioning (positioning method) – 1: absolute – 0: relative
9	Telegram 111, modulo direction selection positive – 1: positive direction Bit 9 and bit 10 identical (0 or 1): shortest path
10	Telegram 111, modulo direction selection negative – 1: negative direction Bit 9 and bit 10 identical (0 or 1): shortest path
11 … 13	reserved
14	Operating mode, setup 1: Setup mode 0: Positioning mode
15	MDI selection – 1: activate MDI – 0: deactivate MDI

Tab. 947: Positioner control word 1 (POS_STW1)

POS_STW1.0 … 6 Traversing block selection

Bit	Command	Description
0	Positioning record selection bit 0 (2^0)	Positioning record selection (0 … 127)
1	Positioning record selection bit 1 (2^1)	
2	Positioning record selection bit 2 (2^2)	
3	Positioning record selection bit 3 (2^3)	
4	Positioning record selection bit 4 (2^4)	
5	Positioning record selection bit 5 (2^5)	
6	Positioning record selection bit 6 (2^6)	

Tab. 948: POS_STW1.0

POS_STW1.8 Absolute positioning (Positioning Method)

Value	Command	Description
1	Absolute positioning	Position specification corresponds to the absolute target position of the motion.
0	Relative positioning	Position specification is defined relative to the current axis position.

Tab. 949: POS_STW1.8

POS_STW1.9 … 10 direction selection

The positioning direction in the MDI mode is preset with these control bits during parameterisation of a modulo range. If the modulo range is restricted to 0 with the modulo limits, MinLimit = MaxLimit (= 0), the direction set here will be ignored.

Value		Description
Bit 10	Bit 9	
0	0	Position absolute on shortest path
0	1	Position absolute in positive direction

Value		Description
Bit 10	Bit 9	
1	0	Position absolute in negative direction
1	1	Position absolute on shortest path

Tab. 950: POS_STW1.9...10

POS_STW1.14 Setting up selected

In the setup mode, the parameters velocity, acceleration and deceleration can be used to set an endless position-controlled behaviour.

Value	Command	Description
1	Setup mode	Setup is being executed. Positioning task is executed at the range limits with the dynamic values from the MDI specification.
0	Positioning mode	Normal positioning task is executed with the position and dynamic values from the MDI specification.

Tab. 951: POS_STW1.14

POS_STW1.15 MDI selection (Target Value Specification)

Value	Command	Description
1	Activate MDI	If a task is currently active, it switches first to MDI, if the current task is finished or interrupted (e.g. with STW1.4 = 0) and the drive is in the S41 Basic State Positioning Mode status.
0	Deactivate MDI	If a MDI task is currently active, it switches to the S43 Braking With Ramp status, braked at maximum deceleration and at standstill switches to the S41 Basic State Positioning Mode status. The current task is rejected.

Tab. 952: POS_STW1.15

PNUs for positioner control word 1 (POS_STW1)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112411990	220.0	POS_STW1	UINT
Px.	Manufacturer-specific parameters		
112411000	12348.0	POS_STW1.0 ... 6 Traversing block selection	USINT
112411080	12349.0	POS_STW1.8 Absolute positioning	BOOL
112411090	12350.0	POS_STW1.9 ... 10 direction selection	UDINT
112411120	12351.0	POS_STW1.12 Setpoint transfer	BOOL
112411140	12352.0	POS_STW1.14 Setting up selected	BOOL
112411150	12353.0	POS_STW1.15 MDI selection	BOOL
112411990	12354.0	POS_STW1	UINT

Tab. 953: PNUs

12.4.8.26 Positioner status word 1 (POS_ZSW1)

Bit	Meaning
0	active positioning record bit 0 (2^0)
1	active positioning record bit 1 (2^1)
2	active positioning record bit 2 (2^2)
3	active positioning record bit 3 (2^3)
4	active positioning record bit 4 (2^4)
5	active positioning record bit 5 (2^5)
6	active positioning record bit 6 (2^6)
7	reserved

Bit	Meaning
8	negative limit switch active – 1: active – 0: inactive
9	Positive limit switch active – 1: active – 0: inactive
10	Jogging active – 1: active – 0: inactive
11	Homing active – 1: active – 0: inactive
12	reserved
13	Positioning records active – 1: active – 0: inactive
14	Setup active/inactive – 1: active – 0: inactive
15	MDI active – 1: active – 0: inactive

Tab. 954: Positioner status word 1 (POS_ZSW1)

POS_ZSW1.0 ... 6 Traversing block bit

Bit	Meaning	Description
0	Active positioning record bit 0 (2^0)	only relevant in record mode Specifies the record number of the currently active record (0 to 127). A record is active if the drive is in the S45 Traversing Task Interpolation status (including all sub-statuses). If a new task is started during the intermediate stop ramp or during the intermediate stop, the active record switches immediately to the new record number. The value 0 is shown if MDI is active or if there is no record currently active.
1	Active positioning record bit 1 (2^1)	
2	Active positioning record bit 2 (2^2)	
3	Active positioning record bit 3 (2^3)	
4	Active positioning record bit 4 (2^4)	
5	Active positioning record bit 5 (2^5)	
6	Active positioning record bit 6 (2^6)	

Tab. 955: POS_ZSW1.0

POS_ZSW1.8 Negative limit switch active

Value	Meaning	Description
1	Negative limit switch active	Signal status of the negative limit switch
0	negative limit switch active	

Tab. 956: POS_ZSW1.8

POS_ZSW1.9 Positive limit switch active

Value	Meaning	Description
1	Positive limit switch active	Signal status of the positive limit switch
0	Positive limit switch inactive	

Tab. 957: POS_ZSW1.9

POS_ZSW1.10 Jogging active

Value	Meaning	Description
1	Jogging active	Shows whether jogging is active.
0	Jogging inactive	

Tab. 958: POS_ZSW1.10

POS_ZSW1.11 Reference point approach active

Value	Meaning	Description
1	Homing active	Shows whether homing is active.
0	Homing inactive	

Tab. 959: POS_ZSW1.11

POS_ZSW1.13 Traversing block active

Value	Meaning	Description
1	Positioning records active	Shows whether positioning records are active.
0	Positioning records inactive	

Tab. 960: POS_ZSW1.13

POS_ZSW1.14 Setup active

Value	Meaning	Description
1	Setup active	Shows whether setup is active or inactive.
0	Setup inactive	

Tab. 961: POS_ZSW1.14

POS_ZSW1.15 MDI active (Target Value Specification)

Value	Meaning	Description
1	MDI active	Target value specification is active. The setpoint values are specified directly by the open-loop controller. If a positioning task is currently being executed (drive is in the S45 Traversing Task Interpolation or S43 Braking With Rampstatus), the setpoint value was specified directly.
0	MDI inactive	Record mode is active. The record number of a new task is which the setpoint values for the task are saved is taken from bit 0 - 6: record selection. If a positioning task is currently being executed (drive is in the S45 Traversing Task Interpolation or S43 Braking With Rampstatus), the setpoint value was specified in record mode and the record number of the record is shown in bit 0 - 6: active record.

Tab. 962: POS_ZSW1.15

PNUs positioner status word 1 (POS_ZSW1)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112412990	221.0	POS_ZSW1	UINT
Px.	Manufacturer-specific parameters		
112412000	12357.0	POS_ZSW1.0 ... 6 Traversing block bit	USINT
112412080	12358.0	POS_ZSW1.8 Negative limit switch active	BOOL
112412090	12359.0	POS_ZSW1.9 Positive limit switch active	BOOL
112412100	12360.0	POS_ZSW1.10 Jogging active	BOOL
112412110	12361.0	POS_ZSW1.11 Reference point approach active	BOOL
112412130	12362.0	POS_ZSW1.13 Traversing block active	BOOL
112412140	12363.0	POS_ZSW1.14 Setup active	BOOL
112412150	12364.0	POS_ZSW1.15 MDI active	BOOL
112412990	12365.0	POS_ZSW1	UINT

Tab. 963: PNUs

12.4.8.27 Positioner control word 2 (POS_STW2)

Bit	Meaning
0	Tracking mode – 1: activate – 0: deactivate
1	Set homing point – 1: set – 0: do not set
2 ... 4	reserved
5	Incremental jogging – 1: incremental – 0: velocity
6 ... 9	reserved
10	Touch Probe source – 1: secondary encoder – 0: primary encoder
11	Touch Probe edge – 1: falling edge – 0: rising edge
12 ... 13	reserved
14	Activate software limit switch – 1: activate – 0: deactivate
15	Activate hardware limit switch – 1: activate – 0: deactivate

Tab. 964: Positioner control word 2 (POS_STW2)

POS_STW2.0 Tracking mode

This function is only available in not enabled status. In tracking mode the internal setpoint position value tracks the actual position value, therefore setpoint position value = actual position value. The standstill monitoring is deactivated in this operating mode.

Value	Command	Description
1	Activate tracking mode	Tracking mode is activated.
0	Deactivate tracking mode	Tracking mode is deactivated.

Tab. 965: POS_STW2.0

POS_STW2.1 Set reference point

Value	Command	Description
1	Set homing point	rising edge activated internal homing method 37
0	Do not set homing point	Homing point will not be set

Tab. 966: POS_STW2.1

POS_STW2.5 Jogging incremental active

Value	Command	Description
1	Incremental jogging	Incremental jogging is activated.
0	Velocity jog	Velocity jog is activated.

Tab. 967: POS_STW2.5

POS_STW2.10 Selection touch probe

Value	Command	Description
1	Select probe 2	Probe 2 is activated with logic 1.
0	Select probe 1	Probe 1 is activated with logic 0.

Tab. 968: POS_STW2.10

POS_STW2.11 Touch probe edge

Value	Command	Description
1	Falling edge	Determines the type of signal edge with which the measurement shall be triggered.
0	Rising edge	

Tab. 969: POS_STW2.11

POS_STW2.14 Activate software limit switch

Value	Command	Description
1	Activate software limit switch	Specifies whether software end position monitoring should be active or inactive.
0	Deactivate software limit switch	

Tab. 970: POS_STW2.14

POS_STW2.15 Activate hardware limit switch

Value	Command	Description
1	Activate hardware limit switch	The evaluation of the hardware limit switch is activated.
0	Deactivate hardware limit switch	The evaluation of the hardware limit switch is deactivated.

Tab. 971: POS_STW2.15

PNUs for positioner control word 2 (POS_STW2)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112414990	222.0	POS_STW2	UINT
Px.	Manufacturer-specific parameters		
112414000	12382.0	POS_STW2.0 Tracking mode	BOOL
112414010	12383.0	POS_STW2.1 Set reference point	BOOL
112414050	12384.0	POS_STW2.5 Jogging incremental active	BOOL
112414100	12385.0	POS_STW2.10 Selection touch probe	BOOL
112414110	12386.0	POS_STW2.11 Touch probe edge	BOOL
112414140	12387.0	POS_STW2.14 Activate software limit switch	BOOL
112414150	12388.0	POS_STW2.15 Activate hardware limit switch	BOOL
112414990	12389.0	POS_STW2	UINT

Tab. 972: PNUs

12.4.8.28 Positioner status word 2 (POS_ZSW2)

Bit	Meaning
0	Tracking mode active – 1: active – 0: inactive
1	Velocity limiting active – 1: active – 0: inactive
2	Setpoint value stopped – 1: setpoint value stopped – 1: setpoint value not stopped
3	reserved
4	Drive moves forward – 1: drive moves forward – 0: drive does not move forward
5	Drive moves backwards – 1: drive moves backwards – 0: drive does not move backwards
6	Negative software limit switch active – 1: active – 0: inactive

Bit	Meaning
7	Positive software limit switch active – 1: active – 0: inactive
8	Actual position ≤ cam switch 0 – 1: actual position ≤ as position of cam switch 0 – 0: actual position > as position of cam switch 0
9	Actual position ≤ cam switch 1 – Actual position ≤ as position of cam switch 1 – Actual position > as position of cam switch 1
10	Direct output 1 via positioning record – 1: active – 0: inactive
11	Direct output 2 via positioning record – 1: active – 0: inactive
12	Fixed stop reached – 1: reached – 0: not reached
13	Fixed stop clamping torque reached – 1: reached – 0: not reached
14	Move to fixed stop active – 1: active – 0: inactive
15	Positioning command active – 1: active – 0: inactive

Tab. 973: Positioner status word 2 (POS_ZSW2)

POS_ZSW2.0 Tracking mode active

In tracking mode the internal setpoint position value tracks the actual position value. Therefore setpoint position value = actual position value. The standstill monitoring is deactivated in this operating mode. The comparison of setpoint position value = actual position value is executed only with deactivate output stage.

Value	Meaning	Description
1	Tracking mode active	Shows that tracking mode is active (comparison of setpoint position value = actual position value).
0	Tracking mode inactive	Tracking mode is inactive.

Tab. 974: POS_ZSW2.0

POS_ZSW2.1 Velocity limitation active

Value	Meaning	Description
1	Speed limitation active	Shows that speed limitation is active in the application limiting manager. The current trajectory is run at limited speed. The speed limitation can be set with the following parameter: – Limit value velocity limit positive and negative direction of movement: Px.1304.0.0, PNU 11334.0
0	Speed limitation inactive	Shows that speed limitation is inactive

Tab. 975: POS_ZSW2.1

POS_ZSW2.2 Setpoint available

Value	Meaning	Description
1	Setpoint value stopped	Shows that the setpoint position value is not changed. The internal setpoint velocity value according to the trajectory generator is 0.
0	Setpoint value not stopped	Shows that the setpoint position value is changed. The internal setpoint velocity value according to the trajectory generator is not equal to 0.

Tab. 976: POS_ZSW2.2

POS_ZSW2.4 Drive moves forward

Value	Meaning	Description
1	Drive moves forward	Shows that the drive moves forward. The internal setpoint velocity value according to the trajectory generator is > 0.
0	Drive does not move forward	Shows that the drive is stopped or moves backwards. The internal setpoint velocity value according to the trajectory generator is ≤ 0.

Tab. 977: POS_ZSW2.4

POS_ZSW2.5 Drive moves backwards

Value	Meaning	Description
1	Drive moves backwards	Shows that the drive is stopped or moves backwards. The internal setpoint velocity value according to the trajectory generator is ≠ 0.
0	Drive does not move backwards	Shows that the drive moves forward. The internal setpoint velocity value according to the trajectory generator is > 0.

Tab. 978: POS_ZSW2.5

POS_ZSW2.6 Software limit switch minus reached

Value	Meaning	Description
1	Negative software limit switch active	Specifies that the negative software limit switch is active.
0	Negative software limit switch not active	

Tab. 979: POS_ZSW2.6

POS_ZSW2.7 Software limit switch plus reached

Value	Meaning	Description
1	Positive software limit switch active	Specifies that the positive software end position is active.
0	Positive software limit switch not active	

Tab. 980: POS_ZSW2.7

POS_ZSW2.8 Position actual value <= position switch 0

Value	Meaning	Description
1	Actual position ≤ as position of cam switch 0	Specifies whether the actual position value ≤ or > as cam switch position 0.
0	0: actual position > as position of cam switch 0	

Tab. 981: POS_ZSW2.8

POS_ZSW2.9 Position actual value <= position switch 1

Value	Meaning	Description
1	Actual position ≤ as position of cam switch 1	Specifies whether the actual position value ≤ or > as cam switch position 1.
0	Actual position > as position of cam switch 1	

Tab. 982: POS_ZSW2.9

POS_ZSW2.10 Direct output 1 via traversing block

Value	Meaning	Description
1	Direct output 1 active	Shows whether direct output 1 is active via positioning record.
0	Direct output 1 not active	

Tab. 983: POS_ZSW2.10

POS_ZSW2.11 Direct output 2 via traversing block

Value	Meaning	Description
1	Direct output 2 active	Shows whether direct output 2 is active via positioning record.
0	Direct output 2 not active	

Tab. 984: POS_ZSW2.11

POS_ZSW2.12 Fixed stop reached

Value	Meaning	Description
1	Fixed stop reached	Specifies whether the fixed stop was reached.
0	Fixed stop not reached	

Tab. 985: POS_ZSW2.12

POS_ZSW2.13 Fixed stop Clamping torque reached

Value	Meaning	Description
1	Fixed stop clamping torque reached	Specifies whether the clamping torque was reached after move to the fixed stop.
0	Fixed stop clamping torque not reached	

Tab. 986: POS_ZSW2.13

POS_ZSW2.14 Move to fixed stop active

Value	Meaning	Description
1	Move to fixed stop active	Specifies whether move to the fixed stop is active.
0	Move to fixed stop not active	

Tab. 987: POS_ZSW2.14

POS_ZSW2.15 Traversing command active

Value	Meaning	Description
1	Positioning command active	Specifies whether a positioning command is active (motion manager status).
0	Positioning command not active	

Tab. 988: POS_ZSW2.15

PNUs positioner status word 2 (POS_ZSW2)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112413990	223.0	POS_ZSW2	UINT
Px.	Manufacturer-specific parameters		
112413000	12366.0	POS_ZSW2.0 Tracking mode active	BOOL
112413010	12367.0	POS_ZSW2.1 Velocity limitation active	BOOL
112413020	12368.0	POS_ZSW2.2 Setpoint available	BOOL
112413040	12369.0	POS_ZSW2.4 Drive moves forward	BOOL
112413050	12370.0	POS_ZSW2.5 Drive moves backwards	BOOL
112413060	12371.0	POS_ZSW2.6 Software limit switch minus reached	BOOL
112413070	12372.0	POS_ZSW2.7 Software limit switch plus reached	BOOL
112413080	12373.0	POS_ZSW2.8 Position actual value <= position switch 0	BOOL
112413090	12374.0	POS_ZSW2.9 Position actual value <= position switch 1	BOOL
112413100	12375.0	POS_ZSW2.10 Direct output 1 via traversing block	BOOL
112413110	12376.0	POS_ZSW2.11 Direct output 2 via traversing block	BOOL
112413120	12377.0	POS_ZSW2.12 Fixed stop reached	BOOL

Parameter	PNU	Name	Data type
112413130	12378.0	POS_ZSW2.13 Fixed stop Clamping torque reached	BOOL
112413140	12379.0	POS_ZSW2.14 Move to fixed stop active	BOOL
112413150	12380.0	POS_ZSW2.15 Traversing command active	BOOL
112413990	12381.0	POS_ZSW2	UINT

Tab. 989: PNUs

12.4.8.29 Active Error (FAULT_CODE)

Active error Shows the error code of the first entry in the error memory (➔ 12.4.9.1 PROFIdrive malfunction/fault buffer mechanism, PNU 947).

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280062	301.0	Active error	UINT
Px.	**Manufacturer-specific parameters**		
11280062	12314.0	Active error	UINT

Tab. 990: PNUs

12.4.8.30 Active Warning (WARN_CODE)

Active warning Shows the warning code of the first entry in the warning buffer (➔ 12.4.9.3 PROFIdrive warnings/warning mechanism, PNU 847).

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280063	303.0	Active warning	UINT
Px.	**Manufacturer-specific parameters**		
11280063	12315.0	Active warning	UINT

Tab. 991: PNUs

12.4.9 Diagnostics

12.4.9.1 PROFIdrive malfunction/fault buffer mechanism

A malfunction in PROFIdrive is defined with one or more diagnostic messages leading to a device-specific fault reaction, e.g. shutdown of the output stage.
An unacknowledged fault situation is reported in status word 1 (ZSW1) with bit 3 (fault present). The fault buffer mechanism allows fault situations and fault messages to be tracked.
The fault buffer contains the fault messages that resulted in a fault situation.
The fault number list contains the explanation and allocation to the fault messages in the device.
Malfunctions can only be remedied by clearing the cause of the malfunction first and then acknowledging the malfunction.
A malfunction can be acknowledged by:
- The malfunction is acknowledged by POWER ON (switching the drive device off and on). Note: if the cause of the malfunction is not yet cleared, the malfunction appears again immediately after restart.
- Acknowledgment by PROFIdrive control signal: STW1.7 = 0→1 (edge)
- Festo Automation Suite with plug-in
- if available: Operating unit, e.g . CDSB

The structure of the fault buffer is shown in the following diagram:

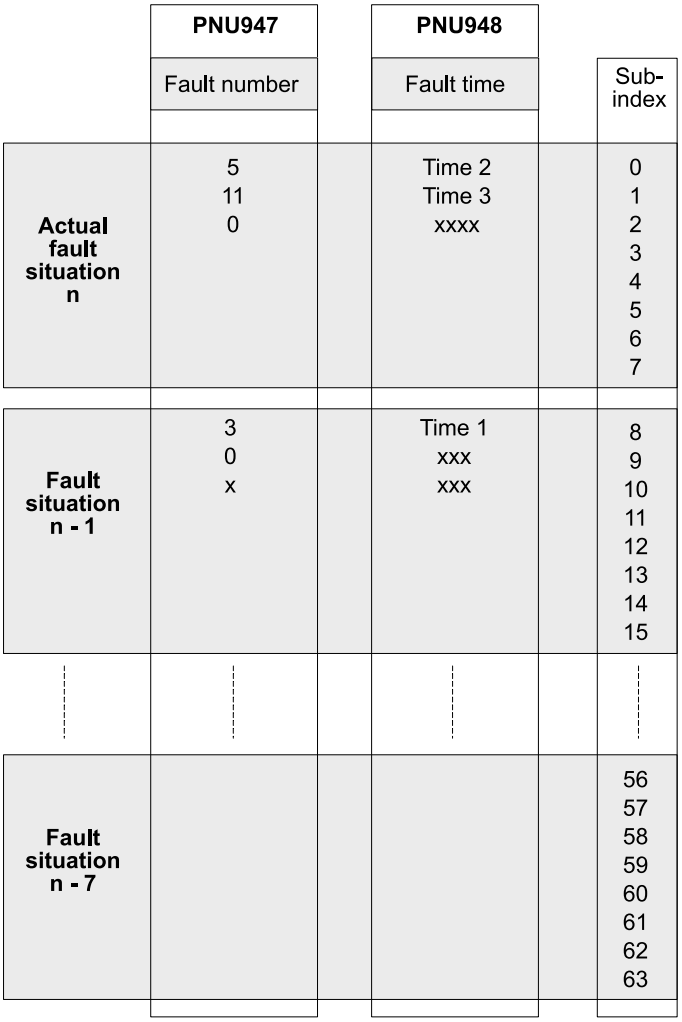


Fig. 148: Fault buffer

PNU947 contains the error number (the last group of the diagnostic number). Example: with diagnostic message 01 | 02 | 00012 PNU 947 contains the value 12 in decimal format.

12.4.9.2 Error Response

One of the following stop categories is executed as error reaction depending on the error:

– Fault with Ramp Stop
– Fault with Quick Stop
– Fault with Coast Stop

Then the base state machine changes to the S1 Switching On Inhibited status.

12.4.9.3 PROFIdrive warnings/warning mechanism

Warnings in servo drives with Festo PROFIdrive are saved in a warning buffer, similar to the fault buffer.

A warning in PROFIdrive is defined by one or more diagnostic messages that do not result in a device-specific fault reaction.

A pending warning is reported in status word 1 (ZSW1) with bit 7 (warning present). The warning buffer mechanism allows warnings to be tracked.

The warning buffer contains the warning messages that resulted in a warning situation. Warning messages are saved in the warning buffer with number (PNU 847) and time stamp (PNU 848).

12.5 PNUs reference list

PNU	Name	Data type	Access	Parameter
Profile specific parameters				
1.0	STW1	UINT	rw	P1.1147990.0.0
2.0	ZSW1	UINT	ro	P1.1145990.0.0
3.0	STW2	UINT	rw	P1.1148990.0.0
4.0	ZSW2	UINT	ro	P1.1146990.0.0
5.0	NSOLL_A/NSOLL_B	INT	rw	P1.11280502.0.0
6.0	Actual velocity value encoder channel 1	INT	ro	P1.1210.0.0
7.0	NSOLL_A/NSOLL_B	DINT	rw	P1.11280502.0.0
8.0	Actual velocity value encoder channel 1	DINT	ro	P1.1210.0.0
9.0	Gn_STW	UINT	rw	P1.1149990.0.0
10.0	Gn_ZSW	UINT	ro	P1.1143990.0.0
11.0	Encoder n actual position value 1 (Gn_XIST1)	UDINT	ro	P1.1142990.0.0
12.0	Encoder n actual position value 2 (Gn_XIST2)	UDINT	ro	P1.1141990.0.0
13.0	Gn_STW	UINT	rw	P1.1149990.1.0
14.0	Gn_ZSW	UINT	ro	P1.1143990.1.0
15.0	Encoder n actual position value 1 (Gn_XIST1)	UDINT	ro	P1.1142990.1.0
16.0	Encoder n actual position value 2 (Gn_XIST2)	UDINT	ro	P1.1141990.1.0
25.0	XERR	DINT	rw	P1.1129990.0.0
26.0	KPC	DINT	rw	P1.1127990.0.0
28.0	Actual value modulo	DINT	ro	P1.113104.0.0
32.0	SATZANW	UINT	rw	P1.112415990.0.0
33.0	AKTSATZ	UINT	ro	P1.112416990.0.0
34.0	Target position MDI	DINT	rw	P1.11280604.0.0
35.0	Profile velocity MDI	UDINT	rw	P1.11280605.0.0
36.0	Acceleration MDI	INT	rw	P1.11280606.0.0
37.0	Deceleration MDI	INT	rw	P1.11280607.0.0
38.0	MDI_MOD	UINT	rw	P1.112417990.0.0
101.0	MOMRED	INT	rw	P1.1126990.0.0
102.0	MELDW	UINT	ro	P1.11249990.0.0
205.0	Velocity override	INT	rw	P1.11280611.0.0
220.0	POS_STW1	UINT	rw	P1.112411990.0.0
221.0	POS_ZSW1	UINT	ro	P1.112412990.0.0
222.0	POS_STW2	UINT	rw	P1.112414990.0.0
223.0	POS_ZSW2	UINT	ro	P1.112413990.0.0
301.0	Active error	UINT	ro	P1.11280062.0.0
303.0	Active warning	UINT	ro	P1.11280063.0.0
311.0	M_ADD	INT	rw	P1.101951.0.0
312.0	M_LIMIT_POS	INT	rw	P1.101985.0.0
313.0	M_LIMIT_NEG	INT	rw	P1.101981.0.0
314.0	Actual torque value gear shaft	INT	ro	P1.151.0.0
315.0	Kp_Adapt	INT	rw	P1.101993.0.0
800.0	Sync Time	REAL	rw	P0.31235.0.0
801.0	Status PROFINET request	DINT	rw	P0.54543.0.0
802.0	Active status PROFINET	DINT	ro	P0.54544.0.0
803.0	Reduction ratio	UDINT	rw	P1.4246.0.0

PNU	Name	Data type	Access	Parameter
810.0	Base value acceleration	REAL	rw	P1.11280702.0.0
811.0	Base value deceleration	REAL	rw	P1.11280703.0.0
830.0	Activation touch probe Tel. 111	UINT	rw	P1.11280116.0.0
831.0	Axis zero point offset	DINT	rw	P1.8416.0.0
832.0	Lower limit value modulo	DINT	rw	P1.113102.0.0
833.0	Upper limit value modulo	DINT	rw	P1.113113.0.0
834.0	Negative software limit position	DINT	rw	P1.4629.0.0
835.0	Positive software limit position	DINT	rw	P1.4630.0.0
836.0	Output unwind	DINT	ro	P1.102966.0.0
837.0	Unwind range	DINT	rw	P1.102964.0.0
844.0	Counter warning messages	UINT	ro	P1.11280060.0.0
847.0 ... 63	Warning number	UINT	ro	P1.11280042.0.0 ... 63
848.0 ... 63	Release time warning	UDINT	ro	P1.11280043.0.0 ... 63
860.0	Diagnostic value test 1	UINT	rw	P1.66061.0.0
861.0	Diagnostic value test 2	UINT	rw	P1.66062.0.0
870.0	STW_AC4	UINT	rw	P1.11280540.0.0
871.0	ZSW_AC4	UINT	ro	P1.11280541.0.0
922.0	PZD telegram selection	UINT	ro	P0.11280201.0.0
924.0 ... 1	Assignment controller enable	UINT	ro	P1.24126.0.0 ... 1
925.0	Maximum failure Sign of Life	UINT	rw	P1.4243.0.0
927.0	Parameterization authority Connection	UDINT	ro	P0.100072.0.0
930.0	Operating mode PROFIdrive	UINT	ro	P1.11280002.0.0
944.0	Counter error messages	UINT	ro	P1.11280061.0.0
947.0 ... 63	Error number	UINT	ro	P1.11280040.0.0 ... 63
948.0 ... 63	Casting time error	UDINT	ro	P1.11280041.0.0 ... 63
964.0 ... 5	Drive unit data	UINT	ro	P1.24125.0.0 ... 5
965.0 ... 1	Profile identification number	USINT	ro	P1.11280004.0.0 ... 1
972.0	Reset device	UINT	rw	P0.112901.0.0
974.0 ... 2	Parameter channel description PROFIdrive	UINT	ro	P1.11280030.0.0 ... 2
975.0 ... 7	Drive object data	UINT	ro	P1.24124.0.0 ... 7
976.0	Load factory settings	UINT	rw	P0.112902.0.0
977.0	Save the parameter set	UINT	rw	P0.112903.0.0
979.0 ... 20	Encoder format	UDINT	ro	P1.231243.0.0 ... 20
2018.0	Order number	UDINT	ro	P0.70.0.0
2019.0 ... 49	Order code	STRING(50)	ro	P0.71.0.0 ... 49
2020.0 ... 1	Major version servo drive	STRING(2)	ro	P0.73.0.0 ... 1
2021.0 ... 4	Serial number	STRING(5)	ro	P0.79.0.0 ... 4
2032.0	Status LED	UINT	ro	P0.160.0.0
2033.0	Power LED	UINT	ro	P0.161.0.0
2034.0	Safety LED	UINT	ro	P0.162.0.0
2035.0	Application LED	UINT	ro	P0.163.0.0
2040.0	Debug variable index 0	REAL	rw	P0.190.0.0
2041.0	Debug variable index 1	REAL	rw	P0.191.0.0
2042.0	Debug variable index 2	REAL	rw	P0.192.0.0
2043.0	Debug variable index 3	REAL	rw	P0.193.0.0
2044.0	Debug variable index 4	REAL	rw	P0.194.0.0

PNU	Name	Data type	Access	Parameter
2045.0	Debug variable index 5	REAL	rw	P0.195.0.0
2046.0	Debug variable index 6	REAL	rw	P0.196.0.0
2047.0	Debug variable index 7	REAL	rw	P0.197.0.0
2048.0	Debug variable index 8	REAL	rw	P0.198.0.0
2049.0	Debug variable index 9	REAL	rw	P0.199.0.0
2058.0	Serial number	UDINT	ro	P0.246.0.0
2059.0 ... 5	MAC address	USINT	ro	P0.247.0.0 ... 5
2060.0 ... 5	MAC address	USINT	ro	P0.248.0.0 ... 5
2061.0 ... 5	MAC address	USINT	ro	P0.249.0.0 ... 5
2062.0	Material number control unit	UDINT	ro	P0.250.0.0
2063.0 ... 49	Order code control unit	STRING(50)	ro	P0.251.0.0 ... 49
2064.0 ... 1	Major version control unit	STRING(2)	ro	P0.253.0.0 ... 1
2065.0	Compatibility index control unit	UINT	ro	P0.254.0.0
2075.0 ... 5	MAC address	USINT	ro	P0.265.0.0 ... 5
2076.0 ... 8	Serial number control unit	STRING(9)	ro	P0.266.0.0 ... 8
2079.0	Control unit data set ID	UDINT	ro	P0.269.0.0
2081.0	Diagnostic device status	UINT	ro	P0.300.0.0
2082.0	Diagnostic axis status	UINT	ro	P0.301.0.0
2083.0	Diagnostic axis status	UINT	ro	P0.301.1.0
2084.0	Diagnostic response axis	UINT	ro	P0.302.0.0
2085.0	Diagnostic response axis	UINT	ro	P0.302.1.0
2086.0	Maximum number of components in the message buffer	UDINT	ro	P0.303.0.0
2087.0	Actual number of components in the message buffer	UDINT	ro	P0.304.0.0
2113.0	Trace type	UDINT	ro	P0.340.0.0
2114.0	Trigger type	UDINT	rw	P0.341.0.0
2148.0	Actual value DC link voltage	REAL	ro	P0.480.0.0
2153.0	Diagnostic category: Undervoltage in DC link	UINT	rw	P0.487.0.0
2154.0	Storage option: Undervoltage in DC link	USINT	rw	P0.488.0.0
2155.0	Diagnostic category	UINT	rw	P0.489.0.0
2157.0	Load voltage root mean square value	REAL	ro	P0.491.0.0
2159.0	Lower load voltage limit value	REAL	rw	P0.493.0.0
2160.0	Upper load voltage limit value	REAL	rw	P0.494.0.0
2166.0	Diagnostic category: Overvoltage in load voltage	UINT	rw	P0.517.0.0
2168.0	Diagnostic category: Undervoltage in load voltage	UINT	rw	P0.519.0.0
2169.0	Supply voltage 24 V logic	REAL	ro	P0.520.0.0
2173.0	Data trace status	UDINT	ro	P0.556.0.0
2174.0	Trace delay	DINT	rw	P0.557.0.0
2175.0	Recording length	UDINT	rw	P0.558.0.0
2176.0	Down sampling factor	UDINT	rw	P0.559.0.0
2180.0	Number of parameter sets	UDINT	ro	P0.571.0.0
2201.0	Scaling factor start value pulse energy monitoring braking resistor	REAL	ro	P0.650.0.0
2202.0	Limit value pulse energy monitoring braking resistor	REAL	ro	P0.651.0.0
2203.0	Scaling factor maximum value after switching on	REAL	ro	P0.652.0.0
2204.0	Actual value pulse energy monitoring braking resistor	REAL	ro	P0.653.0.0
2205.0	Actual value pulse energy monitoring braking resistor (standardised)	REAL	ro	P0.654.0.0

PNU	Name	Data type	Access	Parameter
2206.0	Scaling factor warning limit pulse energy monitoring braking resistor	REAL	rw	P0.655.0.0
2207.0	Actual value power dissipation braking resistor	REAL	ro	P0.656.0.0
2209.0	Activate of external braking resistor	BOOL	rw	P0.658.0.0
2210.0	Status selected braking resistor	BOOL	ro	P0.659.0.0
2211.0	PWM frequency selection	UDINT	rw	P0.670.0.0
2215.0 ... 14	Product key	STRING(15)	ro	P0.710.0.0 ... 14
2217.0 ... 31	Order code	STRING(32)	ro	P0.711.0.0 ... 31
2219.0	Material number	UDINT	ro	P0.712.0.0
2221.0 ... 19	Serial number	STRING(20)	ro	P0.713.0.0 ... 19
2223.0	Pole pairs	UDINT	ro	P0.717.0.0
2225.0	Minor version servo drive	UINT	ro	P0.739.0.0
2234.0	Compatibility index servo drive	UINT	ro	P0.748.0.0
2235.0 ... 8	Test number	STRING(9)	ro	P0.790.0.0 ... 8
2236.0 ... 14	Product key	STRING(15)	ro	P0.791.0.0 ... 14
2238.0	Diagnostic category: Failure of fieldbus synchronisation signal	UINT	rw	P0.801.0.0
2239.0	Storage option: Failure of fieldbus synchronisation signal	USINT	rw	P0.802.0.0
2241.0 ... 40	Project name	STRING(41)	rw	P0.900.0.0 ... 40
2242.0 ... 160	Project description	STRING(161)	rw	P0.901.0.0 ... 160
2243.0 ... 127	Device name	STRING(128)	rw	P0.902.0.0 ... 127
2244.0 ... 160	Device description	STRING(161)	rw	P0.903.0.0 ... 160
2246.0	Temperature power output stage	REAL	ro	P0.920.0.0
2247.0	Temperature status power output stage	DINT	ro	P0.921.0.0
2248.0	Diagnostic category: Warning threshold: Insufficient temperature in power unit	UINT	rw	P0.922.0.0
2249.0	Storage option: Warning threshold: Insufficient temperature in power unit	USINT	rw	P0.923.0.0
2252.0	Diagnostic category: Warning threshold: Power unit overtemperature	UINT	rw	P0.926.0.0
2253.0	Storage option: Warning threshold: Power unit overtemperature	USINT	rw	P0.927.0.0
2259.0	Storage option: Warning threshold: Insufficient temperature in device	USINT	rw	P0.933.0.0
2263.0	Storage option: Warning threshold: Device overtemperature	USINT	rw	P0.937.0.0
2266.0 ... 29	Firmware version	STRING(30)	ro	P0.960.0.0 ... 29
2267.0	Major Version Firmware	UDINT	ro	P0.961.0.0
2268.0	Minor Version Firmware	UDINT	ro	P0.962.0.0
2269.0	Patch Version Firmware	UDINT	ro	P0.963.0.0
2270.0	Build Version Firmware	UDINT	ro	P0.964.0.0
2271.0	Firmware status	UDINT	ro	P0.965.0.0
2272.0	Actual firmware slot	UDINT	ro	P0.966.0.0
2306.0	Scaled value analog input sine track 1	REAL	ro	P0.1190.0.0
2318.0	Operating hour counter	REAL	ro	P0.1423.0.0
2335.0 ... 1	Major version communication data set	STRING(2)	ro	P0.2204.0.0 ... 1
2336.0	Minor version communication data set	UINT	ro	P0.2205.0.0
2339.0 ... 1	Major version control unit data set	STRING(2)	ro	P0.2208.0.0 ... 1

PNU	Name	Data type	Access	Parameter
2340.0	Minor version control unit data set	UINT	ro	P0.2209.0.0
2341.0	Minor version control unit	UINT	ro	P0.2212.0.0
2342.0 … 1	Major version device data set	STRING(2)	ro	P0.2213.0.0 … 1
2343.0	Minor version device data set	UINT	ro	P0.2214.0.0
2408.0	Commutation angle from user configuration	LINT	rw	P0.3219.0.0
2410.0	Actual commutation angle	LINT	ro	P0.3220.0.0
2412.0	Zero point offset from encoder memory	LINT	rw	P0.3221.0.0
2414.0	Zero point offset from user configuration	LINT	rw	P0.3223.0.0
2416.0	Actual zero point offset	LINT	ro	P0.3224.0.0
2418.0	Encoder referencing is valid	BOOL	ro	P0.3225.0.0
2420.0	Referencing in user configuration is valid	BOOL	rw	P0.3226.0.0
2422.0	Actual referencing is valid	BOOL	ro	P0.3227.0.0
2424.0	Valid commutation angle from encoder memory	BOOL	ro	P0.3228.0.0
2426.0	Valid commutation angle from user configuration	BOOL	ro	P0.3229.0.0
2428.0	Actual commutation angle valid	BOOL	ro	P0.3230.0.0
2434.0	Electrical angular frequency filtered	REAL	ro	P0.3234.0.0
2438.0	Activate compatible motor change	BOOL	rw	P0.3236.0.0
2440.0	Encoder permanently homed	BOOL	rw	P0.3237.0.0
2442.0	Material number motor reference configuration	UDINT	rw	P0.3238.0.0
2444.0 … 12	Serial number motor reference configuration	STRING(13)	rw	P0.3239.0.0 … 12
2446.0 … 14	Product key motor reference configuration	STRING(15)	rw	P0.3240.0.0 … 14
2466.0	Activation automatic encoder detection	BOOL	rw	P0.3250.0.0
2468.0	Selection gear ratio group	USINT	rw	P0.3251.0.0
2477.0	Actual trace status	UDINT	ro	P0.3400.0.0
2478.0	Actual trigger status	UDINT	ro	P0.3401.0.0
2479.0	Actual trace type code	UDINT	ro	P0.3402.0.0
2530.0	Status brake chopper	BOOL	ro	P0.4801.0.0
2533.0	Warning threshold DC link voltage	REAL	rw	P0.4811.0.0
2534.0	Switch-on threshold brake chopper	REAL	rw	P0.4812.0.0
2535.0	Upper limit value DC link voltage	REAL	rw	P0.4813.0.0
2536.0	Lower limit value DC link voltage	REAL	rw	P0.4814.0.0
2539.0	Brake chopper threshold actual value	REAL	ro	P0.4817.0.0
2546.0	Storage option: DC link warning threshold reached	USINT	rw	P0.4890.0.0
2553.0	Storage option: Undervoltage in load voltage	USINT	rw	P0.5180.0.0
2578.0 … 7	Trace channel	BOOL	rw	P0.5500.0.0 … 7
2579.0 … 7	Axis ID trace data	UINT	rw	P0.5501.0.0 … 7
2580.0 … 7	Data ID trace data	UDINT	rw	P0.5502.0.0 … 7
2581.0 … 7	Data instance ID trace data	UINT	rw	P0.5503.0.0 … 7
2582.0 … 7	Array ID trace data	UINT	rw	P0.5504.0.0 … 7
2583.0 … 7	Status Trace channel	BOOL	ro	P0.5505.0.0 … 7
2584.0 … 7	Actual axis ID trace data	UINT	ro	P0.5506.0.0 … 7
2585.0 … 7	Actual data ID trace data	UDINT	ro	P0.5507.0.0 … 7
2586.0 … 7	Actual data instance ID trace data	UINT	ro	P0.5508.0.0 … 7
2587.0 … 7	Actual array ID trace data	UINT	ro	P0.5509.0.0 … 7
2588.0	Actual pre-trigger	DINT	ro	P0.5513.0.0
2589.0	Actual recording length	UDINT	ro	P0.5514.0.0

PNU	Name	Data type	Access	Parameter
2590.0	Actual downsampling factor	UDINT	ro	P0.5515.0.0
2591.0	Maximum recording length	UDINT	ro	P0.5516.0.0
2592.0	Basic sampling interval	REAL	ro	P0.5517.0.0
2593.0	Timestamp End trace	LINT	ro	P0.5518.0.0
2605.0	Storage option: Parameter not writable	USINT	rw	P0.5709.0.0
2607.0	Storage option: Transmission error in parameter set	USINT	rw	P0.5711.0.0
2609.0	Storage option: Parameter set: store failed	USINT	rw	P0.5713.0.0
2611.0	Storage option: Parameter set: delete failed	USINT	rw	P0.5715.0.0
2615.0	Storage option: Store device failed	USINT	rw	P0.5719.0.0
2617.0	Storage option: Factory parameter set not found	USINT	rw	P0.5721.0.0
2619.0	Storage option: Factory parameter set invalid	USINT	rw	P0.5723.0.0
2621.0	Storage option: Factory parameter set incompatible	USINT	rw	P0.5725.0.0
2623.0	Storage option: Factory parameter not found	USINT	rw	P0.5727.0.0
2624.0	Parameter set status	UDINT	ro	P0.5728.0.0
2625.0	Start-up parameter set	DINT	rw	P0.5729.0.0
2626.0	Active parameter set	DINT	ro	P0.5730.0.0
2640.0 ... *99*	Compatibility index firmware	STRING(100)	ro	P0.5773.0.0 ... *99*
2646.0	Axis ID data trigger	UINT	rw	P0.6000.0.0
2647.0	Data ID data trigger	UDINT	rw	P0.6001.0.0
2648.0	Data instance ID data trigger	UINT	rw	P0.6002.0.0
2649.0	Array ID data trigger	UINT	rw	P0.6003.0.0
2650.0	Trigger event	UDINT	rw	P0.6004.0.0
2651.0	Actual axis ID data trigger	UINT	ro	P0.6006.0.0
2652.0	Actual data ID data trigger	UDINT	ro	P0.6007.0.0
2653.0	Actual data instance ID data trigger	UINT	ro	P0.6008.0.0
2654.0	Actual array ID data trigger	UINT	ro	P0.6009.0.0
2655.0	Actual data trigger type	UDINT	ro	P0.6010.0.0
2656.0	Actual trigger threshold	LINT	ro	P0.6013.0.0
2700.0	Resistance value external braking resistor	REAL	rw	P0.6510.0.0
2701.0	Nominal value of the power dissipation external braking resistor	REAL	rw	P0.6511.0.0
2702.0	Limit value pulse energy monitoring external braking resistor	REAL	rw	P0.6512.0.0
2703.0	Diagnostic category: Warning: pulse energy monitoring, braking resistor	UINT	rw	P0.6513.0.0
2704.0	Storage option: Warning: pulse energy monitoring, braking resistor	USINT	rw	P0.6514.0.0
2705.0	Diagnostic category: Error: pulse energy monitoring, braking resistor	UINT	rw	P0.6515.0.0
2706.0	Storage option: Error: pulse energy monitoring, braking resistor	USINT	rw	P0.6516.0.0
2707.0	Diagnostic category: Parameterisation braking resistor	UINT	rw	P0.6517.0.0
2721.0	Motor inertia	REAL	ro	P0.7110.0.0
2723.0	Phase sequence	BOOL	ro	P0.7113.0.0
2725.0	Nominal current	REAL	ro	P0.7116.0.0
2727.0	Maximum current	REAL	ro	P0.7119.0.0
2729.0	Maximum rpm	REAL	ro	P0.7122.0.0
2731.0	Nominal rotary velocity	REAL	ro	P0.7125.0.0

PNU	Name	Data type	Access	Parameter
2733.0	Winding inductance	REAL	ro	P0.7128.0.0
2735.0	Winding resistance	REAL	ro	P0.7131.0.0
2737.0	Torque constant	REAL	ro	P0.7134.0.0
2739.0	Time constant I^2t	REAL	ro	P0.7143.0.0
2741.0	Winding temperature	REAL	ro	P0.7146.0.0
2743.0	Nominal motor voltage	REAL	ro	P0.7149.0.0
2745.0 ... 1	Major version hardware	STRING(2)	ro	P0.7150.0.0 ... 1
2747.0	Minor version hardware	UINT	ro	P0.7151.0.0
2749.0	Temperature sensor	UDINT	ro	P0.7152.0.0
2751.0 ... 1	Temperature sensor characteristic	REAL	ro	P0.7155.0.0 ... 1
2753.0	Holding brake	BOOL	ro	P0.7158.0.0
2755.0	Switch-on delay holding brake 1	REAL	ro	P0.7161.0.0
2757.0	Switch-off delay holding brake 1	REAL	ro	P0.7164.0.0
2759.0	Continuous current	REAL	ro	P0.7181.0.0
2761.0	Encoder data set ID	UDINT	ro	P0.7183.0.0
2763.0 ... 1	Major version motor data set	STRING(2)	ro	P0.7186.0.0 ... 1
2765.0	Minor version motor data set	UINT	ro	P0.7187.0.0
2767.0	Lq inductance	REAL	ro	P0.7428.0.0
2769.0	Ld inductance	REAL	ro	P0.7429.0.0
2771.0	Motor type	USINT	ro	P0.7430.0.0
2773.0	Actual time without synchronisation	LINT	ro	P0.7534.0.0
2774.0	Actual time with synchronisation	LINT	ro	P0.7535.0.0
2784.0	Test user 10	USINT	rw	P0.9303.0.0
2785.0	Test user 20	USINT	rw	P0.9304.0.0
2786.0	Test user 30	USINT	rw	P0.9305.0.0
2787.0	Test user 40	USINT	no access	P0.9306.0.0
2788.0	Test user 50	USINT	no access	P0.9307.0.0
2795.0	Upper limit value warning threshold power output stage temperature	REAL	rw	P0.9314.0.0
2796.0	Upper limit value power output stage temperature	REAL	rw	P0.9315.0.0
2797.0	Lower limit value warning threshold power output stage temperature	REAL	rw	P0.9316.0.0
2798.0	Lower limit value power output stage temperature	REAL	rw	P0.9317.0.0
2803.0	Actual upper limit value warning threshold power output stage temperature	REAL	ro	P0.9322.0.0
2804.0	Actual upper limit value power output stage temperature	REAL	ro	P0.9323.0.0
2805.0	Actual lower limit value warning threshold power output stage temperature	REAL	ro	P0.9324.0.0
2806.0	Actual lower limit value power output stage temperature	REAL	ro	P0.9325.0.0
2807.0 ... 29	Firmware package version	STRING(30)	ro	P0.9550.0.0 ... 29
2808.0	Major version firmware package	UDINT	ro	P0.9560.0.0
2809.0	Minor version firmware package	UDINT	ro	P0.9570.0.0
2810.0	Patch version firmware package	UDINT	ro	P0.9580.0.0
2811.0	Build version firmware package	UDINT	ro	P0.9590.0.0
2813.0	Storage option: Writing of firmware failed	USINT	rw	P0.9601.0.0
2815.0	Storage option: Reading of firmware failed	USINT	rw	P0.9603.0.0
2817.0	Storage option: Firmware invalid	USINT	rw	P0.9605.0.0

PNU	Name	Data type	Access	Parameter
2819.0	Storage option: Firmware incompatible	USINT	rw	P0.9607.0.0
2821.0	Storage option: Firmware save location invalid	USINT	rw	P0.9609.0.0
2823.0	Storage option: Firmware save location empty	USINT	rw	P0.9611.0.0
2825.0	Storage option: Firmware update not allowed	USINT	rw	P0.9613.0.0
2827.0	Storage option: Firmware package in use	USINT	rw	P0.9615.0.0
2837.0	Encoder resolution	UINT	rw	P0.10040.0.0
2840.0	Raw value position	UINT	ro	P0.10041.0.0
2843.0	Raw value number of revolutions	INT	ro	P0.10042.0.0
2852.0	Supply voltage encoder	REAL	rw	P0.10046.0.0
2855.0	Encoder supply voltage monitoring window	REAL	rw	P0.10049.0.0
2861.0	Filter time constant quadrature evaluation	UDINT	rw	P0.10051.0.0
2867.0	Lower limit value encoder monitoring voltage	REAL	rw	P0.10053.0.0
2870.0	Maximum transverse mode voltage	REAL	rw	P0.10054.0.0
2888.0	Device interface X1A status	UDINT	ro	P0.10151.0.0
2889.0	Device interface X1C status	UDINT	ro	P0.10152.0.0
2890.0	Internal interface status	UDINT	ro	P0.10153.0.0
2891.0	Exception Count	UDINT	ro	P0.10300.0.0
2892.0	Exception Type	UDINT	ro	P0.10301.0.0
2894.0	Error Code	UDINT	ro	P0.10303.0.0
2896.0	Reg R14ex	UDINT	ro	P0.10305.0.0
2908.0 ... 3	Servo drive initialisation status	UDINT	ro	P0.10320.0.0 ... 3
2909.0	Status ReInit	UDINT	ro	P0.10321.0.0
2910.0	Status ReInit requested	BOOL	ro	P0.10322.0.0
2911.0	Status ReInit active	BOOL	ro	P0.10323.0.0
2912.0	Status ReInit device restart	BOOL	ro	P0.10324.0.0
2916.0	Storage option: Task ignored as reinitialisation not possible	USINT	rw	P0.10328.0.0
2917.0	Number ReInit requests	UDINT	ro	P0.10329.0.0
2918.0	Number activated ReInit	UDINT	ro	P0.10330.0.0
2937.0	Standardised encoder position	LINT	ro	P0.11600.0.0
2939.0	Absolute position in user units	LINT	ro	P0.11601.0.0
2941.0	Actual Velocity in user units	REAL	ro	P0.11602.0.0
2943.0	Filtered velocity in user units	REAL	ro	P0.11603.0.0
2945.0	Electrical angle	UDINT	ro	P0.11604.0.0
2947.0	Electrical angular frequency	REAL	ro	P0.11605.0.0
2953.0	Commutation angle from encoder memory	LINT	rw	P0.11608.0.0
2967.0	Actual position	LINT	ro	P0.11615.0.0
2969.0	Encoder selection	UDINT	rw	P0.11616.0.0
2971.0	Active encoder	UDINT	ro	P0.11617.0.0
2973.0	Velocity filter filter time constant	REAL	rw	P0.11618.0.0
2989.0	Activation commutation angle transfer (CMMP type plate)	BOOL	rw	P0.11626.0.0
2991.0	Activate DHCP	BOOL	rw	P0.12000.0.0
2992.0	Activate DHCP	BOOL	rw	P0.12000.1.0
2993.0	IP address	UDINT	rw	P0.12001.0.0
2994.0	IP address	UDINT	rw	P0.12001.1.0
2995.0	Subnet mask	UDINT	rw	P0.12002.0.0
2996.0	Subnet mask	UDINT	rw	P0.12002.1.0

PNU	Name	Data type	Access	Parameter
2997.0	Gateway address	UDINT	rw	P0.12003.0.0
2998.0	Gateway address	UDINT	rw	P0.12003.1.0
2999.0	Active IP address	UDINT	ro	P0.12004.0.0
3000.0	Active IP address	UDINT	ro	P0.12004.1.0
3001.0	Active subnet mask	UDINT	ro	P0.12005.0.0
3002.0	Active subnet mask	UDINT	ro	P0.12005.1.0
3003.0	Active gateway address	UDINT	ro	P0.12006.0.0
3004.0	Active gateway address	UDINT	ro	P0.12006.1.0
3005.0 ... 5	MAC address	USINT	ro	P0.12007.0.0 ... 5
3006.0 ... 5	MAC address	USINT	ro	P0.12007.1.0 ... 5
3007.0	Activate keep-alive-signal	BOOL	rw	P0.12008.0.0
3008.0	Keep-alive-signal wait time	UDINT	rw	P0.12009.0.0
3009.0	Keep-alive-signal repeat time	UDINT	rw	P0.12010.0.0
3010.0	Maximum number of repetitions	UDINT	rw	P0.12011.0.0
3011.0	Active connection access	UINT	ro	P0.12012.0.0
3012.0	Maximum connection access	UINT	ro	P0.12013.0.0
3013.0	Connection active	BOOL	ro	P0.12014.0.0
3014.0	Connection active	BOOL	ro	P0.12014.1.0
3015.0	Connection ID	UDINT	ro	P0.12015.0.0
3016.0	Connection ID	UDINT	ro	P0.12015.1.0
3017.0	Host IP address	UDINT	ro	P0.12016.0.0
3018.0	Host IP address	UDINT	ro	P0.12016.1.0
3019.0	Port host	UINT	ro	P0.12017.0.0
3020.0	Port host	UINT	ro	P0.12017.1.0
3046.0	Sync trigger detected	BOOL	ro	P0.20812.0.0
3047.0	PLL locked	BOOL	ro	P0.20813.0.0
3052.0	Actual lower limit value load voltage	REAL	ro	P0.28151.0.0
3053.0	Actual upper limit value load voltage	REAL	ro	P0.28152.0.0
3057.0	Sync Time	REAL	rw	P0.31235.0.0
3061.0	Status PROFINET request	DINT	rw	P0.54543.0.0
3062.0	Active status PROFINET	DINT	ro	P0.54544.0.0
3065.0	Actual warning threshold DC link voltage	REAL	ro	P0.56799.0.0
3066.0	Actual upper limit value DC link voltage	REAL	ro	P0.56800.0.0
3067.0	Actual lower limit value DC link voltage	REAL	ro	P0.56801.0.0
3068.0	Actual switch-on threshold brake chopper	REAL	ro	P0.56802.0.0
3071.0	Trigger level	LINT	rw	P0.60012.0.0
3072.0	Bit mask data trigger	ULINT	rw	P0.60013.0.0
3073.0	Actual acceleration value unfiltered	REAL	ro	P0.71500.0.0
3075.0	Actual acceleration value filtered	REAL	ro	P0.71501.0.0
3077.0	Filter time constant acceleration filter	REAL	rw	P0.71502.0.0
3082.0	Message counter	UDINT	ro	P0.100501.0.0
3083.0	Actual file pointer	UDINT	ro	P0.100502.0.0
3084.0	Actual file size	UDINT	ro	P0.100503.0.0
3086.0	Storage option: Diagnostics log file has invalid format	USINT	rw	P0.100505.0.0
3088.0	Storage option: Loss of messages from diagnostics log	USINT	ro	P0.100509.0.0
3089.0	Actual indicator in the message buffer	UDINT	ro	P0.100510.0.0

PNU	Name	Data type	Access	Parameter
3140.0	Axis ID diagnostic trace	UINT	rw	P0.103100.0.0
3141.0	Diagnostics ID diagnostic trace	UDINT	rw	P0.103101.0.0
3142.0	Data instance ID diagnostic trace	UINT	rw	P0.103102.0.0
3143.0	Actual axis ID diagnostic trace	UINT	ro	P0.103103.0.0
3144.0	Actual diagnostics ID diagnostic trace	UDINT	ro	P0.103104.0.0
3145.0	Actual data instance ID diagnostic trace	UINT	ro	P0.103105.0.0
3146.0	Diagnostics trigger	UDINT	rw	P0.103106.0.0
3147.0	Actual diagnostics trigger	UDINT	ro	P0.103107.0.0
3158.0	Number diagnostics acknowledgements	UDINT	ro	P0.103401.0.0
3159.0	Number diagnostics acknowledgements	UDINT	ro	P0.103401.1.0
3191.0	Scaled value analog input cosine track 1	REAL	ro	P0.111200.0.0
3242.0	Reset device	UINT	rw	P0.112901.0.0
3243.0	Load factory settings	UINT	rw	P0.112902.0.0
3244.0	Save the parameter set	UINT	rw	P0.112903.0.0
3262.0	PLL error	REAL	ro	P0.526783.0.0
3263.0	PLL output	REAL	ro	P0.526784.0.0
3284.0	Major version bootloader	UDINT	ro	P0.1130121.0.0
3285.0	Minor version bootloader	UDINT	ro	P0.1130122.0.0
3286.0	Patch version bootloader	UDINT	ro	P0.1130123.0.0
3287.0	Build version bootloader	UDINT	ro	P0.1130124.0.0
3288.0 ... 31	Version bootloader	STRING(32)	ro	P0.1130125.0.0 ... 31
3291.0	Activation of variable message function	BOOL	rw	P0.1174200.0.0
3292.0	Axis ID data trigger	UINT	rw	P0.1174201.0.0
3293.0	Data ID data trigger	UDINT	rw	P0.1174202.0.0
3294.0	Data instance ID data trigger	UINT	rw	P0.1174203.0.0
3295.0	Array ID data trigger	UINT	rw	P0.1174204.0.0
3296.0	Trigger level MELDW.5	LINT	rw	P0.1174205.0.0
3297.0	Hysteresis of trigger level	LINT	rw	P0.1174206.0.0
3298.0	Data trigger damping time	REAL	rw	P0.1174207.0.0
3299.0	Variable message function status	BOOL	ro	P0.1174210.0.0
3300.0	Actual axis ID data trigger	UINT	ro	P0.1174211.0.0
3301.0	Actual data ID data trigger	UDINT	ro	P0.1174212.0.0
3302.0	Actual data instance ID data trigger	UINT	ro	P0.1174213.0.0
3303.0	Actual array ID data trigger	UINT	ro	P0.1174214.0.0
3304.0	Actual trigger level	LINT	ro	P0.1174215.0.0
3305.0	Actual hysteresis of trigger level	LINT	ro	P0.1174216.0.0
3306.0	Actual data trigger damping time	REAL	ro	P0.1174217.0.0
3307.0	Data trigger status	BOOL	ro	P0.1174220.0.0
3312.0	ID reintialisation	UDINT	ro	P0.11280019.0.0
3313.0 ... 19	URL address	STRING(20)	rw	P0.11280052.0.0 ... 19
3314.0	PZD telegram selection	UINT	ro	P0.11280201.0.0
3316.0	Storage option: Telegram not supported	USINT	rw	P0.11280203.0.0
3317.0	Maximum number of parameters	UINT	ro	P0.11280801.0.0
3318.0	Multi-parameter access active	BOOL	ro	P0.11280802.0.0
3320.0 ... 240	Name of Station	STRING(241)	ro	P0.11295001.0.0 ... 240
3321.0 ... 32	I&M 1 System identification	STRING(33)	rw	P0.11295002.0.0 ... 32

PNU	Name	Data type	Access	Parameter
3322.0 … 22	I&M 1 location marking	STRING(23)	rw	P0.11295003.0.0 … 22
3323.0 … 16	I&M 2 installation date	STRING(17)	rw	P0.11295004.0.0 … 16
3324.0 … 54	I&M 3 additional name	STRING(55)	rw	P0.11295005.0.0 … 54
3326.0 … 9	Revision	STRING(10)	ro	P0.72.0.0 … 9
3327.0	Resolution single turn	UDINT	rw	P0.3601.0.0
3328.0	Resolution multi-turn	UDINT	rw	P0.3602.0.0
3329.0	Single-turn position	UDINT	ro	P0.3603.0.0
3330.0	Multi-turn numerator	UDINT	ro	P0.3604.0.0
3338.0	Baud rate	UDINT	rw	P0.3612.0.0
3339.0	Activation of correction table	BOOL	rw	P0.3613.0.0
3343.0	Activation read out extended encoder data	BOOL	rw	P0.3618.0.0
3352.0	DC link recovery deactivation	REAL	ro	P0.10181.0.0
3353.0	DC link recovery status	BOOL	ro	P0.10182.0.0
3354.0	DC link recovery	BOOL	rw	P0.10183.0.0
3355.0	Activate automatic voltage determination	BOOL	rw	P0.10184.0.0
3356.0	Switch-off threshold power feedback	REAL	rw	P0.10185.0.0
3357.0	Scaling factor offset of voltage calculation	REAL	rw	P0.10186.0.0
3364.0	Digital input X1A.7	UDINT	rw	P0.11201.0.0
3365.0	Digital input X1A.8	UDINT	rw	P0.11202.0.0
3366.0	Digital output X1A.9	UDINT	rw	P0.11203.0.0
3367.0	Digital output X1A.10	UDINT	rw	P0.11204.0.0
3368.0	Digital input X1C.2	UDINT	rw	P0.11205.0.0
3371.0	Web server activation	BOOL	rw	P0.11280051.0.0
3373.0	Storage option: Parameter set with older version	USINT	rw	P0.5781.0.0
3375.0	Storage option: Parameter set with newer version	USINT	rw	P0.5783.0.0
3376.0	Actually most serious error	UDINT	ro	P0.315.0.0
3377.0	Actually most serious error	UDINT	ro	P0.315.1.0
3378.0	Activation inversion zero pulse	BOOL	rw	P0.10045.0.0
3381.0	Zero pulse monitoring window	UINT	rw	P0.10047.0.0
3384.0	Storage option: Number of increments between two zero pulses invalid	USINT	rw	P0.10060.0.0
3387.0	Diagnostic category: Number of increments between two zero pulses invalid	UINT	rw	P0.10061.0.0
3390.0	PLL Sync Timeout	REAL	rw	P0.526785.0.0
3397.0	Diagnostic category: Failure of synchronization signal Fieldbus	UINT	rw	P0.54545.0.0
3398.0	Storage option: Failure of synchronization signal Fieldbus	USINT	rw	P0.54546.0.0
3399.0	Diagnostic category: Invalid parameterization variable message function	UINT	rw	P0.1174230.0.0
3400.0	Storage option: Invalid parameterization variable message function	USINT	rw	P0.1174231.0.0
3401.0	Extended process data	UINT	ro	P0.11280204.0.0
3402.0 … 4	Active telegrams	UINT	ro	P0.11280210.0.0 … 4
3403.0	Status word Object 0x60FE	UINT	rw	P0.11310.0.0
3404.0	Denominator pole pairs	UDINT	ro	P0.7171.0.0
3487.0	Maximum number of parameters	UINT	rw	P0.303101.0.0
3488.0	Multi-parameter access active	BOOL	rw	P0.303102.0.0
3489.0	Status EtherNet/IP	DINT	ro	P0.303302.0.0

PNU	Name	Data type	Access	Parameter
3490.0	Telegram selection	UINT	rw	P0.3030101.0.0
3491.0	Extended process data (EtherNet/IP)	BOOL	rw	P0.3030104.0.0
3492.0	Storage option: Invalid encoder resolution	USINT	rw	P0.179.0.0
3495.0	Diagnostic category: Invalid encoder resolution	UINT	rw	P0.181.0.0
3500.0	Storage option: Maximum write cycles reached	USINT	rw	P0.203.0.0
3501.0	Diagnostic category: Maximum write cycles reached	UINT	rw	P0.205.0.0
3502.0	Enabled Memory access EEProm	BOOL	rw	P0.100025.0.0
3503.0	Number of memory access EEProm	UDINT	ro	P0.100026.0.0
3504.0	Switching threshold Diagnostic message	UDINT	rw	P0.100027.0.0
3505.0	Maximum write accesses	UDINT	ro	P0.666.0.0
3506.0	IRT Output time	REAL	rw	P0.31236.0.0
3507.0	IRT Input time	REAL	rw	P0.31237.0.0
3508.0	CACF	UINT	rw	P0.31238.0.0
3509.0	Activation multi-turn	BOOL	rw	P0.100556.0.0
3512.0	Encoder serial number	UDINT	ro	P0.3625.0.0
3513.0	Manufacturer ID BiSS-C	UINT	ro	P0.3626.0.0
3514.0	Actual encoder ID	ULINT	ro	P0.3627.0.0
3515.0	Storage option: Input frequency A/B signals too high	USINT	rw	P0.101125.0.0
3518.0	Diagnostic category: Input frequency A/B signals too high	UINT	rw	P0.101127.0.0
3522.0	Storage option: The requested telegram is not supported	USINT	rw	P0.141.0.0
3523.0	Diagnostic category: The requested telegram is not supported	UINT	rw	P0.144.0.0
3532.0 ... 49	Order code product	STRING(50)	ro	P0.701.0.0 ... 49
3533.0	EtherCAT state machine state (ESM)	UDINT	ro	P0.720.0.0
3534.0 ... 4	Sync manager communication type EtherCAT	USINT	rw	P0.750.0.0 ... 4
3535.0	Sync manager 0 PDO assignment EtherCAT	USINT	ro	P0.751.0.0
3536.0	Sync manager 1 PDO assignment EtherCAT	USINT	ro	P0.752.0.0
3542.0	Diagnostic category: Process data not received at Sync time	UINT	rw	P0.758.0.0
3543.0	Storage option: Process data not received at Sync time	USINT	rw	P0.759.0.0
3544.0	Receive PDO number of objects EtherCAT	USINT	rw	P0.760.0.0
3545.0 ... 15	Receive PDO Mapped Objects EtherCAT	UDINT	rw	P0.761.0.0 ... 15
3546.0	Sync manager x number of assigned PDOs EtherCAT	USINT	rw	P0.770.0.0
3547.0	Sync manager x number of assigned PDOs EtherCAT	USINT	rw	P0.770.1.0
3548.0 ... 2	PDO mapping object index of assigned PDO EtherCAT	UINT	rw	P0.771.0.0 ... 2
3549.0 ... 2	PDO mapping object index of assigned PDO EtherCAT	UINT	rw	P0.771.1.0 ... 2
3550.0	Transmit PDO number of objects EtherCAT	USINT	rw	P0.880.0.0
3551.0	Transmit PDO number of objects EtherCAT	USINT	rw	P0.880.1.0
3552.0	Transmit PDO number of objects EtherCAT	USINT	rw	P0.880.2.0
3553.0 ... 15	Transmit PDO mapped objects EtherCAT	UDINT	rw	P0.881.0.0 ... 15
3554.0 ... 15	Transmit PDO mapped objects EtherCAT	UDINT	rw	P0.881.1.0 ... 15
3555.0 ... 15	Transmit PDO mapped objects EtherCAT	UDINT	rw	P0.881.2.0 ... 15
3556.0	Synchronisation mode	UINT	rw	P0.1050.0.0
3557.0	Synchronisation process repetition time	REAL	rw	P0.1051.0.0
3559.0	Sync mode supported	UINT	ro	P0.1053.0.0
3560.0	Sync Minimum Cycle Time	REAL	ro	P0.1054.0.0
3561.0	Sync Calc And Copy Time	REAL	ro	P0.1055.0.0

PNU	Name	Data type	Access	Parameter
3562.0	Sync Get Cycle Time	UINT	rw	P0.1056.0.0
3563.0	Sync Delay Time	REAL	ro	P0.1057.0.0
3564.0	Sync0 Cycle Time	REAL	rw	P0.1058.0.0
3565.0	Sync SM Event Missed	UINT	ro	P0.1059.0.0
3566.0	Sync cycle time too small	UINT	ro	P0.1060.0.0
3567.0	Sync Error	BOOL	ro	P0.1061.0.0
3568.0	Calc and copy time	REAL	ro	P0.1062.0.0
3569.0	Maximum delay time	REAL	ro	P0.1063.0.0
3570.0	Counter Process data loss	UDINT	ro	P0.1770.0.0
3572.0	EtherCAT explicit device ID	UINT	rw	P0.7600.0.0
3573.0	Device type CiA402	UDINT	rw	P0.7601.0.0
3574.0	Error register CiA402	USINT	rw	P0.7602.0.0
3575.0 ... 31	Device name CiA402	STRING(32)	rw	P0.7603.0.0 ... 31
3576.0 ... 5	Hardware version CiA402	STRING(6)	rw	P0.7604.0.0 ... 5
3577.0 ... 31	Software version CiA402	STRING(32)	rw	P0.7605.0.0 ... 31
3579.0	Vendor ID	UDINT	rw	P0.7607.0.0
3580.0	Product code	UDINT	rw	P0.7608.0.0
3581.0	Revision number	UDINT	rw	P0.7609.0.0
3582.0 ... 19	Hash firmware package	STRING(20)	ro	P0.9595.0.0 ... 19
3586.0	Operating hours counter UINT	UDINT	ro	P0.14231.0.0
3587.0 ... 14	Expected ITAC number Power unit	STRING(15)	ro	P0.16000.0.0 ... 14
3588.0 ... 14	Expected ITAC number safety unit	STRING(15)	ro	P0.16001.0.0 ... 14
3589.0	Activation automatic detection Protocol Bits	BOOL	rw	P0.36029.0.0
3590.0	Active singleturn resolution	UDINT	ro	P0.36030.0.0
3591.0	Active multi-turn resolution	UDINT	ro	P0.36031.0.0
3592.0	Timeout BiSS-C	REAL	rw	P0.36032.0.0
3596.0	Local error reaction	UDINT	rw	P0.43543.0.0
3597.0	Sync error counter limit	UINT	rw	P0.43544.0.0
3598.0	Maximum messages	USINT	rw	P0.43545.0.0
3599.0	Newest message	USINT	rw	P0.43546.0.0
3600.0	Newest ack message	USINT	rw	P0.43547.0.0
3601.0	New message available	BOOL	rw	P0.43548.0.0
3602.0	Flags	UINT	rw	P0.43549.0.0
3603.0	Timestamp object	ULINT	rw	P0.43550.0.0
3604.0 ... 19	SDO 10F3 Diag Array 0	USINT	rw	P0.43551.0.0 ... 19
3605.0 ... 19	SDO 10F3 Diag Array 1	USINT	rw	P0.43552.0.0 ... 19
3606.0 ... 19	SDO 10F3 Diag Array 2	USINT	rw	P0.43553.0.0 ... 19
3607.0 ... 19	SDO 10F3 Diag Array 3	USINT	rw	P0.43554.0.0 ... 19
3608.0 ... 19	SDO 10F3 Diag Array 4	USINT	rw	P0.43555.0.0 ... 19
3609.0 ... 19	SDO 10F3 Diag Array 5	USINT	rw	P0.43556.0.0 ... 19
3610.0 ... 19	SDO 10F3 Diag Array 6	USINT	rw	P0.43557.0.0 ... 19
3611.0 ... 19	SDO 10F3 Diag Array 7	USINT	rw	P0.43558.0.0 ... 19
3612.0 ... 19	SDO 10F3 Diag Array 8	USINT	rw	P0.43559.0.0 ... 19
3613.0 ... 19	SDO 10F3 Diag Array 9	USINT	rw	P0.43560.0.0 ... 19
3614.0 ... 19	SDO 10F3 Diag Array 10	USINT	rw	P0.43561.0.0 ... 19
3615.0 ... 19	SDO 10F3 Diag Array 11	USINT	rw	P0.43562.0.0 ... 19

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3616.0 ... 19	SDO 10F3 Diag Array 12	USINT	rw	P0.43563.0.0 ... 19
3617.0 ... 19	SDO 10F3 Diag Array 13	USINT	rw	P0.43564.0.0 ... 19
3618.0 ... 19	SDO 10F3 Diag Array 14	USINT	rw	P0.43565.0.0 ... 19
3619.0 ... 19	SDO 10F3 Diag Array 15	USINT	rw	P0.43566.0.0 ... 19
3620.0 ... 19	SDO 10F3 Diag Array 16	USINT	rw	P0.43567.0.0 ... 19
3621.0 ... 19	SDO 10F3 Diag Array 17	USINT	rw	P0.43568.0.0 ... 19
3622.0 ... 19	SDO 10F3 Diag Array 18	USINT	rw	P0.43569.0.0 ... 19
3623.0 ... 19	SDO 10F3 Diag Array 19	USINT	rw	P0.43570.0.0 ... 19
3624.0	Status FoE	UDINT	ro	P0.44550.0.0
3625.0	File type FoE	UINT	ro	P0.44551.0.0
3626.0	Counter FoE	UDINT	ro	P0.44552.0.0
3627.0	Number of update jobs	INT	ro	P0.100023.0.0
3628.0	Active update job	INT	ro	P0.100024.0.0
3629.0	Total number of bytes written Flash	DINT	ro	P0.100028.0.0
3630.0	Number of bytes written Flash	DINT	ro	P0.100029.0.0
3643.0	Parameterization authority ID Profile	UDINT	ro	P0.100046.0.0
3644.0	Parameterization authority ID Connection	UDINT	ro	P0.100047.0.0
3645.0	Status Parameterization authority	USINT	ro	P0.100048.0.0
3646.0	Parameterization authority Connection	UDINT	ro	P0.100072.0.0
3647.0	RTE Configuration (user defined)	UDINT	rw	P0.100159.0.0
3648.0	RTE configuration active	UDINT	ro	P0.100179.0.0
3649.0	RTE Configuration next	UDINT	ro	P0.100181.0.0
3650.0	RTE Switches device start	UDINT	ro	P0.100185.0.0
3651.0	RTE Switches Active	UDINT	ro	P0.100189.0.0
3654.0	State OS	UDINT	ro	P0.100257.0.0
3655.0	Reg DFSR	UDINT	ro	P0.100265.0.0
3656.0	Reg IFSR	UDINT	ro	P0.100273.0.0
3657.0	Major Version APPloader	UDINT	ro	P0.100680.0.0
3658.0	Minor Version APPloader	UDINT	ro	P0.100681.0.0
3659.0	Patch Version APPloader	UDINT	ro	P0.100682.0.0
3660.0	Build Version APPloader	UDINT	ro	P0.100683.0.0
3661.0 ... 31	Version String APPloader	STRING(32)	ro	P0.100684.0.0 ... 31
3662.0 ... 47	Timestamp APPloader	STRING(48)	ro	P0.100685.0.0 ... 47
3663.0	Major Version RTE	UINT	ro	P0.100686.0.0
3664.0 ... 31	User Build APPloader	STRING(32)	ro	P0.100689.0.0 ... 31
3665.0	Minor Version RTE	UINT	ro	P0.100690.0.0
3666.0	Build Version RTE	UINT	ro	P0.100691.0.0
3667.0	Revision Version RTE	UINT	ro	P0.100692.0.0
3668.0 ... 62	Version String RTE	STRING(63)	ro	P0.100693.0.0 ... 62
3672.0	Diagnostic category: Parameter set stored CRC1	UINT	ro	P0.100811.0.0
3673.0	Activation PROFINET diagnostics	SINT	rw	P0.100821.0.0
3676.0	Reg DFAR	UDINT	ro	P0.101133.0.0
3677.0	Reg IFAR	UDINT	ro	P0.101134.0.0
3678.0	Reg VBAR	UDINT	ro	P0.101135.0.0
3679.0	Reg ISR	UDINT	ro	P0.101137.0.0
3680.0	Active Task ID	UDINT	ro	P0.101139.0.0

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3681.0	Active Task Stack Fill Level	UDINT	ro	P0.101140.0.0
3682.0	Active Task Stack Size	UDINT	ro	P0.101141.0.0
3683.0	Actual Task Id	UDINT	ro	P0.101142.0.0
3684.0	Actual Task Stack Fill Level	UDINT	ro	P0.101144.0.0
3685.0	Actual Task Stack Size	UDINT	ro	P0.101145.0.0
3686.0	Heap used	UDINT	ro	P0.101146.0.0
3687.0	Heap size	UDINT	ro	P0.101147.0.0
3688.0	Storage option: Incompatible device configuration PROFINET IRT	USINT	rw	P0.101291.0.0
3689.0	Diagnostic category: Incompatible device configuration PROFINET IRT	UINT	rw	P0.101296.0.0
4310.0	Activate automatic detection Switching threshold brake chopper	BOOL	rw	P0.48012.0.0
4311.0	Offset switching threshold brake chopper	REAL	rw	P0.48013.0.0
4312.0	Error counter Sync 0	UINT	ro	P0.1064.0.0
4316.0	Reg R14 last	UDINT	ro	P0.101492.0.0
4317.0	Reg R13 sp	UDINT	ro	P0.101494.0.0
4318.0	Activation of extended encoder resolution	BOOL	rw	P0.101502.0.0
4321.0	Extended encoder resolution	UDINT	rw	P0.101503.0.0
4526.0	Database ID Braking resistor	UDINT	rw	P0.101529.0.0
4527.0 ... 36	Order code Braking resistor	STRING(37)	rw	P0.101530.0.0 ... 36
4528.0	Storage option: Incorrect IP address settings	USINT	rw	P0.101561.0.0
4529.0	Storage option: Incorrect IP address settings	USINT	rw	P0.101561.1.0
4532.0 ... 9	Debug Variable UINT64	ULINT	rw	P0.101711.0.0 ... 9
4533.0 ... 7	Debug Variable SINT64 Position	LINT	rw	P0.101713.0.0 ... 7
4534.0	Memory location INT32	DINT	rw	P0.101715.0.0
4535.0	Memory location INT32	DINT	rw	P0.101715.1.0
4536.0	Memory location INT32	DINT	rw	P0.101715.2.0
4537.0	Memory location INT32	DINT	rw	P0.101715.3.0
4538.0	Memory location FLOAT32	REAL	rw	P0.101717.0.0
4539.0	Memory location FLOAT32	REAL	rw	P0.101717.1.0
4540.0	Memory location FLOAT32	REAL	rw	P0.101717.2.0
4541.0	Memory location FLOAT32	REAL	rw	P0.101717.3.0
4637.0	Diagnostic category: Factory parameter set activated	UINT	ro	P0.102816.0.0
4654.0	Fieldweakening: Max. rotary speed	REAL	ro	P0.7137.0.0
4656.0	Pitch length	REAL	ro	P0.7443.0.0
4658.0	Nominal velocity linear	REAL	ro	P0.7444.0.0
4660.0	Maximum velocity linear	REAL	ro	P0.7445.0.0
4662.0	Maximum velocity fieldweakening linear	REAL	ro	P0.7446.0.0
4664.0	Force constant linear	REAL	ro	P0.7447.0.0
4666.0	Slide weight linear	REAL	ro	P0.7448.0.0
4668.0	Severest Diagnosis ID	UDINT	ro	P0.102935.0.0
4669.0	Synced trace: Synchronised	BOOL	ro	P0.102898.0.0
4672.0	Synced trace: end timestamp	ULINT	ro	P0.102894.0.0
4673.0	Synced trace: trigger event timestamp	ULINT	ro	P0.102895.0.0
4674.0	Synced trace: Enable	BOOL	rw	P0.102896.0.0
4675.0	Synced trace: Enabled	BOOL	ro	P0.102897.0.0

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4676.0	Active trigger bitmask	ULINT	ro	P0.102902.0.0
4677.0	Encoder resolution	REAL	rw	P0.102903.0.0
4680.0	Enable linear measurement	BOOL	rw	P0.102908.0.0
4684.0	Diagnostic category: BiSS-C common notifications	UINT	rw	P0.102916.0.0
4697.0	Encoder linearisation status	UDINT	ro	P0.50301.0.0
4713.0	Active telegram Subslot 5	UINT	ro	P0.101935.0.0
4714.0	Storage option: System starts	USINT	rw	P0.101990.0.0
4715.0	Diagnostic category: System starts	UINT	rw	P0.101992.0.0
4834.0	Activation Legacy Mode Station Alias	BOOL	rw	P0.7610.0.0
4837.0	CiP Sync: Timestamp associated with the position setpoint	UDINT	rw	P0.303303.0.0
4838.0	CiP Sync: Sync interval	REAL	ro	P0.303305.0.0
4839.0	CiP Sync: PTP timestamp (us)	ULINT	ro	P0.303306.0.0
4841.0	Diagnostic category: Invalid device parameter	UINT	ro	P0.102883.0.0
4846.0	Amplification gain analog input	REAL	rw	P0.201.0.0
4847.0	Offset analog input	REAL	rw	P0.202.0.0
4848.0	Scaled value analog input	REAL	ro	P0.206.0.0
4851.0	Dead zone analog input	REAL	rw	P0.102046.0.0
4852.0	Filter time constant analog input	REAL	rw	P0.102096.0.0
4853.0	Activation Save data recording	BOOL	rw	P0.102260.0.0
4854.0	ModBus TCP timeout	REAL	rw	P0.102393.0.0
4855.0	Data recording storage status	UDINT	ro	P0.102403.0.0
4856.0	Time stamp Data recording storage	LINT	ro	P0.102411.0.0
4859.0	Status synchronization	UDINT	ro	P0.102476.0.0
4983.0 ... 7	Trace channel bitmask	ULINT	rw	P0.5520.0.0 ... 7
4984.0 ... 7	Aktive trace channel bitmask	ULINT	ro	P0.5521.0.0 ... 7
4985.0	IO-Profile	UINT	rw	P0.102886.0.0
4986.0	IO-Link telegram selection	UINT	rw	P0.102889.0.0
4987.0	IO-Link device ID	UDINT	ro	P0.102890.0.0
4988.0 ... 31	IO-Link application tag	STRING(32)	rw	P0.102891.0.0 ... 31
4989.0 ... 31	IO-Link function tag	STRING(32)	rw	P0.102892.0.0 ... 31
4990.0 ... 31	IO-Link localisation tag	STRING(32)	rw	P0.102893.0.0 ... 31
5017.0 ... 31	NOC motor reference configuration	STRING(32)	rw	P0.32410.0.0 ... 31
5024.0	Device interface X1B status	UDINT	ro	P0.10154.0.0
5044.0	Diagnostic category: Parameterisation braking resistor pulse energy	UINT	rw	P0.102676.0.0
5046.0	Diagnostic category: Parameterisation braking resistor pulse energy	UINT	rw	P0.102688.0.0
5047.0 ... 7	Debug U32	UDINT	rw	P0.102706.0.0 ... 7
5048.0 ... 7	Debug I32	DINT	rw	P0.102708.0.0 ... 7
5049.0 ... 7	Debug U16	UINT	rw	P0.102709.0.0 ... 7
5050.0 ... 7	Debug I16	INT	rw	P0.102710.0.0 ... 7
5099.0	Diagnostic category: BiSS-C encoder error	UINT	rw	P0.102791.0.0
5101.0	Diagnostic category: BiSS-C encoder warning	UINT	rw	P0.102793.0.0
5103.0	Activation Identification code	BOOL	ro	P0.102760.0.0
5104.0	Activation EtherNet/IP	BOOL	rw	P0.102726.0.0
5106.0	Diagnostic category: Safety parameter set saved by user	UINT	ro	P0.102756.0.0
5107.0	Parameter set Hash	UDINT	ro	P0.102764.0.0

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11000.0	Counter overruns 32-bit	DINT	ro	P1.11.0.0
11001.0	Use of user specific motor data	BOOL	rw	P1.14.0.0
11002.0	Switch-on delay holding brake 1	REAL	ro	P1.20.0.0
11003.0	Switch-off delay holding brake 1	REAL	ro	P1.21.0.0
11006.0	Status holding brake 1	UDINT	ro	P1.24.0.0
11008.0	Status holding brakes 1 and 2	UDINT	ro	P1.26.0.0
11011.0	Selection of holding brake	UDINT	ro	P1.29.0.0
11021.0	Actual phase U current value	REAL	ro	P1.39.0.0
11022.0 ... 2	Filter frequency notch filter	REAL	rw	P1.40.0.0 ... 2
11024.0	Controller operating status	UDINT	ro	P1.42.0.0
11026.0	Change closed loop parameter set status	BOOL	ro	P1.44.0.0
11027.0	Diagnostic category: Resolution of position factorgroup invalid	UINT	rw	P1.45.0.0
11028.0	Storage option: Resolution of position factorgroup invalid	USINT	rw	P1.46.0.0
11031.0 ... 2	Band width of notch filter	REAL	rw	P1.49.0.0 ... 2
11032.0 ... 2	Notch filter output active current	REAL	ro	P1.50.0.0 ... 2
11033.0 ... 2	Activation of notch filter	BOOL	rw	P1.51.0.0 ... 2
11034.0	Setpoint value active current unfiltered	REAL	ro	P1.52.0.0
11035.0	Current controller amplification gain (reactive current)	REAL	rw	P1.80.0.0
11036.0	Current controller integration constant (reactive current)	REAL	rw	P1.81.0.0
11037.0	Current controller amplification gain (active current)	REAL	rw	P1.82.0.0
11038.0	Current controller integration constant (active current)	REAL	rw	P1.83.0.0
11039.0	Setpoint value voltage Ud	REAL	ro	P1.84.0.0
11040.0	Setpoint value voltage Uq	REAL	ro	P1.85.0.0
11041.0	Setpoint value active current	REAL	ro	P1.86.0.0
11042.0	Setpoint value reactive current	REAL	ro	P1.87.0.0
11043.0	Maximum output voltage	REAL	ro	P1.88.0.0
11044.0	Actual Clarke-Transformation Ia current value	REAL	ro	P1.89.0.0
11045.0	Setpoint position	LINT	ro	P1.90.0.0
11046.0	Setpoint velocity	REAL	ro	P1.91.0.0
11047.0	Setpoint acceleration	REAL	ro	P1.92.0.0
11048.0	Setpoint jerk	REAL	ro	P1.93.0.0
11049.0	Setpoint torque	REAL	ro	P1.94.0.0
11050.0	Setpoint current	REAL	ro	P1.95.0.0
11051.0	Fine interpolator output position	LINT	ro	P1.100.0.0
11052.0	Fine interpolator output velocity	REAL	ro	P1.101.0.0
11053.0	Fine interpolator output acceleration	REAL	ro	P1.102.0.0
11054.0	Fine interpolator output jerk	REAL	ro	P1.103.0.0
11055.0	Fine interpolator output torque	REAL	ro	P1.104.0.0
11056.0	Fine interpolator output current	REAL	ro	P1.105.0.0
11058.0	Fine interpolator status	UDINT	ro	P1.107.0.0
11061.0	Selection encoder channel 1 position	UDINT	ro	P1.122.0.0
11067.0	Actual position value encoder channel 1	LINT	ro	P1.128.0.0
11069.0	Actual torque value motor shaft	REAL	ro	P1.150.0.0
11070.0	Actual torque value gear shaft	REAL	ro	P1.151.0.0
11071.0	Motion Manager status	UDINT	ro	P1.171.0.0
11072.0	Active motion task	UDINT	ro	P1.172.0.0

PNU	Name	Data type	Access	Parameter
11073.0	Active motion task status	UDINT	ro	P1.173.0.0
11080.0	Position controller amplification gain	REAL	rw	P1.220.0.0
11081.0	Dead zone position controller	LINT	rw	P1.221.0.0
11082.0	Minimum correction velocity	REAL	rw	P1.222.0.0
11083.0	Maximum correction velocity	REAL	rw	P1.223.0.0
11084.0	Velocity controller amplification gain	REAL	rw	P1.224.0.0
11085.0	Velocity controller integration constant	REAL	rw	P1.225.0.0
11086.0 ... 2	Position controller amplification gain	REAL	rw	P1.226.0.0 ... 2
11094.0	Setpoint value reactive current	REAL	rw	P1.270.0.0
11104.0	Setpoint management output position	LINT	ro	P1.290.0.0
11105.0	Setpoint management output velocity	REAL	ro	P1.291.0.0
11106.0	Setpoint management output acceleration	REAL	ro	P1.292.0.0
11107.0	Setpoint management output jerk	REAL	ro	P1.293.0.0
11108.0	Setpoint management output torque	REAL	ro	P1.294.0.0
11109.0	Setpoint management output current	REAL	ro	P1.295.0.0
11110.0	Setpoint management control structure	UDINT	ro	P1.296.0.0
11111.0	Setpoint management controller operating status	UDINT	ro	P1.297.0.0
11112.0 ... 4	Status setpoint sources	UDINT	ro	P1.298.0.0 ... 4
11113.0	Actual phase V current value	REAL	ro	P1.310.0.0
11122.0	Maximum motor torque/servo drive	REAL	ro	P1.381.0.0
11123.0	Maximum motor velocity	REAL	ro	P1.382.0.0
11124.0	STO hysteresis time	REAL	rw	P1.390.0.0
11125.0	STO discrepancy time	REAL	rw	P1.391.0.0
11126.0	STO safety status	UDINT	ro	P1.392.0.0
11127.0	STO error status	UDINT	ro	P1.393.0.0
11128.0	STO signal status	UDINT	ro	P1.394.0.0
11144.0	Movement monitoring status	UDINT	ro	P1.460.0.0
11145.0	Configuration word movement monitoring	UDINT	ro	P1.461.0.0
11146.0	Damping time position: following error	REAL	rw	P1.462.0.0
11147.0	Monitoring window position: following error	REAL	rw	P1.463.0.0
11148.0	Monitoring window velocity: following error	REAL	rw	P1.464.0.0
11149.0	Standstill damping time	REAL	rw	P1.465.0.0
11150.0	Monitoring window velocity standstill monitoring	REAL	rw	P1.466.0.0
11151.0	Monitoring window position standstill	REAL	rw	P1.467.0.0
11152.0	Damping time target reached	REAL	rw	P1.468.0.0
11153.0	Monitoring window target position	REAL	rw	P1.469.0.0
11154.0	Device control status	UDINT	ro	P1.530.0.0
11159.0	Maximum current motor	REAL	ro	P1.620.0.0
11160.0	Motor nominal current	REAL	ro	P1.621.0.0
11161.0	Maximum current servo drive	REAL	ro	P1.622.0.0
11162.0	Nominal current servo drive	REAL	ro	P1.623.0.0
11163.0	Resulting maximum current	REAL	ro	P1.624.0.0
11164.0	Resulting minimum current	REAL	ro	P1.625.0.0
11165.0	Resulting nominal current	REAL	ro	P1.626.0.0
11168.0	Scaling factor start value I^2t monitoring motor	REAL	rw	P1.631.0.0
11169.0	Limit value I^2t monitoring motor	REAL	ro	P1.632.0.0

PNU	Name	Data type	Access	Parameter
11170.0	Scaling factor maximum value after switching on	REAL	ro	P1.633.0.0
11171.0	Actual value I²t monitoring motor	REAL	ro	P1.634.0.0
11172.0	Scaling factor warning limit I²t monitoring motor	REAL	rw	P1.635.0.0
11173.0	Maximum I²t time	REAL	ro	P1.636.0.0
11174.0	Scaling factor start value I²t monitoring power output stage	REAL	ro	P1.637.0.0
11175.0	Limit value I²t monitoring power output stage	REAL	ro	P1.638.0.0
11176.0	Scaling factor maximum value after switching on	REAL	ro	P1.639.0.0
11177.0	Status of state machine commutation finding	UDINT	ro	P1.660.0.0
11178.0	Commutation finding status	UDINT	ro	P1.661.0.0
11179.0	Time current increase	REAL	rw	P1.662.0.0
11180.0	Electrical Increment	REAL	rw	P1.664.0.0
11182.0	Mode	UDINT	rw	P1.668.0.0
11183.0	Velocity	REAL	rw	P1.669.0.0
11184.0	Pole pairs (user defined)	UDINT	rw	P1.718.0.0
11185.0	Actual pole pairs	UDINT	ro	P1.719.0.0
11186.0	Actual Clarke-Transformation Ib current value	REAL	ro	P1.810.0.0
11189.0	Actual reactive current value	REAL	ro	P1.813.0.0
11190.0	Actual active current value	REAL	ro	P1.814.0.0
11195.0	Control parameter equalisation for active and reactive current controllers	BOOL	rw	P1.819.0.0
11196.0	Functional safety status	UDINT	ro	P1.820.0.0
11197.0	Diagnostic category: Safety function requested	UINT	rw	P1.821.0.0
11198.0	Storage option: Safety function requested	USINT	rw	P1.822.0.0
11199.0	Control word Motion Manager	UDINT	ro	P1.823.0.0
11200.0	Reactive current control error	REAL	ro	P1.824.0.0
11201.0	Active current control error	REAL	ro	P1.825.0.0
11202.0	Referencing status	UDINT	ro	P1.840.0.0
11203.0	Move to axis zero point after homing	BOOL	rw	P1.841.0.0
11204.0	Homing timeout	REAL	rw	P1.842.0.0
11205.0	Search for reference mark setpoint velocity	REAL	rw	P1.843.0.0
11206.0	Search for reference mark setpoint acceleration	REAL	rw	P1.844.0.0
11207.0	Search for reference mark setpoint jerk	REAL	rw	P1.845.0.0
11208.0	Setpoint reference mark creeping velocity	REAL	rw	P1.846.0.0
11209.0	Setpoint reference mark creeping acceleration	REAL	rw	P1.847.0.0
11210.0	Setpoint reference mark creeping jerk	REAL	rw	P1.848.0.0
11211.0	Move to axis zero point setpoint velocity	REAL	rw	P1.849.0.0
11212.0	Lower limit value velocity (closed loop controller)	REAL	rw	P1.850.0.0
11213.0	Upper limit value velocity (closed loop controller)	REAL	rw	P1.851.0.0
11214.0	Lower limit value torque (closed loop controller)	REAL	rw	P1.852.0.0
11215.0	Upper limit value torque (closed loop controller)	REAL	rw	P1.853.0.0
11216.0	Lower limit value active current (closed loop controller)	REAL	rw	P1.854.0.0
11217.0	Upper limit value active current (closed loop controller)	REAL	rw	P1.855.0.0
11218.0	Limit value total current (closed loop controller)	REAL	rw	P1.856.0.0
11219.0	Status auto tuning	USINT	ro	P1.860.0.0
11222.0	Interpolator output position	LINT	ro	P1.911.0.0
11223.0	Interpolator output velocity	REAL	ro	P1.912.0.0

PNU	Name	Data type	Access	Parameter
11224.0	Interpolator output acceleration	REAL	ro	P1.913.0.0
11225.0	Interpolator output jerk	REAL	ro	P1.914.0.0
11226.0	Interpolator output torque	REAL	ro	P1.915.0.0
11227.0	Interpolator output current	REAL	ro	P1.916.0.0
11228.0	Counter motion task	UDINT	ro	P1.917.0.0
11229.0	Motor temperature	REAL	ro	P1.940.0.0
11230.0	Status motor temperature	DINT	ro	P1.941.0.0
11231.0	Temperature sensor type motor	UDINT	ro	P1.942.0.0
11234.0	Lower limit value warning threshold motor temperature	REAL	rw	P1.945.0.0
11235.0	Hysteresis lower limit value warning threshold motor temperature	REAL	rw	P1.946.0.0
11236.0	Lower limit value motor temperature	REAL	rw	P1.947.0.0
11237.0	Hysteresis lower limit value motor temperature	REAL	rw	P1.948.0.0
11238.0	Upper limit value warning threshold motor temperature	REAL	rw	P1.949.0.0
11239.0	SFB error status	UDINT	ro	P1.950.0.0
11240.0	Feedback signals	UDINT	ro	P1.951.0.0
11241.0	STA hysteresis time	REAL	ro	P1.952.0.0
11246.0	Inactive time position setpoint value	UDINT	rw	P1.957.0.0
11247.0	Time constant velocity setpoint value filter	REAL	rw	P1.958.0.0
11248.0	Time constant acceleration setpoint value filter	REAL	rw	P1.959.0.0
11249.0	Amplification gain velocity feed forward control	REAL	rw	P1.967.0.0
11250.0	Amplification gain torque feed forward control	REAL	rw	P1.968.0.0
11251.0	Offset torque	REAL	rw	P1.969.0.0
11252.0	Total inertia	REAL	rw	P1.973.0.0
11253.0	Setpoint value friction compensation	REAL	ro	P1.974.0.0
11254.0	Setpoint value inertia compensation	REAL	ro	P1.975.0.0
11255.0 ... 15	Support point velocity [rad/s]	REAL	rw	P1.976.0.0 ... 15
11256.0 ... 15	Support point torque [Nm]	REAL	rw	P1.977.0.0 ... 15
11257.0	Number of support points	UDINT	rw	P1.978.0.0
11258.0 ... 2	Bypass	BOOL	rw	P1.991.0.0 ... 2
11259.0 ... 2	First derivation	REAL	rw	P1.992.0.0 ... 2
11260.0 ... 2	Second derivation	REAL	rw	P1.993.0.0 ... 2
11261.0 ... 2	Dead zone	REAL	rw	P1.994.0.0 ... 2
11262.0 ... 2	Scaling factor	REAL	rw	P1.995.0.0 ... 2
11263.0 ... 2	Offset (analog)	REAL	rw	P1.996.0.0 ... 2
11264.0 ... 2	Monitoring window safe zero	REAL	rw	P1.997.0.0 ... 2
11265.0 ... 2	Lower limit value analog input	REAL	rw	P1.998.0.0 ... 2
11266.0 ... 2	Upper limit value analog input	REAL	rw	P1.999.0.0 ... 2
11267.0	IPO mode position	LINT	ro	P1.1140.0.0
11268.0	IPO mode velocity	REAL	ro	P1.1141.0.0
11269.0	IPO mode acceleration	REAL	ro	P1.1142.0.0
11270.0	IPO mode jerk	REAL	ro	P1.1143.0.0
11271.0	IPO mode torque	REAL	ro	P1.1144.0.0
11272.0	IPO mode current	REAL	ro	P1.1145.0.0
11273.0	IPO mode active	UDINT	ro	P1.1146.0.0
11274.0	Next IPO mode	UDINT	ro	P1.1147.0.0
11275.0	Actual IPO mode	UDINT	ro	P1.1148.0.0

PNU	Name	Data type	Access	Parameter
11276.0	Status next IPO mode	UDINT	ro	P1.1149.0.0
11277.0	Actual user unit	UDINT	ro	P1.1150.0.0
11278.0	Selection of next user unit	UDINT	rw	P1.1151.0.0
11279.0	User unit status	UDINT	ro	P1.1152.0.0
11280.0	Actual torque constant	REAL	ro	P1.1153.0.0
11281.0	Actual pole pairs	UDINT	ro	P1.1154.0.0
11282.0 ... 2	Actual denominator gear unit	REAL	ro	P1.1155.0.0 ... 2
11283.0 ... 2	Actual numerator gear unit	REAL	ro	P1.1156.0.0 ... 2
11284.0 ... 2	Actual numerator feed constant	REAL	ro	P1.1157.0.0 ... 2
11285.0 ... 2	Actual denominator feed constant	REAL	ro	P1.1158.0.0 ... 2
11286.0	Diagnostic category: User unit error	UINT	ro	P1.1159.0.0
11287.0	Reversing direction of motion	BOOL	rw	P1.1170.0.0
11288.0 ... 2	Invert encoder signal	BOOL	rw	P1.1171.0.0 ... 2
11289.0	Phase rotation	BOOL	rw	P1.1172.0.0
11290.0	Reversing the direction of rotation validation status	BOOL	ro	P1.1173.0.0
11292.0	Validation status of phase rotation	BOOL	ro	P1.1175.0.0
11293.0	Database ID of axis	UDINT	rw	P1.1191.0.0
11294.0 ... 49	Order code Axis	STRING(50)	rw	P1.1192.0.0 ... 49
11295.0	Load weight / load inertia	REAL	rw	P1.1193.0.0
11296.0	Feed constant numerator	UDINT	rw	P1.1194.0.0
11297.0	Feed constant denominator	UDINT	rw	P1.1195.0.0
11298.0	Working stroke	LINT	rw	P1.1196.0.0
11299.0	Design axis	UDINT	rw	P1.1197.0.0
11300.0	Length connecting shaft	REAL	rw	P1.1198.0.0
11301.0	Maximum driving torque axis	REAL	rw	P1.1199.0.0
11302.0	Database ID of mounting kit	UDINT	rw	P1.1200.0.0
11303.0 ... 36	Order code mounting kit	STRING(37)	rw	P1.1201.0.0 ... 36
11304.0	Database ID connecting shaft / coupling	UDINT	rw	P1.1202.0.0
11305.0 ... 36	Order code connecting shaft / coupling	STRING(37)	rw	P1.1203.0.0 ... 36
11306.0	Database ID cable set	UDINT	rw	P1.1204.0.0
11307.0 ... 36	Order code cable set	STRING(37)	rw	P1.1205.0.0 ... 36
11308.0	Length motor cable	REAL	rw	P1.1206.0.0
11309.0	Status device configured	BOOL	rw	P1.1207.0.0
11310.0	Cable cross section	REAL	rw	P1.1208.0.0
11311.0	Actual velocity value encoder channel 1	REAL	ro	P1.1210.0.0
11313.0	Electrical angle	UDINT	ro	P1.1212.0.0
11314.0	Electrical angular frequency	REAL	ro	P1.1213.0.0
11317.0	Database ID gear unit 1	UDINT	rw	P1.1230.0.0
11318.0 ... 36	Order code gear unit 1	STRING(37)	rw	P1.1231.0.0 ... 36
11319.0	Conversion factor gear unit 1 numerator	UDINT	rw	P1.1232.0.0
11320.0	Conversion factor gear unit 1 denominator	UDINT	rw	P1.1233.0.0
11321.0	Database ID gear unit 2	UDINT	rw	P1.1234.0.0
11322.0 ... 36	Order code gear unit 2	STRING(37)	rw	P1.1235.0.0 ... 36
11323.0	Conversion factor gear unit 2 numerator	UDINT	rw	P1.1236.0.0
11324.0	Conversion factor gear unit 2 denominator	UDINT	rw	P1.1237.0.0
11325.0	Database ID gear unit 3	UDINT	rw	P1.1238.0.0

PNU	Name	Data type	Access	Parameter
11326.0 ... 36	Order code gear unit 3	STRING(37)	rw	P1.1239.0.0 ... 36
11327.0	Conversion factor gear unit 3 numerator	UDINT	rw	P1.1240.0.0
11328.0	Conversion factor gear unit 3 denominator	UDINT	rw	P1.1241.0.0
11329.0	Total conversion factor gear unit numerator	UDINT	rw	P1.1242.0.0
11330.0	Total conversion factor gear unit denominator	UDINT	rw	P1.1243.0.0
11331.0	Velocity limitation status	BOOL	ro	P1.1301.0.0
11332.0	Acceleration limitation status	BOOL	ro	P1.1302.0.0
11333.0	Torque limitation status	BOOL	ro	P1.1303.0.0
11334.0	Limit value velocity limit positive and negative direction of movement	REAL	rw	P1.1304.0.0
11335.0	Upper limit value acceleration limitation	REAL	rw	P1.1305.0.0
11336.0	Upper limit value deceleration limitation	REAL	rw	P1.1306.0.0
11337.0	Upper limit torque limitation	REAL	rw	P1.1307.0.0
11338.0	Lower limit torque limitation	REAL	rw	P1.1308.0.0
11339.0	Mileage 1	LINT	rw	P1.1411.0.0
11343.0	Mileage warning threshold	LINT	rw	P1.1417.0.0
11344.0	Diagnostic category: Mileage warning threshold reached	UINT	rw	P1.1419.0.0
11345.0	Load change counter 1	LINT	rw	P1.1421.0.0
11349.0	Warning threshold load change counter	LINT	rw	P1.1427.0.0
11350.0	Diagnostic category: Load change warning threshold reached	UINT	rw	P1.1429.0.0
11351.0	Jog duration 1 movement	REAL	rw	P1.1510.0.0
11352.0	Slow jog 1 velocity	REAL	rw	P1.1511.0.0
11353.0	Slow jog 1 acceleration	REAL	rw	P1.1512.0.0
11354.0	Slow jog 1 jerk	REAL	rw	P1.1513.0.0
11355.0	Fast jog 1 velocity	REAL	rw	P1.1514.0.0
11356.0	Fast jog 1 acceleration	REAL	rw	P1.1515.0.0
11357.0	Fast jog 1 jerk	REAL	rw	P1.1516.0.0
11358.0	Current ramp	REAL	rw	P1.1555.0.0
11359.0	Conversion factor torque	REAL	rw	P1.1556.0.0
11371.0	Storage option: Task ignored as device not ready	USINT	rw	P1.1733.0.0
11380.0 ... 127	Command record type	UDINT	rw	P1.1810.0.0 ... 127
11381.0 ... 127	Record number	DINT	rw	P1.1811.0.0 ... 127
11382.0 ... 127	Record table field 1	LINT	rw	P1.1812.0.0 ... 127
11383.0 ... 127	Record table field 2	LINT	rw	P1.1813.0.0 ... 127
11384.0 ... 127	Record table field 3	LINT	rw	P1.1814.0.0 ... 127
11385.0 ... 127	Record table field 4	LINT	rw	P1.1815.0.0 ... 127
11386.0 ... 127	Record table field 5	LINT	rw	P1.1816.0.0 ... 127
11387.0 ... 127	Record table field 6	LINT	rw	P1.1817.0.0 ... 127
11388.0 ... 127	Record table field 7	LINT	rw	P1.1818.0.0 ... 127
11389.0 ... 127	Record step enabling type	UDINT	rw	P1.1831.0.0 ... 127
11390.0 ... 127	Record sequencing record number start	DINT	rw	P1.1832.0.0 ... 127
11391.0 ... 127	Record sequencing record number target	DINT	rw	P1.1833.0.0 ... 127
11392.0 ... 127	Record sequencing field time	REAL	rw	P1.1834.0.0 ... 127
11393.0 ... 127	Record sequencing field 1	LINT	rw	P1.1835.0.0 ... 127
11394.0 ... 127	Record sequencing field 2	LINT	rw	P1.1836.0.0 ... 127
11395.0	Actual record table index	DINT	ro	P1.1837.0.0

PNU	Name	Data type	Access	Parameter
11396.0 ... 127	Selection start condition record	UDINT	rw	P1.1838.0.0 ... 127
11397.0	Maximum number record links	UDINT	ro	P1.1839.0.0
11398.0	Activate Event table	BOOL	rw	P1.1840.0.0
11399.0 ... 15	Event type	UDINT	rw	P1.1841.0.0 ... 15
11400.0 ... 15	Next event target	DINT	rw	P1.1842.0.0 ... 15
11401.0 ... 15	Next event field time	REAL	rw	P1.1843.0.0 ... 15
11402.0 ... 15	Next event field 1	LINT	rw	P1.1844.0.0 ... 15
11403.0 ... 15	Next event field 2	LINT	rw	P1.1845.0.0 ... 15
11404.0	Status of record table	UDINT	ro	P1.1846.0.0
11405.0	Diagnostic category: Record table incorrect	UINT	rw	P1.1850.0.0
11406.0	Storage option: Record table incorrect	USINT	rw	P1.1851.0.0
11407.0	Diagnostic category: Invalid record table parameter	UINT	rw	P1.1852.0.0
11408.0	Storage option: Invalid record table parameter	USINT	rw	P1.1853.0.0
11409.0 ... 2	Velocity controller amplification gain	REAL	rw	P1.2210.0.0 ... 2
11410.0 ... 2	Velocity controller integration constant	REAL	rw	P1.2211.0.0 ... 2
11411.0	Velocity control error	REAL	ro	P1.2215.0.0
11412.0	Setpoint value velocity controller	REAL	ro	P1.2216.0.0
11413.0	Position control error	LINT	ro	P1.2217.0.0
11414.0	Minimum torque	REAL	ro	P1.2218.0.0
11415.0	Maximum torque	REAL	ro	P1.2219.0.0
11416.0	Setpoint value torque	REAL	ro	P1.2220.0.0
11419.0 ... 2	Current controller amplification gain (active current)	REAL	rw	P1.2223.0.0 ... 2
11420.0 ... 2	Integration constant current controller (active current)	REAL	rw	P1.2224.0.0 ... 2
11421.0 ... 2	Current controller amplification gain (reactive current)	REAL	rw	P1.2225.0.0 ... 2
11422.0 ... 2	Integration constant current controller (reactive current)	REAL	rw	P1.2226.0.0 ... 2
11423.0 ... 2	Total inertia	REAL	rw	P1.2227.0.0 ... 2
11424.0 ... 2	Velocity filter time constant	REAL	rw	P1.2228.0.0 ... 2
11425.0 ... 2	Load weight / load inertia	REAL	rw	P1.2229.0.0 ... 2
11426.0	Unlimited axis	BOOL	rw	P1.2424.0.0
11427.0 ... 1	Power unit dataset major version	STRING(2)	ro	P1.2800.0.0 ... 1
11428.0	Minor version power unit dataset	UINT	ro	P1.2801.0.0
11437.0	Lower limit value minimum DC link voltage	REAL	ro	P1.2818.0.0
11438.0	Upper limit value minimum DC link voltage	REAL	ro	P1.2819.0.0
11445.0	Potential difference brake chopper ON	REAL	ro	P1.2829.0.0
11446.0	Hysteresis brake chopper ON/OFF	REAL	ro	P1.2830.0.0
11451.0	Lower limit value resistance value external braking resistor	REAL	ro	P1.2835.0.0
11452.0	Upper limit value resistance value external braking resistor	REAL	ro	P1.2836.0.0
11453.0	Nominal power external braking resistor	REAL	ro	P1.2837.0.0
11454.0	Maximum pulse energy external braking resistor	REAL	ro	P1.2838.0.0
11465.0	Upper limit value power output stage temperature	REAL	ro	P1.2850.0.0
11466.0	Lower limit value power output stage temperature	REAL	ro	P1.2851.0.0
11467.0	Upper limit value servo drive temperature	REAL	ro	P1.2852.0.0
11468.0	Lower limit value servo drive temperature	REAL	ro	P1.2853.0.0
11498.0	Setpoint generator output position	LINT	ro	P1.3010.0.0
11499.0	Setpoint generator output velocity	REAL	ro	P1.3011.0.0
11500.0	Setpoint generator output acceleration	REAL	ro	P1.3012.0.0

PNU	Name	Data type	Access	Parameter
11501.0	Setpoint generator output jerk	REAL	ro	P1.3013.0.0
11502.0	Setpoint generator output torque	REAL	ro	P1.3014.0.0
11503.0	Setpoint generator output current	REAL	ro	P1.3015.0.0
11504.0	Setpoint generator input relative target position	LINT	ro	P1.3016.0.0
11505.0	Setpoint generator input relative target velocity	REAL	ro	P1.3017.0.0
11506.0	Status setpoint generator	UDINT	ro	P1.3018.0.0
11542.0	Activation of open loop operation	BOOL	rw	P1.4001.0.0
11544.0	Control structure of open loop operation	UDINT	rw	P1.4003.0.0
11545.0	Active control structure	UDINT	ro	P1.4004.0.0
11546.0	Selection of mode of operation open loop/closed loop	UDINT	rw	P1.4005.0.0
11547.0	Selection of mode of operation	UDINT	rw	P1.4006.0.0
11548.0	Active mode of operation	UDINT	ro	P1.4007.0.0
11549.0	Velocity switching threshold	REAL	rw	P1.4008.0.0
11551.0	Current rise time	REAL	rw	P1.4010.0.0
11552.0	Diagnostic category: Change of control structure not permissible	UINT	rw	P1.4020.0.0
11553.0	Storage option: Change of control structure not permissible	USINT	rw	P1.4021.0.0
11558.0	Current reduction activation	BOOL	rw	P1.4026.0.0
11559.0	Current reduction delay time	REAL	rw	P1.4027.0.0
11560.0	Current reduction scaling factor	REAL	rw	P1.4028.0.0
11564.0	Maximum failure Sign of Life	UINT	rw	P1.4243.0.0
11565.0	Monitoring window target velocity	REAL	rw	P1.4610.0.0
11566.0	Monitoring window target torque	REAL	rw	P1.4611.0.0
11567.0	Diagnostic category: Target position reached	UINT	rw	P1.4612.0.0
11568.0	Storage option: Target position reached	USINT	rw	P1.4613.0.0
11569.0	Diagnostic category: Target velocity reached	UINT	rw	P1.4614.0.0
11570.0	Storage option: Target velocity reached	USINT	rw	P1.4615.0.0
11571.0	Diagnostic category: Target torque reached	UINT	rw	P1.4616.0.0
11572.0	Storage option: Target torque reached	USINT	rw	P1.4617.0.0
11573.0	Diagnostic category: Standstill reached	UINT	rw	P1.4618.0.0
11574.0	Storage option: Standstill reached	USINT	rw	P1.4619.0.0
11575.0	Diagnostic category: Standstill reached and in standstill window	UINT	rw	P1.4620.0.0
11576.0	Storage option: Standstill reached and in standstill window	USINT	rw	P1.4621.0.0
11577.0	Diagnostic category: Position: following error	UINT	rw	P1.4622.0.0
11578.0	Storage option: Position: following error	USINT	rw	P1.4623.0.0
11579.0	Diagnostic category: Velocity: following error	UINT	rw	P1.4624.0.0
11580.0	Storage option: Velocity: following error	USINT	rw	P1.4625.0.0
11581.0	Stop detection limit value	REAL	rw	P1.4626.0.0
11582.0	Damping time limit detection	REAL	rw	P1.4627.0.0
11583.0	Software limit positions active	BOOL	rw	P1.4628.0.0
11584.0	Negative software limit position	LINT	rw	P1.4629.0.0
11585.0	Positive software limit position	LINT	rw	P1.4630.0.0
11586.0	Activation of automatic stop ramp software limit position	BOOL	rw	P1.4631.0.0
11587.0	Diagnostic category: Negative software limit position	UINT	rw	P1.4632.0.0

PNU	Name	Data type	Access	Parameter
11588.0	Storage option: Negative software limit position	USINT	rw	P1.4633.0.0
11589.0	Diagnostic category: Positive software limit position	UINT	rw	P1.4634.0.0
11590.0	Storage option: Positive software limit position	USINT	rw	P1.4635.0.0
11591.0	Diagnostic category: Limitation negative direction	UINT	rw	P1.4636.0.0
11592.0	Storage option: Limitation negative direction	USINT	rw	P1.4637.0.0
11593.0	Diagnostic category: Limitation positive direction	UINT	rw	P1.4638.0.0
11594.0	Storage option: Limitation positive direction	USINT	rw	P1.4639.0.0
11602.0	Diagnostic category: Fixed stop not detected	UINT	rw	P1.4647.0.0
11603.0	Storage option: Fixed stop not detected	USINT	rw	P1.4648.0.0
11604.0	Diagnostic category: Monitoring window of fixed stop left	UINT	rw	P1.4649.0.0
11605.0	Storage option: Monitoring window of fixed stop left	USINT	rw	P1.4650.0.0
11606.0	Maximum velocity	REAL	rw	P1.4660.0.0
11607.0	Diagnostic category: Velocity too high	UINT	rw	P1.4661.0.0
11609.0	Monitoring window pushback	REAL	rw	P1.4663.0.0
11610.0	Damping time pushback	REAL	rw	P1.4664.0.0
11611.0	Damping time target range	REAL	rw	P1.4665.0.0
11612.0	Monitoring window target position	REAL	rw	P1.4666.0.0
11613.0	Monitoring window velocity	REAL	rw	P1.4667.0.0
11614.0	Monitoring window torque	REAL	rw	P1.4668.0.0
11615.0	Diagnostic category: Out of target range	UINT	rw	P1.4669.0.0
11616.0	Storage option: Out of target range	USINT	rw	P1.4670.0.0
11617.0	Diagnostic category: Reverse feed monitoring	UINT	rw	P1.4671.0.0
11618.0	Storage option: Reverse feed monitoring	USINT	rw	P1.4672.0.0
11619.0	Activation of automatic stop ramp stroke limit	BOOL	rw	P1.4675.0.0
11620.0	Diagnostic category: Negative stroke limit reached	UINT	rw	P1.4676.0.0
11621.0	Storage option: Negative stroke limit reached	USINT	rw	P1.4677.0.0
11622.0	Diagnostic category: Positive stroke limit reached	UINT	rw	P1.4678.0.0
11623.0	Storage option: Positive stroke limit reached	USINT	rw	P1.4679.0.0
11624.0	Actual position: following error	REAL	ro	P1.4682.0.0
11625.0	Actual velocity: following error	REAL	ro	P1.4683.0.0
11626.0	Actual stroke value	LINT	ro	P1.4684.0.0
11627.0	Limit value remaining distance monitoring	LINT	rw	P1.4685.0.0
11628.0	Diagnostic category: Residual distance too low	UINT	rw	P1.4686.0.0
11629.0	Storage option: Residual distance too low	USINT	rw	P1.4687.0.0
11630.0	Bit mask movement monitoring	UDINT	rw	P1.4688.0.0
11631.0	Movement monitoring (masked)	UDINT	ro	P1.4689.0.0
11632.0	Damping time velocity: following error	REAL	rw	P1.4690.0.0
11633.0	Diagnostic category: Trajectory completed	UINT	rw	P1.4691.0.0
11634.0	Storage option: Trajectory completed	USINT	rw	P1.4692.0.0
11635.0	Fixed stop detection damping time	REAL	rw	P1.4693.0.0
11636.0	Limit value following error	REAL	rw	P1.4694.0.0
11640.0	Resulting lower limit value velocity (closed loop controller)	REAL	ro	P1.6100.0.0
11641.0	Resulting upper limit value velocity (closed loop controller)	REAL	ro	P1.6101.0.0
11644.0	Resulting lower limit value torque (closed loop controller)	REAL	ro	P1.6104.0.0
11645.0	Resulting upper limit value torque (closed loop controller)	REAL	ro	P1.6105.0.0
11646.0	Diagnostic category: Torque control limitation invalid	UINT	rw	P1.6106.0.0

PNU	Name	Data type	Access	Parameter
11648.0	Resulting lower limit value active current (closed loop controller)	REAL	ro	P1.6108.0.0
11649.0	Resulting upper limit value active current (closed loop controller)	REAL	ro	P1.6109.0.0
11650.0	Diagnostic category: Current control limitation invalid	UINT	rw	P1.6110.0.0
11652.0	Resulting upper limit value total current (closed loop controller)	REAL	ro	P1.6112.0.0
11655.0	Actual value I²t monitoring power output stage	REAL	ro	P1.6310.0.0
11656.0	Scaling factor warning limit I²t monitoring power output stage	REAL	rw	P1.6311.0.0
11657.0	Scaling factor start value I²t monitoring power output stage at standstill	REAL	ro	P1.6313.0.0
11658.0	Limit value I²t monitoring power output stage at standstill	REAL	ro	P1.6314.0.0
11659.0	Scaling factor maximum value after drive at standstill	REAL	ro	P1.6315.0.0
11660.0	Actual value I²t monitoring power output stage at standstill	REAL	ro	P1.6316.0.0
11661.0	Scaling factor warning limit I²t monitoring drive at standstill	REAL	rw	P1.6317.0.0
11662.0	Diagnostic category: I²t monitoring: motor warning limit	UINT	rw	P1.6319.0.0
11663.0	Storage option: I²t monitoring: motor warning limit	USINT	rw	P1.6320.0.0
11664.0	Diagnostic category: I²t monitoring: motor error limit	UINT	rw	P1.6321.0.0
11665.0	Storage option: I²t monitoring: motor error limit	USINT	rw	P1.6322.0.0
11666.0	Diagnostic category: I²t monitoring: output stage warning limit	UINT	rw	P1.6323.0.0
11667.0	Storage option: I²t monitoring: output stage warning limit	USINT	rw	P1.6324.0.0
11668.0	Diagnostic category: I²t monitoring: output stage error limit	UINT	rw	P1.6325.0.0
11669.0	Storage option: I²t monitoring: output stage error limit	USINT	rw	P1.6326.0.0
11670.0	Diagnostic category: I²t monitoring: output stage v0 warning limit	UINT	rw	P1.6327.0.0
11671.0	Storage option: I²t monitoring: output stage v0 warning limit	USINT	rw	P1.6328.0.0
11672.0	Diagnostic category: I²t monitoring: output stage v0 error limit	UINT	rw	P1.6329.0.0
11673.0	Storage option: I²t monitoring: output stage v0 error limit	USINT	rw	P1.6330.0.0
11674.0	Actual value relative I²t monitoring of motor to limit	REAL	ro	P1.6331.0.0
11675.0	Actual value relative I²t monitoring of power output stage to limit	REAL	ro	P1.6332.0.0
11676.0	Actual value relative I²t monitoring of power output stage at standstill to limit	REAL	ro	P1.6333.0.0
11677.0	Actual value I²t monitoring of the total current	REAL	ro	P1.6334.0.0
11682.0	Acceleration	REAL	rw	P1.6691.0.0
11683.0	Jerk	REAL	rw	P1.6692.0.0
11684.0	Monitoring window angle	REAL	rw	P1.6693.0.0
11685.0	Factor current setpoint value	REAL	rw	P1.6694.0.0
11686.0	Motor inertia (user defined)	REAL	rw	P1.7111.0.0
11687.0	Actual motor inertia	REAL	ro	P1.7112.0.0
11688.0	Phase sequence (user defined)	BOOL	rw	P1.7114.0.0
11689.0	Actual phase sequence	BOOL	ro	P1.7115.0.0
11690.0	Nominal current (user defined)	REAL	rw	P1.7117.0.0
11691.0	Actual nominal current	REAL	rw	P1.7118.0.0

PNU	Name	Data type	Access	Parameter
11692.0	Maximum peak current (user defined)	REAL	rw	P1.7120.0.0
11693.0	Actual maximum current	REAL	ro	P1.7121.0.0
11694.0	Maximum rpm (user defined)	REAL	rw	P1.7123.0.0
11695.0	Actual maximum velocity	REAL	ro	P1.7124.0.0
11696.0	Nominal rotary velocity (user defined)	REAL	rw	P1.7126.0.0
11697.0	Actual nominal velocity	REAL	ro	P1.7127.0.0
11698.0	Winding inductance (user defined)	REAL	rw	P1.7129.0.0
11699.0	Actual winding inductance	REAL	ro	P1.7130.0.0
11700.0	Winding resistance (user defined)	REAL	rw	P1.7132.0.0
11701.0	Actual winding resistance	REAL	ro	P1.7133.0.0
11702.0	Torque constant (user defined)	REAL	rw	P1.7135.0.0
11703.0	Actual torque constant	REAL	ro	P1.7136.0.0
11704.0	Resulting nominal torque	REAL	ro	P1.7139.0.0
11705.0	Resulting maximum torque	REAL	ro	P1.7142.0.0
11706.0	Time constant I^2t (user defined)	REAL	rw	P1.7144.0.0
11707.0	Actual time constant I^2t	REAL	ro	P1.7145.0.0
11708.0	Winding temperature (user defined)	REAL	rw	P1.7147.0.0
11709.0	Actual winding temperature	REAL	ro	P1.7148.0.0
11710.0	Temperature sensor (user defined)	UDINT	rw	P1.7153.0.0
11711.0	Actual temperature sensor motor	UDINT	ro	P1.7154.0.0
11712.0 ... 1	Temperature sensor characteristic (user defined)	REAL	rw	P1.7156.0.0 ... 1
11713.0 ... 1	Actual temperature sensor characteristic motor	REAL	ro	P1.7157.0.0 ... 1
11714.0	Holding brake (user defined)	BOOL	rw	P1.7159.0.0
11715.0	Holding brake	BOOL	ro	P1.7160.0.0
11716.0	Switch-on delay holding brake 1 (user defined)	REAL	rw	P1.7162.0.0
11717.0	Actual switch-on delay holding brake 1	REAL	ro	P1.7163.0.0
11718.0	Switch-off delay holding brake 1 (user defined)	REAL	rw	P1.7165.0.0
11719.0	Actual switch-off delay holding brake 1	REAL	ro	P1.7166.0.0
11720.0 ... 31	Order code motor (user defined)	STRING(32)	rw	P1.7182.0.0 ... 31
11721.0	Database ID motor (user defined)	UDINT	rw	P1.7184.0.0
11722.0 ... 31	Actual order code motor	STRING(32)	ro	P1.7188.0.0 ... 31
11723.0	Actual database ID motor	UDINT	ro	P1.7189.0.0
11724.0	Resolution position	SINT	rw	P1.7841.0.0
11725.0	Resolution velocity	SINT	rw	P1.7842.0.0
11726.0	Resolution acceleration	SINT	rw	P1.7843.0.0
11727.0	Resolution jerk	SINT	rw	P1.7844.0.0
11728.0	Move to axis zero point setpoint acceleration	REAL	rw	P1.8410.0.0
11729.0	Search for move to axis zero point setpoint jerk	REAL	rw	P1.8411.0.0
11730.0	Maximum search stroke in positive direction	LINT	rw	P1.8412.0.0
11731.0	Maximum search stroke in negative direction	LINT	rw	P1.8413.0.0
11732.0	Nominal current limit value scaling factor	REAL	rw	P1.8414.0.0
11733.0	Limit position detection time monitoring window	REAL	rw	P1.8415.0.0
11734.0	Axis zero point offset	LINT	rw	P1.8416.0.0
11735.0	Referencing method	DINT	rw	P1.8417.0.0
11736.0	Status state machine homing	UDINT	ro	P1.8418.0.0
11742.0	Diagnostic category: Configuration of homing run invalid	UINT	rw	P1.8450.0.0

PNU	Name	Data type	Access	Parameter
11743.0	Storage option: Configuration of homing run invalid	USINT	rw	P1.8451.0.0
11744.0	Diagnostic category: Homing: Timeout	UINT	rw	P1.8452.0.0
11745.0	Storage option: Homing: Timeout	USINT	rw	P1.8453.0.0
11746.0	Diagnostic category: Homing: Search path exceeded	UINT	rw	P1.8454.0.0
11747.0	Storage option: Homing: Search path exceeded	USINT	rw	P1.8455.0.0
11748.0	Result of position controller amplification gain	REAL	rw	P1.8601.0.0
11749.0	Result of velocity controller integration constant	REAL	rw	P1.8602.0.0
11750.0	Result of velocity controller amplification gain	REAL	rw	P1.8603.0.0
11752.0	Storage option: Transmission of auto tuning measured values failed	USINT	rw	P1.8605.0.0
11753.0	Start value position controller amplification gain	REAL	rw	P1.8611.0.0
11754.0	Start value velocity controller amplification gain	REAL	rw	P1.8612.0.0
11755.0	Start value velocity controller integration constant	REAL	rw	P1.8613.0.0
11756.0	Filter time constant velocity controller	REAL	rw	P1.8614.0.0
11757.0	Filter time constant noise signal generator	REAL	rw	P1.8615.0.0
11758.0	Noise signal generator amplification gain	REAL	rw	P1.8616.0.0
11759.0	Signal selection noise signal generator	USINT	rw	P1.8617.0.0
11760.0	Time delay noise signal for the start identification	REAL	rw	P1.8618.0.0
11761.0	Identification with movement	BOOL	rw	P1.8619.0.0
11762.0	Number of identifications for averaging	USINT	rw	P1.8620.0.0
11763.0	Maximum movement stroke during the identification	LINT	rw	P1.8621.0.0
11764.0	Maximum velocity during the identification	REAL	rw	P1.8622.0.0
11765.0	Maximum acceleration during the identification	REAL	rw	P1.8623.0.0
11766.0	Maximum deceleration during the identification	REAL	rw	P1.8624.0.0
11767.0	Maximum jerk during the identification	REAL	rw	P1.8625.0.0
11768.0	Number of validation movements	USINT	rw	P1.8630.0.0
11769.0	Movement stroke during validation movement	LINT	rw	P1.8631.0.0
11770.0	Maximum velocity during validation movement	REAL	rw	P1.8632.0.0
11771.0	Maximum acceleration during validation movement	REAL	rw	P1.8633.0.0
11772.0	Maximum deceleration during validation movement	REAL	rw	P1.8634.0.0
11773.0	Maximum jerk during validation movement	REAL	rw	P1.8635.0.0
11782.0	Hysteresis upper limit value warning threshold motor temperature	REAL	rw	P1.9410.0.0
11783.0	Upper limit value motor temperature	REAL	rw	P1.9411.0.0
11784.0	Hysteresis upper limit value motor temperature	REAL	rw	P1.9412.0.0
11785.0	Diagnostic category: Warning threshold: Insufficient temperature in motor	UINT	rw	P1.9413.0.0
11786.0	Storage option: Warning threshold: Insufficient temperature in motor	USINT	rw	P1.9414.0.0
11787.0	Diagnostic category: Insufficient temperature in motor	UINT	rw	P1.9415.0.0
11788.0	Storage option: Insufficient temperature in motor	USINT	rw	P1.9416.0.0
11789.0	Diagnostic category: Warning threshold: Motor overtemperature	UINT	rw	P1.9417.0.0
11790.0	Storage option: Warning threshold: Motor overtemperature	USINT	rw	P1.9418.0.0
11791.0	Diagnostic category: Motor overtemperature	UINT	rw	P1.9419.0.0
11792.0	Storage option: Motor overtemperature	USINT	rw	P1.9420.0.0
11793.0	Active encoder temperature monitoring motor	UDINT	ro	P1.9421.0.0

PNU	Name	Data type	Access	Parameter
11794.0	Activation analog input	BOOL	rw	P1.9910.0.0
11795.0	Alternative setpoint value	REAL	rw	P1.9911.0.0
11796.0	Setpoint value analog input	REAL	ro	P1.9912.0.0
11797.0	Diagnostic category: Analog setpoint specification limit exceeded	UINT	rw	P1.9913.0.0
11798.0	Storage option: Analog setpoint specification limit exceeded	USINT	rw	P1.9914.0.0
11800.0	Device status IO	UDINT	ro	P1.10231.0.0
11801.0	Controller enable selection	UDINT	rw	P1.10232.0.0
11802.0	Controller enable operating mode	UDINT	rw	P1.10234.0.0
11803.0	Target velocity for controller enable (velocity operation)	REAL	rw	P1.10235.0.0
11804.0	Target torque for controller enable (torque operation)	REAL	rw	P1.10236.0.0
11805.0	Maximum velocity for controller enable (torque operation)	REAL	rw	P1.10237.0.0
11806.0	Index for controller enable	DINT	rw	P1.10238.0.0
11807.0	Request directional lock	DINT	rw	P1.10351.0.0
11808.0	Active directional lock	DINT	ro	P1.10352.0.0
11809.0	Status directional lock	DINT	ro	P1.10353.0.0
11812.0	Default value target position	LINT	rw	P1.10361.0.0
11813.0	Default value maximum velocity	REAL	rw	P1.10362.0.0
11814.0	Default value maximum acceleration	REAL	rw	P1.10363.0.0
11815.0	Default value maximum deceleration	REAL	rw	P1.10364.0.0
11816.0	Default value maximum jerk	REAL	rw	P1.10365.0.0
11817.0	Default value target velocity	REAL	rw	P1.10366.0.0
11818.0	Default value activation stroke limitation	BOOL	rw	P1.10367.0.0
11819.0	Default value negative stroke limit	LINT	rw	P1.10368.0.0
11820.0	Default value positive stroke limit	LINT	rw	P1.10369.0.0
11821.0	Default value target torque	REAL	rw	P1.10370.0.0
11822.0	Default value Torque rise ramp	REAL	rw	P1.10371.0.0
11823.0	IPO mode (status)	UDINT	ro	P1.11410.0.0
11824.0	Interpolation step size	UDINT	ro	P1.11411.0.0
11827.0	Timing tolerance	DINT	ro	P1.11417.0.0
11828.0	Interpolation step loss counter	DINT	ro	P1.11418.0.0
11829.0	Storage option: User unit error	USINT	rw	P1.11590.0.0
11834.0	Deceleration Stop ramp	REAL	rw	P1.12101.0.0
11835.0	Jerk Stop ramp	REAL	rw	P1.12111.0.0
11836.0	Stop ramp velocity	REAL	rw	P1.12112.0.0
11837.0	Stop position	LINT	ro	P1.12201.0.0
11838.0	Stop ramp time	REAL	ro	P1.12202.0.0
11841.0	Status Stop ramp	UDINT	ro	P1.12205.0.0
11842.0	Factor extrapolation stop ramp	REAL	rw	P1.12206.0.0
11843.0	Storage option: Mileage warning threshold reached	USINT	rw	P1.14110.0.0
11844.0	Mileage error threshold	LINT	rw	P1.14111.0.0
11845.0	Diagnostic category: Mileage error threshold reached	UINT	rw	P1.14113.0.0
11846.0	Storage option: Mileage error threshold reached	USINT	rw	P1.14114.0.0
11847.0	Storage option: Load change warning threshold reached	USINT	rw	P1.14210.0.0
11848.0	Error threshold load change counter	LINT	rw	P1.14211.0.0
11849.0	Diagnostic category: Load change error threshold reached	UINT	rw	P1.14213.0.0

PNU	Name	Data type	Access	Parameter
11850.0	Storage option: Load change error threshold reached	USINT	rw	P1.14214.0.0
11851.0 ... 7	Drive object data	UINT	ro	P1.24124.0.0 ... 7
11852.0 ... 5	Drive unit data	UINT	ro	P1.24125.0.0 ... 5
11853.0 ... 1	Assignment controller enable	UINT	ro	P1.24126.0.0 ... 1
11857.0	Upper limit value minimum load voltage	REAL	ro	P1.28120.0.0
11858.0	Lower limit value minimum load voltage	REAL	ro	P1.28121.0.0
11859.0	Upper limit value maximum load voltage	REAL	ro	P1.28130.0.0
11860.0	Lower limit value maximum load voltage	REAL	ro	P1.28131.0.0
11861.0	Lower limit value maximum DC link voltage	REAL	ro	P1.28180.0.0
11862.0	Upper limit value maximum DC link voltage	REAL	ro	P1.28181.0.0
11863.0	Upper limit value warning threshold maximum DC link voltage	REAL	ro	P1.28200.0.0
11864.0	Lower limit value warning threshold maximum DC link voltage	REAL	ro	P1.28201.0.0
11868.0	Upper limit value brake chopper ON	REAL	ro	P1.28280.0.0
11869.0	Lower limit value brake chopper ON	REAL	ro	P1.28281.0.0
11872.0	Diagnostic category: Trajectory generator error	UINT	rw	P1.30127.0.0
11873.0	Storage option: Trajectory generator error	USINT	rw	P1.30128.0.0
11874.0	Monitoring window factor	REAL	rw	P1.30129.0.0
11889.0	Velocity limitation active	BOOL	ro	P1.52675.0.0
11890.0	Current limitation active	BOOL	ro	P1.52676.0.0
11891.0	Diagnostic category: Limit for velocity or current active	UINT	rw	P1.52677.0.0
11892.0	Storage option: Limit for velocity or current active	USINT	rw	P1.52678.0.0
11893.0	Voltage limitation filter time constant	REAL	rw	P1.52679.0.0
11894.0	Voltage limitation Ud active	BOOL	ro	P1.52680.0.0
11895.0	Voltage limitation Uq active	BOOL	ro	P1.52681.0.0
11896.0	Diagnostic category: Voltage limitation active	UINT	rw	P1.52682.0.0
11897.0	Storage option: Voltage limitation active	USINT	rw	P1.52683.0.0
11898.0	UINT8	USINT	rw	P1.66003.0.0
11899.0	UINT16	UINT	rw	P1.66008.0.0
11900.0	UINT32	UDINT	rw	P1.66009.0.0
11901.0	INT8	SINT	rw	P1.66010.0.0
11902.0	INT16	INT	rw	P1.66012.0.0
11903.0	INT32	DINT	rw	P1.66013.0.0
11904.0	BOOL	BOOL	rw	P1.66015.0.0
11905.0 ... 4	UINT8 (Array)	USINT	rw	P1.66016.0.0 ... 4
11906.0 ... 4	UINT16 (Array)	UINT	rw	P1.66017.0.0 ... 4
11907.0 ... 4	UINT32 (Array)	UDINT	rw	P1.66018.0.0 ... 4
11908.0 ... 4	INT8 (Array)	SINT	rw	P1.66019.0.0 ... 4
11909.0 ... 4	INT16 (Array)	INT	rw	P1.66053.0.0 ... 4
11910.0 ... 4	INT32 (Array)	DINT	rw	P1.66055.0.0 ... 4
11911.0 ... 4	BOOL (Array)	BOOL	rw	P1.66056.0.0 ... 4
11916.0	Diagnostic value test 1	UINT	rw	P1.66061.0.0
11917.0	Diagnostic value test 2	UINT	rw	P1.66062.0.0
11918.0	Nominal motor voltage (user defined)	REAL	rw	P1.71421.0.0
11919.0	Actual nominal motor voltage	REAL	ro	P1.71422.0.0
11920.0	Continuous current (user defined)	REAL	rw	P1.71424.0.0

PNU	Name	Data type	Access	Parameter
11921.0	Actual continuous current	REAL	ro	P1.71425.0.0
11922.0	Actual Lq inductance	REAL	ro	P1.71426.0.0
11923.0	Actual Ld inductance	REAL	ro	P1.71427.0.0
11924.0	Actual motor type	USINT	ro	P1.71428.0.0
11925.0	Diagnostic category: Motor type is not supported	UINT	rw	P1.71429.0.0
11926.0	Lq inductance (user defined)	REAL	rw	P1.71430.0.0
11927.0	Ld inductance (user defined)	REAL	rw	P1.71431.0.0
11928.0	Motor type	USINT	rw	P1.71432.0.0
11929.0	Storage option: Motor type is not supported	USINT	rw	P1.71433.0.0
11930.0	Configure negative hardware limit switch	UDINT	rw	P1.101100.0.0
11931.0	Configure positive hardware limit switch	UDINT	rw	P1.101101.0.0
11932.0	Diagnostic category: Negative hardware limit switch reached	UINT	rw	P1.101102.0.0
11933.0	Storage option: Negative hardware limit switch reached	USINT	rw	P1.101103.0.0
11934.0	Diagnostic category: Limitation by negative hardware limit switch	UINT	rw	P1.101104.0.0
11935.0	Storage option: Limitation by negative hardware limit switch	USINT	rw	P1.101105.0.0
11936.0	Diagnostic category: Positive hardware limit switch reached	UINT	rw	P1.101106.0.0
11937.0	Storage option: Positive hardware limit switch reached	USINT	rw	P1.101107.0.0
11938.0	Diagnostic category: Limitation by positive hardware limit switch	UINT	rw	P1.101108.0.0
11939.0	Storage option: Limitation by positive hardware limit switch	USINT	rw	P1.101109.0.0
11940.0	Diagnostic category: Error: both hardware limit switches activated	UINT	rw	P1.101110.0.0
11941.0	Storage option: Error: both hardware limit switches activated	USINT	rw	P1.101111.0.0
11942.0	Negative hardware limit switch detected	BOOL	ro	P1.101112.0.0
11943.0	Positive hardware limit switch detected	BOOL	ro	P1.101113.0.0
11944.0	Negative limit switch position detected	LINT	ro	P1.101114.0.0
11945.0	Positive limit switch position detected	LINT	ro	P1.101115.0.0
11946.0	Activation of hardware limit switch monitoring	BOOL	rw	P1.101116.0.0
11947.0	Reference switch configuration	UDINT	rw	P1.101200.0.0
11948.0	Reference switch status	BOOL	ro	P1.101201.0.0
11949.0	Activation of field weakening	BOOL	rw	P1.102201.0.0
11950.0	Field weakening status	BOOL	ro	P1.102202.0.0
11960.0	Position trigger mode	UINT	rw	P1.112700.0.0
11961.0	Position trigger mode	UINT	rw	P1.112700.1.0
11962.0	Position trigger source	UINT	rw	P1.112701.0.0
11963.0	Position trigger source	UINT	rw	P1.112701.1.0
11964.0	Upper limit value modulo	LINT	rw	P1.112702.0.0
11965.0	Upper limit value modulo	LINT	rw	P1.112702.1.0
11966.0	Lower limit value modulo	LINT	rw	P1.112703.0.0
11967.0	Lower limit value modulo	LINT	rw	P1.112703.1.0
11968.0	Inactive time compensation of first switching point	REAL	rw	P1.112704.0.0
11969.0	Inactive time compensation of first switching point	REAL	rw	P1.112704.1.0

PNU	Name	Data type	Access	Parameter
11970.0	Inactive time compensation of second switching point	REAL	rw	P1.112705.0.0
11971.0	Inactive time compensation of second switching point	REAL	rw	P1.112705.1.0
11972.0	Hysteresis	LINT	rw	P1.112706.0.0
11973.0	Hysteresis	LINT	rw	P1.112706.1.0
11974.0	Switching time (manual)	REAL	rw	P1.112707.0.0
11975.0	Switching time (manual)	REAL	rw	P1.112707.1.0
11976.0 ... 3	Selection of switching function	UINT	rw	P1.112708.0.0 ... 3
11977.0 ... 3	Selection of switching function	UINT	rw	P1.112708.1.0 ... 3
11978.0 ... 3	Selection of switching characteristics	UINT	rw	P1.112709.0.0 ... 3
11979.0 ... 3	Selection of switching characteristics	UINT	rw	P1.112709.1.0 ... 3
11980.0 ... 3	First switching point	LINT	rw	P1.112710.0.0 ... 3
11981.0 ... 3	First switching point	LINT	rw	P1.112710.1.0 ... 3
11982.0 ... 3	Second switching point	LINT	rw	P1.112711.0.0 ... 3
11983.0 ... 3	Second switching point	LINT	rw	P1.112711.1.0 ... 3
11984.0 ... 3	Switching time (automatic)	REAL	rw	P1.112712.0.0 ... 3
11985.0 ... 3	Switching time (automatic)	REAL	rw	P1.112712.1.0 ... 3
11986.0	Actual Position Trigger mode	UINT	ro	P1.112713.0.0
11987.0	Actual Position Trigger mode	UINT	ro	P1.112713.1.0
11988.0	Actual Position Trigger source	UINT	ro	P1.112714.0.0
11989.0	Actual Position Trigger source	UINT	ro	P1.112714.1.0
11990.0	Actual upper limit value modulo	LINT	ro	P1.112715.0.0
11991.0	Actual upper limit value modulo	LINT	ro	P1.112715.1.0
11992.0	Actual lower limit value modulo	LINT	ro	P1.112716.0.0
11993.0	Actual lower limit value modulo	LINT	ro	P1.112716.1.0
11994.0	Actual inactive time first switching point	REAL	ro	P1.112717.0.0
11995.0	Actual inactive time first switching point	REAL	ro	P1.112717.1.0
11996.0	Actual inactive time second switching point	REAL	ro	P1.112718.0.0
11997.0	Actual inactive time second switching point	REAL	ro	P1.112718.1.0
11998.0	Actual hysteresis	LINT	ro	P1.112719.0.0
11999.0	Actual hysteresis	LINT	ro	P1.112719.1.0
12000.0	Actual switching time (manual)	REAL	ro	P1.112720.0.0
12001.0	Actual switching time (manual)	REAL	ro	P1.112720.1.0
12002.0 ... 3	Actual selection of switching function	UINT	ro	P1.112721.0.0 ... 3
12003.0 ... 3	Actual selection of switching function	UINT	ro	P1.112721.1.0 ... 3
12004.0 ... 3	Actual selection of switching characteristics	UINT	ro	P1.112722.0.0 ... 3
12005.0 ... 3	Actual selection of switching characteristics	UINT	ro	P1.112722.1.0 ... 3
12006.0 ... 3	Actual first switching point	LINT	ro	P1.112723.0.0 ... 3
12007.0 ... 3	Actual first switching point	LINT	ro	P1.112723.1.0 ... 3
12008.0 ... 3	Actual second switching point	LINT	ro	P1.112724.0.0 ... 3
12009.0 ... 3	Actual second switching point	LINT	ro	P1.112724.1.0 ... 3
12010.0 ... 3	Actual switching time (automatic)	REAL	ro	P1.112725.0.0 ... 3
12011.0 ... 3	Actual switching time (automatic)	REAL	ro	P1.112725.1.0 ... 3
12012.0	Modulo position for the logic (ON)	LINT	ro	P1.112726.0.0
12013.0	Modulo position for the logic (ON)	LINT	ro	P1.112726.1.0
12014.0	Modulo position for the logic (OFF)	LINT	ro	P1.112727.0.0
12015.0	Modulo position for the logic (OFF)	LINT	ro	P1.112727.1.0

PNU	Name	Data type	Access	Parameter
12016.0	Position switch status ON/OFF	BOOL	ro	P1.112728.0.0
12017.0	Position switch status ON/OFF	BOOL	ro	P1.112728.1.0
12018.0	Status modulo limit reached	BOOL	ro	P1.112729.0.0
12019.0	Status modulo limit reached	BOOL	ro	P1.112729.1.0
12020.0	Status active position switch	USINT	ro	P1.112730.0.0
12021.0	Status active position switch	USINT	ro	P1.112730.1.0
12024.0	Offset modulo position	LINT	rw	P1.112732.0.0
12025.0	Offset modulo position	LINT	rw	P1.112732.1.0
12026.0	Initialisation modulo	LINT	rw	P1.112733.0.0
12027.0	Initialisation modulo	LINT	rw	P1.112733.1.0
12028.0	Actual offset modulo position	LINT	ro	P1.112734.0.0
12029.0	Actual offset modulo position	LINT	ro	P1.112734.1.0
12030.0	Counter modulo cycles	UDINT	ro	P1.112735.0.0
12031.0	Counter modulo cycles	UDINT	ro	P1.112735.1.0
12032.0	Modulo hysteresis	LINT	rw	P1.112736.0.0
12033.0	Modulo hysteresis	LINT	rw	P1.112736.1.0
12034.0	Actual modulo hysteresis	LINT	ro	P1.112737.0.0
12035.0	Actual modulo hysteresis	LINT	ro	P1.112737.1.0
12036.0	Error active	BOOL	ro	P1.112819.0.0
12037.0	Touch probe mode	UINT	rw	P1.113000.0.0
12038.0	Touch probe mode	UINT	rw	P1.113000.1.0
12039.0	Touch probe source	UINT	rw	P1.113001.0.0
12040.0	Touch probe source	UINT	rw	P1.113001.1.0
12041.0	Selection trigger event	UINT	rw	P1.113002.0.0
12042.0	Selection trigger event	UINT	rw	P1.113002.1.0
12043.0	Upper limit value modulo	LINT	rw	P1.113003.0.0
12044.0	Upper limit value modulo	LINT	rw	P1.113003.1.0
12045.0	Lower limit value modulo	LINT	rw	P1.113004.0.0
12046.0	Lower limit value modulo	LINT	rw	P1.113004.1.0
12047.0	Lower limit value trigger event	LINT	rw	P1.113005.0.0
12048.0	Lower limit value trigger event	LINT	rw	P1.113005.1.0
12049.0	Upper limit value trigger event	LINT	rw	P1.113006.0.0
12050.0	Upper limit value trigger event	LINT	rw	P1.113006.1.0
12051.0	Actual touch probe mode	UINT	ro	P1.113007.0.0
12052.0	Actual touch probe mode	UINT	ro	P1.113007.1.0
12053.0	Actual touch probe source	UINT	ro	P1.113008.0.0
12054.0	Actual touch probe source	UINT	ro	P1.113008.1.0
12055.0	Actual selection trigger event	UINT	ro	P1.113009.0.0
12056.0	Actual selection trigger event	UINT	ro	P1.113009.1.0
12057.0	Actual upper limit value modulo	LINT	ro	P1.113010.0.0
12058.0	Actual upper limit value modulo	LINT	ro	P1.113010.1.0
12059.0	Actual lower limit value modulo	LINT	ro	P1.113011.0.0
12060.0	Actual lower limit value modulo	LINT	ro	P1.113011.1.0
12061.0	Actual lower limit value trigger event	LINT	ro	P1.113012.0.0
12062.0	Actual lower limit value trigger event	LINT	ro	P1.113012.1.0
12063.0	Actual upper limit value trigger event	LINT	ro	P1.113013.0.0

PNU	Name	Data type	Access	Parameter
12064.0	Actual upper limit value trigger event	LINT	ro	P1.113013.1.0
12065.0	Touch probe position	LINT	ro	P1.113014.0.0
12066.0	Touch probe position	LINT	ro	P1.113014.1.0
12067.0	Time stamp touch probe position	ULINT	ro	P1.113015.0.0
12068.0	Time stamp touch probe position	ULINT	ro	P1.113015.1.0
12069.0	Trigger event initiated	BOOL	ro	P1.113016.0.0
12070.0	Trigger event initiated	BOOL	ro	P1.113016.1.0
12071.0	Trigger event NOT initiated	BOOL	ro	P1.113017.0.0
12072.0	Trigger event NOT initiated	BOOL	ro	P1.113017.1.0
12073.0	Trigger events counter triggered	UDINT	ro	P1.113018.0.0
12074.0	Trigger events counter triggered	UDINT	ro	P1.113018.1.0
12075.0	Trigger events counter NOT triggered	UDINT	ro	P1.113019.0.0
12076.0	Trigger events counter NOT triggered	UDINT	ro	P1.113019.1.0
12077.0	Counter modulo cycles	UDINT	ro	P1.113020.0.0
12078.0	Counter modulo cycles	UDINT	ro	P1.113020.1.0
12079.0	Status touch probe input	BOOL	ro	P1.113021.0.0
12080.0	Status touch probe input	BOOL	ro	P1.113021.1.0
12081.0	Status modulo limit reached	BOOL	ro	P1.113022.0.0
12082.0	Status modulo limit reached	BOOL	ro	P1.113022.1.0
12083.0	Modulo position	LINT	ro	P1.113023.0.0
12084.0	Modulo position	LINT	ro	P1.113023.1.0
12085.0	Offset modulo position	LINT	rw	P1.113024.0.0
12086.0	Offset modulo position	LINT	rw	P1.113024.1.0
12087.0	Initialisation modulo	LINT	rw	P1.113025.0.0
12088.0	Initialisation modulo	LINT	rw	P1.113025.1.0
12089.0	Actual offset modulo position	LINT	ro	P1.113026.0.0
12090.0	Actual offset modulo position	LINT	ro	P1.113026.1.0
12091.0	Time stamp touch probe position positive CiA402	ULINT	ro	P1.113027.0.0
12092.0	Time stamp touch probe position positive CiA402	ULINT	ro	P1.113027.1.0
12093.0	Time stamp touch probe position negative CiA402	ULINT	ro	P1.113028.0.0
12094.0	Time stamp touch probe position negative CiA402	ULINT	ro	P1.113028.1.0
12095.0	Touch probe position positive CiA402	LINT	ro	P1.113029.0.0
12096.0	Touch probe position positive CiA402	LINT	ro	P1.113029.1.0
12097.0	Touch probe position negative CiA402	LINT	ro	P1.113030.0.0
12098.0	Touch probe position negative CiA402	LINT	ro	P1.113030.1.0
12099.0	Counter initiated trigger events positive edge CiA402	UDINT	ro	P1.113031.0.0
12100.0	Counter initiated trigger events positive edge CiA402	UDINT	ro	P1.113031.1.0
12101.0	Counter initiated trigger events negative edge CiA402	UDINT	ro	P1.113032.0.0
12102.0	Counter initiated trigger events negative edge CiA402	UDINT	ro	P1.113032.1.0
12103.0	Touch probe status CiA402	UINT	ro	P1.113033.0.0
12104.0	Touch probe status CiA402	UINT	ro	P1.113033.1.0
12105.0	Modulo hysteresis	LINT	rw	P1.113034.0.0
12106.0	Modulo hysteresis	LINT	rw	P1.113034.1.0
12107.0	Actual modulo hysteresis	LINT	ro	P1.113035.0.0
12108.0	Actual modulo hysteresis	LINT	ro	P1.113035.1.0
12109.0	Delay time	REAL	rw	P1.113036.0.0

PNU	Name	Data type	Access	Parameter
12110.0	Delay time	REAL	rw	P1.113036.1.0
12111.0	Actual delay time	REAL	ro	P1.113037.0.0
12112.0	Actual delay time	REAL	ro	P1.113037.1.0
12113.0	Requested modulo mode	UINT	rw	P1.113100.0.0
12115.0	Lower limit value modulo	LINT	rw	P1.113102.0.0
12116.0	Setpoint value modulo	LINT	ro	P1.113103.0.0
12117.0	Actual value modulo	LINT	ro	P1.113104.0.0
12118.0	Actual mode modulo	UINT	ro	P1.113105.0.0
12119.0	Actual upper limit value modulo	LINT	ro	P1.113106.0.0
12120.0	Actual lower limit value modulo	LINT	ro	P1.113107.0.0
12121.0	Counter modulo cycles	UDINT	ro	P1.113108.0.0
12122.0	Modulo overflow status	BOOL	ro	P1.113109.0.0
12123.0	Offset modulo position	LINT	rw	P1.113110.0.0
12124.0	Initialisation modulo position	LINT	rw	P1.113111.0.0
12125.0	Actual offset modulo position	LINT	ro	P1.113112.0.0
12126.0	Activation of symmetrical jog	BOOL	rw	P1.214526.0.0
12127.0	Relative position jog 1	LINT	rw	P1.214530.0.0
12128.0	Slow jog 2 velocity	REAL	rw	P1.214535.0.0
12129.0	Slow jog 2 acceleration	REAL	rw	P1.214536.0.0
12130.0	Slow jog 2 jerk	REAL	rw	P1.214537.0.0
12131.0	Relative position jog 2.	LINT	rw	P1.214538.0.0
12132.0	Jog duration 2 movement	REAL	rw	P1.214539.0.0
12133.0	Fast jog 2 velocity	REAL	rw	P1.214540.0.0
12134.0	Fast jog 2 acceleration	REAL	rw	P1.214541.0.0
12135.0	Fast jog 2 jerk	REAL	rw	P1.214542.0.0
12136.0	Actually used slow jog 1 velocity	REAL	ro	P1.214543.0.0
12137.0	Actually used slow jog 1 acceleration	REAL	ro	P1.214544.0.0
12138.0	Actually used slow jog 1 jerk	REAL	ro	P1.214545.0.0
12139.0	Actually used jog 1 movement duration	REAL	ro	P1.214546.0.0
12140.0	Actually used fast jog 1 velocity	REAL	ro	P1.214547.0.0
12141.0	Actually used fast jog 1 acceleration	REAL	ro	P1.214548.0.0
12142.0	Actually used fast jog 1 jerk	REAL	ro	P1.214549.0.0
12143.0	Actually used slow jog 2 velocity	REAL	ro	P1.214550.0.0
12144.0	Actually used slow jog 2 acceleration	REAL	ro	P1.214551.0.0
12145.0	Actually used slow jog 2 jerk	REAL	ro	P1.214552.0.0
12146.0	Actually used jog 2 movement duration	REAL	ro	P1.214553.0.0
12147.0	Actually used fast jog 2 velocity	REAL	ro	P1.214554.0.0
12148.0	Actually used fast jog 2 acceleration	REAL	ro	P1.214555.0.0
12149.0	Actually used fast jog 2 jerk	REAL	ro	P1.214556.0.0
12150.0 ... 20	Encoder format	UDINT	ro	P1.231243.0.0 ... 20
12151.0	Selection voltage limitation prioritisation	UDINT	rw	P1.526772.0.0
12152.0	Selection voltage limitation prioritisation	UDINT	rw	P1.526773.0.0
12153.0 ... 127	Record sequencing field 3	LINT	rw	P1.526778.0.0 ... 127
12154.0 ... 15	Next event field 3	LINT	rw	P1.526779.0.0 ... 15
12157.0 ... 15	Next event field 4	LINT	rw	P1.526786.0.0 ... 15
12158.0 ... 15	Next event field 5	LINT	rw	P1.526787.0.0 ... 15

PNU	Name	Data type	Access	Parameter
12159.0 ... 15	Next event field 6	LINT	rw	P1.526788.0.0 ... 15
12160.0 ... 15	Next event field 7	LINT	rw	P1.526789.0.0 ... 15
12161.0 ... 127	Record sequencing field 4	LINT	rw	P1.526790.0.0 ... 127
12162.0 ... 127	Record sequencing field 5	LINT	rw	P1.526791.0.0 ... 127
12163.0 ... 127	Record sequencing field 6	LINT	rw	P1.526792.0.0 ... 127
12164.0 ... 127	Record sequencing field 7	LINT	rw	P1.526793.0.0 ... 127
12165.0	Filter time constant controller limitation	REAL	rw	P1.526794.0.0
12166.0	Maximum torque symmetrical	REAL	rw	P1.526796.0.0
12167.0	Record table status	DINT	ro	P1.526797.0.0
12168.0	Clamping torque	REAL	rw	P1.526801.0.0
12169.0	Jogging state	UDINT	ro	P1.526917.0.0
12170.0	Commutation-angle detection damping time	REAL	rw	P1.545454.0.0
12171.0	Commutation angle	LINT	rw	P1.545455.0.0
12178.0	MELDW.0 ramp generator	BOOL	ro	P1.1124900.0.0
12179.0	MOMRED	INT	rw	P1.1126990.0.0
12180.0	KPC	DINT	rw	P1.1127990.0.0
12181.0	XERR	DINT	rw	P1.1129990.0.0
12182.0	Activation background mode	BOOL	rw	P1.1130224.0.0
12183.0	Diagnostic category: Torque increase ramp invalid	UINT	rw	P1.1130225.0.0
12184.0	Storage option: Torque increase ramp invalid	USINT	rw	P1.1130226.0.0
12185.0	Encoder n actual position value 2 (Gn_XIST2)	UDINT	ro	P1.1141990.0.0
12186.0	Encoder n actual position value 1 (Gn_XIST1)	UDINT	ro	P1.1142990.0.0
12187.0	Gn_ZSW.0 ... 3 Function active	USINT	ro	P1.1143000.0.0
12188.0	Gn_ZSW.4 ... 7 value	USINT	ro	P1.1143040.0.0
12189.0	Gn_ZSW.8 touch probe 0 deflected	BOOL	ro	P1.1143080.0.0
12190.0	Gn_ZSW.9 Touch Probe 1 deflected	BOOL	ro	P1.1143090.0.0
12191.0	Gn_ZSW.11 Error acknowledgment active	BOOL	ro	P1.1143110.0.0
12192.0	Gn_ZSW.12 Homing mode active	BOOL	ro	P1.1143120.0.0
12193.0	Gn_ZSW.13 Transmit absolute value cyclically	BOOL	ro	P1.1143130.0.0
12194.0	Gn_ZSW.14 Parking sensor active	BOOL	ro	P1.1143140.0.0
12195.0	Gn_ZSW.15 sensor error	BOOL	ro	P1.1143150.0.0
12196.0	Gn_ZSW	UINT	ro	P1.1143990.0.0
12197.0	ZSW1.0 Ready to Switch On	BOOL	ro	P1.1145000.0.0
12198.0	ZSW1.1 Ready To Operate	BOOL	ro	P1.1145010.0.0
12199.0	ZSW1.2 Operation Enabled	BOOL	ro	P1.1145020.0.0
12200.0	ZSW1.3 Fault Present	BOOL	ro	P1.1145030.0.0
12201.0	ZSW1.4 Coast Stop Not Active	BOOL	ro	P1.1145040.0.0
12202.0	ZSW1.5 Quick Stop Not Active	BOOL	ro	P1.1145050.0.0
12203.0	ZSW1.6 Switch On Inhibited	BOOL	ro	P1.1145060.0.0
12204.0	ZSW1.7 Warning Present	BOOL	ro	P1.1145070.0.0
12205.0	ZSW1.8 Velocity Error Within Tolerance Range	BOOL	ro	P1.1145080.0.0
12206.0	ZSW1.8 Following Error Within Tolerance Range	BOOL	ro	P1.1145081.0.0
12207.0	ZSW1.9 PLC Control Requested	BOOL	ro	P1.1145090.0.0
12208.0	ZSW1.10 f or n reached or exceeded	BOOL	ro	P1.1145100.0.0
12209.0	ZSW1.10 Traverse Task Motion Complete	BOOL	ro	P1.1145101.0.0
12210.0	ZSW1.11 I, M or P limit not reached	BOOL	ro	P1.1145110.0.0

PNU	Name	Data type	Access	Parameter
12211.0	ZSW1.11 Home Position Set	BOOL	ro	P1.1145111.0.0
12212.0	ZSW1.12 Holding brake open	BOOL	ro	P1.1145120.0.0
12213.0	ZSW1.12 Traversing Task Acknowledgement	BOOL	ro	P1.1145121.0.0
12214.0	ZSW1.13 No warning Overtemperature motor	BOOL	ro	P1.1145130.0.0
12215.0	ZSW1.13 Drive Stopped	BOOL	ro	P1.1145131.0.0
12216.0	ZSW1.14 Motor rotation	BOOL	ro	P1.1145140.0.0
12217.0	ZSW1.14 Drive Accelerating	BOOL	ro	P1.1145141.0.0
12218.0	ZSW1.15 No warning Overtemperature power unit	BOOL	ro	P1.1145150.0.0
12219.0	ZSW1.15 Drive Decelerating	BOOL	ro	P1.1145151.0.0
12220.0	ZSW1	UINT	ro	P1.1145990.0.0
12221.0	ZSW2.7 Drive parked	BOOL	ro	P1.1146070.0.0
12222.0	ZSW2.8 Move to fixed stop active	BOOL	ro	P1.1146080.0.0
12223.0	ZSW2.11 Power stage active	BOOL	ro	P1.1146110.0.0
12224.0	ZSW2.12 ... 15 Slave sign of life	USINT	ro	P1.1146120.0.0
12225.0	ZSW2	UINT	ro	P1.1146990.0.0
12226.0	STW1.0 Power Stage Enable	BOOL	ro	P1.1147000.0.0
12227.0	STW1.1 Coast Stop Disable	BOOL	ro	P1.1147010.0.0
12228.0	STW1.2 Quick Stop Disable	BOOL	ro	P1.1147020.0.0
12229.0	STW1.3 Enable Operation	BOOL	ro	P1.1147030.0.0
12230.0	STW1.4 Enable ramp generator	BOOL	ro	P1.1147040.0.0
12231.0	STW1.4 Reject traversing task	BOOL	ro	P1.1147041.0.0
12232.0	STW1.5 Unfreeze Ramp Generator	BOOL	ro	P1.1147050.0.0
12233.0	STW1.5 Intermediate Stop	BOOL	ro	P1.1147051.0.0
12234.0	STW1.6 Enable setpoint	BOOL	ro	P1.1147060.0.0
12235.0	STW1.6 Traverse Task Active	BOOL	ro	P1.1147061.0.0
12236.0	STW1.7 Fault Acknowledge	BOOL	ro	P1.1147070.0.0
12237.0	STW1.8 Jogging 1	BOOL	ro	P1.1147080.0.0
12238.0	STW1.9 Jogging 2	BOOL	ro	P1.1147090.0.0
12239.0	STW1.10 Control by PLC	BOOL	ro	P1.1147100.0.0
12240.0	STW1.11 Invert setpoint	BOOL	ro	P1.1147110.0.0
12241.0	STW1.11 Start Homing Procedure	BOOL	ro	P1.1147111.0.0
12242.0	STW1.12 Open Holding Brake	BOOL	ro	P1.1147120.0.0
12244.0	STW1.13 Increase the motorized potentiometer setpoint	BOOL	ro	P1.1147130.0.0
12245.0	STW1.13 Start Block Change	BOOL	ro	P1.1147131.0.0
12246.0	STW1.14 Reduce motor potentiometer setpoint	BOOL	ro	P1.1147140.0.0
12247.0	STW1.14 Reserved	BOOL	ro	P1.1147141.0.0
12248.0	STW1.15 Reserved	BOOL	ro	P1.1147150.0.0
12249.0	STW1.15 Reserved	BOOL	ro	P1.1147151.0.0
12250.0	STW1	UINT	rw	P1.1147990.0.0
12253.0	STW2.7 Drive parking	BOOL	ro	P1.1148070.0.0
12254.0	STW2.8 Traverse to fixed endstop	BOOL	ro	P1.1148080.0.0
12255.0	STW2.11 Motor changeover	BOOL	ro	P1.1148110.0.0
12256.0	STW2.12 ... 15 Master sign of life	USINT	ro	P1.1148120.0.0
12257.0	STW2	UINT	rw	P1.1148990.0.0
12260.0	Gn_STW.0 ... 3 Request function	USINT	ro	P1.1149000.0.0
12261.0	Gn_STW.4 ... 6 Request command	USINT	ro	P1.1149040.0.0

PNU	Name	Data type	Access	Parameter
12262.0	Gn_STW.7 Mode	BOOL	ro	P1.1149070.0.0
12263.0	Gn_STW.11 Home position mode	BOOL	ro	P1.1149110.0.0
12264.0	Gn_STW.12 Trigger mode homing	BOOL	ro	P1.1149120.0.0
12265.0	Gn_STW.13 Request absolute value cyclically	BOOL	ro	P1.1149130.0.0
12266.0	Gn_STW.14 Activate parking sensor	BOOL	ro	P1.1149140.0.0
12267.0	Gn_STW.15 Acknowledge sensor error	BOOL	ro	P1.1149150.0.0
12268.0	Gn_STW	UINT	rw	P1.1149990.0.0
12269.0	Gn_STW Cycle-1	UINT	ro	P1.1149991.0.0
12270.0	Master control connection ID	UDINT	ro	P1.10233999.0.0
12279.0	MELDW.1 torque utilization	BOOL	ro	P1.11249010.0.0
12280.0	MELDW.2 Actual velocity <Threshold1	BOOL	ro	P1.11249020.0.0
12281.0	MELDW.3 Actual velocity = <Threshold2	BOOL	ro	P1.11249030.0.0
12282.0	MELDW.5 Variable reporting function	BOOL	ro	P1.11249050.0.0
12283.0	MELDW.6 No warning Overtemperature motor	BOOL	ro	P1.11249060.0.0
12284.0	MELDW.7 No warning Overtemperature power output stage	BOOL	ro	P1.11249070.0.0
12285.0	MELDW.8 velocity setpoint / actual deviation in tolerance	BOOL	ro	P1.11249080.0.0
12286.0	MELDW.11 Controller enable	BOOL	ro	P1.11249110.0.0
12287.0	MELDW.12 Ready for operation	BOOL	ro	P1.11249120.0.0
12288.0	MELDW.13 Power stage active	BOOL	ro	P1.11249130.0.0
12289.0	MELDW	UINT	ro	P1.11249990.0.0
12290.0	Parameter List	UINT	ro	P1.11280001.0.0
12291.0	Operating mode PROFIdrive	UINT	ro	P1.11280002.0.0
12292.0	Error message counter PROFIdrive	UINT	ro	P1.11280003.0.0
12293.0 ... 1	Profile identification number	USINT	ro	P1.11280004.0.0 ... 1
12294.0	Torque increase for controller enable	REAL	rw	P1.11280018.0.0
12295.0	Valid movement monitoring position control	UDINT	rw	P1.11280020.0.0
12296.0	Valid movement monitoring velocity control	UDINT	rw	P1.11280021.0.0
12297.0	Valid movement monitoring torque regulation	UDINT	rw	P1.11280022.0.0
12298.0	Valid movement monitoring position control analog	UDINT	rw	P1.11280023.0.0
12299.0	Valid movement monitoring velocity control analog	UDINT	rw	P1.11280024.0.0
12300.0	Valid movement monitoring torque control analog	UDINT	rw	P1.11280025.0.0
12301.0	Valid movement monitoring CSP	UDINT	rw	P1.11280026.0.0
12302.0	Valid movement monitoring CSV	UDINT	rw	P1.11280027.0.0
12303.0	Valid movement monitoring CST	UDINT	rw	P1.11280028.0.0
12304.0	Valid Power Off movement monitoring	UDINT	rw	P1.11280029.0.0
12305.0 ... 2	Parameter channel description PROFIdrive	UINT	ro	P1.11280030.0.0 ... 2
12306.0 ... 63	Error number	UINT	ro	P1.11280040.0.0 ... 63
12307.0 ... 63	Casting time error	UDINT	ro	P1.11280041.0.0 ... 63
12308.0 ... 63	Warning number	UINT	ro	P1.11280042.0.0 ... 63
12309.0 ... 63	Release time warning	UDINT	ro	P1.11280043.0.0 ... 63
12310.0	Status word MELDW	UINT	ro	P1.11280046.0.0
12312.0	Counter warning messages	UINT	ro	P1.11280060.0.0
12313.0	Counter error messages	UINT	ro	P1.11280061.0.0
12314.0	Active error	UINT	ro	P1.11280062.0.0
12315.0	Active warning	UINT	ro	P1.11280063.0.0
12316.0	Status base state machine PROFIdrive	UDINT	ro	P1.11280102.0.0

PNU	Name	Data type	Access	Parameter
12317.0	Actual application class	UDINT	ro	P1.11280109.0.0
12319.0	Storage option: Required application class not supported	USINT	rw	P1.11280111.0.0
12320.0	Trigger level MELDW.2	REAL	rw	P1.11280112.0.0
12321.0	Hysteresis trigger level	REAL	rw	P1.11280113.0.0
12322.0	Trigger level MELDW.3	REAL	rw	P1.11280114.0.0
12323.0	Hysteresis trigger level	REAL	rw	P1.11280115.0.0
12324.0	Activation touch probe Tel. 111	UINT	rw	P1.11280116.0.0
12325.0	Acceleration	REAL	rw	P1.11280402.0.0
12326.0	Deceleration	REAL	rw	P1.11280403.0.0
12327.0	Jerk	REAL	rw	P1.11280404.0.0
12328.0	Deceleration (system stop)	REAL	rw	P1.11280405.0.0
12329.0	Clamping torque offset	REAL	rw	P1.11280407.0.0
12330.0	Stroke limit positive for detection of a fixed stop	LINT	rw	P1.11280408.0.0
12331.0	Stroke limit negative for detection of a fixed stop	LINT	rw	P1.11280409.0.0
12332.0	Threshold value torque utilization reached	REAL	rw	P1.11280410.0.0
12333.0	Status Application Class 1	UDINT	ro	P1.11280501.0.0
12334.0	NSOLL_A/NSOLL_B	REAL	rw	P1.11280502.0.0
12335.0	Settling time Direction of rotation detection	REAL	rw	P1.11280503.0.0
12336.0	Status Application Class 4	UDINT	ro	P1.11280531.0.0
12337.0	Velocity comparator time window	REAL	rw	P1.11280533.0.0
12338.0	Status Application Class 3	UDINT	ro	P1.11280601.0.0
12339.0	Target position MDI	LINT	rw	P1.11280604.0.0
12340.0	Profile velocity MDI	REAL	rw	P1.11280605.0.0
12341.0	Acceleration MDI	REAL	rw	P1.11280606.0.0
12342.0	Deceleration MDI	REAL	rw	P1.11280607.0.0
12345.0	Base value velocity	REAL	rw	P1.11280701.0.0
12346.0	Base value acceleration	REAL	rw	P1.11280702.0.0
12347.0	Base value deceleration	REAL	rw	P1.11280703.0.0
12348.0	POS_STW1.0 ... 6 Traversing block selection	USINT	ro	P1.112411000.0.0
12349.0	POS_STW1.8 Absolute positioning	BOOL	ro	P1.112411080.0.0
12350.0	POS_STW1.9 ... 10 direction selection	UDINT	ro	P1.112411090.0.0
12351.0	POS_STW1.12 Setpoint transfer	BOOL	ro	P1.112411120.0.0
12352.0	POS_STW1.14 Setting up selected	BOOL	ro	P1.112411140.0.0
12353.0	POS_STW1.15 MDI selection	BOOL	ro	P1.112411150.0.0
12354.0	POS_STW1	UINT	rw	P1.112411990.0.0
12357.0	POS_ZSW1.0 ... 6 Traversing block bit	USINT	ro	P1.112412000.0.0
12358.0	POS_ZSW1.8 Negative limit switch active	BOOL	ro	P1.112412080.0.0
12359.0	POS_ZSW1.9 Positive limit switch active	BOOL	ro	P1.112412090.0.0
12360.0	POS_ZSW1.10 Jogging active	BOOL	ro	P1.112412100.0.0
12361.0	POS_ZSW1.11 Reference point approach active	BOOL	ro	P1.112412110.0.0
12362.0	POS_ZSW1.13 Traversing block active	BOOL	ro	P1.112412130.0.0
12363.0	POS_ZSW1.14 Setup active	BOOL	ro	P1.112412140.0.0
12364.0	POS_ZSW1.15 MDI active	BOOL	ro	P1.112412150.0.0
12365.0	POS_ZSW1	UINT	ro	P1.112412990.0.0
12366.0	POS_ZSW2.0 Tracking mode active	BOOL	ro	P1.112413000.0.0
12367.0	POS_ZSW2.1 Velocity limitation active	BOOL	ro	P1.112413010.0.0

PNU	Name	Data type	Access	Parameter
12368.0	POS_ZSW2.2 Setpoint available	BOOL	ro	P1.112413020.0.0
12369.0	POS_ZSW2.4 Drive moves forward	BOOL	ro	P1.112413040.0.0
12370.0	POS_ZSW2.5 Drive moves backwards	BOOL	ro	P1.112413050.0.0
12371.0	POS_ZSW2.6 Software limit switch minus reached	BOOL	ro	P1.112413060.0.0
12372.0	POS_ZSW2.7 Software limit switch plus reached	BOOL	ro	P1.112413070.0.0
12373.0	POS_ZSW2.8 Position actual value <= position switch 0	BOOL	ro	P1.112413080.0.0
12374.0	POS_ZSW2.9 Position actual value <= position switch 1	BOOL	ro	P1.112413090.0.0
12375.0	POS_ZSW2.10 Direct output 1 via traversing block	BOOL	ro	P1.112413100.0.0
12376.0	POS_ZSW2.11 Direct output 2 via traversing block	BOOL	ro	P1.112413110.0.0
12377.0	POS_ZSW2.12 Fixed stop reached	BOOL	ro	P1.112413120.0.0
12378.0	POS_ZSW2.13 Fixed stop Clamping torque reached	BOOL	ro	P1.112413130.0.0
12379.0	POS_ZSW2.14 Move to fixed stop active	BOOL	ro	P1.112413140.0.0
12380.0	POS_ZSW2.15 Traversing command active	BOOL	ro	P1.112413150.0.0
12381.0	POS_ZSW2	UINT	ro	P1.112413990.0.0
12382.0	POS_STW2.0 Tracking mode	BOOL	ro	P1.112414000.0.0
12383.0	POS_STW2.1 Set reference point	BOOL	ro	P1.112414010.0.0
12384.0	POS_STW2.5 Jogging incremental active	BOOL	ro	P1.112414050.0.0
12385.0	POS_STW2.10 Selection touch probe	BOOL	ro	P1.112414100.0.0
12386.0	POS_STW2.11 Touch probe edge	BOOL	ro	P1.112414110.0.0
12387.0	POS_STW2.14 Activate software limit switch	BOOL	ro	P1.112414140.0.0
12388.0	POS_STW2.15 Activate hardware limit switch	BOOL	ro	P1.112414150.0.0
12389.0	POS_STW2	UINT	rw	P1.112414990.0.0
12392.0	SATZANW.0 ... 6 Traversing block selection	USINT	ro	P1.112415000.0.0
12393.0	SATZANW.15 Activate MDI	BOOL	ro	P1.112415150.0.0
12394.0	SATZANW	UINT	rw	P1.112415990.0.0
12395.0	SATZANW Cycle-1	UINT	ro	P1.112415991.0.0
12396.0	AKTSATZ.0 ... 6 Active traversing block	USINT	ro	P1.112416000.0.0
12397.0	AKTSATZ.15 MDI activated	BOOL	ro	P1.112416150.0.0
12398.0	AKTSATZ	UINT	ro	P1.112416990.0.0
12399.0	MDI_MOD.0 Positioning	BOOL	ro	P1.112417000.0.0
12400.0	MDI_MOD.1 ... 2 Direction of movement	UDINT	ro	P1.112417010.0.0
12401.0	MDI_MOD	UINT	rw	P1.112417990.0.0
12402.0	MDI_MOD Cycle-1	UINT	ro	P1.112417991.0.0
12404.0	Scaling factor start value I^2t monitoring motor model	REAL	rw	P1.6301.0.0
12405.0	Actual value I^2T monitoring motor model	REAL	ro	P1.6302.0.0
12406.0	Maximum start value I^2t monitoring motor model	REAL	ro	P1.6303.0.0
12407.0	Scaling factor warning limit I^2t monitoring motor model	REAL	rw	P1.6305.0.0
12409.0	Activation current reduction holding brake	BOOL	rw	P1.40001.0.0
12410.0	Delay time	REAL	rw	P1.40002.0.0
12411.0	Supply voltage holding brake	REAL	rw	P1.40003.0.0
12412.0	Holding voltage	REAL	rw	P1.40004.0.0
12413.0	Diagnostic category: I^2t monitoring: motor model warning limit	UINT	rw	P1.63019.0.0
12414.0	Storage option: I^2t monitoring: motor model warning limit	USINT	rw	P1.63020.0.0
12415.0	Diagnostic category: I^2t monitoring: motor model error limit	UINT	rw	P1.63021.0.0
12416.0	Storage option: I^2t monitoring: motor model error limit	USINT	rw	P1.63022.0.0

PNU	Name	Data type	Access	Parameter
12417.0	Active switch-on threshold reactive current braking	REAL	ro	P1.102101.0.0
12418.0	Active end value reactive current braking	REAL	ro	P1.102102.0.0
12419.0	Status reactive current braking	BOOL	ro	P1.102103.0.0
12420.0	Activate reactive current braking	BOOL	rw	P1.102104.0.0
12421.0	Maximum reactive current reactive current braking	REAL	ro	P1.102105.0.0
12422.0	Actual value reactive current braking	REAL	ro	P1.102106.0.0
12423.0	Activate automatic voltage determination	BOOL	rw	P1.102107.0.0
12424.0	Switch-on threshold reactive current braking	REAL	rw	P1.102108.0.0
12425.0	End value reactive current braking	REAL	rw	P1.102109.0.0
12426.0	Scaling factor offset of voltage calculation	REAL	rw	P1.102110.0.0
12432.0	Diagnostic category: PLC Control is not set	UINT	rw	P1.11280117.0.0
12433.0	Storage option: PLC Control is not set	USINT	rw	P1.11280118.0.0
12434.0	Jerk (system stop)	REAL	rw	P1.11280406.0.0
12435.0	Threshold value velocity comparator	REAL	rw	P1.11280504.0.0
12436.0	Hysteresis threshold value velocity comparator	REAL	rw	P1.11280505.0.0
12437.0	Switch-on/off delay time velocity comparator	REAL	rw	P1.11280506.0.0
12440.0	Reduction ratio	UDINT	rw	P1.4246.0.0
12442.0	Status sensor state machine	DINT	ro	P1.34234.0.0
12443.0	Status sensor state machine	DINT	ro	P1.34234.1.0
12448.0	Inertia Gear	REAL	rw	P1.124321.0.0
12449.0	Inertia coupling	REAL	rw	P1.124322.0.0
12450.0	Dynamic losses	REAL	rw	P1.124323.0.0
12451.0 ... 1	Damping	REAL	rw	P1.144316.0.0 ... 1
12452.0 ... 1	Natural frequency	REAL	rw	P1.144317.0.0 ... 1
12453.0 ... 1	Activation of vibration suppression	BOOL	rw	P1.144318.0.0 ... 1
12454.0 ... 1	Vibration suppression active	BOOL	ro	P1.144319.0.0 ... 1
12459.0	Encoder n actual position value 2 (Gn_XIST2)	UDINT	ro	P1.1141990.1.0
12460.0	Encoder n actual position value 1 (Gn_XIST1)	UDINT	ro	P1.1142990.1.0
12461.0	Gn_ZSW.0 ... 3 Function active	USINT	ro	P1.1143000.1.0
12462.0	Gn_ZSW.4 ... 7 value	USINT	ro	P1.1143040.1.0
12463.0	Gn_ZSW.8 touch probe 0 deflected	BOOL	ro	P1.1143080.1.0
12464.0	Gn_ZSW.9 Touch Probe 1 deflected	BOOL	ro	P1.1143090.1.0
12465.0	Gn_ZSW.11 Error acknowledgment active	BOOL	ro	P1.1143110.1.0
12466.0	Gn_ZSW.12 Homing mode active	BOOL	ro	P1.1143120.1.0
12467.0	Gn_ZSW.13 Transmit absolute value cyclically	BOOL	ro	P1.1143130.1.0
12468.0	Gn_ZSW.14 Parking sensor active	BOOL	ro	P1.1143140.1.0
12469.0	Gn_ZSW.15 sensor error	BOOL	ro	P1.1143150.1.0
12470.0	Gn_ZSW	UINT	ro	P1.1143990.1.0
12471.0	Gn_STW.0 ... 3 Request function	USINT	ro	P1.1149000.1.0
12472.0	Gn_STW.4 ... 6 Request command	USINT	ro	P1.1149040.1.0
12473.0	Gn_STW.7 Mode	BOOL	ro	P1.1149070.1.0
12474.0	Gn_STW.11 Home position mode	BOOL	ro	P1.1149110.1.0
12475.0	Gn_STW.12 Trigger mode homing	BOOL	ro	P1.1149120.1.0
12476.0	Gn_STW.13 Request absolute value cyclically	BOOL	ro	P1.1149130.1.0
12477.0	Gn_STW.14 Activate parking sensor	BOOL	ro	P1.1149140.1.0
12478.0	Gn_STW.15 Acknowledge sensor error	BOOL	ro	P1.1149150.1.0

PNU	Name	Data type	Access	Parameter
12479.0	Gn_STW	UINT	rw	P1.1149990.1.0
12480.0	Gn_STW Cycle-1	UINT	ro	P1.1149991.1.0
12481.0	Valid motion monitoring Moving to fixed stop	UDINT	rw	P1.11280031.0.0
12482.0	Velocity override	REAL	rw	P1.1309.0.0
12483.0	Mileage 2	LINT	rw	P1.1414.0.0
12484.0	Load change counter 2	LINT	rw	P1.1424.0.0
12485.0	Status Sign of Life	DINT	ro	P1.3424.0.0
12486.0	Sign of Life Cycle-1	USINT	ro	P1.4277.0.0
12487.0	Error counter Sign of Life	DINT	ro	P1.4278.0.0
12520.0	Actual Error ID	UDINT	ro	P1.231250.0.0
12521.0	Actual Error ID	UDINT	ro	P1.231250.1.0
12522.0	Actual resolution per revolution for Gn_XIST	UDINT	ro	P1.231544.0.0
12523.0	Actual resolution per revolution for Gn_XIST	UDINT	ro	P1.231544.1.0
12524.0	Resolution per revolution for Gn_XIST	UDINT	rw	P1.231545.0.0
12525.0	Resolution per revolution for Gn_XIST	UDINT	rw	P1.231545.1.0
12530.0	Valid motion monitoring AC4 without DSC	UDINT	rw	P1.11280032.0.0
12531.0	Valid motion monitoring AC4 with DSC	UDINT	rw	P1.11280033.0.0
12532.0	Torque utilization monitoring window	REAL	rw	P1.11280411.0.0
12533.0	Damping time torque utilization	REAL	rw	P1.11280412.0.0
12534.0	Velocity override	INT	rw	P1.11280611.0.0
12535.0	Conversion factor velocity	REAL	ro	P1.11290701.0.0
12538.0	Diagnostic category: Invalid configuration Extended process data	UINT	rw	P1.424201.0.0
12539.0	Storage option: Invalid configuration Extended process data	USINT	rw	P1.424202.0.0
12540.0	Activation Extended process data	BOOL	rw	P1.424203.0.0
12541.0	Extended process data active	BOOL	ro	P1.424213.0.0
12542.0	Number of objects Rx	USINT	ro	P1.4242101.0.0
12543.0	Number of bytes Rx	USINT	ro	P1.4242102.0.0
12544.0 ... 7	Axis ID Rx	UINT	rw	P1.4242105.0.0 ... 7
12545.0 ... 7	Data ID Rx	UDINT	rw	P1.4242106.0.0 ... 7
12546.0 ... 7	Data instance ID Rx	UINT	rw	P1.4242107.0.0 ... 7
12547.0 ... 7	Array ID Rx	UINT	rw	P1.4242108.0.0 ... 7
12548.0 ... 7	Actual axis ID Rx	UINT	ro	P1.4242115.0.0 ... 7
12549.0 ... 7	Actual data ID Rx	UDINT	ro	P1.4242116.0.0 ... 7
12550.0 ... 7	Actual data instance ID Rx	UINT	ro	P1.4242117.0.0 ... 7
12551.0 ... 7	Actual array ID Rx	UINT	ro	P1.4242118.0.0 ... 7
12552.0 ... 7	Actual data type Rx	UDINT	ro	P1.4242119.0.0 ... 7
12553.0	Number of objects Tx	USINT	ro	P1.4242201.0.0
12554.0	Number of bytes Tx	USINT	ro	P1.4242202.0.0
12555.0 ... 7	Axis ID Tx	UINT	rw	P1.4242205.0.0 ... 7
12556.0 ... 7	Data ID Tx	UDINT	rw	P1.4242206.0.0 ... 7
12557.0 ... 7	Data instance ID Tx	UINT	rw	P1.4242207.0.0 ... 7
12558.0 ... 7	Array ID Tx	UINT	rw	P1.4242208.0.0 ... 7
12559.0 ... 7	Actual axis ID Tx	UINT	ro	P1.4242215.0.0 ... 7
12560.0 ... 7	Actual data ID Tx	UDINT	ro	P1.4242216.0.0 ... 7
12561.0 ... 7	Actual data instance ID Tx	UINT	ro	P1.4242217.0.0 ... 7

PNU	Name	Data type	Access	Parameter
12562.0 ... 7	Actual array ID Tx	UINT	ro	P1.4242218.0.0 ... 7
12563.0 ... 7	Actual data type Tx	UDINT	ro	P1.4242219.0.0 ... 7
12564.0	Status	DINT	rw	P1.103111.0.0
12565.0	Testing phase	UINT	rw	P1.103112.0.0
12566.0	Torque positive limit value	REAL	rw	P1.103113.0.0
12567.0	Torque rise ramp Positive limit value	REAL	rw	P1.103114.0.0
12568.0	Torque negative limit value	REAL	rw	P1.103115.0.0
12569.0	Torque rise ramp Negative limit value	REAL	rw	P1.103116.0.0
12570.0	Monitoring window Position	LINT	rw	P1.103117.0.0
12571.0	Torque monitoring window	REAL	rw	P1.103118.0.0
12572.0	Holding time Torque	REAL	rw	P1.103120.0.0
12573.0	Waiting time	REAL	rw	P1.103121.0.0
12574.0	Test result	UINT	ro	P1.103122.0.0
12575.0	Selection of encoder interface	UDINT	rw	P1.103123.0.0
12588.0	Diagnostic category: Encoder not ready	UINT	rw	P1.103136.0.0
12589.0	Storage option: Encoder not ready	USINT	rw	P1.103137.0.0
12590.0	Diagnostic category: Brake test failed	UINT	rw	P1.103138.0.0
12591.0	Storage option: Brake test failed	USINT	rw	P1.103139.0.0
12592.0	Diagnostic category: Torque failed brake test	UINT	rw	P1.103140.0.0
12593.0	Storage option: Torque failed brake test	USINT	rw	P1.103141.0.0
12594.0	Denominator pole pairs (user-defined)	UDINT	rw	P1.7185.0.0
12595.0	Active denominator Pole pairs	UDINT	ro	P1.7191.0.0
12637.0	Upper limit value modulo	LINT	rw	P1.113113.0.0
12638.0	Extended Modulo mode	USINT	rw	P1.11280612.0.0
12639.0	Storage option: Invalid limit value Application limitation	USINT	rw	P1.18.0.0
12640.0	Diagnostic category: Invalid limit value Application limitation	UINT	rw	P1.53.0.0
12641.0	Storage option: Motion job error due to firmware update	USINT	rw	P1.139.0.0
12642.0	Diagnostic category: Motion job error due to firmware update	UINT	rw	P1.143.0.0
12643.0	Mains voltage	REAL	rw	P1.1209.0.0
12644.0	Limit value velocity limit negative direction of movement	REAL	rw	P1.1310.0.0
12645.0	Lower limit value acceleration limitation	REAL	rw	P1.1311.0.0
12646.0	Lower limit value deceleration limit	REAL	rw	P1.1312.0.0
12650.0	Activation virtual drive	BOOL	rw	P1.71434.0.0
12651.0	Filter time constant velocity filter	REAL	rw	P1.112738.0.0
12652.0	Active filter time constant velocity filter	REAL	ro	P1.112739.0.0
12653.0	Filter time constant Position filter	REAL	rw	P1.112740.0.0
12654.0	Active filter time constant Position filter	REAL	ro	P1.112741.0.0
12655.0	STW_AC4	UINT	rw	P1.11280540.0.0
12656.0	ZSW_AC4	UINT	ro	P1.11280541.0.0
12657.0	ZSW_AC4.11 Home position set	BOOL	ro	P1.11280542.0.0
12658.0	ZSW_AC4.12 Homing run job activated	BOOL	ro	P1.11280543.0.0
12659.0	ZSW_AC4.13 Homing active	BOOL	ro	P1.11280544.0.0
12660.0	STW1.11 Start Homing procedure	BOOL	rw	P1.11280550.0.0
12661.0	Filter time constant velocity filter	REAL	rw	P1.112738.1.0
12662.0	Active filter time constant velocity filter	REAL	ro	P1.112739.1.0

PNU	Name	Data type	Access	Parameter
12663.0	Filter time constant Position filter	REAL	rw	P1.112740.1.0
12664.0	Active filter time constant Position filter	REAL	ro	P1.112741.1.0
12665.0	Start position homing AC4	LINT	rw	P1.1142991.0.0
12666.0	Start position homing AC4	LINT	rw	P1.1142991.1.0
12678.0	Scaling factor I²t velocity dependent	REAL	rw	P1.100009.0.0
12679.0	Activation jog 2 phases	BOOL	rw	P1.100010.0.0
12681.0	Activation Save zero point offset	BOOL	rw	P1.100548.0.0
12682.0	Inertia connecting shaft	REAL	rw	P1.100835.0.0
12683.0	Conversion factor gear unit 4 numerator	UDINT	rw	P1.101215.0.0
12684.0	Conversion factor gear unit 4 denominator	UDINT	rw	P1.101216.0.0
12685.0	Control word CiA402	UINT	rw	P1.730.0.0
12686.0	Status word CiA402	UINT	ro	P1.731.0.0
12689.0	Supported drive modes CiA402	UDINT	ro	P1.734.0.0
12690.0	Internal status state machine profile CiA402	UDINT	ro	P1.735.0.0
12691.0	Internal status state machine profile position mode CiA402	UDINT	ro	P1.736.0.0
12692.0	Internal status state machine profile velocity mode CiA402	UDINT	ro	P1.737.0.0
12693.0	Internal status state machine profile homing CiA402	UDINT	ro	P1.738.0.0
12694.0	User unit position	UINT	rw	P1.7851.0.0
12695.0	User unit velocity	UINT	rw	P1.7852.0.0
12696.0	User unit acceleration	UINT	rw	P1.7853.0.0
12697.0	User unit jerk	UINT	rw	P1.7854.0.0
12698.0	SI unit position CiA402	UDINT	rw	P1.7860.0.0
12699.0	SI unit and velocity CiA402	UDINT	rw	P1.7861.0.0
12700.0	SI unit acceleration CiA402	UDINT	rw	P1.7862.0.0
12701.0	SI unit and jerk CiA402	UDINT	rw	P1.7863.0.0
12702.0	Torque offset CiA402	REAL	rw	P1.8111.0.0
12703.0	Number homing methods CiA402	USINT	ro	P1.8118.0.0
12704.0 ... 16	Supported homing methods CiA402	SINT	ro	P1.8119.0.0 ... 16
12705.0	Target position CiA402	LINT	rw	P1.8130.0.0
12706.0	Profile velocity CiA402	REAL	rw	P1.8131.0.0
12707.0	End velocity CiA402	REAL	rw	P1.8132.0.0
12708.0	Profile acceleration CiA402	REAL	rw	P1.8133.0.0
12709.0	Profile deceleration CiA402	REAL	rw	P1.8134.0.0
12710.0	Quick stop deceleration CiA402	REAL	rw	P1.8135.0.0
12711.0	Profile jerk CiA402	REAL	rw	P1.8136.0.0
12712.0	Target velocity CiA402	REAL	rw	P1.8137.0.0
12713.0	Velocity offset CiA402	REAL	rw	P1.8138.0.0
12714.0	Velocity actual value CiA402	LINT	rw	P1.8140.0.0
12715.0	Active CSx mode CiA402	UDINT	ro	P1.8144.0.0
12716.0	Interpolation mode CSP	UDINT	rw	P1.11412.0.0
12717.0	Interpolation mode CSV	UDINT	rw	P1.11413.0.0
12718.0	Interpolation mode CST	UDINT	rw	P1.11414.0.0
12719.0	Modes of operation CiA402	SINT	rw	P1.12234.0.0
12720.0	Modes of operation display CiA402	SINT	ro	P1.12235.0.0
12721.0	Diagnostic category: Invalid mode of operation	UINT	rw	P1.12236.0.0
12722.0	Storage option: Invalid mode of operation	USINT	rw	P1.12237.0.0

PNU	Name	Data type	Access	Parameter
12723.0	Positioning option code CiA402	UINT	rw	P1.88817.0.0
12724.0	Extended Modulo mode	USINT	rw	P1.88818.0.0
12725.0	CACF	UINT	rw	P1.100990.0.0
12726.0	Threshold value velocity look-ahead	REAL	rw	P1.101017.0.0
12727.0	Threshold value velocity look-ahead	REAL	rw	P1.101017.1.0
12729.0	Activation torque/current limitation	BOOL	rw	P1.101033.0.0
12730.0	Source sensor 0	UDINT	rw	P1.101224.0.0
12731.0	Source sensor 1	UDINT	rw	P1.101252.0.0
12732.0	Internal status state machine profile torque mode CiA402	UDINT	ro	P1.526782.0.0
12733.0	Target torque CiA402	REAL	rw	P1.526795.0.0
12734.0	Torque slope CiA402	REAL	rw	P1.526799.0.0
12735.0	Velocity limitation profile torque mode CiA402	REAL	rw	P1.526800.0.0
12736.0	Positive stroke limitation CiA402	LINT	rw	P1.526802.0.0
12737.0	Negative stroke limitation CiA402	LINT	rw	P1.526803.0.0
12738.0	Activate stroke limit CiA402	BOOL	rw	P1.526804.0.0
12739.0	Digital inputs CiA402	UDINT	ro	P1.1128052.0.0
12740.0	Digital outputs CiA402	UDINT	rw	P1.1128054.0.0
12741.0	Bit mask digital outputs CiA402	UDINT	rw	P1.1128055.0.0
12742.0	CiA402 version	UDINT	ro	P1.1128056.0.0
12743.0	Motor type CiA402	UINT	rw	P1.1128057.0.0
12744.0	Touch probe function CiA402	UINT	rw	P1.1128060.0.0
12745.0	Touch probe status CiA402	UINT	ro	P1.1128061.0.0
12746.0	Next record table index CiA402	DINT	rw	P1.11280053.0.0
12747.0	Status record table CiA402	UDINT	ro	P1.11280055.0.0
12824.0	Storage option: Unsupported homing method	USINT	rw	P1.101344.0.0
12825.0	Diagnostic category: Unsupported homing method	UINT	rw	P1.101348.0.0
12826.0	Actual force	REAL	ro	P1.101362.0.0
12827.0	Filter time constant torque/force	REAL	rw	P1.101374.0.0
12828.0	Reference point torque	UDINT	rw	P1.101382.0.0
12855.0	Modes of operation CiA402	SINT	ro	P1.12238.0.0
12856.0	Modes of operation display CiA402	SINT	ro	P1.12239.0.0
12857.0	Activation Position trigger Device start	BOOL	rw	P1.101547.0.0
12858.0	Activation Position trigger Device start	BOOL	rw	P1.101547.1.0
12859.0	Activation Modulo device start	BOOL	rw	P1.101551.0.0
12860.0	Settling time Following error Acceleration	REAL	rw	P1.101731.0.0
12861.0	Reference Encoder interface	UDINT	rw	P1.101733.0.0
12862.0	Monitoring window Following error acceleration	REAL	rw	P1.101735.0.0
12863.0	Following error acceleration	REAL	ro	P1.101737.0.0
12864.0	Mounting position Axis	REAL	rw	P1.101741.0.0
12865.0	Storage option: Following error acceleration	USINT	rw	P1.101750.0.0
12866.0	Diagnostic category: Following error acceleration	UINT	rw	P1.101753.0.0
13013.0	Storage option: Number of interpolation points exceeded	USINT	rw	P1.101571.0.0
13014.0	Diagnostic category: Number of interpolation points exceeded	UINT	rw	P1.101573.0.0
13015.0	Status Interpolation Position	UDINT	ro	P1.7301.0.0
13016.0	Actual increments per revolution	UDINT	ro	P1.7864.0.0
13017.0	Selection of next increments per revolution	UDINT	rw	P1.7865.0.0

PNU	Name	Data type	Access	Parameter
13018.0	Actual status Activation increments per revolution	BOOL	ro	P1.7866.0.0
13019.0	Selection of activation of increments per revolution	BOOL	rw	P1.7867.0.0
13021.0	Activation of extended gear ratio	BOOL	rw	P1.101905.0.0
13023.0	M_ADD	REAL	rw	P1.101951.0.0
13026.0	Status Cogging Compensation	UDINT	ro	P1.101959.0.0
13030.0	Actual value cogging table	REAL	ro	P1.101967.0.0
13034.0	M_LIMIT_NEG	REAL	rw	P1.101981.0.0
13035.0	M_LIMIT_POS	REAL	rw	P1.101985.0.0
13038.0	Actual gain factor	REAL	rw	P1.101989.0.0
13039.0	Actual integration constant	REAL	rw	P1.101991.0.0
13040.0	Kp_Adapt	REAL	rw	P1.101993.0.0
13041.0	Lower limit input value	REAL	rw	P1.101994.0.0
13042.0	Upper limit input value	REAL	rw	P1.101995.0.0
13043.0	Lower limit value Output value	REAL	rw	P1.101998.0.0
13044.0	Upper limit value Output value	REAL	rw	P1.102000.0.0
13045.0	Mode Gain Calculation	UDINT	rw	P1.102002.0.0
13046.0	Status Identification Cogging	UDINT	ro	P1.102003.0.0
13047.0	Normalisation Factor Identification Cogging	REAL	rw	P1.102004.0.0
13048.0	Offset Identification Cogging	REAL	rw	P1.102005.0.0
13049.0	Evaluation Identification Cogging	REAL	rw	P1.102006.0.0
13050.0	Internal Status Identification Cogging	UDINT	ro	P1.102007.0.0
13051.0 ... 63	Cogging Table Identification	UDINT	ro	P1.102008.0.0 ... 63
13052.0	Storage option: Cogging table recording error	USINT	rw	P1.102017.0.0
13053.0	Diagnosis category: Error in recording the cogging table	UINT	rw	P1.102019.0.0
13058.0	Activate virtual encoder	BOOL	rw	P1.102034.0.0
13059.0	MDI_TARPOS	DINT	ro	P1.102038.0.0
13060.0	Gain factor torque control	REAL	rw	P1.102040.0.0
13061.0	Integration constant torque control	REAL	rw	P1.102042.0.0
13066.0	Threshold value sensor switching	REAL	rw	P1.102085.0.0
13067.0	Hysteresis sensor switching	REAL	rw	P1.102089.0.0
13068.0	Actual value selector torque control	UDINT	rw	P1.102097.0.0
13069.0	Actual value parameter	REAL	rw	P1.102098.0.0
13070.0	Tolerance window modulo	REAL	rw	P1.102100.0.0
13071.0	Activation compatibility V33	BOOL	rw	P1.102137.0.0
13072.0	Offset position relative	LINT	rw	P1.102222.0.0
13073.0	Selection of dynamic torque boost	USINT	rw	P1.102223.0.0
13074.0	K1 factor	REAL	rw	P1.102224.0.0
13075.0	K2 factor	REAL	rw	P1.102225.0.0
13076.0	Tk factor	REAL	rw	P1.102226.0.0
13077.0	Activation symmetrical acceleration/deceleration	BOOL	rw	P1.102395.0.0
13078.0	Deceleration Jog 1 slow	REAL	rw	P1.102397.0.0
13079.0	Actual used deceleration Jog 1 slow	REAL	ro	P1.102399.0.0
13080.0	Deceleration Jog 1 fast	REAL	rw	P1.102401.0.0
13081.0	Actual used deceleration Jog 1 fast	REAL	ro	P1.102405.0.0
13082.0	Deceleration Jog 2 slow	REAL	rw	P1.102407.0.0
13083.0	Actual used deceleration Jog 2 slow	REAL	ro	P1.102409.0.0

PNU	Name	Data type	Access	Parameter
13084.0	Deceleration Jog 2 fast	REAL	rw	P1.102413.0.0
13085.0	Actual used deceleration Jog 2 fast	REAL	ro	P1.102415.0.0
13086.0	Activation of mass/friction estimation	BOOL	rw	P1.102417.0.0
13087.0	Maximum velocity	REAL	rw	P1.102419.0.0
13088.0	Filter time constant velocity	REAL	rw	P1.102421.0.0
13089.0	Filter time constant Acceleration	REAL	rw	P1.102423.0.0
13090.0	Static friction Force	REAL	ro	P1.102425.0.0
13091.0	Filter time constant Torque	REAL	rw	P1.102426.0.0
13092.0	Basic mass	REAL	rw	P1.102427.0.0
13093.0	Standstill damping time	REAL	rw	P1.102428.0.0
13094.0	Monitoring window velocity standstill monitoring	REAL	rw	P1.102429.0.0
13095.0	Standstill monitoring status	BOOL	ro	P1.102431.0.0
13096.0	Velocity dependent friction Force	REAL	ro	P1.102432.0.0
13097.0	Total inertia	REAL	ro	P1.102433.0.0
13098.0	Total mass	REAL	ro	P1.102434.0.0
13099.0	Static friction Torque	REAL	ro	P1.102435.0.0
13100.0	Positioning time	REAL	ro	P1.102436.0.0
13101.0	Load mass	REAL	ro	P1.102437.0.0
13102.0	Status mass/friction estimation	UDINT	ro	P1.102438.0.0
13103.0	Velocity dependent friction Torque	REAL	ro	P1.102439.0.0
13104.0	unused	REAL	rw	P1.102441.0.0
13105.0	unused	REAL	ro	P1.102442.0.0
13107.0	Basic inertia	REAL	rw	P1.102458.0.0
13108.0	Load inertia	REAL	ro	P1.102492.0.0
13109.0	Storage option: Calculation mass/friction value estimate not completed	USINT	rw	P1.102544.0.0
13110.0	Diagnostic category: Calculation mass/friction value estimate not completed	UINT	rw	P1.102548.0.0
13184.0	Diagnosis V034 Compatible	BOOL	rw	P1.100975.0.0
13185.0	Activation Torque/Position	BOOL	rw	P1.101082.0.0
13186.0	Torque/Position	BOOL	ro	P1.101089.0.0
13188.0	Activation torque at standstill	BOOL	rw	P1.101097.0.0
13189.0	Output Torque/Position	REAL	ro	P1.101131.0.0
13190.0	Limit value standstill detection	REAL	rw	P1.101149.0.0
13191.0	Activation STO+SBC	BOOL	rw	P1.102558.0.0
13192.0	Gain factor Torque/Position	REAL	rw	P1.102641.0.0
13193.0	Direction Torque/Position	USINT	rw	P1.102642.0.0
13194.0	Setpoint Selector Torque/Position	USINT	rw	P1.102643.0.0
13195.0 ... 63	Torque table	REAL	rw	P1.102644.0.0 ... 63
13196.0 ... 63	Position table	LINT	rw	P1.102645.0.0 ... 63
13197.0	Number of table elements	UDINT	rw	P1.102646.0.0
13198.0	Offset Position Torque/Position	LINT	rw	P1.102647.0.0
13199.0	Offset Torque Torque/Position	REAL	rw	P1.102648.0.0
13200.0	Source Parameter Torque/Position	LINT	rw	P1.102649.0.0
13201.0 ... 2	Offset analog input	REAL	rw	P1.102673.0.0 ... 2
13202.0	ZSW2.5 Holding brake	BOOL	ro	P1.1146090.0.0
13235.0	Torque on motor side	BOOL	rw	P1.1128062.0.0

PNU	Name	Data type	Access	Parameter
13236.0	Lower limit value jerk	REAL	rw	P1.102777.0.0
13237.0	Upper limit value jerk	REAL	rw	P1.102778.0.0
13238.0	Jerk limitation status	BOOL	ro	P1.102796.0.0
13256.0	Fieldweakening: Active max. rotary speed	REAL	ro	P1.71370.0.0
13257.0	Raw value voltage ZK 600V	REAL	ro	P1.102704.0.0
13258.0	Force constant (active value)	REAL	ro	P1.102927.0.0
13259.0	Slide weight linear	REAL	ro	P1.102929.0.0
13260.0	Fieldweakening: max. rotary speed (user defined)	REAL	rw	P1.71371.0.0
13261.0	Pitch length (user defined)	REAL	rw	P1.102901.0.0
13262.0	Rated velocity linear (user defined)	REAL	rw	P1.102904.0.0
13263.0	Maximum velocity linear (user defined)	REAL	rw	P1.102905.0.0
13264.0	Maximum velocity fieldweakening linear (user defined)	REAL	rw	P1.102906.0.0
13265.0	Force constant (user defined)	REAL	rw	P1.102907.0.0
13266.0	Slide weight linear (user defined)	REAL	rw	P1.102928.0.0
13267.0	Enable working stroke detection	BOOL	rw	P1.102909.0.0
13268.0	Working stroke detection method	DINT	rw	P1.102910.0.0
13269.0	Offset software limit to position mark	LINT	rw	P1.102911.0.0
13270.0	Move free offset	LINT	rw	P1.102912.0.0
13271.0	Detected working stroke	LINT	ro	P1.102913.0.0
13272.0	XSOLL_A	LINT	rw	P1.11280608.0.0
13273.0	CS IPO delta time	REAL	ro	P1.102914.0.0
13274.0	Storage option: Invalid gearbox configuration	USINT	rw	P1.102876.0.0
13275.0	Diagnostic category: Invalid gearbox configuration	UINT	ro	P1.102877.0.0
13276.0	Enable analog velocity override input	BOOL	rw	P1.130911.0.0
13277.0	Valid motion monitoring AC5	UDINT	rw	P1.11280034.0.0
13278.0	Unwind range	LINT	rw	P1.102964.0.0
13279.0	Output setpoint	LINT	ro	P1.102965.0.0
13280.0	Output unwind	LINT	ro	P1.102966.0.0
13281.0	State of application class 5	UDINT	ro	P1.11280532.0.0
13282.0	ZSW2.10 Synchronized active	BOOL	ro	P1.1146091.0.0
13283.0	STW2.9 Set reference point	BOOL	ro	P1.1148130.0.0
60000.0	Base value velocity	REAL	rw	P1.11280701.0.0
60100.0 ... 4	Active telegrams	UINT	ro	P0.11280210.0.0 ... 4
60104.0	Extended process data	UINT	ro	P0.11280204.0.0
60105.0	Active telegram Subslot 5	UINT	ro	P0.101935.0.0

Tab. 992: PNUs reference list

13 EtherNet/IP - Modbus TCP

13.1 General

This part of the documentation describes the implemented standards and the communications of the device in a EtherNet/IP or Modbus network. It is intended for people who are already familiar with the bus protocol.
The Ethernet Industrial Protocol (EtherNet/IP) is an open standard for industrial networks. EtherNet/IP is used for cyclical transmission of control and status data (I/O data) as well as acyclic transmission of parameter data.
EtherNet/IP was developed by Rockwell Automation and the user organisation "ODVA (Open DeviceNet Vendor Association)" and standardised in the international standards series IEC 61158.
EtherNet/IP is based on the general, object-oriented CIP object model.

Downloads

An EDS file is available in the firmware package and as a separate file on the Internet ➔ www.festo.com/sp.

Festo provides function blocks and application notes to facilitate the commissioning of the device with controllers from various manufacturers ➔ www.festo.com/sp, Downloads → Software and Expert knowledge.

13.2 Standards

The user organisation of EtherNet/IP is ODVA. The following documents, among others, can be obtained from this user organisation:

ODVA standards	Description
THE CIP NETWORKS LIBRARY: Volume 1 – Common Industrial Protocol (CIP)	This document describes the general principles of the Common Industrial Protocol (CIP) (e.g. transmission).
THE CIP NETWORKS LIBRARY: Volume 2 – EtherNet/IP Adaptation of CIP	This document describes the general basics and the embedding of EtherNet/IP in the Common Industrial Protocols (CIP).
THE CIP NETWORKS LIBRARY: Volume 7 – Integration of Modbus Devices into the CIP Architecture	This document describes the integration of Modbus devices into a CIP architecture.

Tab. 993: OVDA standards

Additional information on the ODVA user organisation (Open DeviceNet Vendor Asscociation) ➔ www.odva.org.

13.3 EtherNet/IP communication

13.3.1 EtherNet/IP Interface

The EtherNet/IP connection is designed as a 2-port Ethernet switch with 8-pin RJ sockets. Via these connections, the servo drive can be integrated into an EtherNet/IP network.
– Port 1: XF1 IN
– Port 2: XF2 OUT
The servo drive is a pure EtherNet/IP adapter and requires an EtherNet/IP controller (scanner) in order to be controlled via EtherNet/IP.
The servo drive supports the Device Level Ring function (DLR) and is able to communicate with an EtherNet/IP Ring Supervisor. In case of a string failure, the servo drive takes the new path specifications of the Ring Supervisor and uses them.

The EtherNet/IP interface of the servo drive is intended exclusively for connection to local, industrial fieldbus networks.

13.3.2 Configuration EtherNet/IP Stations

Several steps are required in order to produce a functional EtherNet/IP interface. We recommend the following procedure:
- Parameterisation and commissioning with the Festo Automation Suite and the CMMT-ST plug-in
- Linking of the EDS file into the project engineering software.

Parameterisation of the EtherNet/IP interface

The CMMT-ST plug-in can be used to read and parameterise settings of the EtherNet/IP interface. The goal is to configure the EtherNet/IP interface in such a way that the servo drive can establish EtherNet/IP communication with an EtherNet/IP controller.

Setting the IP address

A unique IP address must be assigned to every device in the network. Assignment of already used IP addresses can result in temporary overloading of your network. The following rules apply to setting the EtherNet/IP address:
- There must be no connection to a controller. As soon as a connection is established, the IP address must not be changed.
- There must be a network connection. If a valid network is not available or settings are incorrect, the settings will not be accepted.

Static addressing

The CMMT-ST plug-in can be used to assign the values for IP address, subnet mask and gateway address on the fieldbus panel.
- For manual assigning of a permitted IP address, contact the network administrator.

Dynamic addressing

The CMMT-ST plug-in can be used to activate or deactivate the dynamic addressing.
For dynamic addressing, there is the option of addressing either through DHCP or BOOTP. Both protocols are standard and are supported by the device.
If dynamic addressing is set at device start or reset, an IP address is assigned to the device either through DHCP and an available DHCP server or through the BOOTP protocol.

13.3.3 Connection parameters

ID Px.	Parameter	Description	
12004	Active IP address	Active IP address	
		Access	read/–
		Update	effective immediately
		Unit	–
12005	Active subnet mask	Active subnet mask	
		Access	read/–
		Update	effective immediately
		Unit	–
12006	Active gateway address	Active gateway address	
		Access	read/–
		Update	effective immediately
		Unit	–
12007	MAC address	MAC address	
		Access	read/–

ID Px.	Parameter	Description	
12007	MAC address	Update	effective immediately
		Unit	–

Tab. 994: Parameters

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
12004	2999.0	Active IP address	UDINT
12005	3001.0	Active subnet mask	UDINT
12006	3003.0	Active gateway address	UDINT
12007	3005.0 ... 5	MAC address	USINT

Tab. 995: PNUs

13.3.4 Connection characteristics

ID Px.	Parameter	Description	
3030101	Telegram selection	Specifies the telegram selection for EtherNet/IP or Modbus TCP. The telegram determines the application class (velocity, positioning) the drive is operated in. This also affects the mapping of the process data.	
		Access	read/write
		Update	effective immediately
		Unit	–
11280109	Actual application class	Displays the actual application class.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 996: Parameter

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
3030101	3490.0	Telegram selection	Unsigned16
Px.	**Manufacturer-specific parameters**		
11280109	12317.0	Actual application class	UDINT

Tab. 997: PNUs

13.3.5 Configuring the EtherNet/IP Master

Electronic datasheet (EDS)

The capabilities of the EtherNet/IP interface of the device are described in an EDS file for fast and simple commissioning.
By using a suitable configuration software for the higher-level controller, it is possible to integrate the device into the network by an EDS file. The way in which the network is configured depends on the configuration software used.
Most current version of the EDS file ➔ www.festo.com/sp.

Festo provides function blocks and application notes to facilitate the commissioning of the device with controllers from various manufacturers ➔ www.festo.com/sp, Downloads → Software and Expert knowledge.

Device identification

Key features	Contents
Vendor code	26
Vendor Name	Festo SE & Co. KG
Product Name	Festo CMMT

Key features	Contents
Product Type	43 (Generic Device)
Product Code	65282

Tab. 998: Device identification (example)

13.3.6 Basic Functions

The servo drive supports the following basic functions:
– Cyclic communication (implicit messaging)
– Acyclic Communication (Explicit Messaging)

Cyclic communication (implicit messaging)

Implicit Messaging implements the cyclic data communication with EtherNet/IP. The standard communication method for Implicit Messaging is cyclic, time-based polling.

Acyclic Communication (Explicit Messaging)

Explicit Messaging implements acyclic data communication with EtherNet/IP. All mapped EtherNet/IP objects can be addressed via this channel.
Explicit messaging can be either connected or unconnected.

13.3.7 EtherNet/IP Objects

Objects

The servo drive supports the following function objects:
– Identity Object - 0x01
– Message Route Object - 0x02
– Assembly Object - 0x04
– Connection Manager Object - 0x06
– Device Level Ring Object - 0x47
– Qualtity of Service Object - 0x48
– TCP/IP Interface Object - 0xF5
– Ethernet Link Object - 0xF6

Address Ranges

ODVA has defined an address range from 0 to 65535 for class IDs.

Address ranges (dec.)	Address ranges (hex.)	Description
0 ... 99	0x0000 ... 0x0063	ODVA-specific objects
100 ... 199	0x0064 ... 0x00C7	Manufacturer-specific objects
200 ... 239	0x00C8 ... 0x00EF	Reserved objects
240 ... 767	0x00F0 ... 0x02FF 0x00F0 0x02FF 0x00F0 0x02FF	ODVA-specific objects
768 ... 1279	0x0300 ... 0x04FF	Manufacturer-specific objects
1280 ... 65535	0x0500 ... 0xFFFF	Reserved objects

Tab. 999: Address Ranges

Identity Object - 0x01

This object contains the identification and general information about the device. Instance 1 identifies the entire servo drive. This object can be used to identify a device in the network.

Instance	Name	Attribute ID	Name
0	Class	1	Revision
		2	Max. Instance
		3	Number of instances
		4	Number of attributes
		5	Optional Service list (contains reset service)
		6	Max. Class Attribute

Instance	Name	Attribute ID	Name
0	Class	7	Max. Instance Attribute
1	Instance Attributes	1	Vendor ID
		2	Device Type
		3	Product Code
		4	Major Revision
			Minor Revision
		5	Status
		6	Serial Number
		7	Product Name
		8	State

Tab. 1000: Identity Object - 0x01

Message Router Object - 0x02

This object provides a message link that a client can use to address a service to an object class or an instance within the device. No services are offered by this object.

Assembly Object - 0x04

These objects are used to link input or output data ➔ 13.6.4 Process data.

Instance	Name	Attribute ID	Name
0	Class	1	Revision
		2	Max. Instance
		3	Number Of Instances
		4	Number Of Attributes
100, 101, 102, 110, 111	Instance Attributes	1	Reserved
		2	Reserved
		3	Data
		4	Size

Tab. 1001: Assembly Object - 0x04

Connection Manager Object - 0x06

This object is used to set up a connection. The object is instantiated only once.

Device Level Ring Object - 0x47

This object is used to configure a network with the ring topology according to the DLR specification of EtherNet/IP.

Instance	Name	Attribute ID	Name
0	Class	1	Revision
1	Instance Attributes	1	Network Topology – 0 indicates Linear – 1 indicates Ring
		2	Network Status – 0 indicates Normal – 1 indicates Ring Fault – 2 indicates Unexpected Loop Detected – 3 indicates Partial Network Fault – 4 indicates Rapid Fault/Restore Cycle
		3	Ring Supervisor Status
		4	Ring Supervisor Config Structure
		5	Ring Faults Count
		6	Last Active Node on Port1
		7	Last Active Node on Port2
		8	Ring Protocol Participants Count
		9	Ring Protocol Participants List

Instance	Name	Attribute ID	Name
1	Instance Attributes	10	Active Supervisor Address
		11	Active Supervisor Precendance
		12	Capability Flags

Tab. 1002: Device Level Ring Object - 0x47

Qualtity of Service Object - 0x48

This object provides mechanisms that can assign different priorities to the transmission stream.

Instance	Name	Attribute ID	Name
0	Class	1	Revision
		2	Max. Instance
1	Instance attributes	1	802.1Q Tag Enable
		2	DSCP PTP Event
		3	DSCP PTP General
		4	DSCP Urgent
		5	DSCP Scheduled
		6	High
		7	Low
		8	Explicit

Tab. 1003: Qualtity of Service Object - 0x48

TCP/IP Interface Object - 0xF5

This object is used to configure a TCP/IP network (e.g. IP address, subnet mask and gateway address).

Instance	Name	Attribute ID	Name
0	Class	1	Revision
		2	Max. Instance
1	Instance Attributes	1	Status
		2	Configuration Capacity
		3	Configuration Control
		4	Physical Link Object
		5	Interface Configuration:
			IP-Address
			Network Mask
			Gateway Address
			Name Server
			Name Server 2
			Domain Name
		6	Host Name
		7	Safety Network Number
		8	TTL Value

Tab. 1004: TCP/IP Interface Object - 0xF5

Ethernet Link Object - 0xF6

This object contains link-specific counters and status information for an Ethernet IEEE 802.3 communication interface.
Each instance of the object corresponds exactly to one Ethernet IEEE 802.3 communication interface.
The servo drive is a 2-port EtherNet/IP device and can instantiate 2 Ethernet Link objects.

Instance	Name	Attribute ID	Name
0	Class	1	Revision
		2	Max. Instance
1	Instance Attributes	1	Interface Speed
		2	Interface Flags
		3	Physical Address
		4	Interface Counters
		5	Media Counters
		6	Interface Control
		7	Interface Type
		8	Interface State
		9	Admin State
		10	Interface Label

Tab. 1005: Ethernet Link Object - 0xF6

13.3.8 Parameterisation via the CIP object model

Parameterisation is implemented in conjunction with the drive profile used via fixed mapping. All PNUs in the drive profile can be accessed via CIP Explicit Messaging.
Mapping is based on the following rules:

Field	Value	Comments
Class	= 0x400 + drive object number	In the servo drive, one axis and thus only one DO has been implemented so far. This means that all PNUs can be mapped in the Class 0x401.
Instance	= parameter number (PNU)	e.g. with PNU 2060 = instance 2060
Attributes	= array index number	e.g. with PNU 2060.0 ... 5 = attribute 0 ... 5

Tab. 1006: Mapping CIP-explicit messaging

Example

macAddressCOM1
Internal data ID = P0.248.0.0 to P0.248.0.5, Datatype = UINT08, ArraySize = 6
= PNU 2060.0 to PNU 2060.5
= Class 0x401, Instance 2060, Attribute 0...5

Supported explicit messaging services

– Get attribute single = read a parameter
– Set attribute single = write a parameter

13.4 CIP Sync

CIP Sync provides the mechanism necessary for accurate time coordination in industrial automation applications. The technology is based on the IEEE-1588 standard (Precision Time Protocol, PTP) and enables a synchronisation accuracy of less than 100 nanoseconds between two devices. This makes real-time synchronisation possible even over conventional Ethernet networks with switch-based architecture.
CIP Sync includes a time-sync object and associated services that allow devices – including axis movements – to be synchronised over a common time base.
This method is flexible, scalable and particularly suitable for large-scale motion systems, as it is not limited by the constraints of event- or time-slice-based approaches.
CIP Sync communicates with the additional telegram 908 ➔ 13.6.6 Additional telegram CIP Sync.

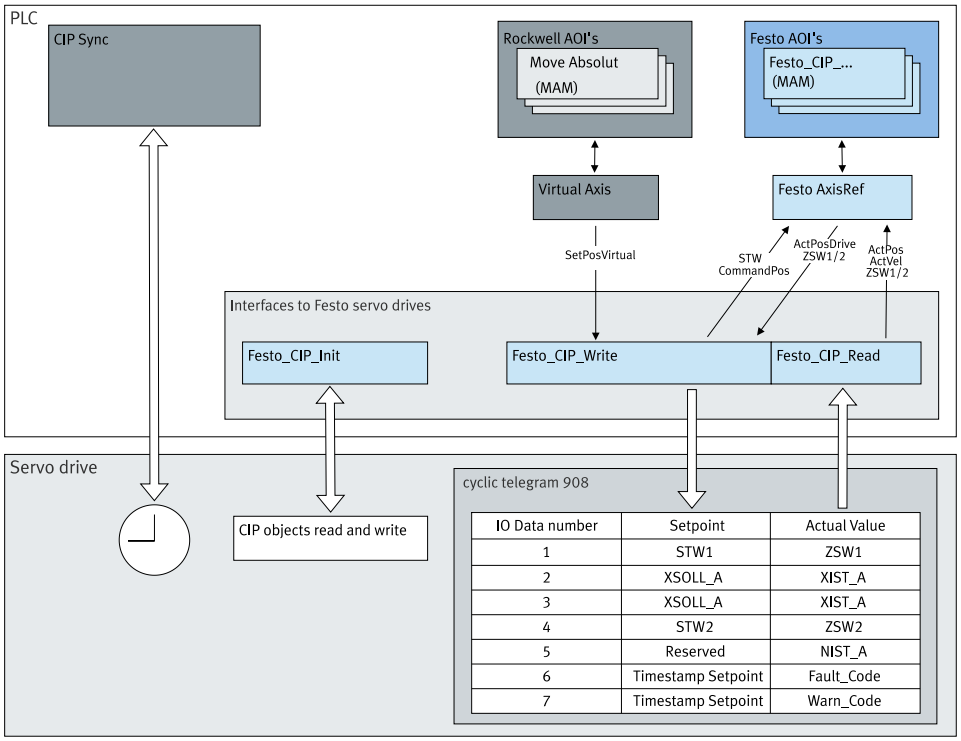


Fig. 149: CIP Sync

Festo provides an application note for the implementation of CIP Sync
➔ www.festo.com/sp, Downloads → Expert knowledge.

13.5 Modbus TCP

13.5.1 Configuration of Modbus device

Modbus is an open communication protocol based on the master-slave architecture. Modbus is an established standard for communication via Ethernet-TCP/IP in automation technology.

Recommended: perform parameterisation of the slave first. Then configure the master. If the parameterisation is correct, the servo drive is immediately ready for communication.

The Modbus connection is implemented via 2 real-time Ethernet interfaces (RTE).
– Port 1: XF1 IN
– Port 2: XF2 OUT
Dynamic IP addressing or static addressing can be used as the IP configuration (DHCP or manual address allocation). The EtherNet/IP communication connection parameters are used for the IP configuration.

Parameterisation

The parameterisation of Modbus TCP takes place exclusively via the standard Ethernet interface [X18]. Parameterisation via the real-time Ethernet interface port 1/2 is not intended.

The parameterisation of the Modbus functionality is only retained after a reset if the parameter set of the device has been saved in the device.

TCP port setting and timeout

The default is:

– TCP port 502 (default port für Modbus TCP)
– Timeout 1 ms (connection timeout to detect an interruption of the Modbus and switch to a corresponding status). The register for the timeout is 400-401.
The connection timeout can be changed by writing the registers 400 and 401. The value must be transmitted in ms and in a 32 bit width. After a successful write, the transferred value is automatically saved in the device. The 32 bit value is divided into the 2 16 bit registers. The lower 16 bits are transferred in register 400 and the upper 16 bits in register 401. The applicable 16 bits of the connection timeout must be entered in the Modbus register in reverse order.

Activation

After switch-on, the device waits for an EtherNet/IP or a Modbus TCP telegram. As soon as the device receives a corresponding telegram, the other protocol is deactivated.

13.5.2 Supported services

Function code	Modbus command	Meaning
3 (0x03)	Read Holding Registers	Read process data (output data)
6 (0x06)	Write Single Register	Write device parameters word-by-word
16 (0x10)	Write Multiple Registers	Write process data (input data)
23 (0x17)	Read/Write Multiple Registers	Combined read/write of process data
43 (0x2B, Subcode 1)	Read Device Identification	Read device information (Basic)
43 (0x2B, Subcode 2)	Read Device Identification	Read device information (Regular)

Tab. 1007: Supported services

13.5.3 Data objects

Object ID		Object name	Value
Basic	0x00	Vendor Name	"Festo SE & Co. KG"
	0x01	Product Code	"CMMT-ST"
	0x02	Major/Minor Revision	dependent on the firmware version
Regular	0x03	Vendor URL	"www.festo.com"
	0x04	Product Name	"CMMT-ST"
	0x05	Model Name	" " (blank)

Tab. 1008: Data objects Read Device Identification

13.5.4 Process data

Modbus TCP offers the same process data as that available in the drive profile of EtherNet/IP.

Process data	Description
Byte 0 ... 23 (24 bytes)	Telegrams 1, 102 or 111 ➔ 13.6.5 Telegrams
Byte 24 ... 55 (32 bytes)	Additional telegram 910 (Extended Process Data, EPD) ➔ 13.6.7 Additional telegram Extended Process Data

Tab. 1009: Process data assignment

The process data are transmitted at a minimum transmission rate of 1 ms.
The process data channel has a fixed length of 56 bytes. If the EPD channel is deactivated, only zeros are transmitted.
From the point of view of the controller:
– Input-Data: register 100 ... 127
– Output-Data: register 0 ... 27

13.5.5 Connection parameters

ID Px.	Parameter	Description	
12004	Active IP address	Active IP address	
		Access	read/–
		Update	effective immediately
		Unit	–
12005	Active subnet mask	Active subnet mask	
		Access	read/–
		Update	effective immediately
		Unit	–
12006	Active gateway address	Active gateway address	
		Access	read/–
		Update	effective immediately
		Unit	–
12007	MAC address	MAC address	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 1010: Parameters

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
12004	2999.0	Active IP address	UDINT
12005	3001.0	Active subnet mask	UDINT
12006	3003.0	Active gateway address	UDINT
12007	3005.0 ... 5	MAC address	USINT

Tab. 1011: PNUs

13.5.6 Connection characteristics

ID Px.	Parameter	Description	
3030101	Telegram selection	Specifies the telegram selection for EtherNet/IP or Modbus TCP. The telegram determines the application class (velocity, positioning) the drive is operated in. This also affects the mapping of the process data.	
		Access	read/write
		Update	effective immediately
		Unit	–
11280109	Actual application class	Displays the actual application class.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 1012: Parameter

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
3030101	3490.0	Telegram selection	Unsigned16
Px.	**Manufacturer-specific parameters**		
11280109	12317.0	Actual application class	UDINT

Tab. 1013: PNUs

13.5.7 Single parameter access

Single parameters can be read or written via registers 500 to 504 and 510. The PNUs with subindex are used.

Register

Register	Length	Access	Name	Description
500	1	r/w	PNU	PNU for single parameter access
501	1	r/w	PNU Subindex	Subindex of the PNU
502	1	r/w	Number of Elements	Number of items in single parameter access
503	1	r/w	Exec	Perform single parameter access, see the following section: – 1: Read – 2: Write – 4: Error (request failed) – 16: Done (request successfully completed)
504	1	r	Data Length	Length of read or written data in bytes
510	128	r/w	Data	Written or read data

Tab. 1014: Register for single parameter access

Perform single parameter access

A PNU read or write is initiated by writing register Exec as the last register of the request.
The table below shows the steps to perform an access.

Step	Register	Description
1	500	Write PNU.
2	501	Write subindex.
3	502	Write number of elements.
4	510... (510 + Data Length)	Write the data, the length depends on the number of elements when writing.
5	503	Write the value 1 or 2 to register Exec.
6	503	Read register Exec until the value Done or Error is present.
7	504 and 510...	Read Data Length and Data (only for read access).

Tab. 1015: Single parameter access steps

13.6 Drive profile

13.6.1 General

The drive profile supports speed and position operating modes divided into application classes.

Motion control is implemented by the functions as with PROFIDRIVE.
The device parameters Px. are accessed via the additional telegram (extended process data).

13.6.2 Application classes

13.6.2.1 Basic values and reference values in the application classes

Effectiveness of the dynamic values in the application classes

When a stop ramp is requested via the control word STW1 and when a motion command is requested in application classes 1 and 3, the following dynamic values are used:

ID Px.	Parameters	Effectiveness of the dynamic values in the application classes (AC)						
		STW1.0 AC1/AC3	STW1.2 AC1/AC3	STW1.4 AC1/AC3	STW1.5 AC3	STW1.6 AC1	ModePos AC3	Profile AC1
11280402	Acceleration	–	–	–	–	–	–	✓
11280403	Deceleration	✓	–	–	–	✓	–	✓
11280404	Jerk	✓	–	–	✓	✓	✓	✓
11280405	Deceleration (system stop)	–	–	✓	–	–	–	–
11280406	Jerk (system stop)	–	–	✓	–	–	–	–
12101.0.0	Deceleration Stop ramp	–	✓	–	–	–	–	–
12111.0.0	Jerk Stop ramp	–	✓	–	–	–	–	–
11280702	Base value acceleration	–	–	–	–	–	✓	–
11280703	Base value deceleration	–	–	–	✓	–	✓	–
11280701	Base value velocity	–	–	–	–	–	✓	✓
–	Base value velocity (PLC)	–	–	–	–	–	✓	✓

Tab. 1016: Effectiveness of the dynamic values

Parameter

ID Px.	Parameter	Description	
11280701	Base value velocity	Specifies the base value for all Application Classes. The base value in user units (drive side without gearbox) is multiplied by the normalized value in the process data and then results in the internal velocity setpoint. As a recommendation, the base value should be half of the maximum velocity in order to use the full value range 0..200% from the control.	
		Access	read/write
		Update	reinitialization
		Unit	user defined
11280702	Base value acceleration	Specifies the base value for acceleration for the Positioning application class in Tel. 111. The base value is multiplied by the normalized value in the process data and then gives the internal acceleration setpoint.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280703	Base value deceleration	Specifies the base value for deceleration for the Positioning application class in Tel. 111. The base value is multiplied by the normalized value in the process data and then gives the internal deceleration setpoint.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280402	Acceleration	Specifies the acceleration value for the application class AC1.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280403	Deceleration	Specifies the deceleration value for the application class AC1 and AC3.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280404	Jerk	Specifies the value for the jerk for the application class AC1 and AC3.	
		Access	read/write

ID Px.	Parameter	Description	
11280404	Jerk	Update	effective immediately
		Unit	user defined

Tab. 1017: Parameter

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
11280701	12345.0	Base value velocity	REAL
11280702	12346.0	Base value acceleration	REAL
11280703	12347.0	Base value deceleration	REAL
11280402	12325.0	Acceleration	REAL
11280403	12326.0	Deceleration	REAL
11280404	12327.0	Jerk	REAL

Tab. 1018: PNUs

13.6.2.2 Application Class 1 – Standard Drive (Speed Mode)

In application class 1 the drive is controlled by a main setpoint, e.g. speed setpoint. The speed is controlled completely in the drive. The bus is simply the transmission medium between the automation system and the servo drive. The higher-level controller (PLC) contains all technological functions for the automation task. Process data (setpoint and actual values) are exchanged cyclically. Cyclical synchronous data transfer can be used, but is typically not necessary for this application class.

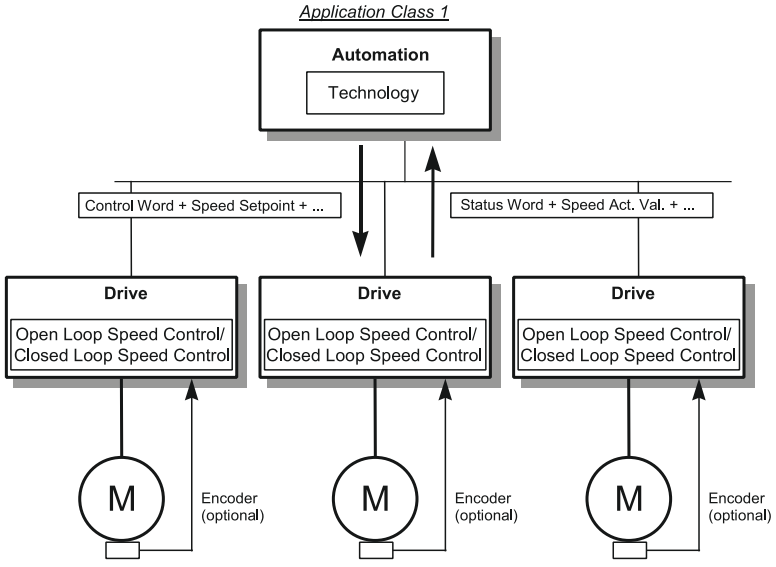


Fig. 150: Application class 1

13.6.2.3 Application Class 3 – Positioning Mode (PtP)

In application class 3 the positioning commands are sent to the drive by the higher-level controller (PLC). The higher-level controller (PLC) only contains the technological functions required for the automation task. The drive itself directly controls the interpolation, positioning and rotational speed and all time-critical control algorithms. Cyclical synchronous operation is only required for complex tracking tasks with multiple axes.

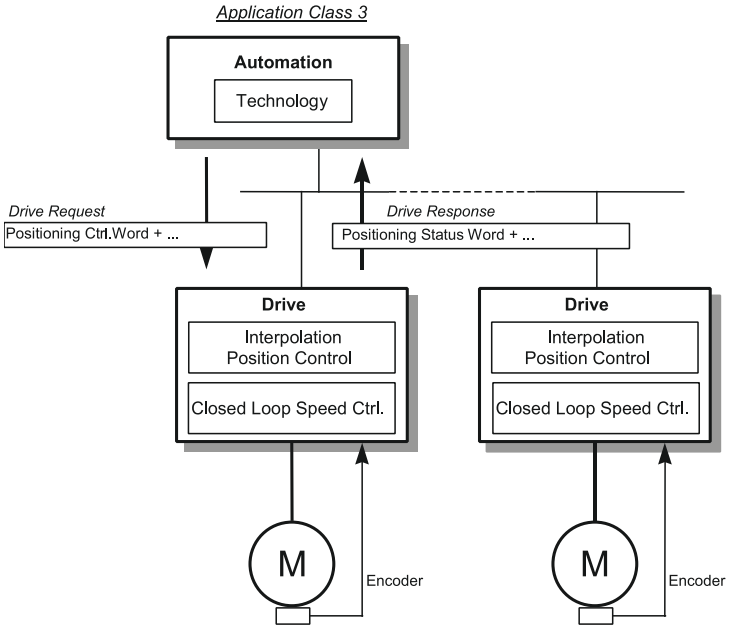


Fig. 151: Application class 3

Sub-mode Record Mode

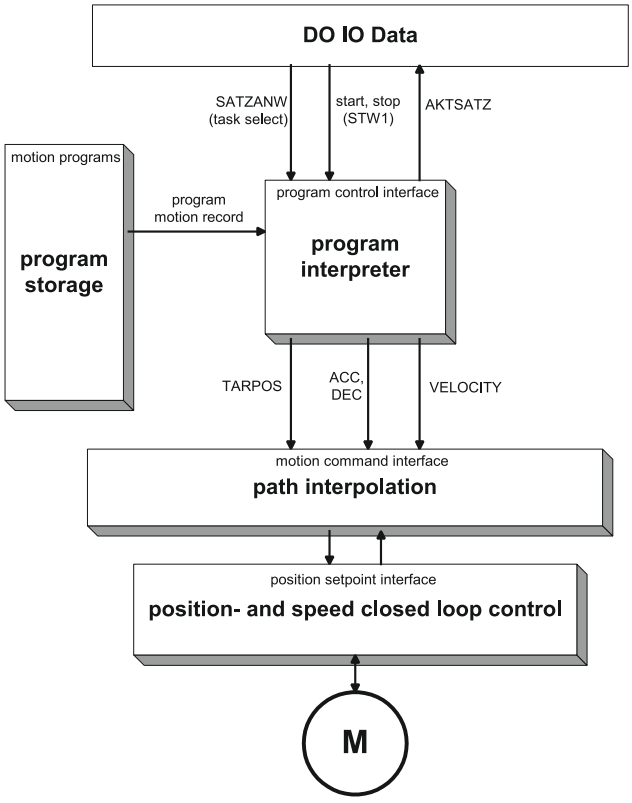


Fig. 152: Record mode

MDI sub-mode/target value specification

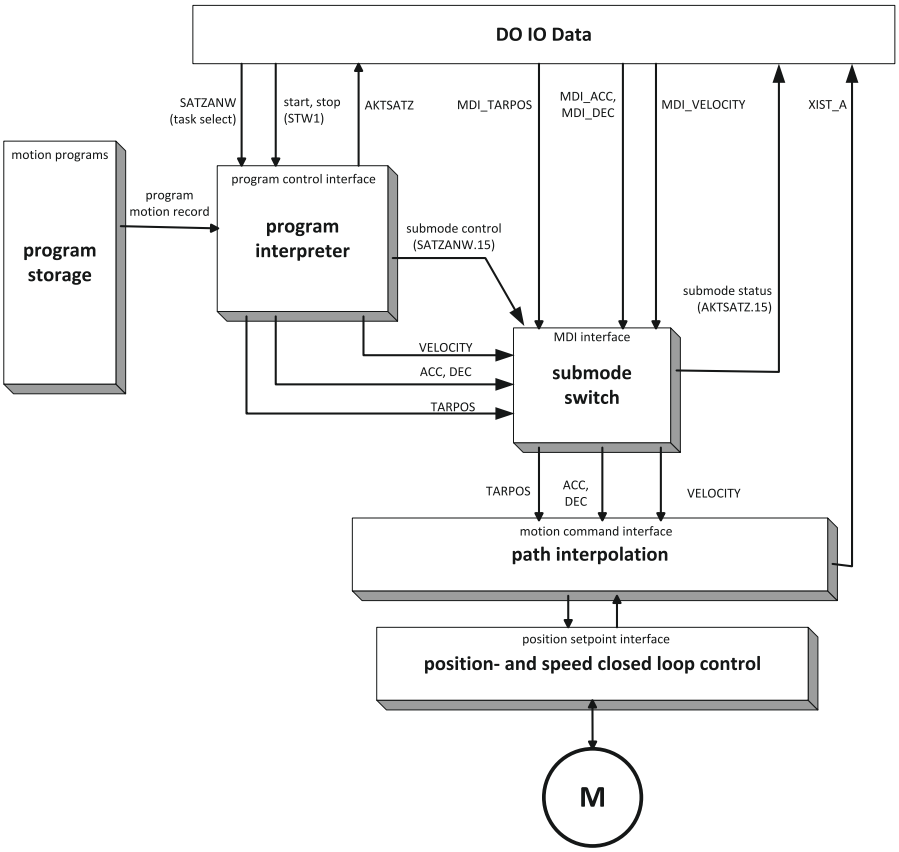


Fig. 153: Target value specification/MDI

13.6.3 Finite State Machines

13.6.3.1 Basic finite state machine

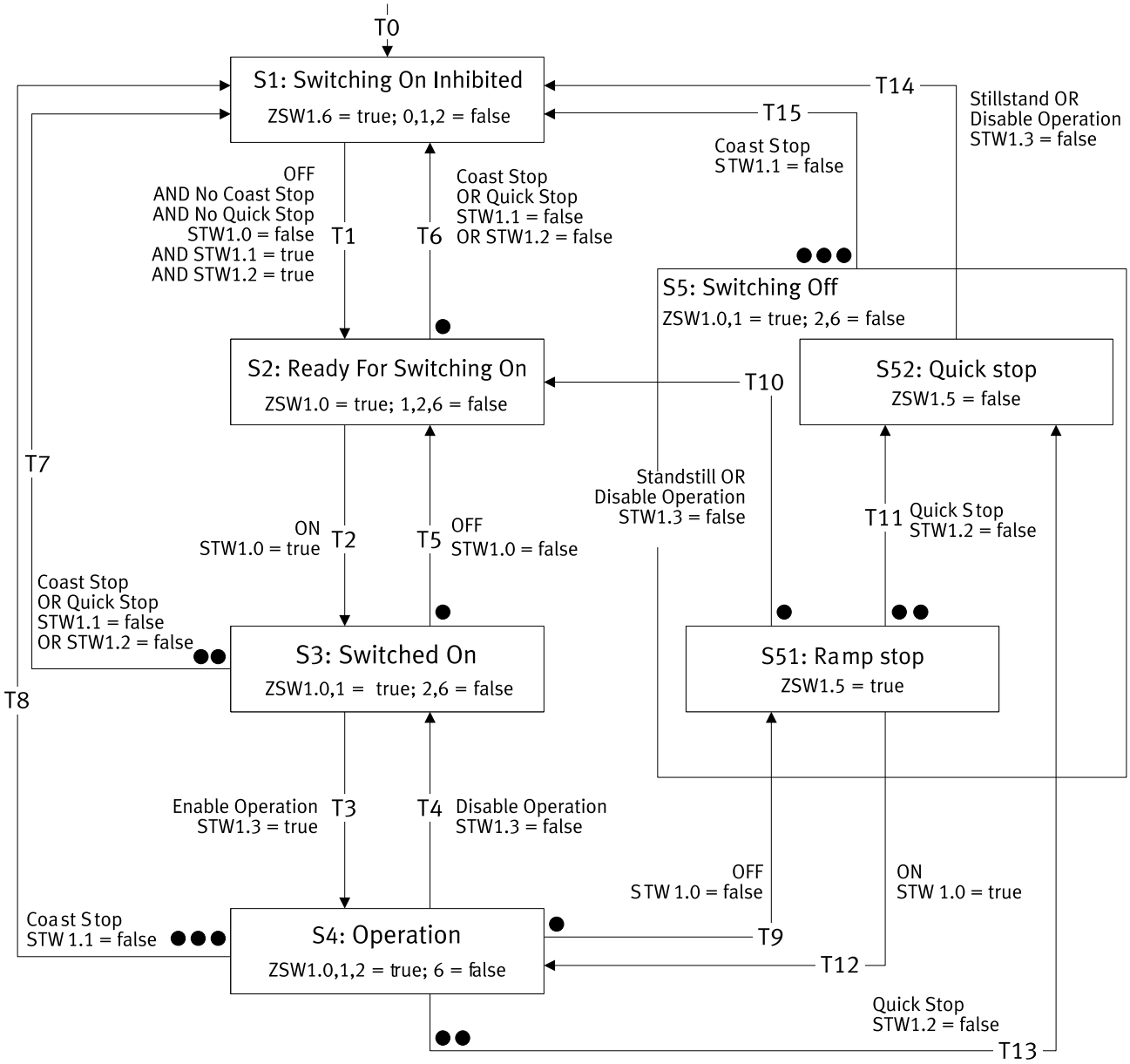


Fig. 154: Basic finite state machine

Multiple transitions are possible from some states. In this case the transitions with assigned priorities are specified in the status diagram. Points are used to identify the priority level. The more points a transition has the higher the priority. A transition with no points has the lowest priority.

No.	condition		Target status
T0	Logic voltage supply present	= 1	S1 Switching On Inhibited

Tab. 1019: Transition T0

Status S1 Switching On Inhibited

Name	Description	Status	
S1 Switching On Inhibited	Switch-on lock	ZSW1.0	= 0
		ZSW1.1	= 0
		ZSW1.2	= 0

Name	Description	Status	
S1 Switching On Inhibited	Switch-on lock	ZSW1.6	= 1
		ZSW2.11	= 0

Tab. 1020: Status S1

No.	Conditions		Target status
T1	STW1.0 Power Stage Enable	= 0	S2 Ready For Switching On
	AND		
	STW1.1 Coast Stop Disable	= 1	
	AND		
	STW1.2 Quick Stop Disable	= 1	

Tab. 1021: Transition from status S1

Status S2 Ready For Switching On

Name	Description	Status	
S2 Ready For Switching On	Ready to be switched on	ZSW1.0	= 1
		ZSW1.1	= 0
		ZSW1.2	= 0
		ZSW1.4	= 1
		ZSW1.5	= 1
		ZSW1.6	= 0
		ZSW2.11	= 0

Tab. 1022: Status S2

No.	Conditions		Target status
T2	STW1.0 Power Stage Enable	= 1	S3 Switched On
T6	STW1.1 Coast Stop Disable	= 0	S1 Switching On Inhibited
	OR		
	STW1.2 Quick Stop Disable	= 0	

Tab. 1023: Transitions from Status S2

Status S3 Switched On

Name	Description	Status	
S3 Switched On	Ready for operation	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 0
		ZSW1.3	= 0
		ZSW1.4	= 1
		ZSW1.5	= 1
		ZSW1.6	= 0
		ZSW2.11	= 0

Tab. 1024: Status S3

No.	Conditions		Target status
T3	STW1.3 Enable Operation	= 1	S4 Operation
T5	STW1.0 Power Stage Enable	= 0	S2 Ready For Switching On
T7	STW1.1 Coast Stop Disable	= 0	S1 Switching On Inhibited
	OR		
	STW1.2 Quick Stop Disable	= 0	

Tab. 1025: Transitions from Status S3

Status S4 Operation

Name	Description	Status	
S4 Operation	Operation	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 1
		ZSW1.6	= 0
		ZSW2.11	= 1

Tab. 1026: Status S4

No.	Conditions		Target status
T4	STW1.3 Enable Operation	= 0	S3 Switched On
T8	STW1.1 Coast Stop Disable	= 0	S1 Switching On Inhibited
T9	STW1.0 Power Stage Enable	= 0	S51 Ramp stop
T13	STW1.2 Quick Stop Disable	= 0	S52 Quick stop

Tab. 1027: Transitions from Status S4

Status S5 Switching off

Name	Description	Status	
S5 Switching off	Switching off	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 0
		ZSW1.6	= 0
		ZSW2.11	= 1

Tab. 1028: Status S5

No.	Conditions		Target status
T15	STW1.1 Coast Stop Disable	= 0	S1 Switching On Inhibited

Tab. 1029: Transitions from Status S5

Status S51 Ramp stop

Name	Description	Status	
S51 Ramp stop	Switching off	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 0
		ZSW1.5	= 1
		ZSW1.6	= 0
		ZSW2.11	= 1

Tab. 1030: Status S51

No.	Conditions		Target status
T10	Standstill detected	–	S2 Ready For Switching On
	OR		
	STW1.3 Enable Operation	= 0	
T11	STW1.2 Quick Stop Disable	= 0	S52 Quick stop
T12	STW1.0 Power Stage Enable	= 1	S4 Operation

Tab. 1031: Transitions from Status S51

The "Standstill detected" condition is an internal condition in the process of the stop ramp and is not triggered by the user.

Status S52 Quick stop

Name	Description	Status	
S52 Quick stop	Fast stop	ZSW1.0	= 1
		ZSW1.1	= 1

Name	Description	Status	
S52 Quick stop	Fast stop	ZSW1.2	= 0
		ZSW1.5	= 0
		ZSW1.6	= 0
		ZSW2.10	= 1

Tab. 1032: Status S52

The value of the status bit is identical to the S5 Switching off status. The status is not distinguishable from S51 Ramp stop status by the status bit.

No.	Conditions		Target status
T10	Standstill detected	–	S1 Switching On Inhibited
	OR		
	STW1.3 Enable Operation	= 0	

Tab. 1033: Transitions from Status S52

The "Standstill detected" condition is an internal condition in the process of the fast stop and is not triggered by the user.

13.6.3.2 Finite State Machine Velocity Mode in Application Class 1

The finite state machine velocity mode is a sub-finite state machine of the status S4 Operation of the basic finite state machine. The same applies to the status messages of the status S4 Operation, they are not executed here.

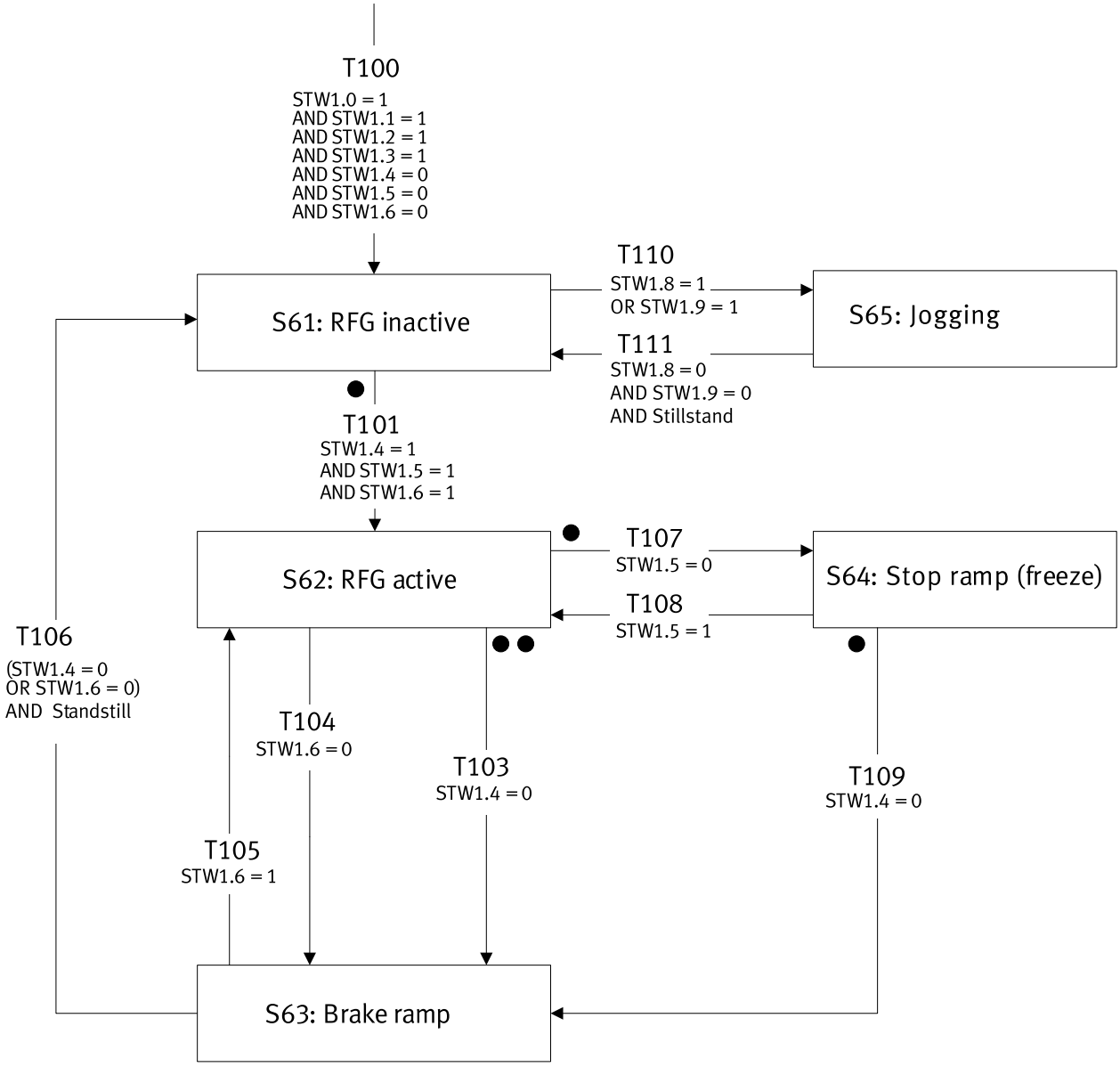


Fig. 155: Finite State Machine Velocity Mode in Application Class 1

Multiple transitions are possible from some states. In this case the transitions with assigned priorities are specified in the status diagram. Points are used to identify the priority level. The more points a transition has the higher the priority. A transition with no points has the lowest priority.

No.	Condition		Target status
T100	STW1.0 Power Stage Enable	= 1	S61 RFG inactive
	STW1.1 Coast Stop Disable	= 1	
	STW1.2 Quick Stop Disable	= 1	
	STW1.3 Enable Operation	= 1	
	STW1.4 Enable ramp generator	= 0	
	STW1.5 Unfreeze Ramp Generator	= 0	
	STW1.6 Enable setpoint	= 0	

Tab. 1034: Transition T100

Status S61 RFG inactive

Name	Description	Status	Value
S61 RFG inactive	RFG reset	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 1
		ZSW1.6	= 0

Tab. 1035: Status S61

No.	Conditions	Value	Target status
T101	STW1.4 Enable ramp generator	= 1	S62 RFG active
	AND		
	STW1.5 Unfreeze Ramp Generator	= 1	
	AND		
	STW1.6 Enable setpoint	= 1	
T110	STW1.8 Jogging 1	= 1	S65 Jogging AC1
	OR		
	STW1.9 Jogging 2	=1	

Tab. 1036: Transitions from Status S61

Status S62 RFG active

Name	Description	Status	Value
S62 RFG active	RFG active	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 1
		ZSW1.6	= 0

Tab. 1037: Status S62

No.	Conditions	Value	Target status
T103	STW1.4 Enable ramp generator (system stop)	= 0	S63
T104	STW1.6 Enable setpoint	= 0	S63 Brake ramp
T107	STW1.5 Unfreeze Ramp Generator	= 0	S64 Stop ramp (freeze)

Tab. 1038: Transitions from Status S62

Status S63 Brake ramp

Name	Description	Status	Value
S63 Brake ramp	Braking ramp	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 1
		ZSW1.6	= 0

Tab. 1039: Status S63

No.	Conditions	Value	Target status
T105	STW1.6 Enable setpoint	= 1	S62 RFG active
T106	STW1.4 Enable ramp generator OR STW1.6 Enable setpoint	= 0 = 0	S61 RFG inactive
	AND		
	Standstill	–	

Tab. 1040: Transitions from Status S63

Status S64 Stop ramp (freeze)

Name	Description	Status	Value
S64 Stop ramp (freeze)	Stop ramp	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 1
		ZSW1.6	= 0

Tab. 1041: Status S64

No.	Conditions	Value	Target status
T108	STW1.5 Unfreeze Ramp Generator	= 1	S62 RFG active
T109	STW1.4 Enable ramp generator	= 0	S63 Brake ramp

Tab. 1042: Transitions from Status S64

Status S65 Jogging AC1

Name	Description	Status	Value
S65 Jogging AC1	Jog Mode	ZSW1.0	= 1
		ZSW1.1	= 1
		ZSW1.2	= 1
		ZSW1.6	= 0

Tab. 1043: Status S65

No.	Conditions	Value	Target status
T111	STW1.8 Jogging 1	= 0	S61 RFG inactive
	AND		
	STW1.9 Jogging 2	= 0	
	AND		
	Standstill	–	

Tab. 1044: Transitions from Status S64

13.6.3.3 Finite State Machine Positioning Mode in Application Class 3

The positioning mode state machine in application class 3 is a substate machine of the S4 Operation status of the basic state machine. The same applies to the status messages of the S4 Operation status.

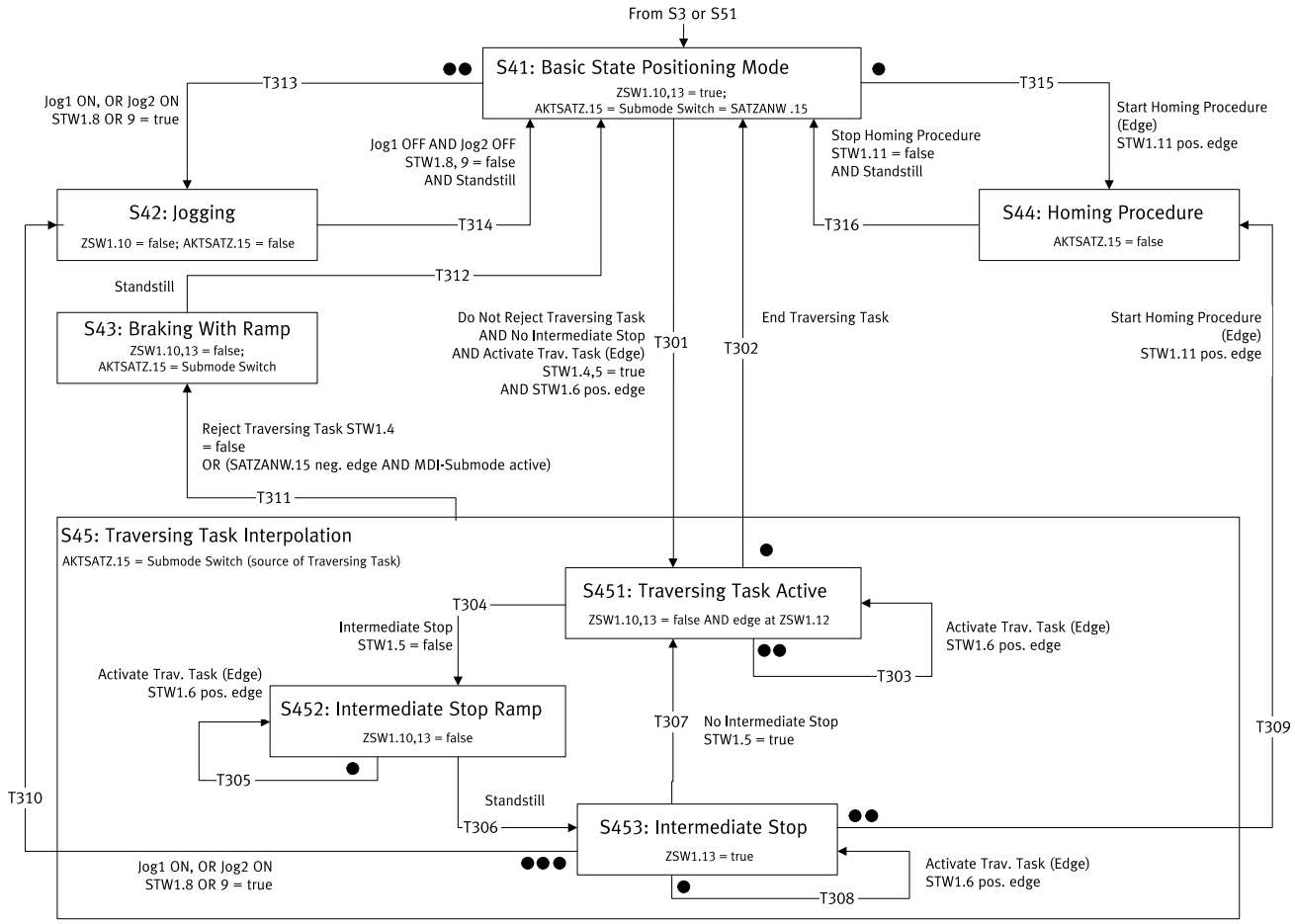


Fig. 156: Finite State Machine Positioning Mode in Application Class 3

Multiple transitions are possible from some states. In this case the transitions with assigned priorities are specified in the status diagram. Points are used to identify the priority level. The more points a transition has the higher the priority. A transition with no points has the lowest priority.
Further information on the basic state machine ➔ 12.4.3.1 Basic finite state machine.

S41 Basic State Positioning Mode status

Name	Description	Status	Value
S41 Basic State Positioning Mode	Basic state positioning mode	ZSW1.10	= 1
		ZSW1.13	= 1
		AKTSATZ, bit 15 = SATZANW, bit 15 (setpoint direct specification switch)	–

Tab. 1045: Status S41

A changeover of the MDI selection (SATZANW, bit 15) is only possible in S41 Basic State Positioning Mode status.

No.	Conditions	Value	Target status
T301	STW1.4 Reject traversing task	= 1	S451 Traversing Task Active
	AND		
	STW1.5 Intermediate Stop	= 1	
	AND		
	STW1.6 Traverse Task Active	0→1	
T313	STW1.8 Jogging 1	= 1	S42 Jogging
	OR		

No.	Conditions	Value	Target status
T313	STW1.9 Jogging 2	=1	S42 Jogging
T315	STW1.11 Start Homing Procedure	0→1	S441 Homing Procedure Running

Tab. 1046: Transitions from Status S42

T313 has higher priority than T301.
T315 has higher priority than T301.
T313 has higher priority than T315.

S42 Jogging status

Name	Description	Status	Value
S42 Jogging	Jogging	ZSW1.10 Traverse Task Motion Complete	= 0
		ZSW1.13 Drive Stopped	= x
		AKTSATZ bit 15	= 0

Tab. 1047: Status S42

AKTSATZ Bit 15 is set to 0 independently of SATZANW bit 15, i.e. also if MDI selection is set (SATZANW.15 = 1).

No.	Conditions	Value	Target status
T314	STW1.8 Jogging 1	= 0	S41 Basic State Positioning Mode
	AND		
	STW1.9 Jogging 2	= 0	
	AND		
	Standstill detected	–	

Tab. 1048: Transitions from Status S42

The "Standstill detected" condition is an internal condition and is not triggered by the user.

S43 Braking With Ramp status

Name	Description	Status	Value
S43 Braking With Ramp	Braking ramp	ZSW1.10 Traverse Task Motion Complete	= 0
		ZSW1.13 Drive Stopped	= 0
		AKTSATZ Bit 15 = setpoint specification switch (source for prior setpoint specification)	

Tab. 1049: Status S43

No.	Conditions	Value	Target status
T312	Standstill detected	–	S41 Basic State Positioning Mode

Tab. 1050: Transitions from Status S43

The "Standstill detected" condition is an internal condition in the process of the braking ramp and is not triggered by the user.

S44 Homing Procedure status

Name	Description	Status	Value
S44 Homing Procedure	Referencing	ZSW1.10 Traverse Task Motion Complete	= x
		ZSW1.11 Home Position Set	= x
		ZSW1.13 Drive Stopped	= x
		AKTSATZ bit 15	= 0

Tab. 1051: Status S44

x = value depends on sub-status

No.	Conditions	Value	Target status
T316	STW1.11 Start Homing Procedure	= 0	S41 Basic State Positioning Mode
	AND		
	Standstill detected		

Tab. 1052: Transitions from Status S44

The "Standstill detected" condition is an internal condition and is not triggered by the user.

S45 Traversing Task Interpolation status

Name	Description	Status	Value
S45 Traversing Task Interpolation	Traversing task positioning	ZSW1.10 Traverse Task Motion Complete	= x
		ZSW1.12 Traversing Task Acknowledgement	= x
		ZSW1.13 Drive Stopped	= x
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 1053: Status S45

x = value depends on sub-status

No.	Conditions	Value	Target status
T311	STW1.4 Reject traversing task	= 0	S43 Braking With Ramp
	OR		
	SATZANW bit 15 AND AKTSATZ bit 15	0→1 = 1	

Tab. 1054: Transitions from Status S45

S451 Traversing Task Active status

Name	Description	Status	Value
S451 Traversing Task Active	Positioning task active	ZSW1.10 Traverse Task Motion Complete	= 0
		ZSW1.12 Traversing Task Acknowledgement	0→1
		ZSW1.13 Drive Stopped	= 0
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 1055: Status S451

No.	Conditions	Value	Target status
T302	Positioning task complete		S41 Basic State Positioning Mode
T303	STW1.6 Traverse Task Active	0→1	S451 Traversing Task Active
T304	STW1.5 Intermediate Stop	= 0	S452 Intermediate Stop Ramp

Tab. 1056: Transitions from Status S451

The "Positioning task complete" condition is an internal condition and is not triggered by the user.
T303 has higher priority than T302.
T303 has higher priority than T304.
T302 has higher priority than T304.

S452 Intermediate Stop Ramp status

Name	Description	Status	Value
S452 Intermediate Stop Ramp	Intermediate stop ramp	ZSW1.10 Traverse Task Motion Complete	= 0
		ZSW1.12 Traversing Task Acknowledgement	= x
		ZSW1.13 Drive Stopped	= 0
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 1057: Status S452

No.	Conditions	Value	Target status
T305	STW1.6 Traverse Task Active	0→1	S452 Intermediate Stop Ramp
T306	Standstill detected		S453 Intermediate Stop

Tab. 1058: Transitions from Status S452

The "Standstill detected" condition is an internal condition in the process of the intermediate stop ramp and is not triggered by the user.
T305 has higher priority than T306.

S453 Intermediate Stop status

Name	Description	Status	Value
S453 Intermediate Stop	Intermediate stop	ZSW1.10 Traverse Task Motion Complete	= 0
		ZSW1.12 Traversing Task Acknowledgement	= x
		ZSW1.13 Drive Stopped	= 1
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 1059: Status S453

No.	Conditions	Value	Target status
T307	STW1.5 Intermediate Stop	1	S451 Traversing Task Active
T308	STW1.6 Traverse Task Active	0→1	S453 Intermediate Stop
T309	STW1.11 Start Homing Procedure	0→1	S441 Homing Procedure Running
T310	STW1.8 Jogging 1	= 1	S42 Jogging
	OR		
	STW1.9 Jogging 2	= 1	

Tab. 1060: Transitions from Status S453

T310 has higher priority than T307.
T309 has higher priority than T307.
T308 has higher priority than T307.
T310 has higher priority than T309.

13.6.3.4 Finite State Machine Homing Application Class 3

The finite state machine homing in application class 3 is a sub-finite state machine of the status S44 Homing Procedure of the finite state machine positioning mode.

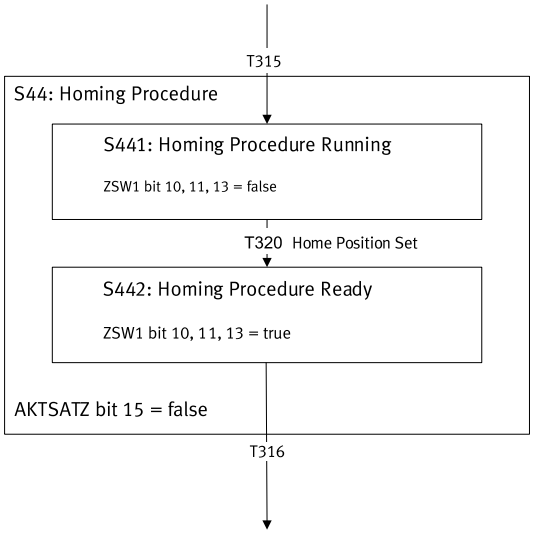


Fig. 157: Finite State Machine Homing Application Class 3

Transition T315 is described in the finite state machine positioning mode and is therefore not considered in detail here.
Transition T316 is described in the finite state machine positioning mode and is therefore not considered in detail here. The transition is possible from every sub-status.

Status S441 Homing Procedure Running

Name	Description	Status	Value
S441 Homing Procedure Running	Homing active	ZSW1.10 Traverse Task Motion Complete	= 0
		ZSW1.11 Home Position Set	= 0
		ZSW1.13 Drive Stopped	= 1

Tab. 1061: Status S441

No.	Conditions	Value	Target status
T320	Reference point set	–	S442 Homing Procedure Ready

Tab. 1062: Transitions from Status S441

The condition "Homing point set" is an internal condition in the homing process.

Status S442 Homing Procedure Ready

Name	Description	Status	Value
S442 Homing Procedure Ready	Homing complete	ZSW1.10 Traverse Task Motion Complete	= 1
		ZSW1.11 Home Position Set	= 1
		ZSW1.13 Drive Stopped	= 1

Tab. 1063: Status S442

13.6.4 Process data

13.6.4.1 Process data signals

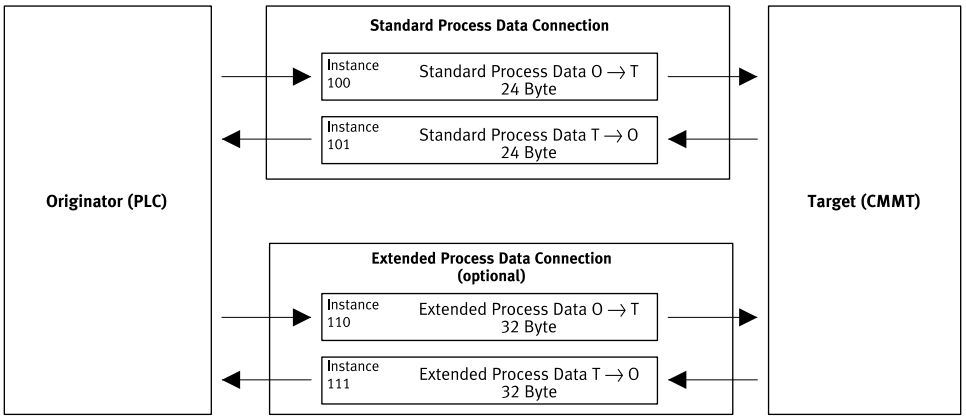


Fig. 158: Connections

Instances 100 and 101 are used for the standard process data, optional instances 110 and 111 for the extended process data.
Instance 102 contains the startup parameterisation via Ethernet/IP (config assembly).

13.6.4.2 Process data configuration

The process data (input/output data) can be configured and defined as individual setpoint and actual values. Device parameters are available for configuring the process data (input/output data).

Parameters	PNU	Meaning	Access	Data type
Px.	Manufacturer-specific parameters			
3030101	3490.0	Telegram selection	rw	UINT

Tab. 1064: Process data configuration

13.6.5 Telegrams

Telegram number	Description	Supported application classes
Telegrams		
1	Rotational speed setpoint value 16 bit	Speed
9	Positioning telegram 9 (single positioning with record selection and direct specification, MDI)	Positioning
102	Rotational speed setpoint value 32 bit with position encoder and torque reduction	Speed
111	Single positioning in the record selection operating mode and direct specification (MDI)	Positioning
908	Telegram for CIP Sync at EtherNet/IP ➔ 13.6.6 Additional telegram CIP Sync	Positioning
910	Transmission of additional process data (EPD) ➔ 13.6.7 Additional telegram Extended Process Data	Independent of the application class

Tab. 1065: Telegrams

Telegram								
No.	1		9		102		111	
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	NSOLL_A	NIST_A	SATZANW	AKTSATZ	NSOLL_B	NIST_B	POS_STW1	POS_ZSW1
PZD3			STW2	ZSW2			POS_STW2	POS_ZSW2
PZD4			MDI_TARPOS	XIST_A	STW2	ZSW2	STW2	ZSW2
PZD5					MOMRED	MELDW	OVERRIDE	MELDW
PZD6			MDI_VELOCITY		G1_STW	G1_ZSW	MDI_TARPOS	XIST_A
PZD7						G1_XIST- 1		
PZD8			MDI_ACC				MDI_VELOCITY	NIST_B
PZD9			MDI_DEC			G1_XIST- 2		
PZD10			MDI_MOD				MDI_ACC	FAULT_CODE
PZD11							MDI_DEC	WARN_CODE
PZD12							reserved	reserved

Tab. 1066: Telegram speed

Telegram				
No.	9		111	
PZD1	STW1	ZSW1	STW1	ZSW1
PZD2	SATZANW	AKTSATZ	POS_STW1	POS_ZSW1
PZD3	STW2	ZSW2	POS_STW2	POS_ZSW2
PZD4	MDI_TARPOS	XIST_A	STW2	ZSW2
PZD5			OVERRIDE	MELDW
PZD6	MDI_VELOCITY		MDI_TARPOS	XIST_A
PZD7				
PZD8	MDI_ACC		MDI_VELOCITY	NIST_B
PZD9	MDI_DEC			
PZD10	MDI_MOD		MDI_ACC	FAULT_CODE
PZD11			MDI_DEC	WARN_CODE
PZD12			reserved	reserved

Tab. 1067: Positioning telegrams

13.6.6 Additional telegram CIP Sync

Additional telegram 908 (CIP Sync)

PZD	Setpoint value	Actual value
1	STW1 (P1.1147990)	ZSW1 (P1.1145990)
2	XSOLL (P1.11280308)	XIST_A (P1.113104)
3		
4	STW2 (P1.1148990)	ZSW2 (P1.1146990)
5	Reserved for NSOLL_A/NSOLL_B (P1.11280502)	NIST_A (P1.1210)
6	TimestampSetpoint (P0.303303)	Fault_Code (P1.11280062)
7	TimestampSetpoint (P0.303303)	Warn_Code (P1.11280063)

Tab. 1068: Additional telegram 908 (CIP Sync)

Parameters for additional telegram 908 (CIP Sync)

ID Px.	Parameter	Description	
1147990	STW1	Specifies the control word STW1.	
		Access	read/write

ID Px.	Parameter	Description	
1147990	STW1	Update	effective immediately
		Unit	–
1145990	ZSW1	Displays the status word ZSW1.	
		Access	read/–
		Update	effective immediately
		Unit	–
113104	Actual value modulo	Actual position XIST_A. Actual value based on the modulo limits	
		Access	read/–
		Update	effective immediately
		Unit	user defined
1148990	STW2	Displays the control word STW2.	
		Access	read/write
		Update	effective immediately
		Unit	–
1146990	ZSW2	Displays the status word ZSW2.	
		Access	read/–
		Update	effective immediately
		Unit	–
11280502	NSOLL_A/NSOLL_B	Displays the target velocity NSOLL_A or NSOLL_B.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1210	Actual velocity value encoder channel 1	Specifies the velocity measured by the primary encoder.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
303303	CiP Sync: Timestamp associated with the position setpoint	CiP Sync: Timestamp associated with the position setpoint	
		Access	read/write
		Update	effective immediately
		Unit	–
11280608	XSOLL_A	Target position in AC5 mode	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280062	Active error	Displays the active error.	
		Access	read/–
		Update	effective immediately
		Unit	–
11280063	Active warning	Displays the active warning.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 1069: Parameter

PNUs additional telegram 908 (CIP Sync)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1147990	1.0	STW1	UINT
1145990	2.0	ZSW1	UINT
1148990	3.0	STW2	UINT
1146990	4.0	ZSW2	UINT
11280502	5.0	NSOLL_A/NSOLL_B	INT
1210	6.0	Actual velocity value encoder channel 1	INT
303303	316.0	CiP Sync: Timestamp associated with the position setpoint	UDINT
11280608	27.0	XSOLL_A	DINT
113104	28.0	XIST_A, parameter name "Actual value modulo"	DINT
11280062	301.0	Active error	UINT
11280063	303.0	Active warning	UINT
Px.	**Manufacturer-specific parameters**		
1147990	12250.0	STW1	UINT
1145990	12220.0	ZSW1	UINT
1148990	12257.0	STW2	UINT
1146990	12225.0	ZSW2	UINT
11280502	12334.0	NSOLL_A/NSOLL_B	REAL
1210	11311.0	Actual velocity value encoder channel 1	REAL
303303	4837.0	CiP Sync: Timestamp associated with the position setpoint	UDINT
11280608	13272.0	XSOLL_A	LINT
113104	12117.0	XIST_A, parameter name "Actual value modulo"	LINT
11280062	12314.0	Active error	UINT
11280063	12315.0	Active warning	UINT

Tab. 1070: PNUs

13.6.7 Additional telegram Extended Process Data

Additional telegram 910 (Extended Process Data, EPD)

The manufacturer-specific additional telegram 910 is available for transmitting additional process data. The additional telegram can be selected during the process data configuration with the configuration software of the master and becomes active after loading the process data configuration.
The extended process data in the additional telegram can be parameterised with the CMMT-ST plug-in.

Telegram number	Description	Supported application classes
Additional telegram		
910	Transmission of additional process data (EPD)	independent of the application class

Tab. 1071: Additional telegram

The additional telegram 910 enables the cyclic transmission of additional parameters. All device parameters of the servo drive can be transferred.
The additional telegram 910 has a fixed length of 32 bytes for each transmission direction in which up to 8 parameters can be transmitted.
Parameters with the "read/write" access right can be sent and received by the servo drive (setpoint value).

Parameters with the "read" access right can only be sent by the servo drive (actual value).
Up to 8 parameters can be mapped in the tabular view of the ‘Extended Process Data’ panel in the input and output data with the help of the plug-in.

PZD	Setpoint value (Rx data)	Actual value (Tx data)
1	max. 8 parameters (32 bytes)	max. 8 parameters (32 bytes)
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

Tab. 1072: Additional telegram 910

Parameters for Process Data Configuration

The input/output data of the additional telegram can be configured individually. The following parameters are available for configuration.

ID Px.	Parameter	Description	
4242101	Number of objects Rx	Displays the actual number of objects that mapped for Rx data.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242102	Number of bytes Rx	Displays the actual number of bytes that mapped for Rx data.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242105	Axis ID Rx	Specifies the axis ID of the object to be mapped for the extended process data Rx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242106	Data ID Rx	Specifies the data ID of the object to be mapped for the extended process data Rx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242107	Data instance ID Rx	Specifies the instance number of the object to be mapped for the extended process data Rx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242108	Array ID Rx	Specifies the array ID of the object to be mapped for the extended process data Rx.	
		Access	read/write

ID Px.	Parameter	Description	
4242108	Array ID Rx	Update	reinitialization
		Unit	–
4242115	Actual axis ID Rx	Displays the actual axis ID of the object mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242116	Actual data ID Rx	Displays the actual data ID of the object mapped Rx for the extended process data.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242117	Actual data instance ID Rx	Displays the actual instance no. of the object mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242118	Actual array ID Rx	Displays the actual array ID of the object mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242119	Actual data type Rx	Displays the data type of the objects mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 1073: Parameter (Rx data)

ID Px.	Parameter	Description	
4242201	Number of objects Tx	Displays the actual number of objects that mapped for Tx data.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242202	Number of bytes Tx	Displays the actual number of bytes that mapped for Tx data.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242205	Axis ID Tx	Specifies the axis ID of the object to be mapped for the extended process data Tx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242206	Data ID Tx	Specifies the data ID of the object to be mapped for the extended process data Tx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242207	Data instance ID Tx	Specifies the instance no. of the object to be mapped for the extended process data Tx.	
		Access	read/write
		Update	reinitialization
		Unit	–
4242208	Array ID Tx	Specifies the array ID of the object to be mapped for the extended process data Tx.	
		Access	read/write

ID Px.	Parameter	Description	
4242208	Array ID Tx	Update	reinitialization
		Unit	–
4242215	Actual axis ID Tx	Displays the actual axis ID of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242216	Actual data ID Tx	Displays the actual data ID of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242217	Actual data instance ID Tx	Displays the actual instance number of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242218	Actual array ID Tx	Displays the actual array ID of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242219	Actual data type Tx	Displays the data type of the objects mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 1074: Parameter (Tx data)

Extended process data parameters

ID Px.	Parameter	Description	
3030101	Telegram selection	Specifies the telegram selection for EtherNet/IP or Modbus TCP. The telegram determines the application class (velocity, positioning) the drive is operated in. This also affects the mapping of the process data.	
		Access	read/write
		Update	effective immediately
		Unit	–
3030104	Extended process data (EtherNet/IP)	Activates the extended process data for EtherNet/IP.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 1075: Extended process data parameters

PNUs Rx and Tx data

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4242101	12542.0	Number of objects Rx	USINT
4242102	12543.0	Number of bytes Rx	USINT
4242105	12544.0 ... 7	Axis ID Rx	UINT
4242106	12545.0 ... 7	Data ID Rx	UDINT
4242107	12546.0 ... 7	Data instance ID Rx	UINT
4242108	12547.0 ... 7	Array ID Rx	UINT
4242115	12548.0 ... 7	Actual axis ID Rx	UINT
4242116	12549.0 ... 7	Actual data ID Rx	UDINT
4242117	12550.0 ... 7	Actual data instance ID Rx	UINT
4242118	12551.0 ... 7	Actual array ID Rx	UINT
4242119	12552.0 ... 7	Actual data type Rx	UDINT
4242201	12553.0	Number of objects Tx	USINT
4242202	12554.0	Number of bytes Tx	USINT
4242205	12555.0 ... 7	Axis ID Tx	UINT
4242206	12556.0 ... 7	Data ID Tx	UDINT
4242207	12557.0 ... 7	Data instance ID Tx	UINT
4242208	12558.0 ... 7	Array ID Tx	UINT
4242215	12559.0 ... 7	Actual axis ID Tx	UINT
4242216	12560.0 ... 7	Actual data ID Tx	UDINT

Tab. 1076: PNUs

PNUs extended process data

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
3030101	3490.0	Telegram selection	UINT
3030104	3491.0	Extended process data (EtherNet/IP)	BOOL

Tab. 1077: PNUs

13.6.8 Process data signals in detail

13.6.8.1 Control word 1 (STW1)

Bit	Meaning	
	Speed mode	Positioning mode
0	Output stage enable (ON/OFF, precondition STW1.3 = 1) – 0→1: power output stage enabled (ON) – 0: brake drive to standstill and then deactivate the power output stage (OFF1). If bit STW1.3 is already active, activation of STW1.0 implements a transition to S4 and therefore switches on the output stage. As a rule, however, STW1.0 is active and STW1.3 (output stage enable) is activated.	
1	Drive coast (OFF 2) – 1: no coasting – 0: coasting. Power output stage is deactivated (OFF2). The drive coasts to a stop.	
2	Fast stop (OFF 3) – 1: no fast stop – 0: brake drive to standstill with fast stop and then deactivate the power output stage (OFF3).	
3	Enable operation – 1: enabled – 0: block	

Bit	Meaning	
	Speed mode	Positioning mode
4	Ramp generator enabled – 1: enabled – 0: block	Reject positioning task – 1: inactive – 0: active
5	Start ramp generator – 1: start (precondition STW1.4 = 1) – 0: freeze	Intermediate stop – 1: inactive – 0: active
6	Enable rotational speed setpoint value – 1: enable – 0: block	Activate positioning task – 0→1: active – 0: inactive(no effect)
7	Acknowledge malfunction – 0→1: active – 0: inactive(no effect)	
8	Jogging 1 – 1: active (jogging with the dynamic values of jogging 1) – 0: inactive	
9	Jogging 2 – 1: active (jogging with the dynamic values of jogging 2) – 0: inactive	
10	PLC master control – 1: the higher-order controller requests the master control. The signal must be set if the process data sent are to be applied and effective. – 0: master control not requested	
11	Invert setpoint value – 1: active – 0: inactive	Start homing – 0→1: active – 0: inactive
12	Release holding brake – 1: active – 0: inactive	
13	reserved	Start record change – 0→1: active – 0: inactive
14 ... 15	reserved	reserved

Tab. 1078: Control word 1 (STW1)

Significance of General Bits (STW1)

STW1.0 Power Stage Enable (ON/OFF)

Value	Command	Description
0→1	Output stage enable (ON)	If bit STW1.3 is already active, activation of STW1.0 implements a transition to S4 and therefore switches on the output stage. As a rule, however, STW1.0 is active and STW1.3 (output stage enable) is activated.
0	Output stage block (OFF1)	– The drive is braked to standstill and then the power output stage is switched off (OFF1). – The drive switches to the status S2 Ready For Switching On. – If it is coming from the S4 Operation status, it is braked with the ramp generator (S51 Ramp stop). – After standstill is reached the power output stage is switched off.

Tab. 1079: STW1.0

Braking with the OFF1 command can be interrupted with the following commands that trigger a higher prioritised stop response:
– Fast stop (OFF3) ➔ bit 2, fast stop
– Block ramp generator or reject positioning task ➔ STW1.4

– Block rotational speed setpoint value or activate positioning task ➔ STW1.6
– Enable power output stage ➔ STW1.0. In this case it switches back to the S4 Operation status.

STW1.1 Coast Stop Disable (OFF 2)

Value	Command	Description
1	No coasting	A coasting command is not pending. The motor can be switched on.
0	Coast (OFF2)	– Power output stage is switched off. – The drive coasts to a stop. – The drive switches to the status S1 Switching On Inhibited.

Tab. 1080: STW1.1

STW1.2 Quick Stop Disable (OFF 3)

Value	Command	Description
1	No fast stop	A fast stop command is not pending. The motor can be switched on.
0	Fast stop (OFF3)	– The drive is braked to standstill with fast stop. Then the power output stage is switched off. – The drive switches to the status S1 Switching On Inhibited. – If it is coming from the S4 Operation status, braking with fast stop ramp (status S52 Quick stop).

Tab. 1081: STW1.2

– The fast stop command cannot be interrupted (OFF3).
– The fast stop command can interrupt braking with the OFF1 command. In this case, braking is continued to standstill with the fast stop ramp.
– If the block operation command (STW1.3) is applied before reaching standstill, the voltage is disconnected without waiting for standstill and switched to the S1 Switching On Inhibited status.
– The controller is not yet active in the S2 Ready For Switching On and S3 Switched On closed-loop controller is not active. Only the energy is already enabled. Therefore, a fast stop ramp is not generated. It is immediately switched to the S1 Switching On Inhibited status.

STW1.3 Enable Operation

Value	Command	Description
1	Enable operation	If the drive is in the status S3 Switched On: – Switch to status S4 Operation The closed-loop controller is activated. The drive/closed-loop controller is enabled. The setpoint value is only applied after enabling the rotational speed setpoint value (STW1.6) or by activating the positioning task (edge 0➔1 on STW1.6) (preconditions STW1.4, STW1.5).
0	Disable operation	– Closed-loop controller is blocked. – The drive coasts to a standstill (without ramp). If it is coming from the S4 Operation coming: – Switch to status S3 Switched On

Tab. 1082: STW1.3

The status is changed immediately. Standstill is not required. The setpoint value is specified as follows with a rising edge at STW1.3:

– In velocity mode: the setpoint value is effective immediately depending on control bits bit 4 ... bit 6. The setpoint rotational speed affects the closed-loop control; a starting edge or other is not required.
– In positioning mode: setpoint position = current actual position. The current actual position is retained, a new setpoint position is only activated with rising edge at STW1.6 (activate positioning task).

STW1.7 Fault Acknowledge

Value	Command	Description
0→1	Acknowledge malfunction	– With a positive edge the drive attempts to acknowledge pending errors. The reaction depends on the pending messages. If the error reaction caused a shutdown of the output stage, the drive then switches to the status S1 Switching On Inhibited.
0	No effect	–

Tab. 1083: STW1.7

STW1.8 Jogging 1

Value	Command	Description
1	Jogging 1 on	Execute jogging 1
0	Jogging 1 off	Stop jogging 1

Tab. 1084: STW1.8

STW1.9 Jogging 2

Value	Command	Description
1	Jogging 2 on	Execute jogging 2
0	Jogging 2 off	Stop jogging 2

Tab. 1085: STW1.9

STW1.10 Control by PLC

Value	Command	Description
1	Transfer master control	The master control is transferred to the higher-order open-loop control. The output data of the higher-order open-loop control are thus valid.
0	Do not transfer master control	The output data of the open-loop control are invalid. The reaction of the removal of the master control of the higher-order open-loop control depends on the device. Possible reactions include: – With velocity control: retain process data, no status change – With position control: set PLC output data to 0, cancel positioning and block closed-loop controller If the drive is in a status not equal to S1 Switching On Inhibited an error is reported and it switches to the S1 Switching On Inhibited status. If the power output stage is active, it is switched off and the drive coasts to a stop.

Tab. 1086: STW1.10

STW1.12 Open Holding Brake

Value	Command	Description
1	Release holding brake	The holding brake is released.
0	Do not release holding brake	The holding brake is not released.

Tab. 1087: STW1.12

PNUs for the General Bits (STW1)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1147990	1.0	STW1	UINT
Px.	**Manufacturer-specific parameters**		
1147000	12226.0	STW1.0 Power Stage Enable	BOOL
1147010	12227.0	STW1.1 Coast Stop Disable	BOOL
1147020	12228.0	STW1.2 Quick Stop Disable	BOOL
1147030	12229.0	STW1.3 Enable Operation	BOOL
1147070	12236.0	STW1.7 Fault Acknowledge	BOOL
1147080	12237.0	STW1.8 Jogging 1	BOOL
1147090	12238.0	STW1.9 Jogging 2	BOOL
1147100	12239.0	STW1.10 Control by PLC	BOOL
1147120	12242.0	STW1.12 Open Holding Brake	BOOL
1147990	12250.0	STW1	UINT

Tab. 1088: PNUs

Significance of the special bits for velocity mode (STW1)

The commands for velocity mode are also relevant outside the S4 Operation status. This applies particularly to the commands Block ramp generator (STW1.4) and Block setpoint value (STW1.6). These commands interrupt braking in the S51 Ramp stopbecause they trigger a stop reaction with a higher priority.

STW1.4 Enable ramp generator

Value	Command	Description
1	Ramp generator enabled	If enable is possible, the ramp generator is enabled.
0	Block ramp generator	– The output of the ramp generator is set to 0. – The drive remains under power and is braked in accordance with system stop. Additional system stop with separate deceleration and jerk: – Deceleration (system stop): Px.11280405.0.0, PNU 12328.0 – Jerk (system stop): Px.11280406, PNU 12434.0

Tab. 1089: STW1.4

STW1.5 Unfreeze Ramp Generator

Value	Command	Description
1	Start ramp generator	The ramp generator is started.
0→1	Freeze ramp generator	The current setpoint value of the ramp generator is frozen with falling edge at the current pending actual value.

Tab. 1090: STW1.5

STW1.6 Enable setpoint

Value	Command	Description
1	Enable rotational speed setpoint value	The rotational speed setpoint value is enabled.
0	Block rotational speed setpoint value	The input of the ramp generator is set to 0.

Tab. 1091: STW1.6

STW1.11 Invert setpoint

Value	Command	Description
1	Inversion of setpoint value	The setpoint value is inverted.
0	no inversion of setpoint value	The setpoint value is not inverted.

Tab. 1092: STW1.11

PNUs of special bits for speed mode (STW1)

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1147040	12230.0	STW1.4 Enable ramp generator	BOOL
1147050	12232.0	STW1.5 Unfreeze Ramp Generator	BOOL
1147060	12234.0	STW1.6 Enable setpoint	BOOL
1147110	12240.0	STW1.11 Invert setpoint	BOOL
1147150	12248.0	STW1.15 Reserved	BOOL

Tab. 1093: PNUs

Significance of the special bits for positioning mode (STW1)

The functions defined for positioning mode are relevant only in the S4 Operation status.

STW1.4 Reject traversing task

Value	Command	Description
1	Do not reject positioning task	The current positioning task is not rejected.
0	Reject positioning task	– The current positioning task is rejected. – The drive switches to the status S43 Braking With Ramp and brakes to standstill with system stop. – Then the drive switches to the S41 Basic State Positioning Mode status and remains controlled. – A new positioning task cannot be started.

Tab. 1094: STW1.4

STW1.5 Intermediate Stop

Value	Command	Description
1	No intermediate stop	A new positioning task can be executed or an interrupted positioning task can be resumed.
0	Activate intermediate stop	If the drive is in the S451 Traversing Task Active status: – Switch to status S452 Intermediate Stop Ramp – The drive is braked with the deceleration of the current positioning task until standstill, then switches to the S453 Intermediate Stop status and remains controlled. – The current positioning task is not rejected and it can be resumed by setting the STW1.5 bit. If in the status S41 Basic State Positioning Mode: – positioning task cannot be started.

Tab. 1095: STW1. 5

STW1.6 Traverse Task Active

Value	Command	Description
0→1	Activate positioning task	The setpoint value is enabled.
0	Do not activate positioning task	No effect

Tab. 1096: STW1.6

If the drive is in the S41 Basic State Positioning Mode status and the "Do not reject positioning task" (STW1.4) and "No intermediate stop" (see STW1.5) commands are pending, a positioning task is started with rising edge at STW1.6 (record or direct setpoint value specification).
If the drive is in the S451 Traversing Task Active status, a new positioning task is started with a rising edge. The new positioning task is effective immediately and the currently active positioning task is rejected.
If the drive is in the S452 Intermediate Stop Ramp or S453 Intermediate Stop status, a new positioning task is started with a rising edge at STW1.6.

The setpoint values of the new positioning task are applied immediately. The currently active positioning task is rejected.
In record mode the returned record number switches to the number of the positioning task (AKTSATZ, Bit 0 ... 6).
If there are several start edges in the S452 Intermediate Stop Ramp status or in the S453 Intermediate Stop status, the last started positioning task is executed with the "No intermediate stop" (STW1.5) command (no saving effect).
The command "Activate motion task" is confirmed by a handshake with the status "Acknowledge motion task active".

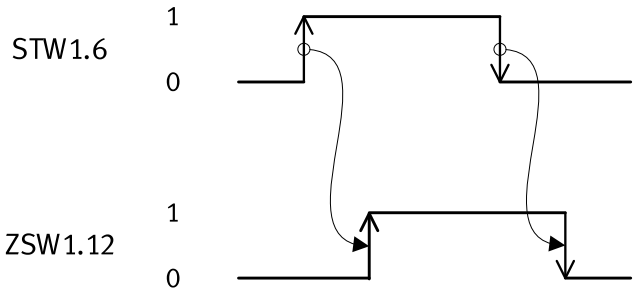


Fig. 159: Activate timing positioning task

The start of another new task before acknowledgement or during ZSW1.12 = 1 is ignored.

STW1.11 Start Homing Procedure

Value	Command	Description
0→1	Start homing	If in the status S41 Basic State Positioning Mode status or the S43 Braking With Ramp: – Homing is started during rising edge.
0	Stop homing	On successful completion of homing (ZSW1.11 = 1, homing point set): – The homing is terminated. – Switch to status S41 Basic State Positioning Mode With active homing: – Homing is interrupted. – The drive is braked to standstill. – Switch to status S41 Basic State Positioning Mode

Tab. 1097: STW1.1

STW1.13 Start Block Change

Value	Command	Description
0→1	external record change	The external record change is triggered by a rising edge.
0	No effect	No effect

Tab. 1098: STW1.13

PNUs of special bits for positioning mode (STW1)

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1147041	12231.0	STW1.4 Reject traversing task	BOOL
1147051	12233.0	STW1.5 Intermediate Stop	BOOL
1147061	12235.0	STW1.6 Traverse Task Active	BOOL
1147111	12241.0	STW1.11 Start Homing Procedure	BOOL
1147131	12245.0	STW1.13 Start Block Change	BOOL
1147141	12247.0	STW1.14 Reserved	BOOL
1147151	12249.0	STW1.15 Reserved	BOOL

Tab. 1099: PNUs

13.6.8.2 Status word 1 (ZSW1)

Bit	Meaning	
	Speed mode	Positioning mode
0	Ready to be switched on – 1: active – 0: inactive	
1	Ready for operation – 1: active – 0: inactive	
2	Operation enabled – 1: active – 0: inactive (blocked)	
3	Malfunction effective – 1: active – 0: inactive	
4	Coasting active – 1: inactive (OFF2 inactive) – 0: active (OFF2 active)	
5	Quick stop active – 1: inactive (OFF3 inactive) – 0: active (OFF3 active)	
6	Switch-on lock active – 1: active – 0: inactive	
7	Warning effective – 1: active – 0: inactive	
8	Rotational speed setpoint/actual deviation within tolerance – 1: in tolerance range – 0: not yet in tolerance range	Position setpoint/actual deviation within tolerance – 1: in tolerance range – 0: not yet in tolerance range
9	Guide required – 1: active – 0: inactive	
10	Speed comparison value reached – 1: active – 0: inactive	Target position reached – 1: active – 0: inactive
11	I, M or P limit not reached – 1: active – 0: inactive	Reference point set – 1: active – 0: inactive
12	Holding brake released – 1: active – 0: inactive	Positioning task activated (acknowledgement) – 0→1: active – 0: inactive
13	No warning of motor overtemperature – 1: motor overtemperature warning not effective – 0: motor overtemperature warning effective	Drive is stationary – 1: active – 0: inactive
14	Motor direction of rotation – 1: actual rotational speed ≥ 0 – 0: actual rotational speed < 0	Axis accelerated – 1: active – 0: inactive
15	no power unit overtemperature warning – 1: warning of thermal overload not effective – 0: warning of thermal overload effective	Drive decelerated – 1: active – 0: inactive

Tab. 1100: Status word 1 (ZSW1)

Significance of General Bits (ZSW1)

ZSW1.0 Ready to Switch On

Value	Meaning	Description
1	active (ready to be switched on)	The power supply is switched on. The electronics are initialised. Output stage is active. The drive is in one of the following statuses: – S2 Ready For Switching On – S3 Switched On – S4 Operation – S5 Switching off.
0	inactive (not ready to be switched on)	The drive is in the status S1 Switching On Inhibited.

Tab. 1101: ZSW1.0

ZSW1.1 Ready To Operate

Value	Meaning	Description
1	Active (ready for operation)	The output stage is in the ready for operation status. The drive is in one of the following statuses: – S3 Switched On – S4 Operation – S5 Switching off
0	Inactive (not ready for operation)	The Output stage enable command is not pending (STW1.0). The drive is in one of the following statuses: – S1 Switching On Inhibited – S2 Ready For Switching On

Tab. 1102: ZSW1.1

ZSW1.2 Operation Enabled

Value	Meaning	Description
1	Active	The output stage is active. The drive follows the pending setpoint value. The drive is in the status S4 Operation.
0	Inactive	The output stage is not active. The drive does not follow the pending setpoint value. The drive is in one of the following statuses: – S1 Switching On Inhibited – S2 Ready For Switching On – S3 Switched On – S5 Switching off

Tab. 1103: ZSW1.2

ZSW1.3 Fault Present

Value	Meaning	Description
1	Active	At least one not acknowledged or not acknowledgeable error is pending. The drive is not operational. The error reaction depends on the actual error (see error reaction). The pending errors are in the error memory.
0	Inactive	There are no errors in the error memory.

Tab. 1104: ZSW1.3

ZSW1.4 Coast Stop Not Active

Value	Meaning	Description
1	Inactive	The coasting command is inactive.
0	Active (OFF2)	The coasting command is active (OFF2).

Tab. 1105: ZSW1.4

ZSW1.5 Quick Stop Not Active

Value	Meaning	Description
1	Inactive	The fast stop command is inactive.
0	Active (OFF3)	The fast stop command is active (OFF3).

Tab. 1106: ZSW1.5

ZSW1.6 Switch On Inhibited

Value	Meaning	Description
1	Active	The switch-on lock is active. The drive is in the status S1 Switching On Inhibited. Switching on is only possible with the following command sequence: OFF (OFF1) and no coasting (no OFF2) and no fast stop (no OFF3) and then ON.
0	Inactive	Switching on is possible. The drive is in the status S2 Ready For Switching On, S3 Switched On, S4 Operation or S5 Switching off.

Tab. 1107: ZSW1.6

ZSW1.7 Warning Present

Value	Meaning	Description
1	Active	At least one warning is pending. The drive is continuing in operation. Warnings can be acknowledged if the cause is remedied. The pending warnings are in the warning buffer.
0	Inactive	There is no warning in the warning buffer.

Tab. 1108: ZSW1.7

ZSW1.9 PLC Control Requested

Value	Meaning	Description
1	Active	The guide is required by the higher-order controller. Condition for use with cycle synchronicity: the drive is synchronous to the automation system.
0	Inactive	Control over the automation system (PLC) is not possible. Control is only possible directly at the device or by a different interface.

Tab. 1109: ZSW1.9

PNUs of General Bits (ZSW1)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1145990	2.0	ZSW1	UINT
Px.	**Manufacturer-specific parameters**		
1145990	12220.0	ZSW1	UINT
1145000	12197.0	ZSW1.0 Ready to Switch On	BOOL
1145010	12198.0	ZSW1.1 Ready To Operate	BOOL
1145020	12199.0	ZSW1.2 Operation Enabled	BOOL
1145030	12200.0	ZSW1.3 Fault Present	BOOL
1145040	12201.0	ZSW1.4 Coast Stop Not Active	BOOL
1145050	12202.0	ZSW1.5 Quick Stop Not Active	BOOL
1145060	12203.0	ZSW1.6 Switch On Inhibited	BOOL
1145070	12204.0	ZSW1.7 Warning Present	BOOL
1145090	12207.0	ZSW1.9 PLC Control Requested	BOOL

Tab. 1110: PNUs

Significance of the special bits for speed mode (ZSW1)

ZSW1.8 Velocity Error Within Tolerance Range

Value	Meaning	Description
1	in tolerance range	The rotational speed actual value is within a parameterisable tolerance range. A dynamic overshoot or undershoot for time t < t_{max} is acceptable. The tolerance range and the time t_{max} can be parameterised: – Monitoring window velocity: following error: Px.464.0.0, PNU 11148.0 – Damping time velocity: following error: Px.4690.0.0, PNU 11632.0
0	not in tolerance range	The actual rotational speed value is outside a tolerance range.

Tab. 1111: ZSW1.8

ZSW1.10 f or n reached or exceeded

Value	Meaning	Description
1	active	The rotational speed comparison value is reached or exceeded. The absolute value is considered: $\|n_{act}\| \geq n_{threshold}$ The comparison value is defined via a threshold value $n_{threshold\ value}$ and a hysteresis n_{hyst}. A switch-on delay time t_{del} can be parameterised during which the rotational speed after falling below $n_{threshold}$ must not fall below the value $n_{threshold}$-n_{hyst}. – Threshold value velocity comparator: Px.11280504, PNU 12435.0 – Hysteresis threshold value velocity comparator: Px.11280505, PNU 12436.0 – Switch-on/off delay time velocity comparator: Px.11280506, PNU 12437.0
0	inactive	Rotational speed comparison value not reached or below setpoint value: $\|n_{act}\| < (n_{threshold} - n_{hyst})$

Tab. 1112: ZSW1.10

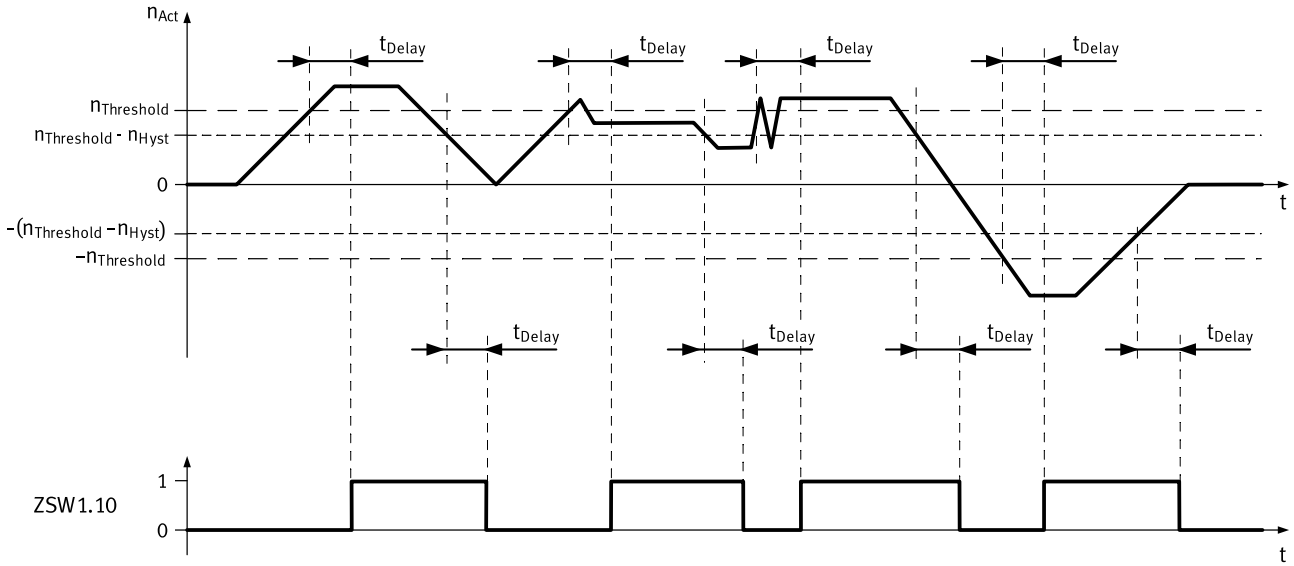


Fig. 160: Rotational speed comparison timing reached

Name	Description	ID Px.
n_{Act}	Actual velocity value encoder channel 1 (rotational speed)	1210
$n_{threshold}$	Threshold value velocity comparator	11280504

Name	Description	ID Px.
n_{hyst}	Hysteresis threshold value velocity comparator	11280505
t_{Delay}	Switch-on/off delay time velocity comparator	11280506

Tab. 1113: Legend for rotational speed comparison timing reached

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value encoder channel 1	INT
Px.	**Manufacturer-specific parameters**		
11280504	12435.0	Threshold value velocity comparator	REAL
11280505	12436.0	Hysteresis threshold value velocity comparator	REAL
11280506	12437.0	Switch-on/off delay time velocity comparator	REAL

Tab. 1114: PNUs rotational speed comparison timing reached

ZSW1.11 I, M or P limit not reached

Value	Meaning	Description
1	active (not reached)	Indicates that the I, M or P limit has not yet been reached.
0	inactive (reached or exceeded)	Indicates that the I, M or P limit has been reached or exceeded

Tab. 1115: ZSW1.11

The motor moves with specified torque and works against the stop when the stop is reached. If the torque limit is reached, the status change is reported by ZSW1.11.

ZSW1.12 Holding brake open

Value	Meaning	Description
1	Active	Shows the "Holding brake opened" status.
0	Inactive	Shows the "Holding brake closed" status.

Tab. 1116: ZSW1.12

ZSW1.13 No warning Overtemperature motor

Value	Meaning	Description
1	Motor overtemperature warning not effective	A warning is not output if the defined motor temperature warning threshold is exceeded.
0	Motor overtemperature warning effective	A warning is output if the defined motor temperature warning threshold is exceeded.

Tab. 1117: ZSW1.13

ZSW1.14 Motor rotation

Value	Meaning	Description
1	Positive	Actual rotational speed value ≥ 0
0	negative	Actual rotational speed value < 0

Tab. 1118: ZSW1.14

ZSW1.15 No warning Overtemperature power unit

Value	Meaning	Description
1	Warning of power unit thermal overload not effective	Shows that a warning or malfunction is not output in case of thermal overload of the power unit.
0	Warning of power unit thermal overload effective	Shows that an appropriate warning or malfunction is output in case of thermal overload of the power unit.

Tab. 1119: ZSW1.15

PNUs of special bits for speed mode (ZSW1)

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1145080	12205.0	ZSW1.8 Velocity Error Within Tolerance Range	BOOL
1145100	12208.0	ZSW1.10 f or n reached or exceeded	BOOL
1145110	12210.0	ZSW1.11 I, M or P limit not reached	BOOL
1145120	12212.0	ZSW1.12 Holding brake open	BOOL
1145130	12214.0	ZSW1.13 No warning Overtemperature motor	BOOL
1145140	12216.0	ZSW1.14 Motor rotation	BOOL
1145150	12218.0	ZSW1.15 No warning Overtemperature power unit	BOOL

Tab. 1120: PNUs

Significance of the special bits for positioning mode (ZSW1)

ZSW1.8 Following Error Within Tolerance Range

Value	Meaning	Description
1	Following distance within tolerance range	The dynamic comparison of the setpoint position with the actual position is within the tolerance range. The tolerance range can be parameterised: – Damping time position: following error: Px.462.0.0, PNU 11146.0 – Monitoring window position: following error: Px.463.0.0, PNU 11147.0
0	Following distance not yet in tolerance range	The dynamic comparison of the setpoint position with the actual position is not within the parameterised tolerance range.

Tab. 1121: ZSW1.8

ZSW1.10 Traverse Task Motion Complete

Value	Meaning	Description
1	active	The actual position value is within the target position window. If the target position window is reached once, the bit remains set until the start of the next task even if the actual position leaves the target position window beforehand. The following can be parameterised: – Damping time target reached: Px.468.0.0, PNU 11152.0 – Monitoring window target position: Px.469.0.0, PNU 11153.0
0	inactive	The actual position value is not within the target position window.

Tab. 1122: ZSW1.10

ZSW1.11 Home Position Set

Value	Meaning	Description
1	Active	A homing was run and a valid homing point is set.
0	Inactive	A valid homing point is not set.

Tab. 1123: ZSW1.11

ZSW1.12 Traversing Task Acknowledgement (acknowledgment)

Value	Meaning	Description
0→1	Active	With a rising edge the import of a new position task (record or direct setpoint value specification) is acknowledged. The rising edge at ZSW1.12 is the reaction to a rising edge at STW1.6 in in the following statuses: – S41 Basic State Positioning Mode – S451 Traversing Task Active – S452 Intermediate Stop Ramp – S453 Intermediate Stop
0	Inactive	The positioning task acknowledgement is inactive. The status bi is set to 0 if: – STW1.6 = 0, regardless of the current status – the S4 Operation status is left regardless of STW1.6

Tab. 1124: ZSW1.12

ZSW1.13 Drive Stopped

Value	Meaning	Description
1	active	The drive is stationary. A prior task is completed or standstill after a braking process is reached (brake ramp, intermediate stop ramp, stop ramp, fast stop). – Standstill damping time: Px.465.0.0, PNU 11149.0 – Monitoring window velocity standstill monitoring: Px.466.0.0, PNU 11150.0 – Damping time target reached: Px.468.0.0, PNU 11152.0 – Monitoring window target position: Px.469.0.0, PNU 11153.0
0	inactive	The drive moves.

Tab. 1125: ZSW1.13

Standstill means that the actual rotational speed is less than or equal to a parameterisable threshold value.

$|n_{act}| \leq n_{threshold}$

The signal is effective in all statuses (powered/non-powered).

ZSW1.14 Drive Accelerating

Value	Meaning	Description
1	Active	The axis accelerates. The ramp generator is in the acceleration phase. The signal is not set based on external influences (e.g. malfunction forces acting on the drive).
0	Inactive	The axis does not accelerate. The ramp generator is not in the acceleration phase.

Tab. 1126: ZSW1.14

ZSW1.15 Drive Decelerating

Value	Meaning	Description
1	Active	The ramp generator is in the deceleration phase. The drive brakes. The signal is not set based on external influences (e.g. malfunction forces acting on the drive).
0	Inactive	The axis does not decelerate. The ramp generator is not in the deceleration phase.

Tab. 1127: ZSW1.15

PNUs of special bits for positioning mode (ZSW1)

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1145081	12206.0	ZSW1.8 Following Error Within Tolerance Range	BOOL
1145101	12209.0	ZSW1.10 Traverse Task Motion Complete	BOOL

Parameter	PNU	Name	Data type
1145111	12211.0	ZSW1.11 Home Position Set	BOOL
1145121	12213.0	ZSW1.12 Traversing Task Acknowledgement	BOOL
1145131	12215.0	ZSW1.13 Drive Stopped	BOOL
1145141	12217.0	ZSW1.14 Drive Accelerating	BOOL
1145151	12219.0	ZSW1.15 Drive Decelerating	BOOL

Tab. 1128: PNUs

13.6.8.3 Control word 2 (STW2)

Bit	Meaning
0 ... 6	reserved
8	Moving to fixed stop – 1: activate move to fixed stop (must be set before reaching the fixed stop). – 1→0: deactivate move to fixed stop
9 ... 15	reserved

Tab. 1129: Control word 2 (STW2)

STW2.8 Traverse to fixed endstop

Value	Command	Description
1	Activate	Move to fixed stop is activated with the command. The signal must be set before reaching the fixed stop.
1→0	Deactivate	Move to the fixed stop is deactivated.

Tab. 1130: STW2.8,

For example, with the move to fixed stop command it can be moved to a workpiece with a specified torque to clamp it securely. Detailed information on the function
➔ Move to fixed stop (application class 3).

PNUs of control word 2 (STW2)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
1148990	3.0	STW2	UINT
Px.	Manufacturer-specific parameters		
1148080	12254.0	STW2.8 Traverse to fixed endstop	BOOL
1148990	12257.0	STW2	UINT

Tab. 1131: PNUs

13.6.8.4 Status word 2 (ZSW2)

Bit	Meaning
0 ... 7	reserved
8	Moving to fixed stop – 1: active – 0: inactive
9 ... 10	reserved
11	Output stage active – 1: active – 0: inactive
12 ... 15	reserved

Tab. 1132: Status word 2

ZSW2.8 Move to fixed stop active

Value	Meaning	Description
1	Active	This status bit shows that the positioning task "Move to fixed stop" is being executed ➔ Move to fixed stop (application class 3).
0	Inactive	Shows the status "Move to fixed stop is inactive".

Tab. 1133: ZSW2.8

ZSW2.11 Power stage active

Value	Meaning	Description
1	Active	Shows that the output stage is enabled (pulses for motor control).
0	Inactive	Shows that the output stage is blocked.

Tab. 1134: ZSW2.11

PNUs of status word 2 (ZSW2)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
1146990	4.0	ZSW2	UINT
Px.	Manufacturer-specific parameters		
1146080	12222.0	ZSW2.8 Move to fixed stop active	BOOL
1146110	12223.0	ZSW2.11 Power stage active	BOOL
1146990	12225.0	ZSW2	UINT

Tab. 1135: PNUs

13.6.8.5 Rotational speed setpoint value A, B (NSOLL_A, NSOLL_B)

Rotational Speed Setpoint Value A (NSOLL_A)

Rotational speed setpoint value A has a 16-bit resolution with sign bit. Bit 15 sets the sign of the setpoint value:
– Bit 15 = 0: positive setpoint value
– Bit 15 = 1: negative setpoint value
The rotational speed is standardised via PNU 60000.
NSOLL_A = 0x4000 or 16384 corresponds to 100 %.

Rotational Speed Setpoint Value B (NSOLL_B)

Rotational speed setpoint value B has a 32-bit resolution with sign bit. Bit 31 sets the sign of the setpoint value:
– Bit 31 = 0: positive setpoint value
– Bit 31 = 1: negative setpoint value
The rotational speed is standardised via PNU 60000.
NSOLL_B = 0x4000 0000 or 1 073 741 824 corresponds to 100 %.

Parameters for rotational speed setpoint value A, B (NSOLL_A, NSOLL_B)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280502	5.0	Target velocity NSOLL_A	Signed16
11280502	7.0	Target velocity NSOLL_B	Signed32
Px.	**Manufacturer-specific parameters**		
11280502	12334.0	NSOLL_A/NSOLL_B	REAL

Tab. 1136: Parameter

13.6.8.6 Rotational speed value A, B (NIST_A, NIST_B)

Rotational speed value A (NIST_A)

Rotational speed value A has a 16-bit resolution.
Rotational speed value A is standardised like the setpoint value ➔ 13.6.8.5 Rotational speed setpoint value A, B (NSOLL_A, NSOLL_B).

Rotational speed value B (NIST_B)

Rotational speed value B has a 32-bit resolution.
Rotational speed value B is standardised like the setpoint value ➔ 13.6.8.5 Rotational speed setpoint value A, B (NSOLL_A, NSOLL_B).
NIST_A and NIST_B are mapped to the same parameter (Px.1210).

Parameters for rotational speed actual value A, B (NIST_A, NIST_B).

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual value of velocity NIST_A	Signed16
	8.0	Actual value of velocity NIST_B	Signed32
Px.	Manufacturer-specific parameters		
1210	11311.0	Actual velocity value encoder channel 1	REAL

Tab. 1137: Parameter

13.6.8.7 Encoder n actual position value 1 (Gn_XIST1)

Gn_XIST is used to transmit the cyclic actual position value to the higher-level controller.
The device displays actual position values internally in SINT64 format (64 bit).
40 bits are used for multi-turn information (number of revolutions) and 24 bits for single-turn information (pulses per revolution).
All encoder values are internally normalised to 24 bit single-turn information (pulses per revolution) regardless of the encoder resolution.
In telegrams, the actual position values are transmitted in UINT32 format. The number of bits used for multi-turn and single-turn information can be parameterised.

When the preset is active, the device-internal 24 bits are standardised to the following values:

– Single-turn information (pulses per revolution): 18 bits (262144)
– Multiturn information: 14 bits (16383)

Parameter Px.231545 can be used to define the number of bits used for normalising the single-turn information. The remaining bits are used to record the multiturn information. If necessary, overflows must be compensated by the higher-level control system.
The settings used must be consistent with the settings of the higher-level controller.

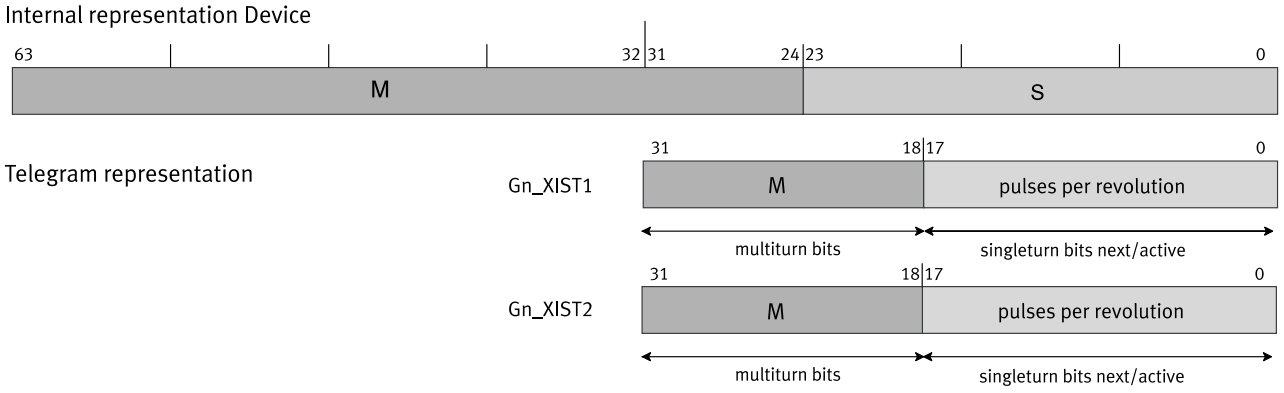


Fig. 161: Display of actual position values (example)

Name	Description
Internal representation device	Internal representation of position values in the device
M	Multiturn information
multi-turn bits	Bits for the representation of the multi-turn values
pulses per revolution	Single-turn information (pulses per revolution)
singleturn bits next/active	Bits for displaying the single-turn values
Telegram representation	Representation of the position values in the telegram

Tab. 1138: Legend for Figure "Actual Position Value 1"

Detailed information on the mode of operation of the encoder interface
➔ 13.6.8.10 Status Diagram "Position Feedback Interface".

Encoder n position actual value 1 parameter (Gn_XIST1)

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
231544	12522.0	Actual resolution per revolution for Gn_XIST	UDINT
231545	12524.0	Resolution per revolution for Gn_XIST	UDINT

Tab. 1139: PNUs

The device has an instance for each encoder interface. The parameters are allocated to the primary encoder with instance 0 (the commutation encoder is at encoder interface 1).

13.6.8.8 Encoder n actual position value 2 (Gn_XIST2)

Depending on the respective function, different values are entered in Gn_XIST2. The scaling of the position values is carried out analogously to Gn_XIST1 via parameter Px.231545 ➔ 13.6.8.7 Encoder n actual position value 1 (Gn_XIST1). The following priorities must be observed for the values in Gn_XIST2:

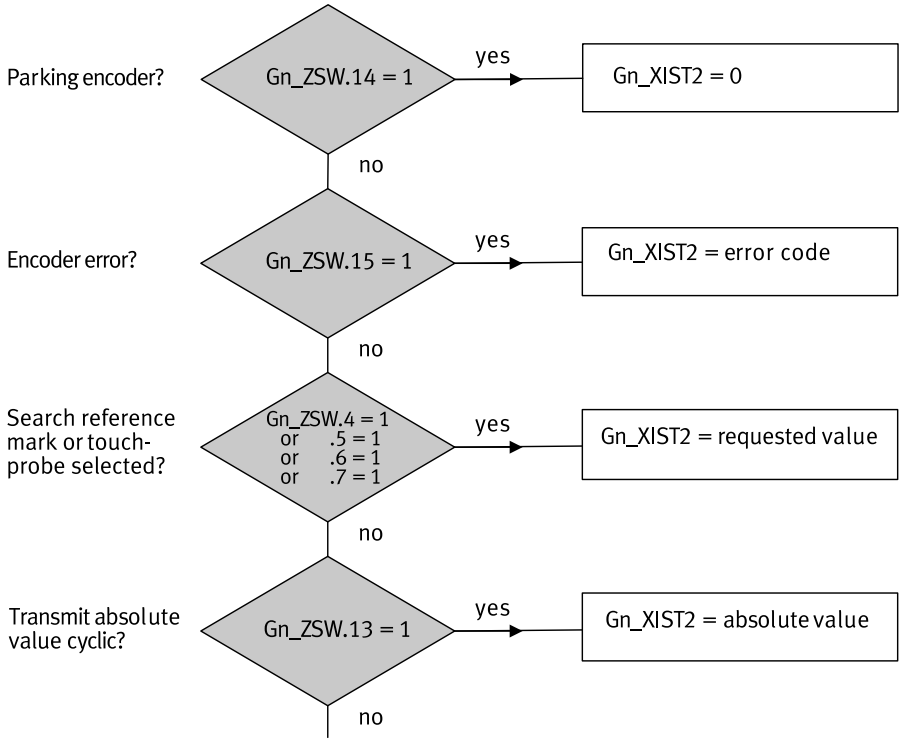


Fig. 162: Priorities for Gn_XIST2 (actual position value 2)

Name	Description
Encoder error?	Is there a sensor error?
Search reference mark or touchprobe selected	Is a reference mark being searched for or is the Touch Probe (flying measurement) function selected?
Transmit absolute value cyclic?	Is the absolute value transmitted cyclically?
Parking encoder?	parking encoder?
Gn_XIST2 = error code	Gn_XIST2 contains the error code.
Gn_XIST2 = request value	Gn_XIST2 contains the requested value.
Gn_XIST2 = absolute value	Gn_XIST2 contains the cyclically transmitted absolute value.

Tab. 1140: Legend for figure "Priorities for Gn_XIST2 (Actual Position Value 2)"

Detailed information on the mode of operation of the encoder interface
➔ 13.6.8.10 Status Diagram "Position Feedback Interface".

13.6.8.9 Encoder n control word (Gn_STW)

The encoder status machine is controlled via the encoder control word. The following functions are implemented in the device via the encoder control word and the encoder state machine:

Bit	Meaning
	If Gn_STW.7 = 0; request "Search zero pulse" Value: Function requirement
0	1: Function 1, zero pulse 1
1	1: Function 2, reserved
2	1: Function 3, reserved
3	1: Function 4, reserved
4 … 6	Value: Command – 0: – – 1: Activate function (defined by bit 0 … 3 and 7) – 2: Read value via Gn_XIST2 (defined via bit 0 … 3 and 7) – 3: Abort function (defined via bit 0 … 3 and 7) – 4 … 7: reserved
7	Value: Mode – 0: Request "Search for zero pulse" – 1: reserved
8 … 12	reserved
13	Request absolute value cyclically – 1: Request of an additional cyclic transmission of the absolute actual position in Gn_XIST2
14	Activate encoder parking – 1: Request to switch off the monitoring of the encoder and the actual value measurements in the drive. If the Park encoder function is active, the encoder (or a motor with encoder) can be removed from the machine without having to change the drive configuration or cause an error. If parking of the encoder interface is requested by Gn_STW1.14, all current encoder interface errors are also cleared. Normally the parking of the encoder is not permitted while the drive (S4) is running and leads to an error of the encoder interface (error code 0x0003 in Gn_XIST2).
15	Acknowledge encoder error 1: Request to reset an encoder error (Gn_ZSW.15)

Tab. 1141: Control word Gn_STW

Detailed information on the mode of operation of the encoder interface
➔ 13.6.8.10 Status Diagram "Position Feedback Interface".

Parameter encoder n control word (Gn_STW)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1149990	9.0	Gn_STW	UINT
Px.	**Manufacturer-specific parameters**		
1149000	12260.0	Gn_STW.0 ... 3 Request function	USINT
1149040	12261.0	Gn_STW.4 ... 6 Request command	USINT
1149070	12262.0	Gn_STW.7 Mode	BOOL
1149110	12263.0	Gn_STW.11 Home position mode	BOOL
1149120	12264.0	Gn_STW.12 Trigger mode homing	BOOL
1149130	12265.0	Gn_STW.13 Request absolute value cyclically	BOOL
1149140	12266.0	Gn_STW.14 Activate parking sensor	BOOL
1149150	12267.0	Gn_STW.15 Acknowledge sensor error	BOOL
1149990	12268.0	Gn_STW	UINT
1149991	12269.0	Gn_STW Cycle-1	UINT

Tab. 1142: PNUs

13.6.8.10 Status Diagram "Position Feedback Interface"

The statuses SD11, SD10 and SD7 are not supported.

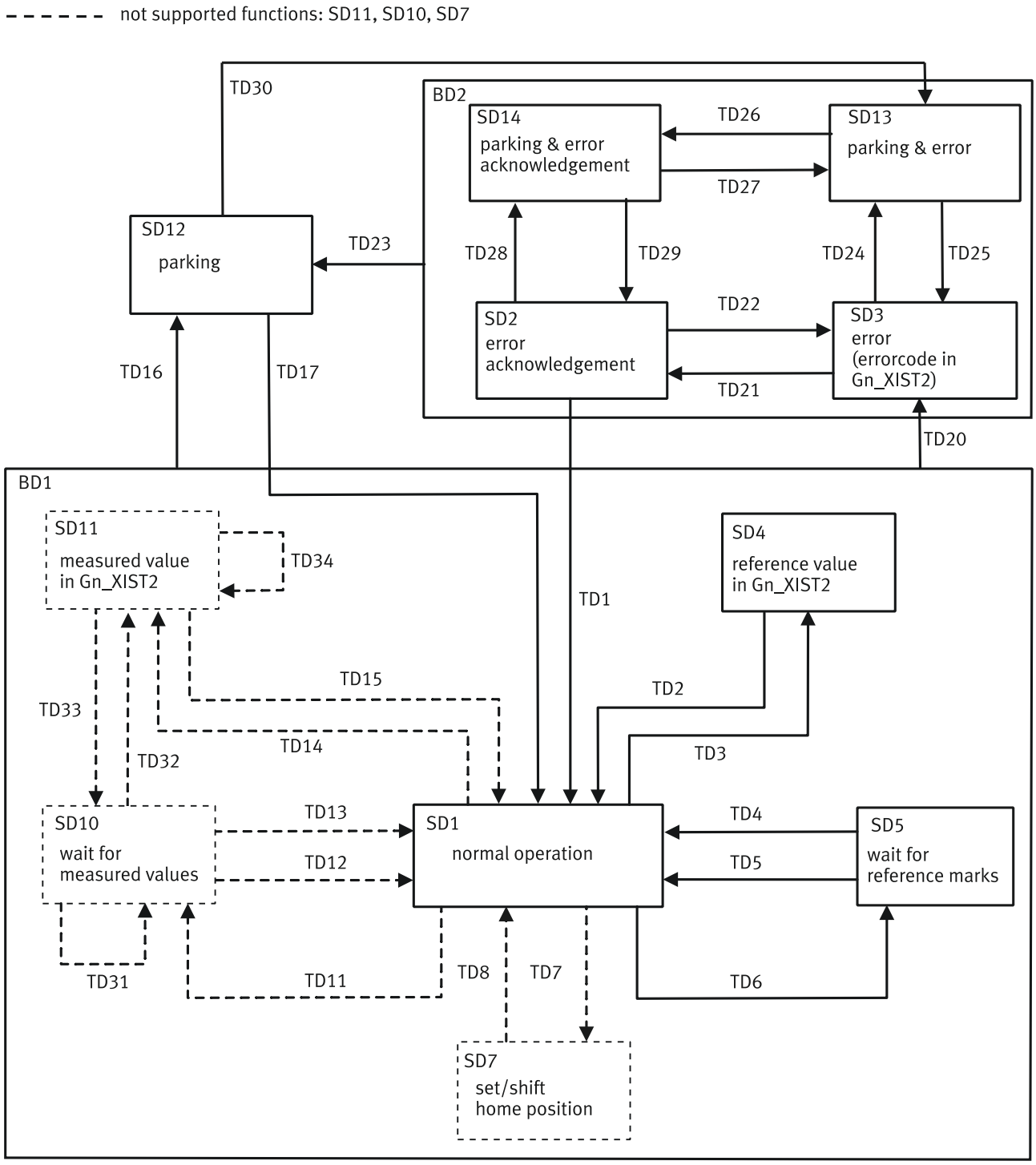


Fig. 163: Status diagram of the position feedback interface

13.6.8.11 Actual position value A (XIST_A)

XIST_A shows the actual position value based on the scaling that is set in the factor group.

PNU actual position value A (XIST_A)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
113104	28.0	XIST_A, parameter name "Actual value modulo"	DINT

Tab. 1143: PNUs

13.6.8.12 MDI target position (MDI_TARPOS)

This process datum specifies the position with MDI.
Scaling is analogous to the CiA402 factor group via the following parameter:
– Resolution position: Px.7841, PNU 11724.0
The scalability is limited to the power of 10 ➔ 3.2.4.3 Scaling of internal units for fieldbus ("Factor group").

Parameter MDI target position (MDI_TARPOS)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280604	34.0	Target position MDI	DINT
Px.	**Manufacturer-specific parameters**		
11280604	12339.0	Target position MDI	LINT

Tab. 1144: PNUs

13.6.8.13 MDI velocity (MDI_VELOCITY)

This process data specifies the velocity with MDI.
Scaling is analogous to the CiA402 factor group via the following parameter:
– Resolution velocity: Px.7842, PNU 11725.0
The scalability is limited to the power of 10 ➔ 3.2.4.3 Scaling of internal units for fieldbus ("Factor group").

Parameters of MDI velocity (MDI_VELOCITY)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280605	35.0	Profile velocity MDI	UDINT
Px.	**Manufacturer-specific parameters**		
11280605	12340.0	Profile velocity MDI	REAL

Tab. 1145: PNUs

13.6.8.14 MDI acceleration (MDI_ACC)

This process datum specifies the acceleration with MDI records.
Standardisation: 0x4000 (16384) corresponds to 100%. The value is internally limited to 0.1 ... 100%.

PNUs of MDI acceleration (MDI_ACC)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280606	36.0	Acceleration MDI	INT
Px.	**Manufacturer-specific parameters**		
11280606	12341.0	Acceleration MDI	REAL

Tab. 1146: PNUs

13.6.8.15 MDI deceleration (MDI_DEC)

This process datum specifies the percentage value for the deceleration override with MDI records.
Standardisation: 0x4000 (16384) corresponds to 100%. The value is internally limited to 0.1 ... 100%.

PNUs of MDI deceleration (MDI_DEC)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280607	37.0	Deceleration MDI	INT
Px.	**Manufacturer-specific parameters**		
11280607	12342.0	Deceleration MDI	REAL

Tab. 1147: PNUs

13.6.8.16 Status word messages (MELDW)

Bit	Meaning
0	Ramp generator – 1: inactive – 0: active
1	Torque utilisation – 1: < threshold value – 0: > threshold value
2	Actual rotational speed < threshold 1 – 1: value < threshold value – 0: value > threshold value
3	Actual rotational speed ≤ threshold 2 – 1: value < threshold value – 0: value > threshold value
4	reserved
5	Variable message function – 1: threshold value exceeded – 0: below the threshold value or message function not active
6	No warning of motor overtemperature – 1: active (no warning) – 0: inactive (warning active)
7	No warning of power output stage overtemperature – 1: active (no warning) – 0: inactive (warning active)
8	Velocity setpoint/actual deviation within tolerance – 1: active – 0: inactive
9 ... 10	Reserved
11	Controller enable – 1: active – 0: inactive
12	Ready for operation – 1: active – 0: inactive
13	Power stage enable – 1: active – 0: inactive
14 ... 15	Reserved

Tab. 1148: Status Word Messages (MELDW)

MELDW.0 ramp generator

Value	Message	Description
1	Inactive	Ramp generator is inactive. Startup phase is complete.
0	Active	Ramp generator active. Startup phase is still active.

Tab. 1149: MELDW.0

MELDW.0 shows how far the setpoint value change to a new velocity setpoint value is complete.

MELDW.1 torque utilization

Value	Message	Description
1	< Threshold value	The current torque value is within the torque utilisation monitoring window.
0	> Threshold value	The current torque value is outside the torque utilisation monitoring window.

Tab. 1150: MELDW.1

This message can determine an overload of the motor in order to initialise a corresponding reaction (e.g. stop motor or reduce load).
The threshold, the monitoring window and the settling time can be parameterised:
– Threshold value torque utilization reached: Px.11280410, PNU 12332.0
– Torque utilization monitoring window: Px.11280411, PNU 12532
– Damping time torque utilization: Px.11280412, PNU 12533

MELDW.2 Actual velocity <Threshold1

Value	Message	Description
1	Value < specified threshold value	$\|n_{act}\| <$ threshold
0	Value > or equal to specified threshold value	$\|n_{act}\| \geq$ threshold

Tab. 1151: MELDW.2

The threshold can be parameterised.
– Trigger level MELDW.2: Px.11280112, PNU 12320.0
– Hysteresis trigger level: Px.11280113, PNU 12321.0

MELDW.3 Actual velocity = <Threshold2

Value	Message	Description
1	Value < specified threshold value	$\|n_{act}\| \leq$ threshold
0	Value > or equal to specified threshold value	$\|n_{act}\| >$ threshold

Tab. 1152: MELDW.3

The message is parameterisable and is used for monitoring the rotational speed:
– Trigger level MELDW.3: Px.11280114, PNU12322.0
– Hysteresis trigger level: Px.11280115, PNU 12323.0

MELDW.5 Variable reporting function

Value	Message	Description
1	Threshold value exceeded (Value > threshold value)	The monitored signal of a drive system has exceeded the specified threshold value.
0	Below the threshold value or message function not active (Value ≤ threshold value)	The monitored signal of a drive system is below the specified threshold value or the message function is not active.

Tab. 1153: MELDW.5

The function monitors any parameter to check whether it exceeds a threshold value.

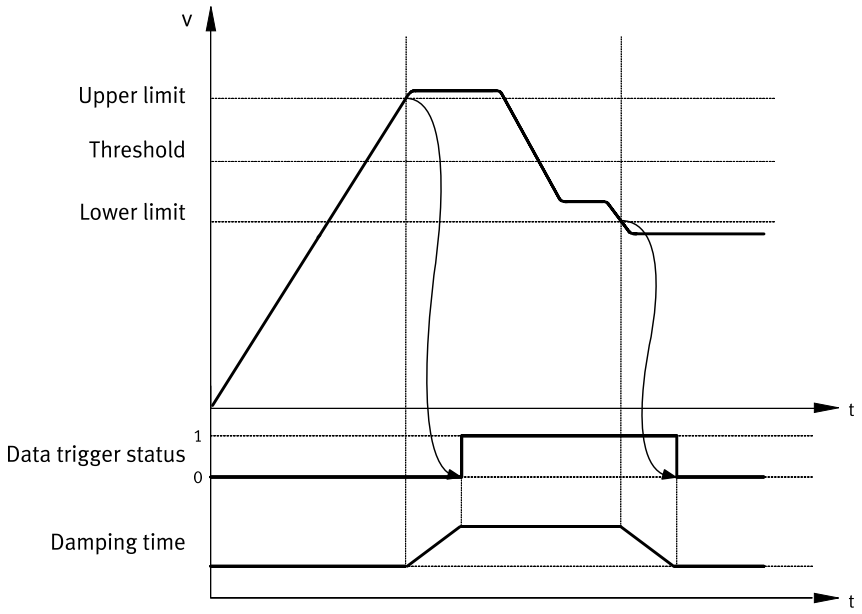


Fig. 164: Variable message function timing (example)

Name	Description	ID Px.
Threshold	Threshold value of the monitored parameter	–
	Trigger level MELDW.5	1174205
	Hysteresis of trigger level	1174206
Upper limit	upper limit value (threshold value + hysteresis)	–
Lower limit	lower limit value (threshold value - hysteresis)	–
Data trigger status	Data trigger status (mapped to MELDW.5)	1174220
Cushioning time	Data trigger damping time	1174207

Tab. 1154: Legend for variable message function timing graph

The monitored parameters are specified with the following parameters:
– Axis ID data trigger: P0.1174201.0.0, PNU 3292.0
– Data ID data trigger: P0.1174202.0.0, PNU 3293.0
– Data instance ID data trigger: P0. 1174203.0.0, PNU 3294.0
– Array ID data trigger: P0.1174204, PNU 3295.0
The resolution is specified with the following parameters:
– Trigger level MELDW.5: P0.1174205.0.0, PNU 3296.0
– Hysteresis of trigger level: P0.1174206.0.0, PNU 3297.0
– Data trigger damping time: P0.1174207.0.0, PNU 3298.0
The input values must be specified in the correct format for trigger level and hysteresis (data type of the monitored parameter).
Hysteresis and cushioning times are optional and may be omitted.
On completion of parameterisation the function can be activated with the following parameter:
– Activation of variable message function: P0.1174200.0.0, PNU 3291.0
The specified values are not enabled until the function is activated. The specified values may also be modified without affecting the currently active function.
The status can also be queried with the following parameters in addition to MELDW.5:
– Data trigger status: P0.1174220.0.0, PNU 3307.0

MELDW.6 No warning Overtemperature motor

Value	Message	Description
1	No warning of motor overtemperature	The temperature in the motor is within the permissible range
0	Warning of motor overtemperature	The temperature in the motor is outside the permissible range

Tab. 1155: MELDW.6

The bit returns the value 1 so long as the temperature remains within the permissible range (lower warning limit < permissible range < upper warning limit).
The limits are formed by combination of threshold value + hysteresis:
– Lower limit value warning threshold motor temperature: Px.945.0.0, PNU 11234.0
– Hysteresis lower limit value warning threshold motor temperature: Px.946.0.0, PNU 11235.0
– Upper limit value warning threshold motor temperature: Px.949.0.0, PNU 11238.0
– Hysteresis upper limit value warning threshold motor temperature: Px.9410.0.0, PNU 11782.0
A difference between warning and error cannot be distinguished with this bit.
Temperature outside the permissible range means warning and/or error.

MELDW.7 No warning Overtemperature power output stage

Value	Message	Description
1	No warning of thermal overload in power unit	The temperature of the cooling element in the power unit is within the permissible range
0	Warning of thermal overload in power unit	The temperature of the cooling element in the power unit is outside the permissible range

Tab. 1156: MELDW.7

The bit returns the value 1 so long as the temperature remains within the permissible range (warning limit < permissible range < upper warning limits).
– Lower limit value warning threshold power output stage temperature: Px.9316.0.0, PNU 2797.0
– Upper limit value warning threshold power output stage temperature: Px.9314.0.0, PNU 2795.0
A difference between warning and error cannot be distinguished with this bit.
Temperature outside the permissible range means warning and/or error.

MELDW.8 velocity setpoint / actual deviation in tolerance

Value	Message	Description
1	active	The rotational speed setpoint/actual deviation as specified is within the tolerance.
0	inactive	The rotational speed setpoint/actual deviation as specified is outside the tolerance.

Tab. 1157: MELDW.8

– Monitoring window velocity: following error: Px.464.0.0, PNU 11148.0
– Damping time velocity: following error: Px.4690.0.0, PNU 11632.0

MELDW.11 Controller enable

Value	Message	Description
1	Active	Controller enable reported
0	Inactive	Controller enable not reported

Tab. 1158: MELDW.11

MELDW.12 Ready for operation

Value	Message	Description
1	Active	Ready for operation reported
0	Inactive	Ready for operation not reported

Tab. 1159: MELDW.12

MELDW.13 Power stage active

Value	Message	Description
1	Active	Output stage active reported
0	Inactive	Output stage not active reported

Tab. 1160: MELDW.13

PNUs for status word messages (MELDW)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
11249990	102.0	MELDW	UINT
Px.	Manufacturer-specific parameters		
1174205	3296.0	Trigger level MELDW.5	LINT
11280046	12310.0	Status word MELDW	UINT
11280112	12320.0	Trigger level MELDW.2	REAL
11280114	12322.0	Trigger level MELDW.3	REAL
1124900	12178.0	MELDW.0 ramp generator	BOOL
11249010	12279.0	MELDW.1 torque utilization	BOOL
11249020	12280.0	MELDW.2 Actual velocity <Threshold1	BOOL
11249030	12281.0	MELDW.3 Actual velocity = <Threshold2	BOOL
11249050	12282.0	MELDW.5 Variable reporting function	BOOL
11249060	12283.0	MELDW.6 No warning Overtemperature motor	BOOL
11249070	12284.0	MELDW.7 No warning Overtemperature power output stage	BOOL
11249080	12285.0	MELDW.8 velocity setpoint / actual deviation in tolerance	BOOL
11249110	12286.0	MELDW.11 Controller enable	BOOL
11249120	12287.0	MELDW.12 Ready for operation	BOOL
11249130	12288.0	MELDW.13 Power stage active	BOOL
11249990	12289.0	MELDW	UINT

Tab. 1161: PNUs

13.6.8.17 Velocity Override (OVERRIDE)

The process data item OVERRIDE specifies the percentage value for the velocity override for the following movement types in positioning mode of application class 3:

– Positioning records
– Jogging
– Go to Home/Reference
– Homing point specification (MDI)

The velocity setpoint value of these movement types is multiplied by the override factor.

Standardisation: 0x4000 (16384) corresponds to 100%.

Value range according to drive profile: 0 ...0x7FFF (Px.11280611)

Device parameters value range: 0 ... 2 (Px.1309)

Values below this range are interpreted as 0 %.

Values above this range are interpreted as 200 %.

PNUs position speed override (OVERRIDE)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280611	205.0	Velocity override	INT
Px.	**Manufacturer-specific parameters**		
1309	12482.0	Velocity override	REAL
11280611	12534.0	Velocity override	INT

Tab. 1162: PNUs

13.6.8.18 Torque reduction (MOMRED)

The process date MOMRED specifies the percentage by which the torque limit is to be reduced. With MOMRED, the maximum permissible torque of the motor or controller (Px.381) can be reduced in the range of 0 ... 100%.
The value 0x4000 corresponds to a reduction of 100%.
The value 0x0000 corresponds to a reduction of 0%.
The symmetrical torque limit (Px.526796) is set according to the following formula:
Px.526796 = Px.381 - Px.381 * Px.1126990 : 0x4000
A reduction of the torque limit is only effective when using telegrams with the control word MOMRED.
MOMRED is only evaluated if STW1.10 is set.

PNUs torque reduction (MOMRED)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
1126990	101.0	MOMRED	INT
Px.	Manufacturer-specific parameters		
381	11122.0	Specifies the maximum torque from the minimum values of the motor and servo drive controller relative to the output side with gearbox.	REAL
526796	12166.0	Maximum torque symmetrical	REAL
1126990	12179.0	MOMRED	INT

Tab. 1163: PNUs

13.6.8.19 Positioner control word 1 (POS_STW1)

Bit	Meaning
0	Positioning record selection bit 0 (2^0)
1	Positioning record selection bit 1 (2^1)
2	Positioning record selection bit 2 (2^2)
3	Positioning record selection bit 3 (2^3)
4	Positioning record selection bit 4 (2^4)
5	Positioning record selection bit 5 (2^5)
6	Positioning record selection bit 6 (2^6)
7	reserved
8	absolute positioning (positioning method) – 1: absolute – 0: relative
9	Telegram 111, modulo direction selection positive – 1: positive direction Bit 9 and bit 10 identical (0 or 1): shortest path

Bit	Meaning
10	Telegram 111, modulo direction selection negative – 1: negative direction Bit 9 and bit 10 identical (0 or 1): shortest path
11 … 13	reserved
14	Operating mode, setup 1: Setup mode 0: Positioning mode
15	MDI selection – 1: activate MDI – 0: deactivate MDI

Tab. 1164: Positioner control word 1 (POS_STW1)

POS_STW1.0 … 6 Traversing block selection

Bit	Command	Description
0	Positioning record selection bit 0 (2^0)	Positioning record selection (0 … 127)
1	Positioning record selection bit 1 (2^1)	
2	Positioning record selection bit 2 (2^2)	
3	Positioning record selection bit 3 (2^3)	
4	Positioning record selection bit 4 (2^4)	
5	Positioning record selection bit 5 (2^5)	
6	Positioning record selection bit 6 (2^6)	

Tab. 1165: POS_STW1.0

POS_STW1.8 Absolute positioning (Positioning Method)

Value	Command	Description
1	Absolute positioning	Position specification corresponds to the absolute target position of the motion.
0	Relative positioning	Position specification is defined relative to the current axis position.

Tab. 1166: POS_STW1.8

POS_STW1.9 … 10 direction selection

The positioning direction in the MDI mode is preset with these control bits during parameterisation of a modulo range. If the modulo range is restricted to 0 with the modulo limits, MinLimit = MaxLimit (= 0), the direction set here will be ignored.

Value		Description
Bit 10	Bit 9	
0	0	Position absolute on shortest path
0	1	Position absolute in positive direction
1	0	Position absolute in negative direction
1	1	Position absolute on shortest path

Tab. 1167: POS_STW1.9…10

POS_STW1.14 Setting up selected

In the setup mode, the parameters velocity, acceleration and deceleration can be used to set an endless position-controlled behaviour.

Value	Command	Description
1	Setup mode	Setup is being executed. Positioning task is executed at the range limits with the dynamic values from the MDI specification.
0	Positioning mode	Normal positioning task is executed with the position and dynamic values from the MDI specification.

Tab. 1168: POS_STW1.14

POS_STW1.15 MDI selection (Target Value Specification)

Value	Command	Description
1	Activate MDI	If a task is currently active, it switches first to MDI, if the current task is finished or interrupted (e.g. with STW1.4 = 0) and the drive is in the S41 Basic State Positioning Mode status.
0	Deactivate MDI	If a MDI task is currently active, it switches to the S43 Braking With Ramp status, braked at maximum deceleration and at standstill switches to the S41 Basic State Positioning Mode status. The current task is rejected.

Tab. 1169: POS_STW1.15

PNUs for positioner control word 1 (POS_STW1)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112411990	220.0	POS_STW1	UINT
Px.	Manufacturer-specific parameters		
112411000	12348.0	POS_STW1.0 ... 6 Traversing block selection	USINT
112411080	12349.0	POS_STW1.8 Absolute positioning	BOOL
112411090	12350.0	POS_STW1.9 ... 10 direction selection	UDINT
112411120	12351.0	POS_STW1.12 Setpoint transfer	BOOL
112411140	12352.0	POS_STW1.14 Setting up selected	BOOL
112411150	12353.0	POS_STW1.15 MDI selection	BOOL
112411990	12354.0	POS_STW1	UINT

Tab. 1170: PNUs

13.6.8.20 Positioner status word 1 (POS_ZSW1)

Bit	Meaning
0	active positioning record bit 0 (2^0)
1	active positioning record bit 1 (2^1)
2	active positioning record bit 2 (2^2)
3	active positioning record bit 3 (2^3)
4	active positioning record bit 4 (2^4)
5	active positioning record bit 5 (2^5)
6	active positioning record bit 6 (2^6)
7	reserved
8	negative limit switch active – 1: active – 0: inactive
9	Positive limit switch active – 1: active – 0: inactive
10	Jogging active – 1: active – 0: inactive

Bit	Meaning
11	Homing active – 1: active – 0: inactive
12	reserved
13	Positioning records active – 1: active – 0: inactive
14	Setup active/inactive – 1: active – 0: inactive
15	MDI active – 1: active – 0: inactive

Tab. 1171: Positioner status word 1 (POS_ZSW1)

POS_ZSW1.0 ... 6 Traversing block bit

Bit	Meaning	Description
0	Active positioning record bit 0 (2^0)	only relevant in record mode Specifies the record number of the currently active record (0 to 127). A record is active if the drive is in the S45 Traversing Task Interpolation status (including all sub-statuses). If a new task is started during the intermediate stop ramp or during the intermediate stop, the active record switches immediately to the new record number. The value 0 is shown if MDI is active or if there is no record currently active.
1	Active positioning record bit 1 (2^1)	
2	Active positioning record bit 2 (2^2)	
3	Active positioning record bit 3 (2^3)	
4	Active positioning record bit 4 (2^4)	
5	Active positioning record bit 5 (2^5)	
6	Active positioning record bit 6 (2^6)	

Tab. 1172: POS_ZSW1.0

POS_ZSW1.8 Negative limit switch active

Value	Meaning	Description
1	Negative limit switch active	Signal status of the negative limit switch
0	negative limit switch active	

Tab. 1173: POS_ZSW1.8

POS_ZSW1.9 Positive limit switch active

Value	Meaning	Description
1	Positive limit switch active	Signal status of the positive limit switch
0	Positive limit switch inactive	

Tab. 1174: POS_ZSW1.9

POS_ZSW1.10 Jogging active

Value	Meaning	Description
1	Jogging active	Shows whether jogging is active.
0	Jogging inactive	

Tab. 1175: POS_ZSW1.10

POS_ZSW1.11 Reference point approach active

Value	Meaning	Description
1	Homing active	Shows whether homing is active.
0	Homing inactive	

Tab. 1176: POS_ZSW1.11

POS_ZSW1.13 Traversing block active

Value	Meaning	Description
1	Positioning records active	Shows whether positioning records are active.
0	Positioning records inactive	

Tab. 1177: POS_ZSW1.13

POS_ZSW1.14 Setup active

Value	Meaning	Description
1	Setup active	Shows whether setup is active or inactive.
0	Setup inactive	

Tab. 1178: POS_ZSW1.14

POS_ZSW1.15 MDI active (Target Value Specification)

Value	Meaning	Description
1	MDI active	Target value specification is active. The setpoint values are specified directly by the open-loop controller. If a positioning task is currently being executed (drive is in the S45 Traversing Task Interpolation or S43 Braking With Rampstatus), the setpoint value was specified directly.
0	MDI inactive	Record mode is active. The record number of a new task is which the setpoint values for the task are saved is taken from bit 0 - 6: record selection. If a positioning task is currently being executed (drive is in the S45 Traversing Task Interpolation or S43 Braking With Rampstatus), the setpoint value was specified in record mode and the record number of the record is shown in bit 0 - 6: active record.

Tab. 1179: POS_ZSW1.15

PNUs positioner status word 1 (POS_ZSW1)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112412990	221.0	POS_ZSW1	UINT
Px.	Manufacturer-specific parameters		
112412000	12357.0	POS_ZSW1.0 ... 6 Traversing block bit	USINT
112412080	12358.0	POS_ZSW1.8 Negative limit switch active	BOOL
112412090	12359.0	POS_ZSW1.9 Positive limit switch active	BOOL
112412100	12360.0	POS_ZSW1.10 Jogging active	BOOL
112412110	12361.0	POS_ZSW1.11 Reference point approach active	BOOL
112412130	12362.0	POS_ZSW1.13 Traversing block active	BOOL
112412140	12363.0	POS_ZSW1.14 Setup active	BOOL
112412150	12364.0	POS_ZSW1.15 MDI active	BOOL
112412990	12365.0	POS_ZSW1	UINT

Tab. 1180: PNUs

13.6.8.21 Positioner control word 2 (POS_STW2)

Bit	Meaning
0	Tracking mode – 1: activate – 0: deactivate
1	Set homing point – 1: set – 0: do not set
2 ... 4	reserved
5	Incremental jogging – 1: incremental – 0: velocity
6 ... 9	reserved
10	Touch Probe source – 1: secondary encoder – 0: primary encoder

Bit	Meaning
11	Touch Probe edge – 1: falling edge – 0: rising edge
12 ... 13	reserved
14	Activate software limit switch – 1: activate – 0: deactivate
15	Activate hardware limit switch – 1: activate – 0: deactivate

Tab. 1181: Positioner control word 2 (POS_STW2)

POS_STW2.0 Tracking mode

This function is only available in not enabled status. In tracking mode the internal setpoint position value tracks the actual position value, therefore setpoint position value = actual position value. The standstill monitoring is deactivated in this operating mode.

Value	Command	Description
1	Activate tracking mode	Tracking mode is activated.
0	Deactivate tracking mode	Tracking mode is deactivated.

Tab. 1182: POS_STW2.0

POS_STW2.1 Set reference point

Value	Command	Description
1	Set homing point	rising edge activated internal homing method 37
0	Do not set homing point	Homing point will not be set

Tab. 1183: POS_STW2.1

POS_STW2.5 Jogging incremental active

Value	Command	Description
1	Incremental jogging	Incremental jogging is activated.
0	Velocity jog	Velocity jog is activated.

Tab. 1184: POS_STW2.5

POS_STW2.10 Selection touch probe

Value	Command	Description
1	Select probe 2	Probe 2 is activated with logic 1.
0	Select probe 1	Probe 1 is activated with logic 0.

Tab. 1185: POS_STW2.10

POS_STW2.11 Touch probe edge

Value	Command	Description
1	Falling edge	Determines the type of signal edge with which the measurement shall be triggered.
0	Rising edge	

Tab. 1186: POS_STW2.11

POS_STW2.14 Activate software limit switch

Value	Command	Description
1	Activate software limit switch	Specifies whether software end position monitoring should be active or inactive.
0	Deactivate software limit switch	

Tab. 1187: POS_STW2.14

POS_STW2.15 Activate hardware limit switch

Value	Command	Description
1	Activate hardware limit switch	The evaluation of the hardware limit switch is activated.
0	Deactivate hardware limit switch	The evaluation of the hardware limit switch is deactivated.

Tab. 1188: POS_STW2.15

PNUs for positioner control word 2 (POS_STW2)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112414990	222.0	POS_STW2	UINT
Px.	Manufacturer-specific parameters		
112414000	12382.0	POS_STW2.0 Tracking mode	BOOL
112414010	12383.0	POS_STW2.1 Set reference point	BOOL
112414050	12384.0	POS_STW2.5 Jogging incremental active	BOOL
112414100	12385.0	POS_STW2.10 Selection touch probe	BOOL
112414110	12386.0	POS_STW2.11 Touch probe edge	BOOL
112414140	12387.0	POS_STW2.14 Activate software limit switch	BOOL
112414150	12388.0	POS_STW2.15 Activate hardware limit switch	BOOL
112414990	12389.0	POS_STW2	UINT

Tab. 1189: PNUs

13.6.8.22 Positioner status word 2 (POS_ZSW2)

Bit	Meaning
0	Tracking mode active – 1: active – 0: inactive
1	Velocity limiting active – 1: active – 0: inactive
2	Setpoint value stopped – 1: setpoint value stopped – 1: setpoint value not stopped
3	reserved
4	Drive moves forward – 1: drive moves forward – 0: drive does not move forward
5	Drive moves backwards – 1: drive moves backwards – 0: drive does not move backwards
6	Negative software limit switch active – 1: active – 0: inactive
7	Positive software limit switch active – 1: active – 0: inactive
8	Actual position ≤ cam switch 0 – 1: actual position ≤ as position of cam switch 0 – 0: actual position > as position of cam switch 0
9	Actual position ≤ cam switch 1 – Actual position ≤ as position of cam switch 1 – Actual position > as position of cam switch 1
10	Direct output 1 via positioning record – 1: active – 0: inactive
11	Direct output 2 via positioning record – 1: active – 0: inactive
12	Fixed stop reached – 1: reached – 0: not reached

Bit	Meaning
13	Fixed stop clamping torque reached – 1: reached – 0: not reached
14	Move to fixed stop active – 1: active – 0: inactive
15	Positioning command active – 1: active – 0: inactive

Tab. 1190: Positioner status word 2 (POS_ZSW2)

POS_ZSW2.0 Tracking mode active

In tracking mode the internal setpoint position value tracks the actual position value. Therefore setpoint position value = actual position value. The standstill monitoring is deactivated in this operating mode. The comparison of setpoint position value = actual position value is executed only with deactivate output stage.

Value	Meaning	Description
1	Tracking mode active	Shows that tracking mode is active (comparison of setpoint position value = actual position value).
0	Tracking mode inactive	Tracking mode is inactive.

Tab. 1191: POS_ZSW2.0

POS_ZSW2.1 Velocity limitation active

Value	Meaning	Description
1	Speed limitation active	Shows that speed limitation is active in the application limiting manager. The current trajectory is run at limited speed. The speed limitation can be set with the following parameter: – Limit value velocity limit positive and negative direction of movement: Px.1304.0.0, PNU 11334.0
0	Speed limitation inactive	Shows that speed limitation is inactive

Tab. 1192: POS_ZSW2.1

POS_ZSW2.2 Setpoint available

Value	Meaning	Description
1	Setpoint value stopped	Shows that the setpoint position value is not changed. The internal setpoint velocity value according to the trajectory generator is 0.
0	Setpoint value not stopped	Shows that the setpoint position value is changed. The internal setpoint velocity value according to the trajectory generator is not equal to 0.

Tab. 1193: POS_ZSW2.2

POS_ZSW2.4 Drive moves forward

Value	Meaning	Description
1	Drive moves forward	Shows that the drive moves forward. The internal setpoint velocity value according to the trajectory generator is > 0.
0	Drive does not move forward	Shows that the drive is stopped or moves backwards. The internal setpoint velocity value according to the trajectory generator is ≤ 0.

Tab. 1194: POS_ZSW2.4

POS_ZSW2.5 Drive moves backwards

Value	Meaning	Description
1	Drive moves backwards	Shows that the drive is stopped or moves backwards. The internal setpoint velocity value according to the trajectory generator is ≠ 0.
0	Drive does not move backwards	Shows that the drive moves forward. The internal setpoint velocity value according to the trajectory generator is > 0.

Tab. 1195: POS_ZSW2.5

POS_ZSW2.6 Software limit switch minus reached

Value	Meaning	Description
1	Negative software limit switch active	Specifies that the negative software limit switch is active.
0	Negative software limit switch not active	

Tab. 1196: POS_ZSW2.6

POS_ZSW2.7 Software limit switch plus reached

Value	Meaning	Description
1	Positive software limit switch active	Specifies that the positive software end position is active.
0	Positive software limit switch not active	

Tab. 1197: POS_ZSW2.7

POS_ZSW2.8 Position actual value <= position switch 0

Value	Meaning	Description
1	Actual position ≤ as position of cam switch 0	Specifies whether the actual position value ≤ or > as cam switch position 0.
0	0: actual position > as position of cam switch 0	

Tab. 1198: POS_ZSW2.8

POS_ZSW2.9 Position actual value <= position switch 1

Value	Meaning	Description
1	Actual position ≤ as position of cam switch 1	Specifies whether the actual position value ≤ or > as cam switch position 1.
0	Actual position > as position of cam switch 1	

Tab. 1199: POS_ZSW2.9

POS_ZSW2.10 Direct output 1 via traversing block

Value	Meaning	Description
1	Direct output 1 active	Shows whether direct output 1 is active via positioning record.
0	Direct output 1 not active	

Tab. 1200: POS_ZSW2.10

POS_ZSW2.11 Direct output 2 via traversing block

Value	Meaning	Description
1	Direct output 2 active	Shows whether direct output 2 is active via positioning record.
0	Direct output 2 not active	

Tab. 1201: POS_ZSW2.11

POS_ZSW2.12 Fixed stop reached

Value	Meaning	Description
1	Fixed stop reached	Specifies whether the fixed stop was reached.
0	Fixed stop not reached	

Tab. 1202: POS_ZSW2.12

POS_ZSW2.13 Fixed stop Clamping torque reached

Value	Meaning	Description
1	Fixed stop clamping torque reached	Specifies whether the clamping torque was reached after move to the fixed stop.
0	Fixed stop clamping torque not reached	

Tab. 1203: POS_ZSW2.13

POS_ZSW2.14 Move to fixed stop active

Value	Meaning	Description
1	Move to fixed stop active	Specifies whether move to the fixed stop is active.
0	Move to fixed stop not active	

Tab. 1204: POS_ZSW2.14

POS_ZSW2.15 Traversing command active

Value	Meaning	Description
1	Positioning command active	Specifies whether a positioning command is active (motion manager status).
0	Positioning command not active	

Tab. 1205: POS_ZSW2.15

PNUs positioner status word 2 (POS_ZSW2)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112413990	223.0	POS_ZSW2	UINT
Px.	Manufacturer-specific parameters		
112413000	12366.0	POS_ZSW2.0 Tracking mode active	BOOL
112413010	12367.0	POS_ZSW2.1 Velocity limitation active	BOOL
112413020	12368.0	POS_ZSW2.2 Setpoint available	BOOL
112413040	12369.0	POS_ZSW2.4 Drive moves forward	BOOL
112413050	12370.0	POS_ZSW2.5 Drive moves backwards	BOOL
112413060	12371.0	POS_ZSW2.6 Software limit switch minus reached	BOOL
112413070	12372.0	POS_ZSW2.7 Software limit switch plus reached	BOOL
112413080	12373.0	POS_ZSW2.8 Position actual value <= position switch 0	BOOL
112413090	12374.0	POS_ZSW2.9 Position actual value <= position switch 1	BOOL
112413100	12375.0	POS_ZSW2.10 Direct output 1 via traversing block	BOOL
112413110	12376.0	POS_ZSW2.11 Direct output 2 via traversing block	BOOL
112413120	12377.0	POS_ZSW2.12 Fixed stop reached	BOOL
112413130	12378.0	POS_ZSW2.13 Fixed stop Clamping torque reached	BOOL
112413140	12379.0	POS_ZSW2.14 Move to fixed stop active	BOOL
112413150	12380.0	POS_ZSW2.15 Traversing command active	BOOL
112413990	12381.0	POS_ZSW2	UINT

Tab. 1206: PNUs

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