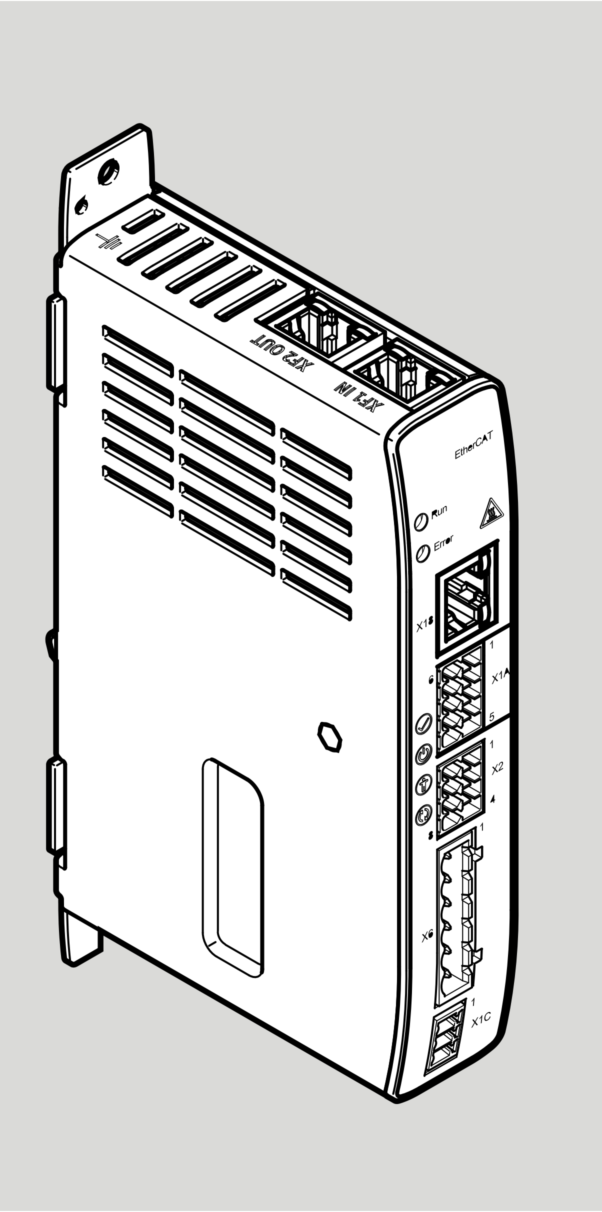
CMMT-ST-SW
Servo drive



FESTO

Description | Software, Function, Fieldbus, Device profile

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Translation of the original instructions

Table of contents

1 About this document

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
– Firmware of the servo drive
– Bus protocol EtherCAT and device profile CiA402
– Bus protocol PROFINET and device profile PROFIdrive
– Bus EtherNet/IPprotocol and drive profile

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.

1.1 Applicable documents

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

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

Designation	Contents
Product instruction manual	Installation, safety sub-function
Product descriptions	Detailed description of assembly, installation
	Detailed description of safety sub-function
Description/online help plug-in	Plug-in: – Functions and operation of the software – Initial commissioning assistant 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

1.2 Product Version

This documentation refers to the following version:

- Servo drive (revision ➔ product labelling)
  - CMMT-ST-C8-1C-EC as of revision 1
  - CMMT-ST-C8-1C-PN Revision 1 and higher
  - CMMT-ST-C8-1C-EP revision 1 and higher
- Firmware package version V017 and higher
- CMMT-ST Plug-in version 1.3.0 and higher for the Festo Automation Suite

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

1.3 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.

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Further general safety instructions for the servo drive controller can be found in the product instruction manual (Installation, Safety sub-function) ➔ 1.1 Applicable documents.

1.4 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 Depiction of the parameters
  - Diagnostic messages (D …)➔ 9.4.2 Structure of Messages
- Objects assigned to the parameters are displayed according to the device profile used; e. g., objects according to CiA 402 are shown as hexadecimal values with index and subindex ➔ 3.2.3 Depiction of the Objects Specific to the Device Profile

2 CMMT-ST Plug-in

2.1 CMMT-ST Getting to know the plug-in

2.1.1 Overview

Function

The CMMT-ST plug-in is integrated in the Festo Automation Suite, enabling parameterisation, commissioning, diagnostics and manual control of servo drives from the range. CMMT-STThe plug-in can be loaded and used in a Festo Automation Suite project.

When inserting Festo components, the component-specific parameters are copied from a device directory (database) and do not have to be entered. The application-specific parameters are entered 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, deinstallation and language switchover of the plug-in is managed in Festo Automation Suite. If a text in the plug-in is not available in the selected language, it switches back to the standard language – English. Projects that contain the devices are also managed via the Festo Automation Suite. ➔ Online help for Festo Automation Suite.

Device parameter record

The device parameter record (user parameter record) is part of the project and is managed with the project in Festo Automation Suite.
Unsaved changes are marked with "*" behind the project name in the title line. The "Save" or "Save as" function of 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 subsequent, manual moving within the file system

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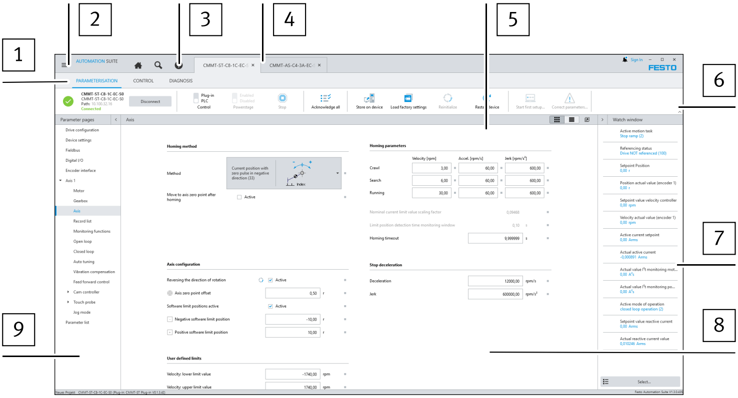
Recommendation: Archive completed projects so that the parameter record is available if the device is replaced. Standard mechanisms can be used, such as the creation of a ZIP archive. After unpacking, the archived project can be opened again in the suite.

2.1.2 Surface

2.1.2.1 Overview



1 Selection of context-dependent areas
➔ 2.1.2.2 Contexts

2 Backstage area of the Festo Automation Suite

3 Program areas of the Festo Automation Suite

4 Tabs of device entities that are currently open

5 Title bar of working area
➔ 2.1.2.5 Working Area in the Title Bar

6 Toolbar ➔ 2.1.2.3 Toolbar

7 Sidebar➔ 2.1.2.7 Side bar with

8 Working area
➔ 2.1.2.5 Working Area in the Title Bar

9 Navigator ➔ 2.1.2.4 Navigator

Fig. 1 Interface of the plug-in (example)

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 area by clicking on a context. The content of the toolbar and sidebar are adjusted to the relevant context that is selected.

Context	**Description**
"Parameterisation"	Parameterise drive by reading and writing device parameters ➔ 2.3.
"Control"	Manually control the device ➔ 2.4.
"Diagnosis"	Performing diagnostics on the device status ➔ 2.5.

Tab. 2 Description of the Contexts

2.1.2.3 Toolbar

Overview

The toolbar contains frequently used commands:

– Context-independent standard commands and sections, e.g. for connection control, error acknowledgement or re-initialisation
– Context-dependent commands for the contexts:
  – ➔ Toolbar "Parameterisation"
  – ➔ Toolbar "Control"
  – ➔ Toolbar "Diagnosis"

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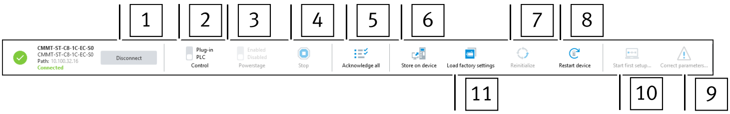
Compatibility with Firmware

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.



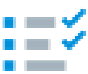
1	Connection Control	7	Reinitialisation
2	Master control	8	Restart device
3	Controller Enable	9	Context-dependent: correct parameters
4	Stop	10	Context-dependent: start initial commissioning
5	Acknowledge all	11	Context-dependent: load factory settings
6	Save to device		

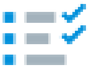
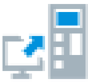
Fig. 2 Toolbar area

No.	Section/command	Description
1	 "Connection Control"	Functions: – Connect the plug-in to a device. – Display current connection and device status. – Manage the plug-in communication settings. Additional information ➔ 2.2.2.1 Connection Control.
2	 "Control"	Function: – Assign the master control to the plug-in or higher-level controller. Note: – The displayed scroll bar shows the current setting.
		Requirements: – The plug-in is connected to a device. – No other plug-in has the master control.

No.	Section/command	Description
2		If another plug-in has the master control, an information symbol is displayed over the deactivated command "Control". Note: The tool tip for the command "Control" contains the IP address and the port number of the device.

3	
	"Powerstage"
		Function:
		– Enable the output stage of the servo drive.
		Information:
		– The scroll bar shows the current setting.
		– During activation of controller enable, a check determines whether a reinitialisation is required. If the command is executed, a selection dialogue shows the following options:
		  – "Ok": The reinitialisation is executed and controller enable is activated.
		  – "Cancel": The reinitialisation is not executed and controller enable remains deactivated.

		Requirements: – The plug-in is connected to a device. – The plug-in has the master control. – The device is not in error status.
		If another plug-in has the master control, an information symbol is displayed over the deactivated command "Powerstage". The tool tip for the command "Powerstage" contains the IP address and the port number of the device.
4	 "Stop"	Function: – Send the 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.
5	 "Acknowledge all"	Function: – Acknowledge all cancelled current diagnostic messages for the servo drive. Additional information ➔ 2.5.2.

No.	Section/command	Description
5	 "Acknowledge all"	Requirements: – The plug-in is connected to a device. – The plug-in has the master control.
6	 "Store on device"	Function: – Permanently save the current parameterisation on the device.
		Requirement: – The plug-in is connected to a device.
7	 "Reinitialize"	Function: – Re-initialising the device Information: – If the function for accepting changed device parameters must be executed, the button is highlighted optically – The reinitialisation will update the device parameters, but not save them.
		Requirements: – The plug-in is connected to a device. – The device parameters that required a reinitialisation have been changed. – Controller enable is deactivated.

8	
	"Restart device"
		Function:
		– Reinitialisation and restart of the device
		Information:
		– If the function for accepting changed device parameters must be executed, the button is highlighted optically.
		– If the command is executed, a selection dialogue offers the following options:
		  – "Store and restart":➔ The data is saved on the device before the restart.
		  – "Restart device only"➔ The device is restarted without saving the data.
		When restarting, a dialogue with the status of the connection setup is displayed. If the connection attempt fails, the process is aborted with a connection error and the plug-in is offline. If no connection is established within 30 seconds, the plug-in aborts the process with a connection error.

No.	Section/command	Description
8	 "Restart device"	Requirement: – The plug-in is connected to a device.

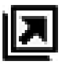
Tab. 3 Context-Independent Sections and Toolbar Commands

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. ➔ Working Area in the Title Bar.

2.1.2.5 Working Area in the Title Bar

The working area displays the current content screen of the selected context. The title bar of the working area shows available commands for the current content page:

Symbol	Description
	Current content page is opened in own window.

Tab. 4 Description of the symbols in the Title Bar of the Working Area

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

– Parameter screens for the Parameterisation context ➔ 2.3
– Diagnostics screen "Error log"for Diagnostics context➔ 2.5.4
– Control screen "Manual movement"for the Control context➔ 2.4.2

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.

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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 ➔ 2.5.2.

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, for example , 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. 5 Colour coding

Display of errors and warnings in the context and navigator

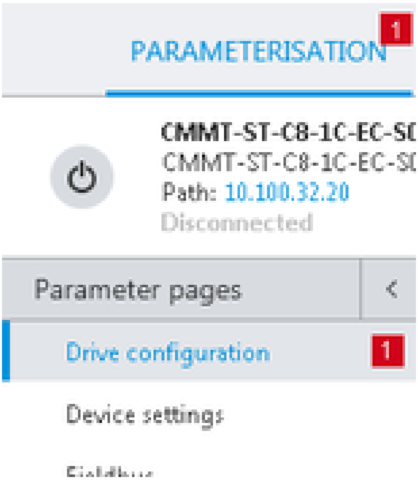

Fig. 3 Displaying errors in the navigator

If parameters on a screen 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 several parameter screens, it is only counted once in the total number.

2.1.2.7 Side bar with Watch window and device information

On the "Drive configuration" screen, the sidebar can be opened with the buttons and to toggle between the Watch window view and the monitoring list view and the additional device information. The sidebar displays real-time values that are cyclically read and updated by the device when the device connection is active.

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

Selecting real-time values of the watch list

The real-time values that are displayed in the monitor list can be selected.

Proceed as follows to select real-time values:

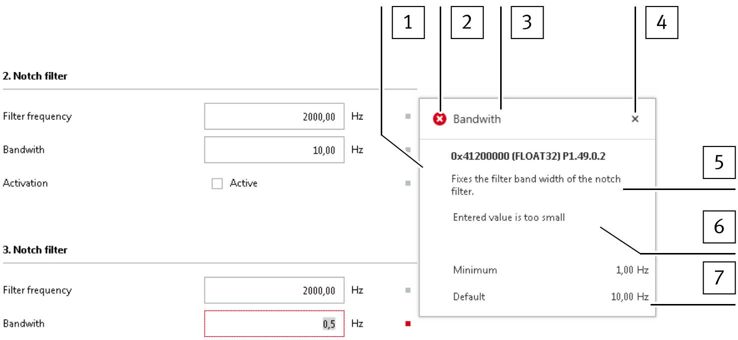
1. Press the "Select..." button.
2. Select checkboxes for real-time values that should be displayed.
3. Actuate "Apply" button.
   - ↳ The selected real-time values are displayed in the sidebar.

2.1.2.8 Adorner

Overview

Adorners provide additional information for parameters. If the cursor is moved over the adorner, a pop-up window with the additional information opens.

Surface



1 Adorner	5 Description of the display or control element
2 Status symbol	6 Status message
3 Title	7 Command area
4 Close pop-up	

Fig. 4 Design of an adorner and the pop-up

With internal parameters (I...), the plug-in displays, for example, settings on several device parameters (P...) or 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
– Data type of parameter
– ID of device parameter or the internal parameter ➔ 3.2.1 Depiction of the parameters
– Description of the parameter

Command area

Depending on the device parameter, corresponding buttons for further actions are available in the command area of the pop-up:

- Change the value of the device parameter
- Reset values of other parameters
- Jump to another screen
- Accept the value for other parameters, e.g. software end positions

Button	Description
"Minimum"	Resets the device parameter to the minimum value shown.
"Maximum"	Resets the device parameter to the maximum value shown.
"Default"	Resets the device parameter to the standard value shown.
"Recomm. minimum"	Resets the device parameter to the recommended minimum value shown.
"Recomm. maximum"	Resets the device parameter to the recommended maximum value shown.
"Last saved"	Resets the device parameter to the most recently saved value in the project.

Tab. 6 Buttons for Value Change

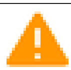
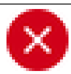
Displaying Information, Warnings or Errors

The current state of the device parameters is displayed as information, warning or error as follows:

- A coloured marking of the adorner
- The respective status symbol 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 screens can be called up using a button in the adorner.

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

Tab. 7 Description of Possible Statuses

2.1.2.9 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.
Changing or rounding a value	– An entered value is automatically changed, rounded up/down by the plug-in. – An information symbol is displayed in the pop-up.

Tab. 8 Correction of user inputs

2.1.3 Key combinations

The plug-in can be operated via the keyboard using the following key combinations:

Key combination	Function
General	
F1	Open online help for plug-in.
Tab	Access next input field, next checkbox or next button.
Ctrl + 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 graphical and tabular display. Additional information ➔ Title Bar of the Working Area.
Parameter panels (tabular display)	
Ctrl + L	Show/hide all of the filters ➔ Title Bar of the Working Area.
Ctrl + F	Switch to search field in title bar of the working area ➔ Title Bar of the Working Area.
Enter	Switch from the search back to the parameter panel.
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.

Key combination	Function
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 key to complete processing.
Esc	Close pop-up.

Tab. 9 Description of the key combinations for 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:

– Internal increments [Inci, Inci/s, ...]
– Increments [Inc, Inc/s, ...]
– Rev [rev, rps, ...]
– Rev [rev, rpm, ...]
– 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 pages during axis configuration:

– ➔ 2.2.3 Initial Commissioning Assistant
– ➔ 3.3 Drive Configuration

If there is a change to the user unit with the plug-in, a query appears asking whether the values of the affected parameters should be reset to the standard values.
If the answer is "no", the values of the affected parameters are recalculated in the new unit taking into account the feed constant. If the answer is "yes", the values of the affected parameters are reset to the standard values stored in the firmware.

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
➔ Synchronising the Configuration and Parameters.

2.2 Working with CMMT-ST the plug-in

2.2.1 Open plug-in

An overlay dialogue is automatically displayed the first time a plug-in is opened. The following options are available:

– "Start first setup..." to open the initial commissioning assistant, which guides the user through the most important steps in parameterisation.
– "Manual setup..." for customised input of parameters, starting with the parameter panel for drive configuration.

If an option is selected, an overlay dialogue is not displayed next time the plug-in is opened.

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.

No.	Identifier	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 ➔ Connection Status.
6	Device Status	Connected device: Display device status (device warning or error) ➔ Device Status.

Tab. 10 Legend

Connection Status

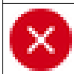
The connection status between plug-in and device is indicated by the following symbols:

Symbol	Connection Status	Description
	Disconnected (offline)	The plug-in is not connected to a device. Control sides for movement of the drive are deactivated.
Depending on device status → Tab. 12 Device Status symbols	Connected (online)	The plug-in is connected with the device from the configured address. Control sides for movement of the drive are activated.

Tab. 11 Connection Status symbols

Device Status

If the plug-in is connected to a device, the device status is indicated by the following symbols:

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

Tab. 12 Device Status symbols

Viewing the Details of the Device Status

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

- Place 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 further details.

During an active device connection, the "Device state" diagnostic panel displays the current status of the servo drive and axis and the message directory. The button "Show details" in the pop-up displays the diagnostic panel "Device state" in the working area.

Message symbol	Category of diagnostic message
	Information

Message symbol	Category of diagnostic message
	Warning
	Error

Tab. 13 Symbols in the Diagnostic Message Pop-up

Specifying the 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.

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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.

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:
   – ➔ Selecting a Device in the Network
   – ➔ Entering the IP Address of a Device

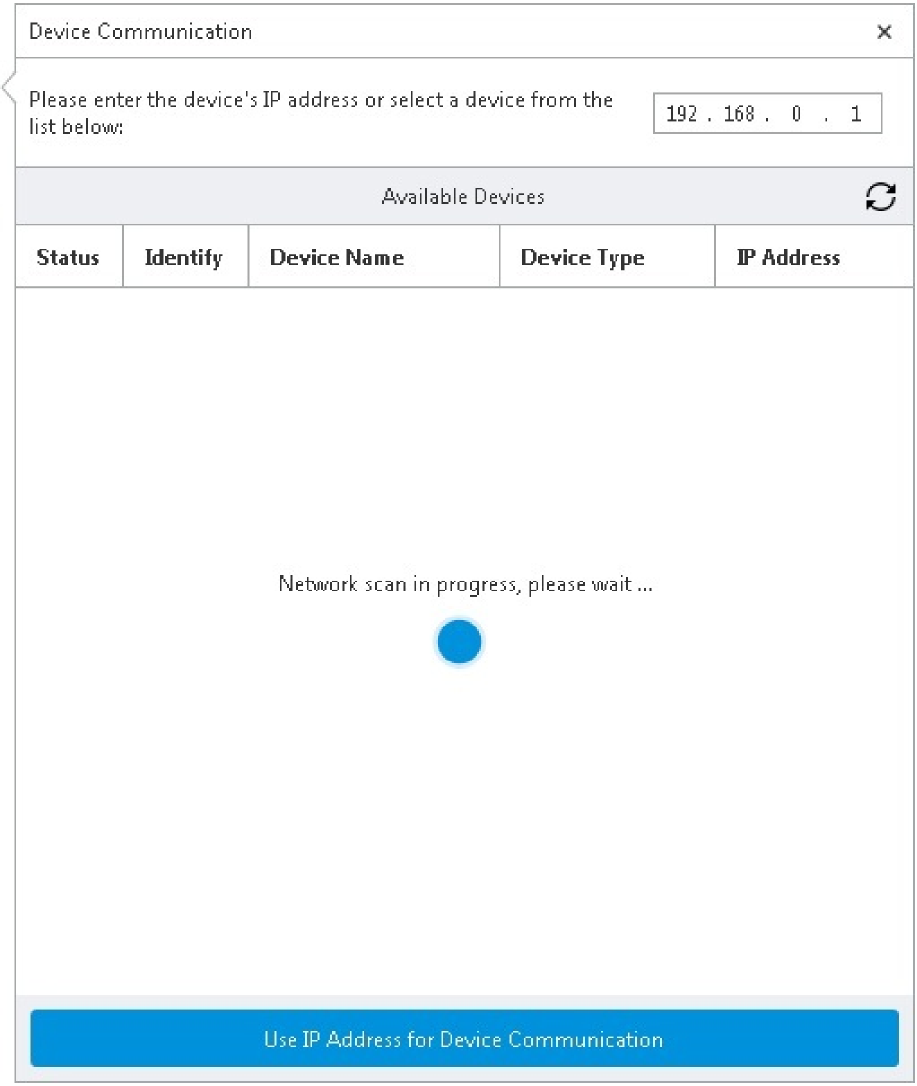

Fig. 5 Device communication dialogue

In addition, the dialogue supports:

– the identification of a device from the device list in the network➔ Identifying the Device
– the individual definition of a device name➔ Specifying the Device Name
– the network settings of a device➔ Defining Network Settings

Selecting a 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 "Use IP Address for Device Communication" button.
   ↳ The IP address of the selected device is transferred and the device communication dialogue closes.

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The plug-in and servo drive controller are connected via port 7507.

Entering the IP Address of a Device

Requirements:

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

1. Enter the IP address of the device in the input field.
2. Press the "Use IP Address for Device Communication" button.
   ↳ The dialogue for device communication is closed.

Identifying the Device

A signal can be sent to the required device to be able to identify devices in a control cabinet, for example.

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 column "Identify"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.

Specifying the 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.

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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.

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

Defining Network Settings

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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:
   – Exclude 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 the 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.

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If other devices 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 devices
- Connection ID for identification of the 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.

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Before the plug-in establishes a connection, a check is completed to determine whether the firmware is compatible with the current version of the plug-in. If the firmware is not compatible, no connection to the servo drive is established.

- Press the "Connect" button.

  ↳ **i**

  The current connection process is cancelled by pressing the button again.

The connection status is updated. As long as the connection is established, the data is automatically synchronised.

Disconnecting the Device

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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, a check is run to ensure that the defined device data of the plug-in are compatible with the connected device, 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.

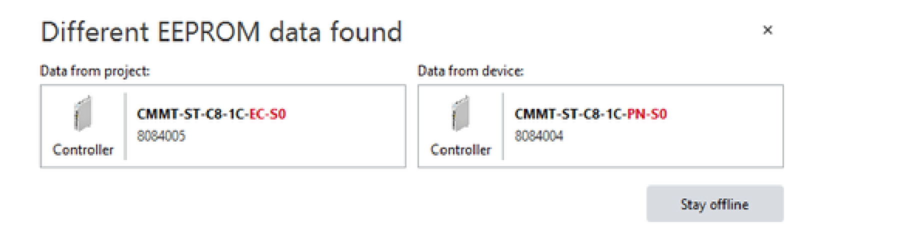

Fig. 6 Message for synchronising the device data

2.2.2.4 Synchronising the Configuration and Parameters

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If device parameter values are changed during the existing connection, these are transferred to the device ➔ 2.1.5 Automatic data synchronisation.

Firmware Version Compatibility

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 determined and displayed in the editing dialogue Parameter synchronisation if relevant.

Firmware (device)	Action
Parameter is supported.	If supported parameters in the plug-in and in the device are synchronous, the connection is established without further message. If the supported parameters are not synchronous, the dialogue Parameter synchronisation is displayed
Parameter is not supported.	The dialogue Parameter synchronisationis displayed. The dialogue also contains the following information: – the information that parameters are not supported by the device. – the list of parameters not supported by the device Parameters that are not supported by the device are marked with a warning. Deviating parameters on the device are displayed in the firmware column as "Not supported".

Tab. 14 Comparison of the firmware versions in the plug-in and in the device

Configuration Compatibility

Before the connection is established, a check is run to determine whether configuration in the project match that of the device. In case of deviations between project and device, invalid or unsupported parameters are displayed in the editing dialogue Parameter synchronisation.

Configuration in the project	Configuration in the device	Additional information
None present	None present	➔ No Configuration Available in the Project or on the Device
None present	Present	➔ No Configuration Available in the Project, Configuration Available on the Device
Present	None present	➔ Configuration Available in the Project, No Configuration Available on the Device
Present	Present	➔ Configuration Available in the Project and on the Device

Tab. 15 Synchronising the Configuration in the Project and in the Device

Before the connection is established, a check is run to determine whether parameterisation and configuration in the project match that of the device. If there are deviations between the project and the device, invalid parameters are shown so that they can be corrected.

No Configuration Available in the Project or on the Device

In this case, the plug-in uses a standard parameter record. Data transfer does not take place initially. A query offers the following actions:

Action	Description
"Start first setup... "(standard)	– Connection to the device is established. – Servo drive and motor data are imported. – Connection is terminated. – Initial commissioning assistant is launched.
"Connect"	– Connection to the device is established.
"Stay offline"	– No connection with the device

Tab. 16 Actions

Configuration Available in the Project, No Configuration Available on the Device

Data cannot be transferred from the device to the project. Prior to data transfer from the project to the device, the parameter settings are checked in the project:

- If parameters are invalid, a corresponding message is displayed stating that no connection is established.
- If all parameters are valid, a query offers the following actions.

Action	Description
"Write to device"	– Connection to the device is established. – Configuration is transferred from the project to the device.
"Stay offline"	– Query is terminated without any further action. – A connection is not established.

Tab. 17 Actions

No Configuration Available in the Project, Configuration Available on the Device

Data transfer from the project to the device is not possible. For data transfer from the device to the project, a query offers the following actions:

Action	Description
"Read from device"	– Connection to the device is established. – Configuration is transferred from the device to the project.
"Stay offline"	– Query is terminated without any further action. – A connection is not established.

Tab. 18 Actions

Configuration Available in the Project and on the Device

Prior to data transfer, the parameter settings in the project are checked:

- If parameters in the project are invalid, data migration from the project is not possible. The configuration can only be read from the device.
- If all parameters in the project are valid and the data match the device, the values are transmitted from the device to the project.
- If all parameters are valid in the project and the data does not match that of the device, deviating parameters between the device and project are displayed. The configuration can optionally be read from the device or written to the device

  When writing the configuration from the project to the device, all writeable parameters are transferred from the project to the device. The units used in the project and on the device are checked. If the units differ, a synchronisation and re-initialisation are carried out:
  - The units saved in the project are written to the device.
  - The parameter set is saved.
  - The device runs a re-initialisation.

If the data deviates between the project and the device, a query in the plug-in offers the following actions for synchronisation:

Action if all the project parameters are valid	Description
"Write to device" (Standard)	– Connection to the device is established. – Configuration is transferred from the project to the device.

Action if all the project parameters are valid	Description
"Read from device"	– Connection to the device is established. – Configuration is transferred from the device to the project.
"Stay offline"	– Query is terminated without any further action. – A connection is not established.

Tab. 19 Actions

Action if project parameters are invalid	Description
"Read from device"	– Connection to the device is established. – Configuration is transferred from the device to the project.
"Stay offline"	– Query is terminated without any further action. – A connection is not established.

Tab. 20

2.2.2.5 Device control (master control)

Device Control is an exclusive access right and it ensures that the drive is only ever controlled via 1 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 (other 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 the IP address and port of the device with the master control.

2.2.3 Initial Commissioning Assistant

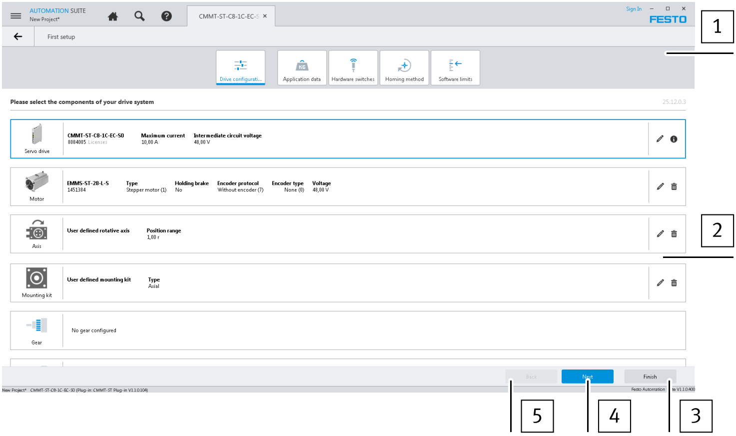
2.2.3.1 Overview

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

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

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

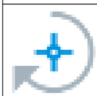
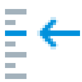
The initial commissioning assistant is started via the "Start first setup..." button in the toolbar.



1	Header with selection of the commissioning steps	
2	Drive configuration start panel in the initial commissioning assistant	
3	Finishes initial commissioning and closes the assistant	
4	Continue with the next commissioning step	
5	Back to the previous commissioning step	

Fig. 7 Initial commissioning assistant start panel

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 of the panels can be processed in any order.

Page		**Use**
	"Configuring drive"	Selection of the hardware components of the drive ➔ Drive Configuration
	"Application data"	Setting specific application data and the reversal of the direction of rotation ➔ Setting Application Data
	"Hardware switches"	Configuration of limit switches and reference switches ➔ 2.2.3.4 Activating the Hardware Switch
	"Homing method"	Selected settings for the homing run, e.g., meth-od ➔ Setting the Homing
	"Software limits"	Selected settings of software end switches and the offset to the axis zero point ➔ Setting the Software End Positions

Tab. 21 Panels of the Initial Commissioning Assistant

Navigation to the individual screens takes place using the following buttons:
– Buttons in the header
– "Next" and "Back" buttons in the footer

The initial commissioning assistant is closed with the "Exit" button in the footer.

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At the end of the initial commissioning assistant, changes are applied directly to the project and displayed in the "Parameterisation" context on the applicable screens

2.2.3.2 Drive Configuration

Using the Parameter Panel

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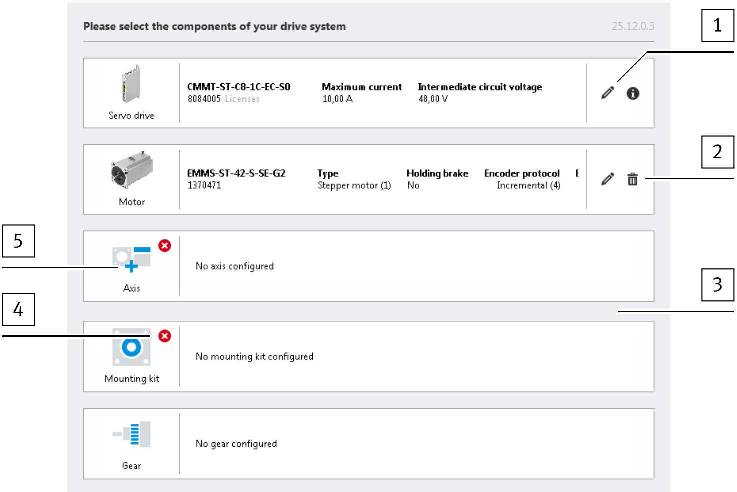
Operation of the "Drive configuration" parameter screen of the initial commissioning assistant and the "Parameterisation" context is identical. Changes in the parameterisation are automatically applied in both panels.

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.



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

Fig. 8 Interface of the "Configuring drive"parameter panel

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: Selection of drive components in the search field and/or results list
– Step 2: Check of properties and setting of the selected components.

Fig. 9 Plus symbol to select a drive component

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, mounting kit, gear unit) are displayed by symbols beside the list entry.
   ↳ 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 ✎ 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:

- Button 🗑 button beside the drive component.
  ↳ The drive component is deleted after confirmation of the check dialogue.

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Drive components that cannot be removed are marked with a tool tip, e.g.:

- Servo drive
- automatically added drive components

Automatically added drive components cannot be individually removed but only in combination with the associated axis or axis-motor combination.

Automatic Integration of Drive Components

The program can automatically add more drive components when one component is selected.
The Festo axis-motor combinations (e.g. type EPCO, ERMO) are easy to configure with the automatic addition of drive components. It is not necessary to select motor or mounting kit separately. The integrated motor and the integrated mounting kit are automatically configured and displayed when the Axis drive component is selected.
Examples of automatic integration of 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

Automatically added components are shown in the selection dialogue and are marked with a tool tip. Previously selected single components are overwritten at the same time. Integrated components are shown by symbols in the drive configuration overview.

Automatically added drive components cannot be edited. The output components cannot be individually removed but only in combination with the associated axis or axis-motor combination.

Status of Drive Components

The plug-in automatically checks whether 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 was selected and is supported.
	Warning – The selected drive component is not supported by the drive configuration.
	The drive component is missing.

Tab. 22 Drive Component Status

Compatibility of the components		Test criteria	Negative test
Servo drive	Motor	– The load voltage of the servo drive matches that of the motor. – The motor measuring system is supported by the servo drive (encoder interfaces).	 Servo drive Motor
Motor	Gear unit	The gear unit is mechanically compatible with the motor.	 Motor Gear unit
Mounting kit	Motor Gear unit Axis	The mounting kit is mechanically compatible with the motor or the gear unit and the axis.	 Mounting kit
Gear	Gear unit	The total transmission ratio matches the adjusted gear unit (gear unit 1 * gear unit 2 * gear unit 3).	 Gear unit

Tab. 23 Check of the Drive Configuration

Notes on Parameterisation

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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

Component	Parameterisation
Servo drive	Configuration not required
Motor	When configuring Festo motors using the plug-in, the motor data is automatically imported from the database after selection of the motor. During the configuration of third-party motors, the data must be entered manually. The following parameters for the motor cable are set on the "Application data" panel of the initial commissioning assistant 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 upon 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: – Internal increments [Inci, Inci/s, ...] – Increments [Inc, Inc/s, ...] – Rev [rev, rps, ...] – Rev [rev, rpm, ...] – Rad [rad, rad/s, ...] – Degree [°, °/s, ...] – Metric [m, m/s, ...] – Imperial [in, in/s, ...] The following units are available for rotative axes: – Internal increments [Inci, Inci/s, ...] – Increments [Inc, Inc/s, ...]

Component	Parameterisation
	– Rev [rev, rps, ...] – Rev [rev, rpm, ...] – Rad [rad, rad/s, ...] – Degree [°, °/s, ...] Other parameters may also need to be entered, depending on the axis type (e.g. length, feed constant).
Mounting kit	No parameterisation required
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: with a transmission ratio of 3:1, there are 3 revolutions on the gear unit input ➔ and 1 revolution on the gear unit output.

Tab. 24 Notes on Parameterisation of Components

Parameter	Comments
EMF constant	Electromotive voltage constant (Phase-Phase)
Encoder type	Type of the motor encoder

Tab. 25 Information on Internal Parameters

2.2.3.3 Setting Application Data

The panel is opened with the "Application data" button.

"Application data"

In this parameter group, the load mass / load inertia (Px.1193) is set and the mass moments of inertia of the axis and the total mass are displayed.

"Rotation polarity"

In this parameter group, the direction of movement of the load is matched and displayed with the direction of rotation of the motor:

- Automatic assignment of the direction of movement to the positive direction of rotation of the motor, depending on the mounting position of the motor on the axis
- Individual assignment of the direction of motion/direction of rotation by reversing the direction of rotation.

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
Spindle axis without parallel kit	2
Spindle axis with parallel kit	2

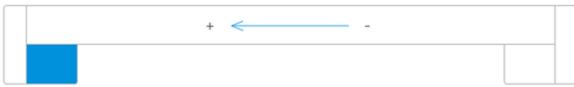
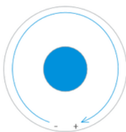
Drive variant	Number of mounting positions of the motor
Rotative axis	–

Tab. 26 Mounting Positions of the Motor

The mounting position of the motor is set using the interactive display of the axis. The currently set position is marked in blue.

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.

Drive variant	Direction of motion (default)
Toothed belt axis	
Spindle axis without parallel kit	
Spindle axis with parallel kit	
Rotative axis	

Tab. 27 Mounting Positions of the Motor and Direction of Load Movement (Without Reversing the Direction of Rotation)

The direction of movement of load is, for example, dependent on the installation position of the motor, the spindle type of the axis (clockwise/anti-clockwise) and the gear unit used. 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
– using the checkbox below the interactive graphic

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During commissioning:
- Check the direction of rotation/direction of travel of the drive, e.g., by jogging.
- Optional: Activate/deactivate reversal of direction of rotation.
- After changing the reversal of the direction of rotation: Carry out the homing again.

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 possible on the side "X-axis", "Closed loop" as an option.

2.2.3.4 Activating 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. For each of the switches, the use and switch type (normally closed contact/normally open contact) can be selected. Used switches are automatically assigned to the following digital inputs:

Switch	Digital input
Reference switch	X1C.2
Positive/negative hardware limit switch	X1C.6, X1C.7

Tab. 28 Switch Digital Inputs

Parameter	Comments
Reference switch	Defines the function of the reference switch. The setting affects parameter Px.101200.
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. 29 Information on the Parameters

Additional information about digital inputs and outputs ➔ 2.3.6.

2.2.3.5 Setting the 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.

Setting	Description
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.

Tab. 30 Setting the 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 screen is also possible using a button.

2.2.3.6 Setting the Software End Positions

The panel is opened with the "Software limits" button.

Defining Parameters

The following parameters can be specified via the interactive graphic or via the "Software limits" parameter group:

– Axis zero point offset
– Negative software end position
– Positive software end position

The software end positions can be activated with the "Software limits enabled" checkbox.

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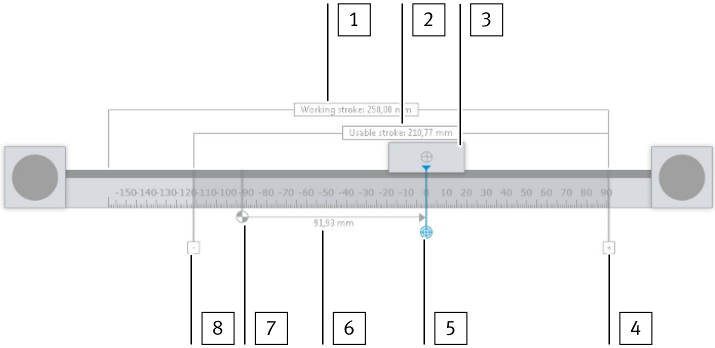
If the software end positions are activated, the positive and negative software limit positions can be specified via the interactive graphic or in the "Software limits" parameter group.
If the software end positions are not activated, the interactive graphic does not contain the software limit positions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

Interactive Graphic



1 Working stroke	5 Axis zero point
2 Effective stroke	6 Measurement arrow for distance measurement
3 Slides	7 Homing point
4 Positive software limit position	8 Negative software limit position

Fig. 10 Interactive graphic for gantry axes

Identifier	Description
Working stroke	Theoretically available working stroke of the axis.
Working stroke	Actual available stroke of the axis based on the current configuration.
Reference point	Reference point for the system of measurement units. The position of the reference point is dependent on the selected referencing method.
Slide (for linear axis) Piston rod (for electric cylinders) Drive shaft (for rotative 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 reference point and axis zero point.

Tab. 31 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 reference point is set in the "Software limits"parameter group.
When moving the axis zero point, 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 reference point value is modified. The displayed position of the reference 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 useful stroke is calculated and the corresponding text field in the graphic is updated. The values of the software end positions can also be defined in the "Software limits" parameter group and are then updated in the interactive graphic.

Defining the Reference Point

The standard value of the reference point is 0.0 if a referencing method with a negative direction is selected.
If a referencing method with a positive direction is selected, the reference point is at the point of the set working stroke. The scale is depicted in a negative way.
If the reference point is selected in the interactive graphic, it is displayed in blue and can be shifted.
When the reference point is shifted, the scale is shifted by the same dimension.
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 Parameter Correction Assistant

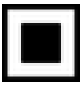
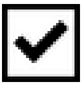
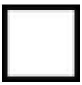
The CMMT plug-in checks whether the entered parameter values are within calculated limits. The CMMT plug-in behaves tolerantly and allows limit value violations within certain limits, depending on the parameter.
Festo recommends checking all existing limit value violations and complying with the calculated limit values.
The assistant for parameter correction is started using the "Correct parameters" button in the toolbar.
If the plug-in is connected to the device or there is no limit value violation, the button is deactivated.
All existing limit value violations, together with the calculated limit values, are displayed in tabular form centrally in the working area of the assistant 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.

Colour of the adorner	Meaning	Description
Red	Error	Limit value violations are not tolerated and cannot be loaded into the device. Errors must be corrected.

Tab. 32 Marking of Limit Value Violations

The parameter correction assistant offers the possibility 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 using 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. Parameters are partially 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 respective 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.
(none)	Shows the adorner for each parameter. When the mouse pointer hovers over an adorner, a pop-up with additional information opens.
Recommended value	Displays the calculated limit value.
Unit	Shows the unit of the respective parameter.

Tab. 33 Table Columns in the Parameter Correction Assistant

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 Parameterisation

2.3.1 Surface

Toolbar

In addition to the standard commands, the toolbar for the "Parameterisation" context also contains the following commands:

Identifier	Function
 "Load factory settings"	Load factory parameter record for the device. The command can be executed if the following prerequisites are met: – The plug-in is connected to a device.
 "Start first setup..."	Open initial commissioning assistant for the device. The command can be executed if the following prerequisites are met: – The plug-in is **not** connected to a device. – The drive configuration is **not** open for editing.
 Correct parameters	Open the parameter correction assistant. The command can be executed if the following prerequisites are met: – The plug-in is **not** connected to a device. – At least one limit value violation has occurred (error or warning).

Tab. 34 Additional Commands of the Context "Parameterisation"

Title Bar of the Working Area

The title bar of the working area for the "Parameterisation" context contains additional commands. The title bar of the workspace or the [Ctrl][F5] or [Ctrl][F6] key combinations can be used to switch between the available views of the current parameter page ➔ 2.1.3 Key combinations.

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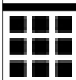
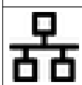
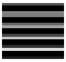
When switching the view of a parameter page, all other parameter pages of the plug-in are switched synchronously. If the view setting for a parameter page does not exist, the most prioritised alternative is displayed.

Depending on the parameter page, the available views are displayed via the following symbols in the title bar:

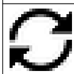
Symbol	Description	Priority
	Switch to the grouped view. This view shows the parameters usually required for configuration in parameter groups with dialogue boxes.	1
	Switch to the functional view. This view shows functionally related parameters, e.g. in a block diagram.	2

Symbol	Description	Priority
	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. 35 Description of the symbols for Switching the Page View

Tabular Display

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

Symbol	Description
	Open parameter groupings.
	Close parameter groupings.
	Show / hide all filters applicable to the parameter view. The set filters remain set after acceptance until a reset is carried out. Alternative call of the function with the [Ctrl] [L] shortcut ➔ 2.1.3 Key combinations.
	Update filtered list.
	Search device parameters. The [Ctrl] and [F] key combination can be used to switch to the search field ➔ 2.1.3 Key combinations. When completing a search, no distinction is made between upper and lower case letters. The following placeholders can be used: – "*" replaces any number of characters. – "?" replaces an individual character.

Tab. 36 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.

Column name	Description
– (Adorner)	Display adorner of the device parameter including the status.

Tab. 37 Description of the Parameter List Columns

By clicking on in the column header, filters can be assigned to the individual columns.
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 parameter panel can only be sorted by one column.
– The sorting of the parameter panel does not have any influence on the grouping of the device parameters.
– The sorting is only implemented within the groups.

Display of the Values on a Parameter Panel

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The following applies to write-protected parameters:

- In the functional 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.

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 field	0
Boolean expression (activated or deactivated)	Checkbox	☑ Active
Values lists of parameters	Combo box	AmPrimaryEncoder (0)
Read-only parameters	Simple entry, black	1,00
For the current setting of non-relevant parameters	Simple entry, grey	0,20

Tab. 38 Display of the Values on a Parameter Panel

Changing Values

The modified value is applied as follows:

– After leaving the input field.
– After the [Enter] key on the keyboard has been pressed.

If device parameter values are changed during the existing connection, these are transferred to the device ➔ 2.1.5 Automatic data synchronisation.

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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 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 device object
– Missing device object
– Inconsistent device object

The following displays are possible depending on the view:

– Display in graphical view.
  The graphical display cannot be used if a parameter is not present in the device description transferred from the device or is defined inconsistently.
  A corresponding message is displayed.
– Display in tabular view.
  The cases in the tabular display are depicted in colour as follows:

Case	Colour display[1]	Meaning
Unknown device object	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 accepted in the device and saved in the project file. A newer version of the plug-in may provide a parameter page that allows more convenient parameterisation of the device function in question.
Missing device object	Different shades of yellow	This parameter is not supported by the device firmware. Please update the firmware to use it.
Inconsistent device object	Different shades of light red	Please contact Festo.

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

Tab. 39 Colour display of possible cases

Permissible characters

The following characters are permitted for input values:

– Texts: Unicode, UTF-8.
– Whole number: numbers 0 ... 9 and the minus sign.

– Decimal numbers: numbers 0 ... 9, the minus sign, comma or dot.

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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. 40 Description of parameter identification marks

2.3.3 Drive configuration

Selection Dialogue for Drive Configuration

After inserting a device from the device catalogue into a project, the data model is created when the plug-in is opened for the first time and the "Drive configuration" screen with the following dialogue for selecting the commissioning method is displayed:

Button	Description
"Start first setup..."	Closes the dialogue and starts the initial commissioning assistant, which guides you through the most important parameterisation steps.
"Manual commissioning..."	Closes the dialogue and starts the manual setting of the drive parameters.

Tab. 41 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 assistant can be started with the "Start first setup..." button in the toolbar.

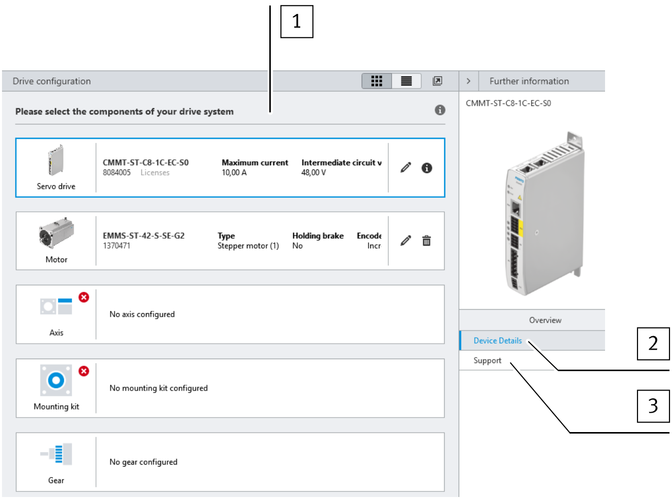
Structure of the Parameter Screen

In the working area of the parameter screen, the drive components for configuring the drive are displayed in an overview.

Click on a configured drive component to show additional information 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.



1 Overview of drive components
2 Device details
3 Selection of device-specific documentation

Fig. 11 Interface of the Drive configuration parameter panel

Using the Parameter Panel

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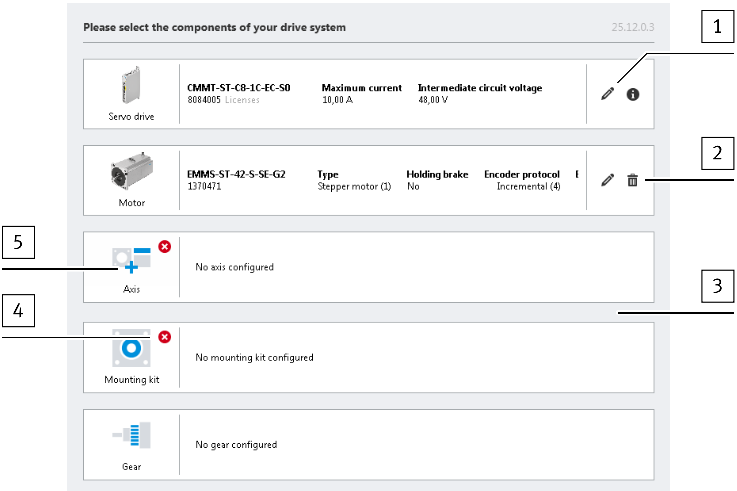
Operation of the "Drive configuration" parameter screen of the initial commissioning assistant and the "Parameterisation" context is identical. Changes in the parameterisation are automatically applied in both panels.

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.



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

Fig. 12 Interface of the "Configuring drive" parameter panel

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: Selection of drive components in the search field and/or results list
– Step 2: Check of properties and setting of the selected components.

Fig. 13 Plus symbol to select a drive component

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, mounting kit, gear unit) are displayed by symbols beside the list entry.
   ↳ 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 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:

- Button button beside the drive component.
  ↳ The drive component is deleted after confirmation of the check dialogue.

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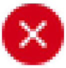
Drive components that cannot be removed are marked with a tool tip, e.g.:
- Servo drive
- automatically added drive components

Automatically added drive components cannot be individually removed but only in combination with the associated axis or axis-motor combination.

Status of Drive Components

The plug-in automatically checks whether 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 was selected and is supported.
	Warning – The selected drive component is not supported by the drive configuration.
	The drive component is missing.

Tab. 42 Drive Component Status

Compatibility of the components		Test criteria	Negative test
Servo drive	Motor	– The load voltage of the servo drive matches that of the motor. – The motor measuring system is supported by the servo drive (encoder interfaces).	 Servo drive Motor
Motor	Gear unit	The gear unit is mechanically compatible with the motor.	 Motor Gear unit
Mounting kit	Motor Gear unit Axis	The mounting kit is mechanically compatible with the motor or the gear unit and the axis.	 Mounting kit
Gear	Gear unit	The total transmission ratio matches the adjusted gear unit (gear unit 1 * gear unit 2 * gear unit 3).	 Gear unit

Tab. 43 Check of the Drive Configuration

Automatic Integration of Drive Components

The program can automatically add more drive components when one component is selected.
The Festo axis-motor combinations (e.g. type EPCO, ERMO) are easy to configure with the automatic addition of drive components. It is not necessary to select motor or mounting kit separately. The integ-

rated motor and the integrated mounting kit are automatically configured and displayed when the Axis drive component is selected.
Examples of automatic integration of 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

Automatically added components are shown in the selection dialogue and are marked with a tool tip. Previously selected single components are overwritten at the same time. Integrated components are shown by symbols in the drive configuration overview.
Automatically added drive components cannot be edited. The output components cannot be individually removed but only in combination with the associated axis or axis-motor combination.

Notes on Parameterisation

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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

Component	**Parameterisation**
Servo drive	Configuration not required
Motor	When configuring Festo motors using the plug-in, the motor data is automatically imported from the database after selection of the motor. During the configuration of third-party motors, the data must be entered manually. The following parameters for the motor cable are set on the "Application data" panel of the initial commissioning assistant 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 upon 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

Component	Parameterisation
Axis	Specification of the user units ➔ 2.1.4 Basic and user units. The following units are available for linear axes: – Internal increments [Inci, Inci/s, ...] – Increments [Inc, Inc/s, ...] – Rev [rev, rps, ...] – Rev [rev, rpm, ...] – Rad [rad, rad/s, ...] – Degree [°, °/s, ...] – Metric [m, m/s, ...] – Imperial [in, in/s, ...] The following units are available for rotative axes: – Internal increments [Inci, Inci/s, ...] – Increments [Inc, Inc/s, ...] – Rev [rev, rps, ...] – Rev [rev, rpm, ...] – Rad [rad, rad/s, ...] – Degree [°, °/s, ...] Other parameters may also need to be entered, depending on the axis type (e.g. length, feed constant).
Mounting kit	No parameterisation required
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: with a transmission ratio of 3:1, there are 3 revolutions on the gear unit input ➔ and 1 revolution on the gear unit output.

Tab. 44 Notes on Parameterisation of Components

Parameter	Comments
EMF constant	Electromotive voltage constant (Phase-Phase)
Encoder type	Type of the motor encoder

Tab. 45 Information on Internal Parameters

2.3.4 Device settings

The working area contains parameter groups to specify the device settings.

The following device settings can be implemented:

– "Enable servo drive"

"Enable servo drive"

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

Additional information on controller enable
➔ 4.1.9 Switch-on/off Behaviour and Closed-loop Controller Enable.

2.3.5 Fieldbus

2.3.5.1 Device and Connection Parameters

The parameter page contains parameter groups for communication between the servo drive and the higher-level controller via the fieldbus. The device parameters depend on the servo drive of the drive.
Prerequisite for displaying current parameter values:

– Establish device connection.

"Factor group"

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

– Position
– Velocity

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

Ten exponent		Resolution
Minimum	-9	0.000 000 001 m/s
Standard	-3	0.001 m/s (= 1mm/s)
Maximum	9	100 000 000 m/s

Tab. 46 Example of Scaling Factor of Velocity, User Unit m/s

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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 ➔ Configurable measuring units ("user unit").
Additional information on the group of factors
➔ Scaling of internal units for the fieldbus ("factor group").

"Reference values" for EtherNet/IP, PROFINET

In this parameter group, the base values of the application classes for motion commands are defined, for example:

– Basic value for the application class of velocity in user unit
– Basic value of the velocity for transfer to the configuration tool

To determine the internal setpoint value, the normalised value in the process data is multiplied by this basic value.
Additional information on the basic values for PROFINET
➔ 12.4.2.1 Basic Values and Reference Values in the Application Classes

Additional information on the basic values for Ethernet/IP
➔ 13.4.1.1 Basic Values and Reference Values in the Application Classes

"Dynamic values" for EtherNet/IP, PROFINET

In this parameter group, the dynamic values for motion commands are specified, for example:

– Acceleration for the application class velocity

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
➔ 13.4.1.1 Basic Values and Reference Values in the Application Classes

"EtherNet/IP interface" for EtherNet/IP, PROFINET

This parameter group shows the connection parameters to the EtherNet/IP interface e.g.:

– IP address
– Subnet mask
– Gateway address
– Mac address

If the device connection is active, the current connection parameters PROFINETare displayed.
The connection parameters in the subgroup "Configuration" can be changed for EtherNet/IP. If the device connection is active, the subgroup "Active"displays the current connection parameters.
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

"Connection properties" for EtherNet/IP, PROFINET

Connection properties are defined or displayed in this parameter group, e.g.:

– PZD telegram selection for setting the receive and send telegram
– With active device connection: display of the current application class

Additional information on the connection properties for
PROFINET➔ 12.3.5 Connection Characteristics.
Additional information on the connection properties for Ethernet/IP
➔ 13.3.4 Connection Characteristics

Application Class "AC4" for PROFINET

This parameter group contains parameters for application class AC4 of PROFIdrive.
Certain parameter values must be set the same for the 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)
  ➔ 12.4.7.7 Encoder n Actual Position Value 1 (Gn_XIST1)

To synchronise the settings:

– Note the information in the adorners of the parameters.
– Synchronise values with the configuration software of the master and, if necessary, transfer parameter values to the configuration software of the master (e.g. TIA Portal).

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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).

"CODESYS device driver"

This parameter group is only displayed under the following conditions:

– In the Festo Automation Suite System Designer, there is a connection to another plug-in ➔ 2.6 Integrating a Device in a Festo Controller. Additional information in the ➔ online help for the Festo Automation Suite.
– The other plug-in connector is active.

The "Version" field is populated as follows as a function of the "Mode" field:

"Mode"	Contents of "Version"
"Point to point"	Devices for point-to-point operation (ID ends with "_PTP")
"SoftMotion"	Devices for interpolated operation (ID ends with "_SM")

Tab. 47 Content of the Field "Version"

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

2.3.5.2 Extended Process Data (Additional Telegram) for EtherNet/IP, PROFINET

Process data e.g. setpoints / 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➔ 12.4.6 Additional Telegram
The parameter page "Extended process" data 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"

In this parameter group, you can set whether the extended process data should be transferred (only for EtherNet/IP). For PROFINET, this is done via the configuration software of the master.
In addition, a parameter indicates whether the extended process data are active or inactive.

Add process channel

1. With the button "Add process channel", open the selection dialogue.
   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. With the button "Accept process channel", accept the selection and close the dialogue.
   ↳ The process channel is added at the end of the table view of the send data or the receive data.

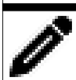
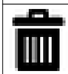
Editing or Removing the Process Channel

Edit the process channel:

1. Select the process channel in the table view of the send or receive data.
2. With the button "Edit process channel", open the selection dialogue.
3. Select parameters by category, ID, name or description.
4. With the button "Change process channel", accept the selection and close the dialogue.

Remove process channel:

1. With the button "Remove process channel", open the selection dialogue.
2. Confirm remove.
   ↳ The process channel is deleted from the table view.

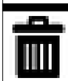
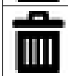
Symbol	Description
	Edit process channel
	Remove process channel

Tab. 48 Functions for Editing the Table View"Extended process data"

Removing All Process Channels

With the menu functions of the parameter page, all entries of the table view of the send or receive data can be completely deleted

1. With the button "Remove process channel", open the selection dialogue.
2. Confirm remove.
   ↳ All process channels of the table view of the send or receive data are deleted.

Symbol	Description
	Remove all send data
	Remove all receive data

Tab. 49 Specific Menu Functions of the Parameter Page " "

2.3.6 Digital I/O

The working area contains parameter groups to configure the digital inputs and outputs.
Depending on the application, different signals can be assigned to some of the digital inputs and outputs.
Additional information about digital inputs and outputs ➔ 3.3.5 Digital Inputs and Outputs.

General settings

The characteristics of the inputs and outputs can be parameterised.

Additional information on the parameterisation of the PNP input and output characteristics
➔ 3.3.5 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 several device parameters (Px...) by the plug-in with internal parameters (I...). This can be, for example, the assignment and switching function of the switch at the input.

Parameter	Comments
X1C.02 (Input)	Defines the function of the digital input signal at connection X1C.02. The setting affects parameter Px.101200.
X1A.07 (Input)	Defines the function of the digital input signal at terminal X1A.07. The setting affects parameter Px.11201.

Tab. 50 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.
Additional information on the parameterisation of digital I/Os ➔ 3.3.5 Digital Inputs and Outputs.

2.3.7 Encoder interface

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The encoder selection on this parameter page determines which encoder type will be used after the next reinitialisation. 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 used encoder. The configuration data are automatically applied or read out in the following cases:
– for Festo motors from the database
– for motors or encoders with electronic nameplate and existing device connection

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

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

Tab. 51 Encoder

The configuration and parameterisation options are dependent on the properties of the used encoder. The configuration data are automatically applied or read out in the following cases:
– for Festo motors from the database

– for motors or encoders with electronic nameplate and existing device connection

"Feed constant"

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

Feed constant	Comments
Encoder feed constant at encoder interface 1	When using Festo linear axes, the feed constant cannot be configured. When using user-defined linear axes, the feed constant can be configured: – Setting in the initial commissioning assistant – Setting on the parameter page "Drive configuration" (axis)

Tab. 52 Setting the feed constants

Parameter	Comments
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. 53 Information on Internal Parameters

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

"Encoder 1"

The motor encoder at encoder interface 1 is displayed and 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.

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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:

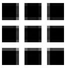
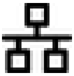
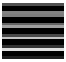
– Encoder with BISS interface (Continuous Mode protocol)
– Incremental encoder

Additional information on the encoder configuration ➔ 3.3.3 Encoder Configuration.

2.3.8 Axis 1

Switching the side view

The view of the parameter pages can be switched via the title bar of the working area.

Symbol	Description
	Switch to the grouped view via the subordinate parameter pages: "Drive settings" and "Servo drive functions"
	Switch to the functional view of the control loop with active elements for switching between the pilot control, position, velocity and current regulator, motor, encoder and velocity filter components.
	Change to the tabular complete view of the parameters, listed according to parameter groups.

Tab. 54 Description of the title bar

Page	Description
"Drive settings"	
Motor	→ 2.3.8.1
Gearbox	→ 2.3.8.2
Axis	→ 2.3.8.3
"Servo drive functions"	
Record list	→ 2.3.8.4
Monitoring functions	→ 2.3.8.5
Open loop	→ 2.3.8.6
Closed loop	→ 2.3.8.7
Auto tuning	→ 2.3.8.8
Vibration compensation	→ 2.3.8.10
Feed forward control	→ 2.3.8.11
Cam controller	→ 2.3.8.12 Cam Controller (Position Trigger)
Touch probe	→ 2.3.8.13 Position Detection (Touch Probe)
Jog mode	→ 2.3.8.14

Tab. 55 Subordinate pages of the grouped view

2.3.8.1 Motor

The working area contains parameter groups to display and specify the stepper motor characteristics.

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The setting of the encoder parameters is mandatory for user-defined motors. If a user-defined motor is selected in the drive configuration, the encoder selection (P1.11616.0.0) on the parameter page "Encoder interface" 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. For Festo motors, the motor parameters are automatically transferred from the database upon selection of the motor. For motors from other manufacturers, the motor parameters must be defined manually.

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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.

Parameter	Comments
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.
Nominal motor torque	Displays the nominal torque calculated from the rated current Px.7117 and the torque constant Px.7135 of the configured motor.
EMF constant	Electromotive voltage constant (Phase-Phase)

Tab. 56 Information on Internal Parameters

Additional information on the motor configuration ➔ 3.3.1 Motor configuration.

"Holding brake 1 (motor, user configuration)"

The properties 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 Brake Control.

"Holding current reduction brake one"

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

2.3.8.2 Gearbox

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

"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 transmission factor is specified in this parameter group.
Additional information on the transmission ratio ➔ 3.3.4 Gear unit.

2.3.8.3 Axis

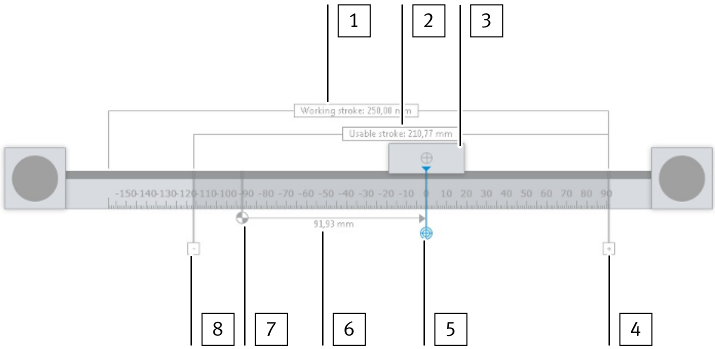
The working area contains parameter groups to display and specify axis-specific parameters, e. g. for homing, axis configurations, stop delay times and limit values.

Interactive Graphic

Depending on the homing mode, axis zero point and software end positions, the reference system of the axis is displayed in an interactive graphic based on the selected axis type.

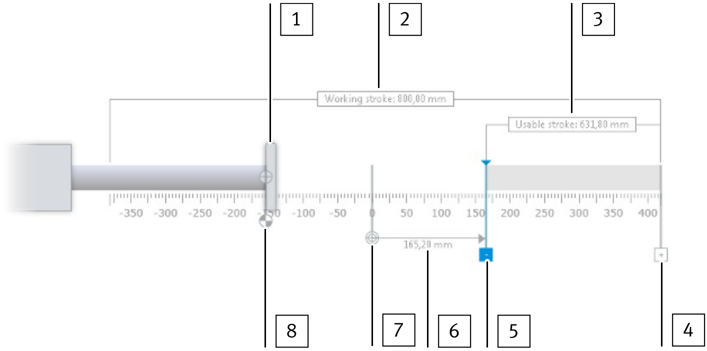
The interactive graphic is displayed if the following prerequisite is met:

– An axis with a finite working stroke has been configured.



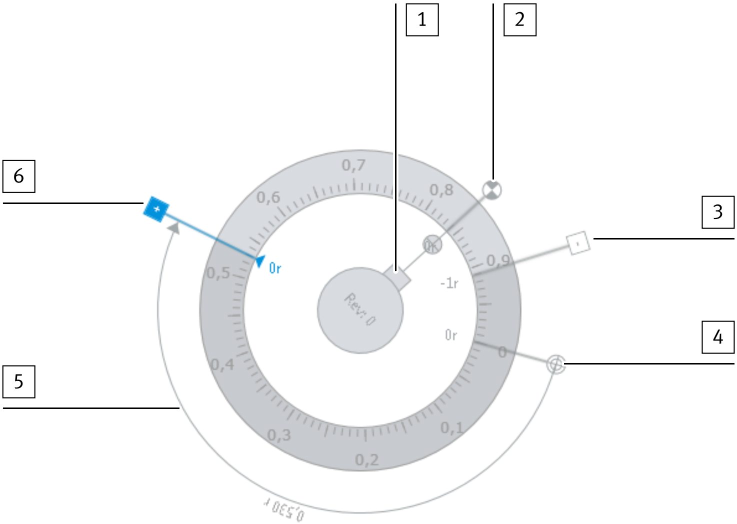
1	Working stroke	5	Axis zero point
2	Effective stroke	6	Measurement arrow for distance measurement
3	Slides	7	Homing point
4	Positive software limit position	8	Negative software limit position

Fig. 14 Interactive graphic for gantry axes



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

Fig. 15 Interactive graphic for cantilever axes



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

Fig. 16 Interactive graphic for rotative axes

Identifier	Description
Working stroke	Theoretically available working stroke of the axis
Working stroke	Actual available stroke of the axis based on the current configuration
Reference point	Reference point of the measuring system The position of the reference point is dependent on the selected referencing method.
Slide (for linear axis) Piston rod (for electric cylinders) Drive shaft (for rotative axes)	Axis reference point; moveable part of the axis
Axis zero point	Axis zero point of the measuring system
Negative software end position	Software end position in negative direction of movement
Positive software end position	Software end position in positive direction of movement

Identifier	Description
Measurement arrow for distance measurement	Distance between two points, e.g. offset between reference point and axis zero point

Tab. 57 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 rotative axes

Positioning the Reference Point

If the reference point is selected, it is displayed in blue and can be moved.
When moving the reference point, 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 the Axis Zero Point

If the axis zero point is selected, it is displayed in blue and can be moved.
When moving the axis zero point, 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 reference point value is modified. The displayed position of the reference point remains the same.

---

i

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 the Axis Reference Point

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

Positioning the 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 is updated in the graphic.
The software end positions are checked by the plug-in for plausibility upon input. If the set software end positions are not plausible, the frames around the two input fields for the "software limit positions" and, for linear axes, the frame around the text field "Working stroke" are displayed in orange, e.g. if the negative software limit position is larger than the positive software limit position.

---

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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 homing method is selected in this parameter group and it is specified whether the axis zero point should be approached following referencing.
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 screen is also possible using a button.

"Homing parameters"

The values for the velocity, acceleration and jerk limitation for the homing are specified in this parameter group.
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 system of measurement units
➔ 3.2.5 Dimension Reference System and axis zero point ➔ 4.4 Homing.
Additional information on monitoring the software end positions
➔ 5.6 Software limit position reached.

"Stop deceleration"

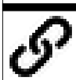
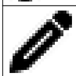
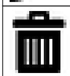
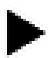
The stop ramp is parameterised in this parameter group.
Additional information on stopping ➔ 4.2 Stop.

"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.

2.3.8.4 Record list

In the working area, you are able to create new records, edit existing records and create record links.
If records or record links have been created, the following symbols are displayed to the right:

Symbol	Description
	Create new record link.
	Edit record or record link.
	Delete record or record link.
	Execute record set
	Stop record set

Tab. 58 Description of the symbols in the Parameter Panel "Record list"

Parameter	Comments
Record name	Description of the record
Record sequence Name	Name of the record sequence

Tab. 59 Information on Internal Parameters

Additional information on records and record links ➔ 4.5 Task for record selection.

Creating a 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:

1. Press the "Add new record set" button.
   - ➥ The pop-up to create a new record is opened.
2. Define record number and name.

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>
> 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.

3. Define record type.
4. Define record group.
5. Define record parameters for selected record group.

> i
>
> Standard values are entered for the following records:
> - Position
> - Velocity
> - Force/torque
> - Stop

6. Press the "Apply record set" button.
   - ➥ The record is added to the record list.

Creating and Editing a Record Link

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

1. Button 🔗Actuate ("Add transition").

> i
>
> If three record links have already been created for a record, the button 🔗 ("Add transition") is deactivated.
> If a type of record link that has not been described is specified, this is indicated by a symbol next to the record number in the record list. The button 🔗 ("Add transition") is deactivated.

   - ➥ The pop-up to create a new record link is opened.
2. Define name of the record link.
3. Select record link condition.

4. Define parameters for selected condition.

---
i

This step is skipped if a record link condition does not have any parameters.

Fig. 17 Identification of a non-existent consecutive record

5. Define consecutive record for record link.

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i

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 list.

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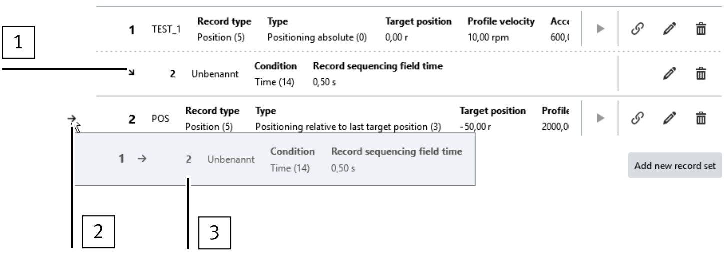
6. Press the "Apply transition" button.
   ↳ The record link is displayed underneath the record for which it was created.



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

Fig. 18 Elements of a record link

Deleting and Editing Records and Record Links

Records and record links can be edited or deleted via the corresponding ✎ and 🗑 buttons next to the record or record link (➔ Tab. 58 Description of the symbols in the Parameter Panel "Record list").

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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 list. The button ✎ ("Edit record set") is deactivated.

Executing or Stopping a Record

The commands are called using the symbols "Execute record set" and "Stop record set" ➔ Tab. 58 Description of the symbols in the Parameter Panel "Record list".

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.
– Controller enable is activated.

2.3.8.5 Monitoring functions

The working area 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 overloading.

Additional information on monitoring functions ➔ 5 Motion monitoring and ➔ 3.4 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 monitor indicates whether a target figure has been reached.

Additional information on target window monitoring ➔ 5.2 Target Window Reached.

"Target area left"

The target monitoring parameters are defined in this parameter group.

Additional information on 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 monitor indicates any 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"

Recoil monitoring is parameterised in this parameter group.

Recoil monitoring checks the movement of the drive as a function of the effective direction of the torque.

Additional information on recoil 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 ➔ 3.4.2 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 the excessive supply of electrical energy.
Additional information on I^2t monitoring for the output stage
➔ 3.4.1 I^2t monitoring of the power output stage and I^2t monitoring for the motor
➔ 3.4.2 I^2t monitoring of motor.

2.3.8.6 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.
Additional information ➔ 7.3 Open-loop operation

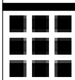
"Current for open loop"
The current values for open-loop operation are specified in this parameter group. The following parameters are active only if the Current reduction activation is activated:

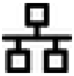
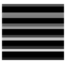
- Current reduction delay time
- Current reduction scaling factor,

However, the P1.270.0.0 parameter is always active.
Additional information ➔ 7.3 Open-loop operation

2.3.8.7 Closed loop

Switching the side view
The view of the parameter pages can be switched via the title bar of the working area.

Symbol	Description
	Switch to the grouped view. This view shows all parameter groups usually required for calculating and manually optimising the controller settings in the working area. 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 area and can also be edited there.

Symbol	Description
	Switch to the functional view. The working area shows the following: – A symbolic illustration in the upper left area of the working window for quickly switching between the block views of the controller components using active elements – 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.
	Change to the tabular complete view of the parameters, listed according to parameter groups.

Tab. 60 Description of the side view

Parameter group "Application data" of the grouped view

This parameter group allows the load inertia ("Application moment of inertia") to be parameterised according to the application. If the load inertia is changed, the controller data is recalculated. The total inertia determined indicates the moment of inertia of the drive train (axis, gear unit, motor, load) in relation to the gear unit output.

Parameter	Comments
Inertia ratio	Inertia ratio of the system.

Tab. 61 Information on Internal Parameters

Parameter group "Velocity control" of the standard view

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

Parameter	Comments
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. 62 Information on Internal Parameters

Parameter group "Position control" of the standard view

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

Parameter group "Closed loop calculation" of the standard view
In this group, the current status of the controller data is displayed 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 closed-loop settings originate from the device description file in the plug-in.
Calculated values	The controller data were determined optionally: – by actuating the "Calculate" button – by the drive configuration on the basis of 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 closed-loop settings.
Online optimized values	The displayed controller data was read from the last connected device.
Open shaft	The controller data displayed correspond to the controller data of the configured motor with open shaft.
Unsupported values	The controller data were determined optionally: – by actuating 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 closed-loop controller data must be adapted manually to avoid overloading the components.
Invalid values	No useful data could be calculated for the velocity controller. The data must be adapted manually.

Tab. 63 Status of Controller Data

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The addition of "Changed manually" is attached to the relevant status as soon as at least one closed-loop parameter has been changed manually.

Calculation
The dynamic of the closed-loop controller is set using the slider in the working area to calculate the controller data. The "Hard" setting generally improves the positioning behaviour, but can also lead to a rough control behaviour and a high-frequency humming motor.
Countermeasures:
– Move slider in the "Soft" direction.
– Increase the filter time constant of the velocity filter (parameter "Velocity control"group).
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 is **not** connected to a device.

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

Calculate with open shaft
The calculation of suitable closed-loop settings without load is started with the "Calculate with open shaft" button based on the current drive configuration. The calculated closed-loop settings are only useful for operation of a motor that is not connected to the load (axis). A test run with an open shaft is often sensible during initial commissioning.

Start auto tuning...
Via the button "Start auto tuning...", the assistant for configuration and execution of the auto-tuning is displayed.
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 assistant for auto-tuning ➔ Running Auto-Tuning

Reset to default values
The closed-loop parameters can be reset to the values in the device description file with the "Reset to default values" button.
The button is only active if the following prerequisites are met:
– A complete drive configuration has been created.
– The plug-in is **not** connected to a device.

Transferring Data to Closed-Loop Settings Record
Active closed-loop settings can be transferred to a closed-loop settings record via the ("Apply active parameter to closed-loop settings record") button.
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.

Proceed as follows to transfer the active closed-loop settings to a closed-loop settings record:
1. Button ("Apply active parameter to closed-loop settings record") button at the top edge of the parameter screen.
   ↳ A pop-up to select the closed-loop settings record opens.
2. Click checkbox for required closed-loop settings record.
3. Press the "Apply" button.
   ↳ The active closed-loop settings are transferred to the selected closed-loop settings record.

Overview of the Closed-Loop Settings Records

An overview of the existing closed-loop settings records is displayed at the bottom of the parameter panel.

Symbol	Description
	Edit closed-loop settings record.
	Apply closed-loop settings record to active parameter.

Tab. 64 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 is **not** connected to a device.

Parameter	Comments
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. 65 Information on Internal Parameters

Editing the Closed-Loop Settings Record

Proceed as follows to edit the closed-loop settings record:

1. Button ("Edit closed-loop settings record") button.
   ↳ A pop-up to define the parameters opens.
2. Edit parameters of the closed-loop settings record.
3. Actuate the "Save changes" button.

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The parameters are only transferred to the active parameter, once the ("Apply closed-loop settings record to active parameter") button has been actuated.

Transferring Closed-Loop Settings Record to Active Parameters

A closed-loop settings record can be transferred to the active parameters by actuating the ("Apply closed-loop settings record to active parameters") button.

2.3.8.8 Auto tuning

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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 during which the closed-loop 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:

- Current regulator, which is already designed
- Suitable start parameters for position and velocity controllers
- Amplitude of excitation signal

Servo drive start values

The standard values for the position controller and velocity controller are determined in this parameter group. The start parameters are determined automatically on the basis of the drive configuration.
Additional information on auto tuning ➔ 6.5 Auto-tuning.

Results

The auto-tuning results are displayed in this parameter group once the values have been adopted by the assistant.
Additional information on auto tuning ➔ 6.5 Auto-tuning.

Measurement of movement (identification) and Test movement (validation)

The properties for the movement measurement and movement 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 the acceleration and deceleration. A synchronisation is not carried out until the function is started in the assistant.
Additional information on auto-tuning ➔ 6.5 Auto-tuning

Start auto tuning...

Via the button "Start auto tuning...", the assistant for configuration and execution of the auto-tuning is displayed. The button is only active if the following prerequisites are met:

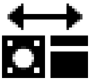
- The plug-in is connected to the device.
- The plug-in has the master control.

Additional information on the assistant for auto-tuning ➔ Running Auto-Tuning

2.3.8.9 Assistant for Auto-Tuning

Overview

The assistant can be called up from the page "Closed loop" or the page "Auto tuning" using the button "Start auto tuning...". On the start page, the currently set marginal conditions for motions during the motion measurement (identification) are displayed. The following steps are run using the button "Next" or selection of the next page in the toolbar.

Symbol	Description
 "Constraints"	Display marginal conditions for motion measurement (identification) and parameterise (assistant start page)
 "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. 66 Description of the Toolbar symbols for Auto-Tuning

Section/command	Description
 "Control"	Function: – Assign master control to the plug-in or higher-level 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 released again, it automatically goes to the fieldbus. If the connection is interrupted, the plug-in releases the master control again.
	Requirement: – The plug-in is connected to a device. – No other plug-in has the master control.
	If another device has the master control, an information symbol is displayed over the deactivated command "Control". The tool tip for the command "Control" contains the IP address and the port number of the device.
 "Powerstage"	Function: – Release output stage of the servo drive The scroll bar shows the current setting.

Section/command	Description
 "Powerstage"	Requirement: – The plug-in is connected to a device. – The plug-in has the master control. – The device is not in error status.
	During activation of controller enable, a check determines whether a reinitialisation is required. If a reinitialisation is required, a query is displayed offering the following options: – "Ok": The reinitialisation is executed and controller enable is activated. – "Cancel": The reinitialisation 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 command "Powerstage" 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 current diagnostic messages for the servo drive. Additional information ➔ 2.5.2.
	Requirement: – The plug-in is connected to a device. – The plug-in has the master control.

Tab. 67 Description of the Toolbar symbols for Motion Control

Copying Device Parameters from the Assistant to the Plug-in

Device parameters that are defined or calculated in the auto-tuning assistant are only transferred to the plug-in through specific actions. The device parameters are not transferred if these actions are not executed and the assistant 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 amplification gain of position controller – Result amplification gain of velocity controller – Result integration constant of velocity controller

Tab. 68 Transferring Device Parameters

Running Auto-Tuning

Before identification:

1. On page "Constraints" of the assistant, adjust the motion parameters for identification.

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   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" screen is displayed.
3. On page "Start":
   – Adjust the rigidity to the axis type.
   – The dynamics for the closed-loop controller calculation can be defined with the scroll bar. When the slider is changed, the start values for the controller parameters are automatically recalculated.

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   The start parameters for the closed-loop controller are influenced by the selection. A standard 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 button "Start auto tuning" 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.

1. Press the "Start auto tuning..." button.
   ↳ The "Status" screen is displayed. The calculation of the auto-tuning is completed.
2. Press the "Next" button.
   ↳ The page "Results" opens and shows the current and newly calculated parameter values of the velocity and position controller.
3. On page "Results", a motion test (validation) may be optionally completed:
   – Adjust the motion parameters for validation.
   – Using the button "Execute test run", start the validation.
4. If required: repeat identification.
   The button "Retry" leads back to page "Constraints" for the assistant.
5. Once the auto-tuning is complete, use the button "Apply values" to transfer the results to the plug-in.
   The following new values are then displayed on the page "Closed loop" and the page "Auto tuning":
   – Result amplification gain of position controller
   – Result amplification gain of velocity controller
   – Result integration constant of velocity controller

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In order to optimise the closed-loop settings for specific applications, the auto-tuning measurement result can be evaluated as follows on the "Auto tuning" diagnostics screen:

- Display or export of logarithmic diagrams
- Export settings to a CSV file

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

2.3.8.10 Vibration compensation

"1. Notch filter", "2. Notch filter" and "3. Notch filter"

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 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.

2.3.8.11 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 contouring 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.

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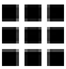
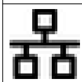
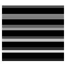
Recommendation for vertically mounted axis
For weight compensation by the pilot control a value typical for the load used is specified as Offset torque .

Additional information on pilot control ➔ 6.3 Pilot control (Setpoint value control).

Switching the side view
The view of the parameter pages can be switched via the title bar of the working area.

Symbol	Description
	Switch to the grouped view. This view shows in the working area all parameters of the parameter group usually required for calculating and manually optimising the controller settings.
	Switch to the functional view. The working area shows the following: – A symbolic illustration in the upper left area of the working window for quickly switching between the block views of the controller components using active elements – 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.
	Change to the tabular complete view of the parameters, listed according to parameter groups.

Tab. 69 Description of the symbols for Switching the Page View

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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)
When the device connection is active, the Adorner (pop-up) of parameter Offset torque the current value of the parameter Setpoint value torque is displayed. The displayed value can be accepted with a mouse click as Offset torque .

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 drive train (axis, gear unit, motor, load) based on the gear unit output
– Torque [Nm] of the drive train (axis, gear unit, motor, load) based on 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 supporting points for velocity and torque.
3. Press the "Apply parameters" button.

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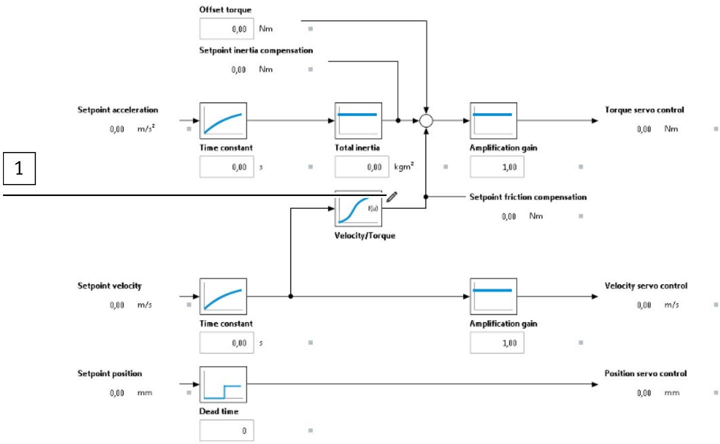
If the pop-up is not closed with the "Apply parameters" button, the modified values will not be applied.



1 "Edit friction"

Fig. 19 Block view of the parameter page "Feed forward control"

2.3.8.12 Cam Controller (Position Trigger)

With the cam controller function, position switches and rotor position switches, for example , can be simulated in positioning mode.

For every cam switch mechanism of the device there is in the navigation tree under the "Cam controller" page a "Cam controller 0" … "n" page for parameterisation of the applicable cam switch mechanism. The number of possible cam switches depends on the device and its firmware.

By selecting the corresponding screen in the navigation tree, the respective screen can be selected directly. You can use links in the working area of the "Cam controller" screen to select the "Cam controller 0" … "n" screen alternatively.

Detailed information on how to parameterise the function of the cam controllers

➔ 7.1 Cam controller (position trigger).

Prepared values

The initial values of the respective cam controller can be defined in the "Prepared values" parameter group.

Parameters can be set in the "General parameters" subgroup depending on the selected mode of the cam controller. Parameters that are not relevant for the selected mode are invisible.

General parameters	Brief description
Cam controller mode	Defines the mode of the cam controller➔ Tab. 515 Possible modes of the cam controller function.
Configured output	Internal parameters: Displays the configured output for the cam controller.
Cam controller source	Determines the source of the measured values.
Switching time (manual)	Determines the switching time for time-based manual switching (mode 4/5).
T_{t1}	Determines 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}	Determines 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	Determines the lower limit value for the modulo calculation. When the lower limit value is undershot, the position jumps to the upper limit value.
+Mod	Determines the upper limit value for the modulo calculation. When the upper limit value is exceeded, the position jumps to the lower limit value.
Hy	Through the determination of the hysteresis range, undesired switching procedures are suppressed around the switching point during fluctuations.
Offset	Offset of the modulo position

Tab. 70

Timing Diagram (Automatic Mode)

The timing diagram is only visible if the parameter "Current mode cam controller" 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.

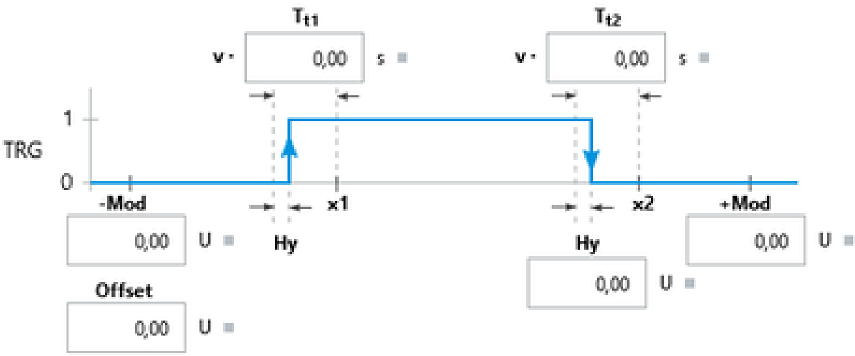


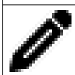
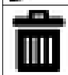
Fig. 20 Timing diagram with input fields for the automatic mode

Cam switches

This parameter group is only visible if the "Mode cam controller" parameter is set to Automatic. In the parameter group, you can define new ones Cam switches for automatic mode and edit existing Cam switchesones.

When editing a cam switch, a pop-up appears that allows you to edit the selected cam switch in individual steps. When editing the existing cam switches, the last step of the pop-up control is opened.

Symbols can be used to trigger the following commands:

Symbol	Meaning	Description
"New cam switch"	"New cam switch" button	Adds a new entry to the list.
	Edit	Allows you to edit the corresponding cam switch.
	Delete	Deletes the cam switch from the list after a prompt.

Tab. 71

Acceptance of the 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 taken over 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 parameter Current cam controller mode is displayed.

If there is a connection with the device, the parameters of the cam controller active in the device are displayed in the Active values parameter group.

General parameters	Brief description
Cam controller mode	Specifies the current mode of the cam controller function.
Configured port	Shows the digital output connected to the cam controller.
Current cam controller source	Specifies the current source of the position values of the cam controller.
Switching time (manual)	Specifies the current switch-on time for mode 4.
T_{t1}	Specifies the current delay compensation of the first switching point for the switch-on process.
T_{t2}	Specifies the current delay compensation of the second switching point for the switch-on process.
-Mod	Specifies the currently determined lower limit value for the modulo calculation.
+Mod	Specifies the currently determined upper limit value for the modulo calculation.
Hy	Specifies the current hysteresis. In the hysteresis range, switching procedures are suppressed around the switching point during fluctuations.
Offset	Specifies the currently used offset of the modulo position.

Tab. 72

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.

Cam switches

This parameter group is only visible if the "automatic" mode is active. The parameter group shows the parameters for the cam switches defined for the automatic mode.

2.3.8.13 Position Detection (Touch Probe)

The Touch Probe function enables the exact detection of current positions during the processing of commands. In the process, the position detection function is triggered by the trigger signals at a trigger input (CAP).
For each trigger input of the device there is a "Touch probe 0" … n screen in the navigation tree below the "Touch probe" screen for parameterising the respective position acquisition. The number of possible position acquisitions depends on the device and its firmware.
By selecting the corresponding screen in the navigation tree, the respective screen can be selected directly. You can use links in the working area of the "Touch probe" screen to select the "Touch probe 0" … n screen alternatively.
The screens provide the following functions:

– Selection of the desired Touch Probe mode
– Displays the input configured for the Touch Probe function
– Warning if no input is configured and possibility to jump to the Digital I/O screen via adorner/popup

– Graphically supported input option for the parameters relevant to the selected operating mode
– When connected to the device: Activation possibility 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).

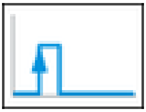
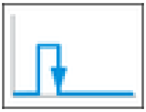
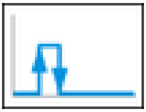
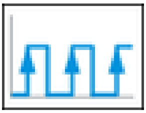
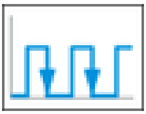
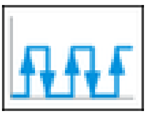
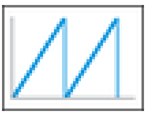
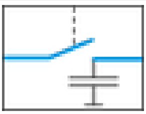
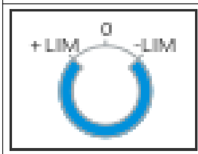
Prepared values

In the "Prepared values" parameter group, you can define the initial values of the respective position acquisition.

In the "General parameters" subgroup, parameters can be set depending on the selected position acquisition mode. Parameters that are not relevant for the selected mode are invisible.

General parameters	Brief description
Touch probe mode	Determines 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	Determines the type of signal edge with which the measurement shall be triggered.
Configured input	Internal parameters: Displays the configured input for the touch probe function.
Touch probe source	Determines the source of the measured values.
+MOD	Determines the upper limit value for the modulo calculation. When the upper limit value is exceeded, the position jumps to the lower limit value.
–MOD	Determines 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 of the modulo position
+MOD	Determines 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	Determines 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. 73

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

Tab. 74 Description of the symbols in the Touch Probe Block Diagram

Acceptance of the 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 taken over 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 parameter Current touch probe mode 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
Current touch probe mode	Specifies the current mode of the touch probe function.
Current values	
Current selection trigger event	Specifies the currently defined signal edge of the trigger event.
Configured input	Displays the configured input for the touch probe function.
Current touch probe source	Specifies the current sources of the measured values.
Absolute position in user units	Indicate the position in the user units in relation to the axis zero point.
+MOD	Specifies the currently determined upper limit value for the modulo calculation.
–MOD	Specifies the currently determined lower limit value for the modulo calculation.
Offset	Specifies the currently used offset of the modulo position.
+MOD	Specifies the upper limit for trigger signals within the modulo range. Trigger signals at positions above the limit are ignored.
–MOD	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	Indicates 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.

General parameters	Brief description
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. 75

2.3.8.14 Jog mode

The working area includes a parameter group to configure the motion parameter for jog mode.
Jog mode enables manual travel of the drive. This is required in the following situations, amongst others:

– Moving to the teach position.
– Moving to a safe position following a system error.

Jog mode is executed on the Manual movement control side or by the PLC.

"Movement parameters"

The individual parameters for jog mode are specified in this parameter group.
Additional information on jog mode ➔ 4.6 Jog Mode.

2.3.9 Parameter list

The working area contains a table with all of the servo drive parameters.
The "Parameter list" parameter panel is always displayed in a table view. Switchover to page view is not possible.
Notes on entering parameters ➔ 2.3.2 Entering parameters.

2.4 Control

2.4.1 Surface

Toolbar

In addition to the standard commands, the toolbar for the "Control" context also contains the following command:

Identifier	Function
 "Start trace"	Start currently configured recording on the device. Requirements: – The plug-in is connected to a device. – No recording is currently being performed.

Tab. 76 Additional Command of the Context "Control"

2.4.2 Manual movement

The working area contains sections to complete homing and execute manual movements.

Requirements:
– The plug-in is connected to a device.
– The plug-in has the master control.
– Controller enable is activated.

Using Default Values

For some parameter settings, standard values are defined which 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 to default values" button in the working area title bar overwrites the entered target position and velocity values with the default values.

"Homing"

The section "Homing" 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 homing run status "Homed" is displayed.

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Depending on the drive configuration, a zero point offset is determined during homing. After successful completion of the homing run, the determined 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 button "Save zero point offset"permanently secures the zero point offset. This ensures that the determined value is retained when the device is restarted.

"Manual movement"

The section "Manual movement" supports simple manual operation and does not require an active control program. This function allows, for example, the testing and setting up of the mechanics of a machine during commissioning.

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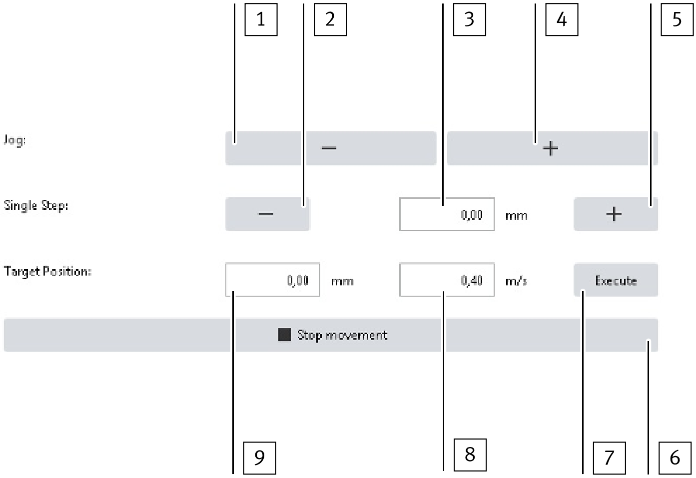
The current actual position is displayed and can be adopted using the command buttons in the adorner pop-up, e.g. for setting the software end position.



1 Jogging in negative direction
2 Single step in negative direction
3 Distance of single step
4 Jogging in positive direction
5 Single step in positive direction
6 "Stop movement"
7 "Execute"
8 Velocity
9 Target position

Fig. 21 Manual movements

No.	Name	Function
Jog Mode		
1	Negative jogging	Jog movement in negative direction Motion parameters: – "Jog mode" parameter screen – ➔ 2.3.8.14,
4	Positive jogging	Jog movement in positive direction Motion parameters: – "Jog mode" parameter screen – ➔ 2.3.8.14.
Single step, target position		
3	Distance of single step	Indication of the traverse path per step
2	Negative single step	Execution of a single step: – In a negative direction – With indicated distance and velocity – With standstill at target achievement

No.	Name	Function
5	Positive single step	Execution of a single step: – In a positive direction – With indicated distance and velocity – With standstill at target achievement
9	Target position	Define target position of movement.
8	Velocity	Parameterisation of the velocity for the following functions: – Executing a single step – The drive is to be carried out to the target position.
7	"Execute"	Start driving to target position Standstill when targets are reached
6	"Stop movement"	Issue stop command

Tab. 77 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. The section is only visible if the device configuration includes a motor with a brake.

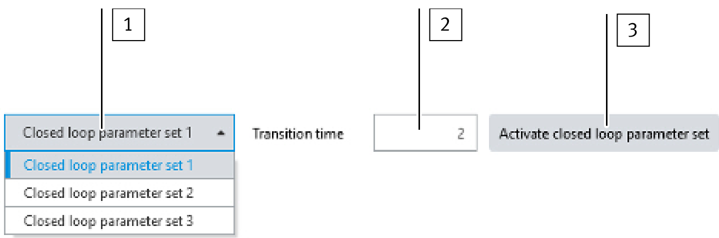
The button in this section can be operated if the following requirements are met:

– The plug-in is connected to a device.
– Only the master control is set.

"Active closed loop parameter set"

A different closed-loop settings record can be transferred to the active closed-loop parameters in this section.

The closed-loop settings records are parameterised on the Closed loop panel ➔ 2.3.8.7.



1 Select closed-loop settings record

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

3 "Activate closed-loop settings record"

Fig. 22 Manual movements – closed-loop settings record

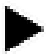
2.4.3 Record list

All of the records and record links that were created in the "Record list" parameter panel (➔ 2.3.8.4) are listed in the working area.
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.
– Controller enable is activated.

Executing or Stopping a Record

Records can be executed and stopped via the corresponding button. If a record is being executed, the symbol Execute record set changes to the symbol Stop record set.

Symbol	Description
	Execute record set
	Stop record set

Tab. 78 Description of the Control Side symbols

2.5 Diagnosis

2.5.1 Surface

Toolbar

In addition to the standard commands, the toolbar contains the following commands for the "Diagnosis" context:

Identifier	Function
 "Start trace"	Start currently configured recording on the device. The command can be executed if the following prerequisites are met: – The plug-in is connected to a device. – No recording is currently being performed.
	If a recording is active or the device is waiting for a trigger, an information symbol is displayed over the deactivated "Start trace" button.

Tab. 79 Additional commands of the "Diagnosis"context

2.5.2 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.

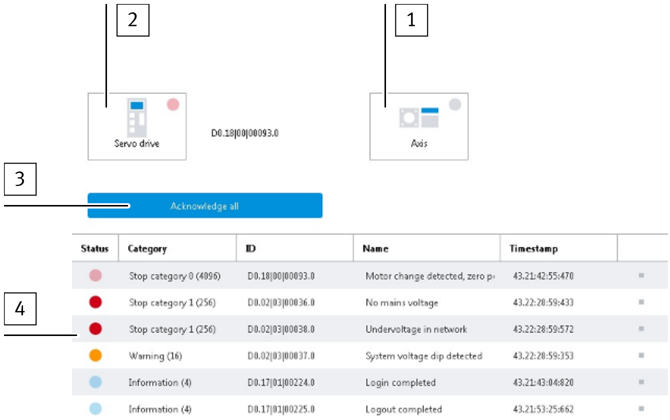


Fig. 23 Device Status

No.	Identifier	Function
1	Status "Servo drive"	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	Status "Axis"	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.
3	"Acknowledge all"	Acknowledge all of the current diagnostic messages ➔ 9.4.5 Acknowledging messages and errors.

No.	Identifier	Function
4	Message Directory	Display all diagnostic messages sorted according to status, priority or time stamp Information on dividing the error messages into the main group, sub-group and by number ➔ 9.4.2 Structure of Messages

Tab. 80 Legend for Device Status

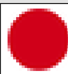
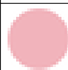
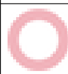
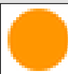
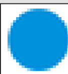
Message Directory

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 no longer active.	
	Acknowledged	Diagnostic message has already been acknow-ledged.	
Warning: Diagnostic message with a medium degree of severity			
Warning	Active	Cause is active.	
	Cancelled	Cause no longer active.	
	Acknowledged	Diagnostic message has already been acknow-ledged.	
Information: Diagnostic message with a low degree of severity			
Information	Active	Cause is active.	

Category	Status	Meaning	Colour display
Ignore (not displayed in the message list)	Cancelled	Cause no longer active.	
	Acknowledged	Diagnostic message has already been acknowledged.	
No diagnostic message (not displayed in the message list)			
–	–	No current diagnostic message	

Tab. 81 Categories and Status of the Message List

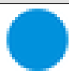
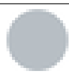
2.5.3 I/O state

The following I/O interfaces are displayed in the working area:

– "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	Representation
Active symbol (logic 1)	
Inactive signal (logic 0)	
Unavailable signal	

Tab. 82 Description of Possible Statuses

2.5.4 Error log

The following prerequisite applies for reading out the error memory on the diagnostics screen "Error log":

– The plug-in is connected to a device.

A table of all the diagnostic messages currently on the device is available in the working area. The continuous error index is displayed in the first column. The last column contains the adorner 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.

Additional information:

– On the error memory ➔ 9.4.4 Error memory.
– On classifying the error messages into the main group or sub-group and by number ➔ 9.4.2 Structure of Messages

Reading out the Diagnostic Memory

The diagnostic memory can be read out with the "Update" command.

The diagnostic memory is automatically read out in the following cases:

– The content page is opened.
– The content page 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 area.

All of the servo drive parameters can also be exported. The following files are saved in a .zip file during this process:

– "DeviceParameters.csv" containing the device parameters
– "Diagnosis.csv" containing the diagnostic data
– "InternalParameters.csv" containing the internal parameters
– "Recorded trace_[period].csv" for every recorded trace

i

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. 83 Description of the Error Classification Columns

Changing the Diagnostic Level

The classification of a diagnostic message can be changed via the dropdown menu.

The levels are depicted in colour as follows:

Diagnostic level	Colour display
Ignore	Ignore (2)
Information	Information (4)
Warning	Warning (16)
Stop category 2	Stop category 2 (64)
Stop category 1	Stop category 1 (256)
Stop category 1	Stop category 0 (4096)

Tab. 84 Description of Possible Diagnostic Levels

Transferring Warnings to the Diagnostic Memory

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
■ Active	There are various settings. Some messages that have been classified as warnings are written to the diagnostic memory, others are not.
☑ Active	All messages that have been classified as warnings are written to the diagnostic memory.
☐ Active	All messages that have been classified as warnings are not written to the diagnostic memory.

Tab. 85 Description of the Statuses of the Checkbox "Store warnings to error log"

Switching to the "Error log" Panel

Actuating the "Go to diagnosis page "Error log"" button via the table opens the "Error log" diagnostics panel.

2.5.6 Trace configuration

The working area contains parameter groups to configure a trace recording.
All available device parameters can be recorded. 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 ➔ 9.5 Recording measuring data (trace).

Creating a New Recording Channel

New recording channels can be created with the "Add new trace channel" button by means of a pop-up. When selecting parameters, the pop-up supports multiple selection with the mouse in conjunction with the [CTRL] key or the [Shift pushbutton].

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 new trace channel" button.
   ↳ The pop-up to create a recording channel is opened.

   i

   A direct search for a device parameter can be completed via the search field using the ID, name or description.

2. Select the category for the device parameter to be recorded.

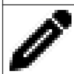
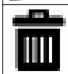
   i

   The "Frequently used" category contains the most common device parameters.

3. To select a device parameter to be recorded, select the device parameter.
   To select several device parameters at the same time, use the multiple selection options with the mouse in conjunction with the [CTRL] pushbutton or the [Shift pushbutton].
4. 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. Only as many recording channels are created as are permitted. 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
	Activate or deactivate the existing recording channel; The recording channel can be temporarily removed from the recording without being deleted.
	Edit existing recording channel
	Delete existing recording channel

Tab. 86 Description of the Diagnostics Panel Buttons

"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.

Parameter	Comments
Trace duration	Configured duration with selected trace resolution in s.

Parameter	Comments
Trace resolution	Sets the resolution of the trace recording.

Tab. 87 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.

Parameter	Comments
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).

Tab. 88 Information on Internal Parameters

If the trigger time should be set by pressing the button "Start trace", a trigger does not need to be added. No trigger settings are needed (trigger type 0).

If data in the parameter directory for the device (trigger type 1) or a diagnostic result (trigger type 2) should be used as a trigger, the trigger is selected as follows:

1. If a trigger has not yet been configured, actuate the button "Add new trigger" . If a trigger was already configured, actuate the symbol ✎ ("Edit trigger") .
   ↳ The pop-up to edit a trigger is opened. If a trigger was already configured, the pop-up displays the last edit step directly. Buttons in the pop-up enable scrolling to the previous or next step.
2. In the first edit step of the pop-up, select the trigger type (trigger type 1 or 2).
   ↳ The following steps depend on the selected trigger type.

If the data trigger (1) trigger type is selected, the following steps are required:

1. Select device parameter category.

   i

   The "Frequently used" category contains the most common device parameters.
   A direct search for a device parameter can be completed via the search field using the ID, name or description.

2. Select device parameter.

   i

   Device parameters are combined in groups. The group can be hidden or shown by clicking on the group title.

3. Depending on the data type of the selected device parameter, it is possible to select the trigger condition bit mask or threshold value. If the selected data type only permits the selection of a "threshold" value, this is set automatically. Next step in the next step.
4. Select the second trigger condition (e.g. "Falling edge") e.g. if the value falls below the threshold value.

5. If the trigger condition "Threshold value" has been selected, set the threshold value.
   If the trigger condition Bit Mask was selected, set Bit Mask. The pop-up supports multiple selection with the mouse in connection with the [CTRL] pushbutton or the [Shift] pushbutton.
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 diagnostic trigger (2) trigger type was selected, the following steps are required:

1. Select trigger condition.
2. Select diagnostic element.

> **i**
>
> 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 specifies during which period measurements are performed before and after the trigger event.

The Trace delay 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 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 the Trace

Recordings can be started with the button "Start trace" or the symbol ("Start trace") of the toolbar.

The button and the symbol "Start trace" are active if the following prerequisites are met:

– A valid trace configuration is set.
– The plug-in is connected to a device.
– No recording is currently being performed.

Stopping the Trace

The recording is stopped with the button "Stop trace".

The "Stop trace" button is only active if the following prerequisites are met:

– The plug-in is connected to a device.
– A recording is currently being performed.

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>
> The "Stop trace" button stops the recording even if the recording is not fully completed.

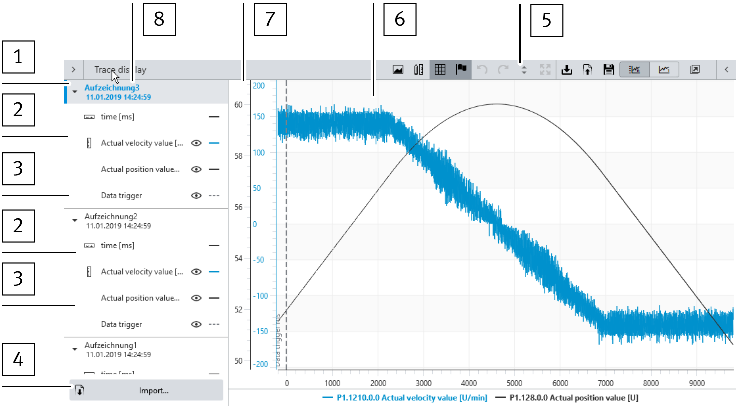
2.5.7 Trace display

Finished recordings are automatically read from the device when a connection to the device is established. The "Trace display" diagnostics page enables the display, analysis and export of the read trace data.
The configuration of the recording is done with the aid of the diagnostic page "Trace configuration" ➔ 2.5.6.
For example, recording can be started with the toolbar of the "Diagnosis" context with the "Start trace" command ➔ 2.5.1 Surface.
If the "Trace display" page is undocked, the "Start trace" command is available in the page menu of the undocked page.
If there are no recordings available, a corresponding message is displayed in the graph section of the "Trace display" diagnostic page. If recordings are available, the most recent recording is displayed in the graph section.
Under the recording names, the recorded signals and the recording trigger are displayed as elements.
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 (history saving)	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 area of the trace display.
Simple trace display	When new trace data arrives, the trace data of the currently displayed recording is replaced by the new trace data. If the replaced trace data was not previously saved as an FMD or CSV file, it cannot be restored. In this mode, the list of all recordings and elements is hidden.

Tab. 89 Trace Display Modes

The desired mode can be toggled with the buttons on the title bar
➔ Tab. 92 Symbols in the Title Bar of the Working Area.



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

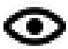
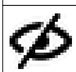
Fig. 24 Interface of Trace display diagnostics panel

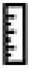
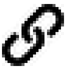
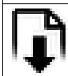
No.	Identifier	Function
1	Recording (selected) (only visible in mode Standard trace display (history saving))	Name, date and time of the recording shown in the graph section; The text of the selected recording is highlighted in bold.
2	Elements of the preceding recording (only visible in mode Standard trace display (history saving))	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. Using a symbol, the visibility of the element in the graph can be switched on or off 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 tooltip of the element.

No.	Identifier	Function
3	Recording (deselected) (only visible in mode Standard trace display (history saving))	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 mode Standard trace display (history saving))	Recordings previously exported can be imported into the list of recordings.
5	Buttons in the title bar	➔ Tab. 92 Symbols in the Title Bar of the Working Area
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 mode Standard trace display (history saving))	The list contains the available recordings and their elements. Elements are recorded signals and the trigger for the respective recording.

Tab. 90 Legend

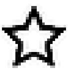
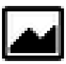
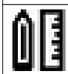
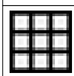
The list of recordings is only visible in the Standard trace display (history saving). The symbols in the list of records have the following meanings:

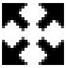
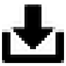
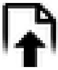
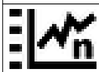
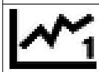
Symbol	Meaning	Description
	Element visible	Indicates that the element is visible if the associated recording is shown in the graph section. Clicking on it switches the element to non-visible. If an element is hidden that is scaled on the Y primary axis, the following visible element is scaled on the Y primary axis, and it not scaled on the X axis. With elements that are scaled on the X axis, the visibility cannot be changed.
	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.

Symbol	Meaning	Description
	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.
	Scaled on the Y primary axis	The marked element is scaled on the Y primary axis.
	Scaled on the 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).
	"Import..." button	enables the import of recordings that were previously exported as: – FMD file (Festo measurement data) – CSV file (Comma-separated values)

Tab. 91 Symbols in the working area

Via the symbols in the title bar of the working area, the following commands can be triggered:

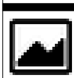
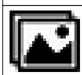
Symbol	Command	Description
	Store to trace list	Allows you to save the current recording in the "Simple trace display" mode. The stored recordings can be selected in the "Standard trace display (history saving)" mode via the list of recordings.
	Export chart as image	Exports the graph shown as an image file.
	Show/hide cursor	Displays a cursor as a measuring bar with which points in the graph can be marked. The recorded value, parameter number and parameter names are displayed as tooltips 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.

Symbol	Command	Description
	Enable/disable legend	Shows and hides the legend below the graph. The legend shows signal names and the corresponding signal colours.
	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.
	Read trace	Reads the trace data from the device.
	Export as CSV	Opens a dialogue for exporting the data as a CSV file.
	Save as FMD	Opens a dialogue for saving the data as an FMD file.
	Start trace (only visible if the "Trace display" page is undocked)	Starts the recording.
	Standard trace display (history saving)	Switches the trace display to the "Standard trace display (history saving)" mode (add new records).
	Simple trace display	Switches the trace display to the "Simple trace display" mode (replace trace data of the current recording).

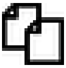
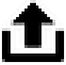
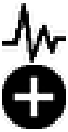
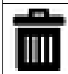
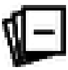
Tab. 92 Symbols in the Title Bar of the Working Area

Commands of the Context Menu

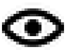
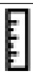
For the graph section, recordings and elements of the recordings, there are separate context menus with the following commands and symbols:

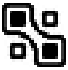
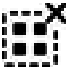
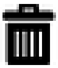
Symbol	Menu command	Description
	Export chart as image	Exports the selected graph as an image file.
	Copy chart to clipboad	Copies the selected graph as an image to the Windows clipboard.

Tab. 93 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.
	Export as CSV	Exports the recording as a CSV file.
	Add user defined channel	Adds a custom channel to an existing recording.
	Rename	Enables the renaming of the recording (also possible with the function key [F2]).
	Delete	Removes the diagram of the selected recording from the trace display.
	Delete all	Removes all diagrams from the trace display.
	Delete all but this	Removes all diagrams from the trace display except the selected diagram.
	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. 94 Context Menu Commands 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.

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

Tab. 95 Commands of the Context Menu for the Elements

Adjusting the Graph Display

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

Adjustment	Required action	Behaviour
Move graph	– Click on the graph with the [left mouse button]. – Keep the [mouse button] pressed and move the mouse.	The cursor changes to a hand. The graph moves with the mouse motion.
Zooming with the zoom box	– Keep the [shift key] + [left mouse button] pressed and drag the mouse. – Release the [mouse button] at the desired end point.	The zoom box will stretch from the start point to the current mouse position. Releasing the [mouse button] will cause the size of the zoom box to become zoomed.
Zooming with the mouse wheel	– Point to the graph section with the mouse. – Zoom 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.	The scaling follows the movement of the mouse while the [left mouse button] is pressed.

Adjustment	Required action	Behaviour
	– Keep the [left mouse button] pressed and move the mouse. A vertical movement must be performed to scale the Y axes and a horizontal movement performed to scale the X axis.	

Tab. 96 Adjusting the 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.

Combine Y-axes

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.

Combining Y-axes of Elements with the Same Unit

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. Keep the [Ctrl button] pressed.
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 command Combine axes 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.

Add user defined channel

You can add a custom channel to an existing recording. Custom channels enable the following:

– Representation 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 command "Add user defined channel" 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. it mask).
2. Enter the channel name and unit and select Calculation.
   ↳ Step 2: The pop-up will display depending on the selected Calculation name of the possible recording channels.
3. Select Calculation.
   ↳ Step 3: The pop-up displays additional input fields depending on the selected Calculation.

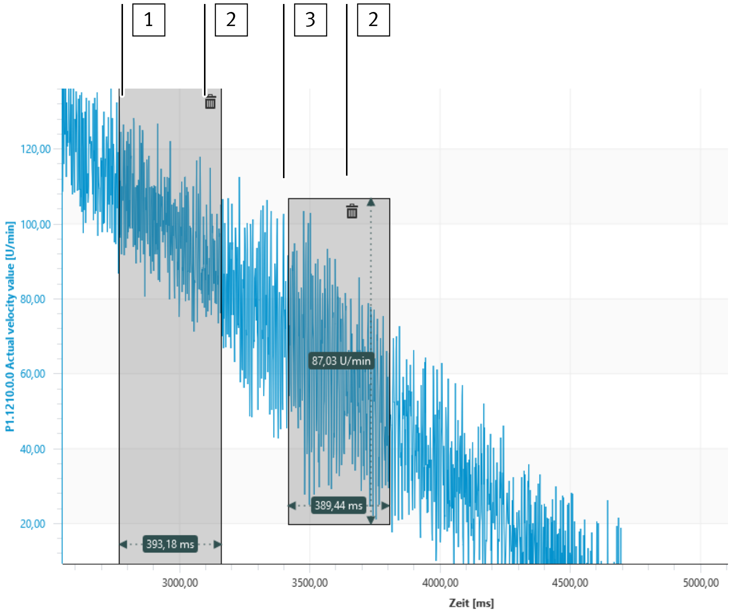
4. Edit input fields and activate settings with the button "Apply".
   - ↳ The pop-up is closed. The user-defined channel is added to the list of elements and displayed graphically in the diagram.

Adding the Measuring Bar

In the graph, simple measurements related to the X axis and the Y primary axis can be carried out via 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	Keep the [CTRL] + [shift] + [left mouse button] pressed and drag the mouse	The measuring bar will stretch to the the entire graph height.
Measuring bar with dimensional reference to the X axis and to the Y primary axis	Keep the [CTRL] + [left mouse button] pressed and drag the mouse	The measuring bar will stretch from the start point to the current mouse position.

Tab. 97 Expanding the 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

Fig. 25 Measuring bar

Depending on the measuring bar added, 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 symbols shown in the measuring bar "Delete" will remove the measuring bar from the graph once again. If the scaling of the Y primary axis or the X axis is changed, all measuring bars are removed from the graph again. This action cannot be undone.

Graph Tool Tip

The tool tip for the graph can be activated and deactivated using the symbol for the title bar of the working area. The tool tip 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.

Mode	Description
Cross-hair pointer	If there is no time plotted on the X axis, a cross-hair pointer is shown in the graph. The position of the crosshairs is attached to the mouse pointer. If the cursor is over one or more data points, an information box with the corresponding Y-value and signal name is displayed at this position for each data point.

Tab. 98 Modes of the Tool Tip Command

Exporting the 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.

Export 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 area.
  ↳ A dialogue opens which enables the file to be saved.

Export recording as CSV file (Comma-separated values)

- Select the "Export as CSV" command in the context menu of the recording name or in the title bar of the working area.
  ↳ A dialogue opens which enables the file to be saved.

Copying CSV Data of the Recording to the Clipboard

- Select the "Copy to clipboard" 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. In the context menu of the graph section or in the title bar of the working area, select the "Export chart as image" command.
   ↳ A dialogue opens which enables the file to be saved.

Copying the Recording as an Image to the Clipboard

1. Select the recording so that this is shown in the graph section.
2. In the context menu of the graph section, select the "Copy chart to clipboad" command.
   ↳ 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 which enables the the imported file to be selected.
2. Select file format (*.csv or *.fmd).
3. Find and select the required file.
4. Actuate the button "Open".

Deleting a Recording

Recordings can be deleted with the command "Delete"in the context menu of the recording name.

2.5.8 Auto tuning (evaluation)

Functions

In order to optimise the closed-loop settings for specific applications, the auto-tuning measurement result can be evaluated as follows on the "Auto tuning" diagnostics screen:

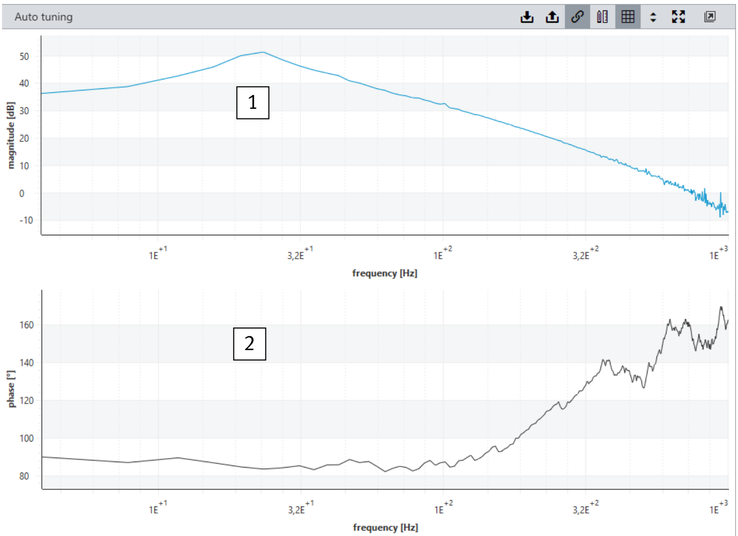
– Display or export of logarithmic diagrams
– Export settings to a CSV file

Requirements for using the functions:

– Perform auto-tuning.
– Establish connection to the device.
– Read out settings.

Reading Out Settings

Settings can be read out from the device with the "Read out settings" command if the device is connected. The settings are then immediately shown in the graphs.



1 Logarithmic view of the frequency response
2 Logarithmic view of the phase response

Fig. 26 Auto-tuning measurement result

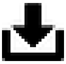
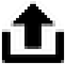
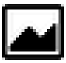
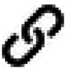
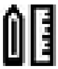
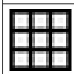
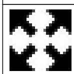
Functions for Evaluating the Auto-tuning

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)
- Activate tool tip

The synchronisation of the actions is activated or deactivated with the "Synchronise graphs" command.
The "Grid", "Y Zoom" and "Reset graph section" commands are not synchronised, but applied independently to both graphs.

Symbol	**Command**	**Description**
	Reading Out Settings	Reads auto-tuning settings from the device.
	Export data	Exports the displayed settings to a CSV file.
	Export graph	Exports the displayed graphs to a common image file .png. The generated files contains the names of the measured variables and their measured values.
	Synchronise graphs	Activates or deactivates synchronisation of the graphs.
	Activate tool tip	Activates or deactivates the tool tip in the graphs. If the tool tip is activated, the associated values are displayed in a window by positioning a vertical reference line on the values curve of the graphs.
	Activate grid	Activates or deactivates the grid in the graphs.
	Y-zoom	Zoom y-axes of the graphs to maximum extension with reference to the data.
	Reset graph section	Reset graphs to maximum extension with reference to the settings.

Tab. 99 Functions

2.6 Integrating a Device in a Festo Controller

Devices can be connected to networks via connectors within the Designer of the Festo Automation Suite. Depending on the type of device, the connectors are displayed on different sides of the tile. In the event of a master/slave connection, one of the two devices is a master device and the other a slave device.

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Device Functions

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.

The following example describes the integration of a CMMT servo drive into a CODESYS program.

Connecting Device to a Controller as a Slave

- Connect device to a Festo controller as a slave (➔ Online help for Festo Automation Suite, chapter "Projecting device networks").
  ↳ – The slave device is displayed in the "Programming" context of the controller (master device)
  – The slave device is automatically integrated in the control program when a connection to the controller is established (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.

Setting the Operating Mode on the "Fieldbus" Parameter Panel

If the device is connected to a controller, the operating mode in which the servo drive should be activated in the control program and the version of the device driver in the CODESYS CODESYS extension of the Festo Automation Suite can be specified on the "Fieldbus" parameter panel ➔ 2.3.5.
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 via the fieldbus. This operating mode enables the coordinated movement of several axes. It requires a controller with CODESYS SoftMotion function.

Tab. 100 Operating Modes for the Servo Drive

Device drivers for the CODESYS extension of the Festo Automation Suite can be components of device-specific plug-ins for the Festo Automation Suite. By installing a new plug-in version, new versions of the device drivers are also installed. The latest available device driver version is used when establishing a device connection in the Designer 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 Operating Mode "SoftMotion"

The "SoftMotion" operating mode is based on the CODESYS SoftMotion and requires a controller with SoftMotion function. Integration into the control program takes place as in CODESYS by transfer of the SoftMotion axis object to PLCopen modules for SoftMotion.

Functions in the CODESYS Extension of the Festo Automation Suite with Selection of the Operating Mode "Point to point"

When selecting "Point to point" operating mode, there are two options for integrating the device into the control program:

– Transferring an axis object to PLCopen modules (similar to "Interpolated" operating mode/SoftMotion).
– Directly accessing methods and properties of axis objects.

Parameters for movement commands (e.g. target position or velocity) are always specified in user units. If necessary, the device driver automatically adjusts itself internally to the parameterisation saved on the device (e.g. scaling of setpoint values).

The mapping of the process data is also completed automatically and does not need to be implemented manually in the control program.

PLCopen modules are included in the Festo_PtP_BasePLCopen 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 FBs: Modules to execute positioning jobs (absolute, additive and relative)
– Other FBs: 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. It must be ensured that a method is only called up once and not cyclically. The device driver then executes the relevant function itself and the status can be evaluated by requesting 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;
xHomingValid := Axis1.HomingValid;

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

    5: IF NOT Axis1.AxisError THEN           // enable
            Axis1.EnableDrive();
            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);
            iStep := 31;
        END_IF

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

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

Fig. 27 Example: Control program with an integrated slave device (axis 1)

No.	Description
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

No.	Description
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

Tab. 101 Legend for control program

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.
With the "Identify Device" function, a flashing sequence can be activated on the connected servo drive ➔ 2.2.2.2 Establishing and Disconnecting a Connection.

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. In this way, the device can be updated to the latest firmware package. As required, however, an older firmware package can also be loaded, e.g. so that the same firmware version can be used in identical systems.
The firmware can be updated using Festo Automation Suite.

Compatibility Check

Before a firmware package is downloaded, the system checks whether the firmware is compatible with the following:

– Basically for the type of equipment: CMMT-ST-...-EC (EtherCAT), CMMT-ST-...-PN (PROFINET) etc.
– The hardware version of the device

The check is performed by Festo Automation Suite before the download already.

Firmware Download

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

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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 start of the firmware update does not take place at the same time as the download of the firmware files.
3. Start the update procedure. The update procedure is performed in a device-internal manner in interaction between the firmware management component and the bootloader.

Festo Automation Suite carry out the abovementioned steps automatically, one after another.

Information on the Firmware

The firmware package of a device can be read through 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. 102 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. 103 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	UINT32
9570	0x2129.0A	Minor version firmware package	UINT32
9580	0x2129.0B	Patch version firmware package	UINT32
9590	0x2129.0C	Build version firmware package	UINT32

Tab. 104 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	Unsigned32
9570	2809.0	Minor version firmware package	Unsigned32
9580	2810.0	Patch version firmware package	Unsigned32
9590	2811.0	Build version firmware package	Unsigned32

Tab. 105 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. 106 Parameter sets

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

i

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

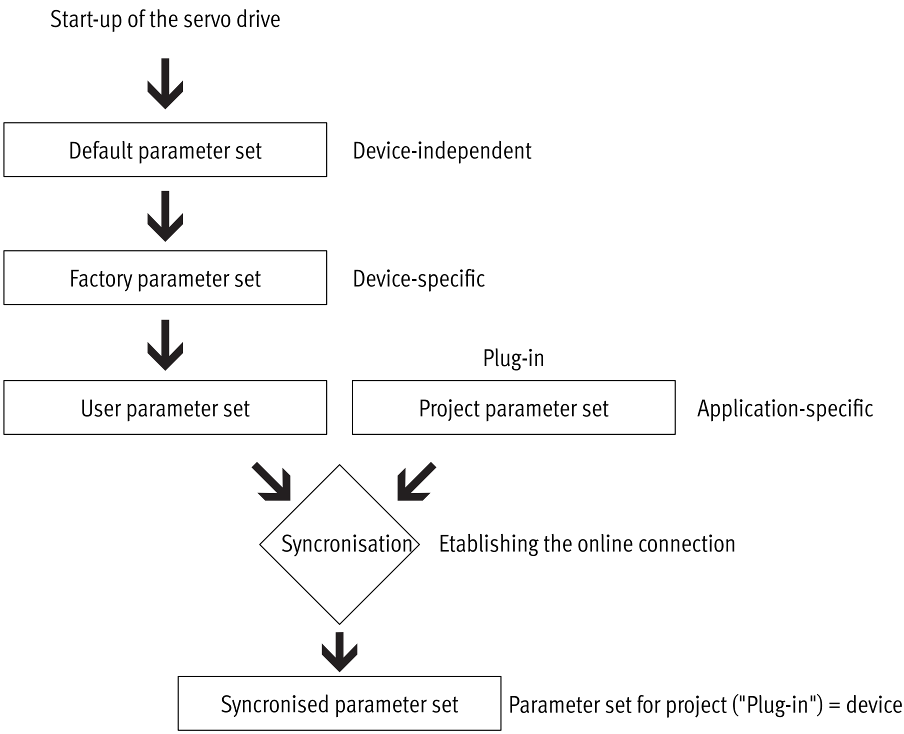


Fig. 28 Sequence at start-up

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 field-bus).

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

i

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.

i

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

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.

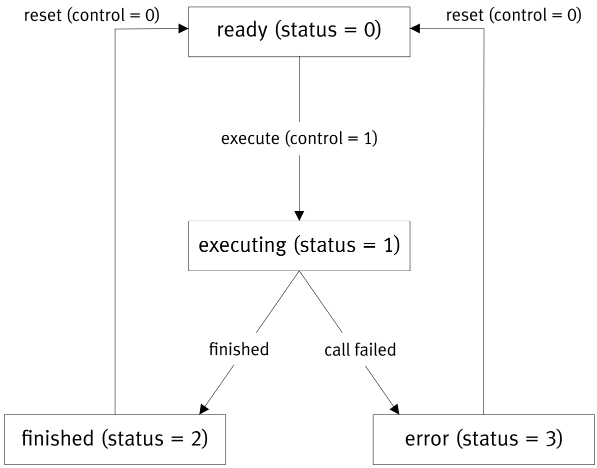


Fig. 29 Method call

The status query of a method delivers one of the following return values:
Method status:

- 0 = ready
- 1 = execute
- 2 = ended
- 3 = error

The query of the return code of a method delivers one of the following return values:

- 0 = successful
- 1 = error

3.1.5.1 Reset device

CiA402

Method	Object	Function	Description
Reset Device	0x2000.01	Controlling method	Value = 1: execute method Value = 0: reset method

Tab. 107 Reset device

PROFIdrive

Method	PNU	Function	Description
Reset Device	1000	Controlling method	Value = 1: execute method Value = 0: reset method

Tab. 108 Reset device

3.1.5.2 Controller parameter set switchover

CiA402

Method	Object	Function	Description
Controller parameter set switchover	0x2001.01	Controlling method	Value = 1: execute method Value = 0: reset method
	0x2001.02	Method status	Status
	0x2001.03	Method transfer value	0 … 2: controller parameter set ID
	0x2001.04	Method transfer value	0 … 100: transition time [s]
	0x2001.05	Method return value	Return code

Tab. 109 Controller parameter set switchover

PROFIdrive

Method	PNU	Function	Description
Controller parameter set switchover	1002	Controlling method	Value = 1: execute method Value = 0: reset method
	1003	Method status	Status
	1004	Method transfer value	0 … 2: controller parameter set ID
	1005	Method transfer value	0 … 100: transition time [s]
	1006	Method return value	Return code

Tab. 110 Controller parameter set switchover

3.1.5.3 Saving zero point offset

CiA402

Method	Object	Function	Description
Save zero point offset	0x2002.01	Controlling method	Value = 1: execute method Value = 0: reset method
	0x2002.02	Method status	Status
	0x2002.03	Method return value	Return code

Tab. 111 Saving zero point offset

PROFIdrive

Method	PNU	Function	Description
Save zero point offset	1007	Controlling method	Value = 1: execute method Value = 0: reset method
	1008	Method status	Status
	1009	Method return value	Return code

Tab. 112 Saving zero point offset

3.1.5.4 Request ReInit

CiA402

Method	Object	Function	Description
Request ReInit	0x2003.01	Controlling method	Value = 1: execute method Value = 0: reset method
	0x2003.02	Method status	Status
	0x2003.03	Method return value	Return code

Tab. 113 Request ReInit

PROFIdrive

Method	PNU	Function	Description
Request ReInit	1010	Controlling method	Value = 1: execute method Value = 0: reset method
	1011	Method status	Status
	1012	Method return value	Return code

Tab. 114 Request ReInit

3.1.5.5 Delete parameter set

CiA402

Method	Object	Function	Description
Delete parameter set	0x2004.01	Controlling method	Value = 1: execute method Value = 0: reset method
	0x2004.02	Method status	Status
	0x2004.03	Method transfer value	Value = 1
	0x2004.04	Method return value	Return code
	0x2004.05	Method return value	Value = 1

Tab. 115 Delete parameter set

PROFIdrive

Method	PNU	Function	Description
Delete parameter set	1013	Controlling method	Value = 1: execute method Value = 0: reset method
	1014	Method status	Status
	1015	Method transfer value	Value = 1
	1016	Method return value	Return code
	1017	Method return value	Value = 1

Tab. 116 Delete parameter set

3.1.5.6 Save parameter set

CiA402

Method	Object	Function	Description
Save parameter set	0x2005.01	Controlling method	Value = 1: execute method Value = 0: reset method
	0x2005.02	Method status	Status
	0x2005.03	Method transfer value	Value = 1
	0x2005.04	Method return value	Return code
	0x2005.05	Method return value	Value = 1

Tab. 117 Save parameter set

PROFIdrive

Method	PNU	Function	Description
Save parameter set	1018	Controlling method	Value = 1: execute method Value = 0: reset method
	1019	Method status	Status
	1020	Method transfer value	Value = 1
	1021	Method return value	Return code
	1022	Method return value	Value = 1

Tab. 118 Save parameter set

3.1.5.7 Cam controller 0

CiA402

Method	Object	Function	Description
Cam controller 0	0x2006.01	Controlling method	Value = 1: execute method Value = 0: reset method
	0x2006.02	Method status	Status
	0x2006.03	Method transfer value	Mode (Px.112700)
	0x2006.04	Method transfer value	Update Mode – 0 = apply immediately – 1 = apply with the next modulo overflow
	0x2006.05	Method return value	Return code

Tab. 119 Cam controller 0

PROFIdrive

Method	PNU	Function	Description
Cam controller 0	1036	Controlling method	Value = 1: execute method Value = 0: reset method
	1037	Method status	Status
	1038	Method transfer value	Mode (Px.112700)
	1039	Method transfer value	Update Mode – 0 = apply immediately – 1 = apply with the next modulo overflow
	1040	Method return value	Return code

Tab. 120 Cam controller 0

3.1.5.8 Cam controller 1

CiA402

Method	Object	Function	Description
Cam controller 1	0x2007.01	Controlling method	Value = 1: execute method Value = 0: reset method
	0x2007.02	Method status	Status
	0x2007.03	Method transfer value	Mode (Px.112700)

Method	Object	Function	Description
Cam controller 1	0x2007.04	Method transfer value	Update Mode – 0 = apply immediately – 1 = apply with the next modulo overflow
	0x2007.05	Method return value	Return code

Tab. 121 Cam controller 1

PROFIdrive

Method	PNU	Function	Description
Cam controller 1	1041	Controlling method	Value = 1: execute method Value = 0: reset method
	1042	Method status	Status
	1043	Method transfer value	Mode (Px.112700)
	1044	Method transfer value	Update Mode – 0 = apply immediately – 1 = apply with the next modulo overflow
	1045	Method return value	Return code

Tab. 122 Cam controller 1

3.1.5.9 Position capture (touch probe) 0

CiA402

For information ➔ 7.2.2 CiA 402.

PROFIdrive

Method	PNU	Function	Description
Position Capture (Touch-Probe) 0	1046	Controlling method	Value = 1: execute method Value = 0: reset method
	1047	Method status	Status
	1048	Method transfer value	Mode (Px.113000)
	1049	Method return value	Return code

Tab. 123 Position capture (touch probe) 0

3.1.5.10 Position capture (touch probe) 1

CiA402

For information ➔ 7.2.2 CiA 402.

PROFIdrive

Method	PNU	Function	Description
Position Capture (Touch-Probe) 1	1046	Controlling method	Value = 1: execute method Value = 0: reset method
	1047	Method status	Status
	1048	Method transfer value	Mode (Px.113000)
	1049	Method return value	Return code

Tab. 124 Position capture (touch probe) 1

3.1.5.11 Modulo operation

CiA402

Method	Object	Function	Description
Modulo	0x2008.01	Controlling method	Value = 1: execute method Value = 0: reset method
	0x2008.02	Method status	Status
	0x2008.03	Method transfer value	Modulo mode – 0 = modulo positioning off (OFF) – 1 = shortest path – 2 = shortest path with reference to modulo limits – 4 = positive direction – 6 = negative direction
	0x2008.04	Method return value	Return code

Tab. 125 Modulo operation

PROFIdrive

Method	PNU	Function	Description
Modulo	10010	Controlling method	Value = 1: execute method Value = 0: reset method
	10011	Method status	Status
Modulo	10012	Method transfer value	Modulo mode – 0 = modulo positioning off (OFF) – 1 = shortest path – 2 = shortest path with reference to modulo limits

Method	PNU	Function	Description
Modulo			– 4 = positive direction – 6 = negative direction
	10013	Method return value	Return code

Tab. 126 Modulo operation

3.2 Fundamentals of Parameterisation

3.2.1 Depiction of the parameters

Structure of parameter IDs

All parameter IDs have the following structure to uniquely identify the parameter:

- System (0) or axis label (1, ...)
- Parameter number
- Instance (identification of the instance to differentiate between similar parameters of different components, e.g. position capture 1 and position capture 2).
- Index (identification of the differentiation of similar parameters within an instance, e.g., record type of record 1, 2, 3, etc.)

Depiction:

P[system or axis label].[parameter number].[instance].[index]

e.g.: "P1.1510.0.0"

Structure of the parameter tables

The parameter tables are structured as follows in the descriptions of the individual functions:

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. 127 Parameter example

Cell	Content/description
1	Parameter number
2	Name of the parameter
3	Brief description of the parameter. If required: additional information on the parameter, e.g. content of indices, value list, etc.
4	Access: The parameter can be read or written

Cell	Content/description
5	Update: change of the parameter: – Immediately effective: assumed immediately in the parameter – Reinitialisation: not effective until after reinitialisation – Restart: does not come into effect until after a restart of the device
6	Unit: – –: no unit – User-defined: position, velocity, acceleration or jerk according to parameterisation (see Px.1150.0.0, Current user unit) – explicit specification of the applicable unit (Nm, kg, s, ...)

Tab. 128 Legend for the parameter example

3.2.2 Data types

Data types used and their value ranges:

Data type	Variable and sign	Value range
BOOL	8-bit without sign	0 ... 255
CHAR	8-bit without sign	0 ... 255
UINT8	8-bit without sign	0 ... 255
SINT8	8-bit with sign	–128 ... 127
UINT16	16-bit without sign	0 ... 65536
SINT16	16-bit with sign	–32768 ... 32767
UINT32	32-bit without sign	0 ... $(2^{32}-1)$
SINT32	32-bit with sign	-2^{31} ... $(2^{32}-1)$
UINT64	64-bit without sign	0 ... $(2^{64}-1)$
SINT64	64-bit with sign	-2^{63} ... $(2^{64}-1)$
FLOAT32	32-bit with floating decimal	$1.17 * 10^{-38}$ ... $3.4 * 10^{38}$
FLOAT64	64-bit with floating decimal	$2.2 * 10^{-308}$ ... $1.8 * 10^{308}$
STRING(X)	X * 8-bit without sign	X * 0 ... 255

Tab. 129 Data types

3.2.3 Depiction 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 Object Tables

In the device-specific section, the function descriptions contain tables in which objects allocated to the parameters involved are listed.

The CiA 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	UINT16
469	0x6067.00	Monitoring window target position	UINT32
4610	0x606D.00	Monitoring window target speed	UINT16
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective. 2		
468	0x2166.09	Damping time target reached	FLOAT32
469	0x2166.0A	Monitoring window target position	FLOAT32
4610	0x2166.0B	Monitoring window target speed	FLOAT32
4611	0x2166.0C	Monitoring window target torque	FLOAT32
3	4	5	6

Tab. 130 Object Table Example

Cell	Content/description
1	Range for CiA 402 objects: only the parameters that are allocated to an object of the standard device profile for drives and motion controllers.
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; can differ from the data type of the parameter Recomm. maximum

Tab. 131 Legend for the Object Table Example

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	FloatingPoint
11280607	37.0	Deceleration MDI	FloatingPoint
11280604	34.0	Target position MDI	Integer64
11280605	35.0	Profile speed MDI	FloatingPoint

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters** 2		
11280606	12341.0	Acceleration MDI	FloatingPoint
11280607	12342.0	Deceleration MDI	FloatingPoint
11280604	12339.0	Target position MDI	Integer64
11280605	12340.0	Profile speed MDI	FloatingPoint
...	...	...	...
3	4	5	6

Tab. 132 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. 133 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 controller 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

Size		Basic unit		Data type
Power	P	Watt	W	FLOAT32
Time	t	Second	s	FLOAT32
Value specification in percent	%	—	—	FLOAT32

Tab. 134 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 conversion of these user units can be performed only in the "Pre-operational" state and requires a reinitialisation of the servo drive. As a result, all pertinent parameters in the servo drive are converted to the new user unit. The controller parameters do not have to be recalculated 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. 135 Configurable measuring units of the position

All measuring units for the position are depicted and preset with data type SINT64. The position is depicted in every measuring unit with a different number of decimal places.

Examples for the depiction of positions

– 0.001 m x 10^{10} ≙ 1 x 10^{7}
– 1 degree x 10^{6} ≙ 1 x 10^{6}

i

To simplify the entry for the user, the plug-in performs the necessary conversion in the commissioning software of Festo. During the use of the plug-in, the units shown there and/or resolution for the entry of the respective parameters must be used.
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	Velocity	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	Rev/s	Rev/s²	Rev/s³	FLOAT32
Revolution [1)]	r	rpm	rpm/s	rpm/s²	FLOAT32
Radian	rad	rad/s	rad/s²	rad/s³	FLOAT32
Degree	°	°/s	°/s²	°/s³	FLOAT32

1) Default

Tab. 136 Configurable measuring units of the position difference and derived variables of the position

i

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	Current user unit	Specifies the active user unit.	
		Access	read/–
		Update	effective immediately
		Unit	–
1151	Selection of next user unit	Selection of the next user unit – 0: Internal increments [Inci, Inci/s, ...] – 1: Increments [Inc, Inc/s, ...] – 2: Rev [rev, rps, ...] – 3: Rev [rev, rpm, ...] – 4: Rad [rad, rad/s, ...] – 5: Degree [°, °/s, ...] – 6: Metric [m, m/s, ...] – 7: Imperial [in, in/s, ...]	
		Access	read/write
		Update	reinitialization
		Unit	–

ID Px.	Parameter	Description	
1152	User unit status	Specifies whether the user unit is active	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 137 Parameter

CiA 402

Objects for the configurable measuring units

Parameters	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
1150	0x217C.01	Current user unit	UINT32
1151	0x217C.02	Selection of next user unit	UINT32
1152	0x217C.03	User unit status	UINT32

Tab. 138 Objects

PROFIdrive

PNUs for the configurable measuring units

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1150	11277.0	Current user unit	Unsigned32
1151	11278.0	Selection of next user unit	Unsigned32
1152	11279.0	User unit status	Unsigned32

Tab. 139 PNUs

3.2.4.3 Scaling of internal units for the fieldbus ("factor group")

The "factor group" and user unit depend directly on each other. 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 depiction of the parameters in the servo drive. The units are scaled to user units according to 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.

Parameters for the scaling of internal units for fieldbus

ID Px.	Parameter	Description	
7841	Resolution position	Determines 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	Determines 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	Determines 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	Determines the resolution of the jerk. The value is interpreted as ten-expont e.g. with meter and -3 the resolution is 1 mm/³.	
		Access	read/write
		Update	reinitialization
		Unit	–
7851	User unit position	Determines the user unit of the position.	
		Access	read/write
		Update	effective immediately
		Unit	–
7852	User unit velocity	Determines the user unit of the velocity.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
7853	User unit acceleration	Determines the user unit of the acceleration.	
		Access	read/write
		Update	effective immediately
		Unit	–
7854	User unit jerk	Determines the user unit of the jerk.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 140 Parameter

CiA 402

Objects for the scaling of internal units for fieldbus

Parameter	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
7841	0x2194.01	Resolution position	SINT8
7842	0x2194.02	Resolution velocity	SINT8
7843	0x2194.03	Resolution acceleration	SINT8
7844	0x2194.04	Resolution jerk	SINT8
7851	0x216E.01	User unit position	UINT16
7852	0x216E.02	User unit velocity	UINT16
7853	0x216E.03	User unit acceleration	UINT16
7854	0x216E.04	User unit jerk	UINT16

Tab. 141 Objects

Unit coding for CiA 402 user units

User unit	Values lists
Position	49920: SI Unit INCI 46336: SI Unit INC 46080: SI Unit ROUND (rev/s) 50176: SI Unit ROUND (rpm) 4096: SI Unit RAD 16640: SI Unit DEGREE 256: SI Unit METRE

User unit	Values lists
	49152: SI Unit INCH
Velocity	49923: SI Unit INCI 1/s 46339: SI Unit INC 1/s 46083: SI Unit ROUND (rev/s) 1/s 50247: SI Unit ROUND (rpm) 1/min 4099: SI Unit RAD 1/s 16643: SI Unit DEGREE 1/s 259: SI Unit METRE 1/s 49155: SI Unit INCH 1/s
Acceleration	50007: SI Unit INCI 1/s^2 46423: SI Unit INC 1/s^2 46167: SI Unit ROUND (U/s) 1/s^2 50369: SI Unit ROUND (rpm) 1/(min*s) 4183: SI Unit RAD 1/s^2 16727: SI Unit DEGREE 1/s^2 343: SI Unit METRE 1/s^2 49239: SI Unit INCH 1/s^2
Jerk	49920: SI Unit INCI 1/s^3 46336: SI Unit INC 1/s^3 46080: SI Unit ROUND (U/s) 1/s^3 50176: SI Unit ROUND (rpm) 1/(min*s^2) 4096: SI Unit RAD 1/s^3 16640: SI Unit DEGREE 1/s^3 256: SI Unit METRE 1/s^3 49152: SI Unit INCH 1/s^3

Tab. 142 Unit coding values list

Example

CMMT is parameterised to revolutions and revolutions per minute. This setting shall also be used through the device profile.

The following shall be parameterised:

– 1 position increment 0.00001 rev = 10 µrev
– 1 velocity increment 1 rpm
– 1 acceleration increment 1 rev/(min*s)
– 1 jerk increment 1 rev/(min*s^2)

Setting factor group parameters (example)		
Parameter	Value	Comments
Resolution position		

Setting factor group parameters (example)		
Parameter	Value	Comments
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}
Resolution jerk		
1.7843.0.0	0	Resolution 10^{-0}

Tab. 143 Parameters for setting factor group (example)

In CODESYS the increments must be set to 100000 so the module writes the position in the correct resolution.

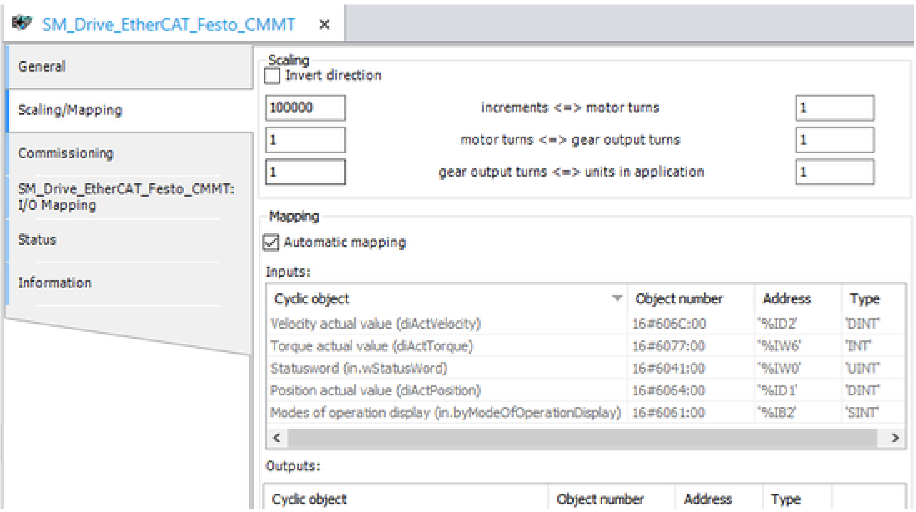


Fig. 30 Example of the user unit for revolutions

Example

CMMT is parameterised to metres. This setting shall also be used through the device profile.

The following shall be parameterised:

– Position increment 0.000001 m = 1 µm
– 1 velocity 0.001 m/s = 1 mm/s
– 1 acceleration 0.001 m/s² = 1 mm/s²
– 1 jerk 0.001 m/s³ = 1 mm/s³

Setting factor group parameters (example)		
Parameter	**Value**	**Comments**
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. 144 Setting factor group parameters (example)

In CODESYS the “Increments” field must be set to 1000000 so the module writes the position in the correct resolution.

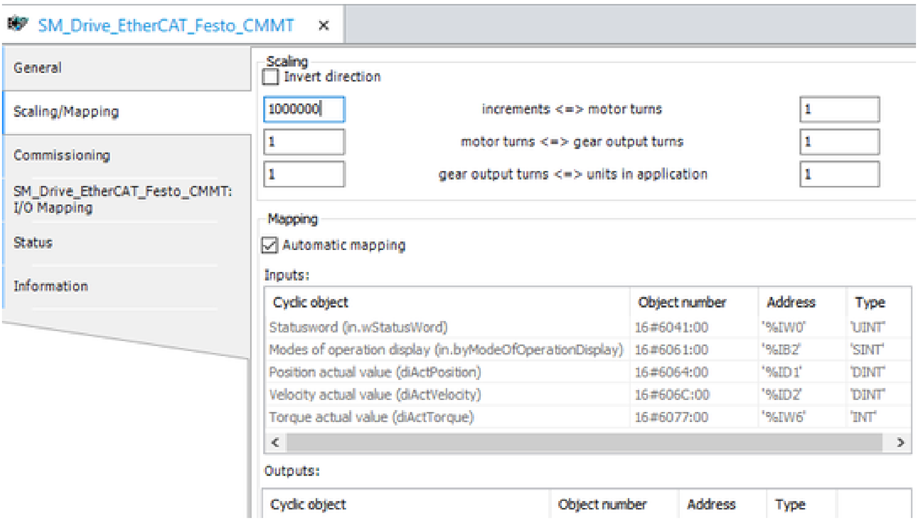


Fig. 31 Example of the user unit for metres

PROFIdrive

PNUs for the scaling of internal units for fieldbus

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
7841	11724.0	Resolution position	Integer8
7842	11725.0	Resolution velocity	Integer8
7843	11726.0	Resolution acceleration	Integer8
7844	11727.0	Resolution jerk	Integer8

Tab. 145 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 measuring reference system, the following steps must be taken during first-time commissioning.

– Defining the Axis Zero Point
– Limitation of the usable range by software end positions and/or limit switches
– Determine the reference point using a homing run and move the factory-set zero point of the absolute encoder

Signs and Directions in the Measuring Reference System

Fig. 32 Positive direction of rotation

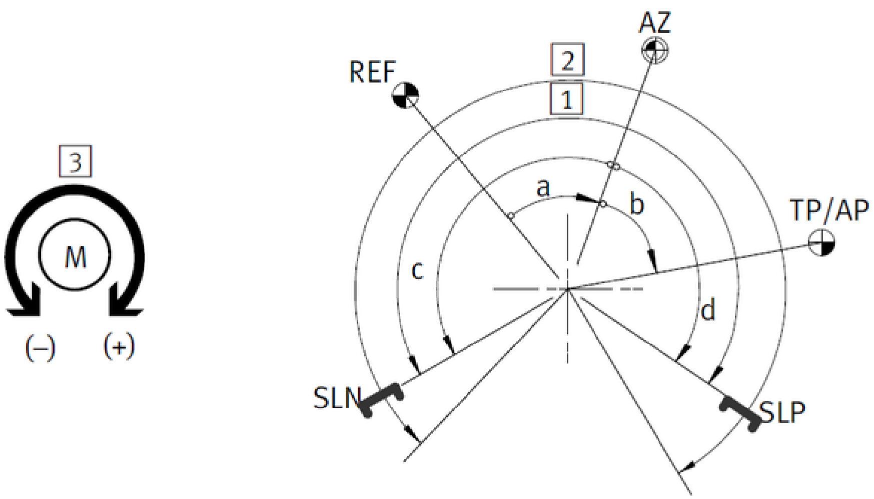
The indication of the signs or directions refer to the view on the front side of the motor drive shaft. The signs of all directional variables are defined at the factory as follows:

– Positive (+) = direction of movement with clockwise direction of rotation of the motor shaft
– Negative (–) = direction of movement with anti-clockwise direction of rotation of the motor shaft

The direction of movement of load is, for example, dependent on the spindle type of the axis (clockwise/anti-clockwise) and on the gear unit employed. If angular or toothed belt gear units are used, the opposite assignment of the direction of rotation can be advantageous and parameterised accordingly.

Rotational Measuring Reference System

Example: rotational drive



REF	Homing 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: positive software end position (SLP)[1]
1	Usable range
2	Working area
3	Direction of rotation with factory setting, looking at the front surface of the motor shaft

1) For rotating axes with the configuration "unlimited", no end position can be parameterised.

Tab. 146 Rotational Measuring Reference System (Positive Direction of Rotation)

Reference point	Calculation rule		
Axis zero point	AZ	= REF + a	
Negative software end position	SLN	= AZ + c	= REF + a + c
Positive software end position	SLP	= AZ + d	= REF + a + d
Target position/actual position	TP/AP	= AZ + b	

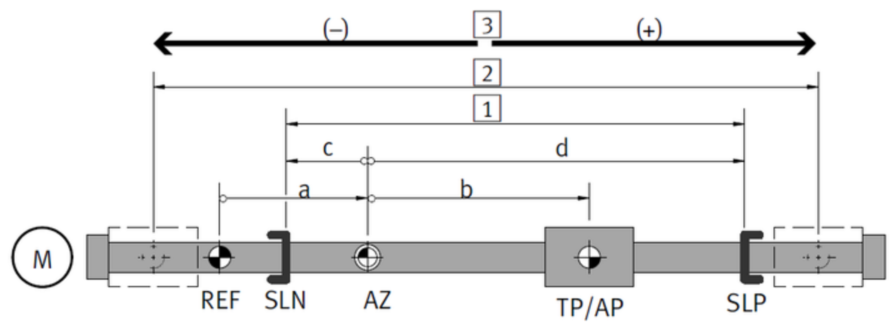
Tab. 147 Rotational Measuring Reference System – Calculation Rule

i

The various positions are specified according to the configured user unit. At the conversion of the user unit, the variables are converted automatically.

Linear Measuring Reference System

Example: linear drive



REF	Homing 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	Negative software end position (SLN)
d	Positive software end position (SLP)

Example: linear drive	
1	Usable range (working stroke)
2	Operating range (working stroke)
3	Direction of movement with the factory setting

Tab. 148 Linear Measuring Reference System

Reference point	Calculation rule		
Axis zero point	AZ	= REF + a	
Negative software end position	SLN	= AZ + c	= REF + a + c
Positive software end position	SLP	= AZ + d	= REF + a + d
Target position/actual position	TP/AP	= AZ + b	= REF + a + b

Tab. 149 Linear Measuring Reference System – Calculation Rule

i

The various positions are specified according to the configured user unit. At the conversion of the user unit, the variables are converted automatically ➔ 3.2.4 Measuring units.

Limitation of the Usable Range

The range of use can be limited by software end positions and hardware limit switches.

Software End Position SLN/SLP

Delineation of a usable range within the operating range takes place through 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 braked 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, no monitoring of software end positions takes place. If the drive is moved manually behind a software end position, after release of the controller, only travel in the opposite direction to the exceeded software limit is possible. If the target of the next positioning motion is beyond the software end position, an error is reported. If the target lies within the permitted area, travel outside the software end position is possible without error.

i

Additional information ➔ 5.6 Software limit 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 dependent on the limit switch type. The reaction of the device to limit switch signals can be parameterised using 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, travel is possible only in the reverse direction after acknowledgment of the error.

i

Additional information ➔ 5.5 Hardware limit switch reached.

Parameters and Diagnostic Messages

ID Px.	Parameter	Description	
1170	Reversing the direction of rotation	Determines whether the reversal of the direction of rotation shall be activated. This means: – 0: inactive – 1: active	
		Access	read/write
		Update	reinitialization
		Unit	–
1171	Invert encoder signal	Determines 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 ➔ Index for 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

ID Px.	Parameter	Description	
1172	Phase rotation	Update	reinitialization
		Unit	–

Tab. 150 Parameter

Diagnostic messages
No specific diagnostic messages are allocated to the function.

3.2.5.2 CiA 402

Objects for the measuring reference system

Parameters	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
1170	0x607E.00	Reversing the direction of rotation	UINT8
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
1170	0x217D.01	Reversing the direction of rotation	BOOL
1171	0x226E.01 ... 0A	Invert encoder signal	BOOL
1172	0x217D.02	Phase rotation	BOOL

Tab. 151 Objects

3.2.5.3 PROFIdrive

PNUs for the measuring reference system

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1170	11287.0	Reversing the direction of rotation	Boolean
1171	11288.0 ... 9	Invert encoder signal	Boolean
1172	11289.0	Phase rotation	Boolean

Tab. 152 PNUs

3.3 Drive Configuration

3.3.1 Motor configuration

3.3.1.1 Function

The device supports Festo motors and the use of the motors of other manufacturers (third-party motors). Information on the motor used must be provided to the device during the configuration of the drive system. The following options are available for configuration:

Configuration options	Description
Readout of motor data from the motor encoder	In the case of certain Festo motors, the motor data is stored in the EEPROM of the integrated encoder. If a corresponding motor is used by Festo, the motor data can be read out using the plug-in and assumed in the current project.
Configuring motor data	All required information to the motor can be configured with the plug-in or transferred to the device through the device profile used. In the case of third-party motors, the requirement information must be taken from the data sheet of the motor. In the case of Festo motors, the information is saved in the database of the current plug-in and assumed automatically in the project during the configuration procedure of the plug-in.

Tab. 153 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 (assume from the database or transfer manually, ➔ 3.3.1.2 Parameter and diagnostic messages for motor data from the user configuration)

Using parameter Px.14.0.0, it is possible to determine which motor data shall be assumed as active data. The motor data is fundamentally not assumed until after reinitialisation.

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Incorrect motor data can damage the motor!

• Check data before transfer.
• For transfer, reinitialise device.

The motor data is fundamentally not assumed until after reinitialisation. Incorrect motor data can damage the motor!

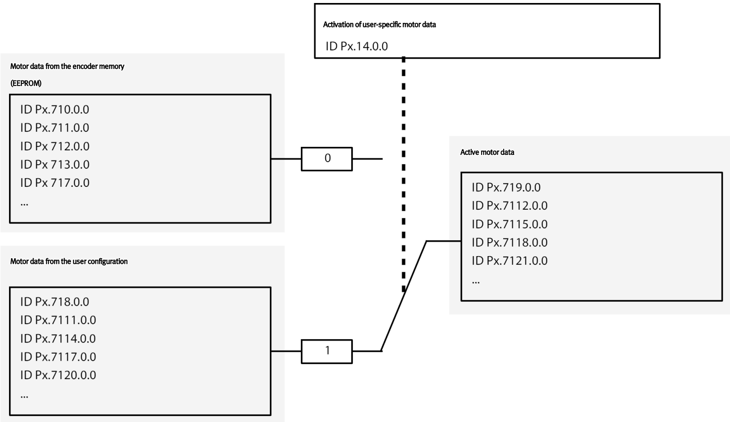

Fig. 33 Allocation of the motor data using parameter Px.14.0.0

3.3.1.2 Parameter and diagnostic messages for motor data from the user configuration

The following list contains the changeable motor data. During the configuration of Festo motors using the plug-in, the motor data is assumed automatically from the database after the selection of the motor. During the configuration of third-party motors, the data must be entered manually.

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	kgm^2
7114	Phase sequence (user defined)	Specifies whether the sequence of phases is swapped. The usu-al 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-	

ID Px.	Parameter	Description	
7114	Phase sequence (user defined)	#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
		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 speed (user defined)	Specifies the nominal rotary speed 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

ID Px.	Parameter	Description	
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. 155 Value list of the temperature sensor parameters.	
		Access	read/write
		Update	reinitialization
		Unit	–

<table>
<tr><th>ID Px.</th><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">7156</td><td rowspan="4">Temperature sensor characteristic (user defined)</td><td colspan="2">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</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>reinitialization</td></tr>
<tr><td>Unit</td><td>–</td></tr>
<tr><td rowspan="4">7159</td><td rowspan="4">Holding brake (user defined)</td><td colspan="2">Determines 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</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>reinitialization</td></tr>
<tr><td>Unit</td><td>–</td></tr>
<tr><td rowspan="4">7162</td><td rowspan="4">Switch-on delay holding brake (user defined)</td><td colspan="2">user-configured switch-on delay
Determines how long the next command is delayed after a controller enable. Using this parameter, the behaviour of the device is adapted to the inertia of the holding brake by parameters. No orders are processed until the switch-on delay has elapsed, so the holding brake can release completely.</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>reinitialization</td></tr>
<tr><td>Unit</td><td>s</td></tr>
<tr><td rowspan="4">7165</td><td rowspan="4">Switch-off delay holding brake (user defined)</td><td colspan="2">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. Using this parameter, the behaviour of the device is adapted to the inertia of the holding brake by parameters. The position controller is switched off after expiration of the switch-off delay. The holding brake should then be completely closed.</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>reinitialization</td></tr>
<tr><td>Unit</td><td>s</td></tr>
</table>

ID Px.	Parameter	Description	
7182	NOC 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)	Determines 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
		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

ID Px.	Parameter	Description	
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. 154 Parameter

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. 155 Value list of the temperature sensor parameters

ID Dx.	Name	Description
06 l 00 l 00248 (100663544)	Motor type is not supported	The parameterised motor type (servo, stepper etc.) is not supported

Tab. 156 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)	UINT32
7111	0x216C.02	Motor inertia (user defined)	FLOAT32
7114	0x216C.03	Phase sequence (user defined)	BOOL
7117	0x216C.04	Nominal current (user defined)	FLOAT32
7120	0x216C.05	Maximum peak current (user defined)	FLOAT32
7123	0x216C.06	Maximum rpm (user defined)	FLOAT32
7126	0x216C.07	Nominal rotary speed (user defined)	FLOAT32
7129	0x216C.08	Winding inductance (user defined)	FLOAT32
7132	0x216C.09	Winding resistance (user defined)	FLOAT32

Parameter	Index.Subindex	Name	Data type
7135	0x216C.0A	Torque constant (user defined)	FLOAT32
7144	0x216C.0B	Time constant I²t (user defined)	FLOAT32
7147	0x216C.0C	Winding temperature (user defined)	FLOAT32
7153	0x216C.0D	Temperature sensor (user defined)	UINT32
7156	0x225B.01 ... 02	Temperature sensor characteristic (user defined)	FLOAT32
7159	0x216C.0E	Holding brake (user defined)	BOOL
7162	0x216C.0F	Switch-on delay holding brake (user defined)	FLOAT32
7165	0x216C.10	Switch-off delay holding brake (user defined)	FLOAT32
7182	0x216C.11	NOC code motor (user defined)	STRING(32)
7184	0x216C.12	Database ID motor (user defined)	UINT32
71421	0x216C.13	Nominal motor voltage (user defined)	FLOAT32
71424	0x216C.14	Continuous current (user defined)	FLOAT32
71430	0x216C.15	Lq inductance (user defined)	FLOAT32
71431	0x216C.16	Ld inductance (user defined)	FLOAT32
71432	0x216C.17	Motor type	UINT8

Tab. 157 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)	Unsigned32
7111	11686.0	Motor inertia (user defined)	FloatingPoint
7114	11688.0	Phase sequence (user defined)	Boolean
7117	11690.0	Nominal current (user defined)	FloatingPoint
7120	11692.0	Maximum peak current (user defined)	FloatingPoint
7123	11694.0	Maximum rpm (user defined)	FloatingPoint
7126	11696.0	Nominal rotary speed (user defined)	FloatingPoint
7129	11698.0	Winding inductance (user defined)	FloatingPoint
7132	11700.0	Winding resistance (user defined)	FloatingPoint
7135	11702.0	Torque constant (user defined)	FloatingPoint

Parameter	PNU	Name	Data type
7144	11706.0	Time constant I^2t (user defined)	FloatingPoint
7147	11708.0	Winding temperature (user defined)	FloatingPoint
7153	11710.0	Temperature sensor (user defined)	Unsigned32
7156	11712.0 … 1	Temperature sensor characteristic (user defined)	FloatingPoint
7159	11714.0	Holding brake (user defined)	Boolean
7162	11716.0	Switch-on delay holding brake (user defined)	FloatingPoint
7165	11718.0	Switch-off delay holding brake (user defined)	FloatingPoint
7182	11720.0 … 31	NOC code motor (user defined)	STRING(32)
7184	11721.0	Database ID motor (user defined)	Unsigned32
71421	11918.0	Nominal motor voltage (user defined)	FloatingPoint
71424	11920.0	Continuous current (user defined)	FloatingPoint
71430	11926.0	Lq inductance (user defined)	FloatingPoint
71431	11927.0	Ld inductance (user defined)	FloatingPoint
71432	11928.0	Motor type	Unsigned8

Tab. 158 PNUs

3.3.1.5 Parameter and diagnostic messages for motor data from the EEPROM memory

If the motor data is stored in the EEPROM of the integrated encoder, the motor data can be read out. The read-out motor data is transferred to the parameters listed here.
The device has an encoder interface. The parameters of the encoder interface are allocated to instance 0.

<table>
<tr><th>ID Px.</th><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">710</td><td rowspan="4">Product key</td><td colspan="2">Specifies the product key of the motor.</td></tr>
<tr><td>Access</td><td>read/–</td></tr>
<tr><td>Update</td><td>reinitialization</td></tr>
<tr><td>Unit</td><td>–</td></tr>
<tr><td rowspan="4">711</td><td rowspan="4">NOC code</td><td colspan="2">Specifies the order code of the motor.</td></tr>
<tr><td>Access</td><td>read/–</td></tr>
<tr><td>Update</td><td>reinitialization</td></tr>
<tr><td>Unit</td><td>–</td></tr>
</table>

ID Px.	Parameter	Description	
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	kgm^2
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

ID Px.	Parameter	Description	
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 speed	Specifies the nominal rotary speed of the motor.	
		Access	read/–
		Update	reinitialization
		Unit	rpm
7128	Winding inductance	Indicates 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

ID Px.	Parameter	Description	
7143	Time constant I^2t	Specifies the duration for which the parameterised maximum current may act. In the case of a servomotor, the current set-point 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. 155 Value list of the temperature sensor parameters.	
		Access	read/–

ID Px.	Parameter	Description	
7152	Temperature sensor	Update	reinitialization
		Unit	–
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	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	The delay saved in the EEPROM for the deactivation of the regulator 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

ID Px.	Parameter	Description	
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
7430	Motor type	Selection of motor type -› data sheet of the motor.	
		Access	read/–
		Update	reinitialization
		Unit	–

Tab. 159 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. 160 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	Product key	STRING(15)
711	0x2106.03	NOC code	STRING(32)
712	0x2106.05	Material number	UINT32
713	0x2106.07	Serial number	STRING(20)
717	0x2106.09	Pole pairs	UINT32
7110	0x2106.0B	Motor inertia	FLOAT32
7113	0x2106.0D	Phase sequence	BOOL
7116	0x2106.0F	Nominal current	FLOAT32
7119	0x2106.11	Maximum current	FLOAT32
7122	0x2106.13	Maximum rpm	FLOAT32
7125	0x2106.15	Nominal rotary speed	FLOAT32
7128	0x2106.17	Winding inductance	FLOAT32
7131	0x2106.19	Winding resistance	FLOAT32
7134	0x2106.1B	Torque constant	FLOAT32
7143	0x2106.1D	Time constant I^2t	FLOAT32
7146	0x2106.1F	Winding temperature	FLOAT32
7149	0x2106.21	Nominal motor voltage	FLOAT32
7150	0x2106.23	Major version hardware	STRING(2)
7151	0x2106.25	Minor version hardware	UINT16
7152	0x2106.27	Temperature sensor	UINT32
7155	0x2202.01 ... 02	Temperature sensor characteristic	FLOAT32
7158	0x2106.29	Holding brake	BOOL
7161	0x2106.2B	Switch-on delay holding brake	FLOAT32

Parameter	Index.Subindex	Name	Data type
7164	0x2106.2D	Switch-off delay holding brake	FLOAT32
7181	0x2106.2F	Continuous current	FLOAT32
7183	0x2106.31	Encoder data set ID	UINT32
7186	0x2106.33	Major version motor data set	STRING(2)
7187	0x2106.35	Minor version motor data set	UINT16
7428	0x2106.37	Lq inductance	FLOAT32
7429	0x2106.39	Ld inductance	FLOAT32
7430	0x2106.3B	Motor type	UINT8

Tab. 161 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	NOC code	STRING(32)
712	2219.0	Material number	Unsigned32
713	2221.0 ... 19	Serial number	STRING(20)
717	2223.0	Pole pairs	Unsigned32
7110	2721.0	Motor inertia	FloatingPoint
7113	2723.0	Phase sequence	Boolean
7116	2725.0	Nominal current	FloatingPoint
7119	2727.0	Maximum current	FloatingPoint
7122	2729.0	Maximum rpm	FloatingPoint
7125	2731.0	Nominal rotary speed	FloatingPoint
7128	2733.0	Winding inductance	FloatingPoint
7131	2735.0	Winding resistance	FloatingPoint
7134	2737.0	Torque constant	FloatingPoint
7143	2739.0	Time constant I^2t	FloatingPoint
7146	2741.0	Winding temperature	FloatingPoint
7149	2743.0	Nominal motor voltage	FloatingPoint
7150	2745.0 ... 1	Major version hardware	STRING(2)

Parameter	PNU	Name	Data type
7151	2747.0	Minor version hardware	Unsigned16
7152	2749.0	Temperature sensor	Unsigned32
7155	2751.0 … 1	Temperature sensor characteristic	FloatingPoint
7158	2753.0	Holding brake	Boolean
7161	2755.0	Switch-on delay holding brake	FloatingPoint
7164	2757.0	Switch-off delay holding brake	FloatingPoint
7181	2759.0	Continuous current	FloatingPoint
7183	2761.0	Encoder data set ID	Unsigned32
7186	2763.0 … 1	Major version motor data set	STRING(2)
7187	2765.0	Minor version motor data set	Unsigned16
7428	2767.0	Lq inductance	FloatingPoint
7429	2769.0	Ld inductance	FloatingPoint
7430	2771.0	Motor type	Unsigned8

Tab. 162 Motor data object PNUs from the EEPROM memory

3.3.1.8 Active motor data parameters

The following parameters contain the active motor data. Using parameter Px.14.0.0, it is possible to determine which motor data shall be assumed as active motor data after reinitialisation ➔ Fig.33.

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	Current pole pairs	Specifies the number of pole pairs of the active motor.	
		Access	read/–
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
7112	Current motor inertia	Specifies the inertia of the active motor used.	
		Access	read/–
		Update	effective immediately
		Unit	kgm²
7115	Current 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	Current nominal current	Specifies the root mean square value of the nominal current when loading the motor with the nominal torque.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
7121	Current 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	Current maximum velocity	Specifies the current maximum velocity of the motor used.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
7127	Current nominal velocity	Specifies the current nominal velocity of the active motor.	
		Access	read/–
		Update	effective immediately
		Unit	user defined

ID Px.	Parameter	Description	
7130	Current 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	Current 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	Current 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	Current 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.	

ID Px.	Parameter	Description	
7145	Current time constant I^2t	Access	read/–
		Update	effective immediately
		Unit	s
7148	Current winding temperature	Specifies the maximum permissible winding temperature of the motor.	
		Access	read/–
		Update	effective immediately
		Unit	°C
7154	Current temperature sensor motor	Specifies the sensor type of the temperature sensor. Possible sensor types ➔ Tab. 155 Value list of the temperature sensor parameters.	
		Access	read/–
		Update	effective immediately
		Unit	–
7157	Current 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	Current switch-on delay holding brake	Specifies the currently used switch-on delay of the holding brake. Determines how long the next command is delayed after a controller enable. Using this parameter, the behaviour of the device is adapted to the inertia of the holding brake by parameters. No orders are processed until the switch-on delay has elapsed, so the holding brake can release completely.	
		Access	read/–

ID Px.	Parameter	Description	
7163	Current switch-on delay holding brake	Update	effective immediately
		Unit	s
7166	Current switch-off delay holding brake	Specifies the current 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. Using this parameter, the behaviour of the device is adapted to the inertia of the holding brake by parameters. 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	Current NOC code motor	Specifies the order code of the motor -> product labelling of the motor.	
		Access	read/–
		Update	effective immediately
		Unit	–
71422	Current 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	Current continuous current	Specifies the effective current that the motor requires to apply the stall torque.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
71426	Current Lq inductance	Specifies the currently 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

ID Px.	Parameter	Description	
71427	Current Ld inductance	Specifies the currently used inductance along the direction of the field. This value is a theoretical construct and cannot be measured.	
		Access	read/–
		Update	effective immediately
		Unit	H
71428	Motor type	Specifies the currently used selection of motor type.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 163 Parameter

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	Current nominal current	UINT32
7139	0x6076.00	Resulting nominal torque	UINT32
7188	0x6403.00	Current NOC 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	BOOL
719	0x2162.02	Current pole pairs	UINT32
7112	0x2162.03	Current motor inertia	FLOAT32
7115	0x2162.04	Current phase sequence	BOOL
7118	0x2162.05	Current nominal current	FLOAT32
7121	0x2162.06	Current maximum current	FLOAT32
7124	0x2162.07	Current maximum velocity	FLOAT32
7127	0x2162.08	Current nominal velocity	FLOAT32
7130	0x2162.09	Current winding inductance	FLOAT32
7133	0x2162.0A	Current winding resistance	FLOAT32
7136	0x2162.0B	Current torque constant	FLOAT32

Parameter	Index.Subindex	Name	Data type
7139	0x2162.0C	Resulting nominal torque	FLOAT32
7142	0x2162.0D	Resulting maximum torque	FLOAT32
7145	0x2162.0E	Current time constant I^2t	FLOAT32
7148	0x2162.0F	Current winding temperature	FLOAT32
7154	0x2162.10	Current temperature sensor motor	UINT32
7157	0x225A.01 … 02	Current temperature sensor characteristic motor	FLOAT32
7160	0x2162.11	Holding brake	BOOL
7163	0x2162.12	Current switch-on delay holding brake	FLOAT32
7166	0x2162.13	Current switch-off delay holding brake	FLOAT32
7188	0x2162.14	Current NOC code motor	STRING(32)
71422	0x2162.16	Current nominal motor voltage	FLOAT32
71425	0x2162.17	Current continuous current	FLOAT32
71426	0x2162.18	Current Lq inductance	FLOAT32
71427	0x2162.19	Current Ld inductance	FLOAT32
71428	0x2162.1A	Motor type	UINT8

Tab. 164 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	Boolean
719	11185.0	Current pole pairs	Unsigned32
7112	11687.0	Current motor inertia	FloatingPoint
7115	11689.0	Current phase sequence	Boolean
7118	11691.0	Current nominal current	FloatingPoint
7121	11693.0	Current maximum current	FloatingPoint
7124	11695.0	Current maximum velocity	FloatingPoint
7127	11697.0	Current nominal velocity	FloatingPoint
7130	11699.0	Current winding inductance	FloatingPoint
7133	11701.0	Current winding resistance	FloatingPoint

Parameter	PNU	Name	Data type
7136	11703.0	Current torque constant	FloatingPoint
7139	11704.0	Resulting nominal torque	FloatingPoint
7142	11705.0	Resulting maximum torque	FloatingPoint
7145	11707.0	Current time constant I^2t	FloatingPoint
7148	11709.0	Current winding temperature	FloatingPoint
7154	11711.0	Current temperature sensor motor	Unsigned32
7157	11713.0 … 1	Current temperature sensor characteristic motor	FloatingPoint
7160	11715.0	Holding brake	Boolean
7163	11717.0	Current switch-on delay holding brake	FloatingPoint
7166	11719.0	Current switch-off delay holding brake	FloatingPoint
7188	11722.0 … 31	Current NOC code motor	STRING(32)
71422	11919.0	Current nominal motor voltage	FloatingPoint
71425	11921.0	Current continuous current	FloatingPoint
71426	11922.0	Current Lq inductance	FloatingPoint
71427	11923.0	Current Ld inductance	FloatingPoint
71428	11924.0	Motor type	Unsigned8

Tab. 165 Active motor data PNU parameters

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	Connection	Name in the CMMT plug-in	Description
BR+/BR-	X6	Holding brake 1	Motor holding brake

Tab. 166 Output for the Brakes (Holding Brake)

The output is intended for the actuation of a brake that drops when the system is in a non-energised status and holds the motor and/or axis in position.
The mechanical delay of the brake means that release and activation takes a certain length of time.
The behaviour of the device can be adapted to the mechanical delay of the brake using parameters:

Parameter	Description
Switch-on delay	Delay in switching on the closed-loop controller until a command 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 accepted 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 controller: – Removal of the controller enable triggers a Category 1 stop. If the set rotational speed is 0, the signal for applying the holding brake is emitted. – The drive is maintained in its current position until the end of the switch-off delay. – The closed-loop controller is switched off after expiration of the switch-off delay.

Tab. 167 Switch-on and Switch-off Delay

Automatic Control of the Brake

The device controls the output for the brake.

Control of the Brakes	
Event	Behaviour
#STO request	– The output stage is switched off immediately. – The outputs are switched off. The brakes apply immediately. – The device enters the “Not ready for operation” status. – An error message is emitted (error status). The error must be reset. When the request is rescinded, the drive can be set in the "ready for operation" status again through the controller enable.
The controller enable (RF) is rescinded	– Stop category 1 – If the set velocity is 0, the brake outputs are switched off. The brakes apply. – The closed-loop controller is switched off upon expiry of the parameterised delay to prevent an unwanted movement of the drive.

Control of the Brakes	
Event	Behaviour
The controller enable (RF) is granted	– The outputs are switched on to release the brakes (exception; force operating mode with brake). The brakes release with a mechanical delay. – The position controller assumes the control (actual position = setpoint position). – The motion commands are not accepted until the parameterised delay has been expired.

Tab. 168 Control of the Brakes

Manual Release of the Holding Brake or Clamping Unit

If the controller release is withdrawn, the output is reset and the holding brake is applied. The holding brake can be released manually in this status.

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- When the brake is released manually, suspended loads generally drop.

Manual release through ...	Description
Open holding brake input (configurable)	The holding brake is released at high level or low level depending on the parameterised switching function ➔ 3.3.2.2 Parameters and Diagnostic Messages.
Plug-in	➔ 2.4.2
Device profile	➔ 3.3.2.3 CiA 402 ➔ 3.3.2.4 PROFIdrive

Tab. 169 Releasing the Holding Brake

When the closed-loop controller is released again, the output is controlled as required for the active operating mode. Another rescinding of the controller enables results in the actuation of the holding brakes ➔ Tab. 168 Control of the Brakes. In order to release the holding brake again, a new level change from low to high is required.

Timing

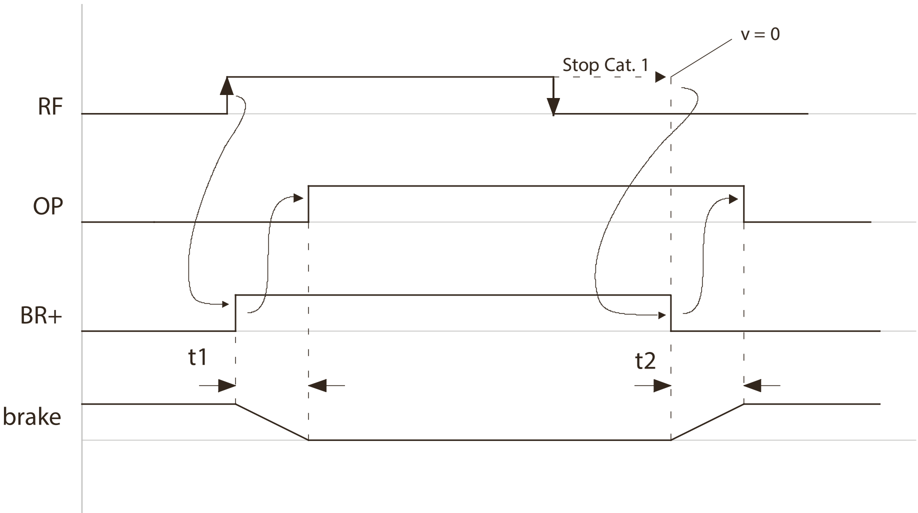

Fig. 34 Brake control timing (example)

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. 170 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 to Px.40003 and after a delay time of Px.40002 the voltage reduction is performed to the parameterised voltage value of Px.40004.

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The voltages for the holding brake in Px.40003 and Px.40004 may not be higher than the logic supply voltage regardless of the parameterisation.

3.3.2.2 Parameters and Diagnostic Messages

ID Px.	Parameter	Description	
20	Switch-on delay holding brake 1	Determines 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	Determines how long the closed-loop controller shall hold the current 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. 172 Holding Brake Status Parameter Values List.	
		Access	read/–
		Update	effective immediately
		Unit	–
29	Selection of holding brake (manual opening)	Selection of holding brake for manual opening – 0: holding brake 1	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
7162	Switch-on delay holding brake (user defined)	user-configured switch-on delay	
		Access	read/write
		Update	reinitialization
		Unit	s
7165	Switch-off delay holding brake (user defined)	user-configured switch-off delay	
		Access	read/write
		Update	reinitialization
		Unit	s
7163	Current switch-on delay holding brake	Specifies the currently used switch-on delay of the holding brake.	
		Access	read/–
		Update	effective immediately
		Unit	s
7166	Current switch-off delay holding brake	Specifies the current effective delay for switching off the closed-loop control.	
		Access	read/–
		Update	effective immediately
		Unit	s
7161	Switch-on delay holding brake	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	The delay saved in the EEPROM for the deactivation of the regulator if an electronic data sheet for the Festo motor is stored.	
		Access	read/–
		Update	reinitialization
		Unit	s
40001	Activation current reduction holding brake	Activation of the current reduction for the holding brake.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
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.4001.0.0)	
		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. 171 Parameter

Value	Status	Description
0	Closed	The holding brake is closed
1	Open	The holding brake is open
2	Opened	The holding brake is being opened
3	Closed	Holding brake is being closed

Tab. 172 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

Parameters	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	FLOAT32
21	0x2150.02	Switch-off delay holding brake 1	FLOAT32

Parameters	Index.Subindex	Name	Data type
24	0x2150.05	Status holding brake 1	UINT32
29	0x2150.09	Selection of holding brake (manual opening)	UINT32
7162	0x216C.0F	Switch-on delay holding brake (user defined)	FLOAT32
7165	0x216C.10	Switch-off delay holding brake (user defined)	FLOAT32
7163	0x2162.12	Current switch-on delay holding brake	FLOAT32
7166	0x2162.13	Current switch-off delay holding brake	FLOAT32
7161	0x2106.2B	Switch-on delay holding brake	FLOAT32
7164	0x2106.2D	Switch-off delay holding brake	FLOAT32
40001	0x21A7.01	Activation current reduction holding brake	BOOL
40002	0x21A7.02	Delay time	FLOAT32
40003	0x21A7.03	Supply voltage holding brake	FLOAT32
40004	0x21A7.04	Holding voltage	FLOAT32

Tab. 173 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	FloatingPoint
21	11003.0	Switch-off delay holding brake 1	FloatingPoint
24	11006.0	Status holding brake 1	Unsigned32
29	11011.0	Selection of holding brake (manual opening)	Unsigned32
7162	11716.0	Switch-on delay holding brake (user defined)	FloatingPoint
7165	11718.0	Switch-off delay holding brake (user defined)	FloatingPoint
7163	11717.0	Current switch-on delay holding brake	FloatingPoint
7166	11719.0	Current switch-off delay holding brake	FloatingPoint
7161	2755.0	Switch-on delay holding brake	FloatingPoint
7164	2757.0	Switch-off delay holding brake	FloatingPoint
40001	12409.0	Activation current reduction holding brake	Boolean
40002	12410.0	Delay time	FloatingPoint
40003	12411.0	Supply voltage holding brake	FloatingPoint

Parameter	PNU	Name	Data type
40004	12412.0	Holding voltage	FloatingPoint

Tab. 174 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 the configuration is performed with the device-specific plug-in, the required data for the encoder configuration is assumed automatically in 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 and N signals), e.g. ROD 426 or compatible
BiSS C protocol	Absolute encoders with BiSS interface that support the BiSS C protocol.

Tab. 175 Supported Standards and Protocols

3.3.3.2 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 assumed during reinitialisation as active data independently of parameter Px.14.0.0 ➔ Fig.33.

<table>
<tr><th>ID Px.</th><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">3219</td><td rowspan="4">Commutation angle from user configuration</td><td colspan="2">Determines 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).</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>reinitialization</td></tr>
<tr><td>Unit</td><td>–</td></tr>
<tr><td rowspan="4">3220</td><td rowspan="4">Current commutation angle</td><td colspan="2">Specifies the currently used commutation angle.</td></tr>
<tr><td>Access</td><td>read/–</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>–</td></tr>
</table>

ID Px.	Parameter	Description	
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	Determines the zero point offset saved in the parameter set.	
		Access	read/write
		Update	reinitialization
		Unit	r
3224	Current zero point off-set	Specifies the currently 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	Determines 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	Current referencing is valid	Displays whether the current homing status shall be valid. This means: – 0: invalid – 1: valid	
		Access	read/–
		Update	effective immediately

ID Px.	Parameter	Description	
3227	Current referencing is valid	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
		Unit	–
3230	Current commutation angle valid	Displays whether the current commutation status shall be valid. This means: – 0: invalid – 1: valid	
		Access	read/–
		Update	effective immediately
		Unit	–
3234	Electrical angular frequency filtered	Specifies the current angular frequency as a filtered value.	
		Access	read/–
		Update	effective immediately
		Unit	Hz
3236	Deactivation motor change check	Determines whether the switch-on phase shall be checked as to whether the detected motor encoder corresponds with the last motor encoder used. The following applies: 0: motor change check active, 1: motor change check inactive. The last motor encoder used is stored after valid homing and saving in the parameter set. The check compares the data in the memory of the encoder with data stored in the parameter set of the device.	

ID Px.	Parameter	Description	
3236	Deactivation motor change check	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	Determines 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	Determines 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.35	

ID Px.	Parameter	Description	
3251	Selection gear ratio group	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	
		Access	read/–
		Update	effective immediately
		Unit	–
11601	Absolute position in user units	Indicate the position in the user units in relation to the axis zero point.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
11602	Velocity in user units	Specifies the current 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

ID Px.	Parameter	Description	
11608	Commutation angle from encoder memory	Specifies the commutation angle saved in the encoder.	
		Access	read/write
		Update	reinitialization
		Unit	–
11615	Current position	Specifies the current 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	Determines 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. 178 Encoder Selection Values List (Px.11616).	
		Access	read/write
		Update	reinitialization
		Unit	–
11617	Active encoder	Specifies the encoder type currently configured for the encoder interface.	
		Access	read/–
		Update	effective immediately
		Unit	–
11618	Velocity filter filter time constant	Determines the filter time constant of the velocity filter. The filter time constant prevents or dampen signal noise in the encoder signal.	
		Access	read/write
		Update	effective immediately
		Unit	s

ID Px.	Parameter	Description	
71500	Actual acceleration value unfiltered	Displays the actual value of the acceleration unfiltered	
		Access	read/–
		Update	effective immediately
		Unit	Inci/s²
71501	Actual acceleration value filtered	Displays the actual value of the acceleration filtered	
		Access	read/–
		Update	effective immediately
		Unit	Inci/s²
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. 176 Encoder Parameters

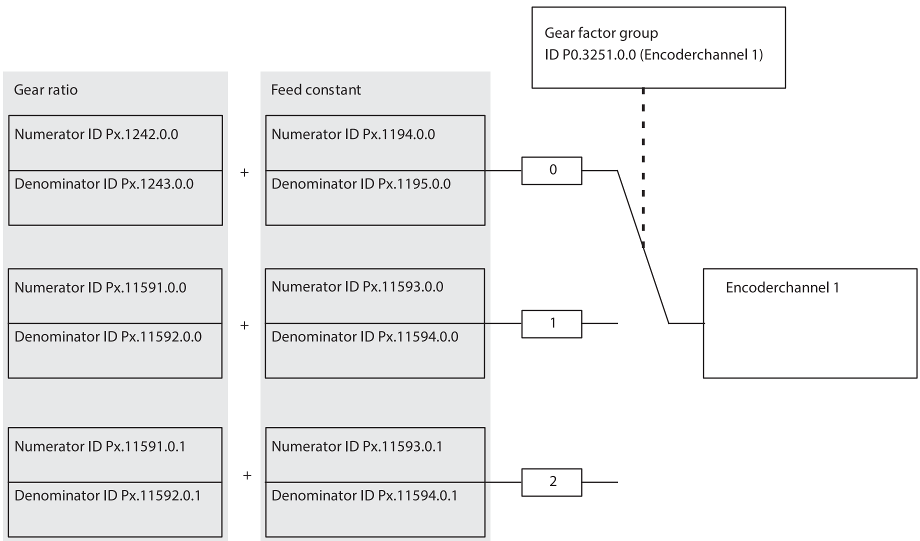


Fig. 35 Selection of the gear ratio and feed constant using the gear ratio group

Name	Description
Gear ratio	Gear ratio
Feed constant	Feed constant
Numerator	Numerator
Denominator	Denominator
Encoderchannel	Encoder channel

Tab. 177 Legend for Selection of the Gear Ratio and Feed Constant

Value list of the encoder selection parameter (Px.11616)		
Value	Standards/protocols	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	Absolut encoders with BiSS C protocol

Tab. 178 Encoder Selection Values List (Px.11616)

Example
A motor with the incremental distance measuring system should be used.

Parameter settings (example)		
Parameter	Value	Comments
Encoder selection		
P0.11616.0.0	4	Instance 0 for encoder channel 1, encoder type: incremental encoder (A, B, N)

Tab. 179 Example: Encoder Selection

ID Dx.	Name	Description
18 l 00 l 00092 (301989980)	Motor change detected, commutation angle invalid	Motor change detected, commutation angle invalid
18 l 00 l 00093 (301989981)	Motor change detected, zero point offset invalid	Motor change detected, zero point offset invalid
18 l 00 l 00094 (301989982)	Commutation angle in encoder invalid	Commutation angle in encoder invalid
18 l 00 l 00095 (301989983)	Encoder type plate invalid	Encoder type plate invalid
18 l 00 l 00096 (301989984)	Encoder type plate (user defined) invalid	Encoder type plate (user defined) invalid

ID Dx.	Name	Description
18 I 00 I 00227 (301990115)	Encoder identification reports incorrect encoder type	Encoder identification reports incorrect encoder type

Tab. 180 Encoder Diagnostic Messages

3.3.3.3 CiA 402

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	0x2130.1F	Commutation angle from user configuration	SINT64
3220	0x2130.21	Current commutation angle	SINT64
3221	0x2130.23	Zero point offset from encoder memory	SINT64
3223	0x2130.25	Zero point offset from user configuration	SINT64
3224	0x2130.27	Current zero point offset	SINT64
3225	0x2130.29	Encoder referencing is valid	BOOL
3226	0x2130.2B	Referencing in user configuration is valid	BOOL
3227	0x2130.2D	Current referencing is valid	BOOL
3228	0x2130.2F	Valid commutation angle from encoder memory	BOOL
3229	0x2130.31	Valid commutation angle from user configura-tion	BOOL
3230	0x2130.33	Current commutation angle valid	BOOL
3234	0x2130.39	Electrical angular frequency filtered	FLOAT32
3236	0x2130.3D	Deactivation motor change check	BOOL
3237	0x2130.3F	Encoder permanently homed	BOOL
3250	0x2130.59	Activation automatic encoder detection	BOOL
3251	0x2130.5B	Selection gear ratio group	UINT8
11600	0x2130.5D	Standardised encoder position	SINT64
11601	0x2130.5F	Absolute position in user units	SINT64
11602	0x2130.61	Velocity in user units	FLOAT32
11603	0x2130.63	Filtered velocity in user units	FLOAT32
11604	0x2130.65	Electrical angle	UINT32
11605	0x2130.67	Electrical angular frequency	FLOAT32

Parameter	Index.Subindex	Name	Data type
11608	0x2130.6D	Commutation angle from encoder memory	SINT64
11615	0x2130.7B	Current position	SINT64
11616	0x2130.7D	Encoder selection	UINT32
11617	0x2130.7F	Active encoder	UINT32
11618	0x2130.81	Velocity filter filter time constant	FLOAT32
71500	0x2130.93	Actual acceleration value unfiltered	FLOAT32
71501	0x2130.95	Actual acceleration value filtered	FLOAT32
71502	0x2130.97	Filter time constant acceleration filter	FLOAT32

Tab. 181 Objects

3.3.3.4 PROFIdrive

PNUs for encoder channels 1/2

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
3219	2408.0	Commutation angle from user configuration	Integer64
3220	2410.0	Current commutation angle	Integer64
3221	2412.0	Zero point offset from encoder memory	Integer64
3223	2414.0	Zero point offset from user configuration	Integer64
3224	2416.0	Current zero point offset	Integer64
3225	2418.0	Encoder referencing is valid	Boolean
3226	2420.0	Referencing in user configuration is valid	Boolean
3227	2422.0	Current referencing is valid	Boolean
3228	2424.0	Valid commutation angle from encoder memory	Boolean
3229	2426.0	Valid commutation angle from user configuration	Boolean
3230	2428.0	Current commutation angle valid	Boolean
3234	2434.0	Electrical angular frequency filtered	FloatingPoint
3236	2438.0	Deactivation motor change check	Boolean
3237	2440.0	Encoder permanently homed	Boolean
3250	2466.0	Activation automatic encoder detection	Boolean
3251	2468.0	Selection gear ratio group	Unsigned8

Parameter	PNU	Name	Data type
11600	2937.0	Standardised encoder position	Integer64
11601	2939.0	Absolute position in user units	Integer64
11602	2941.0	Velocity in user units	FloatingPoint
11603	2943.0	Filtered velocity in user units	FloatingPoint
11604	2945.0	Electrical angle	Unsigned32
11605	2947.0	Electrical angular frequency	FloatingPoint
11608	2953.0	Commutation angle from encoder memory	Integer64
11615	2967.0	Current position	Integer64
11616	2969.0	Encoder selection	Unsigned32
11617	2971.0	Active encoder	Unsigned32
11618	2973.0	Velocity filter filter time constant	FloatingPoint
71500	3073.0	Actual acceleration value unfiltered	FloatingPoint
71501	3075.0	Actual acceleration value filtered	FloatingPoint
71502	3077.0	Filter time constant acceleration filter	FloatingPoint

Tab. 182 PNUs

3.3.3.5 Parameters of Digital Incremental Encoders (A, B and N Signals)

ID Px.	Parameter	Description	
10040	Encoder resolution	Specifies the number of increments per Encoder revolution. Parameter P0.10040.0.0 for the encoder at encoder interface 1 and parameter P0.10040.1.0 for the encoder at encoder interface 2 (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	–

ID Px.	Parameter	Description	
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	–
10043	Quadrature evalu-ation	Determines how the quadrature signal of the encoder shall be evaluated. This means: – 1: single evaluation – 2: double evaluation – 4: quadruple evaluation	
		Access	read/write
		Update	reinitialization
		Unit	–
10044	Activate of position correction when zero pulse	Determines whether the position value is automatically correc-ted to 0 in the case of a zero pulse from the incremental encoder. This means: – 0: inactive – 1: active	
		Access	read/write
		Update	reinitialization
		Unit	–

Tab. 183 Parameters of Digital Incremental Encoders (A, B and N Signals)

ID Dx.	Name	Description
18 l 03 l 00235 (302186731)	Incremental encoder analysis invalid	Common error quadrature encoder

Tab. 184 Diagnostic Messages for Digital Incremental Encoders (A, B and N Signals)

Example

A motor with incremental distance measuring system shall be used (resolution 2000 inc./rev., quad-ruple evaluation, gear unit 3:1, feed constant = 90 mm/rev

Parameter settings (example)		
Parameter	Value	Comments
Encoder selection		

Parameter settings (example)		
Parameter	Value	Comments
P0.11616.0.0	4	Instance 0 for encoder channel 1, encoder type: incremental encoder
Encoder resolution		
P0.10040.0.0	2000	With a resolution of 2000 inc./rev., there is an effective internal resolution of 8000 inc./rev.
Quadrature evaluation		
P0.10043.0.0	4	Quadruple evaluation
Gear unit numerator		
P1.1242.0.0	3	Numerator of total gear unit factor
Gear unit denominator		
P1.1243.0.0	1	Denominator of total gear unit factor
Feed constant numerator		
P1.1194.0.0	9	0.09 m (corresponds with 9/100)
Feed constant denominator		
P1.1195.0.0	100	0.09 m (corresponds with 9/100)
Selection gear ratio group		
P0.3251.0.0	0	Gear ratio group 1 (➔ Fig.35)

Tab. 185 Example: Encoder Parameterisation

3.3.3.6 CiA 402

Objects of digital incremental encoders (A, B and N signals)

Parameters	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
10040	0x2138.01	Encoder resolution	UINT16
10041	0x2138.04	Raw value position	UINT16
10042	0x2138.07	Raw value number of revolutions	SINT16
10043	0x2138.0A	Quadrature evaluation	UINT8
10044	0x2138.0D	Activate of position correction when zero pulse	BOOL

Tab. 186 Objects

3.3.3.7 PROFIdrive

PNUs for digital incremental encoders (A, B and N signals)

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
10040	2837.0	Encoder resolution	Unsigned16
10041	2840.0	Raw value position	Unsigned16
10042	2843.0	Raw value number of revolutions	Integer16
10043	2846.0	Quadrature evaluation	Unsigned8
10044	2849.0	Activate of position correction when zero pulse	Boolean
10046	2852.0	Supply voltage encoder	FloatingPoint
10049	2855.0	Encoder supply voltage monitoring window	FloatingPoint

Tab. 187 PNUs

3.3.3.8 Parameters of Encoders with the BiSS C Protocol

ID Px.	Parameter	Description	
3601	Resolution single turn	Specifies the resolution in bits per revolution.	
		Access	read/write
		Update	reinitialization
		Unit	–
3602	Resolution multiturn	Specifies the number of bits for the distinguishable revolutions of the multiturn scanning of the encoder.	
		Access	read/write
		Update	reinitialization
		Unit	–
3603	Single-turn position	Specifies the current position of the singleturn scanning of the encoder.	
		Access	read/–
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
3604	Multi-turn numerator	Specifies the current position of the multiturn scanning of the encoder.	
		Access	read/–
		Update	effective immediately
		Unit	–
3610	CRC BiSS-C	Specifies the size of the BiSS-C checksum in bits.	
		Access	read/–
		Update	effective immediately
		Unit	–
3612	Baud rate	Defines the baud rate at which the encoder data is transmitted.	
		Access	read/write
		Update	reinitialization
		Unit	–
3613	Activation of correction table	Determines 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	Defines whether the extended encoder data of the encoder should be used. This means: – 0: inactive – 1: active	
		Access	read/write
		Update	reinitialization
		Unit	–
3624	unused	unused	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 188 Parameters of Encoders with the BiSS C Protocol

ID Dx.	Name	Description
18 I 05 I 00239 (302317807)	BiSS-C encoder analysis invalid	Check the wiring of the encoder and the position resolution of the BiSS-C protocol.

Tab. 189 Diagnostic Messages for Encoders with BiSS-C Protocol

3.3.3.9 CiA 402

Objects for encoders with the BBiSS-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	UINT32
3602	0x21A2.02	Resolution multiturn	UINT32
3603	0x21A2.03	Single-turn position	UINT32
3604	0x21A2.04	Multi-turn numerator	UINT32
3610	0x21A2.0A	CRC BiSS-C	UINT8
3612	0x21A2.0C	Baud rate	UINT32
3613	0x21A2.0D	Activation of correction table	BOOL
3618	0x21A2.0E	Activation read out extended encoder data	BOOL
3624	0x21A2.14	unused	STRING(20)

Tab. 190 Objects

3.3.3.10 PROFIdrive

PNUs for encoders with BiSS

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
3601	3327.0	Resolution single turn	Unsigned32
3602	3328.0	Resolution multiturn	Unsigned32
3603	3329.0	Single-turn position	Unsigned32
3604	3330.0	Multi-turn numerator	Unsigned32
3610	3336.0	CRC BiSS-C	Unsigned8
3612	3338.0	Baud rate	Unsigned32
3613	3339.0	Activation of correction table	Boolean
3618	3343.0	Activation read out extended encoder data	Boolean

Parameter	PNU	Name	Data type
3624	3349.0 ... 19	unused	STRING(20)

Tab. 191 PNUs

3.3.3.11 Parameters of the Actual Value Management

ID Px.	Parameter	Description	
122	Encoder channel 1 position	Determines 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	Specifies the current actual position value of the primary encoder.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
1210	Actual velocity value	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

ID Px.	Parameter	Description	
113104	Actual value of modulo	Actual value based on the modulo limits	
		Access	ro
		Update	effective immediately
		Unit	user defined

Tab. 192 Parameters of the Actual Value Management

3.3.3.12 CiA 402

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	SINT32
1210	0x606C.00	Actual velocity value	SINT32
113104	0x6064.00	Actual value of modulo	SINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
122	0x2155.03	Encoder channel 1 position	UINT32
128	0x2155.09	Actual position value	SINT64
1210	0x2155.0B	Actual velocity value	FLOAT32
1212	0x2155.0D	Electrical angle	UINT32
1213	0x2155.0E	Electrical angular frequency	FLOAT32
113104	0x2197.05	Actual value of modulo	SINT64

Tab. 193 Objects

3.3.3.13 PROFIdrive

PNUs of actual value management

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value	FloatingPoint
113104	28.0	Actual value of modulo	Integer64
Px.	**Manufacturer-specific parameters**		
122	11061.0	Encoder channel 1 position	Unsigned32
128	11067.0	Actual position value	Integer64

Parameter	PNU	Name	Data type
1210	11311.0	Actual velocity value	FloatingPoint
1212	11313.0	Electrical angle	Unsigned32
1213	11314.0	Electrical angular frequency	FloatingPoint
113104	12117.0	Actual value of modulo	Integer64

Tab. 194 PNUs

3.3.3.14 Parameters of the Direction of Rotation Manager

The following parameters influence the direction of rotation of the drive:

ID Px.	Parameter	Description	
1170	Reversing the direction of rotation	Determines whether the reversal of the direction of rotation shall be activated. This means: – 0: inactive – 1: active	
		Access	read/write
		Update	reinitialization
		Unit	–
1171	Invert encoder signal	Determines 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 ➔ Index for 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

ID Px.	Parameter	Description	
1172	Phase rotation	Update	reinitialization
		Unit	–

Tab. 195 Parameters of the Direction of Rotation Manager

Index for the "Invert encoder signal" parameter (Px.1171.0.x)	
Index	Assignment
0	Encoder at connection [X2]
1	Providing parameters for future extensions
...	
8	
9	

Tab. 196 Index for the Invert Encoder Signal Parameter (Px.1171)

3.3.3.15 CiA 402

Objects of direction of rotation manager

Parameters	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
1170	0x607E.00	Reversing the direction of rotation	UINT8
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
1170	0x217D.01	Reversing the direction of rotation	BOOL
1171	0x226E.01 ... 0A	Invert encoder signal	BOOL
1172	0x217D.02	Phase rotation	BOOL

Tab. 197 Objects

3.3.3.16 PROFIdrive

PNUs of direction of rotation manager

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1170	11287.0	Reversing the direction of rotation	Boolean
1171	11288.0 ... 9	Invert encoder signal	Boolean
1172	11289.0	Phase rotation	Boolean

Tab. 198 PNUs

3.3.3.17 Parameters of the Commutation-Angle Detection

Commutation-angle detection normally does not have to be performed. If no valid commutation angle has been found in the current data record, the commutation-angle detection is performed automatically. For encoders that do not provide an absolute position on a revolution, a commutation-angle detection is performed once in the switch-on phase. If a commutation-angle detection is required, the drive system must not demonstrate excessive function. The motor shaft should be freely rotating during the commutation-angle detection. After a successful commutation-angle detection, the parameter set must be saved on the device.

ID Px.	Parameter	Description	
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	Determines the time duration of the current rise ramp for the commutation-angle detection.	
		Access	read/write
		Update	effective immediately
		Unit	s
664	Increments	Determines the increment for the commutation-angle detection.	
		Access	read/write
		Update	effective immediately
		Unit	–
668	Mode	Determines the mode of the commutation-angle detection. This means: – 0: always (at each controller enable) – 1: automatic (only once at the first controller enable) – 2: off	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
669	Velocity	Determines the set velocity for the commutation-angle detection.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
6691	Acceleration	Determines the set acceleration for the commutation-angle detection.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
6692	Jerk	Determines the set jerk for the commutation-angle detection.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
6693	Monitoring window angle	Determines the size of the window for monitoring the commutation-angle detection.	
		Access	read/write
		Update	effective immediately
		Unit	–
6694	Factor current setpoint value	Defines the factor for the current setpoint used for the commutation angle determination.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 199 Parameters of the Commutation-Angle Detection

ID Dx.	Name	Description
07 I 04 I 00136 (117702792)	Commutation finding failed	Commutation finding failed
07 I 04 I 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. 200 Diagnostic Messages for the Commutation-Angle Detection

3.3.3.18 CiA 402

Objects of the commutation-angle detection

Parameters	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	UINT32
661	0x216B.02	Commutation finding status	UINT32
662	0x219C.03	Time current increase	FLOAT32
664	0x216B.04	Increments	FLOAT32
668	0x216B.06	Mode	UINT32
669	0x216B.07	Velocity	FLOAT32
6691	0x216B.0A	Acceleration	FLOAT32
6692	0x216B.0B	Jerk	FLOAT32
6693	0x216B.0C	Monitoring window angle	FLOAT32
6694	0x219C.14	Factor current setpoint value	FLOAT32

Tab. 201 Objects

3.3.3.19 PROFIdrive

PNUs for commutation-angle detection

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
660	11177.0	Status of state machine commutation finding	Unsigned32
661	11178.0	Commutation finding status	Unsigned32
662	11179.0	Time current increase	FloatingPoint
664	11180.0	Increments	FloatingPoint
668	11182.0	Mode	Unsigned32
669	11183.0	Velocity	FloatingPoint
6691	11682.0	Acceleration	FloatingPoint
6692	11683.0	Jerk	FloatingPoint
6693	11684.0	Monitoring window angle	FloatingPoint
6694	11685.0	Factor current setpoint value	FloatingPoint

Tab. 202 PNUs

3.3.3.20 Replacement of Motors without an Electronic Data Sheet

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 exchanged, the CMMT generates a corresponding error message.
The exchange of the motor requires another homing run because the zero point offset in the encoder is labelled as invalid.

After the 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 area with the "Store on device" command).

Diagnostic Messages

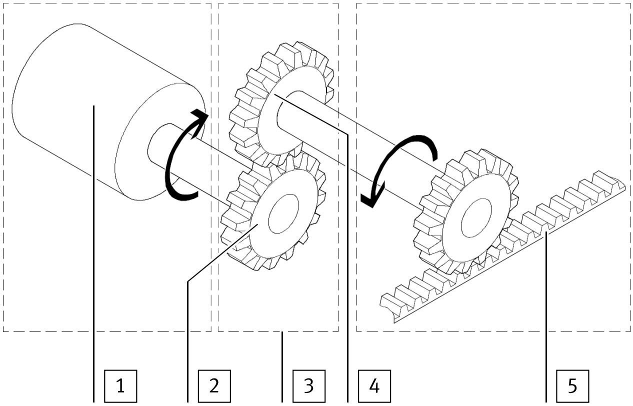
ID Dx.	Name	Description
18 l 00 l 00092 (301989980)	Motor change detected, commutation angle invalid	Motor change detected, commutation angle invalid
18 l 00 l 00093 (301989981)	Motor change detected, zero point offset invalid	Motor change detected, zero point offset invalid

Tab. 203 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. During configuration, the correct transmission ratio for each gear unit used must be specified. 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.



1 Motor shaft

2 Drive side

3 Gear unit

4 Output side

5 Axis

Fig. 36 Gear ratio (example)

Parameters of gear ratio groups 0, 1, 2

The device offers 3 gear ratio groups. For each gear ratio group, a gear ratio and a feed constant can be set.

Using parameter P0.3251.x.0, it is possible to define which gear ratio group shall be used for the respective encoder interface ➔ Fig.35. The gear ratio and feed constant can therefore be set individually for each encoder interface.

The following parameters form gear ratio group 0:

ID Px.	Parameter	Description	
1242	Total conversion factor gear unit numerator	Determines the numerator of the overall gear ratio (drive side).	
		Access	read/write
		Update	reinitialization
		Unit	–
1243	Total conversion factor gear unit denominator	Determines the denominator of the overall gear ratio (output side).	
		Access	read/write
		Update	reinitialization
		Unit	–

ID Px.	Parameter	Description	
1194	Feed constant numerator	Determines the numerator of the feed constant (data type UINT32).	
		Access	read/write
		Update	reinitialization
		Unit	–
1195	Feed constant denominator	Determines the denominator of the feed constant (data type UINT32).	
		Access	read/write
		Update	reinitialization
		Unit	–

Tab. 204 Parameter for gear ratio group 0

The following parameters form gear ratio group 1 and 2:

ID Px.	Parameter	Description	
11591	Numerator gear unit (user defined)	Determines the numerator of the gear ratio for the user-defined gear unit (drive side). Index 0: gear ratio group 1 Index 1: gear ratio group 2	
		Access	read/write
		Update	reinitialization
		Unit	–
11592	Denominator gear unit (user defined)	Determines the denominator of the gear ratio for the user-defined gear unit (output side). Index 0: gear ratio group 1 Index 1: gear ratio group 2	
		Access	read/write
		Update	reinitialization
		Unit	–
11593	Numerator feed constant (user defined)	Determines the numerator of the user-defined feed constant (data type UINT32). Index 0: gear ratio group 1 Index 1: gear ratio group 2	
		Access	read/write
		Update	reinitialization
		Unit	–

ID Px.	Parameter	Description	
11594	Denominator feed constant (user defined)	Determines the denominator of the user-defined feed constant (data type UINT32). Index 0: gear ratio group 1 Index 1: gear ratio group 2	
		Access	read/write
		Update	reinitialization
		Unit	–

Tab. 205 Parameters of gear ratio groups 1 and 2

Parameter from the drive configuration

If a drive configuration was performed using the plug-in, the parameters named in the following table are assumed from the drive configuration. The plug-in calculates the numerator from parameters Px.1232, Px.1233, Px.1236, Px.1237, Px.1240 and Px.1241 and the denominator of the overall transmission ratio of the gear ratio group 0 (Px.1242 and Px.1243).
For the closed-loop controller, the gear ratio of the selected gear ratio group is relevant ➔ Fig.35.
If the gear ratio group 0 is selected, parameters Px.1242 and Px.1243 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	NOC 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	–

ID Px.	Parameter	Description	
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	NOC code gear unit 2	Specifies the order code of the second configured gear unit.	
		Access	read/write
		Update	effective immediately
		Unit	–
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	NOC code gear unit 3	Specifies the order code of the third configured gear unit.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
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	–

Tab. 206 Parameter from the drive configuration

3.3.4.2 CiA 402

Objects of gear ratio group 0

Parameters	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
1242	0x60E8.01	Total conversion factor gear unit numerator	UINT32
1243	0x60ED.01	Total conversion factor gear unit denominator	UINT32
1194	0x60E9.01	Feed constant numerator	UINT32
1195	0x60EE.01	Feed constant denominator	UINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
1242	0x2182.0D	Total conversion factor gear unit numerator	UINT32
1243	0x2182.0E	Total conversion factor gear unit denominator	UINT32
1194	0x217E.04	Feed constant numerator	UINT32
1195	0x217E.05	Feed constant denominator	UINT32

Tab. 207 Objects

Objects of gear ratio groups 1 and 2

Parameters	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
11591	0x60E8.02 ... 03	Numerator gear unit (user defined)	UINT32
11592	0x60ED.02 ... 03	Denominator gear unit (user defined)	UINT32

Parameters	Index.Subindex	Name	Data type
11593	0x60E9.02 ... 03	Numerator feed constant (user defined)	UINT32
11594	0x60EE.02 ... 03	Denominator feed constant (user defined)	UINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
11591	0x226A.01 ... 02	Numerator gear unit (user defined)	UINT32
11592	0x226B.01 ... 02	Denominator gear unit (user defined)	UINT32
11593	0x226C.01 ... 02	Numerator feed constant (user defined)	UINT32
11594	0x226D.01 ... 02	Denominator feed constant (user defined)	UINT32

Tab. 208 Objects

Parameter of the gear units from the drive configuration

Parameters	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	UINT32
1231	0x2182.02	NOC code gear unit 1	STRING(37)
1232	0x2182.03	Conversion factor gear unit 1 numerator	UINT32
1233	0x2182.04	Conversion factor gear unit 1 denominator	UINT32
1234	0x2182.05	Database ID gear unit 2	UINT32
1235	0x2182.06	NOC code gear unit 2	STRING(37)
1236	0x2182.07	Conversion factor gear unit 2 numerator	UINT32
1237	0x2182.08	Conversion factor gear unit 2 denominator	UINT32
1238	0x2182.09	Database ID gear unit 3	UINT32
1239	0x2182.0A	NOC code gear unit 3	STRING(37)
1240	0x2182.0B	Conversion factor gear unit 3 numerator	UINT32
1241	0x2182.0C	Conversion factor gear unit 3 denominator	UINT32

Tab. 209 Objects

3.3.4.3 PROFIdrive

PNUs for gear ratio group 0

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1242	11329.0	Total conversion factor gear unit numerator	Unsigned32

Parameters	PNU	Name	Data type
1243	11330.0	Total conversion factor gear unit denominator	Unsigned32
1194	11296.0	Feed constant numerator	Unsigned32
1195	11297.0	Feed constant denominator	Unsigned32

Tab. 210 PNUs

PNUs for gear ratio groups 1 and 2

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
11591	11830.0 ... 1	Numerator gear unit (user defined)	Unsigned32
11592	11831.0 ... 1	Denominator gear unit (user defined)	Unsigned32
11593	11832.0 ... 1	Numerator feed constant (user defined)	Unsigned32
11594	11833.0 ... 1	Denominator feed constant (user defined)	Unsigned32

Tab. 211 PNUs

PNUs of gear units from the drive configuration

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1230	11317.0	Database ID gear unit 1	Unsigned32
1231	11318.0 ... 36	NOC code gear unit 1	STRING(37)
1232	11319.0	Conversion factor gear unit 1 numerator	Unsigned32
1233	11320.0	Conversion factor gear unit 1 denominator	Unsigned32
1234	11321.0	Database ID gear unit 2	Unsigned32
1235	11322.0 ... 36	NOC code gear unit 2	STRING(37)
1236	11323.0	Conversion factor gear unit 2 numerator	Unsigned32
1237	11324.0	Conversion factor gear unit 2 denominator	Unsigned32
1238	11325.0	Database ID gear unit 3	Unsigned32
1239	11326.0 ... 36	NOC code gear unit 3	STRING(37)
1240	11327.0	Conversion factor gear unit 3 numerator	Unsigned32
1241	11328.0	Conversion factor gear unit 3 denominator	Unsigned32

Tab. 212 PNUs

3.3.5 Digital Inputs and Outputs

3.3.5.1 Function

The function of the digital inputs and outputs listed here 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. “Objective reached”).
The status of the inputs and outputs of the interfaces [X1A] and [X1C] is mapped to the parameters Px.10151 and Px.10152. The status of the respective inputs and outputs can be recorded by recording the parameters with the measurement 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. 214 Assignment of the Status Word of Device Interface X1A.	
		Access	read/–
		Update	effective immediately
		Unit	–
10152	Device interface x1C status	Status of the device interface x1C Assignment of the status word ➔ Tab. 215 Assignment of the Status Word of Device Interface X1C.	
		Access	read/–
		Update	effective immediately
		Unit	–
10153	Internal interface status	Status of the internal interface Assignment of the status word ➔ Tab. 216 Assignment of the Status Word of the Internal Interface.	
		Access	read/–
		Update	effective immediately
		Unit	–
10191	Activate PNP input and output behaviour	Defines the switching logic of the digital inputs and outputs. Here 0 means: NPN logic (ground is switched) and 1 means: PNP logic (a potential is switched). Specifies the switching logic of the digital inputs and outputs. This means: – 0: NPN logic (earth is switched)	

ID Px.	Parameter	Description	
10191	Activate PNP input and output behaviour	– 1: PNP logic (a potential is switched)	
		Access	read/write
		Update	restart
		Unit	–
10192	Inversion of the inputs active	Indicates with 1 that the inputs are inverted.	
		Access	read/–
		Update	effective immediately
		Unit	–
10193	Inversion of the outputs active	Indicates with 1 that the outputs are inverted.	
		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. 217 Configurable Input Signals at X1A.7 and X1A.8.	
		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. 217 Configurable Input Signals at X1A.7 and X1A.8.	
		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. 220 Configurable Output Signals at X1A.9 and X1A.10.	
		Access	read/write
		Update	reinitialization
		Unit	–

ID Px.	Parameter	Description	
11204	Digital output X1A.10	Specifies the function of the digital output signal at connection X1A.10. Possible signals ➔ Tab. 220 Configurable Output Signals at X1A.9 and X1A.10.	
		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. 218 Configurable Input Signals at X1C.2.	
		Access	read/write
		Update	reinitialization
		Unit	–
101200	Reference switch configuration	Determines the configuration of the reference switch. Possible switching functions ➔ Tab. 219 Switching Function of the Reference Switch.	
		Access	read/write
		Update	effective immediately
		Unit	–
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. 213 Parameter

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	Basic in 01	Configurable input ➔ Tab. 217 Configurable Input Signals at X1A.7 and X1A.8
2	X1A.8	Basic in 02	Configurable input ➔ Tab. 217 Configurable Input Signals at X1A.7 and X1A.8
3	X1A.9	Basic out 01	Configurable output ➔ Tab. 220 Configurable Output Signals at X1A.9 and X1A.10
4	X1A.10	Basic out 02	Configurable output ➔ Tab. 220 Configurable Output Signals at X1A.9 and X1A.10

Tab. 214 Assignment of the Status Word of Device Interface X1A

Parameter Device interface x1C status Px.10152			
Bit	Signal name	Brief description	Description
0	X1C.2	REF/IN	Reference signal/limit switch signal

Tab. 215 Assignment of the Status Word of Device Interface X1C

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. 216 Assignment of the Status Word of the Internal Interface

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 used.
7	Touch probe 1	
8	Negative hardware limit switch	The input shows the exceeding of the usable range 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 more information, see ➔ 5.5 Hardware limit switch reached
9	Positive hardware limit switch	
11	Record table input 0	The input can be used as a step enabling condition during record selection (ID Px.1831 = 4).
12	Record table input 1	

Tab. 217 Configurable Input Signals at X1A.7 and X1A.8

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 shows the exceeding of the usable range 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. 218 Configurable Input Signals at X1C.2

Parameters of the reference switch (Px.101200)		
Value	Function	Description
0	Deactivated	The input for the reference switch is deactivated.
1	N/O contact	Switching function of N/O (normally open) contact
2	N/C contact	Switching function of N/C (normally closed) contact

Tab. 219 Switching Function of the Reference Switch

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.
9	Cam switch 0	The output provides the logical status of the corres-ponding cam switch.
10	Cam switch 1	
12	Drive referenced	The output becomes active when the drive is being homed.
13	Target position reached	The output becomes active when the actual position remains in the target window for the duration of the damping time.
14	Target velocity reached	The output becomes active when the actual velocity is within the target window for the duration of the damp-ing time.
15	Target torque reached	The output becomes active when the actual torque is within the target window for the duration of the damp-ing time.
16	Position: following error	The output becomes active when the corresponding following error is present after the operate delay has expired.
17	Velocity: following error	
18	Target range position	The output becomes active after the target range is reached and becomes inactive again when the target range is left.
19	Target range velocity	
20	Target range torque	
21	Positive hardware limit switch	The output provides the logical signal of the corres-ponding limit switch.
22	Negative hardware limit switch	
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 a standstill.
26	Standstill velocity	

Parameters of digital outputs X1A.9, X1A.10 (Px.11203 and Px.11204)		
Value	Function	Description
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 velocity monitoring indicates the exceeding of the limit value.
31	Pushback	The output becomes active when the set torque and direction of movement do not correlate and the parameterised damping time has expired.
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.

Tab. 220 Configurable Output Signals at X1A.9 and X1A.10

Parameters for digital inputs CiA402 (Px.1128052, 0x60FD.00)		
Bit	Function	Description
0	negative limit switch	Shows the exceeding of the usable range in a negative or positive direction
1	positive limit switch	
2	Reference switch	Signal status of the reference switch
3	Power stage enable	Power stage enable

Tab. 221 Digital inputs CiA402 (Px.1128052)

Parameters for digital outputs CiA402 (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 digital output 1, if parameterised as "Bit 16 CiA402 0x60FE (37)".
17	Control digital output 2 (User_Control_Out_2)	Control digital output 2, if parameterised as "Bit 17 CiA402 0x60FE (38)".

Tab. 222 Digital outputs CiA402 (Px.1128054)

ID Dx.	Name	Description
06 l 00 l 00085 (100663381)	Digital I/O configuration invalid	The configuration of the digital inputs or outputs is invalid

Tab. 223 Diagnostic Messages

3.3.5.2 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	UINT32
1128053			
1128054	0x60FE.01	Digital outputs CiA402	UINT32
1128055	0x60FE.02	Bit mask digital outputs CiA402	UINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
10191	0x2140.01	Activate PNP input and output behaviour	UINT8
10192	0x2140.02	Inversion of the inputs active	BOOL
10193	0x2140.03	Inversion of the outputs active	BOOL
11201	0x212F.0A	Digital input X1A.7	UINT32
11202	0x212F.0B	Digital input X1A.8	UINT32
11203	0x212F.0C	Digital output X1A.9	UINT32
11204	0x212F.0D	Digital output X1A.10	UINT32
11205	0x212F.0E	Digital input X1C.2	UINT32
101200	0x218A.01	Reference switch configuration	UINT32
1128052	0x2195.01	Digital inputs CiA402	UINT32
1128053			
1128054	0x2195.02	Digital outputs CiA402	UINT32
1128055	0x2195.03	Bit mask digital outputs CiA402	UINT32

Tab. 224 Objects

3.3.5.3 PROFIdrive

PNUs of digital inputs and outputs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
10191	3361.0	Activate PNP input and output behaviour	Unsigned8
10192	3362.0	Inversion of the inputs active	Boolean
10193	3363.0	Inversion of the outputs active	Boolean
11201	3364.0	Digital input X1A.7	Unsigned32
11202	3365.0	Digital input X1A.8	Unsigned32
11203	3366.0	Digital output X1A.9	Unsigned32
11204	3367.0	Digital output X1A.10	Unsigned32
11205	3368.0	Digital input X1C.2	Unsigned32
101200	11947.0	Reference switch configuration	Unsigned32

Tab. 225 PNUs

3.4 Protective functions

3.4.1 I²t monitoring of the power output stage

The “I²t monitoring of power output stage” protective function is used to protect the power output stage from thermal damage due to an excessive dissipation of electrical energy.
In the process, the limit values of a certain warning threshold and upper limit are monitored. When the respective 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.
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.	Parameters	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	–

ID Px.	Parameters	Description	
638	Limit value I^2t monitoring power output stage	Specifies the limit value for I^2t monitoring of the power output stage.	
		Access	read/–
		Update	effective immediately
		Unit	A^2s
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 I^2t monitoring power output stage	Specifies the actual value for I^2t monitoring of the power output stage.	
		Access	read/–
		Update	effective immediately
		Unit	A^2s
6311	Scaling factor warning limit I^2t monitoring power output stage	Specifies the scaling factor for the warning limit based on the limit value of the I^2t monitoring of the power output stage.	
		Access	read/write
		Update	effective immediately
		Unit	–
6313	Scaling factor start value I^2t monitoring power output stage at standstill	Specifies the scaling factor for the start value based on the limit value of the I^2t monitoring of the power output stage at standstill.	
		Access	read/–
		Update	effective immediately
		Unit	–
6314	Limit value I^2t monitoring power output stage at standstill	Specifies the limit value for I^2t monitoring of the power output stage at standstill.	
		Access	read/–
		Update	effective immediately
		Unit	A^2s

ID Px.	Parameters	Description	
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	–
6316	Actual value I^2t monitoring power output stage at standstill	Specifies the actual value for I^2t monitoring of the power output stage at standstill.	
		Access	read/–
		Update	effective immediately
		Unit	A^2s
6317	Scaling factor warning limit I^2t monitoring drive at standstill	Specifies the scaling factor for the warning limit based on the limit value of the I^2t monitoring of the power output stage if the drive is at standstill.	
		Access	read/write
		Update	effective immediately
		Unit	–
6332	Actual value relative I^2t monitoring of power output stage to limit	Specifies the actual value for relative I^2t monitoring of the power output stage to the limit.	
		Access	read/–
		Update	effective immediately
		Unit	–
6333	Actual value relative I^2t monitoring of power output stage at standstill to limit	Specifies the actual value for relative I^2t monitoring of the power output stage at standstill to the limit.	
		Access	read/–
		Update	effective immediately
		Unit	–
6334	Actual value I^2t monitoring of the total current	Specifies the current actual value of the I^2t monitoring of the total current.	
		Access	read/–
		Update	effective immediately
		Unit	Arms

Tab. 226 Parameters of “I^2t monitoring of power output stage”

ID Dx.	Name	Description
01 I 02 I 00014 (16908302)	I^2t monitoring: output stage warning limit	I^2t monitoring: output stage warning limit
01 I 02 I 00015 (16908303)	I^2t monitoring: output stage error limit	I^2t monitoring: output stage error limit
01 I 02 I 00016 (16908304)	I^2t monitoring: output stage v0 warning limit	I^2t monitoring: output stage in standstill warning limit
01 I 02 I 00017 (16908305)	I^2t monitoring: output stage v0 error limit	I^2t monitoring: output stage in standstill error limit

Tab. 227 Diagnostic messages of “I^2t monitoring of the power output stage”

3.4.1.1 CiA 402

Objects of “I^2t monitoring of the power output stage”

Parameters	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 I^2t monitoring power output stage	FLOAT32
638	0x216A.08	Limit value I^2t monitoring power output stage	FLOAT32
639	0x216A.09	Scaling factor maximum value after switching on	FLOAT32
6310	0x216A.0A	Actual value I^2t monitoring power output stage	FLOAT32
6311	0x216A.0B	Scaling factor warning limit I^2t monitoring power output stage	FLOAT32
6313	0x216A.0C	Scaling factor start value I^2t monitoring power output stage at standstill	FLOAT32
6314	0x216A.0D	Limit value I^2t monitoring power output stage at standstill	FLOAT32
6315	0x216A.0E	Scaling factor maximum value after drive at standstill	FLOAT32
6316	0x216A.0F	Actual value I^2t monitoring power output stage at standstill	FLOAT32
6317	0x216A.10	Scaling factor warning limit I^2t monitoring drive at standstill	FLOAT32
6332	0x216A.1E	Actual value relative I^2t monitoring of power output stage to limit	FLOAT32

Parameters	Index.Subindex	Name	Data type
6333	0x216A.1F	Actual value relative I^2t monitoring of power output stage at standstill to limit	FLOAT32
6334	0x216A.20	Actual value I^2t monitoring of the total current	FLOAT32

Tab. 228 Objects

3.4.1.2 PROFIdrive

PNUs of the I^2t monitoring of the power output stage

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
637	11174.0	Scaling factor start value I^2t monitoring power output stage	FloatingPoint
638	11175.0	Limit value I^2t monitoring power output stage	FloatingPoint
639	11176.0	Scaling factor maximum value after switching on	FloatingPoint
6310	11655.0	Actual value I^2t monitoring power output stage	FloatingPoint
6311	11656.0	Scaling factor warning limit I^2t monitoring power output stage	FloatingPoint
6313	11657.0	Scaling factor start value I^2t monitoring power output stage at standstill	FloatingPoint
6314	11658.0	Limit value I^2t monitoring power output stage at standstill	FloatingPoint
6315	11659.0	Scaling factor maximum value after drive at standstill	FloatingPoint
6316	11660.0	Actual value I^2t monitoring power output stage at standstill	FloatingPoint
6317	11661.0	Scaling factor warning limit I^2t monitoring drive at standstill	FloatingPoint
6332	11675.0	Actual value relative I^2t monitoring of power output stage to limit	FloatingPoint
6333	11676.0	Actual value relative I^2t monitoring of power output stage at standstill to limit	FloatingPoint
6334	11677.0	Actual value I^2t monitoring of the total current	FloatingPoint

Tab. 229 PNUs

3.4.2 I²t monitoring of motor

To protect the connected motor from thermal overload, a simplified thermal motor model is used for the CMMT-ST. 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

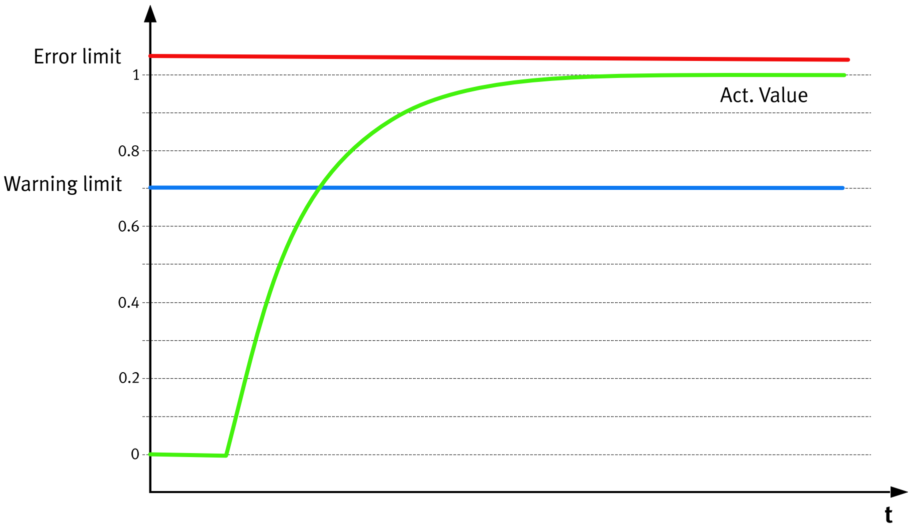


Fig. 37 Timing of I²t monitoring of motor

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. 230 Legend on the timing of I²t monitoring of motor

Parameters and diagnostic messages

ID Px.	Parameter	Description	
6302	Actual value I^2T monitoring motor model	Displays the actual value of I^2t monitoring from the motor model.	
		Access	read/–
		Update	effective immediately
		Unit	–
6301	Scaling factor start value I^2t monitoring motor model	Specifies the scaling factor for setting the start value for I^2t monitoring based on the limit value of I^2t monitoring of the motor model.	
		Access	read/write
		Update	effective immediately
		Unit	–
6305	Scaling factor warning limit I^2t monitoring motor model	Specifies the scaling factor for setting the warning limit for I^2t monitoring based on the limit value of I^2t monitoring of the motor model.	
		Access	read/write
		Update	effective immediately
		Unit	–
6303	Maximum start value I^2t monitoring motor model	Specifies the maximum permissible start value of I^2t monitoring of the motor model.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 231 Parameters of I^2t monitoring of motor

ID Dx.	Name	Description
01 | 02 | 00259 (16908547)	I^2t monitoring: motor model error limit	I^2t monitoring: motor model error limit
01 | 02 | 00258 (16908546)	I^2T monitoring: motor model warning limit	I^2T monitoring: motor model warning limit

Tab. 232 Diagnostic messages of I^2t monitoring of the motor

3.4.2.1 CiA 402

Objects of I²t monitoring of the motor

Parameters	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	FLOAT32
6301	0x21A5.01	Scaling factor start value I²t monitoring motor model	FLOAT32
6305	0x21A5.04	Scaling factor warning limit I²t monitoring motor model	FLOAT32
6303	0x21A5.03	Maximum start value I²t monitoring motor model	FLOAT32

Tab. 233 Objects

3.4.2.2 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	FloatingPoint
6301	12404.0	Scaling factor start value I²t monitoring motor model	FloatingPoint
6305	12407.0	Scaling factor warning limit I²t monitoring motor model	FloatingPoint
6303	12406.0	Maximum start value I²t monitoring motor model	FloatingPoint

Tab. 234 PNUs

3.4.3 Temperature monitoring of the servo drive

The “Temperature monitoring of the servo drive” protective function protects the power module against overtemperature.
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.	Parameters	Description	
920	Temperature power output stage	Specifies the current 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	Determines the upper limit value of warning threshold for the temperature monitoring of the power output stage.	
		Access	read/write
		Update	effective immediately
		Unit	°C
9315	Upper limit value power output stage temperature	Determines 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	Determines 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	Determines the lower limit value of the temperature monitoring of the power output stage.	
		Access	read/write
		Update	effective immediately
		Unit	°C

ID Px.	Parameters	Description	
9322	Current upper limit value warning threshold power output stage temperature	Specifies the current upper limit value of the warning threshold for the temperature monitoring of the power output stage.	
		Access	read/–
		Update	effective immediately
		Unit	°C
9323	Current upper limit value power output stage temperature	Specifies the current upper limit value of the temperature monitoring of the power output stage.	
		Access	read/–
		Update	effective immediately
		Unit	°C
9324	Current lower limit value warning threshold power output stage temperature	Specifies the current lower limit value of the warning threshold for the temperature monitoring of the power output stage.	
		Access	read/–
		Update	effective immediately
		Unit	°C
9325	Current lower limit value power output stage temperature	Specifies the current lower limit value of the temperature monitoring of the power output stage.	
		Access	read/–
		Update	effective immediately
		Unit	°C

Tab. 235 Parameters of “Temperature monitoring of the servo drive”

Diagnostic messages

No specific diagnostic messages are allocated to the function.

3.4.3.1 CiA 402

Objects of "Temperature monitoring of the servo drive"

Parameters	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	FLOAT32
921	0x2128.02	Temperature status power output stage	SINT32
9314	0x2128.19	Upper limit value warning threshold power output stage temperature	FLOAT32

Parameters	Index.Subindex	Name	Data type
9315	0x2128.1A	Upper limit value power output stage temperature	FLOAT32
9316	0x2128.1B	Lower limit value warning threshold power output stage temperature	FLOAT32
9317	0x2128.1C	Lower limit value power output stage temperature	FLOAT32
9322	0x2128.21	Current upper limit value warning threshold power output stage temperature	FLOAT32
9323	0x2128.22	Current upper limit value power output stage temperature	FLOAT32
9324	0x2128.23	Current lower limit value warning threshold power output stage temperature	FLOAT32
9325	0x2128.24	Current lower limit value power output stage temperature	FLOAT32

Tab. 236 Objects

3.4.3.2 PROFIdrive

PNUs "temperature monitoring of the servo drive"

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
920	2246.0	Temperature power output stage	FloatingPoint
921	2247.0	Temperature status power output stage	Integer32
9314	2795.0	Upper limit value warning threshold power output stage temperature	FloatingPoint
9315	2796.0	Upper limit value power output stage temperature	FloatingPoint
9316	2797.0	Lower limit value warning threshold power output stage temperature	FloatingPoint
9317	2798.0	Lower limit value power output stage temperature	FloatingPoint
9322	2803.0	Current upper limit value warning threshold power output stage temperature	FloatingPoint
9323	2804.0	Current upper limit value power output stage temperature	FloatingPoint

Parameters	PNU	Name	Data type
9324	2805.0	Current lower limit value warning threshold power output stage temperature	FloatingPoint
9325	2806.0	Current lower limit value power output stage temperature	FloatingPoint

Tab. 237 PNUs

3.4.4 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.

3.4.5 Mains and DC link monitoring

3.4.5.1 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/–
		Update	effective immediately
		Unit	V
493	Lower load voltage limit value	Determines the lower limit value for load voltage monitoring.	
		Access	read/write
		Update	effective immediately
		Unit	V
494	Upper load voltage value	Determines the upper limit value for load voltage monitoring.	
		Access	read/write
		Update	effective immediately
		Unit	V

ID Px.	Parameter	Description	
28151	Current lower limit value load voltage	Specifies the lower limit value for load voltage monitoring.	
		Access	read/–
		Update	effective immediately
		Unit	V
28152	Current upper limit value load voltage	Specifies the upper limit value for load voltage monitoring.	
		Access	read/–
		Update	effective immediately
		Unit	V

Tab. 238 Mains voltage monitoring parameter

ID Dx.	Name	Description
02 I 03 I 00038 (33751078)	Undervoltage in load voltage	Undervoltage in load voltage
02 I 03 I 00039 (33751079)	Overvoltage in load voltage	Overvoltage in load voltage

Tab. 239 Mains voltage monitoring diagnostic messages

CiA 402

Mains voltage monitoring objects

Parameters	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
490	0x2115.01	Load voltage peak value	FLOAT32
491	0x2115.02	Load voltage root mean square value	FLOAT32
492	0x2115.03	Actual rectified load voltage value	FLOAT32
493	0x2115.04	Lower load voltage limit value	FLOAT32
494	0x2115.05	Upper load voltage value	FLOAT32
495	0x2115.06	Actual load voltage frequency value	FLOAT32
4995	0x2115.12	Status load voltage	BOOL
5113	0x2115.15	Activation DC voltage supply	BOOL
28140	0x2115.17	Load voltage frequency minimum	FLOAT32
28150	0x2115.18	Maximum load voltage frequency	FLOAT32
28151	0x2115.19	Current lower limit value load voltage	FLOAT32

Parameters	Index.Subindex	Name	Data type
28152	0x2115.1A	Current upper limit value load voltage	FLOAT32

Tab. 240 Objects

PROFIdrive

Mains voltage monitoring PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
490	2156.0	Load voltage peak value	FloatingPoint
491	2157.0	Load voltage root mean square value	FloatingPoint
492	2158.0	Actual rectified load voltage value	FloatingPoint
493	2159.0	Lower load voltage limit value	FloatingPoint
494	2160.0	Upper load voltage value	FloatingPoint
495	2161.0	Actual load voltage frequency value	FloatingPoint
4995	2549.0	Status load voltage	Boolean
5113	2552.0	Activation DC voltage supply	Boolean
28140	3050.0	Load voltage frequency minimum	FloatingPoint
28150	3051.0	Maximum load voltage frequency	FloatingPoint
28151	3052.0	Current lower limit value load voltage	FloatingPoint
28152	3053.0	Current upper limit value load voltage	FloatingPoint

Tab. 241 PNUs

3.4.5.2 Monitoring of the DC link voltage

The protective function is used for the monitoring of the DC link voltage. In the process, the DC link voltage is monitored for preset maximum value and parameterised minimum value. In addition, a limit value for the warning threshold can be parameterised. When the respective limit value is reached, a diagnostic message is triggered.

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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.	Parameters	Description	
480	Actual value DC link voltage	Specifies the current actual value of the DC link voltage.	
		Access	read/–
		Update	effective immediately
		Unit	V
4811	Warning thresholds 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	Determines 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	Determines the lower limit value for the monitoring of the DC link voltage.	
		Access	read/write
		Update	effective immediately
		Unit	V
56799	Current warning threshold DC link voltage	Specifies the currently used warning threshold for monitoring the DC link voltage.	
		Access	read/–
		Update	effective immediately
		Unit	V
56800	Current upper limit value DC link voltage	Specifies the currently used upper limit value for monitoring the DC link voltage.	
		Access	read/–
		Update	effective immediately
		Unit	V

ID Px.	Parameters	Description	
56801	Current lower limit value DC link voltage	Specifies the currently used lower limit value for monitoring the DC link voltage.	
		Access	read/–
		Update	effective immediately
		Unit	V

Tab. 242 Parameters of “Monitoring of the DC link voltage”

ID Dx.	Name	Description
02 l 02 l 00030 (33685534)	Overvoltage in DC link	Overvoltage in DC link
02 l 02 l 00031 (33685535)	Undervoltage in DC link	Undervoltage in DC link
02 l 02 l 00032 (33685536)	DC link warning threshold reached	DC link warning threshold reached

Tab. 243 Diagnostic messages of “Monitoring of the DC link voltage”

CiA 402

Parameters	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
480	0x6079.00	Actual value DC link voltage	UINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
480	0x2114.01	Actual value DC link voltage	FLOAT32
4811	0x2114.0A	Warning thresholds DC link voltage	FLOAT32
4813	0x2114.0C	Upper limit value DC link voltage	FLOAT32
4814	0x2114.0D	Lower limit value DC link voltage	FLOAT32
56799	0x2114.18	Current warning threshold DC link voltage	FLOAT32
56800	0x2114.19	Current upper limit value DC link voltage	FLOAT32
56801	0x2114.1A	Current lower limit value DC link voltage	FLOAT32

Tab. 244 Objects of “Monitoring of the DC link voltage”

PROFIdrive

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
480	2148.0	Actual value DC link voltage	FloatingPoint
4811	2533.0	Warning thresholds DC link voltage	FloatingPoint
4813	2535.0	Upper limit value DC link voltage	FloatingPoint
4814	2536.0	Lower limit value DC link voltage	FloatingPoint
56799	3065.0	Current warning threshold DC link voltage	FloatingPoint
56800	3066.0	Current upper limit value DC link voltage	FloatingPoint
56801	3067.0	Current lower limit value DC link voltage	FloatingPoint

Tab. 245 PNUs of "monitoring of the DC link voltage"

3.4.5.3 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.

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

ID Px.	Parameter	Description	
10182	DC link recovery status	Unit	–
10184	Activation automatic voltage determination	Activation of the automatic voltage determination	
		Access	read/write
		Update	reinitialization
		Unit	–
10185	Power feedback switch-off threshold	Power feedback switch-off threshold	
		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 calculation	
		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	
		Access	read/–
		Update	effective immediately
		Unit	–
102104	Activate reactive current braking	Activate reactive current braking	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
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	Activation 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

Tab. 246 Parameter

CiA 402

Return energy feed 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	FLOAT32
10182	0x213F.02	DC link recovery status	BOOL
10184	0x213F.04	Activation automatic voltage determination	BOOL
10185	0x213F.05	Power feedback switch-off threshold	FLOAT32
10186	0x213F.06	Scaling factor offset of voltage calculation	FLOAT32

Parameter	Index.Subindex	Name	Data type
102101	0x218D.01	Active switch-on threshold reactive current braking	FLOAT32
102102	0x218D.02	Active end value reactive current braking	FLOAT32
102103	0x218D.03	Status reactive current braking	BOOL
102104	0x218D.04	Activate reactive current braking	BOOL
102105	0x218D.05	Maximum reactive current reactive current braking	FLOAT32
102106	0x218D.06	Actual value reactive current braking	FLOAT32
102107	0x218D.07	Activation automatic voltage determination	BOOL
102108	0x218D.08	Switch-on threshold reactive current braking	FLOAT32
102109	0x218D.09	End value reactive current braking	FLOAT32

Tab. 247 Objects

PROFIdrive

Return energy feed PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
10181	3352.0	DC link recovery deactivation	FloatingPoint
10182	3353.0	DC link recovery status	Boolean
10184	3355.0	Activation automatic voltage determination	Boolean
10185	3356.0	Power feedback switch-off threshold	FloatingPoint
10186	3357.0	Scaling factor offset of voltage calculation	FloatingPoint
102101	12417.0	Active switch-on threshold reactive current braking	FloatingPoint
102102	12418.0	Active end value reactive current braking	FloatingPoint
102103	12419.0	Status reactive current braking	Boolean
102104	12420.0	Activate reactive current braking	Boolean
102105	12421.0	Maximum reactive current reactive current braking	FloatingPoint
102106	12422.0	Actual value reactive current braking	FloatingPoint
102107	12423.0	Activation automatic voltage determination	Boolean
102108	12424.0	Switch-on threshold reactive current braking	FloatingPoint

Parameter	PNU	Name	Data type
102109	12425.0	End value reactive current braking	FloatingPoint

Tab. 248 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 output 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.

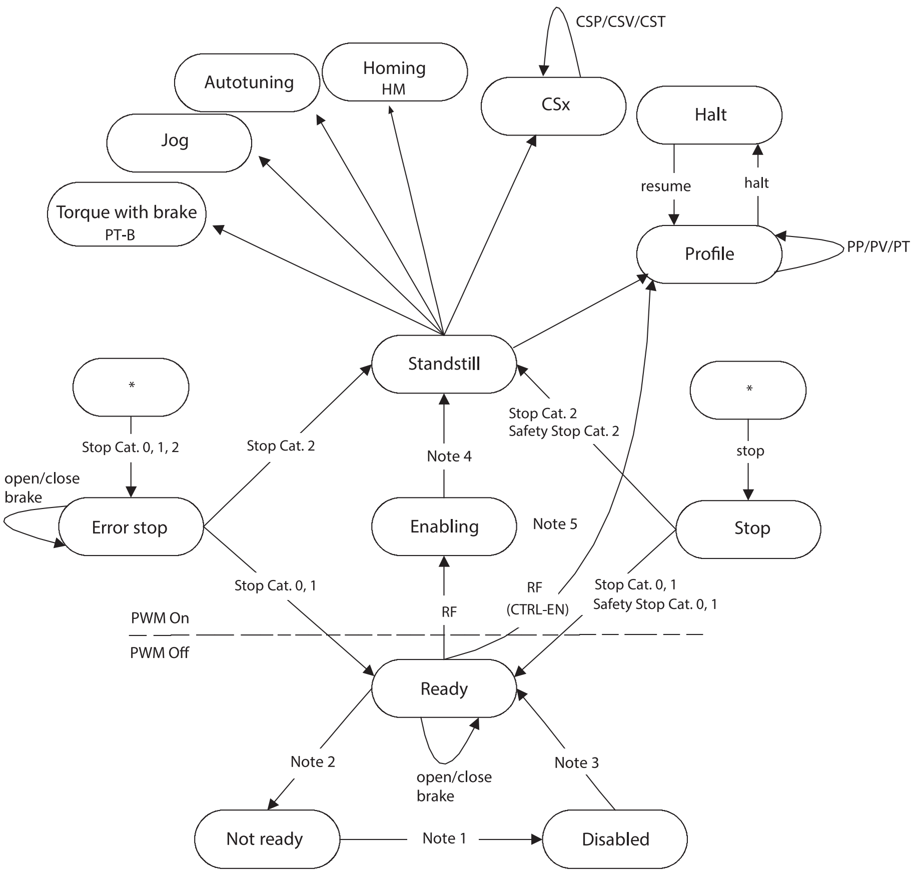

Fig. 38

Statuses	**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 output stage is locked and switched off.
Ready	The device is ready. The output 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.

Statuses	Description
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 autotuning ➔ 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.
Profile	The device is running motion commands ➔ 4.1.2 Operating modes for performing motion commands.
Halt	The current command 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. 249 Statuses of the Internal Finite State Machine

Status transitions	Description
Note 1	The transition to the Disabled status occurs status occurs if the output 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 output stage enable is not exclusively via the CTRL-EN input ➔ 4.1.9 Switch-on/off Behaviour and Closed-loop Controller Enable.
Note 5	Automatic transition to the Profile status if the output stage enable is exclusively via the CTRL-EN input ➔ 4.1.9 Switch-on/off Behaviour and Closed-loop Controller Enable.
RF	Closed-loop controller and output stage enable ➔ 4.1.9 Switch-on/off Behaviour and Closed-loop Controller Enable.
Stop Cat.	Stop of the corresponding category

Status transitions	Description
stop	Stop command via device profile, record list 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. 250 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) – Velocity mode (PV) – Force/torque mode (PT)	The servo drive uses the integrated trajectory generator to generate the relevant setpoint quantities.
Cyclic synchronised ... – ... positioning mode (CSP) – ... velocity mode (CSV) – ... force/torque mode (CST)	The command values are specified at equidistant time points via fieldbus, e. g. via EtherCAT. The time-equidistant command values are input by a fine interpolator of the closed-loop controller.

Tab. 251 Operating modes for performing motion commands

i

The cyclically synchronised operating modes are only available in the CiA402 profile.

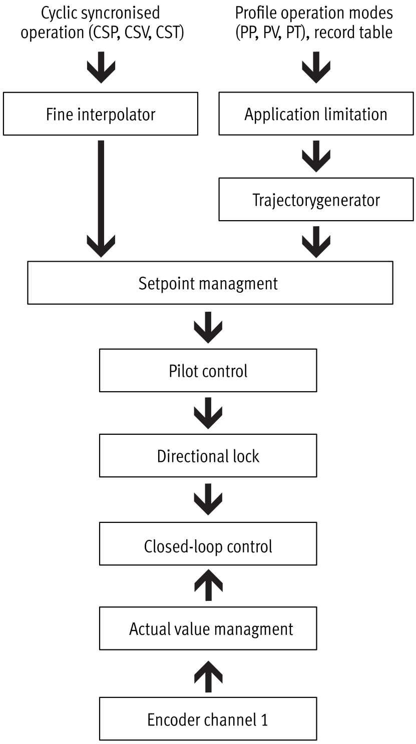

Fig. 39 Internal forwarding of the command values

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

From...	**To...**							
	PP	PV	PT	CSP	CSV	CST	HM	PT-B
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. 252 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 input corresponding command value 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. 253 Operating mode switch – part 2

4.1.2.2 CiA402

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

The following graph shows an example of the switch from the CSV operating mode to the CSP operating mode.

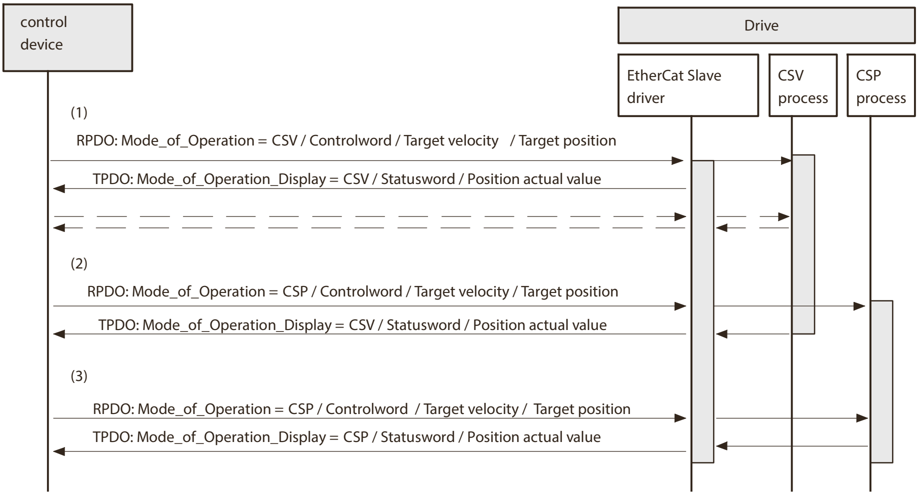

Fig. 40 Operating mode switch from CSV to CSP (example)

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 profile position 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 velocity, the acceleration, the deceleration and the jerk. If the value 0 is defined for the final velocity and no other command is triggered, the drive remains position-controlled at the target position. In positioning mode, the position, velocity and current regulators are active. 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. 254 Variations of Positioning Mode

i

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 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 profile 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 velocity	•
2	TRT	Target window reaches torque	•
3	FEX	Following error position	•
4	FEV	Velocity following error	–
6	TMX	Position target area monitoring	•
7	TMV	Velocity 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 limit position reached negative	•
16	STX	Standstill monitoring position/velocity	•
17	STV	Standstill monitoring velocity	•
18	LS	Stop reached	•

Motion monitoring function status word			
Bit	Code	Name	Effective
19	STLP	Stroke limit reached positive	–
20	STLN	Stroke limit reached negative	–
21	VM	Velocity monitoring	•
22	PB	Pushback 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. 255 Motion Monitoring Function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Motion Quantities

The path course of a positioning command is largely influenced by the following motion quantities:

Motion Quantities	Description
Target position	Target specification (specification of a route or absolute position)
Profile velocity	Setpoint value for velocity
Acceleration	Setpoint value for acceleration
Deceleration	Setpoint value for deceleration
Jerk	Maximum value for the jerk during the acceleration phase and deceleration phase
End velocity	Velocity at the target position

Tab. 256 Motion Quantities

Triggering tasks

– Record table
– Fieldbus (direct mode)
– Page "Manual movement" of the device-specific plug-in

Requirements

– Valid homing
– Controller Enable

Timing

Example: positioning command with end velocity and unequal specifications for acceleration and deceleration

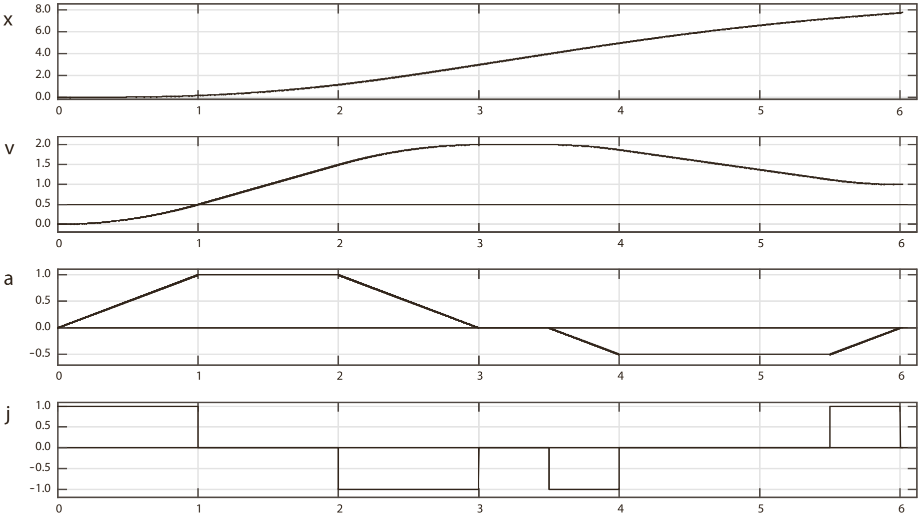

Fig. 41 Positioning mode timing graph (example)

Name	Description
x	Position
v	Velocity
a	Acceleration
j	Jerk

Tab. 257 Legend for Positioning Mode Timing Graph

4.1.3.2 CiA 402

The following graphs show an overview of the objects involved in the positioning mode and their interaction with the trajectory generator:

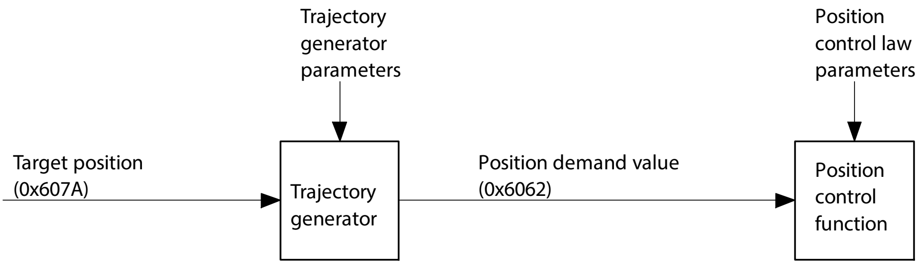

Fig. 42 Overview of the trajectory generator - position control operating mode (PP)

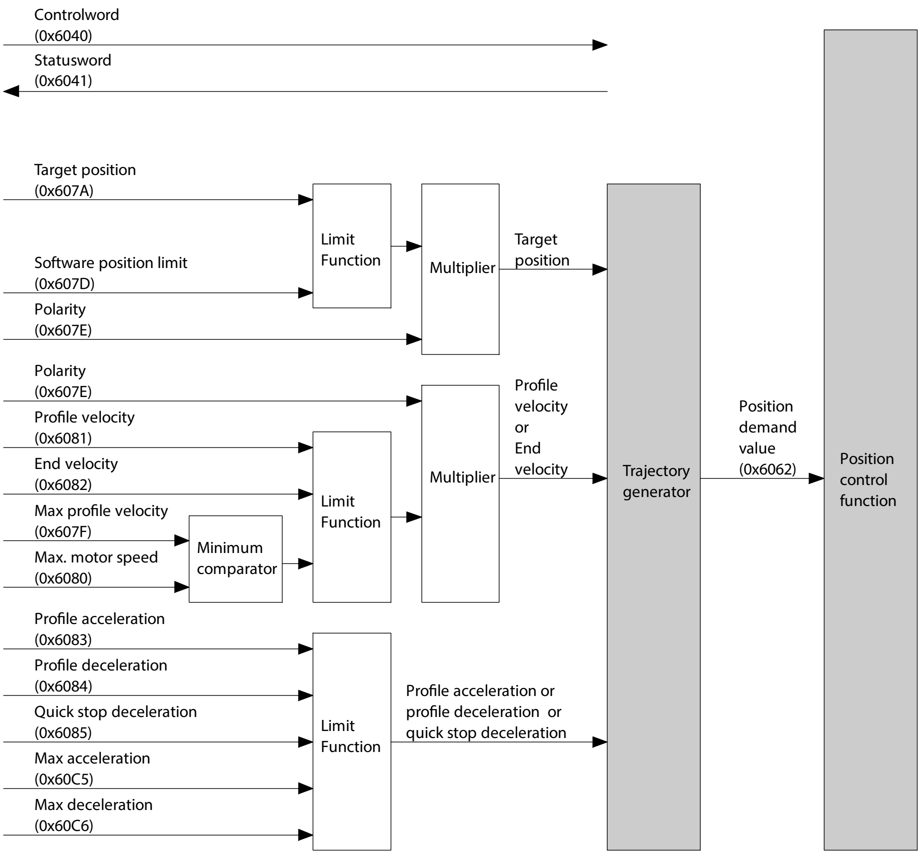

Fig. 43 Trajectory generator in positioning mode (PP)

Objects for positioning mode

Parameter	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
730	0x6040.00	Control word CiA402	UINT16
731	0x6041.00	Status word CiA402	UINT16
90	0x6062.00	Setpoint value position	SINT32
128	0x60E4.01	Actual position value	SINT32
113104	0x6064.00	Actual value of modulo	SINT32
1210	0x606C.00	Actual velocity value	SINT32
151	0x6077.00	Actual torque value gear shaft	SINT16
8130	0x607A.00	Target position CiA402	SINT32
4629	0x607D.01	Negative software limit position	SINT32
4630	0x607D.02	Positive software limit position	SINT32
1170	0x607E.00	Reversing the direction of rotation	UINT8
1304	0x607F.00	Limit value velocity limiting	UINT32
7123	0x6080.00	Maximum rpm (user defined)	UINT32
8131	0x6081.00	Profile velocity CiA402	UINT32
8132	0x6082.00	End velocity CiA402	UINT32
8133	0x6083.00	Profile acceleration CiA402	UINT32
8134	0x6084.00	Profile deceleration CiA402	UINT32
8135	0x6085.00	Quick stop deceleration CiA402	UINT32
8136	0x60A4.00	Profile jerk CiA402	UINT32
1305	0x60C5.00	Limit value acceleration limiting	UINT32
1306	0x60C6.00	Limit value deceleration limiting	UINT32
88817	0x60F2.00	Positioning option code CiA402	UINT16
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
730	0x216D.01	Control word CiA402	UINT16
731	0x216D.02	Status word CiA402	UINT16
90	0x2154.01	Setpoint value position	SINT64
128	0x2155.09	Actual position value	SINT64
113104	0x2197.05	Actual value of modulo	SINT64

Parameter	Index.Subindex	Name	Data type
1210	0x2155.0B	Actual velocity value	FLOAT32
151	0x2157.02	Actual torque value gear shaft	FLOAT32
8130	0x216F.03	Target position CiA402	SINT64
4629	0x2166.1E	Negative software limit position	SINT64
4630	0x2166.1F	Positive software limit position	SINT64
1170	0x217D.01	Reversing the direction of rotation	BOOL
1304	0x2183.04	Limit value velocity limiting	FLOAT32
7123	0x216C.06	Maximum rpm (user defined)	FLOAT32
8131	0x216F.04	Profile velocity CiA402	FLOAT32
8132	0x216F.05	End velocity CiA402	FLOAT32
8133	0x216F.06	Profile acceleration CiA402	FLOAT32
8134	0x216F.07	Profile deceleration CiA402	FLOAT32
8135	0x216F.08	Quick stop deceleration CiA402	FLOAT32
8136	0x216F.09	Profile jerk CiA402	FLOAT32
1305	0x2183.05	Limit value acceleration limiting	FLOAT32
1306	0x2183.06	Limit value deceleration limiting	FLOAT32
88817	0x216F.0C	Positioning option code CiA402	UINT16

Tab. 258 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

Bit[1)]				**Description**
8	6	5	4	
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. 259 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 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

Object 0x60F2, Positioning option code				
Bit 7	Bit 6	Bit 1	Bit 0	Description
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. 260 Positioning option code

Object 0x6041: Statusword

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: velocity = 0
Motion command acknowledged (setpoint acknowledge)			
x	0	x	Wait for new motion command
x	1	x	Motion command has been acknowledged

Bit[1]			Description
13	12	10	
Position 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. 261 Monitoring positioning mode

4.1.3.3 PROFIdrive

Control and Monitoring

Application class ➔ Finite State Machine Positioning Mode in Application Class 3
SATZANW ➔ Record Selection (SATZANW)
AKTSATZ ➔ 12.4.7.16 Active Record (AKTSATZ)

Positioning Mode PNUs

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value	FloatingPoint
113104	28.0	Actual value of modulo	Integer64
Px.	**Manufacturer-specific parameters**		
128	11067.0	Actual position value	Integer64
1210	11311.0	Actual velocity value	FloatingPoint
113104	12117.0	Actual value of modulo	Integer64
90	11045.0	Setpoint value position	Integer64
151	11070.0	Actual torque value gear shaft	FloatingPoint
4629	11584.0	Negative software limit position	Integer64
4630	11585.0	Positive software limit position	Integer64
1170	11287.0	Reversing the direction of rotation	Boolean
1304	11334.0	Limit value velocity limiting	FloatingPoint
7123	11694.0	Maximum rpm (user defined)	FloatingPoint
1305	11335.0	Limit value acceleration limiting	FloatingPoint
1306	11336.0	Limit value deceleration limiting	FloatingPoint

Tab. 262 PNUs

Travel top fixed stop (application class 3)

Travel to fixed stop performs a positioning with reference to a max. clamping torque. During travel to fixed stop a fixed stop is approached from the current position before reaching the target posi-

tion (e.g. at a workpiece). Then a torque is established up to the desired clamping torque. For example, the following parameters can be set:
– Position
– Velocity
– Acceleration
– Deceleration
– Clamping torque
– Clamping torque offset

A current positioning task can be switched by "STW2.8 Traverse to fixed endstop". The switching runs a positioning task with clamping torque. The closed-loop limit manager limits the motion to the clamping torque. On completion of the task the original limit is restored.
The following error monitor is not active during the task 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 task to detect the fixed stop.
When the fixed stop is detected, "POS_ZSW2.12 Fixed stop reached" is set and the stroke limit monitor of the motion monitor is activated based on the current position.
With pending clamping torque "POS_ZSW2.13 Fixed stop Clamping torque reached" is set.
The clamping torque remains pending until a new travel command starts.
When the stroke limits for the fixed stop monitor are reached, "POS_ZSW2.12 Fixed stop reached" is reset.
The following diagrams show the behaviour:

Timing

Example 1: travel to fixed stop with reaching and stopping at the fixed stop

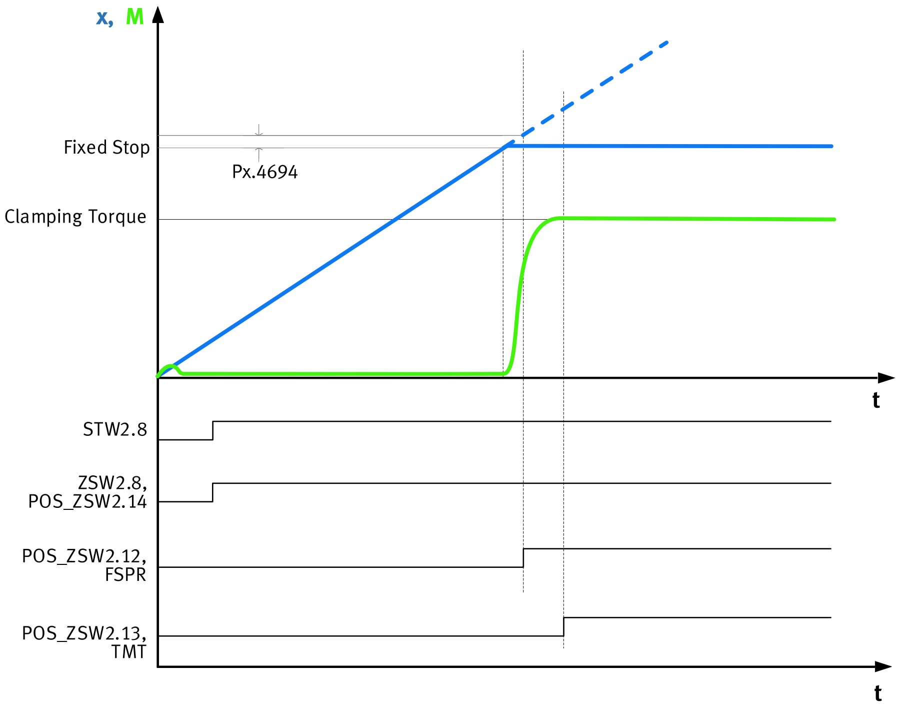

Fig. 44 Timing diagram travel to fixed stop

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. 263 Legend for timing diagram travel to fixed stop

Example 2: travel to fixed stop without reaching the fixed stop

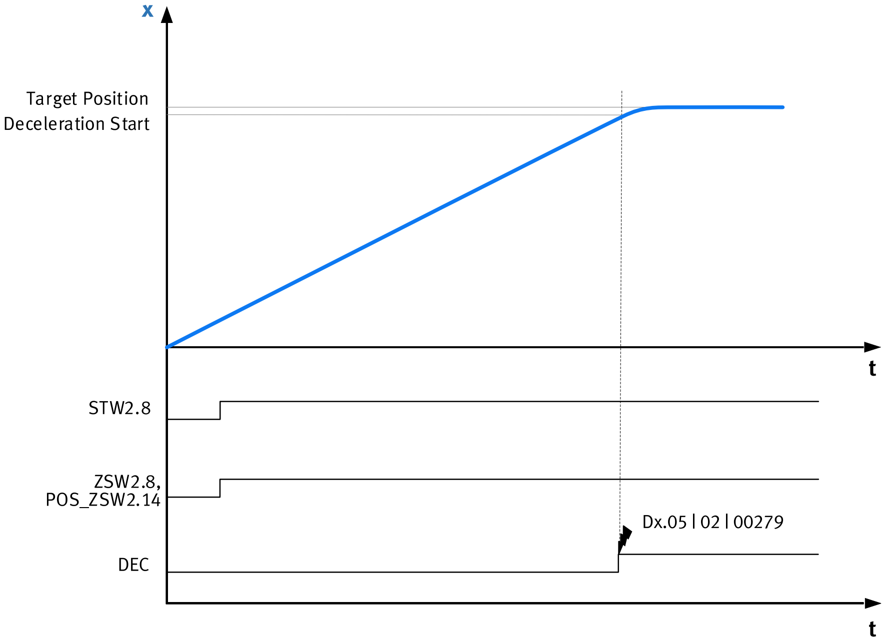

Fig. 45 Timing diagram fixed stop not reached

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. 264 Legend for timing diagram fixed stop not reached

Example 3: travel to fixed stop with reaching and feedback at the fixed stop

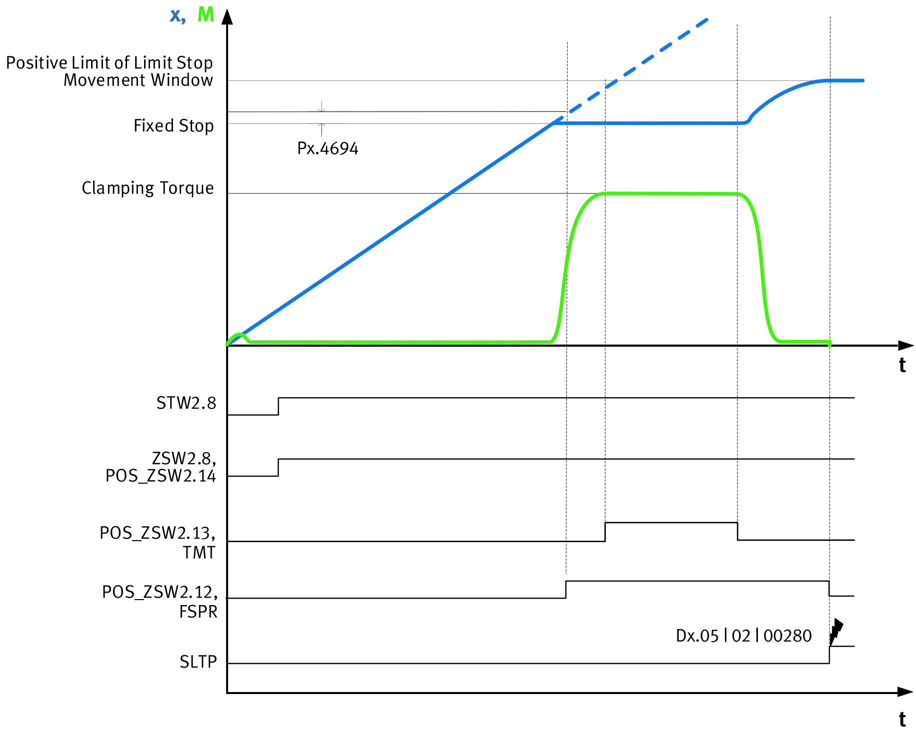

Fig. 46 Timing diagram fixed stop feeds back

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

Name	Description	ID Px.
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.05l02l280	Diagnostic message Monitoring window of fixed stop left	–

Tab. 265 Legend for timing diagram fixed stop feeds back

Parameter

Details of the motion monitoring functions ➔ 5.1 Motion monitoring functions.
The fixed stop detection acts like the following error monitor for position with critical limit and timing ➔ 5.3 Following error. The following error of the position and a damping time are used (Px.4694, Px.4693).

The detection of the pending clamping torque acts like the target range monitor for torque with critical limit and timing ➔ 5.4 Target area monitoring.
The monitoring of the stroke limits after detected fixed stop acts like the stroke limit reached motion monitor ➔ 5.9 Stroke limit reached.
The window limits can be set in the positive and negative directions (Px.11280408, Px.11280409 ➔ Tab. 266 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 behaviour on 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	–

ID Px.	Parameter	Description	
4693	Fixed stop detection damping time	Determines 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	–

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
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
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	Inci/s^2
11280607	Deceleration MDI	Displays the deceleration for the direct-value setpoint MDI.	
		Access	read/write
		Update	effective immediately
		Unit	Inci/s^2

ID Px.	Parameter	Description	
11280604	Target position MDI	Displays the target position for the setpoint direct MDI.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280605	Profile speed MDI	Displays the profile speed for the direct-value setpoint MDI.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 266 Parameter

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280606	36.0	Acceleration MDI	FloatingPoint
11280607	37.0	Deceleration MDI	FloatingPoint
11280604	34.0	Target position MDI	Integer64
11280605	35.0	Profile speed MDI	FloatingPoint
Px.	**Manufacturer-specific parameters**		
460	11144.0	Movement monitoring status	Unsigned32
4693	11635.0	Fixed stop detection damping time	FloatingPoint
4694	11636.0	Limit value following error	FloatingPoint
11280409	12331.0	Stroke limit negative for detection of a fixed stop	Integer64
11280408	12330.0	Stroke limit positive for detection of a fixed stop	Integer64
4675	11619.0	Activation of automatic stop ramp stroke limit	Boolean
4665	11611.0	Damping time target range	FloatingPoint
4668	11614.0	Monitoring window torque	FloatingPoint
526801	12168.0	Clamping torque	FloatingPoint
11280407	12329.0	Clamping torque offset	FloatingPoint
11280606	12341.0	Acceleration MDI	FloatingPoint
11280607	12342.0	Deceleration MDI	FloatingPoint
11280604	12339.0	Target position MDI	Integer64

Parameter	PNU	Name	Data type
11280605	12340.0	Profile speed MDI	FloatingPoint

Tab. 267 PNUs

Diagnostic messages

ID Dx.	Name	Description
05 I 02 I 00279 (84017431)	Fixed stop not detected	Fixed stop was not detected
05 I 02 I 00280 (84017432)	Monitoring window of fixed stop left	Monitoring window of fixed stop left

Tab. 268 Diagnostic messages

4.1.4 Velocity Mode (PV)

4.1.4.1 Function

In the velocity mode profile position operating mode, the theoretical velocity curve is calculated by the integrated trajectory generator (Profile velocity mode). The trajectory for the target velocity is calculated based on the motion quantities for the profile velocity, the acceleration, the deceleration and the jerk.

In velocity mode the velocity and current regulators are active.

The following types of velocity settings are supported in velocity mode:

Velocity specification	Description
... with stroke limitation	When the stroke limit is reached, the device reacts in accordance with parameterised STL monition monitoring ➔ 5.9 Stroke limit reached
... without stroke limitation	Velocity mode without path limitation

Tab. 269 Types of velocity mode

In velocity 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 profile 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 velocity	•
2	TRT	Target window reaches torque	–

Motion monitoring function status word			
Bit	Code	Name	Effective
3	FEX	Following error position	–
4	FEV	Velocity following error	•
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 limit position reached positive	•
15	SLN	Software limit position reached negative	•
16	STX	Standstill monitoring position/velocity	•
17	STV	Standstill monitoring velocity	•
18	LS	Stop reached	•
19	STLP	Stroke limit reached positive	•
20	STLN	Stroke limit reached negative	•
21	VM	Speed monitoring	•
22	PB	Pushback 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. 270 Motion monitoring function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Motion quantities

The path course of a positioning command is largely influenced by the following motion quantities:

Motion quantities	Description
Target velocity	Command value for the target velocity
Acceleration	Nominal acceleration
Deceleration	Nominal deceleration (with target velocity < actual velocity)
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. 271 Motion quantities

Triggering commands

– the record table
– the fieldbus (direct mode)

Requirements

– Controller enable

Timing

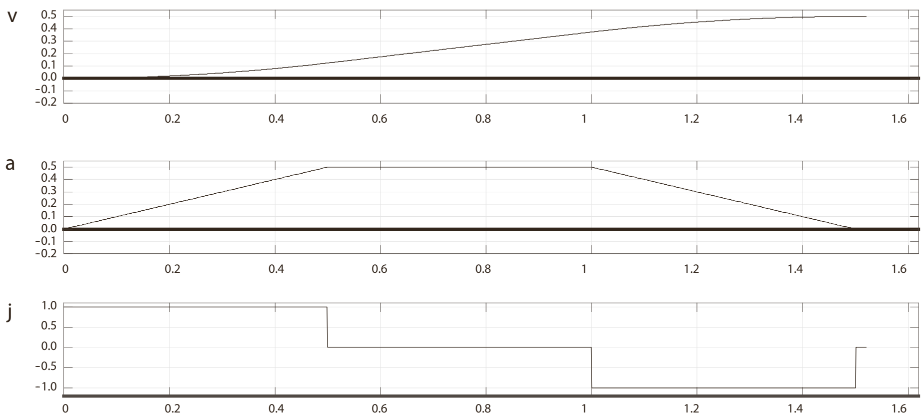

Fig. 47 Timing graph of velocity mode (example)

Name	Description
v	Velocity

Name	Description
a	Acceleration
j	Jerk

Tab. 272 Legend for timing graph of velocity mode

4.1.4.2 CiA 402

The following graphs show an overview of the objects involved in the velocity mode and their interaction with the trajectory generator:

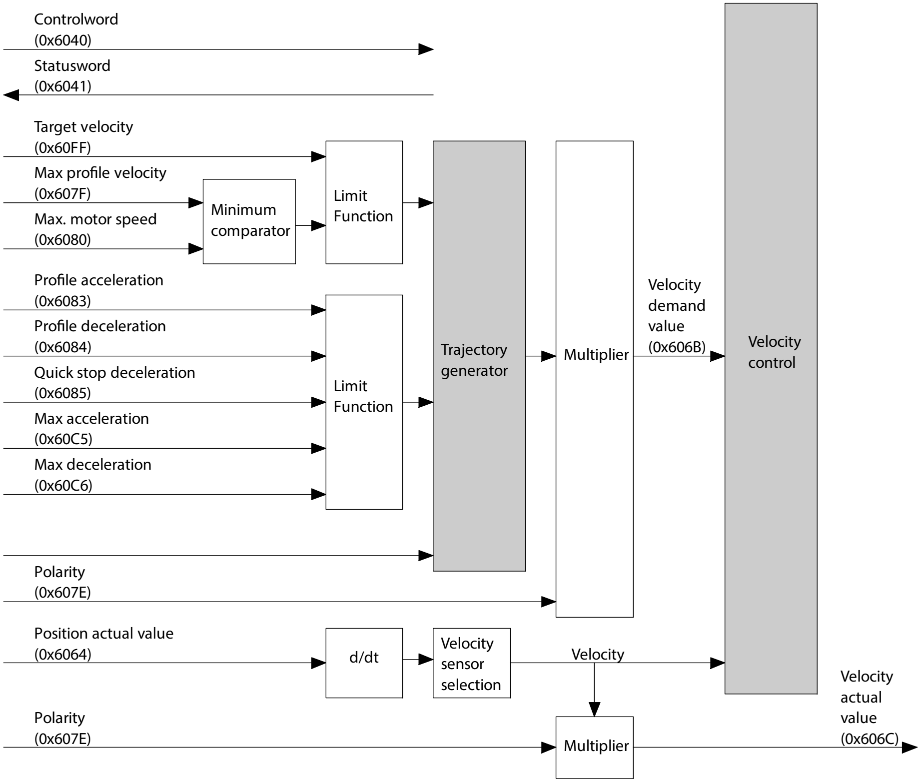

Fig. 48 Trajectory generator in velocity mode (PV)

Objects

Parameter	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
730	0x6040.00	Control word CiA402	UINT16
731	0x6041.00	Status word CiA402	UINT16
128	0x60E4.01	Actual position value	SINT32
113104	0x6064.00	Actual value of modulo	SINT32
1210	0x606C.00	Actual velocity value	SINT32
4610	0x606D.00	Monitoring window target speed	UINT16
468	0x6068.00	Damping time target reached	UINT16
466	0x606F.00	Monitoring window speed standstill monitoring	UINT16
465	0x6070.00	Standstill damping time	UINT16
1170	0x607E.00	Reversing the direction of rotation	UINT8
1304	0x607F.00	Limit value velocity limiting	UINT32
7123	0x6080.00	Maximum rpm (user defined)	UINT32
8133	0x6083.00	Profile acceleration CiA402	UINT32
8134	0x6084.00	Profile deceleration CiA402	UINT32
8135	0x6085.00	Quick stop deceleration CiA402	UINT32
1305	0x60C5.00	Limit value acceleration limiting	UINT32
1306	0x60C6.00	Limit value deceleration limiting	UINT32
464	0x60F8.00	Monitoring window speed: following error	SINT32
8137	0x60FF.00	Target velocity CiA402	SINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
730	0x216D.01	Control word CiA402	UINT16
731	0x216D.02	Status word CiA402	UINT16
128	0x2155.09	Actual position value	SINT64
113104	0x2197.05	Actual value of modulo	SINT64
1210	0x2155.0B	Actual velocity value	FLOAT32
4610	0x2166.0B	Monitoring window target speed	FLOAT32
468	0x2166.09	Damping time target reached	FLOAT32
466	0x2166.07	Monitoring window speed standstill monitoring	FLOAT32

Parameter	Index.Subind-ex	Name	Data type
465	0x2166.06	Standstill damping time	FLOAT32
1170	0x217D.01	Reversing the direction of rotation	BOOL
1304	0x2183.04	Limit value velocity limiting	FLOAT32
7123	0x216C.06	Maximum rpm (user defined)	FLOAT32
8133	0x216F.06	Profile acceleration CiA402	FLOAT32
8134	0x216F.07	Profile deceleration CiA402	FLOAT32
8135	0x216F.08	Quick stop deceleration CiA402	FLOAT32
1305	0x2183.05	Limit value acceleration limiting	FLOAT32
1306	0x2183.06	Limit value deceleration limiting	FLOAT32
464	0x2166.05	Monitoring window speed: following error	FLOAT32
8137	0x216F.0A	Target velocity CiA402	FLOAT32

Tab. 273 Objects

Precondition for Velocity Mode

The following conditions must be fulfilled for velocity mode:

– Modes of operation display (0x6061) = 3
– Statusword (0x6061) = XX0X XX1X X011 0111_b

Control and Monitoring

NOTICE!

In velocity mode, start signal or starting edge is not required to start the motion.

Object 0x6040: Controlword

The object controls the following velocity mode functions:

– Bit 8: stop motion command (Halt)

Bit[1] 8	Description
Stop/continue movement (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. 274 Control Velocity Mode

Object 0x6041: Statusword

The following statuses of velocity mode can be monitored with the object:

– Bit 10: target velocity reached (Target reached)

– Bit 12: velocity (Speed)
– Bit 13: velocity following error (Following error)

Bit[1]			Description
13	12	10	
Target velocity reached (Target reached) (depending on Bit 8 (Halt) in Controlword 0x6040)			
x	x	0	Halt = 0: target velocity was not reached
x	x	1	Halt = 0: target velocity was reached
x	x	0	Halt = 1: drive decelerated
x	x	1	Halt = 1: velocity = 0
Standstill message			
x	0	x	Geschwindigkeitsistwert ≠ 0
x	1	x	Geschwindigkeitsistwert = 0
Velocity following error (Following error)			
0	x	x	A velocity following error is not active
1	x	x	Velocity following error limit reached

1) signal status: 0 = low; 1 = high; x = any

Tab. 275 Monitoring Velocity Mode

4.1.4.3 PROFIdrive

Control and Monitoring

Application class ➔ 12.4.3.2 Finite State Machine Velocity Mode in Application Class 1

PNUs

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value	FloatingPoint
113104	28.0	Actual value of modulo	Integer64
Px.	**Manufacturer-specific parameters**		
128	11067.0	Actual position value	Integer64
113104	12117.0	Actual value of modulo	Integer64
1210	11311.0	Actual velocity value	FloatingPoint
4610	11565.0	Monitoring window target speed	FloatingPoint
468	11152.0	Damping time target reached	FloatingPoint
466	11150.0	Monitoring window speed standstill monitoring	FloatingPoint

Parameter	PNU	Name	Data type
465	11149.0	Standstill damping time	FloatingPoint
1170	11287.0	Reversing the direction of rotation	Boolean
1304	11334.0	Limit value velocity limiting	FloatingPoint
7123	11694.0	Maximum rpm (user defined)	FloatingPoint
1305	11335.0	Limit value acceleration limiting	FloatingPoint
1306	11336.0	Limit value deceleration limiting	FloatingPoint
464	11148.0	Monitoring window speed: following error	FloatingPoint

Tab. 276 PNUs

4.1.5 Force/torque mode (PT) with or without holding brake

4.1.5.1 Function

In the force/torque mode profile position 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. In force/torque mode the velocity and current regulators are active.
The transition to the new setpoint quantity can be influenced by parameterisation of the rise time.
The following variants are supported in force/torque mode:

Force/torque mode ...	Description
With velocity and without stroke limitation	Force/torque with velocity limitation
With velocity and stroke limitation	Force/torque with velocity and stroke limitation

Tab. 277 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 profile operating modes is possible.

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	–

Motion monitoring function status word			
Bit	Code	Name	Effective
1	TRV	Target window reaches velocity	–
2	TRT	Target window reaches torque	•
3	FEX	Following error position	–
4	FEV	Velocity following error	–
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 limit position reached positive	•
15	SLN	Software limit position reached negative	•
16	STX	Standstill monitoring position/velocity	•
17	STV	Standstill monitoring velocity	•
18	LS	Stop reached	•
19	STLP	Stroke limit reached positive	•
20	STLN	Stroke limit reached negative	•
21	VM	Speed monitoring	•
22	PB	Pushback 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. 278 Motion monitoring function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Motion quantities

The path course of a positioning command 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 velocity 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. 279 Motion quantities

Triggering commands

– the record table
– the fieldbus (direct mode)

Requirements for force/torque

– Controller enable

Timing

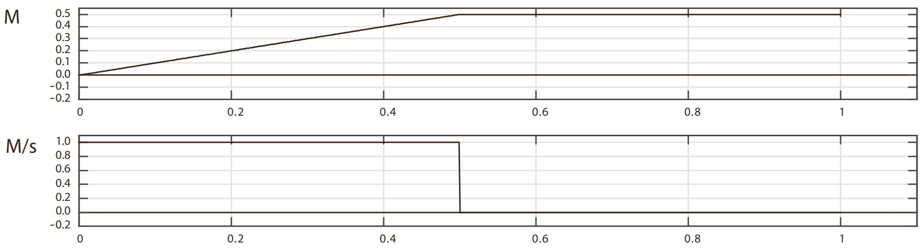

Fig. 49 Force/torque mode timing graph (example)

Name	Description
M	Torque
M/s	Torque increase

Tab. 280 Legend for force/torque mode timing graph

4.1.5.2 CiA 402

The following graphs show an overview of the objects involved in the force/torque mode and their interaction with the trajectory generator:

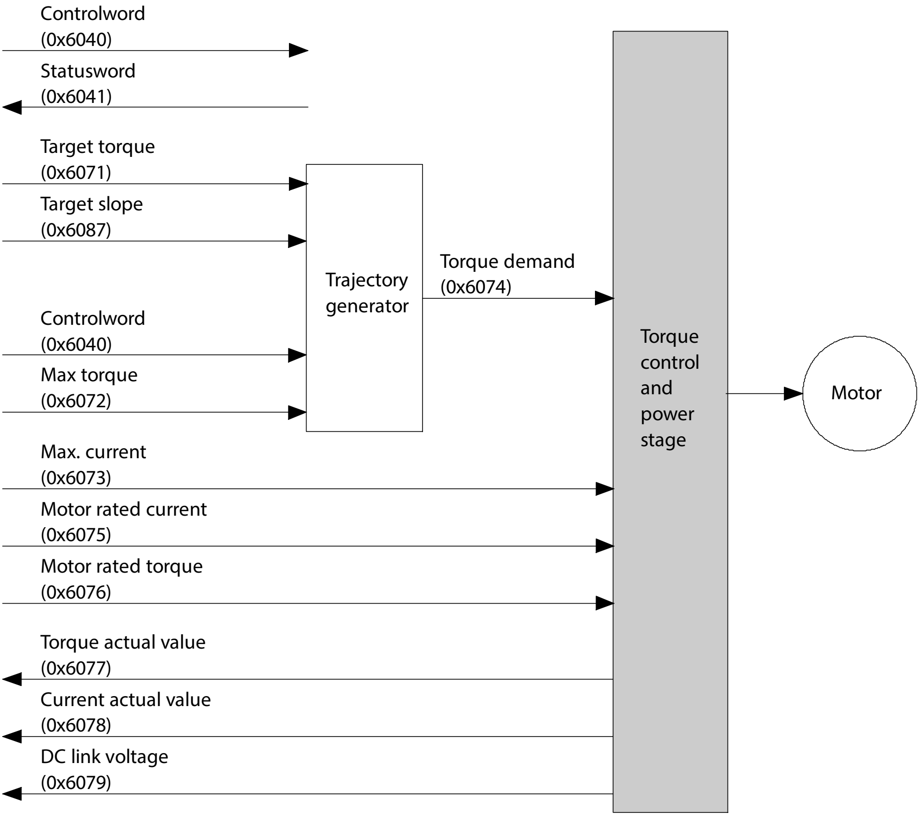

Fig. 50 Trajectory generator in force/torque (PT)

Objects

Parameter	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
730	0x6040.00	Control word CiA402	UINT16
731	0x6041.00	Status word CiA402	UINT16
526795	0x6071.00	Target torque CiA402	SINT16
526796	0x6072.00	Maximum torque symmetrical	UINT16
856	0x6073.00	Limit value total current (closed loop controller)	UINT16
3014	0x6074.00	Setpoint generator output torque	SINT16

Parameter	Index.Subindex	Name	Data type
7118	0x6075.00	Current nominal current	UINT32
7139	0x6076.00	Resulting nominal torque	UINT32
151	0x6077.00	Actual torque value gear shaft	SINT16
814	0x6078.00	Actual active current value	SINT16
480	0x6079.00	Actual value DC link voltage	UINT32
526799	0x6087.00	Torque slope CiA402	UINT32
853	0x60E0.00	Upper limit value torque (closed loop controller)	UINT16
852	0x60E1.00	Lower limit value torque (closed loop controller)	UINT16
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
730	0x216D.01	Control word CiA402	UINT16
731	0x216D.02	Status word CiA402	UINT16
526795	0x216F.0D	Target torque CiA402	FLOAT32
526796	0x2168.17	Maximum torque symmetrical	FLOAT32
856	0x2168.07	Limit value total current (closed loop controller)	FLOAT32
3014	0x2188.07	Setpoint generator output torque	FLOAT32
7118	0x2162.05	Current nominal current	FLOAT32
7139	0x2162.0C	Resulting nominal torque	FLOAT32
151	0x2157.02	Actual torque value gear shaft	FLOAT32
814	0x2153.0F	Actual active current value	FLOAT32
480	0x2114.01	Actual value DC link voltage	FLOAT32
526799	0x216F.0E	Torque slope CiA402	FLOAT32
853	0x2168.04	Upper limit value torque (closed loop controller)	FLOAT32
852	0x2168.03	Lower limit value torque (closed loop controller)	FLOAT32

Tab. 281 Objects

Precondition for force/torque mode

The following conditions must be fulfilled for force/torque mode:

– Modes of operation display (0x6061) = 4
– Statusword (0x6061) = XX0X XX1X X011 0111_b

Control and monitoring

Object 0x6040: Controlword

NOTICE!

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, initiating or continuing movement (Halt)

Bit[1] 8	Description
Stop/continue movement (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. 282 Controlling force/torque mode

Object 0x6041: Statusword

The following statuses of force/torque mode can be monitored with the object:

– Bit 10: target reached (Target reached)

Bit[1] 10	Description
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: velocity = 0

1) Signal status: 0 = low; 1 = high

Tab. 283 Monitoring force/torque mode

4.1.5.3 PROFIdrive

PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
526796	12166.0	Maximum torque symmetrical	FloatingPoint
856	11218.0	Limit value total current (closed loop controller)	FloatingPoint
3014	11502.0	Setpoint generator output torque	FloatingPoint

Parameters	PNU	Name	Data type
7118	11691.0	Current nominal current	FloatingPoint
7139	11704.0	Resulting nominal torque	FloatingPoint
151	11070.0	Actual torque value gear shaft	FloatingPoint
814	11190.0	Actual active current value	FloatingPoint
480	2148.0	Actual value DC link voltage	FloatingPoint
853	11215.0	Upper limit value torque (closed loop controller)	FloatingPoint
852	11214.0	Lower limit value torque (closed loop controller)	FloatingPoint

Tab. 284 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, step 1 ms, ➔ Px.1051). The integrated fine interpolator therefore calculates intermediate support points and derivations from the setpoint quantity 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 velocity	–
2	TRT	Target window reaches torque	–
3	FEX	Following error position	•
4	FEV	Velocity following error	–
6	TMX	Position target area monitoring	–
7	TMV	Velocity target area monitoring	–
8	TMT	Torque target area monitoring	–
9...11	–	Reserved	–
12	HLP	Hardware limit switch reached positive	•

Motion monitoring function status word			
Bit	Code	Name	Effective
13	HLN	Hardware limit switch reached negative	•
14	SLP	Software end position reached positive	•
15	SLN	Software limit position reached negative	•
16	STX	Standstill monitoring position/velocity	•
17	STV	Standstill monitoring velocity	•
18	LS	Stop reached	•
19	STLP	Stroke limit reached positive	–
20	STLN	Stroke limit reached negative	–
21	VM	Velocity monitoring	•
22	PB	Pushback 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. 285 Motion Monitoring Function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Motion Quantities

The path course of a positioning command is largely influenced by the following motion quantities:

Motion Quantities	Description
Setpoint position	The higher-order PLC supplies the setpoint position.
Velocity (optional)	External pilot control values for the velocity and the torque can also be specified (optional).
Torque (optional)	

Tab. 286 Motion Quantities

Requirements

– Controller Enable

Pilot Control Values

External pilot control values for the velocity 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; pilot control values are generated by an internal algorithm – Ipo algorithms 4nd order
CSP-V	external velocity pilot control value – Ipo algorithms 3nd order
CSP-T	external torque pilot control value – Ipo algorithms 3nd order
CSP-VT	external velocity and torque pilot control values – Ipo algorithms 2nd order

Tab. 287 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 generated first and populated with input data. When the algorithms reach the initialised status, the regulation 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.

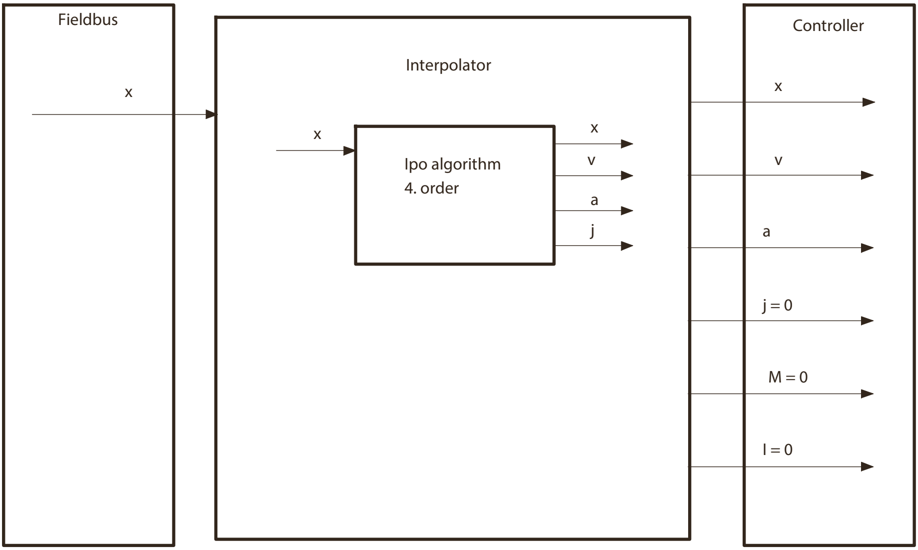

Fig. 51 CSP operation without external pilot control

The following graph shows an example of the input and output values for the interpolator in straight CSP operation with velocity and torque pilot control values.

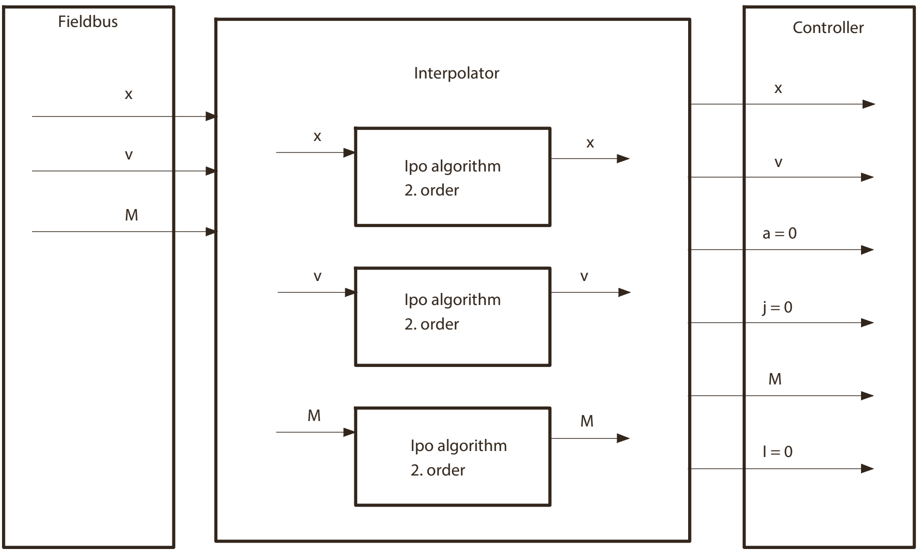

Fig. 52 CSP operation with external velocity and torque pilot control (CSP-VT)

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. 288 Parameter

Diagnostic Messages

ID Dx.	Name	Description
08 I 12 I 00250 (135004410)	Invalid mode of operation	An invalid mode of operation was requested

Tab. 289 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.

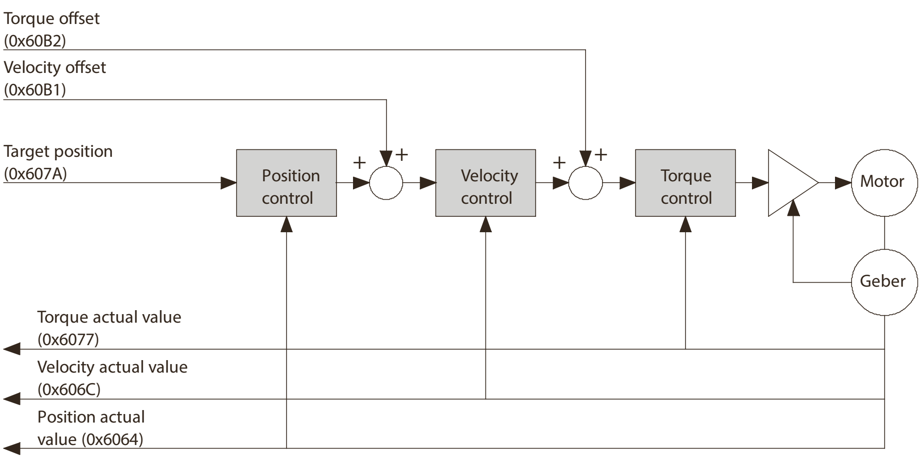

Fig. 53 Overview of the cyclic synchronised positioning operation (CSP)

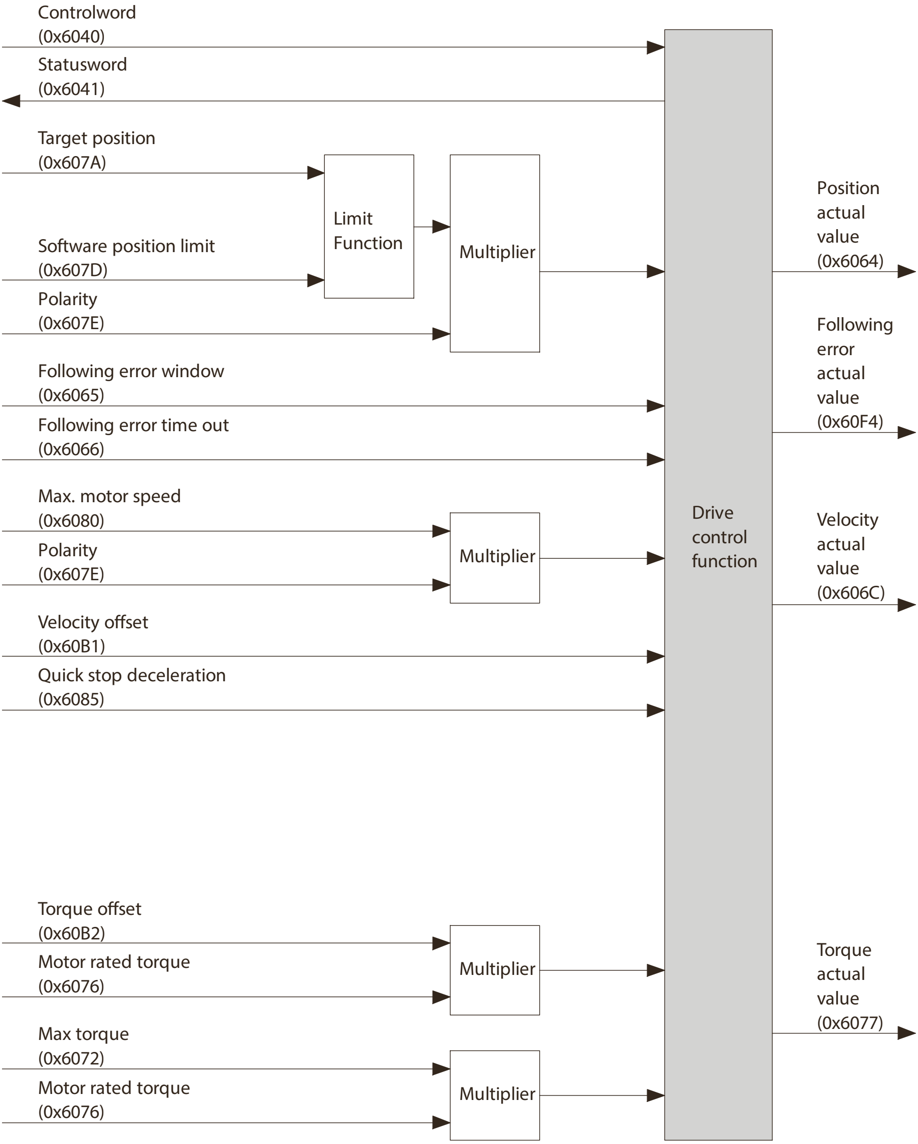

Fig. 54 Object overview of the cyclic synchronised positioning operation (CSP)

NOTICE!

The position following error is only evaluated in the "operation enabled" status.

Parameter	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
730	0x6040.00	Control word CiA402	UINT16
731	0x6041.00	Status word CiA402	UINT16
128	0x60E4.01	Actual position value	SINT32
113104	0x6064.00	Actual value of modulo	SINT32
463	0x6065.00	Monitoring window position: following error	UINT32
462	0x6066.00	Damping time position: following error	UINT16
1210	0x606C.00	Actual velocity value	SINT32
526796	0x6072.00	Maximum torque symmetrical	UINT16
7139	0x6076.00	Resulting nominal torque	UINT32
151	0x6077.00	Actual torque value gear shaft	SINT16
8130	0x607A.00	Target position CiA402	SINT32
4629	0x607D.01	Negative software limit position	SINT32
4630	0x607D.02	Positive software limit position	SINT32
1170	0x607E.00	Reversing the direction of rotation	UINT8
7123	0x6080.00	Maximum rpm (user defined)	UINT32
8135	0x6085.00	Quick stop deceleration CiA402	UINT32
8138	0x60B1.00	Velocity offset CiA402	SINT32
8111	0x60B2.00	Torque offset CiA402	SINT16
4682	0x60F4.00	Current position: following error	SINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
730	0x216D.01	Control word CiA402	UINT16
731	0x216D.02	Status word CiA402	UINT16
128	0x2155.09	Actual position value	SINT64
113104	0x2197.05	Actual value of modulo	SINT64
463	0x2166.04	Monitoring window position: following error	FLOAT32
462	0x2166.03	Damping time position: following error	FLOAT32
1210	0x2155.0B	Actual velocity value	FLOAT32
526796	0x2168.17	Maximum torque symmetrical	FLOAT32
7139	0x2162.0C	Resulting nominal torque	FLOAT32
151	0x2157.02	Actual torque value gear shaft	FLOAT32

Parameter	Index.Subindex	Name	Data type
8130	0x216F.03	Target position CiA402	SINT64
4629	0x2166.1E	Negative software limit position	SINT64
4630	0x2166.1F	Positive software limit position	SINT64
1170	0x217D.01	Reversing the direction of rotation	BOOL
7123	0x216C.06	Maximum rpm (user defined)	FLOAT32
8135	0x216F.08	Quick stop deceleration CiA402	FLOAT32
8138	0x216F.0B	Velocity offset CiA402	FLOAT32
8111	0x216F.01	Torque offset CiA402	FLOAT32
4682	0x2166.42	Current position: following error	FLOAT32
11412	0x217B.0D	Interpolation mode CSP	UINT32

Tab. 290 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. 291 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 (0x6061) = XX0X XX1X X011 0111_b

Control and Monitoring

Object 0x6040: Controlword

Bits specific to operating modes are not required and not evaluated. The operating mode is active immediately.
The bit Halt in the control word is ignored.

Object 0x6041: Statusword

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. 292 Monitoring cyclic synchronised positioning mode (CSP)

4.1.6.3 PROFIdrive

PNUs

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value	FloatingPoint
113104	28.0	Actual value of modulo	Integer64
Px.	Manufacturer-specific parameters		
128	11067.0	Actual position value	Integer64
113104	12117.0	Actual value of modulo	Integer64
463	11147.0	Monitoring window position: following error	FloatingPoint
462	11146.0	Damping time position: following error	FloatingPoint
1210	11311.0	Actual velocity value	FloatingPoint
526796	12166.0	Maximum torque symmetrical	FloatingPoint
7139	11704.0	Resulting nominal torque	FloatingPoint
151	11070.0	Actual torque value gear shaft	FloatingPoint
4629	11584.0	Negative software limit position	Integer64
4630	11585.0	Positive software limit position	Integer64
1170	11287.0	Reversing the direction of rotation	Boolean
7123	11694.0	Maximum rpm (user defined)	FloatingPoint
4682	11624.0	Current position: following error	FloatingPoint

Tab. 293 PNUs

4.1.7 Cyclic Synchronised Velocity Mode (CSV)

4.1.7.1 Function

The cyclic synchronised velocity 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, step 1 ms, ➔ Px.1051). The integrated fine interpolator therefore calculates intermediate support points and derivations from the setpoint quantity 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 velocity	–
2	TRT	Target window reaches torque	–
3	FEX	Following error position	–
4	FEV	Velocity following error	•
6	TMX	Position target area monitoring	–
7	TMV	Velocity 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 limit position reached negative	•
16	STX	Standstill monitoring position/velocity	•
17	STV	Standstill monitoring velocity	•
18	LS	Stop reached	•
19	STLP	Stroke limit reached positive	–
20	STLN	Stroke limit reached negative	–
21	VM	Velocity monitoring	•
22	PB	Pushback monitoring	–
23	RDX	Remaining distance monitoring	–

Motion monitoring function status word			
Bit	Code	Name	Effective
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. 294 Motion Monitoring Function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Motion Quantities

The path course of a positioning command is largely influenced by the following motion quantities:

Motion Quantities	Description
Nominal velocity	The higher-order PLC supplies the setpoint velocity.
Torque	Pilot control values for the torque can also be specified (optional).

Tab. 295 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. – Ipo algorithms 4nd order
CSV-T	external torque pilot control value – Ipo algorithms 3nd order

Tab. 296 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 generated

first and populated with input data. When the algorithms reach the initialised status, the regulation is switched to the new operating mode.
The following graphs show the input and output values for the interpolator in the CSV operating modes.

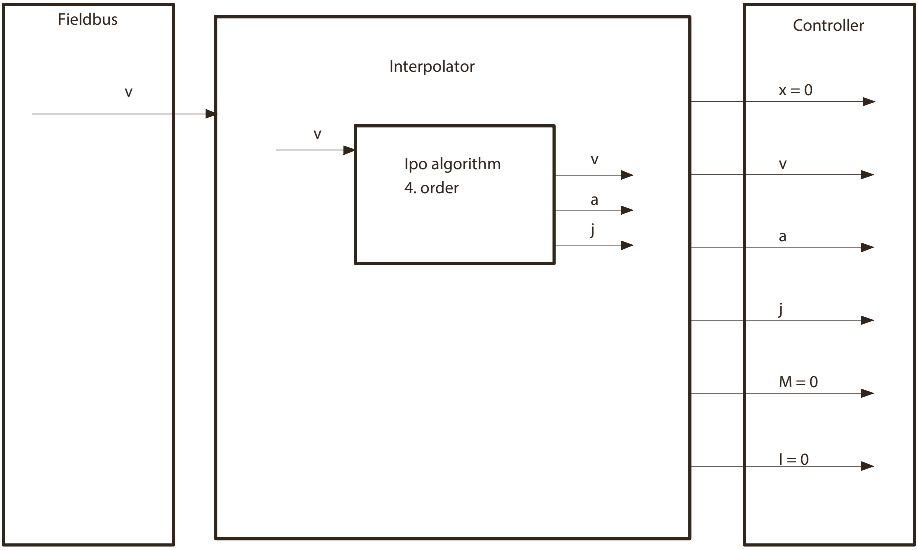

Fig. 55 CSV operation without external pilot control

The following graph shows an example of the input and output values for the interpolator in straight CSV operation with velocity and torque pilot control values.

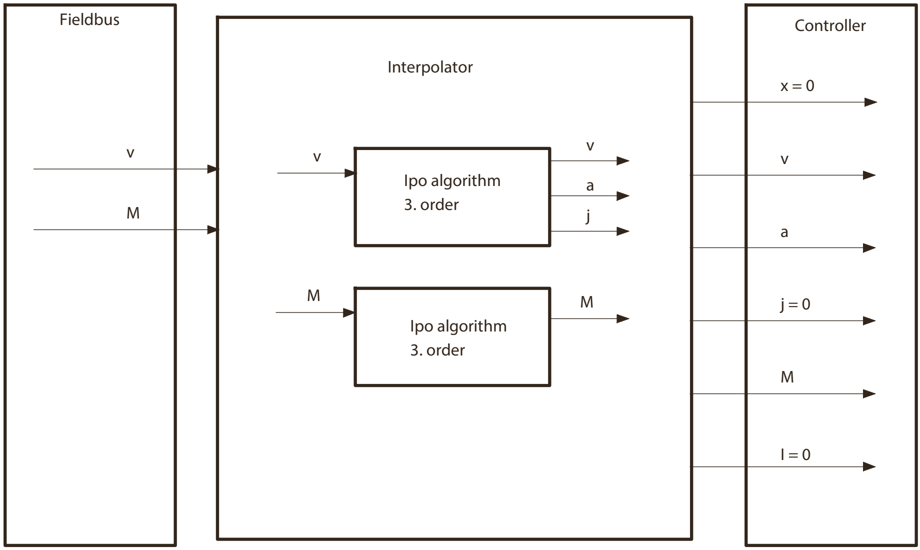

Fig. 56 CSV operation with external torque pilot control (CSV-T)

Parameter

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. 297 Parameter

Diagnostic Messages

ID Dx.	Name	Description
08 I 12 I 00250 (135004410)	Invalid mode of operation	An invalid mode of operation was requested

Tab. 298 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.

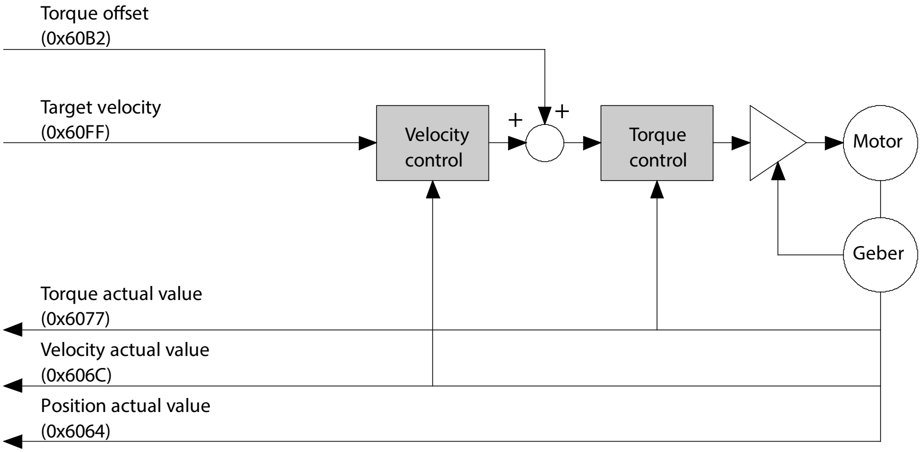

Fig. 57 Overview of the cyclic synchronised velocity operation (CSV)

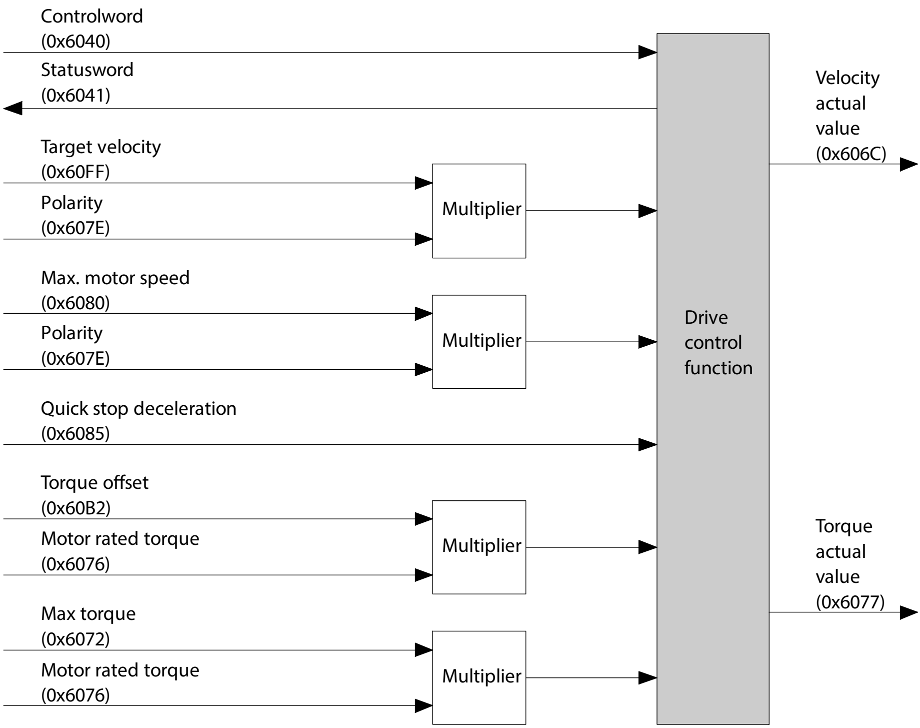

Fig. 58 Object overview of the cyclic synchronised velocity operation (CSV)

Parameter	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
730	0x6040.00	Control word CiA402	UINT16
731	0x6041.00	Status word CiA402	UINT16
128	0x60E4.01	Actual position value	SINT32
113104	0x6064.00	Actual value of modulo	SINT32
1210	0x606C.00	Actual velocity value	SINT32
526796	0x6072.00	Maximum torque symmetrical	UINT16
7139	0x6076.00	Resulting nominal torque	UINT32
151	0x6077.00	Actual torque value gear shaft	SINT16
1170	0x607E.00	Reversing the direction of rotation	UINT8
7123	0x6080.00	Maximum rpm (user defined)	UINT32
8135	0x6085.00	Quick stop deceleration CiA402	UINT32
8111	0x60B2.00	Torque offset CiA402	SINT16
8137	0x60FF.00	Target velocity CiA402	SINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
730	0x216D.01	Control word CiA402	UINT16
731	0x216D.02	Status word CiA402	UINT16
128	0x2155.09	Actual position value	SINT64
113104	0x2197.05	Actual value of modulo	SINT64
1210	0x2155.0B	Actual velocity value	FLOAT32
526796	0x2168.17	Maximum torque symmetrical	FLOAT32
7139	0x2162.0C	Resulting nominal torque	FLOAT32
151	0x2157.02	Actual torque value gear shaft	FLOAT32
1170	0x217D.01	Reversing the direction of rotation	BOOL
7123	0x216C.06	Maximum rpm (user defined)	FLOAT32
8135	0x216F.08	Quick stop deceleration CiA402	FLOAT32
8111	0x216F.01	Torque offset CiA402	FLOAT32
8137	0x216F.0A	Target velocity CiA402	FLOAT32
11413	0x217B.0E	Interpolation mode CSV	UINT32

Tab. 299 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. 300 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 (0x6061) = 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. 301 Monitoring cyclic synchronised velocity mode

4.1.7.3 PROFIdrive

PNUs

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value	FloatingPoint
113104	28.0	Actual value of modulo	Integer64
Px.	**Manufacturer-specific parameters**		
128	11067.0	Actual position value	Integer64
113104	12117.0	Actual value of modulo	Integer64
1210	11311.0	Actual velocity value	FloatingPoint
526796	12166.0	Maximum torque symmetrical	FloatingPoint

Parameter	PNU	Name	Data type
7139	11704.0	Resulting nominal torque	FloatingPoint
151	11070.0	Actual torque value gear shaft	FloatingPoint
1170	11287.0	Reversing the direction of rotation	Boolean
7123	11694.0	Maximum rpm (user defined)	FloatingPoint

Tab. 302 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 command 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, step 1 ms, ➔ Px.1051). The integrated fine interpolator therefore calculates intermediate support points and derivations from the setpoint quantity 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 velocity	–
2	TRT	Target window reaches torque	–
3	FEX	Following error position	–
4	FEV	Velocity following error	•
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 limit position reached positive	•
15	SLN	Software limit position reached negative	•
16	STX	Standstill monitoring position/velocity	•

Motion monitoring function status word			
Bit	Code	Name	Effective
17	STV	Standstill monitoring velocity	•
18	LS	Stop reached	•
19	STLP	Stroke limit reached positive	–
20	STLN	Stroke limit reached negative	–
21	VM	Speed monitoring	•
22	PB	Pushback 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. 303 Motion monitoring function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Motion quantities

The path course of a positioning command is largely influenced by the following motion quantities:

Motion quantities	Description
Setpoint force/setpoint torque	The higher-order PLC supplies the setpoint force.

Tab. 304 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.

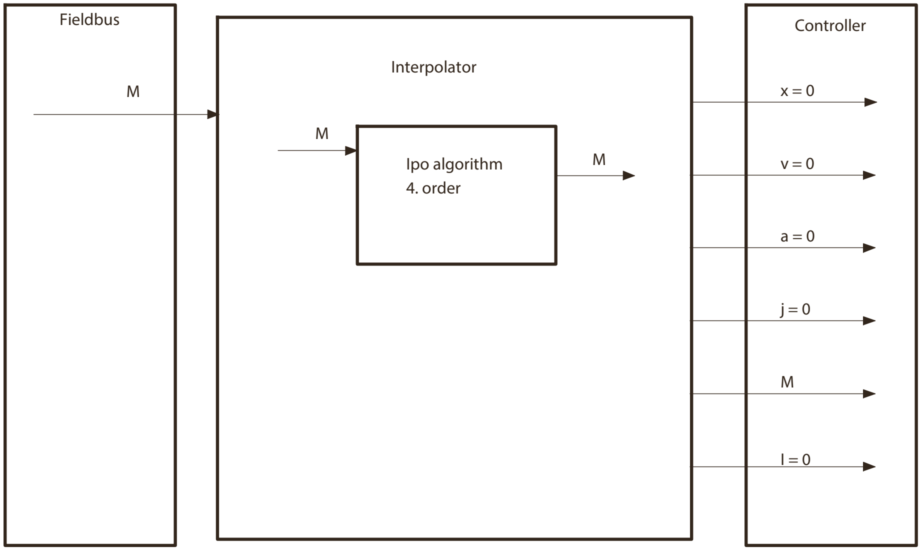

Fig. 59 CST operation

4.1.8.2 CiA 402

The following graphs show an overview of the objects involved in the cyclic synchronised force/torque mode and their interaction with the closed-loop controller.

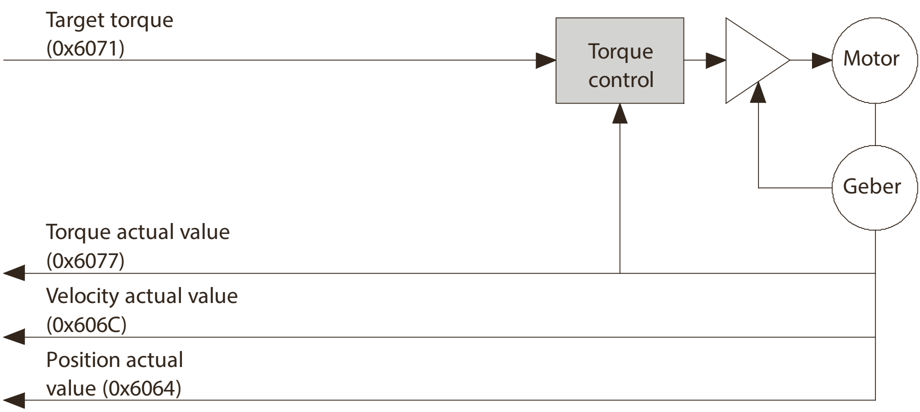

Fig. 60 Overview of the cyclic synchronised force/torque operation (CST)

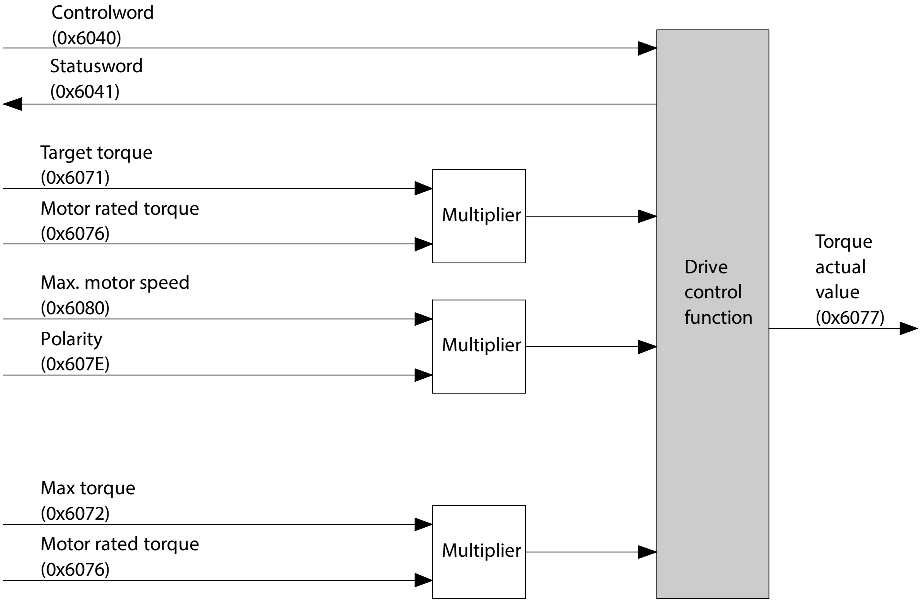

Fig. 61 Object overview of the cyclic synchronised force/torque operation (CST)

Parameter	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
730	0x6040.00	Control word CiA402	UINT16
731	0x6041.00	Status word CiA402	UINT16
128	0x60E4.01	Actual position value	SINT32
113104	0x6064.00	Actual value of modulo	SINT32
1210	0x606C.00	Actual velocity value	SINT32
526795	0x6071.00	Target torque CiA402	SINT16
526796	0x6072.00	Maximum torque symmetrical	UINT16
151	0x6077.00	Actual torque value gear shaft	SINT16
1170	0x607E.00	Reversing the direction of rotation	UINT8
7123	0x6080.00	Maximum rpm (user defined)	UINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
730	0x216D.01	Control word CiA402	UINT16
731	0x216D.02	Status word CiA402	UINT16

Parameter	Index.Subindex	Name	Data type
128	0x2155.09	Actual position value	SINT64
113104	0x2197.05	Actual value of modulo	SINT64
1210	0x2155.0B	Actual velocity value	FLOAT32
526795	0x216F.0D	Target torque CiA402	FLOAT32
526796	0x2168.17	Maximum torque symmetrical	FLOAT32
151	0x2157.02	Actual torque value gear shaft	FLOAT32
1170	0x217D.01	Reversing the direction of rotation	BOOL
7123	0x216C.06	Maximum rpm (user defined)	FLOAT32

Tab. 305 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 (0x6061) = 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] 12	Description
Drive follows the setpoint 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. 306 Monitoring cyclic synchronised force/torque operation

4.1.8.3 PROFIdrive

PNUs

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value	FloatingPoint
113104	28.0	Actual value of modulo	Integer64
Px.	**Manufacturer-specific parameters**		
128	11067.0	Actual position value	Integer64

Parameter	PNU	Name	Data type
113104	12117.0	Actual value of modulo	Integer64
1210	11311.0	Actual velocity value	FloatingPoint
526796	12166.0	Maximum torque symmetrical	FloatingPoint
151	11070.0	Actual torque value gear shaft	FloatingPoint
1170	11287.0	Reversing the direction of rotation	Boolean
7123	11694.0	Maximum rpm (user defined)	FloatingPoint

Tab. 307 PNUs

4.1.9 Switch-on/off Behaviour and Closed-loop Controller Enable

4.1.9.1 Function

Operating Readiness Status

The device can display its operating status via an output (ready). For this, the output must be configured accordingly (Px.11203 or Px.11204 ➔ Tab. 220 Configurable Output Signals at X1A.9 and X1A.10). To configure the output using the plug-in, see ➔ page "Digital I/O".
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 Behaviour

After the device is switched on, it runs through the start-up phase. E.g. it runs the following items:

– 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 intermediate circuit 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 ➔ Parameters and Diagnostic Messages, Parameter Px.10234.
The start-up phase may take several seconds, depending on the encoder used.

Switch-off Behaviour

When switching off the logic power supply the device detects that it has dropped below the defined threshold value and reacts as follows:

– The output stage is switched off
– With multi-turn encoders the multi-turn position is saved in the EEPROM
– The operating hour counter is saved ➔ 9.6.3 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 intermediate circuit 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.
- If commutation angle discovery is required, the commutation angle discovery is performed. Then the relevant operating mode is activated ➔ Tab. 310 Options for controller enable.
- If commutation angle discovery is not required, the relevant operating mode is activated immediately ➔ Tab. 310 Options for controller enable.

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Behaviour 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

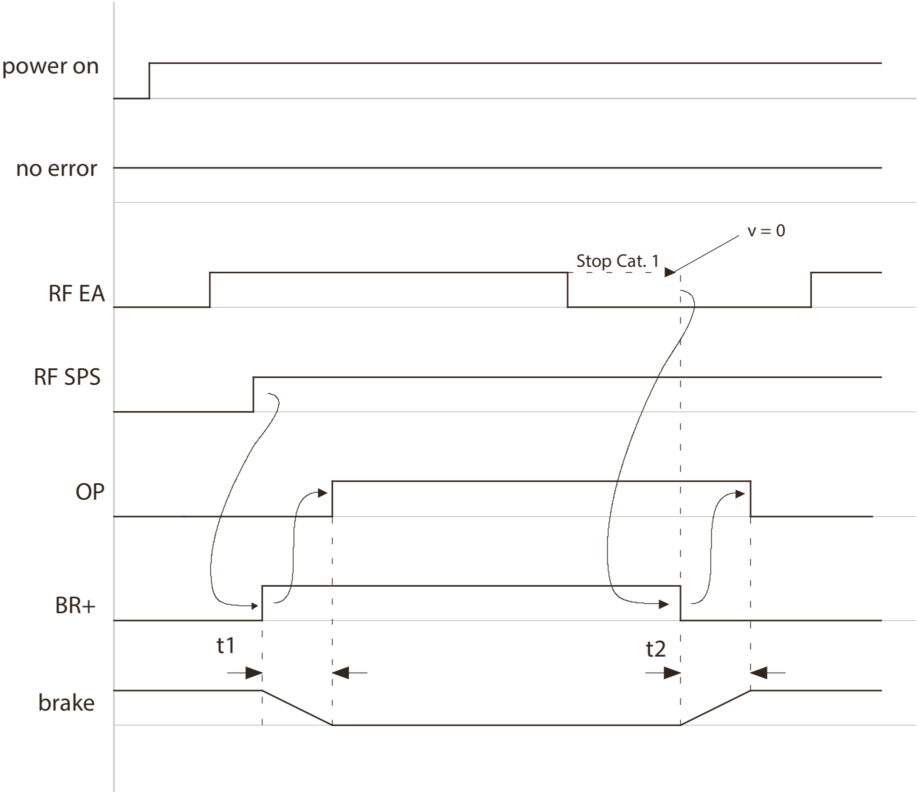

Fig. 62 Timing graph achieve ready status – enable logic: I/O and fieldbus (example)

With a new enable signal via CTRL-EN the closed-loop 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 positive edge of the enable signal must follow via fieldbus.

Name	**Description**	**ID Px.**
power on	Switch on power supplies	–
no error	No error	–
RF IO	Controller enable via CTRL-EN	–
RF PLC	Controller enable via fieldbus	–
OP	Ready for operation	–
BR+	Brake output	–

Name	Description	ID Px.
Brake	Mechanical behaviour of brake (released and set)	–
t1	Switch-on delay depending on the parameterised switch-on delay	
	Switch-on delay holding brake 1	20
t2	Switch-off delay depending on the parameterised switch-off delay	
	Switch-off delay holding brake 1	21
Stop cat. 1	Stop category 1	–

Tab. 308 Legend for the Achieve Ready Status Timing Graph

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Detailed information on automatic control of the holding brakes ➔ 3.3.2 Brake Control.

Commutation Angle Discovery and Controller Enable

If the drive moves during controller enable, automatic commutation angle discovery 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 closed-loop controller is blocked. For product designs without a holding brake, the drive is then freely movable.

Parameters and Diagnostic Messages

ID Px.	Parameter	Description	
10231	Device status	Shows the 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 (CTRL-EN input) – 2: fieldbus – 3: I/O and plug-in – 4: plug-in	

ID Px.	Parameter	Description	
10232	Controller enable selection	For detailed information ➔ Tab. 310 Options for controller enable.	
		Access	read/write
		Update	effective immediately
		Unit	–
10234	Controller enable operating mode	Defines 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. 311 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

ID Px.	Parameter	Description	
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
		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. 309 Parameter

Parameter for selection of controller enable (Px.10232)			
Value	Enable via ...	Description	Operating mode after controller enable
0	I/O and fieldbus	The request of controller enable is issued in common via the following: – CTRL-EN input – 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 issued 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 issued in common via the following: – CTRL-EN input – Device-specific plug-in (Ethernet interface) The enable signal at the CTRL-EN input must be pending before the	Positioning mode

Parameter for selection of controller enable (Px.10232)			
Value	Enable via ...	Description	Operating mode after controller enable
		request is sent via the device-specific plug-in.	Positioning mode
4	Plug-in	The request of controller enable is issued exclusively via the device-specific plug-in (Ethernet interface).	

Tab. 310 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 issued exclusively via the CTRL-EN input, the operating mode defined by the following parameters will be active after controller enable:

Operating mode parameters with controller enable (Px.10234)		
Value	Mode of operation	Description
4	Velocity	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.

Operating mode parameters with controller enable (Px.10234)		
Value	Mode of operation	Description
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. 311 Possible Operating Modes with Controller Enable via I/O

4.1.9.2 CiA 402

Objects

Parameters	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	UINT32
10232	0x218E.02	Controller enable selection	UINT32
10234	0x218E.03	Controller enable operating mode	UINT32
10235	0x218E.04	Target velocity for controller enable (velocity operation)	FLOAT32
10236	0x218E.05	Target torque for controller enable (torque operation)	FLOAT32
10237	0x218E.06	Maximum velocity for controller enable (torque operation)	FLOAT32
10238	0x218E.07	Index for controller enable	SINT32
11280018	0x218E.08	Torque increase for controller enable	FLOAT32

Tab. 312 Objects

4.1.9.3 PROFIdrive

PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
10231	11800.0	Device status	Unsigned32
10232	11801.0	Controller enable selection	Unsigned32
10234	11802.0	Controller enable operating mode	Unsigned32

Parameters	PNU	Name	Data type
10235	11803.0	Target velocity for controller enable (velocity operation)	FloatingPoint
10236	11804.0	Target torque for controller enable (torque operation)	FloatingPoint
10237	11805.0	Maximum velocity for controller enable (torque operation)	FloatingPoint
10238	11806.0	Index for controller enable	Integer32
11280018	12294.0	Torque increase for controller enable	FloatingPoint

Tab. 313 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 braked down 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 braked down 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 braked down 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 brake.

Stop command triggered by ...	Specific reaction
	– The drive is uncontrolled.
– Diagnostic event of stop cat. 0	– The motion command is aborted. – The output stage is switched off. – The brake locks on drives with brake. Without a brake the drive runs down. – The drive is uncontrolled.

Tab. 314 Specific reactions to the stop command

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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. 315 Parameter). 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 quantity.

Parameters and Diagnostic Messages

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Information on parameterisation of stop ramps via the record list ➔ 4.5 Task for record selection.

ID Px.	Parameter	Description	
12101	Stop ramp deceleration	Specifies the deceleration for stops that are triggered by the device profile, the device-specific Plug-in 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

ID Px.	Parameter	Description	
12111	Stop ramp jerk	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. 315 Parameter

ID Dx.	Name	Description
05 I 02 I 00078 (84017230)	Stop ramp: Timeout	Stop ramp: Timeout

Tab. 316 Diagnostic Messages

4.2.2 CiA 402

Objects for stopping

Parameters	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
8135	0x6085.00	Quick stop deceleration CiA402	UINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
8135	0x216F.08	Quick stop deceleration CiA402	FLOAT32
12101	0x2180.01	Stop ramp deceleration	FLOAT32
12111	0x2180.02	Stop ramp jerk	FLOAT32

Tab. 317 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	Stop ramp deceleration	FloatingPoint
12111	11835.0	Stop ramp jerk	FloatingPoint

Tab. 318 PNUs

Control and Monitoring

Priority of stop responses: the table shows the stop responses in descending order. This means that coasting has the highest priority and intermediate stop ramp the lowest.

Deceleration	Condition	Comments	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
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

Deceleration	Condition	Comments	AC
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. 319

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 synchronised 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.

Operating modes	**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. 320 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.
The homing of the drive includes:

– Homing run
– Definition of the axis zero-point
– Definition of the dimension reference system ➔ 3.2.5 Dimension Reference System

Reference mark

In the homing process the position of the reference mark is found in accordance with 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 "velocity, torque and jogging" targets can be run without a valid homing.

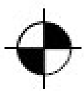


Fig. 63 Symbol: reference mark

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.

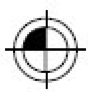


Fig. 64 Symbol: axis zero-point

Homing 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 referencing methods of the open-loop operation without encoder

Referencing 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:

Referencing methods for open-loop operation:
- Method 17: negative limit switch
- Method 18: positive limit switch
- Method 23: Positive reference switch
- Method 27: Negative reference switch
- Method 37: Current position

Because stop monitoring is not possible during a homing movement, timeout monitoring is executed.

Referencing parameter

The "acceleration, velocity and jerk" setpoint values for "search, creeping jerk and travel" can be specified with the "homing parameter".

Homing run

A homing is run 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 "travel to the axis zero-point" function is activated.
- Parameters:
  - Search stroke:
    The search path for the search is limited with the "maximum search stroke in positive/negative direction" parameters.
  - Homing to the stop:
    Travel 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.
  - Encoder emulation:
    Encoder emulation can be activated for the duration of homing with the "Do not activate encoder emulation during homing" parameter.

Axis zero-point travel

Axis zero-point travel can be activated with the "travel to axis zero-point after homing" parameter. The axis zero-point travel is run immediately after a valid homing if the axis zero-point offset ≠ 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 travel.

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

Saving the homing (saving the zero point offset)

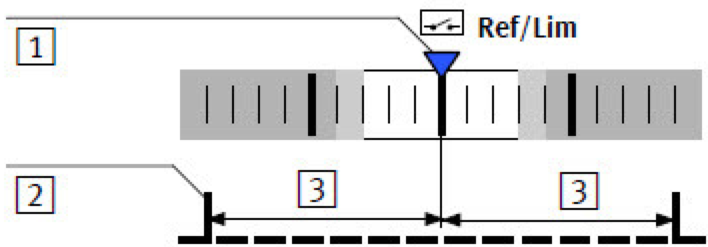
With multi-turn encoders, the zero point offset relative to the axis zero can be saved in the internal memory. This position is used at a restart as the absolute reference point for the dimensional reference system.

Single-turn encoder

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.



1 Position of the falling edge
2 Zero pulse
3 Distance to the zero pulse

Fig. 65

Parameters and Diagnostic Messages

ID Px.	Parameter	Description	
840	Referencing status	Specifies the status of referencing. 0: not referenced 1: referenced	
		Access	read/–
		Update	effective immediately
		Unit	–
843	Search for reference mark setpoint velocity	Shows the setpoint velocity of searching for the reference mark.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

ID Px.	Parameter	Description	
844	Search for reference mark setpoint acceler-ation	Shows 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	Shows the setpoint jerk of searching for the reference mark.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
846	Setpoint reference mark creeping velo-city	Shows the setpoint velocity of creeping of the reference mark.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
847	Setpoint reference mark creeping accel-eration	Shows the setpoint acceleration of creeping of the reference mark.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
848	Setpoint reference mark creeping jerk	Shows 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	Shows 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 accel-eration	Shows the setpoint acceleration of the move to the axis zero point.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

<table>
<tr><th>ID Px.</th><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">8411</td><td rowspan="4">Search for move to axis zero point setpoint jerk</td><td colspan="2">Shows the setpoint jerk of searching for move to the axis zero point.</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>user defined</td></tr>
<tr><td rowspan="4">8412</td><td rowspan="4">Maximum search stroke in positive direction</td><td colspan="2">Shows the maximum search stroke in positive direction.</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>user defined</td></tr>
<tr><td rowspan="4">8413</td><td rowspan="4">Maximum search stroke in negative direction</td><td colspan="2">Shows the maximum search stroke in negative direction.</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>user defined</td></tr>
<tr><td>8417</td><td>Referencing method</td><td colspan="2">Shows the selected homing method for homing of the axis (value = method).
– -27: negative stop/limit switch with travel to reference switch
– -23: positive stop/limit switch with travel to reference switch
– -18: positive stop
– -17: negative stop
– -2: positive stop with zero pulse
– -1: negative stop with zero pulse
– 1: negative HW limit switch with zero pulse
– 2: positive HW limit switch with zero pulse
– 7: positive reference switch with zero pulse
– 11: negative reference switch with zero pulse
– 17: negative HW limit switch
– 18: positive HW limit switch
– 23: positive reference switch
– 27: negative reference switch
– 33: current position with negative zero pulse
– 34: current position with positive zero pulse
– 37: current position (default setting)
Referencing 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.</td></tr>
</table>

ID Px.	Parameter	Description	
8417	Referencing method	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	Shows 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 for the stop detection. The scaling factor refers to the nominal current of the motor.	
		Access	read/write
		Update	effective immediately
		Unit	–
8415	Limit position detection time monitoring window	Shows the time monitoring window for the limit position detection.	
		Access	read/write
		Update	effective immediately
		Unit	s

ID Px.	Parameter	Description	
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
8421	Deactivate encoder emulation during homing	Specifies the status of the encoder emulation during the hom-ing. 0: deactivated 1: activated	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 321 Homing parameters

ID Dx.	Name	Description
05 | 01 | 00056 (83951672)	Configuration of homing run inval-id	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. 322 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 travel to the axis zero-point in negative direction.

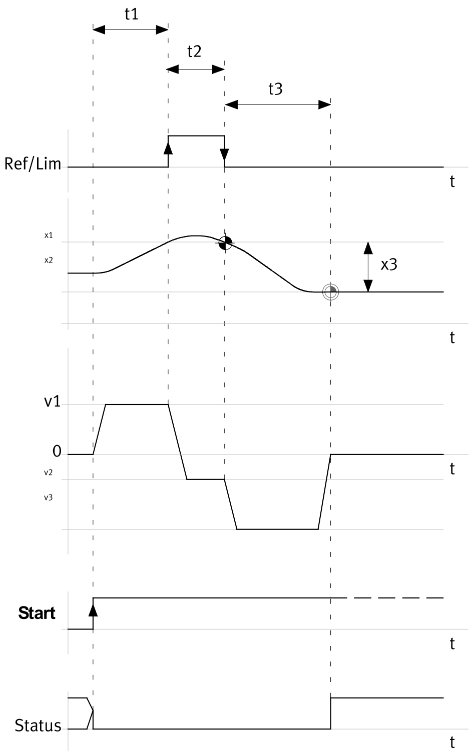


Fig. 66 Homing to reference switch or limit switch

Name	Description
Ref/Lim	Signal reference/limit switches
t1	Duration of search
t2	Duration of crawl
t3	Duration of travel to the axis zero-point
v1	Target velocity search
v2	Target velocity crawl

Name	Description
v3	Target velocity travel
x1	Reference mark reference/limit switches
x2	Axis zero point
x3	Axis zero point offset
Start	Start homing
Status	Referencing status

Tab. 323 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 travel to the axis zero-point in negative direction.

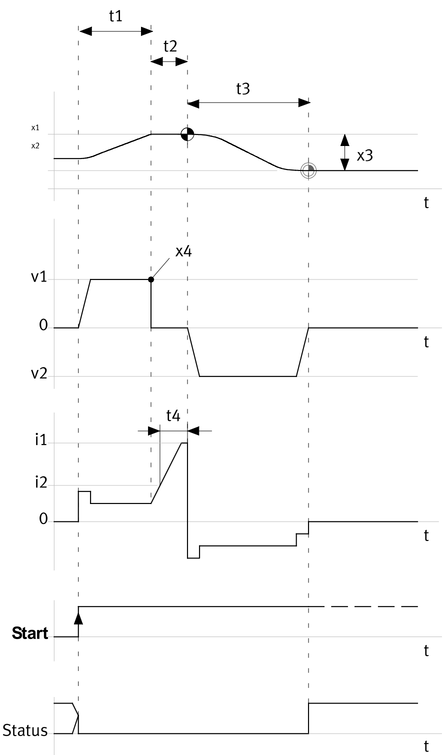


Fig. 67 Homing to stop

Name	Description
i1	Maximum current
i2	Nominal current limit percentage
t1	Duration of search
t2	Duration of stop detection
t3	Duration of travel to the axis zero-point
t4	Setpoint value time monitoring window stop detection
v1	Target velocity search
v2	Target velocity travel
x1	Reference mark stop
x2	Axis zero point
x3	Axis zero point offset
x4	Stop
Start	Start homing
Status	Referencing status

Tab. 324 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 travel are specified by the selected homing method.
Referencing 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" the "limit switch" primary target is searched in the positive direction at search velocity. Then the "zero pulse" secondary target is identified at creep velocity in the negative direction. With travel to axis zero-point 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
Current position	37	—	Current position	—
	34[1)]	positive	Current position	Zero pulse
	33[1)]	negative	Current position	Zero pulse

Method	No. (dec.)	Search direction	Primary target	Secondary target
Limit switch	18	positive	Limit switch	—
	17	negative	Limit switch	—
	2[1]	positive	Limit switch	Zero pulse
	1[1]	negative	Limit switch	Zero pulse
Homing Switch	23	positive	Homing Switch	—
	27	negative	Homing Switch	—
	7[1]	positive	Homing Switch	Zero pulse
	11[1]	negative	Homing Switch	Zero pulse
	-23[1]	positive	Stop/limit switch	Homing Switch
	-27[1]	negative	Stop/limit switch	Homing Switch
Stop	-18[1]	positive	Stop	—
	-17[1]	negative	Stop	—
	-2[1]	positive	Stop	Zero pulse
	-1[1]	negative	Stop	Zero pulse

1) This method is not supported in open-loop operation without encoder.

Tab. 325 Homing methods

4.4.3.1 Method 37: Current position

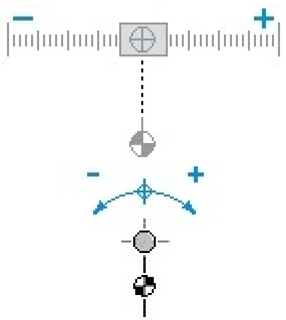
The reference mark is found by the current axis position.

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.

Travel to the axis zero-point ➔ 4.4.3.10 Travel to axis zero-point.

Method 37: Current position



Tab. 326 Sequence principle: current position

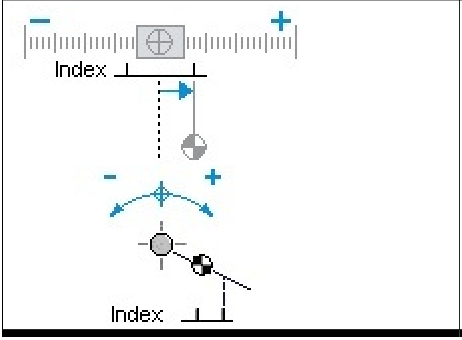
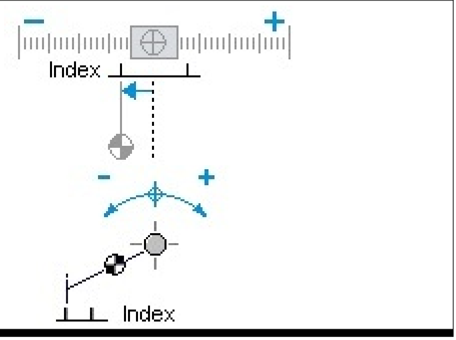
4.4.3.2 Method 33/34: current position with zero pulse in negative/positive direction

The reference mark is found by the first zero pulse of the encoder.

Sequence:

1. Search zero pulse: first zero pulse of the encoder is searched 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.

Travel to the axis zero-point ➔ 4.4.3.10 Travel to axis zero-point.

Method 34: positive search direction	**Method 33: negative search direction**
	

Tab. 327 Sequence principle: homing to zero pulse

Situation	**Reaction**
Zero pulse within one motor revolution not detected	Homing aborted with fault message.
Distance "zero pulse - limit switch" too short	Homing aborted with fault message.
Limit switch detected	Homing aborted with fault message.
Stop detected	Homing aborted with fault message.

Tab. 328 Different sequence scenarios

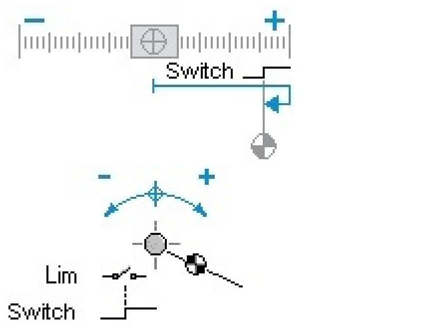
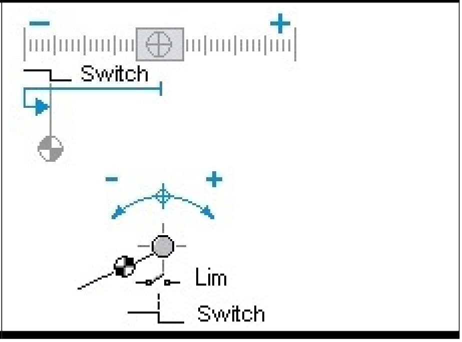
4.4.3.3 Method 17/18 negative/positive limit switch

The reference mark is found by the switching edge of the limit switch.

Sequence:

1. Search limit switch: rising edge of the limit switch is searched in search direction at search velocity.
2. Search limit switch edge: falling edge of the limit switch (rest 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.

Travel to the axis zero-point ➔ 4.4.3.10 Travel to axis zero-point.

Method 18: positive search direction	Method 17: negative search direction
	

Tab. 329 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	Homing aborted with fault message.

Tab. 330 Different sequence scenarios

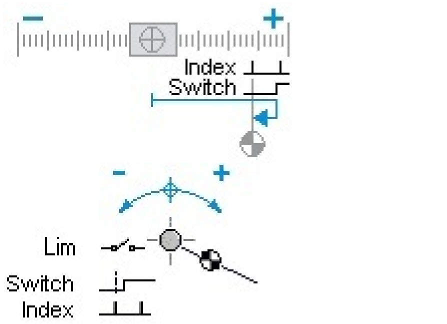
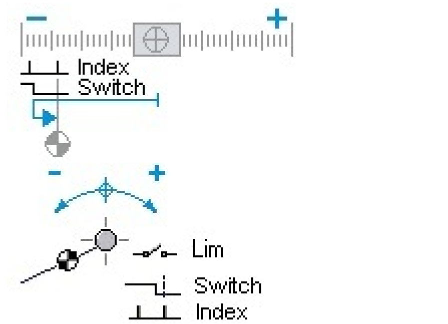
4.4.3.4 Method 1/2: negative/positive limit switch with zero pulse

The reference mark is found after identification of the limit switch by the first zero pulse of the encoder.

Sequence:

1. Search limit switch: rising edge of the limit switch is searched in search direction at search velocity.
2. Search limit switch edge: falling edge of the limit switch (rest 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.

Travel to the axis zero-point ➔ 4.4.3.10 Travel to axis zero-point.

Method 2: positive search direction	Method 1: negative search direction
	

Tab. 331 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.
Distance "zero pulse - limit switch" too short	Homing aborted with fault message.
"Opposite direction" limit switch detected	Homing aborted with fault message.
Stop detected	Homing aborted with fault message.

Tab. 332 Different sequence scenarios

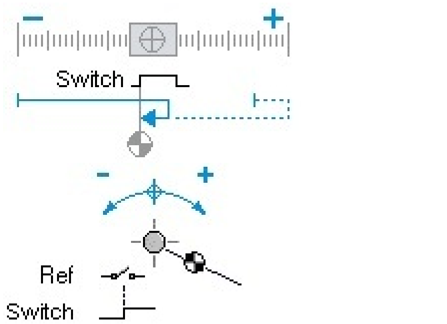
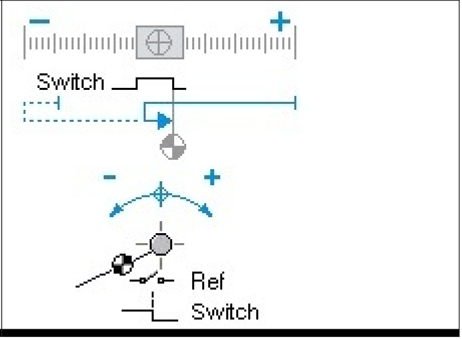
4.4.3.5 Method 23/27: positive/negative reference switch

The reference mark is found by the switching edge of the limit switch.

Sequence:

1. Search reference switch: rising edge of the reference switch is searched in search direction at search velocity.
2. Search reference switch edge: falling edge of the reference switch (rest 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.

Travel to the axis zero-point ➔ 4.4.3.10 Travel to axis zero-point.

Method 23: positive search direction	Method 27: negative search direction
	

Tab. 333 Sequence principle - homing to reference switch

Situation	Reaction
"Search direction" reference switch not detected (rising edge)	Homing aborted with fault message.
Reference switch edge not detected (falling edge)	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.
Stop detected	Homing aborted with fault message.

Tab. 334 Different sequence scenarios

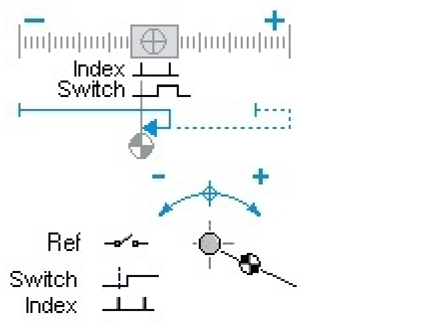
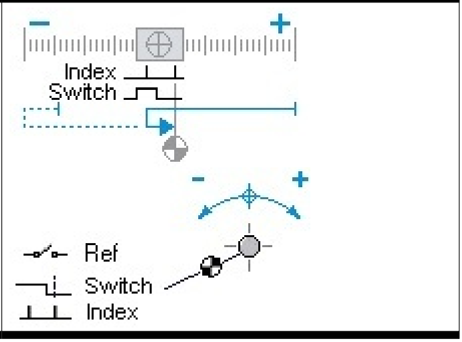
4.4.3.6 Method 7/11: positive/negative reference switch with zero pulse

The reference mark is found after identification of the reference switch by the first zero pulse of the encoder.

Sequence:

1. Search reference switch: rising edge of the reference switch is searched in search direction at search velocity.
2. Search reference switch edge: falling edge of the reference switch (rest 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.

Travel to the axis zero-point ➔ 4.4.3.10 Travel to axis zero-point.

Method 7: positive search direction	Method 11: negative search direction
	

Tab. 335 Sequence principle - homing to reference switch with zero pulse

Situation	Reaction
"Search direction" reference switch not detected (rising edge)	Homing aborted with fault message.
Reference switch edge not detected (falling edge)	Homing aborted with fault message.
Zero pulse within one motor revolution not detected	Homing aborted with fault message.
Distance "zero pulse - reference switch" too short	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.
Stop detected	Homing aborted with fault message.

Tab. 336 Different sequence scenarios

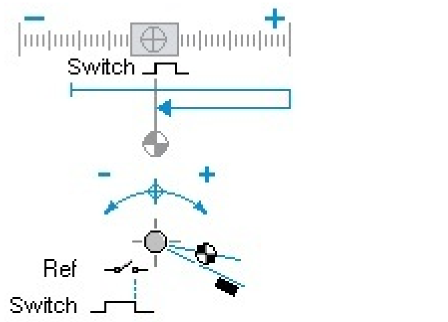
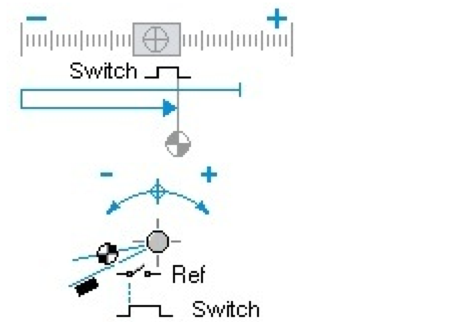
4.4.3.7 Method -23/-27: positive/negative stop/limit switch with run to reference switch

The reference mark is found by the switching edge of the reference switch after identification of the limit switch or the stop.

Sequence:

1. Search stop/limit switch: stop or rising edge of the limit switch is searched in search direction at search velocity.
2. Search reference switch: reference switch is searched in opposite direction at search velocity.
3. Search reference switch edge: falling edge of the reference switch (rest position) is searched again 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.

Travel to the axis zero-point ➔ 4.4.3.10 Travel to axis zero-point.

Method -23: positive search direction	Method -27: negative search direction
	

Tab. 337 Sequence principle – reference movement 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.
"Search direction" reference switch detected	Reference switch is ignored
"Opposite direction" stop detected	Homing aborted with fault message.

Tab. 338 Different sequence scenarios

4.4.3.8 Method -17/-18 negative/positive stop

The reference mark is found by detection of the stop.

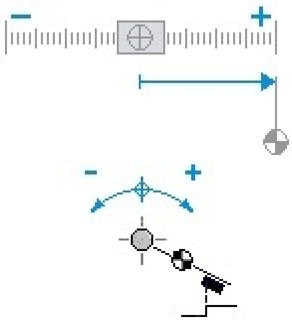
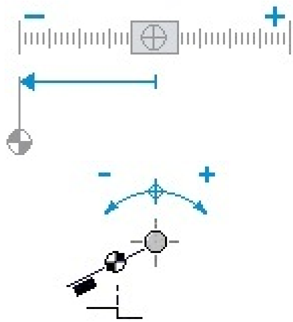
Sequence:

1. Search stop: stop is searched in search direction at search velocity.
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.

Travel to the axis zero-point ➔ 4.4.3.10 Travel to axis zero-point.

NOTICE!

With the homing methods -17/-18 "homing to stop" the drive stands controlled at the stop after the homing. The parameterisation of the travel to the axis zero-point makes continuous control at the stop unnecessary.

Method -18: positive search direction	Method -17: negative search direction
	

Tab. 339 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. 340 Different sequence scenarios

4.4.3.9 Method -1/-2 negative/positive stop with zero pulse

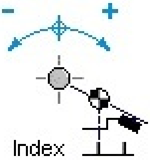
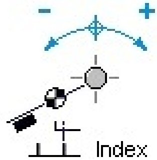
The reference mark is found after identification of the stop by the first zero pulse of the encoder.

Sequence:

1. Search stop: stop is searched in search direction at search velocity.
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.

Travel to the axis zero-point ➔ 4.4.3.10 Travel to axis zero-point.

Method -2: positive search direction	Method -1: negative search direction
	

Method -2: positive search direction	**Method -1: negative search direction**
	

Tab. 341 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. 342 Different sequence scenarios

4.4.3.10 Travel to axis zero-point

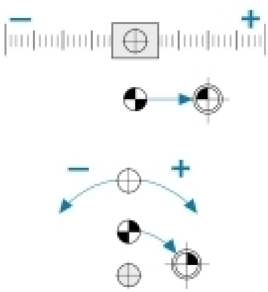
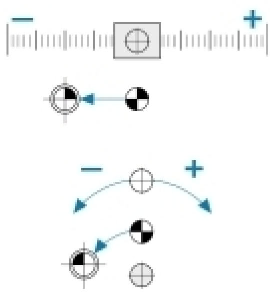
Travel to axis zero-point is run after a valid homing.

The requirements for travel 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. Travel to axis zero-point: axis zero-point is approached at travel 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 travel direction	**Negative axis zero-point offset: negative travel direction**
	

Tab. 343 Sequence principle - travel to axis zero-point

Situation	Reaction
Axis zero-point was not reached	Homing aborted with fault message.
Limit switch detected	Homing aborted with fault message.
Stop detected	Homing aborted with fault message.

Tab. 344 Different sequence scenarios

4.4.4 CiA 402

Objects for homing

Parameters	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
843	0x6099.01	Search for reference mark setpoint velocity	UINT32
844	0x609A.01	Search for reference mark setpoint acceleration	UINT32
846	0x6099.02	Setpoint reference mark creeping velocity	UINT32
847	0x609A.02	Setpoint reference mark creeping acceleration	UINT32
849	0x6099.03	Move to axis zero point setpoint velocity	UINT32
8410	0x609A.03	Move to axis zero point setpoint acceleration	UINT32
8416	0x607C.00	Axis zero point offset	SINT32
8417	0x6098.00	Referencing method	SINT8
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
840	0x2172.01	Referencing status	UINT32
841	0x2172.02	Move to axis zero point after homing	BOOL
842	0x2172.03	Homing timeout	FLOAT32
843	0x2172.04	Search for reference mark setpoint velocity	FLOAT32
844	0x2172.05	Search for reference mark setpoint acceleration	FLOAT32
845	0x2172.06	Search for reference mark setpoint jerk	FLOAT32
846	0x2172.07	Setpoint reference mark creeping velocity	FLOAT32
847	0x2172.08	Setpoint reference mark creeping acceleration	FLOAT32
848	0x2172.09	Setpoint reference mark creeping jerk	FLOAT32
849	0x2172.0A	Move to axis zero point setpoint velocity	FLOAT32
8410	0x2172.0B	Move to axis zero point setpoint acceleration	FLOAT32

Parameters	Index.Subindex	Name	Data type
8411	0x2172.0C	Search for move to axis zero point setpoint jerk	FLOAT32
8412	0x2172.0D	Maximum search stroke in positive direction	SINT64
8413	0x2172.0E	Maximum search stroke in negative direction	SINT64
8414	0x2172.0F	Nominal current limit value scaling factor	FLOAT32
8415	0x2172.10	Limit position detection time monitoring window	FLOAT32
8416	0x2172.11	Axis zero point offset	SINT64
8417	0x2172.12	Referencing method	SINT32
8418	0x2172.13	Status state machine homing	UINT32
8421	0x2172.16	Deactivate encoder emulation during homing	BOOL

Tab. 345 Objects

The overview shows the function of the homing mode:

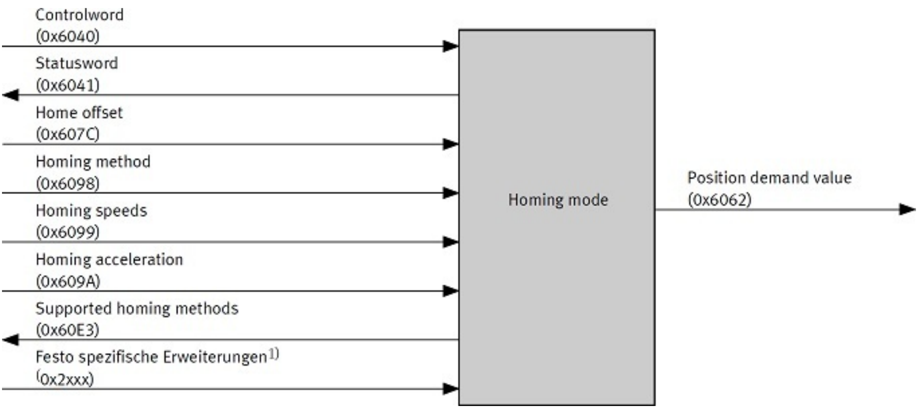


Fig. 68 Overview: homing mode

Additional 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).

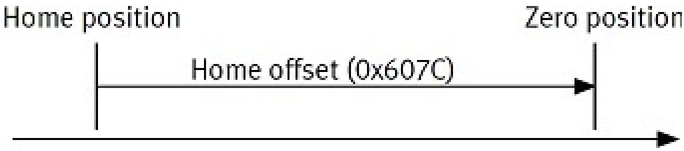


Fig. 69 Overview reference offset

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

i

All homing methods can only be performed in the "operation enabled" status.

The following conditions must be fulfilled for homing mode.

– Operating 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 carried out		
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. 346 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 references 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 velocity = 0
Homing active				
0	0	0	0	Homing is carried out
Drive referenced				
1	0	1	1	Homing was successfully completed, drive is referenced and the velocity = 0
Homing error				
0	1	0	0	A homing error has occurred and the velocity ≠ 0
0	1	0	1	A homing error has occurred and the velocity = 0

1) signal status: 0 = low; 1 = high; x = any

Tab. 347 Monitor homing

4.4.5 PROFIdrive

PNUs for homing

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
840	11202.0	Referencing status	Unsigned32
841	11203.0	Move to axis zero point after homing	Boolean
842	11204.0	Homing timeout	FloatingPoint
843	11205.0	Search for reference mark setpoint velocity	FloatingPoint
844	11206.0	Search for reference mark setpoint acceleration	FloatingPoint

Parameters	PNU	Name	Data type
845	11207.0	Search for reference mark setpoint jerk	FloatingPoint
846	11208.0	Setpoint reference mark creeping velocity	FloatingPoint
847	11209.0	Setpoint reference mark creeping acceleration	FloatingPoint
848	11210.0	Setpoint reference mark creeping jerk	FloatingPoint
849	11211.0	Move to axis zero point setpoint velocity	FloatingPoint
8410	11728.0	Move to axis zero point setpoint acceleration	FloatingPoint
8411	11729.0	Search for move to axis zero point setpoint jerk	FloatingPoint
8412	11730.0	Maximum search stroke in positive direction	Integer64
8413	11731.0	Maximum search stroke in negative direction	Integer64
8414	11732.0	Nominal current limit value scaling factor	FloatingPoint
8415	11733.0	Limit position detection time monitoring window	FloatingPoint
8416	11734.0	Axis zero point offset	Integer64
8417	11735.0	Referencing method	Integer32
8418	11736.0	Status state machine homing	Unsigned32
8421	11739.0	Deactivate encoder emulation during homing	Boolean

Tab. 348 PNUs

Additional 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 for record selection

4.5.1 Record selection

4.5.1.1 Function

Command records can be saved in a record table in the device. 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. 353 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.

Start record table ...	Description
... as background process	Motion commands are illegal and generate a category 1 stop. The event table can monitor events at the same time.

Tab. 349 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 Record sequencing.
Event table	Step enabling conditions that should be monitored in parallel can be defined with the event table (➔ 4.5.3 Monitoring of events).

Tab. 350 Options for sequence control

Mode 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 links 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

Start condition “Interrupt”

The current task (here record A) is interrupted immediately and the newly addressed task (here record B) is then executed immediately.

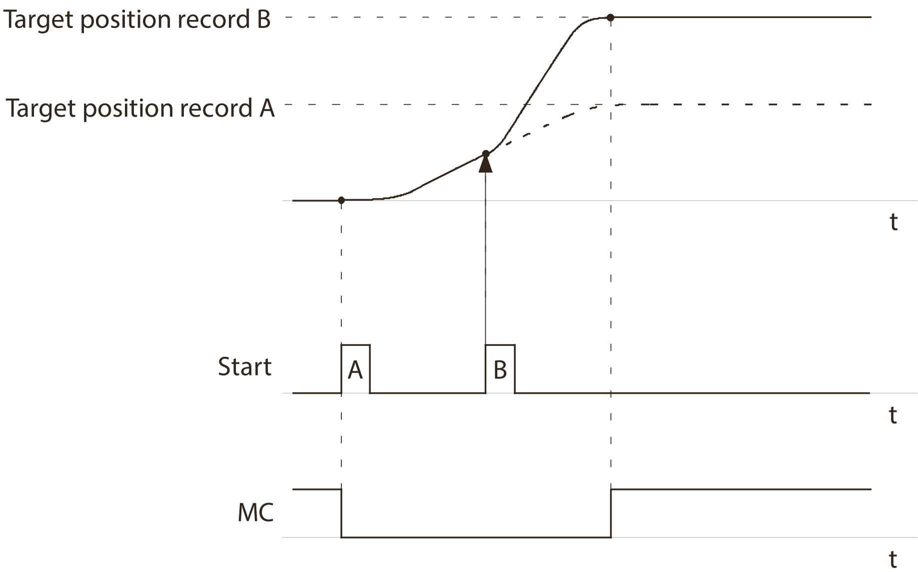


Fig. 70 Start condition “Interrupt” (example)

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. 351 Legend for the "Interrupt" start condition

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 back-ground mode	Specifies whether the record table is activated as a foreground process or a background process. ➔ Tab. 349 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. 353 Command record type parameter (ID Px.1810).	
		Access	read/write
		Update	effective immediately
		Unit	–
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. 353 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. 353 Command record type parameter (ID Px.1810)	
		Access	read/write
		Update	effective immediately

ID Px.	Parameter	Description	
1813	Record table field 2	Unit	–
1814	Record table field 3	Specifies the value of the third parameter depending on the record type ➔ Tab. 353 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. 353 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. 353 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. 353 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. 353 Command record type parameter (ID Px.1810)	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
1838	Selection start condition record	Specifies the behaviour on switching to another command record. This means: – 0: interrupt ➔ Fig.70 The current task is interrupted immediately, and the newly addressed task is executed directly.	
		Access	read/write
		Update	effective immediately
		Unit	–
1846	Status of record table	Display the status of the current record. – 0: Inactive – 1: new – 2: active – 3: executed – 5: buffered – 6: cancelled – 7: synchronised	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 352 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 run	Start homing	1. Homing method as per CiA402 including manufacturer-specific methods

Command record type parameter (ID Px.1810)			
Value	Command record type	Description	Parameters depending on the record type (record table field 1 … 7)
4	Velocity	Velocity mode with or without stroke limitation:	1. Target velocity 2. Acceleration 3. Deceleration 4. Jerk 5. Activation of stroke limitation – 0: inactive – 1: active 6. Negative stroke limitation 7. Positive stroke limitation
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 capture position 2. Target position 3. Profile velocity 4. Acceleration 5. Deceleration 6. Jerk 7. End velocity
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. Negative stroke limitation 6. Positive stroke limitation
10	Flow control	Does not execute an action. Used as placeholder for appending record sequences.	– (none)
25	Torque with brake set	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. Negative stroke limitation 6. Positive stroke limitation 7. Selection of holding brake – 0: holding brake 1
26	Cam controller	Activation of the cam controller (also allowed for background process)	1. Cam controller mode 2. Instance (number of the cam controller) 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 ➔ 3.3.5 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

Command record type parameter (ID Px.1810)			
Value	Command record type	Description	Parameters depending on the record type (record table field 1 ... 7)
28	Position capture (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 the positioning mode (PP)	1. Mode – Inactive – shortest path – shortest path within the modulo limit – only positive path – only negative path – Setting of the modulo position – Reset of the modulo position
30	Controller parameter set switchover	Switch to another closed-loop 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
32	Travel to fixed stop	Activates the travel to fixed stop mode.	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

Command record type parameter (ID Px.1810)			
Value	Command record type	Description	Parameters depending on the record type (record table field 1 ... 7)
32	Travel to fixed stop	Activates the travel to fixed stop mode.	3. Profile velocity 4. Acceleration 5. Deceleration 6. Jerk
33	Travel to fixed stop parameters	Defines the parameters for travel to fixed stop.	1. Clamping torque 2. Clamping torque offset 3. positive stroke limit 4. negative stroke limit

Tab. 353 Command record type parameter (ID Px.1810)

Example

In the first data record (0) the command record no. 0 should be written and in the second data record (1) command record no. 1 should be written with the following parameters:

- 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 "waiting"

Parameter	**Value**	**Comments**
Table type		
P1.1810.0.0	5	Date record 0: positioning mode (5)
P1.1810.0.1	4	Date 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 velocity

Parameter	Value	Comments
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 velocity
P1.1818.0.1	9100000000	Stroke limitation in 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. 354 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 list is activated as a foreground process, complex motion sequences and travel profiles can be created with command sequences, e. g.:

– Positioning and clamping in a motion sequence
– Travelling 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 enabling types ➔ Record step enabling 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 ➔ Record step enabling 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 ➔ Record step enabling type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
1836	Record sequencing field 2	Specifies the value of the second comparator type-dependent parameter ➔ Record step enabling type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	–
1837	Current record table index	Shows the current record number.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 355 Parameter

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The record sequencing depends on the configured monitoring windows with a comparator that depends on a motion monitor.

Record step enabling type parameter (ID Px.1831)			
Value	Record enabling types	The step enabling 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	1. Input: – 11: record table input 0 – 12: record table input 1

Record step enabling type parameter (ID Px.1831)			
Value	Record enabling types	The step enabling condition is achieved when ...	comparator type-dependent parameters
4	Digital input	the record table ➔ 3.3.5 Digital Inputs and Outputs	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 damping time.	1. lower limit 2. upper limit 3. Damping time
6	Velocity	... the actual velocity is within the pre-set window for the duration of the specified damping time.	1. lower limit 2. upper limit 3. Damping time
7	Torque	... the actual torque is within the pre-set window for the duration of the specified damping time.	1. lower limit 2. upper limit 3. Damping time
9 ... 12	reserved		
13	Parameter	... the result of the parameterised comparison operation returns "true" (comparison of parameter and value).	1. Damping 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. With a motion command, DONE corresponds to the status of tar-	– (none)

Record step enabling type parameter (ID Px.1831)			
Value	Record enabling types	The step enabling condition is achieved when ...	comparator type-dependent parameters
		get window reached (Target Reached = TRUE)	
17	Movement monitoring status word		– And (4), Or (5) operator – Bit mask (32-bit)
18	Touch probe valid	The activated touch-probe function has detected a valid event.	1. No. of the capture channel
19	Control word 1 BLOCK CHANGE	... in control word STW1.13 there is an edge change from 0 to 1.	
20 … 23	reserved		

Tab. 356 Record step enabling 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 damping 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)		
Parameter	Value	Comments
Record step enabling type		
P1.1831.0.0	5	Record step enabling type 5 (position)
P1.1831.0.1	4	Record step enabling 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	Damping 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. 357 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 step enabling 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

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 enabling types ➔ Record step enabling 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 ➔ Record step enabling type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	s

ID Px.	Parameter	Description	
1844	Next event field 1	Specifies the value for the first comparator type-dependent parameter ➔ Record step enabling type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	–
1845	Next event field 2	Specifies the value for the second comparator type-dependent parameter ➔ Record step enabling type parameter (ID Px.1831)	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 358 Parameter

Diagnostic Messages

ID Dx.	Name	Description
06 I 00 I 00070 (100663366)	Invalid record table parameter	A record table parameter is invalid
06 I 00 I 00083 (100663379)	Record table incorrect	Record table incorrect

Tab. 359 Diagnostic Messages

4.5.4 CiA 402

Objects command record table

Parameters	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	BOOL
1810	0x2230.01 ... 80	Command record type	UINT32
1811	0x2231.01 ... 80	Record number	SINT32
1812	0x2232.01 ... 80	Record table field 1	SINT64
1813	0x2233.01 ... 80	Record table field 2	SINT64
1814	0x2234.01 ... 80	Record table field 3	SINT64
1815	0x2235.01 ... 80	Record table field 4	SINT64

Parameters	Index.Subindex	Name	Data type
1816	0x2236.01 … 80	Record table field 5	SINT64
1817	0x2237.01 … 80	Record table field 6	SINT64
1818	0x2238.01 … 80	Record table field 7	SINT64
1838	0x223F.01 … 80	Selection start condition record	UINT32
1846	0x2159.04	Status of record table	UINT32

Tab. 360 Objects

Objects command record sequence

Parameters	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	UINT32
1832	0x223A.01 … 80	Record sequencing record number start	SINT32
1833	0x223B.01 … 80	Record sequencing record number target	SINT32
1834	0x223C.01 … 80	Record sequencing field time	FLOAT32
1835	0x223D.01 … 80	Record sequencing field 1	SINT64
1836	0x223E.01 … 80	Record sequencing field 2	SINT64
1837	0x2159.01	Current record table index	SINT32

Tab. 361 Objects

Objects command record event table

Parameters	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	BOOL
1841	0x2240.01 … 10	Event type	UINT32
1842	0x2241.01 … 10	Next event target	SINT32
1843	0x2242.01 … 10	Next event field time	FLOAT32
1844	0x2243.01 … 10	Next event field 1	SINT64
1845	0x2244.01 … 10	Next event field 2	SINT64

Tab. 362 Objects

4.5.5 PROFIdrive

PNUs of command record table

Parameters	PNU	Name	Data type
Px.	Manufacturer-specific parameters		
1130224	12182.0	Activation background mode	Boolean
1810	11380.0 ... 127	Command record type	Unsigned32
1811	11381.0 ... 127	Record number	Integer32
1812	11382.0 ... 127	Record table field 1	Integer64
1813	11383.0 ... 127	Record table field 2	Integer64
1814	11384.0 ... 127	Record table field 3	Integer64
1815	11385.0 ... 127	Record table field 4	Integer64
1816	11386.0 ... 127	Record table field 5	Integer64
1817	11387.0 ... 127	Record table field 6	Integer64
1818	11388.0 ... 127	Record table field 7	Integer64
1838	11396.0 ... 127	Selection start condition record	Unsigned32
1846	11404.0	Status of record table	Unsigned32

Tab. 363 PNUs

PNUs of command record sequence

Parameters	PNU	Name	Data type
Px.	Manufacturer-specific parameters		
1831	11389.0 ... 127	Record step enabling type	Unsigned32
1832	11390.0 ... 127	Record sequencing record number start	Integer32
1833	11391.0 ... 127	Record sequencing record number target	Integer32
1834	11392.0 ... 127	Record sequencing field time	FloatingPoint
1835	11393.0 ... 127	Record sequencing field 1	Integer64
1836	11394.0 ... 127	Record sequencing field 2	Integer64
1837	11395.0	Current record table index	Integer32

Tab. 364 PNUs

PNUs of command record event table

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1840	11398.0	Activate Event table	Boolean
1841	11399.0 … 15	Event type	Unsigned32
1842	11400.0 … 15	Next event target	Integer32
1843	11401.0 … 15	Next event field time	FloatingPoint
1844	11402.0 … 15	Next event field 1	Integer64
1845	11403.0 … 15	Next event field 2	Integer64

Tab. 365 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 message defined depending on the software limit position monitoring function is generated. 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 travel 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.

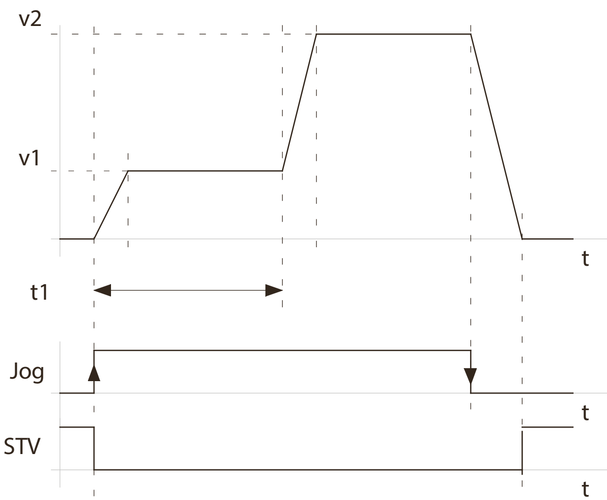

Fig. 71 Jog mode timing graph (example)

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

Name	Description	ID Px.
t1	Jog duration 1 movement	1510
	Jog duration 2 movement	214539

Tab. 366 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. 367 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 velocity 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)

Design	Px.214526.0.0 (value)[1)]	Command	Dynamic value record	
			Phase 1	Phase 2
static slow	1	Jogging 1 (+)	1 langsam	–
	1	Jogging 2 (-)	-1 langsam	
	0	Jogging 1 (+)	1 langsam	
	0	Jogging 2 (-)	2 langsam	
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 langsam	1 fast
	1	Jogging 2 (-)	-1 langsam	-1 fast
	0	Jogging 1 (+)	1 langsam	1 fast
	0	Jogging 2 (-)	2 langsam	2 fast

1) 0 = asymmetrical; 1 = symmetrical

Tab. 368 Overview of the supported commands

Dynamic value record	Prefix	Velocity	Acceleration	Jerk
		Px.	Px.	Px.
1 langsam	+	1511	1512	1513
-1 langsam	-	1511	1512	1513
2 langsam	+	214535	214536	214537
1 fast	+	1514	1515	1516
-1 fast	-	1514	1515	1516
2 fast	+	214540	214541	214542

Tab. 369 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.	
		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

ID Px.	Parameter	Description	
1514	Fast jog 1 velocity	Maximum velocity during phase 2.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1515	Fast jog 1 acceleration	Acceleration (and deceleration) during phase 2.	
		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.	
		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

ID Px.	Parameter	Description	
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.	
		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
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

ID Px.	Parameter	Description	
526917	Jogging state	Unit	–

Tab. 370 Parameter

Diagnostic messages

No specific diagnostic messages are allocated to the function.

4.6.2 CiA 402

Objects

Parameter	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
1510	0x2186.01	Jog duration 1 movement	FLOAT32
1511	0x2186.02	Slow jog 1 velocity	FLOAT32
1512	0x2186.03	Slow jog 1 acceleration	FLOAT32
1513	0x2186.04	Slow jog 1 jerk	FLOAT32
1514	0x2186.05	Fast jog 1 velocity	FLOAT32
1515	0x2186.06	Fast jog 1 acceleration	FLOAT32
1516	0x2186.07	Fast jog 1 jerk	FLOAT32
526917	0x2186.08	Jogging state	UINT32
214526	0x2186.09	Activation of symmetrical jog	BOOL
214535	0x2186.12	Slow jog 2 velocity	FLOAT32
214536	0x2186.13	Slow jog 2 acceleration	FLOAT32
214537	0x2186.14	Slow jog 2 jerk	FLOAT32
214539	0x2186.16	Jog duration 2 movement	FLOAT32
214540	0x2186.17	Fast jog 2 velocity	FLOAT32
214541	0x2186.18	Fast jog 2 acceleration	FLOAT32
214542	0x2186.19	Fast jog 2 jerk	FLOAT32

Tab. 371 Objects

Control and monitoring

Basic functions for jogging ➔ 4.6.1 Function.

Requirements

– Controller enable (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 object 0x6040 Control word CiA402 has the following specific bits in jog operating 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. 372 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, travel 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 langsam	1 fast	1510, Jog duration 1 movement
0 / 0	1	Jog negative	-1 langsam	-1 fast	
0 / 0	0	Jog positive	1 langsam	1 fast	
0 / 0	0	Jog negative	2 langsam	2 fast	214539 Jog duration 2 movement
1 / 0	1	Jog positive	1 langsam	–	–
1 / 0	1	Jog negative	-1 langsam		
1 / 0	0	Jog positive	1 langsam		
1 / 0	0	Jog negative	2 langsam		
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. 373 Overview of the supported parameter combinations

Monitoring

The object 0x6041 Status word CiA402 has the following specific bits in jog operating 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. 374 Specific bits for jogging in the status word

4.6.3 PROFIdrive

The jogging function has the following special features from PROFIdrive:

- Only jogging with a motion phase is supported.
- Jogging of a parameterised distance (can be switched with POS_STW2.5 incremental jogging; applicable only for AC3 with additional parameters).

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	FloatingPoint
1512	11353.0	Slow jog 1 acceleration	FloatingPoint
1513	11354.0	Slow jog 1 jerk	FloatingPoint
214526	12126.0	Activation of symmetrical jog	Boolean
214530	12127.0	Relative position jog 1	Integer64
214535	12128.0	Slow jog 2 velocity	FloatingPoint
214536	12129.0	Slow jog 2 acceleration	FloatingPoint
214537	12130.0	Slow jog 2 jerk	FloatingPoint
214538	12131.0	Relative position jog 2.	Integer64

Tab. 375 PNUs

The following values starting from the value of the Px.214526.0.0 parameters 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. 376 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 para-meters
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. 377 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	Boolean
1147090	12238.0	STW1.9 Jogging 2	Boolean
112412100	12360.0	POS_ZSW1.10 Jogging active	Boolean
112414050	12384.0	POS_STW2.5 Jogging incremental active	Boolean

Tab. 378 Control and Status Words

If both bits (STW1.8, STW1.9) are set, the ramp is frozen at the current velocity.

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).

Requirements
Requirements in application class AC1: the drive is in the status S61 RFG inactive ➔ Fig.130.
Requirements in application class AC3: the drive is in the status S41 Basic State Positioning Mode or S453 Intermediate Stop ➔ Fig.131

5 Motion monitoring

5.1 Motion monitoring functions

The motion monitoring functions monitor the drive system and protect the drive components against damage. Each motion monitoring function reads out values from the servo drive and compares them to the expected behaviour (e.g. threshold value).
The actual values from the actual value management, the setpoint values (determined from between the 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 of the functions will cause an error response is dependent on the operating mode.

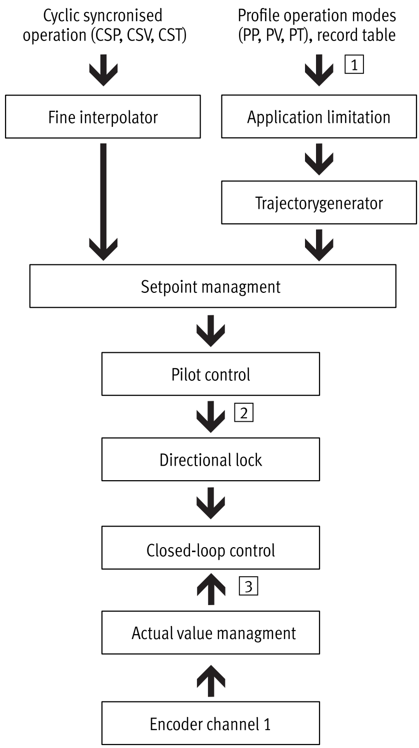

Fig. 72 Determining the target, setpoint and actual values

Name	Description
1 Target values	Parameterised setpoint of the trajectory during profile operation
2 Setpoint	Setpoint values that change with time The setpoint values are determined between the pilot control and directional lock.
3 Actual value	Actual values that change with time The actual values are determined by actual value management.

Tab. 379 Legend for determining the target, setpoint and actual values diagram

The monitoring result is issued as follows:

– as status signal
– As a directional lock when software and hardware limit positions are exceeded
– As a 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		Item	
TRV		Speed	
TRT		Torque	
FE	Following error		→ 5.3 Following error
FEX		Item	
FEV		Speed	
TM	Target area monitoring		→ 5.4 Target area monitoring
TMX		Item	
TMV		Speed	
TMT		Torque	
HL	Hardware limit switch reached		→ 5.5 Hardware limit switch reached
HLP		positive	
HLN		negative	
SL	Software limit position reached		→ 5.6 Software limit 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	Pushback monitoring		→ 5.11 Pushback monitoring
RDX	Remaining distance monitoring		→ 5.12 Remaining distance monitoring

Code	Motion monitoring function	Detailed information
MC	Trajectory completed	➔ 5.13 Trajectory completed
REFS	Reference switch activated	➔ 5.14 Reference switch activated
TUR	Torque utilisation exceeded	Status display
FSPR	Fixed stop reached	
ACC	Drive accelerated	
DEC	Drive decelerated	

Tab. 380 Overview of motion monitoring functions

Status word

The status of each 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 velocity
2	TRT	Target window reaches torque
3	FEX	Following error position
4	FEV	Velocity following error
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 limit position reached positive
15	SLN	Software limit position reached negative
16	STX	Standstill monitoring position/velocity
17	STV	Standstill monitoring velocity
18	LS	Stop reached

Status word bit assignment[1]		
Bit	Code	Name
19	STLP	Stroke limit reached positive
20	STLN	Stroke limit reached negative
21	VM	Speed monitoring
22	PB	Pushback 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. 381 Bit assignment status word

i

Die Bits 9 … 11 und 30 … 31 sind reserviert.

Configuration word

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 specified by the Motion Sequence Control (MSC) component depending on the motion command and parameterisation of the positioning block and is transmitted as part of the command.

Configuration word bit assignment[1]		
Bit	Code	Name
0	TRX	Target window reaches position
1	TRV	Target window reaches velocity
2	TRT	Target window reaches torque
3	FEX	Following error position
4	FEV	Velocity following error
6	TMX	Position target area monitoring

Configuration word bit assignment[1]		
Bit	Code	Name
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 limit position reached positive
15	SLN	Software limit position reached negative
16	STX	Standstill monitoring position/velocity
17	STV	Standstill monitoring velocity
18	LS	Stop reached
19	STLP	Stroke limit reached positive
20	STLN	Stroke limit reached negative
21	VM	Speed monitoring
22	PB	Pushback 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. 382 Configuration word bit assignment

i

Die Bits 9 … 11 und 26 … 31 sind reserviert.

Message types

Message type	Description
Status signals	Signal relating to an event or state to advance the internal state machine.

Message type	Description
Diagnostic messages	Signal relating to a malfunction or error, in part with parameterisable error responses. – Ignore – Information copies – Warning – Stop category 0 – Stop category 1 – Stop category 2

Tab. 383 Message types

5.2 Target Window Reached

Target Reached TRx

The function indicates whether the target value has been reached following the start of a command. Depending on the operating mode, various target values are monitored simultaneously with a comparator during this process. Each comparator is defined by a monitoring window and the damping time. The damping time is set via 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. 384 Status Signals - Target Window Reached (Dependent on Operating Mode)

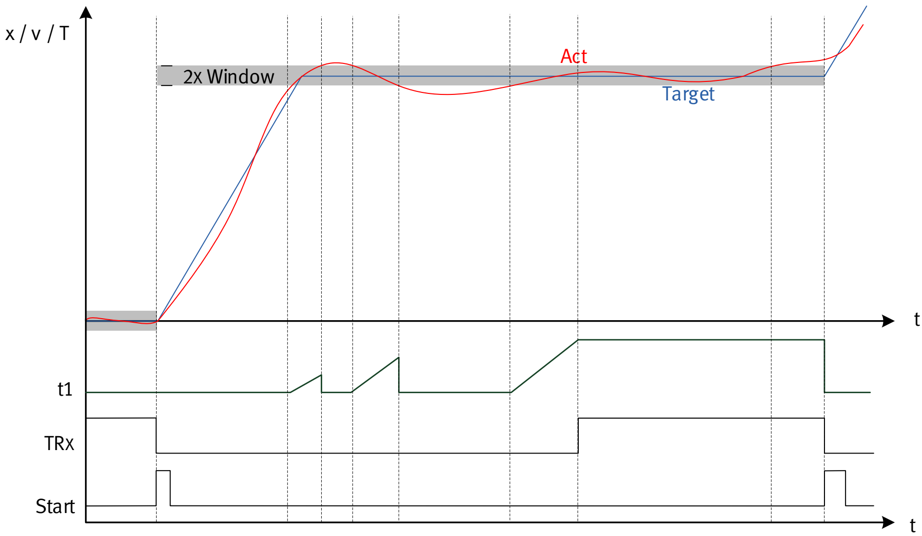

Fig. 73 Timing diagram: target window reached (example)

Name	Description
x/v/T	Position, velocity and torque motion quantities
t1	Damping time
TRx	Diagnostic message
Start	Start motion command
Window	Monitoring window
Act	Actual value
Target	Target value

Tab. 385 Legend for Timing diagram: target window reached (example)

Parameters and Diagnostic Messages

ID Px.	Parameter	Description	
468	Damping time target reached	Specifies the damping time for the target position, speed 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

ID Px.	Parameter	Description	
468	Damping time target reached	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 speed	Specifies the monitoring window for the target speed. 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
		Update	effective immediately
		Unit	Nm

Tab. 386 Parameters - Target Window Reached

ID Dx.	Name	Description
07 I 02 I 00121 (117571705)	Target position reached	Target position reached
07 I 02 I 00122 (117571706)	Target velocity reached	Target velocity reached
07 I 02 I 00123 (117571707)	Target torque reached	Target torque reached

Tab. 387 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	UINT16
469	0x6067.00	Monitoring window target position	UINT32
4610	0x606D.00	Monitoring window target speed	UINT16
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
468	0x2166.09	Damping time target reached	FLOAT32
469	0x2166.0A	Monitoring window target position	FLOAT32
4610	0x2166.0B	Monitoring window target speed	FLOAT32
4611	0x2166.0C	Monitoring window target torque	FLOAT32

Tab. 388 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	FloatingPoint
469	11153.0	Monitoring window target position	FloatingPoint
4610	11565.0	Monitoring window target speed	FloatingPoint
4611	11566.0	Monitoring window target torque	FloatingPoint

Tab. 389 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 damping 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.	Parameters	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 speed: following error	Specifies the monitoring window for the speed 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	Current position: following error	Specifies the current position following error.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
4683	Current velocity: following error	Specifies the current speed following error.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
4690	Damping time velocity: following error	Specifies the damping time for the speed following error. The signal is set if the speed difference for the specified duration is outside the monitoring window. If the speed difference is within the monitoring window, the required damping time re-starts when the difference is outside the window again.	

ID Px.	Parameters	Description	
4690	Damping time velocity: following error	Access	read/write
		Update	effective immediately
		Unit	s

Tab. 390 Parameters - Following error

ID Dx.	Name	Description
07 I 02 I 00126 (117571710)	Position: following error	Position: following error
07 I 02 I 00127 (117571711)	Velocity: following error	Velocity: following error

Tab. 391 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. 392 Status signals - Following error

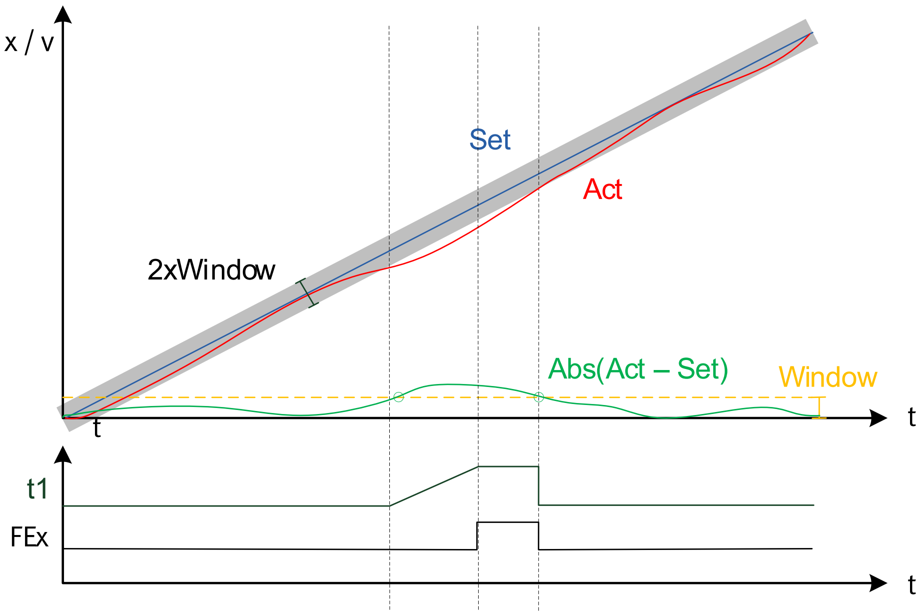

Fig. 74 Timing diagram: following error

Name	Description
x/v	Position and speed motion quantities
t1	Damping time
FEx	Diagnostic message
Window	Monitoring window
Act	Actual value
Set	Setpoint

Tab. 393 Legend for Timing diagram: following error

5.3.1 CiA 402

Objects - Following error

Parameters	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
462	0x6066.00	Damping time position: following error	UINT16
463	0x6065.00	Monitoring window position: following error	UINT32

Parameters	Index.Subindex	Name	Data type
464	0x60F8.00	Monitoring window speed: following error	SINT32
4682	0x60F4.00	Current position: following error	SINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
462	0x2166.03	Damping time position: following error	UINT32
463	0x2166.04	Monitoring window position: following error	FLOAT32
464	0x2166.05	Monitoring window speed: following error	FLOAT32
4682	0x2166.42	Current position: following error	FLOAT32
4683	0x2166.43	Current velocity: following error	FLOAT32
4690	0x2166.4A	Damping time velocity: following error	FLOAT32

Tab. 394 Objects

5.3.2 PROFIdrive

PNUs of following error

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
462	11146.0	Damping time position: following error	FloatingPoint
463	11147.0	Monitoring window position: following error	FloatingPoint
464	11148.0	Monitoring window speed: following error	FloatingPoint
4682	11624.0	Current position: following error	FloatingPoint
4683	11625.0	Current velocity: following error	FloatingPoint
4690	11632.0	Damping time velocity: following error	FloatingPoint

Tab. 395 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

Status signal	TM...
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. 396 Status signals - Target area monitoring

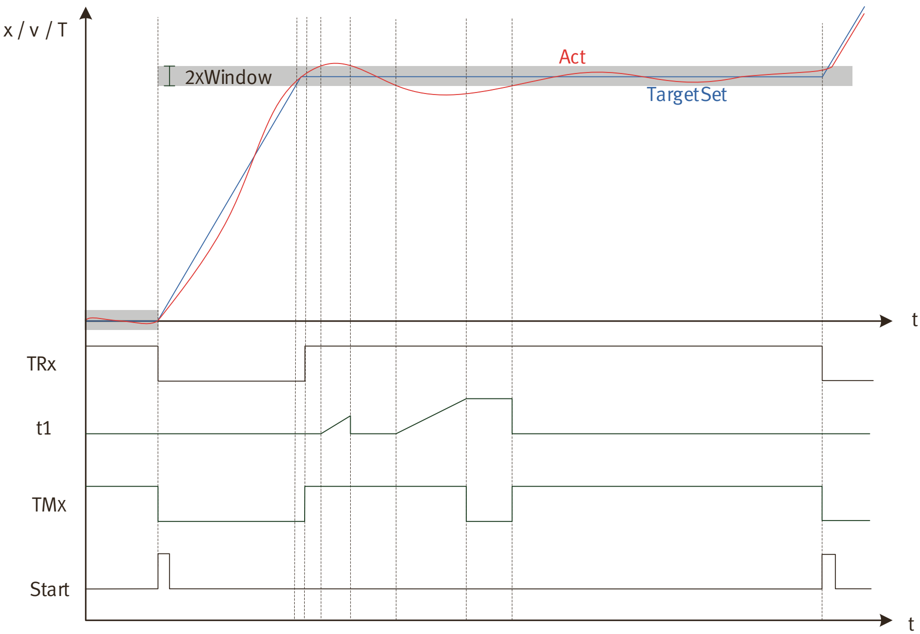

Fig. 75 Timing diagram: target area monitoring (example)

Name	Description
x/v/T	Position, speed and torque motion quantities
TRx	Target reached
t1	Damping time
TMx	Diagnostic message
Start	Start motion command

Name	Description
Window	Monitoring window
Act	Actual value
TargetSet	Target value

Tab. 397 Legend for Timing diagram: target area monitoring (example)

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
4666	Monitoring window position	Determines 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 speed. 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. 398 Parameters - Target area monitoring

ID Dx.	Name	Description
07 I 02 I 00129 (117571713)	Out of target range	Drive has left the target range

Tab. 399 Diagnostic messages - Target area monitoring

5.4.1 CiA 402

Objects - Target area monitoring

Parameters	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	FLOAT32
4666	0x2166.36	Monitoring window position	FLOAT32
4667	0x2166.37	Monitoring window velocity	FLOAT32
4668	0x2166.38	Monitoring window torque	FLOAT32

Tab. 400 Objects

5.4.2 PROFIdrive

PNUs of target area monitoring

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4665	11611.0	Damping time target range	FloatingPoint
4666	11612.0	Monitoring window position	FloatingPoint
4667	11613.0	Monitoring window velocity	FloatingPoint
4668	11614.0	Monitoring window torque	FloatingPoint

Tab. 401 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 the limit switch being exceeded

Application

– Protect the drive against damage:
  An error message is triggered, and the corresponding error response is initiated if the hardware limit switch is reached or exceeded. 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 exceeding the limit 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 reference 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 lower 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 lower 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. 402 Status signals - Hardware limit switch reached

Parameters and diagnostic messages

ID Px.	Parameters	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	effective immediately
		Unit	–

ID Px.	Parameters	Description	
101101	Configure positive hardware limit switch	Specifies the configuration of the positive hardware limit switch: 0: deactivated, 1: normally open, 2: normally closed	
		Access	read/write
		Update	effective immediately
		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 lim-it 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 detec-ted.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
101115	Positive limit switch position detected	Specifies the position where the positive limit switch was detec-ted.	
		Access	read/–
		Update	effective immediately
		Unit	user defined

Tab. 403 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

ID Dx.	Name	Description
07 I 01 I 00117 (117506165)	Limitation by positive hardware limit switch	Limitation of direction of movement owing to positive hardware limit switch
07 I 01 I 00118 (117506166)	Error: both hardware limit switches activated	Error: both hardware limit switches activated

Tab. 404 Diagnostic messages - Hardware limit switch reached

5.5.1 CiA 402

Objects - Hardware limit switch reached

Parameters	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	UINT32
101101	0x2189.02	Configure positive hardware limit switch	UINT32
101112	0x2189.0D	Negative hardware limit switch detected	BOOL
101113	0x2189.0E	Positive hardware limit switch detected	BOOL
101114	0x2189.0F	Negative limit switch position detected	SINT64
101115	0x2189.10	Positive limit switch position detected	SINT64

Tab. 405 Objects

5.5.2 PROFIdrive

PNUs of hardware limit switch reached

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
101100	11930.0	Configure negative hardware limit switch	Unsigned32
101101	11931.0	Configure positive hardware limit switch	Unsigned32
101112	11942.0	Negative hardware limit switch detected	Boolean
101113	11943.0	Positive hardware limit switch detected	Boolean
101114	11944.0	Negative limit switch position detected	Integer64
101115	11945.0	Positive limit switch position detected	Integer64

Tab. 406 PNUs

5.6 Software limit position reached

SW limit reached SL

Monitoring of the software limit positions controls the traversing range of the drive.

The monitoring function includes:
– Status evaluation of the SLN/SLP software limit positions
– Configuration check
– Limit position monitoring (optionally with automatic braking)

The limit position configuration is invalid if the negative limit position is greater or equal to the positive limit position.
The configuration check is only completed if limit position monitoring is activated (default).

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The software limit positions relate to the axis zero point. A valid reference run must therefore be completed. The reference run can also be completed if the drive is outside the limit positions.

Application

– Protect the drive against damage:
  Status SLP or SLN is set when the limit position is exceeded. The status is reset as soon as the drive reaches the valid range again.
– Protect the drive against damage:
  – Limit position monitoring without automatic braking:
    An error message is triggered if the limit 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.
  – Limit position monitoring with automatic braking:
    Due to the current distance and speed, exceeding the limit position can be prevented by braking in time in record, interpolation and jog mode. The dynamic acceleration and jerk values from the stop ramp parameters are used for the projection.
    A message is triggered, and the parameterised error response is initiated, so that a standstill can be achieved before the limit 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 limit position – SLP: If the actual position is greater than the parameterised positive limit position – SLN/SLP, if automatic braking is triggered	0→1

Status signal	SL...
The signal is reset under the following conditions: – SLN: If the actual position is greater than the parameterised negative limit position – SLP: If the actual position is lower than the parameterised positive limit position	1→0

Tab. 407 Status signals - Software limit position reached

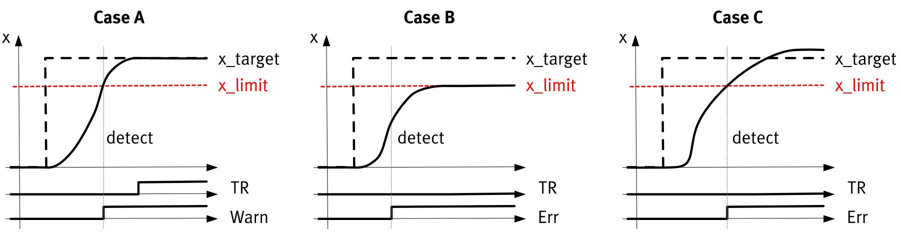

Fig. 76 Timing diagram: software limit position reached

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 overtravel 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. 408 Legend for timing graph

Parameters and diagnostic messages

ID Px.	Parameters	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	–
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. 409 Parameters - Software limit position reached

ID Dx.	Name	Description
07 | 01 | 00109 (117506157)	Negative software limit position	Negative software limit position reached

ID Dx.	Name	Description
07 ǀ 01 ǀ 00110 (117506158)	Positive software limit position	Positive software limit position reached
07 ǀ 01 ǀ 00111 (117506159)	Limitation negative direction	Limitation of direction of movement owing to negative software limit position
07 ǀ 01 ǀ 00112 (117506160)	Limitation positive direction	Limitation of direction of movement owing to positive software limit position
07 ǀ 01 ǀ 00113 (117506161)	Parameterisation of software limit positions	Parameterisation of software limit positions invalid

Tab. 410 Diagnostic messages - Software limit position reached

5.6.1 CiA 402

Objects - Software limit position reached

Parameters	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
4629	0x607D.01	Negative software limit position	SINT32
4630	0x607D.02	Positive software limit position	SINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
4628	0x2166.1D	Software limit positions active	BOOL
4629	0x2166.1E	Negative software limit position	SINT64
4630	0x2166.1F	Positive software limit position	SINT64
4631	0x2166.20	Activation of automatic stop ramp software limit position	BOOL

Tab. 411 Objects

5.6.2 PROFIdrive

PNUs of software limit position reached

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4628	11583.0	Software limit positions active	Boolean
4629	11584.0	Negative software limit position	Integer64
4630	11585.0	Positive software limit position	Integer64

Parameters	PNU	Name	Data type
4631	11586.0	Activation of automatic stop ramp software limit position	Boolean

Tab. 412 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. 413 Status signals - Standstill monitoring

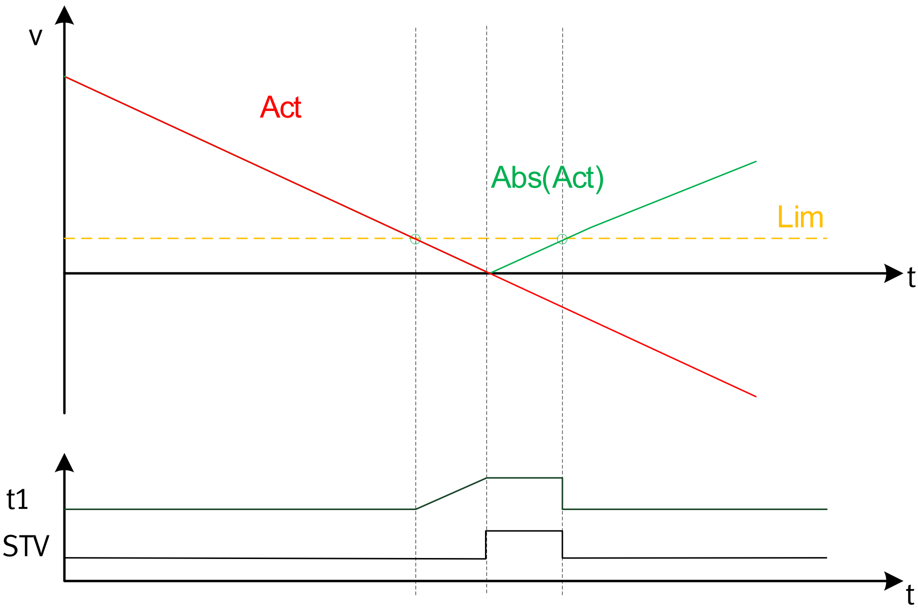

Fig. 77 Timing diagram: standstill monitoring

Name	Description
v	Speed motion quantity
t1	Damping time
STV	Diagnostic message
Act	Actual speed
Lim	Threshold value

Tab. 414 Legend for Timing diagram: standstill monitoring

Parameters and diagnostic messages

ID Px.	Parameters	Description	
465	Standstill damping time	Specifies the damping time of standstill monitoring. If the actual speed 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

ID Px.	Parameters	Description	
465	Standstill damping time	Unit	s
466	Monitoring window speed standstill monitoring	Specifies the monitoring window for speed standstill monitoring (maximum permissible speed at a standstill). A standstill indicates that the actual speed 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. 415 Parameters - Standstill monitoring

ID Dx.	Name	Description
07 l 02 l 00124 (117571708)	Standstill reached	Standstill reached
07 l 02 l 00125 (117571709)	Standstill reached and in standstill window	Standstill reached and in standstill window

Tab. 416 Diagnostic messages - Standstill monitoring

5.7.1 CiA 402

Objects - Standstill monitoring

Parameters	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
465	0x6070.00	Standstill damping time	UINT16
466	0x606F.00	Monitoring window speed standstill monitoring	UINT16

Parameters	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
465	0x2166.06	Standstill damping time	FLOAT32
466	0x2166.07	Monitoring window speed standstill monitor-ing	FLOAT32
467	0x2166.08	Monitoring window position standstill	FLOAT32

Tab. 417 Objects

5.7.2 PROFIdrive

Standstill monitoring PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
465	11149.0	Standstill damping time	FloatingPoint
466	11150.0	Monitoring window speed standstill monitor-ing	FloatingPoint
467	11151.0	Monitoring window position standstill	FloatingPoint

Tab. 418 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. 419 Status signals - Stop reached

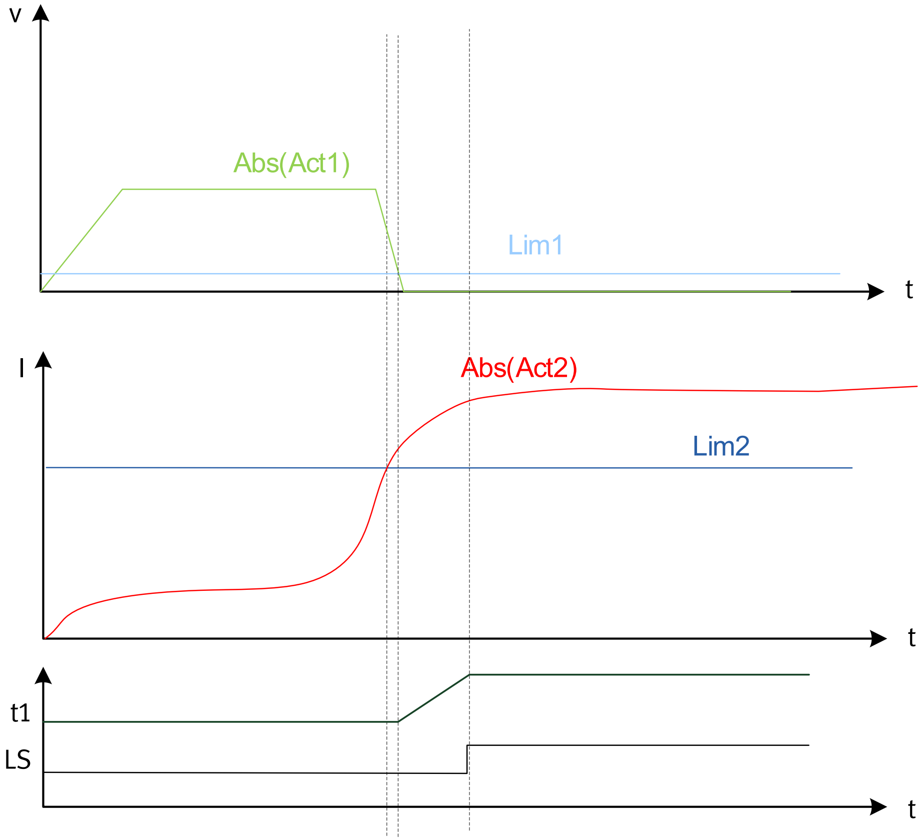

Fig. 78 Timing diagram: stop reached

Name	Description
v	Speed motion quantity
I	Active current
t1	Damping time
LS	Diagnostic message
Act1	Actual speed
Act2	Actual active current
Lim1	Stop detection limit value
Lim2	STV

Tab. 420 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 current 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
		Update	effective immediately
		Unit	s

Tab. 421 Parameters - Stop reached

5.8.1 CiA 402

Objects - Stop reached

Parameters	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	FLOAT32
4627	0x2166.1C	Damping time limit detection	FLOAT32

Tab. 422 Objects

5.8.2 PROFIdrive

Stop reached PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4626	11581.0	Stop detection limit value	FloatingPoint

Parameters	PNU	Name	Data type
4627	11582.0	Damping time limit detection	FloatingPoint

Tab. 423 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 parameterised separately via the relevant command during direct or record operation ("Command with stroke limit monitoring"). Referencing is not necessary. The parameterised, 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

Status signal	STL...
The signal is reset when a new command is started.	1→0

Tab. 424 Status signals - Stroke limit reached

Parameters and diagnostic messages

ID Px.	Parameters	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. 425 Parameters - Stroke limit reached

ID Dx.	Name	Description
07 I 01 I 00119 (117506167)	Negative stroke limit reached	Negative stroke limit reached
07 I 01 I 00120 (117506168)	Positive stroke limit reached	Positive stroke limit reached

Tab. 426 Diagnostic messages - Stroke limit reached

5.9.1 CiA 402

Objects - Stroke limit reached

Parameters	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	SINT64
10369	0x2190.09	Default value positive stroke limit	SINT64
4675	0x2166.3D	Activation of automatic stop ramp stroke limit	BOOL

Tab. 427 Objects

5.9.2 PROFIdrive

Stroke limit reached PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
10368	11819.0	Default value negative stroke limit	Integer64
10369	11820.0	Default value positive stroke limit	Integer64
4675	11619.0	Activation of automatic stop ramp stroke limit	Boolean

Tab. 428 PNUs

5.10 Speed monitoring (spinning protection)

Speed monitor VM

The monitoring function detects excessive speeds and prevents the drive from spinning by stopping category 0. 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. 429 Status signals - Speed monitoring

Parameters and diagnostic messages

ID Px.	Parameters	Description	
4660	Maximum speed	Specifies the absolute value of the maximum speed. When the threshold value is reached, the drive is stopped with stop category 0. A diagnostic message is issued if the parameterised speed value is exceeded.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 430 Parameters - Speed monitoring

ID Dx.	Name	Description
07 I 02 I 00128 (117571712)	Velocity too high	RPM monitoring reports velocity too high

Tab. 431 Diagnostic messages - Speed monitoring

5.10.1 CiA 402

Objects - Speed monitoring

Parameters	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
4660	0x2166.30	Maximum speed	FLOAT32

Tab. 432 Objects

5.10.2 PROFIdrive

Velocity monitoring PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4660	11606.0	Maximum speed	FloatingPoint

Tab. 433 PNUs

5.11 Pushback monitoring

Pushback PB

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 velocity 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: **Torque setpoint ≠ 0:** – The actual speed value exceeds the threshold value for longer than the damping time – AND the drive moves in the opposite direction to the torque. **Torque setpoint = 0:** – The actual speed value exceeds the threshold value for longer than the damping time.	0→1
The signal is reset under the following conditions: – The setting logic is inverted.	1→0

Tab. 434 Status signals - Pushback monitoring

Parameters and diagnostic messages

ID Px.	Parameters	Description	
4663	Monitoring window pushback	Specifies the monitoring window for pushback monitoring. Threshold value for monitoring the actual speed (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. 435 Parameters - Pushback monitoring

ID Dx.	Name	Description
07 I 02 I 00130 (117571714)	Reverse feed monitoring	Reverse feed monitoring reports error

Tab. 436 Diagnostic messages - Pushback monitoring

5.11.1 CiA 402

Objects - Pushback monitoring

Parameters	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	FLOAT32
4664	0x2166.34	Damping time pushback	FLOAT32

Tab. 437 Objects

5.11.2 PROFIdrive

Pushback monitoring PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4663	11609.0	Monitoring window pushback	FloatingPoint
4664	11610.0	Damping time pushback	FloatingPoint

Tab. 438 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. 439 Status signals - Remaining distance monitoring

Parameters and diagnostic messages

ID Px.	Parameters	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. 440 Parameters - Remaining distance monitoring

ID Dx.	Name	Description
07 I 02 I 00131 (117571715)	Residual distance too low	Residual distance too low

Tab. 441 Diagnostic messages - Remaining distance monitoring

5.12.1 CiA 402

Objects - Remaining distance monitoring

Parameters	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
4685	0x2166.69	Limit value remaining distance monitoring	SINT64

Tab. 442 Objects

5.12.2 PROFIdrive

Remaining distance monitoring PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4685	11627.0	Limit value remaining distance monitoring	Integer64

Tab. 443 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. 444 Status signals - Trajectory completed

Parameters and diagnostic messages

ID Dx.	Name	Description
07 I 02 I 00132 (117571716)	Trajectory completed	Trajectory completed (setpoint value reached)

Tab. 445 Diagnostic messages - Trajectory completed

5.14 Reference switch activated

5.14.1 Function

Reference switch REFS

The monitoring function indicates when the reference switch is activated.

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. 446 Status signals - Reference switch

Parameters and diagnostic messages

ID Px.	Parameters	Description	
101200	Reference switch configuration	Determines the configuration of the reference switch. 0: Deactivated 1: N/O contact 2: N/C contact	
		Access	read/write
		Update	effective immediately
		Unit	–
101201	Reference switch status	Specifies whether the reference switch is active. 0: inactive 1: active	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 447 Parameters - Reference switch

Diagnostic messages

No specific diagnostic messages are allocated to the function.

5.14.2 CiA 402

Objects - Reference switch

Parameters	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	UINT32
101201	0x218A.02	Reference switch status	BOOL

Tab. 448 Objects

5.14.3 PROFIdrive

Reference switch PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
101200	11947.0	Reference switch configuration	Unsigned32
101201	11948.0	Reference switch status	Boolean

Tab. 449 PNUs

5.15 Directional lock

5.15.1 Function

The directional lock function blocks the movement of the drive in one or both directions. The directional lock is triggered 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 until the actual position value is in the valid range again or the directional lock is deactivated via parameter Px.10351.
A hardware limit switch has been triggered.	

Tab. 450 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.

Parameters and diagnostic messages

<table>
<tr><th>ID Px.</th><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">10351</td><td rowspan="4">Request directional lock</td><td colspan="2">A directional lock can be triggered via this parameter.</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>–</td></tr>
<tr><td rowspan="4">10352</td><td rowspan="4">Active directional lock</td><td colspan="2">Indicates whether a directional lock has been requested by parameter Px.10351 or the motion monitoring function (software limit position or hardware limit switch reached).</td></tr>
<tr><td>Access</td><td>read/–</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>–</td></tr>
<tr><td rowspan="3">10353</td><td rowspan="3">Status directional lock</td><td colspan="2">Indicates 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.</td></tr>
<tr><td>Access</td><td>read/–</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
</table>

ID Px.	Parameter	Description	
10353	Status directional lock	Unit	–

Tab. 451 Parameter

ID Dx.	Name	Description
05 | 02 | 00080 (84017232)	Simultaneous negative/positive directional lock	Simultaneous negative/positive directional lock

Tab. 452 Diagnostic messages

5.15.2 CiA 402

Directional lock objects

Parameters	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	SINT32
10352	0x218F.02	Active directional lock	SINT32
10353	0x218F.03	Status directional lock	SINT32

Tab. 453 Objects

5.15.3 PROFIdrive

Directional lock PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
10351	11807.0	Request directional lock	Integer32
10352	11808.0	Active directional lock	Integer32
10353	11809.0	Status directional lock	Integer32

Tab. 454 PNUs

6 Control

6.1 Cascade Controller

6.1.1 Function

The movement of the drive systems is controlled via 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 control depends on the selected operating mode. The respective input variables of the individual control loops are controlled to the set values. The actual values are created out of the data of the transducer and the measured current. A better control behaviour can be obtained via a pilot control. Also, limitations for the current and velocity controller can be activated. Aside from the active control parameter set, 3 additional control parameter sets are available for the parameterisation of the cascade controller.

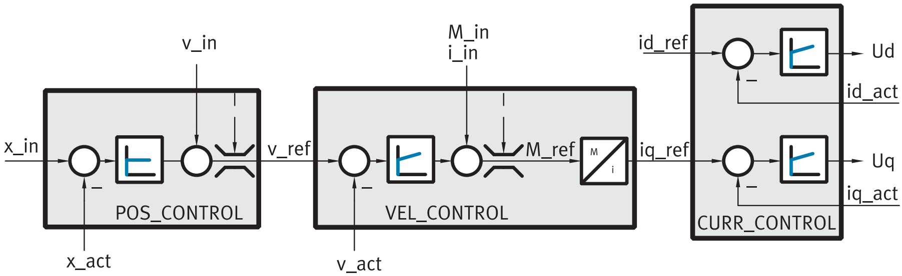

Fig. 79 Block diagram of cascade controller

Name	**Parameter**	**ID Px.**
i_in	Feed forward control current output 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 (Setpoint value control). Between i_in and M_in, there is the relationship i_in = M_in/(torque con-stant x gear unit factor).	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 value torque The setpoint value torque 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 (Setpoint value control).	94
M_refM_r-ef	Setpoint value torque	2220
v_act	Actual velocity value	1210
v_in	Setpoint value velocity The setpoint value velocity is used as a pilot control value for the velocity regulator ➔ 6.3 Pilot control (Setpoint value control).	91

Name	Parameter	ID Px.
v_ref	Setpoint value velocity controller	2216
x_act	Actual position value	128
x_in	Setpoint value position	90

Tab. 455 Legend for the Block Diagram of the Cascade Controller

6.1.2 Position Controller

The position controller is designed as P-controller which calculates the velocity specification for the secondary velocity control circuit from the control difference (setpoint position - actual position). A dead zone member suppresses all control differences with the value "0" if it lies within the parameterised symmetrical dead zone. The P-member generates the setpoint velocity from the control difference and position controller amplification factor. This can be asymmetrically limited via the minimum and maximum correction velocity. At active velocity pilot control (default setting), values "Setpoint velocity" and "Velocity pilot control" are added and issued as velocity specification to the secondary velocity controller. The velocity controller setpoint value can be asymmetrically limited via the resulting lower and upper limit value velocity. If the setpoint value reaches the limit, this can be requested via a status.

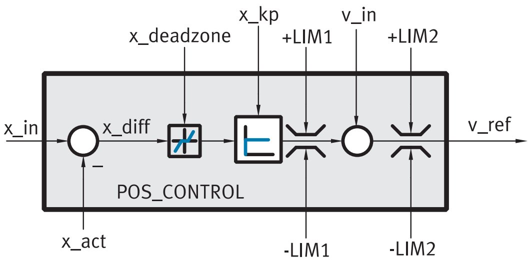

Fig. 80 Block diagram of position controller

Name	Parameter	ID Px.
x_act	Actual position value	128
x_deadzone	Dead zone position controller	221
x_diff	Position control error	2217
x_in	Setpoint value position	90
x_kp	Position controller amplification gain	220

Name	Parameter	ID Px.
v_in	Setpoint value velocity The setpoint value velocity is used as a pilot control value for the velocity regulator ➔ 6.3 Pilot control (Setpoint value control).	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)	6100
+LIM2	Resulting upper limit value velocity (closed loop controller)	6101

Tab. 456 Legend for the Block Diagram of the Position Controller

Parameters and Diagnostic Messages

<table>
<tr><th>ID Px.</th><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">220</td><td rowspan="4">Position controller amplification gain</td><td colspan="2">Specifies the amplification gain for the P-element in the position controller.</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>–</td></tr>
<tr><td rowspan="4">221</td><td rowspan="4">Dead zone position controller</td><td colspan="2">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.</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>user defined</td></tr>
<tr><td rowspan="4">222</td><td rowspan="4">Minimum correction velocity</td><td colspan="2">Specifies the limit value "Minimum correction velocity" for the velocity limitation on the output of the P-element in the position controller.</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>user defined</td></tr>
</table>

ID Px.	Parameter	Description	
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 limiting.	
		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 limiting.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
52675	Velocity limiting active	Specifies the monitoring status of "Velocity limiting is active" for the setpoint value for the velocity controller in the position controller.	
		Access	read/–
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
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. 457 Parameter

ID Dx.	Name	Description
07 l 03 l 00135 (117637255)	Limit for velocity or current active	A limit for the velocity or current is active

Tab. 458 Diagnostic Messages

6.1.2.1 CiA 402

Position controller PNUs

Parameters	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	FLOAT32
221	0x215B.02	Dead zone position controller	SINT64
222	0x215B.03	Minimum correction velocity	FLOAT32
223	0x215B.04	Maximum correction velocity	FLOAT32
2216	0x215B.08	Setpoint value velocity controller	FLOAT32
2217	0x215B.09	Position control error	SINT64
6100	0x2168.08	Resulting lower limit value velocity (closed loop controller)	FLOAT32
6101	0x2168.09	Resulting upper limit value velocity (closed loop controller)	FLOAT32
52675	0x2152.09	Velocity limiting active	BOOL
526794	0x2152.0D	Filter time constant controller limitation	FLOAT32

Tab. 459 Objects

6.1.2.2 PROFIdrive

Position controller PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
220	11080.0	Position controller amplification gain	FloatingPoint
221	11081.0	Dead zone position controller	Integer64
222	11082.0	Minimum correction velocity	FloatingPoint
223	11083.0	Maximum correction velocity	FloatingPoint
2216	11412.0	Setpoint value velocity controller	FloatingPoint
2217	11413.0	Position control error	Integer64
6100	11640.0	Resulting lower limit value velocity (closed loop controller)	FloatingPoint
6101	11641.0	Resulting upper limit value velocity (closed loop controller)	FloatingPoint
52675	11889.0	Velocity limiting active	Boolean
526794	12165.0	Filter time constant controller limitation	FloatingPoint

Tab. 460 PNUs

6.1.3 Velocity Controller

The velocity controller is designed as a PI controller (with anti-windup function) which calculates the torque specifications for the secondary current control circuit from the control difference (setpoint velocity - actual velocity). At active torque pilot control (default setting) the values "Setpoint torque" and "Torque pilot control" are added and issued 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. For use with the Ci402 protocol, the torque setpoint value is asymmetrically limited by means of a further limitation.

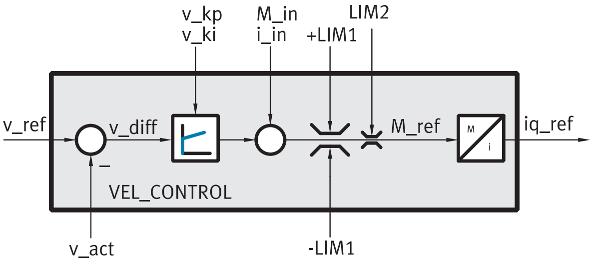

Fig. 81 Block diagram of velocity controller

Name	Parameter	ID Px.
i_in	Feed forward control current output 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 (Setpoint value control). 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 value torque The setpoint value torque is used as a pilot control value for the velocity regulator. The resulting setpoint value is dependent on the parameterised upstream variables of the pilot control ➔ 6.3 Pilot control (Setpoint value control).	94
M_refM_ref	Setpoint value torque	2220
v_kp	Velocity controller amplification gain	224
v_ki	Velocity controller integration constant	225
v_act	Actual velocity value	1210
v_diff	Velocity control error	2215
v_ref	Setpoint value velocity controller	2216
–LIM1	Minimum torque	2218
+LIM1	Maximum torque	2219
LIM2	Maximum torque symmetrical)	526796

Tab. 461 Legend for the Block Diagram of the Velocity Controller

i

Recommendation: Before changing controller parameters, check the signal of the encoder. If required, optimise 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	–
1210	Actual velocity value	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

ID Px.	Parameter	Description	
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 regulator in the velocity controller.	
		Access	read/–
		Update	effective immediately
		Unit	Nm
52676	Current limitation active	Specifies the monitoring status of "Current limiting 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. 462 Parameter

ID Dx.	Name	Description
06 I 02 I 00086 (100794454)	Sign limits	The target torque and the velocity limit are uncorrelated.

Tab. 463 Diagnostic Messages

6.1.3.1 CiA 402

Velocity controller objects

Parameter	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
1210	0x606C.00	Actual velocity value	SINT32
526796	0x6072.00	Maximum torque symmetrical	UINT16
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
224	0x215B.05	Velocity controller amplification gain	FLOAT32
225	0x215B.06	Velocity controller integration constant	FLOAT32
1210	0x2155.0B	Actual velocity value	FLOAT32
2215	0x215B.07	Velocity control error	FLOAT32
2216	0x215B.08	Setpoint value velocity controller	FLOAT32
2218	0x215B.0A	Minimum torque	FLOAT32
2219	0x215B.0B	Maximum torque	FLOAT32
2220	0x215B.0C	Setpoint value torque	FLOAT32
52676	0x2152.0A	Current limitation active	BOOL
526796	0x2168.17	Maximum torque symmetrical	FLOAT32

Tab. 464 Objects

6.1.3.2 PROFIdrive

Velocity controller PNUs

Parameters	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1210	6.0	Actual velocity value	FloatingPoint
Px.	**Manufacturer-specific parameters**		
224	11084.0	Velocity controller amplification gain	FloatingPoint
225	11085.0	Velocity controller integration constant	FloatingPoint
1210	11311.0	Actual velocity value	FloatingPoint
2215	11411.0	Velocity control error	FloatingPoint
2216	11412.0	Setpoint value velocity controller	FloatingPoint
2218	11414.0	Minimum torque	FloatingPoint
2219	11415.0	Maximum torque	FloatingPoint

Parameters	PNU	Name	Data type
2220	11416.0	Setpoint value torque	FloatingPoint
52676	11890.0	Current limitation active	Boolean
526796	12166.0	Maximum torque symmetrical	FloatingPoint

Tab. 465 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 a calculation of the controller parameters is carried out by the plug-in. The calculation can be initiated, for example, via page "Closed loop".

Active Current Regulator:

The active current regulator is designed as a PI controller (with anti-windup functionality), which calculates (Setpoint value active current – Actual active current value) the voltage specification U_{q_ref} for the secondary voltage transformation from the control difference.

Reactive Current Regulator:

The reactive current regulator is designed as a PI controller (with anti-windup functionality), which calculates (Setpoint value reactive current – Actual reactive current value) the voltage specification U_{d_ref} for the secondary voltage transformation from the control difference.

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 respective limitation for U_{q_ref} and U_{d_ref} can be requested.

Voltage Transformation:

The voltage transformation generates the setpoint value specifications for the secondary power output stage from input variables "Voltage setpoint value". This prioritises the voltage U_d as default against voltage U_q.

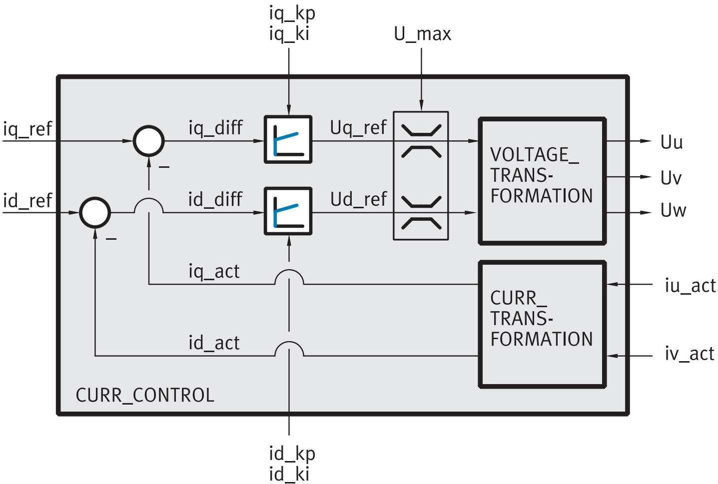

Fig. 82 Block diagram of current regulator

Name	Parameter	ID Px.
id_act	Actual reactive current value	813
id_diff	Reactive current control error	824
id_ki	Integration constant current regulator (reactive current)	81
id_kp	Amplification gain current regulator (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	Integration constant current regulator (active current)	83
iq_kp	Amplification gain current regulator (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 of motor voltage phase U	–

Name	Parameter	ID Px.
Uv	Setpoint value of motor voltage phase V	–
Uw	Setpoint value of motor voltage phase W	–

Tab. 466 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	Amplification gain current regulator (reactive current)	Specifies the amplification gain for the P-element in the reactive current regulator.	
		Access	read/write
		Update	effective immediately
		Unit	–
81	Integration constant current regulator (reactive current)	Specifies the integration constant for the I-element in the reactive current regulator.	
		Access	read/write
		Update	effective immediately
		Unit	–
82	Amplification gain current regulator (active current)	Specifies the amplification gain for the P-element in the effective current regulator.	
		Access	read/write
		Update	effective immediately
		Unit	–
83	Integration constant current regulator (active current)	Specifies the integration constant for the I-element in the effective current regulator.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
84	Setpoint value voltage Ud	Specifies the setpoint voltage Ud at the output of the reactive current regulator.	
		Access	read/–
		Update	effective immediately
		Unit	V
85	Setpoint value voltage Uq	Specifies the setpoint voltage Uq at the output of the active current regulator.	
		Access	read/–
		Update	effective immediately
		Unit	V
86	Setpoint value active current	Specifies the active current setpoint for the current regulator.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
87	Setpoint value reactive current	Specifies the reactive current setpoint for the current regulator.	
		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 regulator.	
		Access	read/–
		Update	effective immediately
		Unit	V
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

ID Px.	Parameter	Description	
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 regulators	Activate equalisation of the control parameters of the current regulator for active current and reactive current – 0: inactive; for the calculation of the controller parameters, the plug-in only calculates the active current regulator. The reactive current regulator remains unaffected. – 1: active; for the calculation of the controller 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 regulator.	
		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 regulator.	
		Access	read/–
		Update	effective immediately
		Unit	Arms
1206	Length motor cable	Determines the length of the motor cable. The length of the motor cable is required for controller sizing.	
		Access	read/write
		Update	effective immediately
		Unit	mCable

ID Px.	Parameter	Description	
1208	Cable cross section	Defines the cable cross-section in mm². The cable cross-section is required for controller sizing.	
		Access	read/write
		Update	effective immediately
		Unit	mm²
52679	Voltage limiting filter time constant	Specifies the filter time constant for reaching the voltage limit.	
		Access	read/write
		Update	effective immediately
		Unit	s
52680	Voltage limiting Ud active	Specifies the monitoring status of "Voltage limiting Ud active" for the voltage Ud setpoint value in the current regulator.	
		Access	read/–
		Update	effective immediately
		Unit	–
52681	Voltage limiting Uq active	Specifies the monitoring status of "Voltage limiting Uq active" for the voltage Uq setpoint value in the current regulator.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 467 Parameter

ID Dx.	Name	Description
07 I 03 I 00134 (117637254)	Voltage limiting active	Voltage limiting active

Tab. 468 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	SINT16

Parameter	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
39	0x2151.0A	Actual phase U current value	FLOAT32
80	0x2153.01	Amplification gain current regulator (reactive current)	FLOAT32
81	0x2153.02	Integration constant current regulator (react-ive current)	FLOAT32
82	0x2153.03	Amplification gain current regulator (active current)	FLOAT32
83	0x2153.04	Integration constant current regulator (active current)	FLOAT32
84	0x2153.05	Setpoint value voltage Ud	FLOAT32
85	0x2153.06	Setpoint value voltage Uq	FLOAT32
86	0x2153.07	Setpoint value active current	FLOAT32
87	0x2153.08	Setpoint value reactive current	FLOAT32
88	0x2153.09	Maximum output voltage	FLOAT32
310	0x2151.0B	Actual phase V current value	FLOAT32
813	0x2153.0E	Actual reactive current value	FLOAT32
814	0x2153.0F	Actual active current value	FLOAT32
819	0x2153.14	Control parameter equalisation for active and reactive current regulators	BOOL
824	0x2153.15	Reactive current control error	FLOAT32
825	0x2153.16	Active current control error	FLOAT32
1206	0x217F.07	Length motor cable	FLOAT32
1208	0x217F.09	Cable cross section	FLOAT32
52679	0x2151.0C	Voltage limiting filter time constant	FLOAT32
52680	0x2151.0D	Voltage limiting Ud active	BOOL
52681	0x2151.0E	Voltage limiting Uq active	BOOL

Tab. 469 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	FloatingPoint
80	11035.0	Amplification gain current regulator (reactive current)	FloatingPoint
81	11036.0	Integration constant current regulator (reactive current)	FloatingPoint
82	11037.0	Amplification gain current regulator (active current)	FloatingPoint
83	11038.0	Integration constant current regulator (active current)	FloatingPoint
84	11039.0	Setpoint value voltage Ud	FloatingPoint
85	11040.0	Setpoint value voltage Uq	FloatingPoint
86	11041.0	Setpoint value active current	FloatingPoint
87	11042.0	Setpoint value reactive current	FloatingPoint
88	11043.0	Maximum output voltage	FloatingPoint
310	11113.0	Actual phase V current value	FloatingPoint
813	11189.0	Actual reactive current value	FloatingPoint
814	11190.0	Actual active current value	FloatingPoint
819	11195.0	Control parameter equalisation for active and reactive current regulators	Boolean
824	11200.0	Reactive current control error	FloatingPoint
825	11201.0	Active current control error	FloatingPoint
1206	11308.0	Length motor cable	FloatingPoint
1208	11310.0	Cable cross section	FloatingPoint
52679	11893.0	Voltage limiting filter time constant	FloatingPoint
52680	11894.0	Voltage limiting Ud active	Boolean
52681	11895.0	Voltage limiting Uq active	Boolean

Tab. 470 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 velocity controllers and current regulators, the total inertia for the torque pilot control and the filter time constant for the actual velocity value filter. When a control parameter set is changed, the total inertia and the velocity filter is also changed.
The individual control parameter sets can be activated via the set table or via the device profile. The switchover duration into another control parameter set can be influenced by the transition time. There is a linear interpolation of all values during the switchover.

Parameters and diagnostic messages

ID Px.	Parameters	Description	
44	Controller parameter set switchover status	Specifies the status of the activated control parameter set in the control parameter set switchover.	
		Access	read/–
		Update	effective immediately
		Unit	–
226	Amplification gain position controller	Specifies the amplification gain in the parameter sets for the P-element in the position controller.	
		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	Amplification gain current regulator (active current)	Specifies the amplification gain "Active current" in the parameter sets for the PI-element in the current regulator.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameters	Description	
2224	Integration constant current regulator (active current)	Specifies the integration constant "Active current" in the parameter sets for the PI-element in the current regulator.	
		Access	read/write
		Update	effective immediately
		Unit	–
2225	Amplification gain current regulator (reactive current)	Specifies the amplification gain "Reactive current" in the parameter sets for the PI-element in the current regulator.	
		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	kgm^2
2228	Velocity filter 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. 471 Parameters

Diagnostic messages

No specific diagnostic messages are allocated to the function.

6.1.5.1 CiA 402

Control parameter sets objects

Parameters	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
44	0x2156.01	Controller parameter set switchover status	BOOL
226	0x2227.01 ... 03	Amplification gain position controller	FLOAT32
2210	0x2228.01 ... 03	Velocity controller amplification gain	FLOAT32

Parameters	Index.Subindex	Name	Data type
2211	0x2229.01 ... 03	Velocity controller integration constant	FLOAT32
2223	0x222A.01 ... 03	Amplification gain current regulator (active current)	FLOAT32
2224	0x222B.01 ... 03	Integration constant current regulator (active current)	FLOAT32
2225	0x222C.01 ... 03	Amplification gain current regulator (reactive current)	FLOAT32
2227	0x222E.01 ... 03	Total inertia	FLOAT32
2228	0x222F.01 ... 03	Velocity filter filter time constant	FLOAT32

Tab. 472 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 on parameterised

1) signal status: 0→1 = rising edge

Tab. 473 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. 474 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. 475 Return value of device access

6.1.5.2 PROFIdrive

Control parameter sets PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
44	11026.0	Controller parameter set switchover status	Boolean
226	11086.0 ... 2	Amplification gain position controller	FloatingPoint
2210	11409.0 ... 2	Velocity controller amplification gain	FloatingPoint
2211	11410.0 ... 2	Velocity controller integration constant	FloatingPoint
2223	11419.0 ... 2	Amplification gain current regulator (active current)	FloatingPoint
2224	11420.0 ... 2	Integration constant current regulator (active current)	FloatingPoint
2225	11421.0 ... 2	Amplification gain current regulator (reactive current)	FloatingPoint
2227	11423.0 ... 2	Total inertia	FloatingPoint
2228	11424.0 ... 2	Velocity filter filter time constant	FloatingPoint

Tab. 476 PNUs

6.2 Limitations

6.2.1 Limitation of Application

The setpoint specifications for the trajectory generator are limited via the application limitation, which are prescribed by the active set table or profile operating mode (positioning, velocity or force/torque). During the test, the variables of movement "velocity (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 limitation, the setpoint values are limited to the respective value and a corrected trajectory is calculated. The torque can be asymmetrically limited via the minimum and maximum torque. If one of the setpoint values reaches the limit, this can be requested via a status.
The parameter velocity override Px.1309 can be used to influence the parameterised target velocity in the range of 0 ... 200 %. The value for the velocity override can be selected in the range from 0 ... 2. The scaling for 100 % corresponds to the value 1. The setting affects the following movement types:

– Positioning records
– Jogging
– Homing
– Target value specification

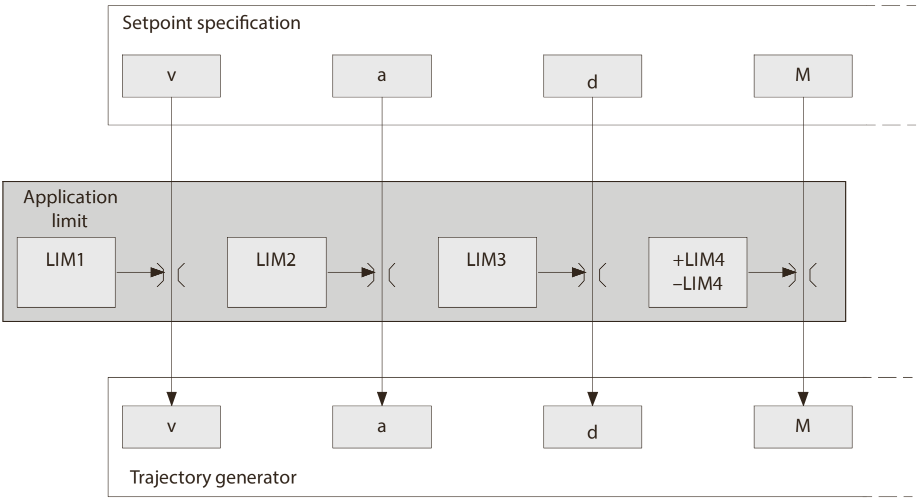

Fig. 83 Structure of the application limit

Name	Parameter	ID Px.
LIM1	Limit value velocity limiting	1304
LIM2	Limit value acceleration limiting	1305
LIM3	Limit value deceleration limiting	1306
+LIM4	Upper limit torque limitation	1307
–LIM4	Lower limit torque limitation	1308

Tab. 477 Legend of the Block Diagram for the Application Limitation

Parameters and Diagnostic Messages

ID Px.	Parameter	Description	
1301	Velocity limiting status	Specifies the velocity limiting status starting from the application limitation.	
		Access	read/–
		Update	effective immediately
		Unit	–
1302	Acceleration limiting status	Specifies the acceleration limitation of the application limitation.	
		Access	read/–
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
1303	Torque limiting status	Specifies the torque limitation starting from the application limitation.	
		Access	read/–
		Update	effective immediately
		Unit	–
1304	Limit value velocity limiting	Specifies the limit value for velocity limiting in the application limitation.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1305	Limit value acceleration limiting	Specifies the limit value for the acceleration limitation in the application limitation.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
1306	Limit value deceleration limiting	Specifies the limit value for the deceleration limitation in the application limitation.	
		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

ID Px.	Parameter	Description	
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	–
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. 478 Parameter

Diagnostic messages

No specific diagnostic messages are allocated to the function.

6.2.1.1 CiA 402

Application limit objects

Parameter	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
1304	0x607F.00	Limit value velocity limiting	UINT32
1305	0x60C5.00	Limit value acceleration limiting	UINT32
1306	0x60C6.00	Limit value deceleration limiting	UINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
1301	0x2183.01	Velocity limiting status	BOOL
1302	0x2183.02	Acceleration limiting status	BOOL
1303	0x2183.03	Torque limiting status	BOOL
1304	0x2183.04	Limit value velocity limiting	FLOAT32
1305	0x2183.05	Limit value acceleration limiting	FLOAT32
1306	0x2183.06	Limit value deceleration limiting	FLOAT32
1307	0x2183.07	Upper limit torque limitation	FLOAT32
1308	0x2183.08	Lower limit torque limitation	FLOAT32

Parameter	Index.Subindex	Name	Data type
1309	0x2183.09	Velocity override	FLOAT32

Tab. 479 Objects

6.2.1.2 PROFIdrive

Application Limit PNUs

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
11280611	205.0	Velocity override ➔ 12.4.7.18 MDI Velocity (MDI_VELOCITY)	Integer16
Px.	**Manufacturer-specific parameters**		
1301	11331.0	Velocity limiting status	Boolean
1302	11332.0	Acceleration limiting status	Boolean
1303	11333.0	Torque limiting status	Boolean
1304	11334.0	Limit value velocity limiting	FloatingPoint
1305	11335.0	Limit value acceleration limiting	FloatingPoint
1306	11336.0	Limit value deceleration limiting	FloatingPoint
1307	11337.0	Upper limit torque limitation	FloatingPoint
1308	11338.0	Lower limit torque limitation	FloatingPoint
1309	12482.0	Velocity override	FloatingPoint
11280611	12534.0	Velocity override ➔ 12.4.7.18 MDI Velocity (MDI_VELOCITY)	Integer16

Tab. 480 PNUs

6.2.2 Control limitation

The cascade controller has two limitations, one limiter for the velocity setpoint and one for the torque setpoint and the active current setpoint. Here the critical limits for the respective limiters are composed of static and dynamic data. Static data are values that are composed of the configuration of the drive system, the size of the servo drive controller and the motor used. Dynamic data () are composed of the specifications of the user and the data from the I^2t monitoring. The values can be adjusted by the user at any time.

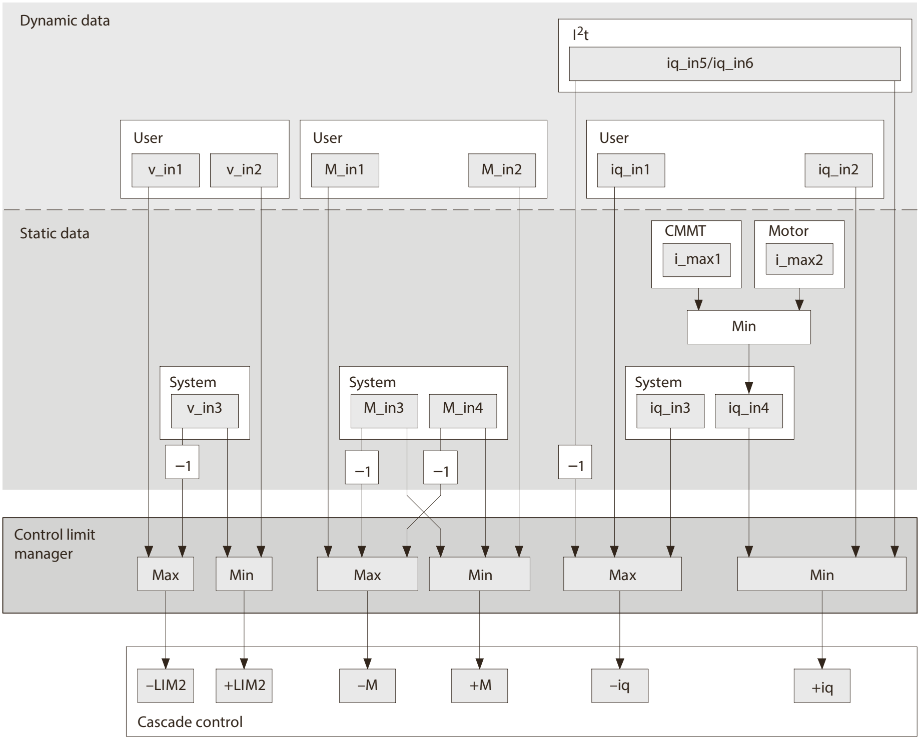

Fig. 84 Structure of control limitation

Name	Parameter	ID Px.
i_max1	Maximum current servo drive	622
i_max2	Maximum current motor	620
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	625
iq_in4	Resulting maximum current	624
iq_in5	When the limit value is reached, the current of the motor is limited to the resulting rated current (ID Px.621).	–
iq_in6	When the limit value is reached, the current of the power output stage is limited to the resulting rated current (ID Px.623).	–
–iq	Resulting lower limit value active current (closed loop controller)	6108

Name	Parameter	ID Px.
+iq	Resulting upper limit value active current (closed loop controller)	6109
M_in1	Lower limit value torque (closed loop controller)	852
M_in2	Upper limit value torque (closed loop controller)	853
M_in3	Maximum motor or servo drive torque	381
M_in4	Maximum driving torque axis	1199
–M	Resulting lower limit value torque (closed loop controller)	6104
+M	Resulting upper limit value torque (closed loop controller)	6105
v_in1	Lower limit value velocity (closed loop controller)	850
v_in2	Upper limit value velocity (closed loop controller)	851
v_in3	Maximum motor or servo drive velocity	382
–LIM2	Resulting lower limit value velocity (closed loop controller)	6100
+LIM2	Resulting upper limit value velocity (closed loop controller)	6101

Tab. 481 Legend for the block diagram of the control limitation

i

The resulting critical limit LIM2 affects the output of the position controllers
➔ 6.1.2 Position Controller.

Parameters and diagnostic messages

ID Px.	Parameter	Description	
381	Maximum motor or servo drive torque	Specifies the maximum torque of the servo drive for transfer to the configuration tool. The maximum torque must always be set the same on the side of the controller and the servo drive.	
		Access	read/–
		Update	effective immediately
		Unit	Nm
382	Maximum motor or servo drive velocity	Specifies the static limit value "Maximum velocity" created from the minimum of the maximum values of the motor or servo drive.	
		Access	read/–
		Update	effective immediately
		Unit	user defined

ID Px.	Parameter	Description	
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
		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

ID Px.	Parameter	Description	
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 limiting.	
		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 limiting.	
		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

ID Px.	Parameter	Description	
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

Tab. 482 Parameter

ID Dx.	Name	Description
06 I 02 I 00087 (100794455)	Velocity control limitation invalid	Velocity control limitation invalid
06 I 02 I 00088 (100794456)	Torque control limitation invalid	Torque control limitation invalid
06 I 02 I 00089 (100794457)	Current control limitation invalid	Current control limitation invalid
06 I 02 I 00090 (100794458)	Maximum peak current control limitation invalid	Maximum peak current control limitation invalid

Tab. 483 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)	UINT16
853	0x60E0.00	Upper limit value torque (closed loop controller)	UINT16

Parameter	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
381	0x2169.01	Maximum motor or servo drive torque	FLOAT32
382	0x2169.02	Maximum motor or servo drive velocity	FLOAT32
624	0x2169.07	Resulting maximum current	FLOAT32
625	0x2169.08	Resulting minimum current	FLOAT32
850	0x2168.01	Lower limit value velocity (closed loop controller)	FLOAT32
851	0x2168.02	Upper limit value velocity (closed loop controller)	FLOAT32
852	0x2168.03	Lower limit value torque (closed loop controller)	FLOAT32
853	0x2168.04	Upper limit value torque (closed loop controller)	FLOAT32
854	0x2168.05	Lower limit value active current (closed loop controller)	FLOAT32
855	0x2168.06	Upper limit value active current (closed loop controller)	FLOAT32
1199	0x217E.09	Maximum driving torque axis	FLOAT32
6100	0x2168.08	Resulting lower limit value velocity (closed loop controller)	FLOAT32
6101	0x2168.09	Resulting upper limit value velocity (closed loop controller)	FLOAT32
6104	0x2168.0C	Resulting lower limit value torque (closed loop controller)	FLOAT32
6105	0x2168.0D	Resulting upper limit value torque (closed loop controller)	FLOAT32
6108	0x2168.10	Resulting lower limit value active current (closed loop controller)	FLOAT32
6109	0x2168.11	Resulting upper limit value active current (closed loop controller)	FLOAT32

Tab. 484 Objects

6.2.2.2 PROFIdrive

Control limitation PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
381	11122.0	Maximum motor or servo drive torque	FloatingPoint
382	11123.0	Maximum motor or servo drive velocity	FloatingPoint
624	11163.0	Resulting maximum current	FloatingPoint
625	11164.0	Resulting minimum current	FloatingPoint
850	11212.0	Lower limit value velocity (closed loop controller)	FloatingPoint
851	11213.0	Upper limit value velocity (closed loop controller)	FloatingPoint
852	11214.0	Lower limit value torque (closed loop controller)	FloatingPoint
853	11215.0	Upper limit value torque (closed loop controller)	FloatingPoint
854	11216.0	Lower limit value active current (closed loop controller)	FloatingPoint
855	11217.0	Upper limit value active current (closed loop controller)	FloatingPoint
1199	11301.0	Maximum driving torque axis	FloatingPoint
6100	11640.0	Resulting lower limit value velocity (closed loop controller)	FloatingPoint
6101	11641.0	Resulting upper limit value velocity (closed loop controller)	FloatingPoint
6104	11644.0	Resulting lower limit value torque (closed loop controller)	FloatingPoint
6105	11645.0	Resulting upper limit value torque (closed loop controller)	FloatingPoint
6108	11648.0	Resulting lower limit value active current (closed loop controller)	FloatingPoint
6109	11649.0	Resulting upper limit value active current (closed loop controller)	FloatingPoint

Tab. 485 PNUs

6.2.3 Torque limitation

The torque limitation limits the torque related to the drive output shaft end directly at the output of the velocity controller. For drive systems with gear unit the shaft end of the gear unit output is on the drive output side. Current critical limits from the configuration of the servo drive, the motor and the specifications of the user are converted internally to a resulting torque related to the shaft end on the drive output side. The resulting limit values form the lower and upper limit value for the limitation.

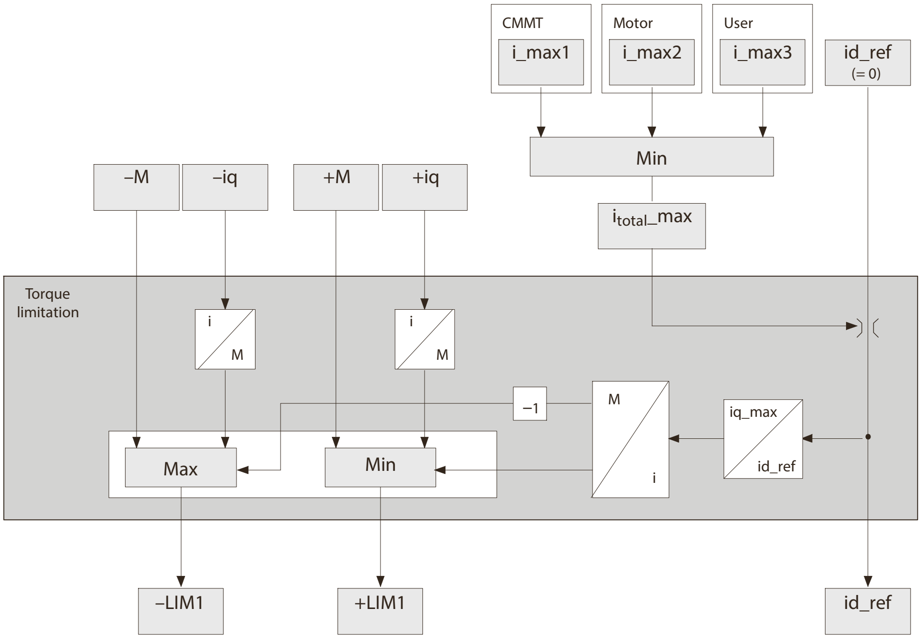

Fig. 85 Structure of current limiter

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
–iq	Resulting lower limit value active current (closed loop controller)	6108
+iq	Resulting upper limit value active current (closed loop controller)	6109
–M	Resulting lower limit value torque (closed loop controller)	6104

Name	Parameter	ID Px.
+M	Resulting upper limit value torque (closed loop controller)	6105
–LIM1	Minimum torque	2218
+LIM1	Maximum torque	2219

Tab. 486 Legend for the block diagram of the current limiter

i

The resulting critical limits iq and are the result of the control limitation ➔ 6.2.2 Control limitation. The minimum and maximum torque affects the output of the velocity controller ➔ 6.1.3 Velocity Controller.

Inertia compensations

The acceleration (a) of the motor, gear unit and coupling inertia reduces the effective torque at the output shaft end, whereby the specified value for the torque limitation is not completely available for accelerating the load. This can be compensated by the following parameters:

– Inertia Gear (Px.124321)
– Inertia coupling (Px.124322)
– Dynamic losses (Px.124323)

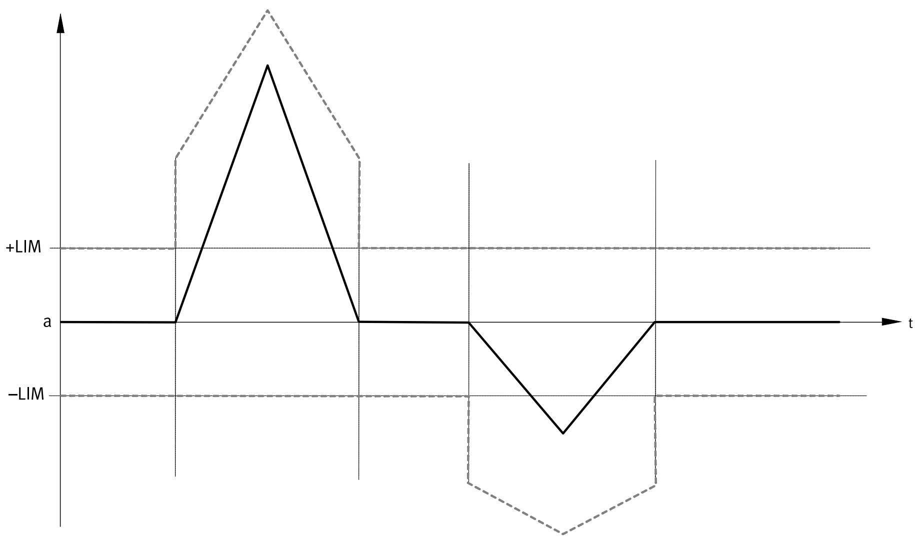

Fig. 86 Inertia compensation

Parameters and diagnostic messages

ID Px.	Parameter	Description	
87	Setpoint value reactive current	Specifies the reactive current setpoint for the current regulator.	
		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
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

ID Px.	Parameter	Description	
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	Indicates the total inertia of all gears 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	kgm^2
124322	Inertia coupling	Indicates 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	kgm^2
124323	Dynamic losses	Indicates the static dynamic losses in Nm related to the drive side. The value is required for increasing the torque limitation during the acceleration phase.	
		Access	read/write
		Update	reinitialization
		Unit	Nm

Tab. 487 Parameter

Diagnostic messages

No specific diagnostic messages are allocated to the function.

6.2.3.1 CiA 402

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	FLOAT32
856	0x2168.07	Limit value total current (closed loop controller)	FLOAT32
2218	0x215B.0A	Minimum torque	FLOAT32
2219	0x215B.0B	Maximum torque	FLOAT32
6104	0x2168.0C	Resulting lower limit value torque (closed loop controller)	FLOAT32
6105	0x2168.0D	Resulting upper limit value torque (closed loop controller)	FLOAT32
6108	0x2168.10	Resulting lower limit value active current (closed loop controller)	FLOAT32
6109	0x2168.11	Resulting upper limit value active current (closed loop controller)	FLOAT32
6112	0x2168.14	Resulting upper limit value total current (closed loop controller)	FLOAT32
124321	0x2182.0F	Inertia Gear	FLOAT32
124322	0x217F.0A	Inertia coupling	FLOAT32
124323	0x217E.0B	Dynamic losses	FLOAT32

Tab. 488 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	FloatingPoint
856	11218.0	Limit value total current (closed loop controller)	FloatingPoint
2218	11414.0	Minimum torque	FloatingPoint
2219	11415.0	Maximum torque	FloatingPoint

Parameter	PNU	Name	Data type
6104	11644.0	Resulting lower limit value torque (closed loop controller)	FloatingPoint
6105	11645.0	Resulting upper limit value torque (closed loop controller)	FloatingPoint
6108	11648.0	Resulting lower limit value active current (closed loop controller)	FloatingPoint
6109	11649.0	Resulting upper limit value active current (closed loop controller)	FloatingPoint
6112	11652.0	Resulting upper limit value total current (closed loop controller)	FloatingPoint
124321	12448.0	Inertia Gear	FloatingPoint
124322	12449.0	Inertia coupling	FloatingPoint
124323	12450.0	Dynamic losses	FloatingPoint

Tab. 489 PNUs

6.3 Pilot control (Setpoint value control)

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 timely diversions of the set values
– a constant value (offset)

This ensures that the positioning behaviour of the drive is greatly improved, e. g. a reduction of the contouring error or improved run-in behaviour 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 respective added value can additionally be influenced by a weighting factor (gain).
– Each mathematical operation with the input variables v (velocity) and a (acceleration) has a deceleration member of the first order connected in series. An inactive time member 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 individual operating modes of the cascade controller. The pilot control also acts in the interpolating operating modes via a fieldbus.

Input variable	Output variable	Pilot control	Operating mode[1]		
			P	V	T
v	v	Velocity (default)	•	–	–

Input variable	**Output variable**	**Pilot control**	**Operating mode**[1]		
			P	V	T
a	M	Torque (inertia)	•	•	–
v	M	Torque (friction)	•	•	–
–	M	Torque (constant value)	•	•	•

1) P = positioning mode, V = velocity mode, T = torque mode

Tab. 490 Pilot control

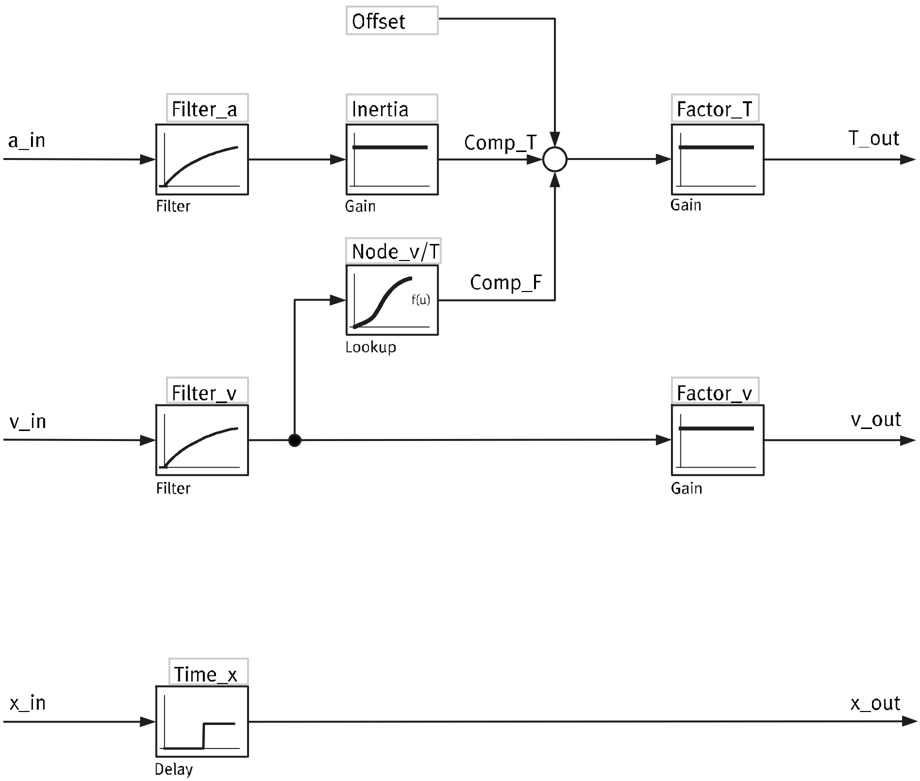

Fig. 87 Pilot control

Name	Description	ID Px.
x_in, v_in, a_in	Setpoint values position, velocity and acceleration as input variables of the pilot control	
	Setpoint management output position	290
	Setpoint management output velocity	291
	Setpoint management output acceleration	292
x_out, v_out, T_out	Setpoint values for the cascade controller	
	Setpoint value position	90
	Setpoint value velocity	91
	Setpoint value 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. 491 Legend for the block diagram of pilot control

Certain parameters of the pilot control are not entered in user units, but in Nm or rad/s and their respective diversions, for example. The conversion of the user unit to rad/s is carried automatically 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).

Parameter

ID Px.	Parameter	Description	
90	Setpoint value 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 value 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 value 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 value 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 value torque	Torque output from feed forward control as setpoint value for the closed-loop controller	
		Access	read/–
		Update	effective immediately
		Unit	Nm
95	Feed forward control current output	Current output from feed forward control	
		Access	read/–
		Update	effective immediately
		Unit	Arms

ID Px.	Parameter	Description	
957	Inactive time position setpoint value	Indicates 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

ID Px.	Parameter	Description	
973	Total inertia	Update	effective immediately
		Unit	kgm^2
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
		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. 492 Parameter

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, also the respective inertia is 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 performed 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 ouput variables for the velocity and torque control can be weighted via separate factors.

Example for inertia compensation

With the inertia compensation a torque can be pilot controlled in dependence of the total inertia in the drive system. The torque is composed of the total inertia multiplied by the set value velocity.

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 data sheet ELGR axis:

Mass moment of inertia		
Size		55
J_O	[kg mm²]	360
J_H per meter stroke	[kg mm²/m]	1.88
J_L per kg payload	[kg mm²/kg]	205.21
J_W for additional slide	[kg mm²]	301.92

Tab. 493 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 work stroke [m] $+ J_L * m_{payload}$ [kg]
K = Number of the additional slides

Excerpt of data sheet EMMS-ST motor:

Technical data			
Size			57-M
Motor			
...			
Total output inertia moment			
	Without brake	[kgcm²]	0.48

Technical data		
Size		57-M
With brake	[kgcm²]	0.50
…		

Tab. 494 Technical data of the EMMS-ST motor

Calculation of total inertia Px.973:

$J_{Total} = J_{ELGR} + J_{EMMS\text{-}ST} * i^2 = 3.6\ kgcm^2 + 0{,}0188\ kgcm^2 / m * 1\ m + 2.0521\ kgcm^2 / kg * 5\ kg + 0.5\ kgcm^2 * 3^2 = 18.3793\ kgcm^2 = 0.00183793\ kgm^2$

(i = gear ratio)

Calculation of torque:

$M = J_{total} * \alpha$

(α = angular acceleration)

Example for friction compensation

There is the option of pilot controlling 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 in dependence of 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_{Stick} = 0.2 Nm
- Velocity-dependent friction M_v = 0.005 Nm * s/rad

Calculation of torque:

$M = M_{stick} + M_v * \omega$

(ω = angular velocity)

Support point	Velocity [rad/s]	Support 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

Support point	Velocity [rad/s]	Support 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. 495 Look-up table

Parameter	Value
P1.978.0.0	15

Tab. 496 Number of support points

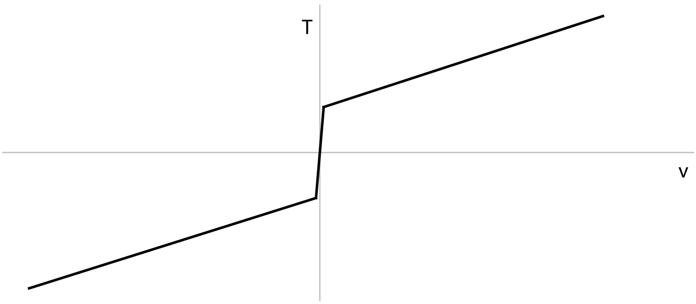

Fig. 88 Representation of look-up table

6.3.3 CiA 402

Pilot control objects

Parameters	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
90	0x6062.00	Setpoint value position	SINT32
91	0x606B.00	Setpoint value velocity	SINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
90	0x2154.01	Setpoint value position	SINT64
91	0x2154.02	Setpoint value velocity	FLOAT32

Parameters	Index.Subindex	Name	Data type
92	0x2154.03	Setpoint value acceleration	FLOAT32
93	0x2154.04	Setpoint value jerk	FLOAT32
94	0x2154.05	Setpoint value torque	FLOAT32
95	0x2154.06	Feed forward control current output	FLOAT32
957	0x2154.07	Inactive time position setpoint value	UINT32
958	0x2154.08	Time constant velocity setpoint value filter	FLOAT32
959	0x2154.09	Time constant acceleration setpoint value filter	FLOAT32
967	0x2154.0A	Amplification gain velocity feed forward control	FLOAT32
968	0x2154.0B	Amplification gain torque feed forward control	FLOAT32
969	0x2154.0C	Offset torque	FLOAT32
973	0x2154.0D	Total inertia	FLOAT32
974	0x2154.0E	Setpoint value friction compensation	FLOAT32
975	0x2154.0F	Setpoint value inertia compensation	FLOAT32
976	0x2225.01 ... 10	Support point velocity [rad/s]	FLOAT32
977	0x2226.01 ... 10	Support point torque [Nm]	FLOAT32
978	0x2154.10	Number of support points	UINT32

Tab. 497 Objects

6.3.4 PROFIdrive

Pilot control PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
90	11045.0	Setpoint value position	Integer64
91	11046.0	Setpoint value velocity	FloatingPoint
92	11047.0	Setpoint value acceleration	FloatingPoint
93	11048.0	Setpoint value jerk	FloatingPoint
94	11049.0	Setpoint value torque	FloatingPoint
95	11050.0	Feed forward control current output	FloatingPoint
957	11246.0	Inactive time position setpoint value	Unsigned32
958	11247.0	Time constant velocity setpoint value filter	FloatingPoint

Parameters	PNU	Name	Data type
959	11248.0	Time constant acceleration setpoint value filter	FloatingPoint
967	11249.0	Amplification gain velocity feed forward control	FloatingPoint
968	11250.0	Amplification gain torque feed forward control	FloatingPoint
969	11251.0	Offset torque	FloatingPoint
973	11252.0	Total inertia	FloatingPoint
974	11253.0	Setpoint value friction compensation	FloatingPoint
975	11254.0	Setpoint value inertia compensation	FloatingPoint
976	11255.0 ... 15	Support point velocity [rad/s]	FloatingPoint
977	11256.0 ... 15	Support point torque [Nm]	FloatingPoint
978	11257.0	Number of support points	Unsigned32

Tab. 498 PNUs

6.4 Notch Filter

6.4.1 Function

Internal notch filters are provided to suppress oscillations. Notch filters can be used to filter out interfering frequencies from the active current calculated from the control loop. The notch filters are wired in series. The number of implemented notch filters is device-specific. The notch filters are arranged before the input of the current regulator and filter the complete setpoint signal including the pilot control values. The characteristics of the filter can be parameterised and are determined by the filter frequency and filter band width.

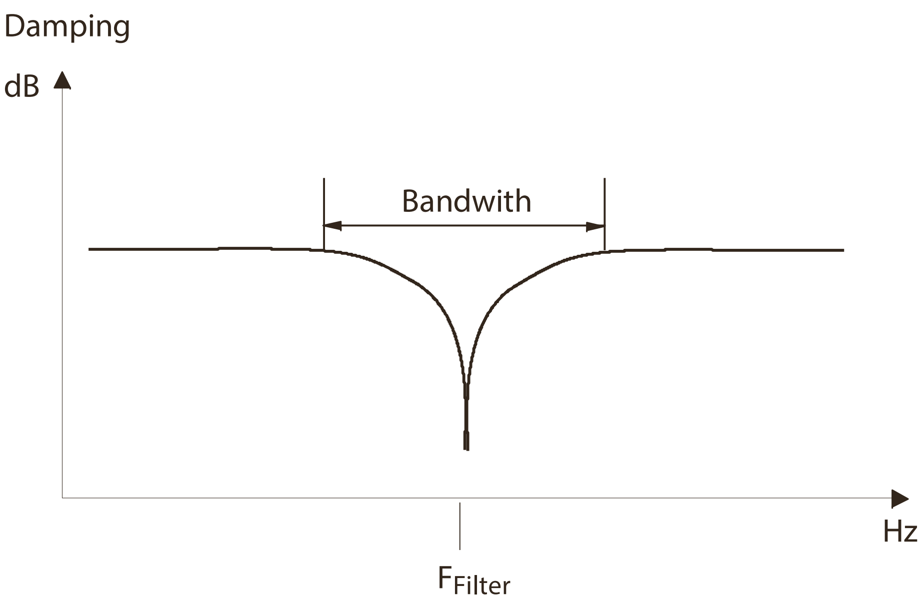

Fig. 89 Filter band width and filter frequency

Name	Description	ID Px.
Band with	Band width of notch filter	49
Damping	Cushioning	–
F_{Filter}	Filter frequency notch filter	40

Tab. 499 Legend for the Filter Band Width and Filter Frequency Diagram

Parameters and Diagnostic Messages

Parameter allocation:

- Index 0: notch filter 1
- Index 1: notch filter 2
- Index 2: notch 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

ID Px.	Parameter	Description	
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	
		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. 500 Parameter

ID Dx.	Name	Description
06 l 00 l 00082 (100663378)	Notch filter frequency invalid	The parameterisation of the notch filter frequency is invalid

Tab. 501 Diagnostic Messages

6.4.2 CiA 402

Notch filter objects

Parameters	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	FLOAT32
49	0x2222.01 ... 03	Band width of notch filter	FLOAT32
50	0x2223.01 ... 03	Notch filter output active current	FLOAT32

Parameters	Index.Subindex	Name	Data type
51	0x2224.01 … 03	Activation of notch filter	BOOL
52	0x2152.06	Setpoint value active current unfiltered	FLOAT32

Tab. 502 Objects

6.4.3 PROFIdrive

Notch filter PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
40	11022.0 … 2	Filter frequency notch filter	FloatingPoint
49	11031.0 … 2	Band width of notch filter	FloatingPoint
50	11032.0 … 2	Notch filter output active current	FloatingPoint
51	11033.0 … 2	Activation of notch filter	Boolean
52	11034.0	Setpoint value active current unfiltered	FloatingPoint

Tab. 503 PNUs

6.5 Auto-tuning

6.5.1 Function

Auto tuning can be used to determine the control parameters for position and velocity controllers. The basis for this is a current regulator that has already been designed and suitable start parameters for position controllers and velocity controllers, as well as the amplitude of the excitation signal. The start parameters are determined automatically on the basis of 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.

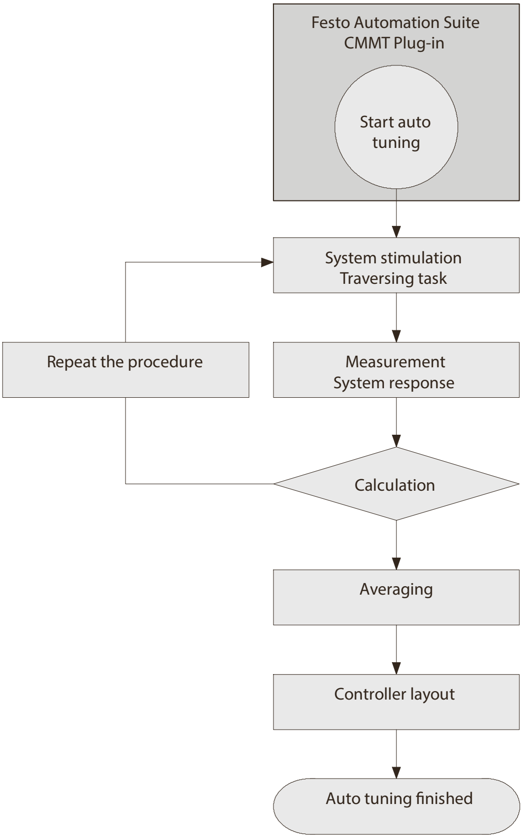

Fig. 90

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 controller start values:

- Start value position controller amplification gain
- Start value velocity controller amplification gain
- Start value velocity controller integration constant
- Filter time constant velocity controller

Mean value calculation:

– Number of identifications for averaging

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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 velocity during the identification
– Maximum acceleration during the identification
– Maximum deceleration during the identification
– Maximum jerk during the identification

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Recommendation: For drives with high friction (e. g. plain-bearing guide) activate parameter "Move drive ...".

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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 amplification gain of position controller	Specifies the results of auto tuning for the amplification gain in the position controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
8602	Result integration constant of velocity controller	Specifies the result of auto tuning for the integration constant of the velocity controller.	
		Access	read/write
		Update	effective immediately
		Unit	–
8603	Result amplification gain of velocity controller	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

ID Px.	Parameter	Description	
8611	Start value position controller amplifica-tion gain	Unit	–
8612	Start value velocity controller amplifica-tion 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 con-stant 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	Amplification gain noise signal generator	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	–

ID Px.	Parameter	Description	
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	–
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

ID Px.	Parameter	Description	
8625	Maximum jerk during the identification	Specifies the maximum jerk during the identification.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 504 Parameter

ID Dx.	Name	Description
13 l 02 l 00217 218235097	Auto tuning aborted	Auto tuning aborted
13 l 02 l 00218 218235098	Auto tuning movement insufficient or synchronous phase too short	Auto tuning movement insufficient
13 l 02 l 00219 218235099	Auto tuning controller parameters invalid	The Auto tuning function could not identify any controller parameters
13 l 02 l 00220 (218235100)	Transmission of auto tuning measured values failed	Transmission of auto tuning measured values failed

Tab. 505 Diagnostic messages

6.5.1.1 CiA 402

Objects Auto Tuning

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	UINT8
8601	0x2173.02	Result amplification gain of position controller	FLOAT32
8602	0x2173.03	Result integration constant of velocity controller	FLOAT32
8603	0x2173.04	Result amplification gain of velocity controller	FLOAT32
8611	0x2174.01	Start value position controller amplification gain	FLOAT32
8612	0x2174.02	Start value velocity controller amplification gain	FLOAT32
8613	0x2174.03	Start value velocity controller integration constant	FLOAT32
8614	0x2174.04	Filter time constant velocity controller	FLOAT32

Parameter	Index.Subindex	Name	Data type
8615	0x2171.01	Filter time constant noise signal generator	FLOAT32
8616	0x2171.02	Amplification gain noise signal generator	FLOAT32
8617	0x2171.03	Signal selection noise signal generator	UINT8
8618	0x2174.05	Time delay noise signal for the start identification	FLOAT32
8619	0x2174.06	Identification with movement	BOOL
8620	0x2174.07	Number of identifications for averaging	UINT8
8621	0x2174.08	Maximum movement stroke during the identification	SINT64
8622	0x2174.09	Maximum velocity during the identification	FLOAT32
8623	0x2174.0A	Maximum acceleration during the identification	FLOAT32
8624	0x2174.0B	Maximum deceleration during the identification	FLOAT32
8625	0x2174.0C	Maximum jerk during the identification	FLOAT32

Tab. 506 Objects

6.5.1.2 PROFIdrive

Auto-tuning PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
860	11219.0	Status auto tuning	Unsigned8
8601	11748.0	Result amplification gain of position controller	FloatingPoint
8602	11749.0	Result integration constant of velocity controller	FloatingPoint
8603	11750.0	Result amplification gain of velocity controller	FloatingPoint
8611	11753.0	Start value position controller amplification gain	FloatingPoint
8612	11754.0	Start value velocity controller amplification gain	FloatingPoint
8613	11755.0	Start value velocity controller integration constant	FloatingPoint
8614	11756.0	Filter time constant velocity controller	FloatingPoint
8615	11757.0	Filter time constant noise signal generator	FloatingPoint

Parameter	PNU	Name	Data type
8616	11758.0	Amplification gain noise signal generator	FloatingPoint
8617	11759.0	Signal selection noise signal generator	Unsigned8
8618	11760.0	Time delay noise signal for the start identification	FloatingPoint
8619	11761.0	Identification with movement	Boolean
8620	11762.0	Number of identifications for averaging	Unsigned8
8621	11763.0	Maximum movement stroke during the identification	Integer64
8622	11764.0	Maximum velocity during the identification	FloatingPoint
8623	11765.0	Maximum acceleration during the identification	FloatingPoint
8624	11766.0	Maximum deceleration during the identification	FloatingPoint
8625	11767.0	Maximum jerk during the identification	FloatingPoint

Tab. 507 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 tuning. With the execution of the test run the drive is moved in the specified stroke range according to the number of validation movements (simple stroke path).

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A test run can no longer be performed after the parameters have been taken over.

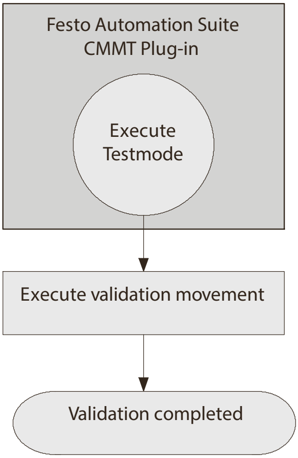

Fig. 91

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 movements
- Movement stroke during validation movement
- Maximum velocity during validation movement
- Maximum acceleration during validation movement
- Maximum deceleration during validation movement
- Maximum jerk during validation movement

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The parameters resulting from auto tuning can be changed manually, and an optional test run can be started with them.

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.	
		Access	read/write
		Update	effective immediately
		Unit	–
8631	Movement stroke during validation movement	Specifies the 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.	
		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. 508 Parameter

ID Dx.	Name	Description
13 I 02 I 00220 (218235100)	Transmission of auto tuning measured values failed	Transmission of auto tuning measured values failed

Tab. 509 Diagnostic messages

6.5.2.1 CiA 402

Test run objects

Parameters	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	UINT8
8631	0x2174.0E	Movement stroke during validation movement	SINT64
8632	0x2174.0F	Maximum velocity during validation movement	FLOAT32
8633	0x2174.10	Maximum acceleration during validation movement	FLOAT32
8634	0x2174.11	Maximum deceleration during validation movement	FLOAT32
8635	0x2174.12	Maximum jerk during validation movement	FLOAT32

Tab. 510 Objects

6.5.2.2 PROFIdrive

Test run PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
8630	11768.0	Number of validation movements	Unsigned8
8631	11769.0	Movement stroke during validation movement	Integer64
8632	11770.0	Maximum velocity during validation movement	FloatingPoint
8633	11771.0	Maximum acceleration during validation movement	FloatingPoint
8634	11772.0	Maximum deceleration during validation movement	FloatingPoint
8635	11773.0	Maximum jerk during validation movement	FloatingPoint

Tab. 511 PNUs

7 Technology functions

7.1 Cam controller (position trigger)

7.1.1 Function

When parameterised positions (x1, x2) are reached, the cam controller function generates trigger signals at the trigger output (TRG). The position switch and rotor position switch, for example, can be simulated using this function.
The cam controller can be activated using the record table ➔ 4.5 Task for record selection. This activation applies the parameterised values (Px.112700 … Px.112712) as currently valid parameters (Px.112713 … Px.112725).
Example: the value of parameter Px.112700 (Cam controller mode) is applied as the value for parameter Px.112713 (current cam controller mode).
The desired trigger output must be parameterised for the function (parameters Px.11303 and Px.11304). The source (Source ...) of the positions can be selected (e.g. primary encoder). The positions (x1, x2) can be freely defined within the modulo limits (+Mod, –Mod).
Using the index of the pertinent parameters, several switching points per trigger output can be configured within the modulo range. Various modes are available for the function (➔ Tab. 515 Possible modes of the cam controller function). The switching duration (t1, t2) of the trigger output, for example, can be parameterised or depend on the defined switching limit values (x1, x2).

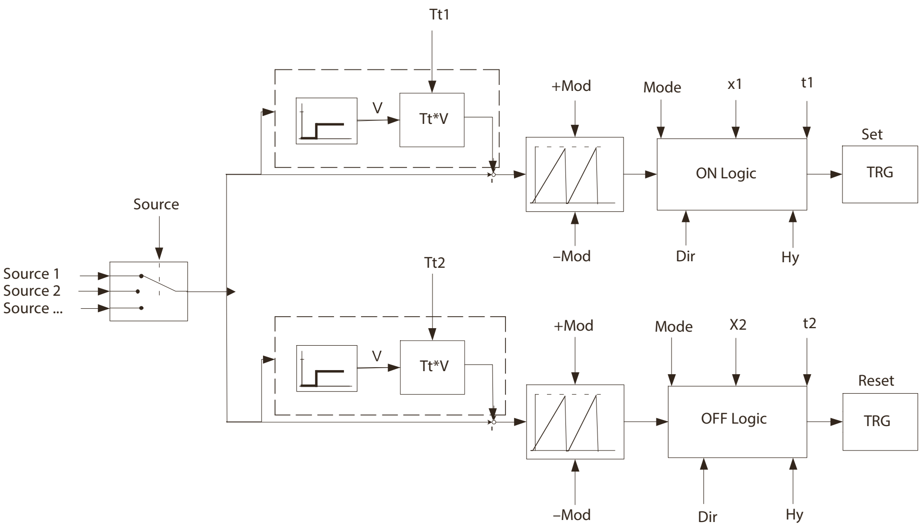

Fig. 92 Block diagram of the cam controller

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: Cam controller 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	Cam controller 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. 512 Legend for the block diagram of the cam controller

Timing

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.

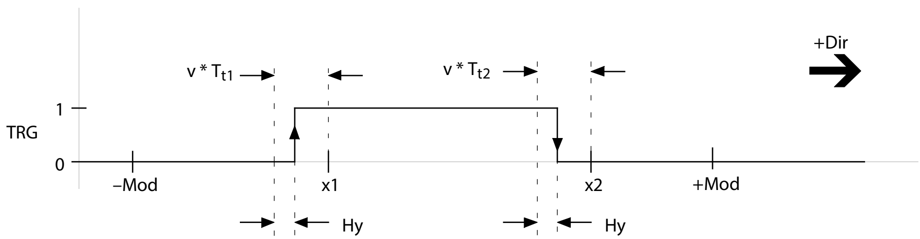

Fig. 93 Timing diagram: hysteresis (example: positive direction)

Signal curve depending on the switching function, delay compensation and hysteresis in "Automatic" mode (6) – examples

a) Positive direction

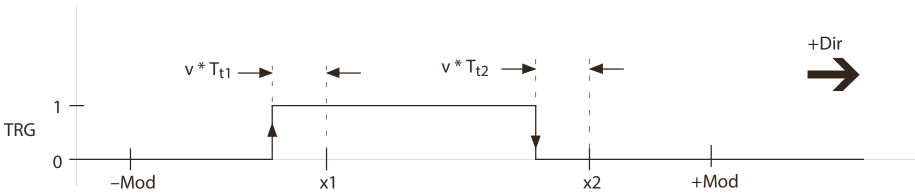

Fig. 94 Timing diagram: positive direction

b) Negative direction

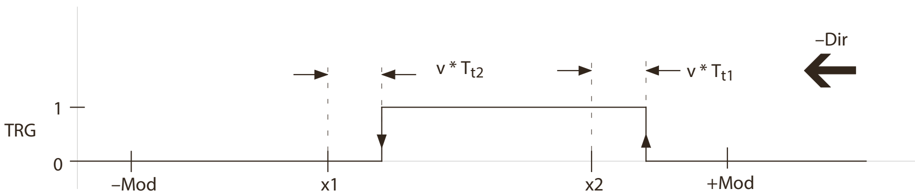

Fig. 95 Timing diagram: negative direction

c) Negative/positive direction

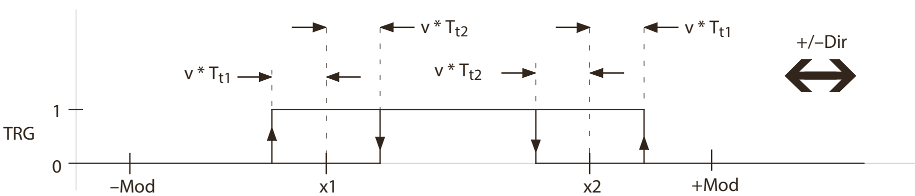

Fig. 96 Timing diagram: negative/positive direction

Signal curve depending on switching function, delay compensation and hysteresis in automatic mode (6) with the switching characteristic time-controlled On (2), example - 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.

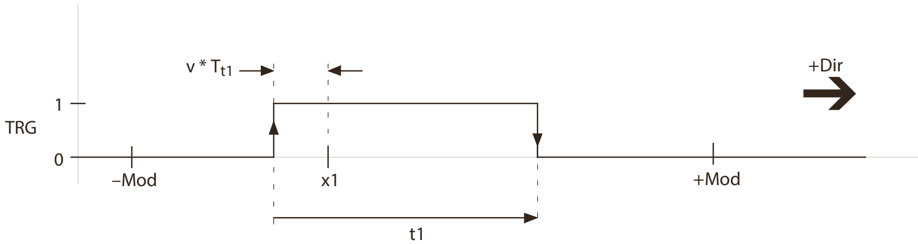

Fig. 97 Timing diagram: mode 4 (switch-on time) - example: positive direction

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 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. 513 Legend for the figures above

Parameters and diagnostic messages
The number of available cam controllers depends on the product design. Each cam controller is organized in its own instance.

– Instance 0: parameters for cam controller 0
– Instance 1: parameters for cam controller 1
– ...

Depending on the device design, several cam switches can be parameterised within a cam controller. The parameterisation of the cam switches of a cam controller is not tested for overlapping or contradictory switching functions. Overlapping or contradictory switching points are ignored.

ID Px.	Parameter	Description	
112700	Cam controller mode	Determines the mode of the cam controller function. For detailed information ➔ Tab. 515 Possible modes of the cam controller function.	
		Access	read/write
		Update	effective immediately
		Unit	–
112701	Cam controller source	Determines the source of the measured values. This means: 0: primary encoder 1: secondary encoder (device-specific) 2: set position	
		Access	read/write
		Update	effective immediately
		Unit	–
112702	Upper limit value modulo	Determines 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	Determines 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	Determines 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

ID Px.	Parameter	Description	
112705	Inactive time compensation of second switching point	Determines 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
		Update	effective immediately
		Unit	user defined
112707	Switching time (manual)	Determines the switching time for time-based manual switching (mode 4/5).	
		Access	read/write
		Update	effective immediately
		Unit	s
112708	Selection of switching function	Determines the direction of movement at which the cam switch shall activate. – 0: Negative/positive direction – 1: Positive direction – 2: Negative direction Depending on the product design, several cams can be parameterised within the defined modulo range. Index 0: cam switch 1 Index 1: cam switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/write
		Update	effective immediately
		Unit	–
112709	Selection of switching characteristics	Determines the switching behaviour of the cam 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.	

<table>
<tr><th>ID Px.</th><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">112709</td><td rowspan="4">Selection of switching characteristics</td><td colspan="2">– 0: Inactive
– 1: Cam switch On/Off
– 2: Cam switch ON, time-controlled
– 3: Cam switch OFF, time-controlled
Depending on the product design, several cams can be parameterised within the defined modulo range.
Index 0: cam switch 1
Index 1: cam switch 2
Index 2: (depending on the product design)
Index 3: ...</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>–</td></tr>
<tr><td rowspan="4">112710</td><td rowspan="4">First switching point</td><td colspan="2">Defines the first switching point at which the cam switch should be active.
Index 0: cam switch 1
Index 1: cam switch 2
Index 2: (depending on the product design)
Index 3: ...</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>user defined</td></tr>
<tr><td rowspan="4">112711</td><td rowspan="4">Second switching point</td><td colspan="2">Defines the second switching point at which the cam switch should be active.
Index 0: cam switch 1
Index 1: cam switch 2
Index 2: (depending on the product design)
Index 3: ...</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>user defined</td></tr>
<tr><td>112712</td><td>Switching time (automatic)</td><td colspan="2">Specifies the time for which the cam is active. Slide specified time refers to the switching point X1, independent of the direction of movement.
The switching time always refers to the switching point x1, independent of the direction of movement.
Index 0: cam switch 1
Index 1: cam switch 2</td></tr>
</table>

ID Px.	Parameter	Description	
112712	Switching time (automatic)	Index 2: (depending on the product design) Index 3: ...	
		Access	read/write
		Update	effective immediately
		Unit	s
112713	Current cam controller mode	Specifies the current mode of the cam controller function.	
		Access	read/–
		Update	effective immediately
		Unit	–
112714	Current cam controller source	Specifies the current source of the position values of the cam controller. This means: – 0: primary encoder (commutation encoder) – 1: secondary encoder – 2: ... (depending on the product design)	
		Access	read/–
		Update	effective immediately
		Unit	–
112715	Current upper limit value modulo	Specifies the currently determined upper limit value for the modulo calculation.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112716	Current lower limit value modulo	Specifies the currently determined lower limit value for the modulo calculation.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112717	Current inactive time first switching point	Specifies the current delay compensation of the first switching point for the switch-on process.	
		Access	read/–
		Update	effective immediately
		Unit	s

ID Px.	Parameter	Description	
112718	Current inactive time second switching point	Specifies the current delay compensation of the second switching point for the switch-on process.	
		Access	read/–
		Update	effective immediately
		Unit	s
112719	Current hysteresis	Specifies the current hysteresis. In the hysteresis range, switching procedures are suppressed around the switching point during fluctuations.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112720	Current switching time (manual)	Specifies the current switch-on time for mode 4.	
		Access	read/–
		Update	effective immediately
		Unit	s
112721	Current selection of switching function	Specifies the current direction of movement at which the cam switch activates. – 0: Negative/positive direction – 1: Positive direction – 2: Negative direction Index 0: cam switch 1 Index 1: cam switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/–
		Update	effective immediately
		Unit	–
112722	Current selection of switching characteristics	Specifies the current switching behaviour of the cam switch. This means: – 0: Inactive – 1: Cam switch On/Off – 2: Cam switch ON, time-controlled – 3: Cam switch OFF, time-controlled Index 0: cam switch 1 Index 1: cam switch 2 Index 2: (depending on the product design)	

ID Px.	Parameter	Description	
112722	Current selection of switching characteristics	Index 3: ...	
		Access	read/–
		Update	effective immediately
		Unit	––
112723	Current first switching point	Specifies the current first switching point at which the cam switch is inactive. Index 0: cam switch 1 Index 1: cam switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112724	Current second switching point	Specifies the current second switching point at which the cam switch is inactive. Index 0: cam switch 1 Index 1: cam switch 2 Index 2: (depending on the product design) Index 3: ...	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112725	Current switching time (automatic)	Specifies the current switching time for time-based switching. Index 0: cam switch 1 Index 1: cam 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 current runtime-compensated module position for the logic (On).	
		Access	read/–
		Update	effective immediately
		Unit	user defined

ID Px.	Parameter	Description	
112727	Modulo position for the logic (OFF)	Specifies the current runtime-compensated module position for the logic (Off).	
		Access	read/–
		Update	effective immediately
		Unit	user defined
112728	Cam 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 cam switch	Specifies which cam switch is active.	
		Access	read/–
		Update	effective immediately
		Unit	–
112731	Counter NO modulo cycles	Specifies how often the modulo limits have been not exceeded.	
		Access	–/–
		Update	effective immediately
		Unit	–
112732	Offset modulo position	Offset of the modulo position	
		Access	read/write
		Update	effective immediately
		Unit	user defined
112733	Initialisation of modulo	Default value for the reference position	
		Access	read/write
		Update	effective immediately
		Unit	user defined

ID Px.	Parameter	Description	
112734	Current offset modulo position	Specifies the currently 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	Current modulo hysteresis	Specifies the currently used hysteresis for the modulo position for secure detection during a modulo run.	
		Access	read/–
		Update	effective immediately
		Unit	user defined

Tab. 514 Parameter

Cam controller parameter mode (Px.112700)		
Value	Meaning	Description
0	Inactive	The cam controller function is inactive
1	ON (manual)	The trigger output is activated when the cam controller function is activated. The trigger output can therefore be activated manually for test purposes.
2	OFF (manual)	The trigger output is activated when the cam controller function is deactivated. The trigger output can therefore be deactivated manually for test purposes.
3	Force last status	The status present at the current point in time remains permanently.
4	Switch-on time (manual)	Activation for the duration of the parameterised switching time (Px.112707).

Cam controller parameter mode (Px.112700)		
Value	Meaning	Description
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 cams.
7	Set modulo position	Sets the modulo position to the value saved in the Px.112733 parameter.

Tab. 515 Possible modes of the cam controller function

Diagnostic messages

No specific diagnostic messages are allocated to the function.

7.1.2 CiA 402

Cam controller objects

Parameter	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
112700	0x2192.01	Cam controller mode	UINT16
112701	0x2192.03	Cam controller source	UINT16
112702	0x2192.05	Upper limit value modulo	SINT64
112703	0x2192.07	Lower limit value modulo	SINT64
112704	0x2192.09	Inactive time compensation of first switching point	FLOAT32
112705	0x2192.0B	Inactive time compensation of second switching point	FLOAT32
112706	0x2192.0D	Hysteresis	SINT64
112707	0x2192.0F	Switching time (manual)	FLOAT32
112708	0x226F.01 ... 04	Selection of switching function	UINT16
112709	0x2270.01 ... 04	Selection of switching characteristics	UINT16
112710	0x2271.01 ... 04	First switching point	SINT64
112711	0x2272.01 ... 04	Second switching point	SINT64
112712	0x2273.01 ... 04	Switching time (automatic)	FLOAT32
112713	0x2192.11	Current cam controller mode	UINT16
112714	0x2192.13	Current cam controller source	UINT16

Parameter	Index.Subindex	Name	Data type
112715	0x2192.15	Current upper limit value modulo	SINT64
112716	0x2192.17	Current lower limit value modulo	SINT64
112717	0x2192.19	Current inactive time first switching point	FLOAT32
112718	0x2192.1B	Current inactive time second switching point	FLOAT32
112719	0x2192.1D	Current hysteresis	SINT64
112720	0x2192.1F	Current switching time (manual)	FLOAT32
112721	0x2274.01 ... 04	Current selection of switching function	UINT16
112722	0x2275.01 ... 04	Current selection of switching characteristics	UINT16
112723	0x2276.01 ... 04	Current first switching point	SINT64
112724	0x2277.01 ... 04	Current second switching point	SINT64
112725	0x2278.01 ... 04	Current switching time (automatic)	FLOAT32
112726	0x2192.21	Modulo position for the logic (ON)	SINT64
112727	0x2192.23	Modulo position for the logic (OFF)	SINT64
112728	0x2192.25	Cam switch status ON/OFF	BOOL
112729	0x2192.27	Status modulo limit reached	BOOL
112730	0x2192.29	Status active cam switch	UINT8
112732	0x2192.2D	Offset modulo position	SINT64
112733	0x2192.2F	Initialisation of modulo	SINT64
112734	0x2192.31	Current offset modulo position	SINT64
112735	0x2192.33	Counter modulo cycles	UINT32
112736	0x2192.35	Modulo hysteresis	SINT64
112737	0x2192.37	Current modulo hysteresis	SINT64

Tab. 516 Objects

7.1.3 PROFIdrive

Cam controller PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
112700	11960.0	Cam controller mode	Unsigned16
112701	11962.0	Cam controller source	Unsigned16
112702	11964.0	Upper limit value modulo	Integer64
112703	11966.0	Lower limit value modulo	Integer64

Parameter	PNU	Name	Data type
112704	11968.0	Inactive time compensation of first switching point	FloatingPoint
112705	11970.0	Inactive time compensation of second switching point	FloatingPoint
112706	11972.0	Hysteresis	Integer64
112707	11974.0	Switching time (manual)	FloatingPoint
112708	11976.0 … 3	Selection of switching function	Unsigned16
112709	11978.0 … 3	Selection of switching characteristics	Unsigned16
112710	11980.0 … 3	First switching point	Integer64
112711	11982.0 … 3	Second switching point	Integer64
112712	11984.0 … 3	Switching time (automatic)	FloatingPoint
112713	11986.0	Current cam controller mode	Unsigned16
112714	11988.0	Current cam controller source	Unsigned16
112715	11990.0	Current upper limit value modulo	Integer64
112716	11992.0	Current lower limit value modulo	Integer64
112717	11994.0	Current inactive time first switching point	FloatingPoint
112718	11996.0	Current inactive time second switching point	FloatingPoint
112719	11998.0	Current hysteresis	Integer64
112720	12000.0	Current switching time (manual)	FloatingPoint
112721	12002.0 … 3	Current selection of switching function	Unsigned16
112722	12004.0 … 3	Current selection of switching characteristics	Unsigned16
112723	12006.0 … 3	Current first switching point	Integer64
112724	12008.0 … 3	Current second switching point	Integer64
112725	12010.0 … 3	Current switching time (automatic)	FloatingPoint
112726	12012.0	Modulo position for the logic (ON)	Integer64
112727	12014.0	Modulo position for the logic (OFF)	Integer64
112728	12016.0	Cam switch status ON/OFF	Boolean
112729	12018.0	Status modulo limit reached	Boolean
112730	12020.0	Status active cam switch	Unsigned8
112732	12024.0	Offset modulo position	Integer64
112733	12026.0	Initialisation of modulo	Integer64
112734	12028.0	Current offset modulo position	Integer64

Parameter	PNU	Name	Data type
112735	12030.0	Counter modulo cycles	Unsigned32
112736	12032.0	Modulo hysteresis	Integer64
112737	12034.0	Current modulo hysteresis	Integer64

Tab. 517 PNUs

7.2 Position detection (touch probe)

7.2.1 Function

The device enables the exact detection of current positions during the processing of commands. In the process, the position detection function is triggered by the trigger signals at a trigger input (CAP input). For this purpose, the corresponding input must be activated for the touch probe function. The signal edge of the trigger event is parameterisable (edge). The typical internal signal runtimes of the trigger signals are compensated by the firmware of the device. The positions can therefore be detected with high precision.
The source (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. 521 Possible modes of the touch probe function. The position detection can take place once or cyclically, for example. 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. 521 Possible modes of the touch probe function).

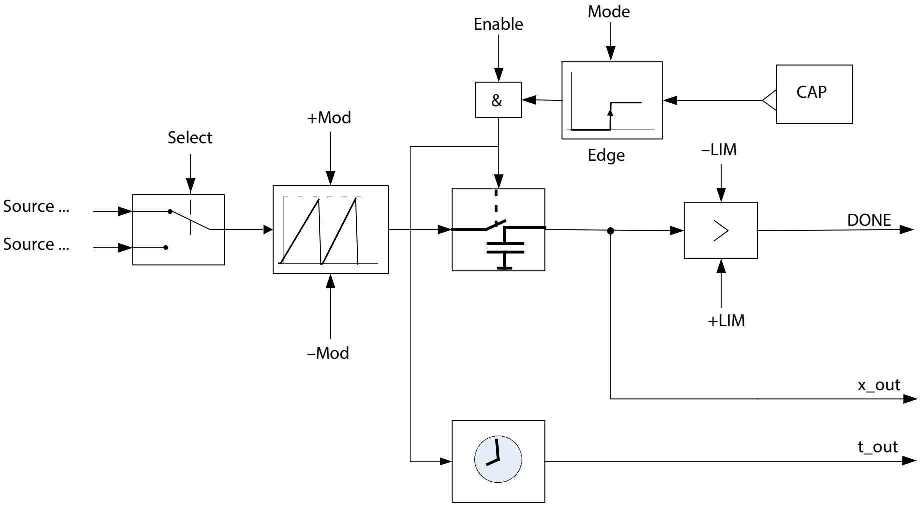

Fig. 98 Touch probe block diagram

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. 518 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 of the window are not accepted.

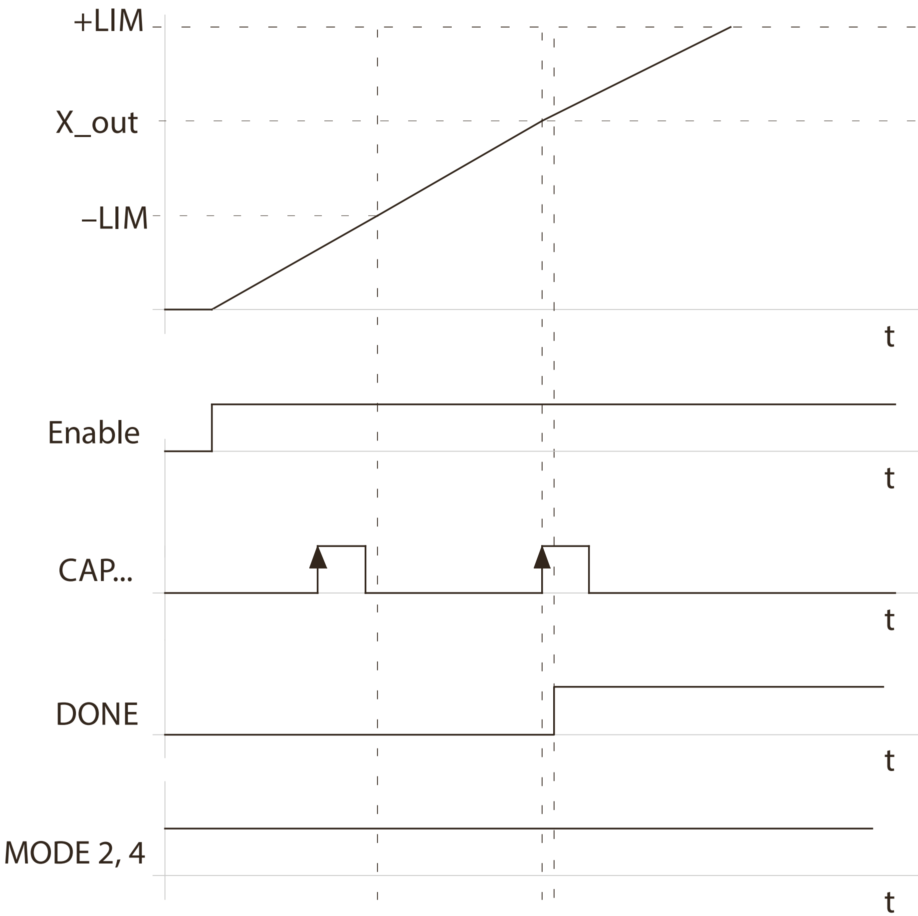

Fig. 99 Touch probe timing diagram (example of “Once with window” touch probe mode)

Name	Description	ID Px.
+LIM	Upper limit value trigger event	113006
–LIM	Lower limit value trigger event	113005
X_out	Touch probe position	113014

Name	Description	ID Px.
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, modus 2 or mode 4 (with window)	113000

Tab. 519 Legend for the touch probe timing (example) figure

Parameter

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. Through this activation, the parameterised values (Px.113000 through Px.113006) are assumed as currently value parameters (Px.113007 ... Px.113013).

<table>
<tr><th>ID Px.</th><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">113000</td><td rowspan="4">Touch probe mode</td><td colspan="2">Determines the mode of the touch probe function. The specified mode is effective on activation of the touch probe function.
For detailed information
➔ Tab. 521 Possible modes of the touch probe function.</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>–</td></tr>
<tr><td rowspan="4">113001</td><td rowspan="4">Touch probe source</td><td colspan="2">Determines the source of the measured values.
This means:
– 0: primary encoder
– 1: secondary encoder (device-specific)
– 2: ... (depending on the product design)</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>–</td></tr>
<tr><td>113002</td><td>Selection trigger event</td><td colspan="2">Determines 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</td></tr>
</table>

ID Px.	Parameter	Description	
113002	Selection trigger event	Access	read/write
		Update	effective immediately
		Unit	–
113003	Upper limit value modulo	Determines 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	Determines 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
113005	Lower limit value trigger event	Determines 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	Determines 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	Current touch probe mode	Specifies the current mode of the touch probe function. Possible modes ➔ Tab. 521 Possible modes of the touch probe function.	
		Access	read/–
		Update	effective immediately

ID Px.	Parameter	Description	
113007	Current touch probe mode	Unit	–
113008	Current touch probe source	Specifies the current 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	Current selection trig-ger event	Specifies the currently 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	Current upper limit value modulo	Specifies the currently determined upper limit value for the modulo calculation.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113011	Current lower limit value modulo	Specifies the currently determined lower limit value for the mod-ulo calculation.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113012	Current 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

ID Px.	Parameter	Description	
113013	Current 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/–
		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	Indicates 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	–

ID Px.	Parameter	Description	
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	–
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 of modulo	Default value for the reference position	
		Access	read/write
		Update	effective immediately
		Unit	user defined

ID Px.	Parameter	Description	
113026	Current offset modulo position	Specifies the currently 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 current 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 current 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	–

ID Px.	Parameter	Description	
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	
		Access	read/write
		Update	effective immediately
		Unit	user defined
113035	Current modulo hysteresis	Specifies the currently 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	Current delay time	Specifies the currently used delay time during which the digital input signal is delayed	
		Access	read/–
		Update	effective immediately
		Unit	s

Tab. 520 Parameter

Parameters of the touch probe mode (Px.113000 and Px.113007)		
Value	Mode	Description
0	Inactive	The position detection is inactive.

Parameters of the touch probe mode (Px.113000 and Px.113007)		
Value	Mode	Description
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	Preset position	Setting of the modulo position
8	Once (CiA 402)	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 (CiA 402)	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.

Tab. 521 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.100).

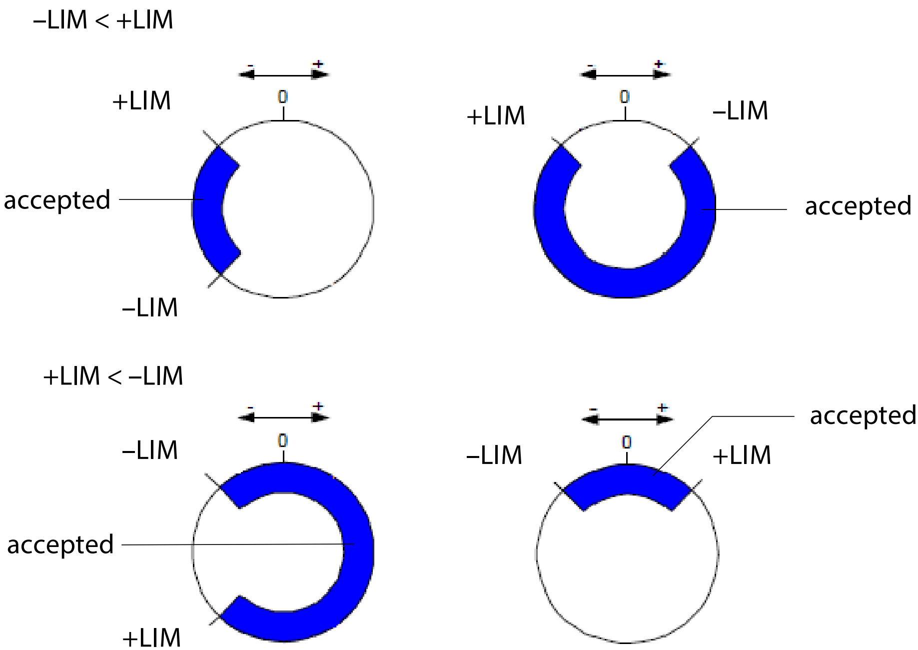

Fig. 100 Diagram of trigger ranges (example)

Name	Description	ID Px.
Accepted	Valid trigger range	–
–LIM	Lower limit value trigger event	113005
+LIM	Upper limit value trigger event	113006

Tab. 522 Legend for the diagram of trigger ranges (example)

Diagnostic messages

No specific diagnostic messages are allocated to the function.

7.2.2 CiA 402

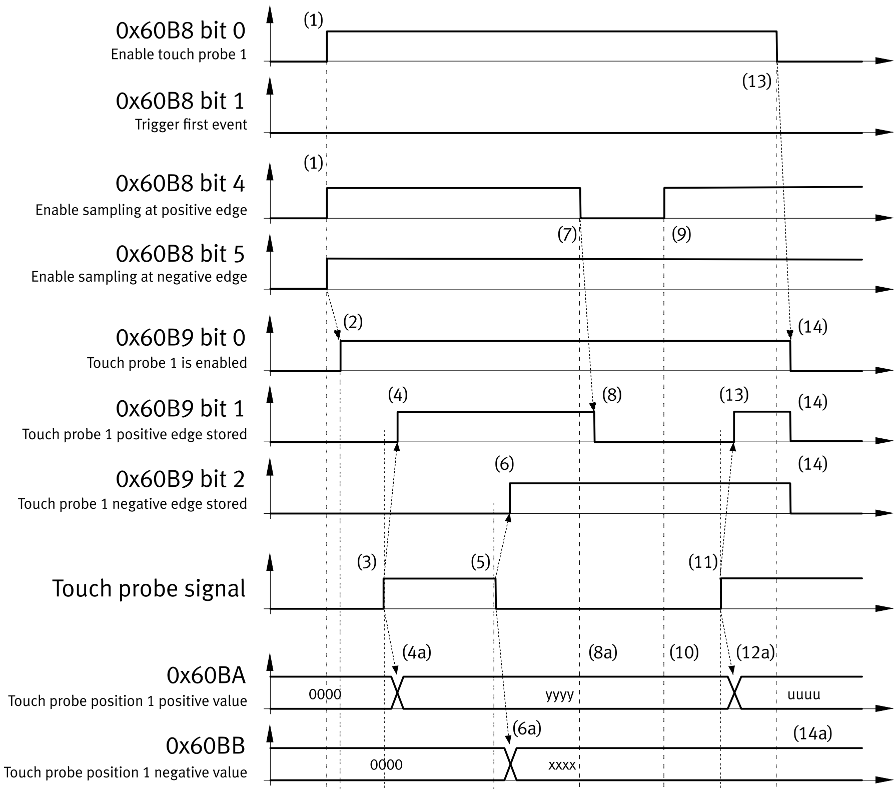

Fig. 101 Touch probe timing graph via CiA402

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	

No.	Touch probe behaviour	
(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. 523 Legend for touch probe timing graph via CiA402

For 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 the 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

Bit	Value	Description
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. 524 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. 525 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	UINT16

Parameter	Index.Subindex	Name	Data type
1128061	0x60B9.00	Touch probe status as per CiA402	UINT16
113027	0x60D1.00	Time stamp touch probe position positive CiA402	UINT32
113028	0x60D2.00	Time stamp touch probe position negative CiA402	UINT32
113029	0x60BA.00	Touch probe position positive CiA402	SINT32
113030	0x60BB.00	Touch probe position negative CiA402	SINT32
113031	0x60D5.00	Counter initiated trigger events positive edge CiA402	UINT16
113032	0x60D6.00	Counter initiated trigger events negative edge CiA402	UINT16
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
1128060	0x2195.06	Touch probe function CiA402	UINT16
1128061	0x2195.07	Touch probe status as per CiA402	UINT16
113000	0x2193.01	Touch probe mode	UINT16
113001	0x2193.03	Touch probe source	UINT16
113002	0x2193.05	Selection trigger event	UINT16
113003	0x2193.07	Upper limit value modulo	SINT64
113004	0x2193.09	Lower limit value modulo	SINT64
113005	0x2193.0B	Lower limit value trigger event	SINT64
113006	0x2193.0D	Upper limit value trigger event	SINT64
113007	0x2193.0F	Current touch probe mode	UINT16
113008	0x2193.11	Current touch probe source	UINT16
113009	0x2193.13	Current selection trigger event	UINT16
113010	0x2193.15	Current upper limit value modulo	SINT64
113011	0x2193.17	Current lower limit value modulo	SINT64
113012	0x2193.19	Current lower limit value trigger event	SINT64
113013	0x2193.1B	Current upper limit value trigger event	SINT64
113014	0x2193.1D	Touch probe position	SINT64
113015	0x2193.1F	Time stamp touch probe position	UINT64
113016	0x2193.21	Trigger event initiated	BOOL
113017	0x2193.23	Trigger event NOT initiated	BOOL

Parameter	Index.Subindex	Name	Data type
113018	0x2193.25	Trigger events counter triggered	UINT32
113019	0x2193.27	Trigger events counter NOT triggered	UINT32
113020	0x2193.29	Counter modulo cycles	UINT32
113021	0x2193.2B	Status touch probe input	BOOL
113022	0x2193.2D	Status modulo limit reached	BOOL
113023	0x2193.2F	Modulo position	SINT64
113024	0x2193.31	Offset modulo position	SINT64
113025	0x2193.33	Initialisation of modulo	SINT64
113026	0x2193.35	Current offset modulo position	SINT64
113027	0x2193.37	Time stamp touch probe position positive CiA402	UINT64
113028	0x2193.39	Time stamp touch probe position negative CiA402	UINT64
113029	0x2193.3B	Touch probe position positive CiA402	SINT64
113030	0x2193.3D	Touch probe position negative CiA402	SINT64
113031	0x2193.3F	Counter initiated trigger events positive edge CiA402	UINT32
113032	0x2193.41	Counter initiated trigger events negative edge CiA402	UINT32
113033	0x2193.43	Touch probe status CiA402	UINT16
113034	0x2193.45	Modulo hysteresis	SINT64
113035	0x2193.47	Current modulo hysteresis	SINT64
113036	0x2193.49	Delay time	FLOAT32
113037	0x2193.4B	Current delay time	FLOAT32

Tab. 526 Objects

7.2.3 PROFIdrive

Position sensing PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
113000	12037.0	Touch probe mode	Unsigned16
113001	12039.0	Touch probe source	Unsigned16
113002	12041.0	Selection trigger event	Unsigned16

Parameters	PNU	Name	Data type
113003	12043.0	Upper limit value modulo	Integer64
113004	12045.0	Lower limit value modulo	Integer64
113005	12047.0	Lower limit value trigger event	Integer64
113006	12049.0	Upper limit value trigger event	Integer64
113007	12051.0	Current touch probe mode	Unsigned16
113008	12053.0	Current touch probe source	Unsigned16
113009	12055.0	Current selection trigger event	Unsigned16
113010	12057.0	Current upper limit value modulo	Integer64
113011	12059.0	Current lower limit value modulo	Integer64
113012	12061.0	Current lower limit value trigger event	Integer64
113013	12063.0	Current upper limit value trigger event	Integer64
113014	12065.0	Touch probe position	Integer64
113015	12067.0	Time stamp touch probe position	Unsigned64
113016	12069.0	Trigger event initiated	Boolean
113017	12071.0	Trigger event NOT initiated	Boolean
113018	12073.0	Trigger events counter triggered	Unsigned32
113019	12075.0	Trigger events counter NOT triggered	Unsigned32
113020	12077.0	Counter modulo cycles	Unsigned32
113021	12079.0	Status touch probe input	Boolean
113022	12081.0	Status modulo limit reached	Boolean
113023	12083.0	Modulo position	Integer64
113024	12085.0	Offset modulo position	Integer64
113025	12087.0	Initialisation of modulo	Integer64
113026	12089.0	Current offset modulo position	Integer64
113027	12091.0	Time stamp touch probe position positive CiA402	Unsigned64
113028	12093.0	Time stamp touch probe position negative CiA402	Unsigned64
113029	12095.0	Touch probe position positive CiA402	Integer64
113030	12097.0	Touch probe position negative CiA402	Integer64
113031	12099.0	Counter initiated trigger events positive edge CiA402	Unsigned32

Parameters	PNU	Name	Data type
113032	12101.0	Counter initiated trigger events negative edge CiA402	Unsigned32
113033	12103.0	Touch probe status CiA402	Unsigned16
113034	12105.0	Modulo hysteresis	Integer64
113035	12107.0	Current modulo hysteresis	Integer64
113036	12109.0	Delay time	FloatingPoint
113037	12111.0	Current delay time	FloatingPoint

Tab. 527 PNUs

7.3 Open-loop operation

Function

In open-loop operation the motor is actuated with constant currents. This type of actuation is particularly suited for reduction of vibration at low rotational speeds. In closed-loop operation the servo drive controls the motor current (closed loop) 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 actuated 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.

Modes	Description
Automatic operation	If the velocity falls below the parameterised target velocity, the servo drive automatically switches to open-loop operation. If the parameterised target velocity 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. 528 Modes of open-loop operation

Parameters and diagnostic messages

The desired operating mode can be specified with the Px.4005 parameter. If open-loop operation without encoder is required even though the motor has an encoder, the parameter Px.4001.0.0 (pure Open-Loop) must be activated and the commutation-angle detection 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.	Parameters	Description	
270	Setpoint value reactive current	Setpoint value of the reactive current	
		Access	read/write
		Update	effective immediately
		Unit	Arms
662	Time current increase	Determines 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	–

ID Px.	Parameters	Description	
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	Specifies the 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/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
		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

ID Px.	Parameters	Description	
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 set-point value	Defines the factor for the current setpoint used for the commut-ation angle determination.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 529 Parameters

ID Dx.	Name	Description
06 | 02 | 00273 (100794641)	Change of control structure not permissible	The change of the control structure is not per-missible
06 | 02 | 00274 (100794642)	Motion command not permissible	The motion command is not permissible in controlled operation
06 | 02 | 00275 (100794643)	Change to closed loop operation not permissible	Change to closed loop operation not permiss-ible because the commutation angle is not valid

Tab. 530 Diagnostic messages

7.3.1 CiA 402

Open-loop operation objects

Parameters	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	FLOAT32
662	0x219C.03	Time current increase	FLOAT32
4001	0x219C.04	Activation of open loop operation	BOOL
4004	0x219C.07	Active control structure	UINT32
4005	0x219C.08	Selection of mode of operation open loop/closed loop	UINT32
4006	0x219C.09	Selection of mode of operation	UINT32
4007	0x219C.0A	Active mode of operation	UINT32
4008	0x219C.0B	Velocity switching threshold	FLOAT32
4010	0x219C.0D	Current rise time	FLOAT32
4026	0x219C.15	Current reduction activation	BOOL
4027	0x219C.16	Current reduction delay time	FLOAT32
4028	0x219C.17	Current reduction scaling factor	FLOAT32
6694	0x219C.14	Factor current setpoint value	FLOAT32

Tab. 531 Objects

7.3.2 PROFIdrive

Open-loop operation PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
270	11094.0	Setpoint value reactive current	FloatingPoint
662	11179.0	Time current increase	FloatingPoint
4001	11542.0	Activation of open loop operation	Boolean
4004	11545.0	Active control structure	Unsigned32
4005	11546.0	Selection of mode of operation open loop/closed loop	Unsigned32
4006	11547.0	Selection of mode of operation	Unsigned32
4007	11548.0	Active mode of operation	Unsigned32

Parameters	PNU	Name	Data type
4008	11549.0	Velocity switching threshold	FloatingPoint
4010	11551.0	Current rise time	FloatingPoint
4026	11558.0	Current reduction activation	Boolean
4027	11559.0	Current reduction delay time	FloatingPoint
4028	11560.0	Current reduction scaling factor	FloatingPoint
6694	11685.0	Factor current setpoint value	FloatingPoint

Tab. 532 PNUs

7.4 Field weakening

Function

Synchronous motors can only be operated at 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 enables the motor to be operated above the nominal rotary speed. The negative reactive current must be limited for some motors.

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	effective immediately
		Unit	–
102202	Field weakening status	Displays whether the field weakening is active or inactive.	
		Access	read/–
		Update	effective immediately
		Unit	–
102203	Field weakening reactive current	Displays the current reactive current of the field weakening	
		Access	read/–
		Update	effective immediately
		Unit	Arms

ID Px.	Parameter	Description	
102207	Current maximum reactive current	Specifies the currently available maximum reactive current.	
		Access	read/–
		Update	effective immediately
		Unit	Arms

Tab. 533 Parameter

7.4.1 CiA 402

Field weakening objects

Parameters	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	BOOL
102202	0x219F.02	Field weakening status	BOOL
102203	0x219F.03	Field weakening reactive current	FLOAT32
102207	0x219F.07	Current maximum reactive current	FLOAT32

Tab. 534 Objects

7.4.2 PROFIdrive

Field weakening PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
102201	11949.0	Activation of field weakening	Boolean
102202	11950.0	Field weakening status	Boolean
102203	11951.0	Field weakening reactive current	FloatingPoint
102207	11955.0	Current maximum reactive current	FloatingPoint

Tab. 535 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 conveyor belts.
The module range is described by a minimum value and a maximum value. If a setpoint value is specified that lies outside the defined module range, only the remaining distance resulting from the modulo division is moved.

The actual position made available via the Real-Time Ethernet interface is always a position that is within the defined modulo limits.
If a multi-turn absolute encoder is used, the revolutions driven are stored so that the correct modulo position can be determined again when the device is switched on again.

Activate/deactivate modulo

Module operation can be activated and deactivated via block selection or via the drive profile of the respective fieldbus.
For activation via the drive profile, the following parameters must be written (both unequal 0):

- Upper limit value modulo
- Lower limit value modulo

To deactivate module operation via the drive profile, both parameters must be written with the value 0.
When module operation is active, you can switch between the "Position Mode PP" profile and the "Velocity Mode PV" profile without deactivating module operation.

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If module operation is activated via the drive profile, the module position is reported as the actual value.

Module modes	Description	Example
Shortest path	The drive moves the shortest path to the target position resulting from the modulo division. The modulo limits are not considered.	Specification: – Module range: 0 ... 360° – The drive is set to 340° and the setpoint is 420°. Reaction: – The drive moves in positive direction 80° over the module limit of 360°. – Actual position: 60°
Shortest path within the modulo boundary	The drive moves the shortest way to the target position resulting from the modulo division. The modulo limits are taken into account.	Specification: – Module range: 0 ... 360° – The drive is set to 340° and the setpoint is 420°. Reaction: – The drive moves in negative direction 280° and does not move over a module limit of 360°. – Actual position: 60°
Only positive path	The drive moves to the target position in positive direction.	Specification: – Module range: 0 ... 360° – The drive is set to 340° and the setpoint specification is 680°. Reaction:

Module modes	Description	Example
		– The drive moves in positive direction 340°. – Actual position: 320°
Only negative path	The drive moves to the target position in negative direction.	Specification: – Module range: 0 ... 360° – The drive is set to 340° and the setpoint is 350°. Reaction: – The drive moves in negative direction 370°. – Actual position: 350°
Setting of the modulo position	Sets the modulo position to a defined offset.	Offset = user-defined
Reset of the modulo position	Resets the offset of the mod-ulo position.	Offset = 0

Tab. 536 Modes of module operation

Monitoring Functions

The monitoring functions marked with a dot are effective in modulo operation:

Motion monitoring function status word			
Bit	Code	Name	Effective
0	TRX	Target window reaches position	•
1	TRV	Target window reaches velocity	•
2	TRT	Target window reaches torque	–
3	FEX	Following error position	•
4	FEV	Velocity following error	•
6	TMX	Position target area monitoring	•
7	TMV	Velocity 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 limit position reached negative	•
16	STX	Standstill monitoring position/velocity	•

Motion monitoring function status word			
Bit	Code	Name	Effective
17	STV	Standstill monitoring velocity	•
18	LS	Stop reached	•
19	STLP	Stroke limit reached positive	–
20	STLN	Stroke limit reached negative	–
21	VM	Velocity monitoring	•
22	PB	Pushback 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. 537 Motion Monitoring Function

Detailed information on the monitoring functions ➔ 5 Motion monitoring.

Parameters and Diagnostic Messages

ID Px.	Parameter	Description	
113100	Modulo mode	Setting the modulo function	
		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

ID Px.	Parameter	Description	
113104	Actual value of modulo	Actual value based on the modulo limits	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113105	Current mode of modulo	Specifies the currently used setting of the modulo function.	
		Access	read/–
		Update	effective immediately
		Unit	–
113106	Current upper limit value modulo	Specifies the currently used upper limit value of the modulo function.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113107	Current lower limit value modulo	Specifies the currently 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 status	Status of the modulo function	
		Access	read/–
		Update	effective immediately
		Unit	–
113110	Offset modulo position	Offset of the modulo position	
		Access	read/write
		Update	effective immediately
		Unit	user defined

ID Px.	Parameter	Description	
113111	Initialisation of modulo	Default value for the reference position	
		Access	read/write
		Update	effective immediately
		Unit	user defined
113112	Current offset modulo position	Specifies the currently used offset of the modulo position.	
		Access	read/–
		Update	effective immediately
		Unit	user defined
113113	Upper limit value modulo	Determines 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

Tab. 538 Parameter

7.5.2 CiA 402

Objects Modulo

Parameter	Index.Subindex	Name	Data type
Px.	CiA402: The factor group is effective.		
113102	0x607B.01	Lower limit value modulo	SINT32
113104	0x6064.00	Actual value of modulo	SINT32
113113	0x607B.02	Upper limit value modulo	SINT32
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
88818	0x216F.16	Extended Modulo Mode This parameter can be used to extend module operation by the following mode: – Shortest path within the modulo boundary	UINT8
113100	0x2197.01	Modulo mode	UINT16
113102	0x2197.03	Lower limit value modulo	SINT64
113103	0x2197.04	Setpoint value modulo	SINT64
113104	0x2197.05	Actual value of modulo	SINT64

Parameter	Index.Subindex	Name	Data type
113105	0x2197.06	Current mode of modulo	UINT16
113106	0x2197.07	Current upper limit value modulo	SINT64
113107	0x2197.08	Current lower limit value modulo	SINT64
113108	0x2197.09	Counter modulo cycles	UINT32
113109	0x2197.0A	Modulo status	BOOL
113110	0x2197.0B	Offset modulo position	SINT64
113111	0x2197.0C	Initialisation of modulo	SINT64
113112	0x2197.0D	Current offset modulo position	SINT64
113113	0x2197.0E	Upper limit value modulo	SINT64

Tab. 539 Objects

7.5.3 PROFIdrive

PNUs Modulo

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
113104	28.0	Actual value of modulo	Integer64
Px.	**Manufacturer-specific parameters**		
113100	12113.0	Modulo mode	Unsigned16
113102	12115.0	Lower limit value modulo	Integer64
113103	12116.0	Setpoint value modulo	Integer64
113104	12117.0	Actual value of modulo	Integer64
113105	12118.0	Current mode of modulo	Unsigned16
113106	12119.0	Current upper limit value modulo	Integer64
113107	12120.0	Current lower limit value modulo	Integer64
113108	12121.0	Counter modulo cycles	Unsigned32
113109	12122.0	Modulo status	Boolean
113110	12123.0	Offset modulo position	Integer64
113111	12124.0	Initialisation of modulo	Integer64
113112	12125.0	Current offset modulo position	Integer64
113113	12637.0	Upper limit value modulo	Integer64

Parameter	PNU	Name	Data type
11280612	12638.0	Extended Modulo Mode This parameter can be used to extend module operation by the following mode: – Shortest path within the modulo boundary	Unsigned8

Tab. 540 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 acknow-ledge)	#STO-A, #STO-B

Tab. 541 Feedback signals for safety sub-functions

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Detailed information on the safety sub-functions of the product can be found in the Description Safety sub-function ➔ 1.1 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	
950	SFB error status	Shows 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 fault – 1: fault in time monitoring All other bits have the value 0.	
		Access	Read/–
		Update	Effective immediately
		Unit	–

ID Px.	Parameter	Description	
951	Feedback signals	Shows the status of the feedback signals. The following allocation applies: Signals as they are pending at the pin Bit 0: STA feedback signal Signals are filtering Bit 16: STA feedback signal This means: – 0: low signal – 1: high signal	
		Access	Read/–
		Update	Effective immediately
		Unit	–
952	STA hysteresis time	Shows the tolerance time for the STA feedback signal.	
		Access	Read/–
		Update	Effective immediately
		Unit	s

Tab. 542 Parameter

ID Dx.	Name	Description
09 I 00 I 00146 (150995090)	Safety function requested	Safety function requested
09 I 00 I 00147 (150995091)	Plausibility check of safety feed-back signals	Error during plausibility check of safety feed-back signals
09 I 01 I 00148 (151060628)	STO: Discrepancy time exceeded	Discrepancy time for #STO-A/B exceeded
09 I 01 I 00149 (151060629)	Plausibility check #STO-A/B	Plausibility check of #STO-A/B input
09 I 01 I 00150 (151060630)	Sequence monitoring #STO-A/B	Sequence monitoring, #STO-A/B inputs

Tab. 543 Diagnostic Messages

8.2 CiA402

Objects

Parameter	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: saved basic unit for the object is effective.		
950	0x2178.01	SFB error status	UINT32
951	0x2178.02	Feedback signals	UINT32
952	0x2178.03	STA hysteresis time	FLOAT32

Tab. 544 Objects

8.3 PROFIdrive

Safety signal PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
950	11239.0	SFB error status	Unsigned32
951	11240.0	Feedback signals	Unsigned32
952	11241.0	STA hysteresis time	FloatingPoint

Tab. 545 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 web server and the plug-in of the Festo Automation Suite provide access to diagnostic messages in plain text format.
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 For additional information see "Description, assembly and installation" ➔ 1.1 Applicable documents.
Diagnostics via the commissioning software	The plug-in of the Festo Automation Suite, for example, provides the following functions ➔ 2 CMMT-ST Plug-in: – Access to the message directory (current messages) – Access to the error history (message history) – Error acknowledgment – Error classification to categorise diagnostic events – Recording measuring data (trace function)
Diagnostics via web server	The web server offers, for example, the following functions ➔ 10 Web server: – Access to the message directory (current messages) – Access to the error history (message history) – Error acknowledgment
Diagnostics via fieldbus – Request diagnostic status – Fieldbus-specific diagnostic functions	Special diagnostic functions and communication services are available, depending on the fieldbus used.

Tab. 546 Diagnostics options

9.2 Classification of Diagnostic Events

If a diagnostic event occurs, the device issues a message and reacts according to the parameterised 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 exceeded, 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 exceeded.

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:

– Ignore
– Information
– Warning
– Error, stop category 2
– Error, stop category 1
– Error, stop category 0

Classification (level)	Severity	Reactions
Ignore	Diagnostic event of minor importance	– Generation of the message and entry in the message directory; the event has no further influence. No entry is added to the error memory as standard

Tab. 547 Ignore Level

Classification (level)	Severity	Reactions
Information	Diagnostic event with low degree of severity	– Generation of the message and entry in the message directory; the event has no further influence. No entry is added to the error memory as standard

Tab. 548 Information Level

Classification (level)	Severity	Reactions
Warning	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 – Depending on the configuration, an entry is added to the error memory.

Tab. 549 Warning Level

Classification (level)	Severity	Reactions
Error, stop category 2	Diagnostic event 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). – Depending on the configuration, an entry is added to the error memory Specific error response of category 2 – The drive is decelerated using the parameterised stop ramp as soon as the error occurs.

Classification (level)	Severity	Reactions
		– When the drive has reached velocity 0, the closed-loop controller maintains the drive at the position achieved upon completion of the stop ramp.

Tab. 550 Error Level, Stop Category 2

Classification (level)	Severity	Reactions
Error, stop category 1	Diagnostic event with high degree of severity and execution of a general and a specific error response	Stop category 1 General error response – The same 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 brake.

Tab. 551 Error Level, Stop Category 1

Classification (level)	Severity	Reactions
Error, stop category 0	Diagnostic event with high degree of severity and execution of a general and a specific error response	Stop category 0 General response – The same as with stop category 2 Specific error response of category 0 – The output stage is switched off immediately after the error has occurred. The brake locks on drives with brake. Without a brake the drive runs down.

Tab. 552 Error Level, Stop Category 0

9.3 Diagnostic 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)
– level of severity (e. g. diagnostic status ≥ 4096 corresponds to stop category 0)

Diagnostic 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. 553 Diagnostic status

The diagnostic status parameter can be requested via the device profile of the fieldbus being used.

Parameters and diagnostic messages

ID Px.	Parameters	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. 554 Parameters

Diagnostic messages

No specific diagnostic messages are allocated to the function.

9.3.1 CiA 402

Diagnostic status objects

Parameters	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	UINT16
112819	0x218E.09	Error active	BOOL

Tab. 555 Objects

9.3.2 PROFIdrive

Diagnostic status PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
300	2081.0	Diagnostic device status	Unsigned16
112819	12036.0	Error active	Boolean

Tab. 556 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. 557 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

All of the messages have the following uniform design:

Characteristics	Brief description

ID (message ID)	Unique identification of the diagnostic event consisting of:
	– System (0) or axis label (1, ...)
	– Diagnostic number displayed as followed:
	  – Ungrouped (total number)
	  – Grouped➔ Grouping and Overview of the Diagnostic Messages

Characteristics	Brief description
	– Instance (identification of the instance to differentiate between similar parameters of different components, e.g. position capture 1 and position capture 2).
Name (message text)	Brief description of the diagnostic event
Status	The following message statuses are possible: – Active (diagnostic event is still active) – Cancelled (diagnostic event is no longer active) – Acknowledged (the cancelled message has been acknowledged)
Classification	Level: – Ignore – Information – Warning – Error stop category 0, 1 or 2
Time stamp	Time of the occurrence in operating hours

Tab. 558 Structure of Messages

Complete list of all diagnostic messages
➔ 9.4.6 Diagnostic messages with information for fault clearance.

Grouping and Overview of the Diagnostic Messages

The diagnostic messages are grouped according to their cause.
This grouping is visible in the corresponding overview, e. g. in the plug-in.

– Grouped overview:
  D[system or axis identification].[main group | sub-group | error number].[instance]
  e. g. "D0.01 | 01 | 00011.0"
– Ungrouped overview:
  D[system or axis number].[diagnostic number].[instance]
  e. g. "D0.16842763.0"

If the device profile only allows 16 bit, only the unique error number is transferred (e. g. 11).
The diagnostic number of the ungrouped overview is determined from the grouped overview as follows:

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 1 and 2
2. The resultant hexadecimal 4-byte number displayed as a decimal number equals the diagnostic number in the ungrouped overview.

Main group		Sub-group	
1	Current	1	Short circuit
		2	I^2t
2	Voltage	1	Supply
		2	Intermediate circuit
		3	Principal voltage
		4	Encoder supply
3	Temperature	1	Device
		2	Output stage
		3	Motor
5	Motion	1	Homing
		2	Motion Control
6	Configuration/parameterisation	0	No allocation
		2	Limit values
		5	Parameter set
7	Monitoring	1	Limitations
		2	Motion monitoring
		3	Limit values
		4	Zero angle detection
8	Communication	0	No allocation
		4	EtherCAT
9	Safety engineering	0	No allocation
		1	STO
10	Internal hardware	1	Module error
11	Software	1	Exception
		2	Task
		3	File system
		4	Firmware update
		5	Device configuration
		6	LibRTE
		7	Warm start
		8	Version management

Main group		Sub-group	
12	Maintenance	1	Operating time
13	Various	1	Diagnostics
		2	Auto-tuning
17	Security (data)	1	User login
18	Encoder	0	No allocation
		3	Quadrature (incremental encoder)
		5	BiSS C

Tab. 559 Grouping of the Diagnostic Messages

9.4.3 Message Directory

All of the 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 sorting of the message directory is as follow:

– Severity in descending order (messages with a higher degree of severity come first)
– Time stamp in ascending order (older messages come first)

The message directory is accessed via the plug-in ➔ menu "Diagnosis", diagnostic panel "Device state".

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 determine whether warnings should also be recorded ➔ 2.5.5. 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 ➔ 2 CMMT-ST Plug-in

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.

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.

i

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 CTRL-EN digital input (trailing edge)
– The device profile of the fieldbus being used
– The plug-in ➔ 2 CMMT-ST Plug-in
– The web server ➔ 10 Web server

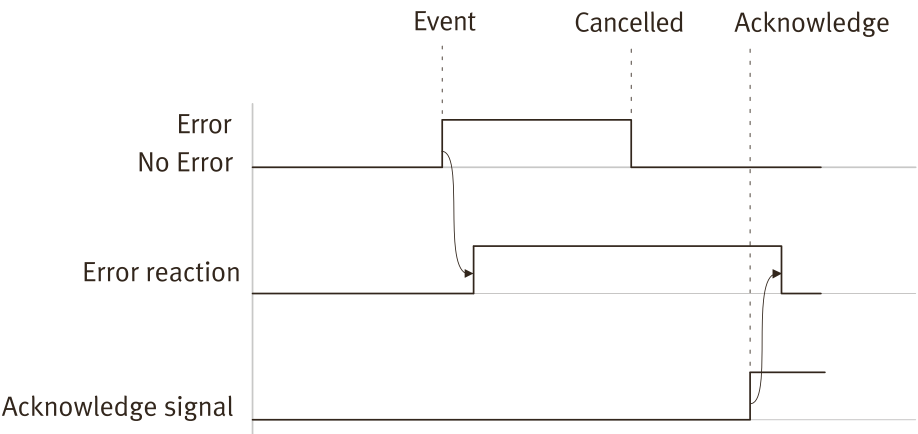

Fig. 102 Acknowledgment

Name	Description
Error/No error	Error/no error
Error reaction	Reaction of the device
Acknowledge sig-nal	Signal or command for acknowledgment (for acknowledgment with the digital input CTRL-EN, a trailing edge is required.)
Event	Diagnostic event, e. g. error
Cancelled	Message cancelled internally
Acknowledge	Acknowledgment

Tab. 560 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:

<table>
<tr><th>ID Dx.</th><th>Message</th><th colspan="3">Description</th></tr>
<tr><td rowspan="6">01 | 02 | 00012
(16908300)
$\boxed{1}$</td><td rowspan="6">I^{2}t monitoring:
motor warning limit
$\boxed{2}$</td><td colspan="2">I^{2}t monitoring: motor warning limit</td><td>$\boxed{3}$</td></tr>
<tr><td>Remedy</td><td>- Reduce dynamic response of tasks
- Motor/mechanical system blocked or sluggish?</td><td>$\boxed{4}$</td></tr>
<tr><td rowspan="2">Classific-
ation</td><td>Default: Warning (16)</td><td>$\boxed{5}$</td></tr>
<tr><td>Can be parameterised: Px.6319
Value list:
Warning (16)
Information (4)
Ignore (2)</td><td>$\boxed{6}$</td></tr>
<tr><td rowspan="2">Error
memory</td><td>Default: Save (1)</td><td>$\boxed{7}$</td></tr>
<tr><td>Can be parameterised: Px.6320</td><td>$\boxed{8}$</td></tr>
</table>

Tab. 561 Sample diagnostic message

Cell	Content/description
$\boxed{1}$	Diagnostic number in grouped overview. Followed by the diagnostic number in brackets in the ungrouped overview.
$\boxed{2}$	Name of the message
$\boxed{3}$	Description of the diagnostic event
$\boxed{4}$	Remedy: Remedial measures
$\boxed{5}$	Classification: Default error response (factory setting)
$\boxed{6}$	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
$\boxed{7}$	Error memory: Default setting of whether message is added to the error memory
$\boxed{8}$	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 parameterised The value list always applies: – Do not save (0) – Save (1)

Tab. 562 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 repair 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 STO wiring and reference switch – Is there too much current there (short circuit?)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
01	02	00012 (16908300)	I^2t monitoring: motor warning limit	I^2t monitoring: motor warning limit	
		Remedy	– Reduce dynamic response of tasks – Motor/mechanical system blocked or sluggish?
		Classification	Default: ignore (2)
			Can be parameterised: Px.6319, value list: Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.6320
01	02	00013 (16908301)	I^2t monitoring: motor error limit	I^2t monitoring: motor error limit	
		Remedy	– Motor/mechanical system blocked or sluggish? – Motor undersized? – Check performance rating of drive package
		Classifica-	Default: ignore (2)

ID Dx.	Message	Description	
01 I 02 I 00013 (16908301)	I²t monitoring: motor error limit	tion	Can be parameterised: Px.6321, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.6322
01 I 02 I 00014 (16908302)	I²t monitoring: output stage warning limit	I²t monitoring: output stage warning limit	
		Remedy	– Reduce dynamic response of tasks – Motor/mechanical system blocked or sluggish?
		Classification	Default: ignore (2)
			Can be parameterised: Px.6323, value list: Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.6324
01 I 02 I 00015 (16908303)	I²t monitoring: output stage error limit	I²t monitoring: output stage error limit	
		Remedy	– Motor/mechanical system blocked or sluggish? – Motor undersized? – Check performance rating of drive package
		Classification	Default: ignore (2)
			Can be parameterised: Px.6325, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.6326

ID Dx.	Message	Description	
01 I 02 I 00016 (16908304)	I^2t monitoring: output stage v0 warning limit	I^2t monitoring: output stage in standstill warning limit	
		Remedy	– Reduce target current/setpoint torque – Reduce standstill time – Allow minimal movement >5 Hz electrical rotational frequency – Check whether the holding brake opens
		Classification	Default: ignore (2)
			Can be parameterised: Px.6327, value list: Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.6328
01 I 02 I 00017 (16908305)	I^2t monitoring: output stage v0 error limit	I^2t monitoring: output stage in standstill error limit	
		Remedy	– Reduce target current/setpoint torque – Reduce standstill time – Allow minimal movement >5 Hz electrical rotational frequency – Check whether the holding brake opens
		Classification	Default: ignore (2)
			Can be parameterised: Px.6329, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.6330
01 I 02 I 00018 (16908306)	Parameterisation: I^2t monitoring of motor invalid	Parameterisation: I^2t monitoring of motor invalid	
		Remedy	– Check parameterisation for I^2t critical limit – Nominal and maximum current of motor plausible?
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error	Default: save (1)

ID Dx.	Message	Description	
01 I 02 I 00018 (16908306)	Parameterisation: I^2t monitoring of motor invalid	memory	Can be parameterised: No
01 I 02 I 00258 (16908546)	I^2T monitoring: motor model warning limit	I^2T monitoring: motor model warning limit	
		Remedy	– Reduce dynamic response of tasks – Motor/mechanical system blocked or sluggish?
		Classification	Default: Warning (16)
			Can be parameterised: Px.63019, value list: Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.63020
01 I 02 I 00259 (16908547)	I^2t monitoring: motor model error limit	I^2t monitoring: motor model error limit	
		Remedy	– Motor/mechanical system blocked or sluggish? – Motor undersized? – Check performance rating of drive package
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.63021, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.63022
02 I 01 I 00022 (33619990)	Undervoltage in logic supply 24V	Undervoltage in logic supply 24V	
		Remedy	– Check the power supply (logic)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error	Default: save (1)

ID Dx.	Message	Description	
02 I 01 I 00022 (33619990)	Undervoltage in logic supply 24V	memory	Can be parameterised: No
02 I 01 I 00023 (33619991)	Overvoltage in logic supply 24V	Overvoltage in logic supply 24V	
		Remedy	– Check the power supply (logic)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
02 I 01 I 00024 (33619992)	Undervoltage in logic supply 5V	Undervoltage in logic supply 5V internal	
		Remedy	– Checking the power supply
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
02 I 01 I 00025 (33619993)	Overvoltage in logic supply 5V	Overvoltage in logic supply 5V internal	
		Remedy	– Checking the power supply
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
02 I 01 I 00026 (33619994)	Undervoltage in logic supply 3.3V	Undervoltage in logic supply 3.3V internal	
		Remedy	– Checking the power supply
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
02 I 01 I 00027 (33619995)	Overvoltage in logic supply 3.3V internal	Overvoltage in logic supply 3.3V internal	
		Remedy	– Checking the power supply
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
02 ǀ 02 ǀ 00030 (33685534)	Overvoltage in DC link	Overvoltage in DC link	
		Remedy	– Check sizing of braking resistor
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
02 ǀ 02 ǀ 00031 (33685535)	Undervoltage in DC link	Undervoltage in DC link	
		Remedy	– Check power supply – Couple intermediate circuits where technically possible – Check DC link voltage (measure) – Check undervoltage monitor (threshold value)
		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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.488
02 ǀ 02 ǀ 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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.4890

<table>
<tr><th>ID Dx.</th><th>Message</th><th colspan="2">Description</th></tr>
<tr><td rowspan="6">02 I 03 I 00038
(33751078)</td><td rowspan="6">Undervoltage in mains voltage</td><td colspan="2">Undervoltage in mains voltage</td></tr>
<tr><td>Remedy</td><td>– Checking the power supply</td></tr>
<tr><td rowspan="2">Classification</td><td>Default: Stop category 1 (256)</td></tr>
<tr><td>Can be parameterised: Px.519, value list:
Stop category 0 (4096)
Stop category 1 (256)
Stop category 2 (64)
Warning (16)
Info (4)
Ignore (2)</td></tr>
<tr><td rowspan="2">Error memory</td><td>Default: save (1)</td></tr>
<tr><td>Can be parameterised: Px.5180</td></tr>
<tr><td rowspan="6">02 I 03 I 00039
(33751079)</td><td rowspan="6">Overvoltage in mains voltage</td><td colspan="2">Overvoltage in mains voltage</td></tr>
<tr><td>Remedy</td><td>– Checking the power supply</td></tr>
<tr><td rowspan="2">Classification</td><td>Default: Stop category 1 (256)</td></tr>
<tr><td>Can be parameterised: No</td></tr>
<tr><td rowspan="2">Error memory</td><td>Default: save (1)</td></tr>
<tr><td>Can be parameterised: No</td></tr>
<tr><td rowspan="6">02 I 03 I 00251
(33751291)</td><td rowspan="6">The critical limit for the energy recovery has been exceeded</td><td colspan="2">The limit value for the energy recovery has been exceeded</td></tr>
<tr><td>Remedy</td><td>– Checking the power supply</td></tr>
<tr><td rowspan="2">Classification</td><td>Default: Stop category 1 (256)</td></tr>
<tr><td>Can be parameterised: No</td></tr>
<tr><td rowspan="2">Error memory</td><td>Default: save (1)</td></tr>
<tr><td>Can be parameterised: No</td></tr>
<tr><td rowspan="6">03 I 01 I 00044
(50397228)</td><td rowspan="6">Warning threshold: temperature in device too low</td><td colspan="2">Warning threshold: temperature in device too low</td></tr>
<tr><td>Remedy</td><td>– Check ambient conditions</td></tr>
<tr><td rowspan="2">Classification</td><td>Default: Warning (16)</td></tr>
<tr><td>Can be parameterised: No</td></tr>
<tr><td rowspan="2">Error memory</td><td>Default: save (1)</td></tr>
<tr><td>Can be parameterised: Px.933</td></tr>
</table>

ID Dx.	Message	Description	
03 I 01 I 00045 (50397229)	Device undertemper-ature	Device undertemperature	
		Remedy	– Check ambient conditions
		Classifica-tion	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
03 I 01 I 00046 (50397230)	Warning threshold device overtemperat-ure	Warning threshold device overtemperature	
		Remedy	– Temperature display plausible? – Device fan defective? – Device overloaded? – Check installation conditions; control cab-inet fan filter dirty? – Check drive layout (possible overloading during continuous operation)
		Classifica-tion	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.937
03 I 01 I 00047 (50397231)	Device overtemperat-ure	Device overtemperature	
		Remedy	– Temperature display plausible? – Device fan defective? – Device overloaded? – Check installation conditions; control cab-inet fan filter dirty? – Check drive layout (possible overloading during continuous operation)
		Classifica-tion	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
03 I 02 I 00048 (50462768)	Warning threshold: Temperature in power unit too low	Warning threshold: Temperature in power unit too low	
		Remedy	– Check ambient conditions
		Classifica-	Default: Warning (16)

ID Dx.	Message	Description	
03 I 02 I 00048 (50462768)	Warning threshold: Temperature in power unit too low	tion	Can be parameterised: Px.922, value list: Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.923
03 I 02 I 00049 (50462769)	Temperature in power unit too low	Temperature in output stage too low	
		Remedy	– Check ambient conditions
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
03 I 02 I 00050 (50462770)	Warning threshold: Power unit overtemperature	Warning threshold: Power unit overtemperature	
		Remedy	– Temperature display plausible? – Device fan defective? – Device overloaded? – Check installation conditions; control cabinet fan filter dirty? – Check drive layout (possible overloading during continuous operation)
		Classification	Default: Warning (16)
			Can be parameterised: Px.926, value list: Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.927
03 I 02 I 00051 (50462771)	Power unit overtemperature	Output stage overtemperature	
		Remedy	– Temperature display plausible? – Device fan defective? – Device overloaded? – Check installation conditions; control cabinet fan filter dirty? – Check drive layout (possible overloading during continuous operation)

ID Dx.	Message	Description	
03 | 02 | 00051 (50462771)	Power unit overtem-perature	Classifica-tion	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 | 01 | 00056 (83951672)	Configuration of hom-ing run invalid	Parameterisation of homing run invalid	
		Remedy	– Travel to hardware limit switch (limit switch configured)
		Classifica-tion	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 configuration of homing run (timeout, type) – At end stop: check parameters for stand-still window and limiting current
		Classifica-tion	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 of slide in relation to limit switch/end stop – Configuration of search path
		Classifica-	Default: Stop category 1 (256)

ID Dx.	Message	Description	
05 I 01 I 00058 (83951674)	Homing: Search path exceeded	tion	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 I 02 I 00059 (84017211)	Positioning task invalid	Task invalid	
		Remedy	– Check parameterisation of task or set
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 I 02 I 00060 (84017212)	Motion command not known	Unknown motion command pending	
		Remedy	– Check task, record number or step enabling condition
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 I 02 I 00061 (84017213)	Task ignored, controller enable missing	Task could not be executed as controller enable for the drive is missing	
		Remedy	– Set enable CTRL-EN
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 I 02 I 00062 (84017214)	Task ignored as safety function requested	Task could not be executed as a safety function is requested	
		Remedy	– Check that logic level of safety function inputs is correct
		Classification	Default: Warning (16)
			Can be parameterised: No

ID Dx.	Message	Description	
05 I 02 I 00062 (84017214)	Task ignored as safety function requested	Error memory	Default: save (1)
			Can be parameterised: No
05 I 02 I 00064 (84017216)	Task ignored as DC-Link coupling not ready	Task could not be executed as no DC link voltage is present or it was not yet detected	
		Remedy	– Check mains voltage is present – Check braking resistor is present, if required
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 I 02 I 00065 (84017217)	Task ignored due to motion command error	The motion command was rejected in the current status	
		Remedy	– Cancel current motion command with a stop – Wait for MC for current motion command
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.1733
05 I 02 I 00066 (84017218)	Task ignored as encoder not ready	Task could not be executed as the encoder is not ready	
		Remedy	– Check encoder cable – Check power supply for the encoder
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 I 02 I 00067 (84017219)	Task ignored as referencing missing	Task could not be executed as the drive is not referenced	
		Remedy	– Home drive
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
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	– Run reinitialisation
		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	– 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 parameterisation task or set (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 specification of trajectory generator	The position specified for the trajectory generator is invalid	
		Remedy	– Change specified position to valid range
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
05 I 02 I 00073 (84017225)	Invalid speed value of trajectory generator	The speed specified for the trajectory generator is invalid	
		Remedy	– Change specified velocity to valid range
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 I 02 I 00074 (84017226)	Invalid acceleration value of trajectory generator	The acceleration specified for the trajectory generator is invalid	
		Remedy	– Change specified acceleration to valid range
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 I 02 I 00075 (84017227)	Invalid deceleration value of trajectory generator	The deceleration specified for the trajectory generator is invalid	
		Remedy	– Change specified deceleration to valid range
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 I 02 I 00076 (84017228)	Invalid jerk value of trajectory generator	The jerk specified for the trajectory generator is invalid	
		Remedy	– Change specified jerk to valid range
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 I 02 I 00077 (84017229)	Trajectory generator error	An error occurred in the trajectory generator when calculating a movement profile	
		Remedy	– Adjust dynamic values for the motion command
		Classifica-	Default: Stop category 1 (256)

ID Dx.	Message	Description	
05 ǀ 02 ǀ 00077 (84017229)	Trajectory generator error	tion	Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 ǀ 02 ǀ 00078 (84017230)	Stop ramp: Timeout	Stop ramp: Timeout	
		Remedy	– Check value for stop ramp timeout (friction?)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 ǀ 02 ǀ 00079 (84017231)	Torque increase ramp invalid	The torque increase ramp is invalid	
		Remedy	– Change torque increase ramp parameter to 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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.1130226
05 ǀ 02 ǀ 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 ǀ 02 ǀ 00278 (84017430)	Job ignored because direction lock active	Task could not be executed because a directional lock is active	
		Remedy	– Note additional diagnostic messages and eliminate the cause of the directional lock

ID Dx.	Message	Description	
05 I 02 I 00278 (84017430)	Job ignored because direction lock active	Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 I 02 I 00279 (84017431)	Fixed stop not detected	Fixed stop was not detected	
		Remedy	– Check that the workpiece is in front of the target position
		Classification	Default: Info (4)
			Can be parameterised: Px.4647, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.4648
05 I 02 I 00280 (84017432)	Monitoring window of fixed stop left	Monitoring window of fixed stop left	
		Remedy	– Check that workpiece was not lost
		Classification	Default: Info (4)
			Can be parameterised: Px.4649, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.4650
05 I 02 I 00282 (84017434)	Encoder not ready	Selected encoder not ready for brake test	
		Remedy	– Check that the encoder interface selection is valid – Check for pending encoder errors

ID Dx.	Message	Description	
05 I 02 I 00282 (84017434)	Encoder not ready	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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.103137
05 I 02 I 00283 (84017435)	Brake test failed	Brake test has failed	
		Remedy	– Check brake wear – Check monitoring window stroke
		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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.103139
05 I 02 I 00284 (84017436)	Error brake test torque	Torque for brake test cannot be established	
		Remedy	– Check brake wear – Check monitoring window torque
		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) Info (4) Ignore (2)
		Error	Default: save (1)

ID Dx.	Message	Description	
05 I 02 I 00284 (84017436)	Error brake test torque	memory	Can be parameterised: Px.103141
05 I 02 I 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 velocity (block table / direct operation) – Check velocity override
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 I 02 I 00396 (84017548)	Error at Gear In	The slave axis could not be synchronised up to the master synch position.	
		Remedy	– Check velocity, acceleration and jerk for up synchronisation
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
05 I 02 I 00397 (84017549)	Error at Gear Out	The slave axis could not be synchronised down to the master stop position.	
		Remedy	– Check velocity, acceleration and jerk for up synchronisation
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
06 I 00 I 00070 (100663366)	Invalid record table parameter	A record table parameter is invalid	
		Remedy	– Check record table parameter
		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)

ID Dx.	Message	Description	
06 l 00 l 00070 (100663366)	Invalid record table parameter	Error memory	Default: save (1)
			Can be parameterised: Px.1853
06 l 00 l 00081 (100663377)	Closed-loop controller operating mode invalid	The operating mode of the closed-loop controller (position, speed, force, stop) does not match the parameterisation	
		Remedy	– Check parameterisation of the closed-loop controller
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
06 l 00 l 00082 (100663378)	Notch filter frequency invalid	The parameterisation of the notch filter frequency is invalid	
		Remedy	– Check parameterisation of notch filter frequency; notch filter frequency is greater than half the scanning frequency
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
06 l 00 l 00083 (100663379)	Record table incorrect	Record table incorrect	
		Remedy	– Check positioning 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)
			Can be parameterised: Px.1851
06 l 00 l 00084 (100663380)	Parameterisation switching frequency	Parameterisation of switching frequency invalid	
		Remedy	– Check parameter set: matches device?
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No

ID Dx.	Message	Description	
06 I 00 I 00084 (100663380)	Parameterisation switching frequency	Error memory	Default: save (1)
			Can be parameterised: No
06 I 00 I 00085 (100663381)	Digital I/O configuration invalid	The configuration of the digital inputs or outputs is invalid	
		Remedy	– Check configuration of digital inputs/outputs for double function assignment
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
06 I 00 I 00248 (100663544)	Motor type is not supported	The parameterised motor type (servo, stepper etc.) is not supported	
		Remedy	– See manual to determine whether motor is actually supported – Check motor configuration data
		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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.71433
06 I 00 I 00252 (100663548)	Incorrect parameterisation of reactive current braking	The start and end voltages for reactive current braking are incompatible	
		Remedy	– Check parameterisation of reactive current braking
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
06 I 00 I 00313 (100663609)	Invalid parameterisation, variable message function	The variable signalling function is incorrectly parameterised.	
		Remedy	– Check input parameters for data triggers (axis assignment, instance selection)
		Classification	Default: Warning (16)
			Can be parameterised: Px.1174230, value list: Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.1174231
06 I 02 I 00086 (100794454)	Sign limits	Setpoint torque and velocity limit do not match.	
		Remedy	– Check limits for torque and current; signs and limits must match (symmetrical?)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
06 I 02 I 00087 (100794455)	Velocity control limitation invalid	Velocity control limitation invalid	
		Remedy	– Check configuration of control limitation (consistency)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
06 I 02 I 00088 (100794456)	Torque control limitation invalid	Torque control limitation invalid	
		Remedy	– Check configuration of control limitation (consistency)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
06 | 02 | 00089 (100794457)	Current control limitation invalid	Current control limitation invalid	
		Remedy	– Check configuration of control limitation (consistency)
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
06 | 02 | 00090 (100794458)	Maximum current control limitation invalid	Maximum current control limitation invalid	
		Remedy	– Check configuration of control limitation (consistency)
		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 current of motor invalid	
		Remedy	– Check parameterisation of nominal current and maximum current (consistency)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		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 the current task is complete – Check task
		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) Info (4) Ignore (2)
		Error	Default: save (1)

ID Dx.	Message	Description	
06 I 02 I 00273 (100794641)	Change of control structure not permissible	memory	Can be parameterised: Px.4021
06 I 02 I 00274 (100794642)	Motion command not permissible	The motion command is not permissible in controlled operation	
		Remedy	– Check task
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
06 I 02 I 00275 (100794643)	Change to closed-loop operation not permissible	Change to closed-loop operation not permissible because the commutation angle is not valid	
		Remedy	– Check task
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
06 I 05 I 00097 (100991073)	Parameter set not found	Parameter set not found	
		Remedy	– Check parameter set selection
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
06 I 05 I 00098 (100991074)	Parameter set invalid	Parameter set invalid	
		Remedy	– Delete parameter set – Overwrite parameter set (save)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
06 I 05 I 00099 (100991075)	Parameter set incompatible	Parameter set incompatible	
		Remedy	– Delete parameter set – Overwrite parameter set (save)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
06 I 05 I 00100 (100991076)	Parameter not found	Parameter not found	
		Remedy	– Delete parameter set – Overwrite parameter set (save)
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
06 I 05 I 00101 (100991077)	Parameter read-only	Parameter read-only	
		Remedy	– Delete parameter set – Overwrite parameter set (save)
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.5709
06 I 05 I 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 I 05 I 00103 (100991079)	Parameter set: save failed	Parameter set: save failed	
		Remedy	– Repeat save process – Format file system if necessary
		Classification	Default: Warning (16)
			Can be parameterised: No

ID Dx.	Message	Description	
06 I 05 I 00103 (100991079)	Parameter set: save failed	Error memory	Default: save (1)
			Can be parameterised: Px.5713
06 I 05 I 00104 (100991080)	Parameter set: delete failed	Parameter set: delete failed	
		Remedy	– Parameter set available? – Repeat delete process – Format file system if necessary
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.5715
06 I 05 I 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 I 05 I 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 I 05 I 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 I 05 I 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 I 05 I 00290 (100991266)	Parameter set with older version	Parameter set was created with an older firmware version	
		Remedy	– Save the parameter set again
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.5781
06 I 05 I 00291 (100991267)	Parameter set with newer version	Parameter set was created with a newer firmware version	
		Remedy	– Save the parameter set again
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.5783
07 I 01 I 00109 (117506157)	Negative software end position	Negative software limit position reached	
		Remedy	– Check movement trajectory (close to end position)? – Check values for software limit positions – Check that automatic braking is enabled
		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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.4633

ID Dx.	Message	Description	
07 ǀ 01 ǀ 00110 (117506158)	Positive software end position	Positive software limit position reached	
		Remedy	– Check movement trajectory (close to end position)? – Check values for software limit positions – Check that automatic braking is enabled
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.4634, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.4635
07 ǀ 01 ǀ 00111 (117506159)	Limitation negative direction	Limitation of direction of movement owing to negative software limit position	
		Remedy	– Check task
		Classification	Default: Warning (16)
			Can be parameterised: Px.4636, value list: Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.4637
07 ǀ 01 ǀ 00112 (117506160)	Limitation positive direction	Limitation of direction of movement owing to positive software limit position	
		Remedy	– Check task
		Classification	Default: Warning (16)
			Can be parameterised: Px.4638, value list: Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.4639

<table>
<tr><th>ID Dx.</th><th>Message</th><th colspan="2">Description</th></tr>
<tr><td rowspan="6">07 | 01 | 00113 (117506161)</td><td rowspan="6">Parameterisation of software limit positions</td><td colspan="2">Parameterisation of software limit positions invalid</td></tr>
<tr><td>Remedy</td><td>– Check values for software limit positions (consistency, negative < positive end position)</td></tr>
<tr><td rowspan="2">Classification</td><td>Default: Stop category 1 (256)</td></tr>
<tr><td>Can be parameterised: No</td></tr>
<tr><td rowspan="2">Error memory</td><td>Default: save (1)</td></tr>
<tr><td>Can be parameterised: No</td></tr>
<tr><td rowspan="6">07 | 01 | 00114 (117506162)</td><td rowspan="6">Negative hardware limit switch reached</td><td colspan="2">Negative hardware limit switch reached</td></tr>
<tr><td>Remedy</td><td>– Check task</td></tr>
<tr><td rowspan="2">Classification</td><td>Default: Stop category 1 (256)</td></tr>
<tr><td>Can be parameterised: Px.101102, value list:
Stop category 0 (4096)
Stop category 1 (256)
Stop category 2 (64)
Warning (16)
Info (4)
Ignore (2)</td></tr>
<tr><td rowspan="2">Error memory</td><td>Default: save (1)</td></tr>
<tr><td>Can be parameterised: Px.101103</td></tr>
<tr><td rowspan="6">07 | 01 | 00115 (117506163)</td><td rowspan="6">Positive hardware limit switch reached</td><td colspan="2">Positive hardware limit switch reached</td></tr>
<tr><td>Remedy</td><td>– Check task</td></tr>
<tr><td rowspan="2">Classification</td><td>Default: Stop category 1 (256)</td></tr>
<tr><td>Can be parameterised: Px.101106, value list:
Stop category 0 (4096)
Stop category 1 (256)
Stop category 2 (64)
Warning (16)
Info (4)
Ignore (2)</td></tr>
<tr><td rowspan="2">Error memory</td><td>Default: save (1)</td></tr>
<tr><td>Can be parameterised: Px.101107</td></tr>
</table>

ID Dx.	Message	Description	
07 I 01 I 00116 (117506164)	Limitation by negative hardware limit switch	Limitation of direction of movement owing to negative hardware limit switch	
		Remedy	– Check task
		Classification	Default: Warning (16)
			Can be parameterised: Px.101104, value list: Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.101105
07 I 01 I 00117 (117506165)	Limitation by positive hardware limit switch	Limitation of direction of movement owing to positive hardware limit switch	
		Remedy	– Check task
		Classification	Default: Warning (16)
			Can be parameterised: Px.101108, value list: Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.101109
07 I 01 I 00118 (117506166)	Error: both hardware limit switches activated	Error: both hardware limit switches activated	
		Remedy	– Check parameterisation – Check wiring
		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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.101111

ID Dx.	Message	Description	
07 I 01 I 00119 (117506167)	Negative stroke limit reached	Negative stroke limit reached	
		Remedy	– Check task
		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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.4677
07 I 01 I 00120 (117506168)	Positive stroke limit reached	Positive stroke limit reached	
		Remedy	– Check task
		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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.4679
07 I 02 I 00121 (117571705)	Target position reached	Target position reached	
		Remedy	– none (info only)
		Classification	Default: Info (4)
			Can be parameterised: Px.4612, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.4613

ID Dx.	Message	Description	
07 | 02 | 00122 (117571706)	Target velocity reached	Target velocity reached	
		Remedy	– none (info only)
		Classification	Default: Info (4)
			Can be parameterised: Px.4614, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (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: Info (4)
			Can be parameterised: Px.4616, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (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)
		Classification	Default: Info (4)
			Can be parameterised: Px.4618, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.4619

ID Dx.	Message	Description	
07 I 02 I 00125 (117571709)	Standstill reached and within standstill window	Standstill reached and within standstill window	
		Remedy	– none (info only)
		Classification	Default: Info (4)
			Can be parameterised: Px.4620, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.4621
07 I 02 I 00126 (117571710)	Following error position	Following error position	
		Remedy	– Locate causes of following error (trace) – Check following error window
		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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.4623
07 I 02 I 00127 (117571711)	Velocity following error	Velocity following error	
		Remedy	– Locate causes of following error (trace) – Check following error window
		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) Info (4) Ignore (2)

ID Dx.	Message	Description	
07 I 02 I 00127 (117571711)	Velocity following error	Error memory	Default: save (1)
			Can be parameterised: Px.4625
07 I 02 I 00128 (117571712)	Speed too high	Speed monitoring reports speed too high	
		Remedy	– Check offset angle, commutation-angle detection failed – Check configuration of maximum velocity
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
07 I 02 I 00129 (117571713)	Out of target range	Drive has left the target range	
		Remedy	– Check target range window and recovery time – Application monitoring reasonable? Possibly deactivate monitoring
		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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.4670
07 I 02 I 00130 (117571714)	Pushback monitoring	Pushback monitoring reports error	
		Remedy	– Check recovery time – Application monitoring reasonable? Possibly deactivate monitoring
		Classifica-	Default: Info (4)
07 I 02 I 00130 (117571714)	Pushback monitoring	tion	Can be parameterised: Px.4671, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16)

ID Dx.	Message	Description	
07 I 02 I 00130 (117571714)	Pushback monitoring		Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.4672
07 I 02 I 00131 (117571715)	Residual distance too low	Residual distance too low	
		Remedy	– none (info only)
		Classification	Default: Info (4)
			Can be parameterised: Px.4686, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.4687
07 I 02 I 00132 (117571716)	Trajectory completed	Trajectory completed (setpoint value reached)	
		Remedy	– none (info only)
		Classification	Default: Info (4)
			Can be parameterised: Px.4691, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.4692
07 I 02 I 00133 (117571717)	Position difference encoder 1 to encoder 2 too large	Position difference encoder 1 to encoder 2 too large	
		Remedy	– Calibrate feed constant encoder 1 to encoder 2 – Check error threshold – Check encoder cable
		Classifica-	Default: ignore (2)

ID Dx.	Message	Description	
07 I 02 I 00133 (117571717)	Position difference encoder 1 to encoder 2 too large	tion	Can be parameterised: No
		Error memory	Default: do not save (0)
			Can be parameterised: No
07 I 03 I 00134 (117637254)	Voltage limiting active	Voltage limiting active	
		Remedy	– Reduce velocity – Reduce torque
		Classification	Default: Info (4)
			Can be parameterised: Px.52682, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.52683
07 I 03 I 00135 (117637255)	Limit for velocity or current active	A limit for the velocity or current is active	
		Remedy	– Reduce dynamic values for the motion command – Check velocity limiting parameters – Check current limitation parameters
		Classification	Default: Info (4)
			Can be parameterised: Px.52677, value list: Info (4) Invalid (0)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.52678
07 I 04 I 00136 (117702792)	Commutation finding failed	Commutation finding failed	
		Remedy	– Check encoder (valid values / connected) – For vertical axes with load: reduce load mass – Check configuration of commutation finding and current regulator according to friction
		Classifica-	Default: Stop category 0 (4096)

ID Dx.	Message	Description	
07 I 04 I 00136 (117702792)	Commutation finding failed	tion	Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
07 I 04 I 00137 (117702793)	Direction error in commutation finding	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	– Freely rotating motor shaft? – Increase current injection for commutation angle detection – Axis blocked? – Adjust dynamic values for finding the commutation angle – Check whether the direction of rotation of the encoder and the motor are compatible.
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
07 I 05 I 00138 (117768330)	Analogue setpoint specification limit exceeded	Limits for analogue setpoint specification exceeded	
		Remedy	– Check critical limits and scaling of setpoint values
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.9914
08 I 00 I 00139 (134217867)	Fieldbus not supported	Fieldbus not supported	
		Remedy	– Install suitable FW package for device
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
08 I 00 I 00140 (134217868)	Failure of fieldbus synchronisation signal	Failure of fieldbus synchronisation signal	
		Remedy	– Check wiring – Check controller 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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.802
08 I 00 I 00243 (134217971)	Invalid cycle time	Cycle time is not an integral multiple of 1 ms	
		Remedy	– Check that cycle time is an integral multiple of 1 ms
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
08 I 03 I 00141 (134414477)	The process data is invalid	The process data is invalid	
		Remedy	– Check process data mapping
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
08 I 03 I 00373 (134414709)	Failure of fieldbus synchronisation signal	The maximum number of failed synchronization signals was exceeded.	
		Remedy	– Check wiring – Check controller configuration
		Classifica-	Default: Stop category 1 (256)

ID Dx.	Message	Description	
08 I 03 I 00373 (134414709)	Failure of fieldbus synchronisation signal	tion	Can be parameterised: Px.54545, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.54546
08 I 03 I 00391 (134414727)	PROFINET process data communication failed	PROFINET process data communication failed	
		Remedy	– Check PROFINET communication (plug, master) etc...
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
08 I 04 I 00142 (134480014)	EtherCAT process data invalid	Parameterisation of process data invalid	
		Remedy	– Check parameterisation of EtherCAT communication
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
08 I 04 I 00143 (134480015)	EtherCAT process data communication failed	EtherCAT process data communication failed	
		Remedy	– Check EtherCAT communication (plug, master), etc.
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
08 I 04 I 00281 (134480153)	Process data not received at Sync time	Process data not received at Sync time	
		Remedy	– Check interaction between process data and sync time in open-loop control
		Classification	Default: Stop category 1 (256)
			Can be parameterised: Px.758, value list: Stop category 0 (4096) Stop category 1a (1024) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2) internal (1) Invalid (0)
		Error memory	Default: save (1)
			Can be parameterised: Px.759
08 I 09 I 00144 (134807696)	Required application class not supported	The required application class is not supported	
		Remedy	– Only request 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 I 09 I 00145 (134807697)	The required telegram is not supported	The required telegram is not supported	
		Remedy	– Only request 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 I 09 I 00288 (134807840)	PROFIdrive test error message 1	PROFIdrive test error message 1	
		Remedy	– Retract test error message by PNU
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No

ID Dx.	Message	Description	
08 I 09 I 00288 (134807840)	PROFIdrive test error message 1	Error memory	Default: save (1)
			Can be parameterised: No
08 I 09 I 00289 (134807841)	PROFIdrive test error message 2	PROFIdrive test error message 2	
		Remedy	– Retract test error message by PNU
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
08 I 09 I 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)
			Can be parameterised: Px.11280117, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.11280118
08 I 09 I 00299 (134807851)	Error life sign	The number of failed life sign 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 capacity utilization
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error	Default: save (1)

ID Dx.	Message	Description	
08 I 09 I 00299 (134807851)	Error life sign	memory	Can be parameterised: No
08 I 09 I 00382 (134807934)	Invalid configuration Extended process data	The extended process data are configured invalid.	
		Remedy	– Check expanded process data mapping
		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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.424202
08 I 12 I 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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.12237
08 I 12 I 00272 (135004432)	Resolution of position factor group invalid	The resolution of the position factor group is invalid	
		Remedy	– Adjust position factor group parameterisation
		Classifica-	Default: Warning (16)
08 I 12 I 00272 (135004432)	Resolution of position factor group invalid	tion	Can be parameterised: Px.45, value list: Stop category 0 (4096) Stop category 1a (1024) Stop category 1 (256) Stop category 2 (64) Warning (16)

ID Dx.	Message	Description	
08 I 12 I 00272 (135004432)	Resolution of position factor group invalid		Info (4) Ignore (2) internal (1) Invalid (0)
		Error memory	Default: save (1)
			Can be parameterised: Px.46
08 I 13 I 00394 (135070090)	The process data is invalid	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 I 13 I 00395 (135070091)	The required telegram is not supported	The required telegram is not supported	
		Remedy	– Only request 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
09 I 00 I 00146 (150995090)	Safety function requested	Safety function requested	
		Remedy	– none (info only)
		Classification	Default: Info (4)
			Can be parameterised: Px.821, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: do not save (0)
			Can be parameterised: Px.822

ID Dx.	Message	Description	
09 I 00 I 00147 (150995091)	Plausibility check of safety feedback signals	Error during plausibility check of safety feedback signals	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
09 I 01 I 00148 (151060628)	STO: Discrepancy time exceeded	Discrepancy time for #STO-A/B exceeded	
		Remedy	– Check timing of STO input signals – Check configuration of discrepancy time
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
09 I 01 I 00149 (151060629)	Plausibility check #STO-A/B	Plausibility check of #STO-A/B input	
		Remedy	– Restart – Return device
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
09 I 01 I 00150 (151060630)	Sequence monitoring #STO-A/B	Sequence monitoring, #STO-A/B inputs	
		Remedy	– Check timing and sequence of STO input signals
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
09 I 02 I 00151 (151126167)	Plausibility check #SBC-A/B	Plausibility check of #SBC-A/B input effective	
		Remedy	– Restart – Return device
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No

ID Dx.	Message	Description	
09 I 02 I 00151 (151126167)	Plausibility check #SBC-A/B	Error memory	Default: save (1)
			Can be parameterised: No
09 I 02 I 00152 (151126168)	SBC: Discrepancy time exceeded	Discrepancy time for #SBC-A/B exceeded	
		Remedy	– Check timing of SBC input signals – Check configuration of discrepancy time
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
10 I 01 I 00153 (167837849)	RTE module cannot be reached	RTE module cannot be reached	
		Remedy	– Restart – Conduct firmware update – Service required
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
10 I 01 I 00154 (167837850)	RTE module initialisation failed	RTE module initialisation failed	
		Remedy	– Restart – Conduct firmware update – Service required
		Classification	Default: Stop category 2 (64)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
10 I 01 I 00156 (167837852)	Common error power output stage	Error power output stage	
		Remedy	– Restart – Return device
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
10 ǀ 01 ǀ 00249 (167837945)	Watchdog error communication module	Monitoring function for the communication module has reported an error	
		Remedy	– Restart – Conduct firmware update – Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 ǀ 01 ǀ 00159 (184615071)	Data directory memory full	Data directory memory full	
		Remedy	– Conduct firmware update – Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 ǀ 01 ǀ 00160 (184615072)	Data directory indexed twice	Data directory indexed twice	
		Remedy	– Conduct firmware update – Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 ǀ 01 ǀ 00161 (184615073)	Overflow diagnostic register	Overflow in diagnostic register, messages not currently acknowledged	
		Remedy	– Acknowledge messages – Eliminate causes of currently active messages
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
11 I 01 I 00162 (184615074)	Overflow buffer diagnostic register	Overflow buffer in diagnostic register, messages currently not acknowledged	
		Remedy	– Acknowledge messages – Eliminate causes of currently active messages
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 01 I 00163 (184615075)	User unit error	An error has occurred when changing the user unit	
		Remedy	– Run reinitialisation again
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.11590
11 I 01 I 00244 (184615156)	Communication module supply voltage	The supply voltage to the communication module dropped	
		Remedy	– Checking the power supply – Restart device
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 02 I 00164 (184680612)	Process runtime exceeded	Process runtime exceeded	
		Remedy	– internal error, service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 02 I 00165 (184680613)	Timeout process level 0	Timeout has occurred in process level 0	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No

ID Dx.	Message	Description	
11 I 02 I 00165 (184680613)	Timeout process level 0	Error memory	Default: save (1)
			Can be parameterised: No
11 I 02 I 00166 (184680614)	Timeout process level 1	Timeout has occurred in process level 1	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 02 I 00167 (184680615)	Timeout process level 2	Timeout has occurred in process level 2	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 02 I 00168 (184680616)	Timeout process level 3	Timeout has occurred in process level 3	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 02 I 00169 (184680617)	Timeout process level 4	Timeout has occurred in process level 4	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 02 I 00170 (184680618)	Timeout process level 5	Timeout has occurred in process level 5	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error	Default: save (1)

ID Dx.	Message	Description	
11 I 02 I 00170 (184680618)	Timeout process level 5	memory	Can be parameterised: No
11 I 02 I 00171 (184680619)	Timeout process level 6	Timeout has occurred in process level 6	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 02 I 00172 (184680620)	Timeout process level 7	Timeout has occurred in process level 7	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 03 I 00173 (184746157)	File system faulty	File system faulty	
		Remedy	– Service required – Reformat file system
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 03 I 00174 (184746158)	File: user file (backup) invalid	The user file backup file is invalid	
		Remedy	– Restart device
		Classification	Default: Info (4)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 03 I 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 required
		Classification	Default: Info (4)
			Can be parameterised: No

ID Dx.	Message	Description	
11 I 03 I 00175 (184746159)	Creation of user file (backup) not possible	Error memory	Default: save (1)
			Can be parameterised: No
11 I 03 I 00176 (184746160)	CRC error in user file	A CRC error was detected in the user file	
		Remedy	– Restart device – Service required
		Classification	Default: Info (4)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 03 I 00177 (184746161)	File: user file invalid	The user file is invalid	
		Remedy	– Restart device
		Classification	Default: Info (4)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 03 I 00178 (184746162)	New user file has been created	A new user file has been generated	
		Remedy	– Information
		Classification	Default: Info (4)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 03 I 00179 (184746163)	Writing to user file not possible	It was not possible to write to the user file	
		Remedy	– Restart device – Service required
		Classification	Default: Info (4)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
11 I 03 I 00180 (184746164)	Unknown user file error	An unknown error was triggered for the user file	
		Remedy	– Restart device – Service required
		Classifica-tion	Default: Info (4)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 04 I 00181 (184811701)	Writing of firmware failed	Writing of firmware failed	
		Remedy	– Repeat transmission of firmware package
		Classifica-tion	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.9601
11 I 04 I 00182 (184811702)	Reading of firmware failed	Reading of firmware failed	
		Remedy	– Read out firmware package again
		Classifica-tion	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.9603
11 I 04 I 00183 (184811703)	Firmware invalid	Firmware invalid	
		Remedy	– Repeat transmission of firmware package
		Classifica-tion	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.9605
11 I 04 I 00184 (184811704)	Firmware incompat-ible	Firmware incompatible	
		Remedy	– Check hardware and firmware versions
		Classifica-tion	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.9607

ID Dx.	Message	Description	
11 I 04 I 00185 (184811705)	Firmware save location invalid	Firmware save location invalid	
		Remedy	– Check storage location
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.9609
11 I 04 I 00186 (184811706)	Firmware storage location empty	Firmware storage location empty	
		Remedy	– Check storage location
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.9611
11 I 04 I 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 I 04 I 00188 (184811708)	Firmware package in use	Firmware package in use	
		Remedy	– Repeat firmware download
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.9615
11 I 04 I 00189 (184811709)	System error during firmware update	System error occurred during firmware update	
		Remedy	– Restart firmware update – Service required
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
11 I 04 I 00190 (184811710)	Firmware update failed	Firmware update failed	
		Remedy	– Restart firmware update
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 05 I 00191 (184877247)	Safety calibration data incorrect	Safety calibration data incorrect	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 05 I 00192 (184877248)	Device data incorrect	Device data incorrect	
		Remedy	– Conduct firmware update
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 05 I 00193 (184877249)	Device data incorrect: Control unit	Device data incorrect: Control unit	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 05 I 00194 (184877250)	Device data incorrect: Communication unit	Device data incorrect: Communication unit	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
11 I 05 I 00195 (184877251)	Device data incorrect: Safety	Device data incorrect: Safety	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 05 I 00196 (184877252)	Calibration data incorrect: Control unit	Calibration data incorrect: Control unit	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 05 I 00197 (184877253)	Calibration data incorrect: Power unit	Calibration data incorrect: Power unit	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 05 I 00198 (184877254)	Device data incorrect: Power unit	Device data incorrect: Power unit	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 I 05 I 00200 (184877256)	Current sensor calibration invalid	Current sensor calibration invalid	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
11 ǀ 05 ǀ 00201 (184877257)	Device not configured	Device not configured	
		Remedy	– If data is missing in the encoder: restart the device – Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 ǀ 05 ǀ 00202 (184877258)	Device data: Saving failed	Device data: Saving failed	
		Remedy	– Restart device – If repeated, return for service
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.5719
11 ǀ 06 ǀ 00203 (184942795)	Answer to a read request is missing in LibRTE	Answer to a read request is missing in LibRTE	
		Remedy	– Restart device – If repeated, return for service
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 ǀ 06 ǀ 00285 (184942877)	Error in the communication module mailbox	Internal software timeout during LibRTE communication	
		Remedy	– Restart device – If repeated, return for service
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 ǀ 06 ǀ 00300 (184942892)	COM module fault	Error in the communication module	
		Remedy	– Restart device – If repeated, return for service
		Classifica-	Default: Stop category 1 (256)

ID Dx.	Message	Description	
11 | 06 | 00300 (184942892)	COM module fault	tion	Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
11 | 07 | 00204 (185008332)	Device initialisation failed	The initialisation of the device has failed	
		Remedy	– Check whether additional diagnostic messages are pending – Reset device to factory settings –
		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	– Revoke 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 whether additional diagnostic messages are pending – Reset device to factory settings –
		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 status	Hardware does not correspond to expected revision status	
		Remedy	– Service required
		Classification	Default: Info (4)
			Can be parameterised: No
		Error	Default: do not save (0)

ID Dx.	Message	Description	
11 | 08 | 00206 (185073870)	Hardware does not correspond to expected revision status	memory	Can be parameterised: No
11 | 08 | 00207 (185073871)	Hardware does not correspond to expected compatibility state	Hardware does not correspond to expected compatibility state	
		Remedy	– Service required
		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	– Information
		Classification	Default: Info (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	– Information
		Classification	Default: Warning (16)
			Can be parameterised: Px.1419, value list: Warning (16) Info (4) Ignore (2)
		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	– Information
		Classifica-	Default: Warning (16)

ID Dx.	Message	Description	
12 I 01 I 00210 (201392338)	Mileage error threshold reached	tion	Can be parameterised: Px.14113, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.14114
12 I 01 I 00211 (201392339)	Maximum load change value reached	The maximum value for the load change is reached	
		Remedy	– Information
		Classifica-tion	Default: Info (4)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
12 I 01 I 00212 (201392340)	Load change warning threshold reached	Threshold value 1 (default: warning threshold) for the load change is reached	
		Remedy	– Information
		Classifica-tion	Default: Warning (16)
			Can be parameterised: Px.1429, value list: Warning (16) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.14210
12 I 01 I 00213 (201392341)	Load change error threshold reached	Threshold value 2 (default: error threshold) for the load change is reached	
		Remedy	– Information
		Classifica-	Default: Warning (16)
12 I 01 I 00213 (201392341)	Load change error threshold reached	tion	Can be parameterised: Px.14213, value list: Stop category 0 (4096) Stop category 1 (256) Stop category 2 (64) Warning (16) Info (4)

ID Dx.	Message	Description	
12 ǀ 01 ǀ 00213 (201392341)	Load change error threshold reached		Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.14214
13 ǀ 01 ǀ 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 ǀ 01 ǀ 00215 (218169559)	Diagnostics log file has invalid format	Diagnostic memory invalid	
		Remedy	– Delete diagnostic memory
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.100505
13 ǀ 01 ǀ 00216 (218169560)	Loss of messages from diagnostics log	Loss of messages from diagnostics log	
		Remedy	– Delete diagnostic memory
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
13 ǀ 02 ǀ 00217 (218235097)	Auto-tuning aborted	Auto-tuning aborted	
		Remedy	– Check for any further error messages and eliminate their cause – Restart auto-tuning
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
13 I 02 I 00218 (218235098)	Auto-tuning travel inadequate or synchronization phase too short	Auto-tuning travel inadequate	
		Remedy	– Check position of slide. Too close to the end positions? – Check travel from positioning record – Check the acceleration and braking ramps, if required increase the maximum acceleration and deceleration for the auto-tuning so that the acceleration and braking phases become shorter
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
13 I 02 I 00219 (218235099)	Auto-tuning controller parameters invalid	The auto-tuning function could not identify any controller parameters	
		Remedy	– Restart auto-tuning with amended noise intensity parameters P1.8616.0.0 – Start auto-tuning with motion P1.8619.0.0 – Evaluate frequency response analysis
		Classification	Default: Stop category 1 (256)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
13 I 02 I 00220 (218235100)	Transmission of auto-tuning measured values failed	Transmission of auto-tuning measured values failed	
		Remedy	– Check whether there is a connection – Restart transmission
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: Px.8605
17 I 01 I 00224 (285278432)	Login completed	Login to access the device at a specific authorisation level has been completed.	
		Remedy	– none (info)
		Classifica-	Default: Info (4)

ID Dx.	Message	Description	
17 I 01 I 00224 (285278432)	Login completed	tion	Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
17 I 01 I 00225 (285278433)	Logout completed	Logout of the device at a specific authorisation level has been completed.	
		Remedy	– none (info)
		Classification	Default: Info (4)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
17 I 01 I 00226 (285278434)	Login error	An error occurred during user login	
		Remedy	– Check password
		Classification	Default: Info (4)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
18 I 00 I 00092 (301989980)	Motor change detected, commutation angle invalid	Motor change detected, commutation angle invalid	
		Remedy	– Run commutation-angle detection and homing and save
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
18 I 00 I 00093 (301989981)	Motor change detected, zero point offset invalid	Motor change detected, zero point offset invalid	
		Remedy	– Carry out homing again and save
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

ID Dx.	Message	Description	
18 | 00 | 00094 (301989982)	Commutation angle in encoder invalid	Commutation angle in encoder invalid	
		Remedy	– Run commutation-angle detection
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
18 | 00 | 00095 (301989983)	Encoder type plate invalid	Encoder type plate invalid	
		Remedy	– Service required
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
18 | 00 | 00096 (301989984)	Encoder type plate (user-defined) invalid	Encoder type plate (user-defined) invalid	
		Remedy	– Complete new configuration using the commissioning tool
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			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 fault	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

ID Dx.	Message	Description	
18 I 03 I 00235 (302186731)	Incremental encoder analysis invalid	Common error quadrature encoder	
		Remedy	– Check encoder cable – Restart device
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
18 I 03 I 00301 (302186797)	Number of increments between two zero pulses invalid	Incorrect zero pulse or incorrect number of increments per revolution	
		Remedy	– Check encoder cable – Check encoder
		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) Info (4) Ignore (2)
		Error memory	Default: save (1)
			Can be parameterised: Px.10060
18 I 05 I 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 device
		Classification	Default: Stop category 0 (4096)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
18 I 07 I 00365 (302449005)	Invalid request Gn_STW1.4...7	Invalid request for the control word Gn_STW1.4...7, bits are reserved.	
		Remedy	– Control word Check PROFIdrive encoder
		Classification	Default: Warning (16)
			Can be parameterised: No

ID Dx.	Message	Description	
18 I 07 I 00365 (302449005)	Invalid request Gn_STW1.4...7	Error memory	Default: save (1)
			Can be parameterised: No
18 I 07 I 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 I 07 I 00367 (302449007)	Axis parking not possible	Axis parking request cannot be executed because the axis is moving.	
		Remedy	– Revoke controller enable before parking
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
18 I 07 I 00368 (302449008)	Error reference marks for 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 I 07 I 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

ID Dx.	Message	Description	
18 I 07 I 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 I 07 I 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.	
		Remedy	– Control word Check PROFIdrive encoder
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No
18 I 07 I 00372 (302449012)	Error transfer absolute position to Gn_XIST2	Error when transferring the absolute position to Gn_XIST2.	
		Remedy	– Control word Check PROFIdrive encoder – Using absolute encoders
		Classification	Default: Warning (16)
			Can be parameterised: No
		Error memory	Default: save (1)
			Can be parameterised: No

Tab. 563 Diagnostic Messages

9.5 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. Various 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. By saving the parameter set, the measuring data configuration is saved in the parameter directory of the device. The device then waits for a trigger event and records the data independently. Once a connection has been established with the plug-in, there is an option to read out the data. 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 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 period of time just before and just after the error has occurred are important for the diagnostics.

Tab. 564 Trigger types

After a recording has started, the measuring data is recorded in the trace memory (ring memory). When the trigger event occurs, the measuring data is not retained on the device upon expiry of the recording. The data is lost when a new recording is started and when the power supply is switched off.

Parameter

ID Px.	Parameter	Description	
5500	Trace channel	Determines 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. 565 Parameter

Example

The following measured values of axis 1 should be recorded at the same time:
- Storage option in error log (P1.4682.0.0) to channel 0
- Actual position value (P1.128.0.0) to channel 1

Parameter settings (example)		
Parameter	Value	Comments
Selection of the axis ID trace data: Axis 1		
P0.5501.0.0	1	Channel 0: Axis 1
P0.5501.0.1	1	Channel 1: Axis 1
Selection of the data ID trace data		
P0.5502.0.0	4682	Channel 0, current position: following error
P0.5502.0.1	128	Channel 1, actual position value

Parameter settings (example)		
Selection of the data instance ID trace data		
P0.5503.0.0	0	Instance = 0
P0.5503.0.1	0	Instance = 0
Selection of the array ID trace data		
5504.0.0	0	ArrayID = 0
5504.0.1	0	ArrayID = 0
Selection of the trace channels		
5500.0.0	1	Activate trace channel 0
5500.0.1	1	Activate trace channel 1

Tab. 566 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.	

ID Px.	Parameter	Description	
557	Trace delay	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. 567 Parameter

Example

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)		
Parameter	Value	Comments
Selection of the trigger type		
P0.341.0.0	1	Data trigger
Selection of recording delay in the samples		
P0.557.0.0	5000	Number of samples before the trigger (5000 * 0.0001 s = 0.5 s)
Selection of down sampling factor		
P0.559.0.0	2	Sampling interval should be 100 µs (2 * base time per sample)

Tab. 568 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	–

<table>
<tr><th>ID Px.</th><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">6004</td><td rowspan="4">Trigger event</td><td colspan="2">Specifies the trigger event.
The following is possible:
– 0 = Trailing 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, the value change triggers the trigger.
– 4 = Comparison (value is the same)</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>–</td></tr>
<tr><td rowspan="4">60012</td><td rowspan="4">Trigger level</td><td colspan="2">Specifies the trigger level value. The value is applied as the active trigger level at the start of the recording (Px.6013).</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>–</td></tr>
<tr><td rowspan="4">60013</td><td rowspan="4">Bit mask data trigger</td><td colspan="2">Bit mask for data trigger AND link</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>–</td></tr>
</table>

Tab. 569 Parameter

Example data trigger, threshold value exceeded

The recording should be started when the value of the following parameter exceeds 0.5 user units:

– Setpoint value speed controller (ID P1.2216.0.0)

Parameter settings (example)		
Parameter	Value	Value
Selection of the axis ID data trigger		
P0.6000.0.0	1	1 = Axis 1
Selection of the data ID data trigger		
P0.6001.0.0	2216	"Setpoint value speed controller" parameter as trigger signal
Selection of the data instance ID data trigger		
P0.6002.0.0	0	Instance 0
Selection of the array ID data trigger		
P0.6003.0.0	0	Array ID = 0
Selection of the trigger event configuration		
P0.6004.0.0	1	1 = Rising edge (exceeding the threshold value in a positive direction)
Selection of the trigger level		
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. 570 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 status (MCMotion complete) is signaled via bit 24 of the motion monitoring status word (parameter Px.460).
– Motion complete (ID Px.460.0.0, bit 24)

Parameter settings (example)		
Parameter	Value	Value
Selection of the axis ID data trigger		
P0.6000.0.0	1	1 = Axis 1
Selection of the data ID data trigger		
P0.6001.0.0	460	Parameter "Status of movement monitoring" as trigger signal
Selection of the data instance ID data trigger		
P0.6002.0.0	0	Instance 0

Parameter settings (example)		
Selection of the array ID data trigger		
P0.6003.0.0	0	Array ID = 0
Selection of the trigger event configuration		
P0.6004.0.0	1	1 = Rising edge
Selection of the trigger level		
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. 571 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.	
		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	Current axis ID diagnostic trace	Specifies the current axis ID of the current recording.	
		Access	read/–
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
103104	Current diagnostics ID diagnostic trace	Specifies the current diagnostics ID of the current recording.	
		Access	read/–
		Update	effective immediately
		Unit	–
103105	Current data instance ID diagnostic trace	Specifies the current 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	Current diagnostics trigger	Specifies the currently 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. 572 Parameter

Diagnostics trigger example

The recording should be started when the following diagnostic event occurs for axis 0:

– Following error position (Dx.117571710)

Parameter settings (example)		
Parameter	Value	Value
Selection of the axis ID diagnostic trace		
P0.103100.0.0	1	Axis 1
Selection of the diagnostics ID diagnostic trace		

Parameter settings (example)		
P0.103101.0.0	117571710	Diagnostic event following error position
Selection of the data instance ID diagnostic trace		
P0.103102.0.0	0	Instance 0
Selection of diagnostics trigger		
P0.103106.0.0	0	0 = Trigger the message

Tab. 573 Parameter settings (example)

Diagnostic messages

No specific diagnostic messages are allocated to the function.

9.5.1 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	BOOL
5501	0x2208.01 ... 08	Axis ID trace data	UINT16
5502	0x2209.01 ... 08	Data ID trace data	UINT32
5503	0x220A.01 ... 08	Data instance ID trace data	UINT16
5504	0x220B.01 ... 08	Array ID trace data	UINT16

Tab. 574 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	UINT32
556	0x2117.01	Data trace status	UINT32
557	0x2117.02	Trace delay	SINT32
558	0x2117.03	Recording length	UINT32
559	0x2117.04	Down sampling factor	UINT32
5516	0x2117.08	Maximum recording length	UINT32
5517	0x2117.09	Basic sampling interval	FLOAT32

Tab. 575 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	UINT16
6001	0x211B.02	Data ID data trigger	UINT32
6002	0x211B.03	Data instance ID data trigger	UINT16
6003	0x211B.04	Array ID data trigger	UINT16
6004	0x211B.05	Trigger event	UINT32
60012	0x211B.0C	Trigger level	SINT64
60013	0x211B.0D	Bit mask data trigger	UINT64

Tab. 576 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	UINT16
103101	0x2142.02	Diagnostics ID diagnostic trace	UINT32
103102	0x2142.03	Data instance ID diagnostic trace	UINT16
103103	0x2142.04	Current axis ID diagnostic trace	UINT16
103104	0x2142.05	Current diagnostics ID diagnostic trace	UINT32
103105	0x2142.06	Current data instance ID diagnostic trace	UINT16
103106	0x2142.07	Diagnostics trigger	UINT32
103107	0x2142.08	Current diagnostics trigger	UINT32

Tab. 577 Objects

9.5.2 PROFIdrive

Channel configuration PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
5500	2578.0 ... 7	Trace channel	Boolean
5501	2579.0 ... 7	Axis ID trace data	Unsigned16
5502	2580.0 ... 7	Data ID trace data	Unsigned32

Parameter	PNU	Name	Data type
5503	2581.0 ... 7	Data instance ID trace data	Unsigned16
5504	2582.0 ... 7	Array ID trace data	Unsigned16

Tab. 578 PNUs

Trace and trigger configuration PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
341	2114.0	Trigger type	Unsigned32
556	2173.0	Data trace status	Unsigned32
557	2174.0	Trace delay	Integer32
558	2175.0	Recording length	Unsigned32
559	2176.0	Down sampling factor	Unsigned32
5516	2591.0	Maximum recording length	Unsigned32
5517	2592.0	Basic sampling interval	FloatingPoint

Tab. 579 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	Unsigned16
6001	2647.0	Data ID data trigger	Unsigned32
6002	2648.0	Data instance ID data trigger	Unsigned16
6003	2649.0	Array ID data trigger	Unsigned16
6004	2650.0	Trigger event	Unsigned32
60012	3071.0	Trigger level	Integer64
60013	3072.0	Bit mask data trigger	Unsigned64

Tab. 580 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	Unsigned16
103101	3141.0	Diagnostics ID diagnostic trace	Unsigned32

Parameter	PNU	Name	Data type
103102	3142.0	Data instance ID diagnostic trace	Unsigned16
103103	3143.0	Current axis ID diagnostic trace	Unsigned16
103104	3144.0	Current diagnostics ID diagnostic trace	Unsigned32
103105	3145.0	Current data instance ID diagnostic trace	Unsigned16
103106	3146.0	Diagnostics trigger	Unsigned32
103107	3147.0	Current diagnostics trigger	Unsigned32

Tab. 581 PNUs

9.6 Condition monitoring

The condition monitoring function records the following data of the servo drive and axis over the entire service life:

– Mileage of the drive
– Drive load change
– Number servo drive operating hours

The data is 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.

9.6.1 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 current 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

ID Px.	Parameter	Description	
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. 582 Parameter

ID Dx.	Name	Description
12 l 01 l 00208 (201392336)	Maximum mileage value reached	Maximum value for the mileage is reached
12 l 01 l 00209 (201392337)	Mileage warning threshold reached	Threshold value 1 (default: warning threshold) for the mileage is reached
12 l 01 l 00210 (201392338)	Mileage error threshold reached	Threshold value 2 (default: error threshold) for the mileage is reached

Tab. 583 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)		
Parameter	Value	Comments
Mileage		
P1.1411.0.0	0	Mileage of axis 1 in user units
Warning threshold for mileage recording		
P1.1417.0.0	90000000	Mileage warning threshold axis 1
Error threshold for mileage recording		
P1.14111.0.0	100000000	Mileage error threshold axis 1

Tab. 584 Parameter settings (example)

9.6.1.1 CiA 402

Mileage counter objects

Parameter	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
1411	0x2184.01	Mileage 1	SINT64
1417	0x2184.05	Mileage warning threshold	SINT64
14111	0x2184.08	Mileage error threshold	SINT64

Tab. 585 Objects

9.6.1.2 PROFIdrive

Mileage counter PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1411	11339.0	Mileage 1	Integer64
1417	11343.0	Mileage warning threshold	Integer64
14111	11844.0	Mileage error threshold	Integer64

Tab. 586 PNUs

9.6.2 Load change counter

The load change counter records how many 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

<table>
<tr><th>ID Px.</th><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">1421</td><td rowspan="4">Load change counter 1</td><td colspan="2">Specifies the current number of load changes for the corres-ponding axis.</td></tr>
<tr><td>Access</td><td>read/write</td></tr>
<tr><td>Update</td><td>effective immediately</td></tr>
<tr><td>Unit</td><td>–</td></tr>
</table>

ID Px.	Parameter	Description	
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.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 587 Parameter

ID Dx.	Name	Description
12 l 01 l 00211 (201392339)	Maximum load change value reached	The maximum value for the load change is reached
12 l 01 l 00212 (201392340)	Load change warning threshold reached	Threshold value 1 (default: warning threshold) for the load change is reached
12 l 01 l 00213 (201392341)	Load change error threshold reached	Threshold value 2 (default: error threshold) for the load change is reached

Tab. 588 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)		
Parameter	Value	Comments
Load change		
P1.1421.0.0	0	Rest 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. 589 Parameter settings (example)

9.6.2.1 CiA402

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	SINT64
1427	0x2185.05	Warning threshold load change counter	SINT64
14211	0x2185.08	Error threshold load change counter	SINT64

Tab. 590 Objects

9.6.2.2 PROFIdrive

Load change counter PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1421	11345.0	Load change counter 1	Integer64
1427	11349.0	Warning threshold load change counter	Integer64
14211	11848.0	Error threshold load change counter	Integer64

Tab. 591 PNUs

9.6.3 Operating hour counter

The operating hour counter records how long the 24 V logic supply of the servo drive was switched on.

Parameters and diagnostic messages

ID Px.	Parameters	Description	
1423	Operating hour counter	Specifies the number servo drive operating hours.	
		Access	read/–
		Update	effective immediately
		Unit	s

Tab. 592 Parameters

Example

The operating hours counter should be read.

Parameter settings (example)		
Parameters	Value	Comment
Operating hour counter		

Parameter settings (example)		
P0.1423.0.0	...	Number servo drive operating hours

Tab. 593 Parameter settings (example)

Diagnostic messages
No specific diagnostic messages are allocated to the function.

9.6.3.1 CiA402

Operating hour counter objects

Parameters	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	FLOAT32

Tab. 594 Objects

9.6.3.2 PROFIdrive

Operating hour counter PNUs

Parameters	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1423	2318.0	Operating hour counter	FloatingPoint

Tab. 595 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 is prevented via web server, the web server can be deactivated with the parameter Px.11280051. 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 via 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.

Call the web server

1. Open the Internet browser.
2. Enter the IP address of the device in the address line of the Internet browser.
   ↳ Then the website of the device appears.

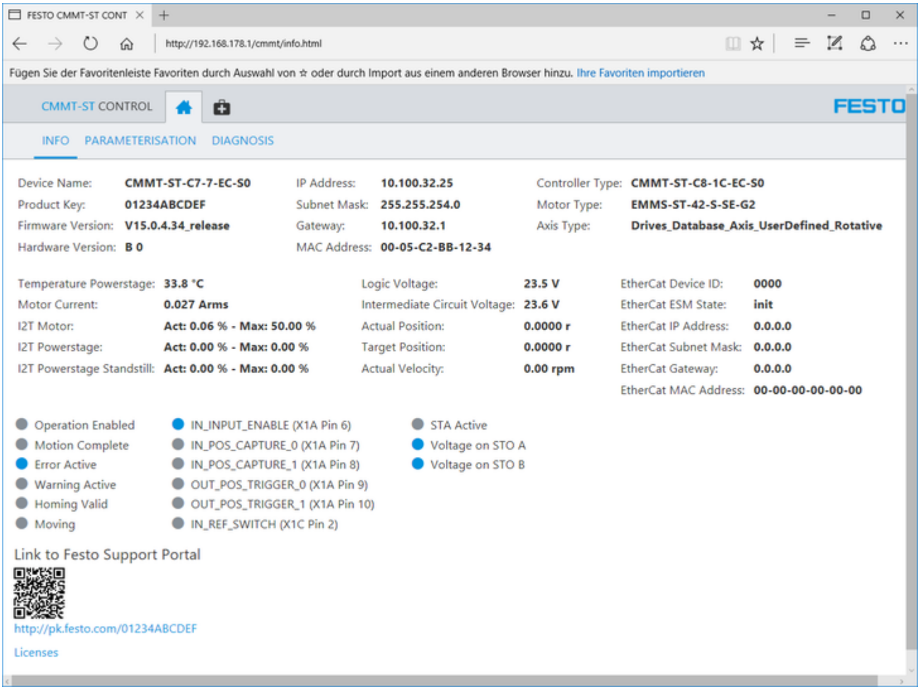

Fig. 103 Website of the web server

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 measurement values (e. g. temperature of output stage, logic power supply, current position of drive) – Signal statuses of digital inputs and outputs, active signals are marked with a blue dot. Inactive signals are marked with a grey dot.

Register	Description
Parametersation	Offers the following commands: – Commands to set the IP configuration – Activation of identification sequence (for visual identification of the device in a network) – Upload and download of firmware – 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. 596 Register of the website of the web server

Parameter

ID Px.	Parameter	Description	
11280051	Web server activation	Activation of the web server – 0: inactive – 1: active	
		Access	read/write
		Update	restart
		Unit	–

Tab. 597 Parameter

10.2 CiA 402

Web server objects

Parameter	Index.Subindex	Name	Data type
Px.	**Manufacturer-specific objects: saved basic unit for the object is effective.**		
11280051	0x21A4.01	Web server activation	BOOL

Tab. 598 Objects

10.3 PROFIdrive

Web server PNUs

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
11280051	3371.0	Web server activation	Boolean

Tab. 599 PNUs

11 EtherCAT

11.1 General

This part of the documentation describes the implemented standards and the communications of the CMMT in an EtherCAT network. It is targeted at 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).
The firmware package includes an ESI file and it is also available as a separate file in the support portal ➔ www.festo.com/sp.

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:

For additional information on the user organisation "EtherCAT Technology Group (ETG)"
➔ www.ethercat.org

EtherCAT implementation

The EtherCAT implementation of the CMMT is based on the following standards:

ETG Draft Standard		Version	Edition
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. 600 EtherCAT implementation

11.3 EtherCAT communication

11.3.1 Overview of EtherCAT communication and synchronisation

The graph illustrates EtherCAT communication and synchronisation of the CMMT with other network devices (e.g. controller (Controller) and Clock Master) a the advanced "CANopen over EtherCAT (CoE)" and "Ethernet over EtherCAT (EoE)" protocols.

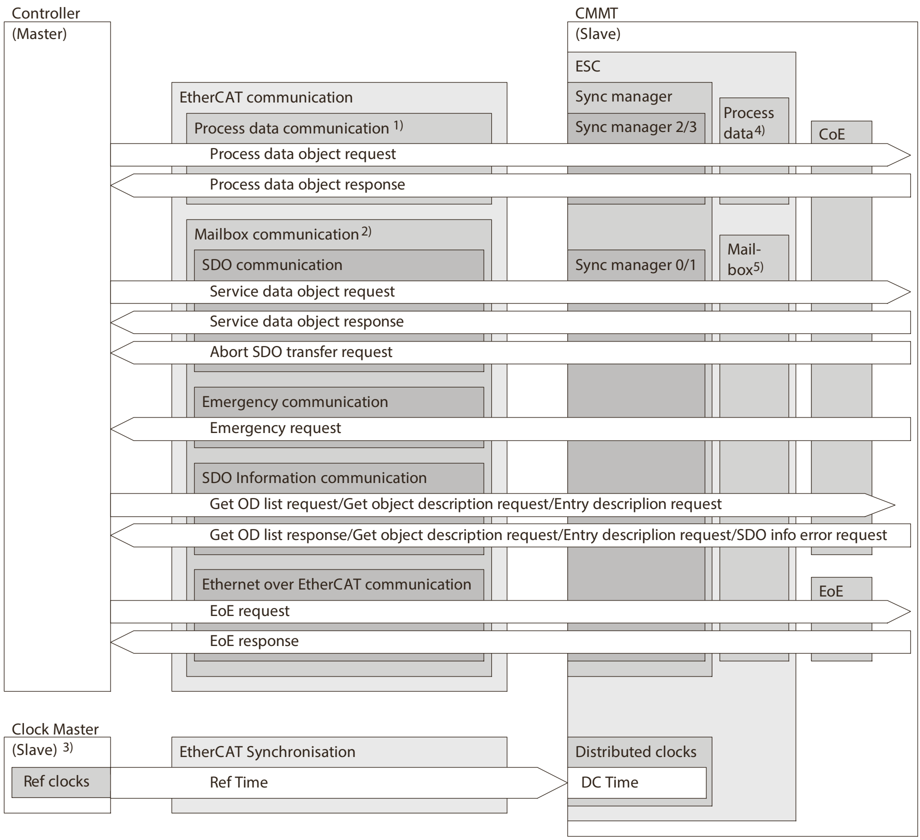

Fig. 104 Overview: EtherCAT communication and synchronisation

1) cyclical transmission

2) acyclical transmission

3) first DC-capable slave in the EtherCAT network

4) internal memory for process data

5) internal memory for mailbox data

EtherCAT communication and synchronisation	Information
EtherCAT bus	→ 11.3.2 EtherCAT bus
Topology	→ Topology
Ports	→ Ports
Termination	→ Termination
Wiring	Description of assembly and installation for the servo drive → 1.1 Applicable documents
EtherCAT Slave Controller ESC	→ 11.3.3 EtherCAT Slave Controller ESC
Protocol (CoE/EoE)	→ 11.3.4 Protocol
Sync Manager (Sync manager)	→ 11.5 Sync Manager
Sync Manager communication (Sync manager communication)	→ 11.5.1 Sync Manager communication
Sync Manager communication type (Sync manager communication type)	→ Tab. 606 Communication type
Sync Manager 0 (Sync manager 0)	→ Communication type
Sync Manager 1 (Sync manager 1)	→ Communication type
Sync Manager 2 (Sync manager 2)	→ Communication type
Sync Manager 3 (Sync manager 3)	→ Communication type
Sync Manager 3 synchronisation	→ 11.5.2 Synchronisation
Sync Manager 2 synchronisation (Sync manager 2 synchronization)	→ 11.5.2 Synchronisation
Sync Manager 3 synchronisation (Sync manager 3 synchronization)	→ 11.5.2 Synchronisation
Distributed Clocks DC	→ 11.6 Distributed clocks DC (Distributed Clocks)
Process data communication (Process data communication)	→ 11.8 Process data communication
Process data mapping	→ 11.8.1 PDO Mapping
Object 0x1600: 1st receive PDO mapping (1st receive PDO mapping)	→ Configuring object 0x1600
Object 0x1A00: 1st send PDO mapping (1st transmit PDO mapping)	→ 11.8.1.2 Function: TxPDO1 mapping, axis 1
Mailbox communication (Mailbox communication)	→ 11.9 Mailbox Communication

EtherCAT communication and synchronisation	Information
SDO communication (SDO communication)	➔ 11.9.1 SDO Communication
SDO read command (SDO upload/Upload SDO)	➔ 11.9.1.2 SDO Read Command (SDO Upload/Upload SDO)
SDO write command (SDO download/Download SDO)	➔ 11.9.1.1 SDO Write Command (SDO Download/Download SDO)
SDO error message (Abort SDO transfer)	➔ 11.9.1.3 SDO Error Message (Abort SDO transfer request)
Emergency communication (Emergency communication)	➔ 11.9.2 Emergency Communication
SDO information communication (SDO information communication)	1)
Ethernet over EtherCAT communication (Ethernet over EtherCAT communication)	➔ 11.9.3 Ethernet over EtherCAT Communication (EoE)
File access over EtherCAT	➔ 11.9.4 File Access over EtherCAT (FoE)

1) The CMMT supports SDO information communication for the transmission of "Get OD list/Get object description/Entry description/SDO info error".

Tab. 601 Overview of EtherCAT communication and synchronisation

11.3.2 EtherCAT bus

Topology

The CMMT can be integrated into an EtherCAT network string with ring, star or line topology

Ports

The CMMT is integrated into an EtherCAT network through 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 CMMT. An open XF2 OUT port is automatically closed by the EtherCAT Slave Controller by the loopback function.

Wiring

For additional information see the description, assembly and installation of the servo drive ➔ 1.1 Applicable documents.

11.3.3 EtherCAT Slave Controller ESC

Der EtherCAT Slave Controller ESC forms the central communication unit for the CMMT for the exchange of data between the control unit and the EtherCAT devices. Via the Distributed Clock DC the

EtherCAT Slave Controller controls the cyclical synchronous processing and transmission of process data.

11.3.4 Protocol

The CMMT supports the following protocols for exchanging communication data:

Protocol	Description
CANopen over EtherCAT CoE	Data transmission in accordance with CANopen, CiA301
Ethernet over EtherCAT EoE	Data transmission in accordance with IEEE 802.3
File access over EtherCAT	File transfer according to ETG specification

Tab. 602 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. 603 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.

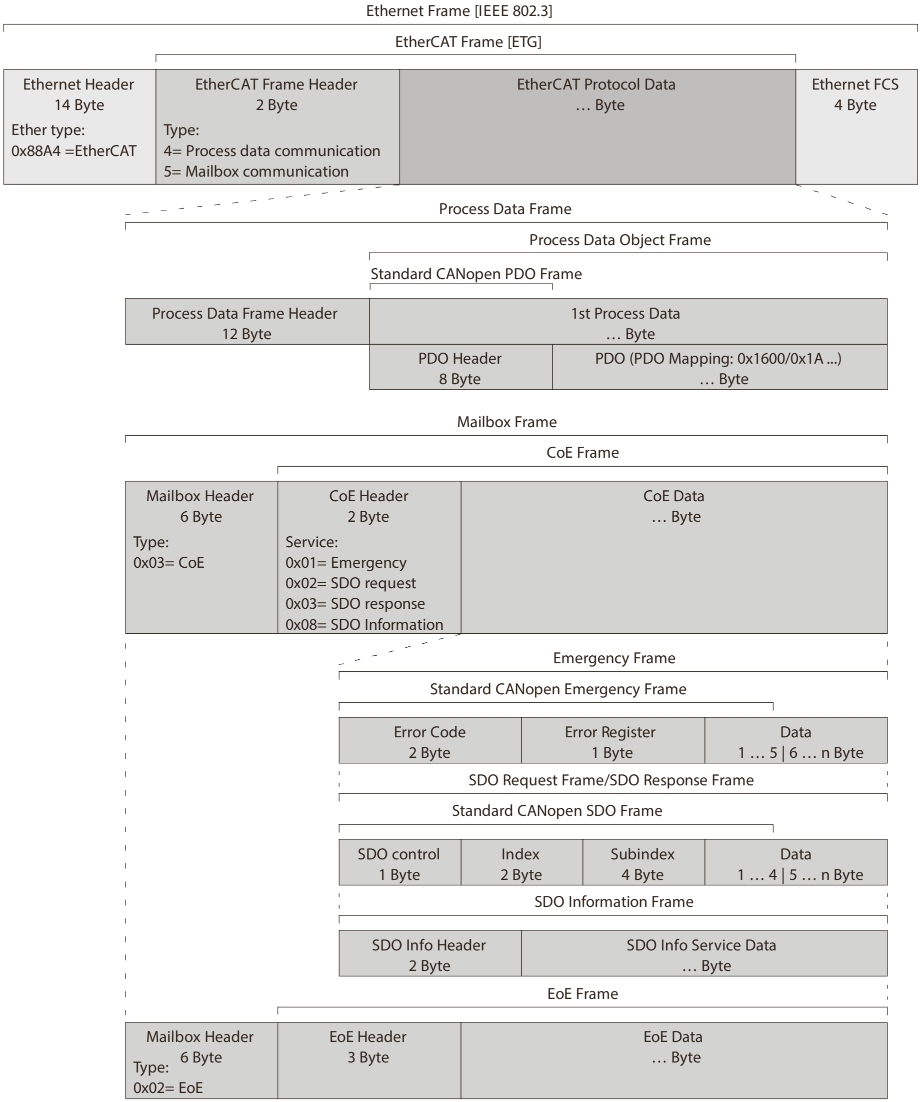

Fig. 105 Layout of the Ethernet and EtherCAT frame

11.4 EtherCAT final state machine

The EtherCAT final state machine contains all statuses needed to establish CMMT communication in an EtherCAT network. After a reboot (Power ON or Reset), the CMMT is initialized by the controller (Master). In the following sequence, communication is established for mailbox data and process data.

By enabling communication, data can be exchanged between the CMMT and the other network devices. All status transitions are controlled by the commands from the higher-order controller. The CMMT does not perform autonomous status changes.
The graph shows all statuses and status transitions of the EtherCAT finite state machine.

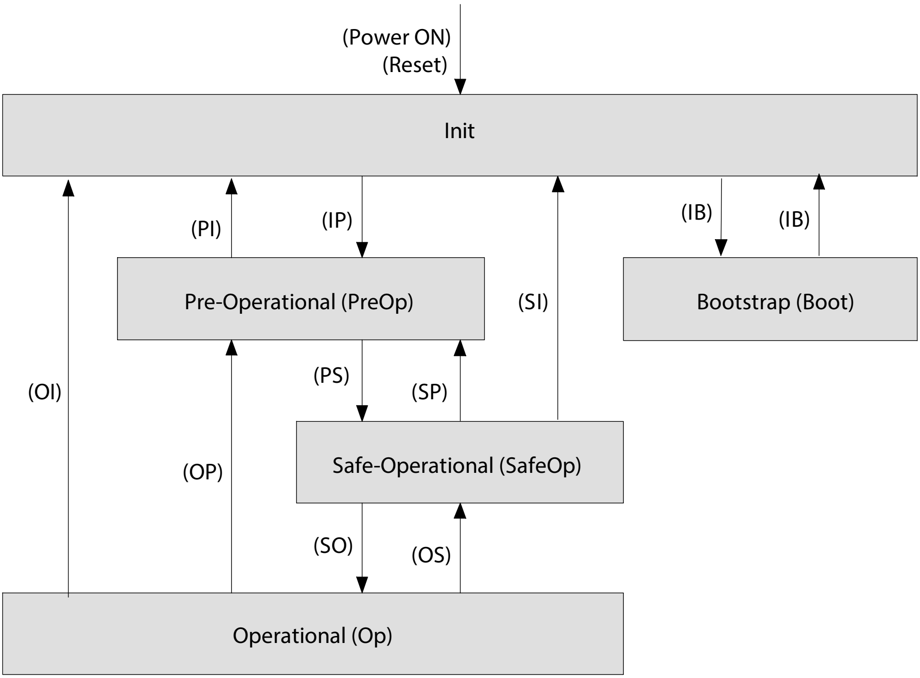

Fig. 106 EtherCAT final state machine

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.

Status	Status

Safe-Operational (SafeOp)	– acyclical mailbox communication (SDO) is possible.
	– cyclical process data communication (PDO) is possible.
	  – the controller does not transmit any setpoint values to the CMMT (RxPDO). The CMMT is in a secure condition.
	  – the CMMT 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 transmits new setpoint values to the CMMT (RxPDO). Setpoint values are processed by the CMMT.
	  – the CMMT transmits current actual values to the controller (TxPDO).

Bootstrap (Boot)	Supported in conjunction with FoE for activating the transferred files.

Tab. 604 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 CMMT was switched on, or a Reset was triggered. The CMMT 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 CMMT triggers a diagnostic message in accordance with the configured response.

Status transition	Status
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. 605 Status transitions of the EtherCAT finite state machine

11.5 Sync Manager

The sync manager supports the following functions:

– Sync Manager communication (network communication) ➔ 11.5.1 Sync Manager communication
– synchronisation (network synchronisation) ➔ 11.5.2 Synchronisation

11.5.1 Sync Manager communication

Der Sync Manager steuert die Mailbox und Prozessdaten-Kommunikation des CMMT zu den anderen Netzwerkteilnehmern (z.B. Steuerung).The Sync Manager controls the CMMT 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. 606 Communication type

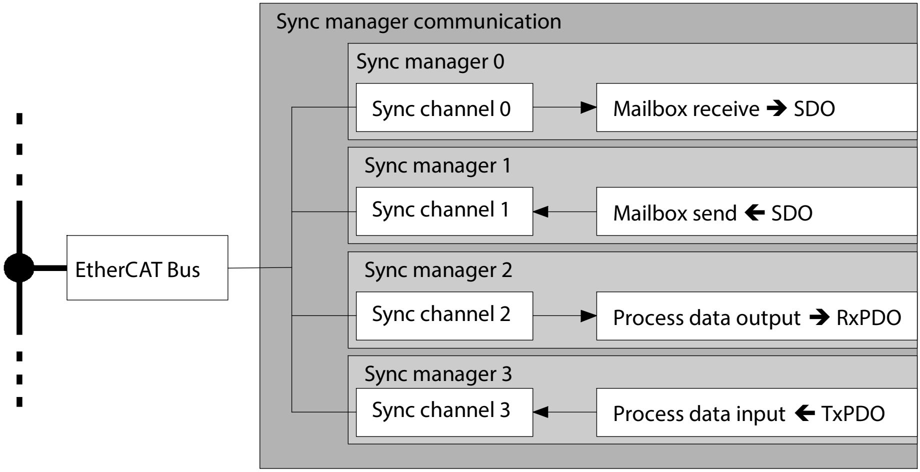

Fig. 107 Parameters and diagnostic messages

Parameters and diagnostic messages

ID Px.	Parameters	Description	
750	Sync manager communication type EtherCAT	Shows 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	Shows 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	Shows the PDO Mapping object index of the assigned PDO of the EtherCAT communication	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 607 Parameters

ID Dx.	Name	Description
08 I 04 I 00142 (134480014)	EtherCAT process data invalid	Parameterisation of process data invalid
08 I 04 I 00143 (134480015)	EtherCAT process data communication failed	EtherCAT process data communication failed

Tab. 608 Diagnostic messages

11.5.1.1 CiA 402

Sync Manager objects

Parameters	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
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
750	0x2213.01 ... 05	Sync manager communication type EtherCAT	UINT8
770	0x2124.01	Sync manager x number of assigned PDOs EtherCAT	UINT8
771	0x2215.01 ... 03	PDO mapping object index of assigned PDO EtherCAT	UINT16

Tab. 609 Objects

11.5.2 Synchronisation

Transmission and processing of cyclical process data is specified by the Sync Manager synchronisation process. The synchronisation is controlled by the Distributed Clocks DC
➔ 11.6 Distributed clocks DC (Distributed Clocks).

The CMMT supports the following synchronisation mode:

– Free Run (no synchronisation)
– Process data (synchronisation to SM2 event)
– Sync (synchronisation with DC Sync 0 event)

Timing of EtherCAT DC

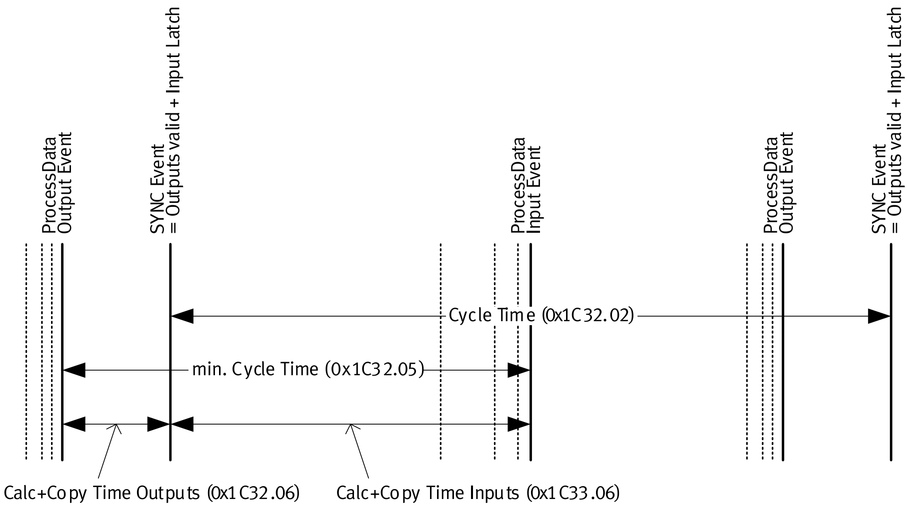

Fig. 108 Timing of EtherCAT DC

Parameters and diagnostic messages

ID Px.	Parameters	Description	
1050	Synchronisation mode	Shows 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	Shows the cycle time [ns] 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
		Update	effective immediately
		Unit	–

ID Px.	Parameters	Description	
1053	Sync mode supported	Shows 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 [l.v.] (fixed value: 1,000,000 l.v.).	
		Access	read/–
		Update	effective immediately
		Unit	–
1055	Sync Calc And Copy Time	Shows the minimum time [ns] between frame and SYNC0 event in Sync synchronisation mode.	
		Access	read/–
		Update	effective immediately
		Unit	–

1056	Sync Get Cycle Time	Shows 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 with access to the parameter Px.1056 via the plug-inn.	

		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameters	Description	
1057	Sync Delay Time	Shows 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	Shows the time [ns] between two Sync 0 events in Sync synchronisation mode.	
		Access	read/write
		Update	effective immediately
		Unit	–
1059	Sync SM Event Missed	Shows 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 with access to the parameter Px.1059 via the plug-in.	
		Access	read/–
		Update	effective immediately
		Unit	–
1060	Sync cycle time too small	Shows 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 with access to the parameter Px.1060 via the plug-in.	
		Access	read/–
		Update	effective immediately
		Unit	–
1061	Sync Error	Shows 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 with access to the parameter Px.1061 via the plug-in.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 610 Parameters

ID Dx.	Name	Description
08 I 00 I 00140 (134217868)	Failure of fieldbus synchronisation signal	Failure of fieldbus synchronisation signal
08 I 00 I 00243 (134217971)	Invalid cycle time	Cycle time is not an integral multiple of 1 ms

Tab. 611 Diagnostic messages

11.5.2.1 CiA 402

Synchronisation objects

Parameters	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

Parameters	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	UINT16
1051	0x212E.02	Synchronisation process repetition time	FLOAT32
1053	0x212E.04	Sync mode supported	UINT16
1054	0x212E.05	Sync Minimum Cycle Time	FLOAT32
1055	0x212E.06	Sync Calc And Copy Time	FLOAT32
1056	0x212E.07	Sync Get Cycle Time	UINT16
1057	0x212E.08	Sync Delay Time	FLOAT32
1058	0x212E.09	Sync0 Cycle Time	FLOAT32
1059	0x212E.0A	Sync SM Event Missed	UINT16
1060	0x212E.0B	Sync cycle time too small	UINT16
1061	0x212E.0C	Sync Error	BOOL

Tab. 612 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 downstream 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. With the Distributed Clocks DC cyclic synchronous processes can be executed (e.g. chronologically synchronous adoption of setpoint value from process data or cyclical synchronous operation of several axes). Transmission and processing of cyclical process data is controlled by the Sync Manager synchronisation ➔ 11.5.2 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.

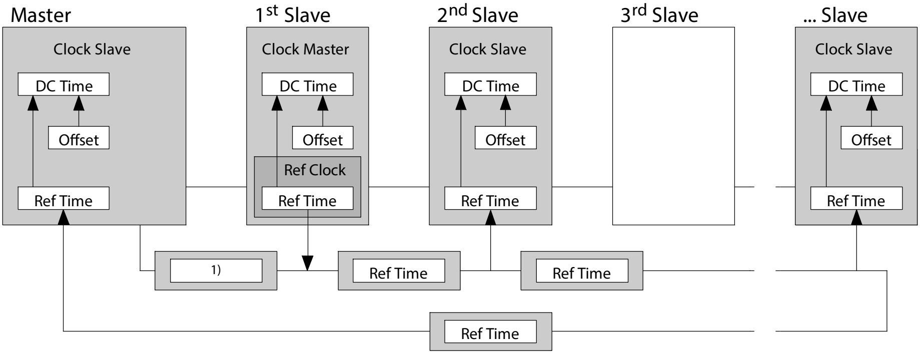

Fig. 109 DC-topology and synchronisation of the EtherCAT network

11.7 CiA 402 Finite State Machine

After switching on, the servo drive automatically changes to the "Not ready to switch on" state.

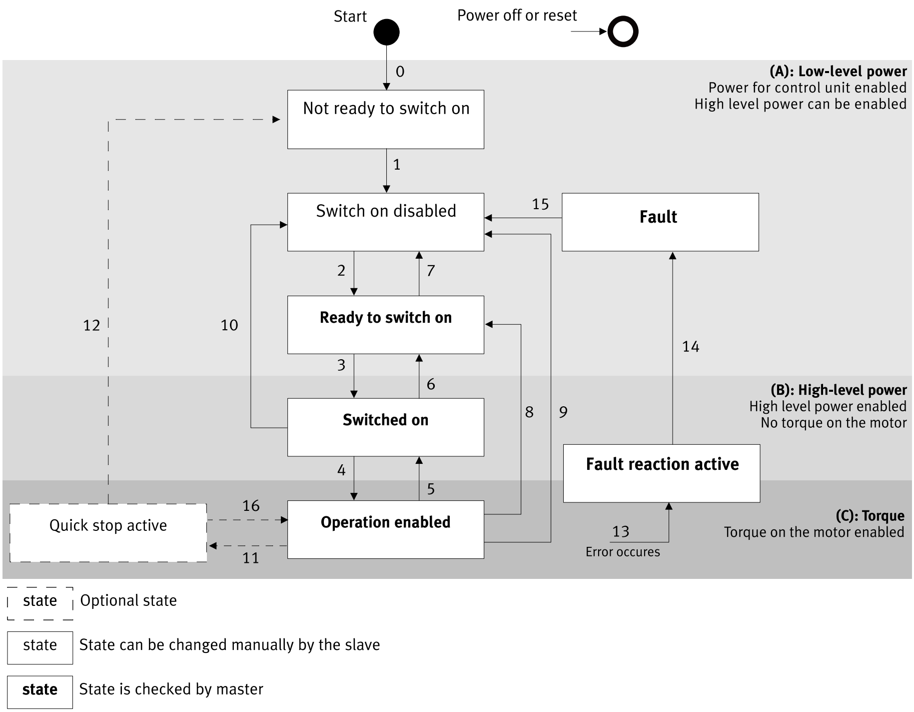

Fig. 110 CiA 402 finite state machine of the servo drive

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 = positive edge; x = arbitrary						

1) Automatic transition to the "Operation enabled" state after execution of the functionality in the "Switched On" state.

Tab. 613 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.

Transition	Event	Action
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 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.
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-order controller	The drive function is deactivated.

Tab. 614 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. 615 Coding

11.7.1 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 function of the bits depends on the operating mode and is described in the various sections.

Bit	Meaning	Comments
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	reserved

Bit	Meaning	Comments
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. 616 Overview of the bit allocation of the control word (object 0x6040)

11.7.2 Status words (objects 0x6041)

The status word returns status information on the current status of the device. The function of the bits depends on the operating mode and is described in the various sections.

Bit	Meaning	Comments
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

Bit	Meaning	Comments
11	Internal limit active	One or more of the following internal limits is exceeded. This prevents the target/setpoint values from being completely reached: – Directional lock active – Velocity limit reached – Torque limiting reached – Software end positions – Hardware end positions – Stroke limit
12	Operation mode specific	CSP: Drive follows the command value CSV: Drive follows the command value CST: Drive follows the command value PP: Set-point 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. 617 Overview of the bit allocation of the status word (object 0x6041)

11.8 Process data communication

With process data communication (Process data communication), process data (e.g. setpoint and actual values) are exchanged cyclically between the CMMT 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 CMMT 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 CMMT 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 CMMT.
Synchronisation of the CMMT can be controlled by the Distributed Clocks DC
➔ 11.6 Distributed clocks DC (Distributed Clocks).

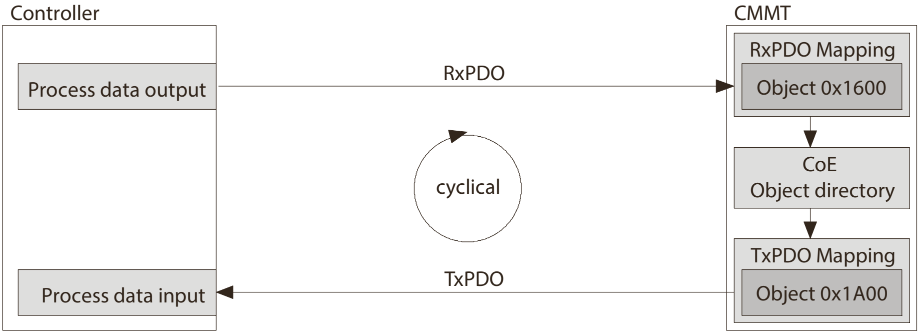

Fig. 111 Access procedure via process data objects PDO

11.8.1 PDO Mapping

PDO mapping can be used to create application-specific output and input data sets for data exchange.

11.8.1.1 Function: RxPDO1 mapping

The graph shows the default setting (factory setting) for the 1st receive PDO mapping RxPDO1 in object 0x1600.

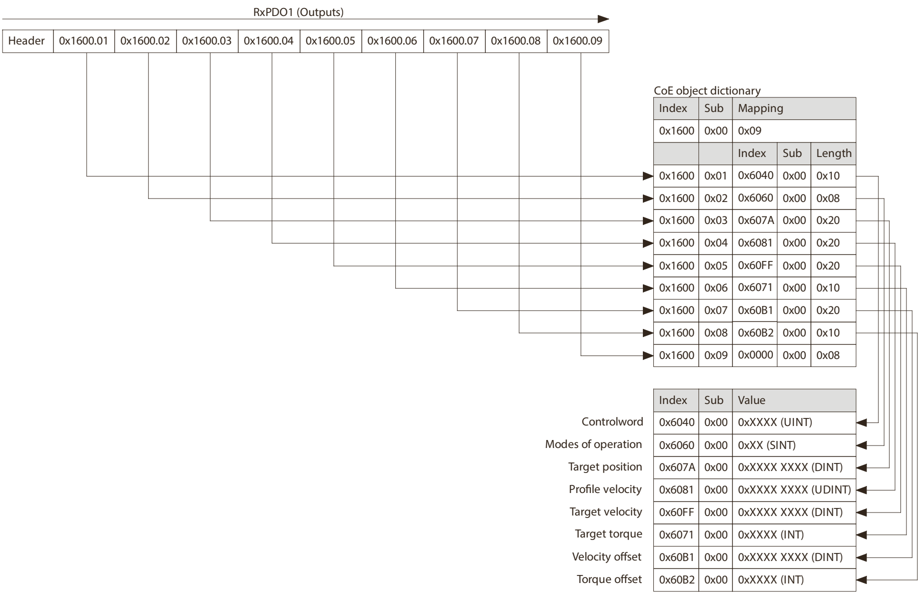

Fig. 112 Overview: default RxPDO1 mapping

Configuring object 0x1600

The following steps are required to configure object 0x1600 (only if the "complete access" function is not enabled):

– Switch CMMT to the "Pre-Operational status (PreOp)".
– Set subindex 0x00 to value 0.
– Configure subindex 0x01 … …0x10.
– Set subindex 0x00 to the value of the assigned PDOs.
– Switch CMMT to the "Safe-Operational (SafeOp) and Operational (Op)" status.

11.8.1.2 Function: TxPDO1 mapping, axis 1

The graph shows the default setting (factory setting) for the 1st send PDO mapping TxPDO1 in object 0x1A00.

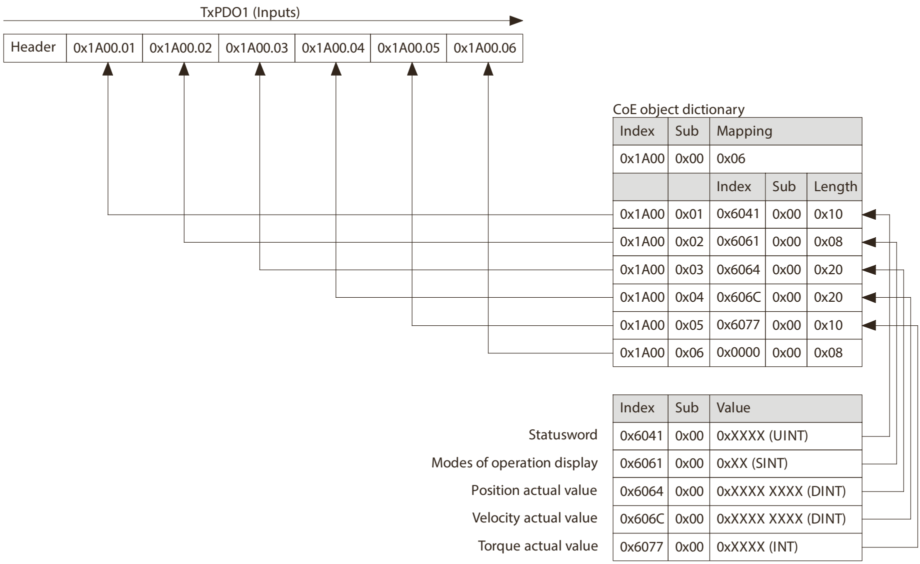

Fig. 113 Overview: default TxPDO1 mapping

Configuring object 0x1A00

The following steps are required to configure object 0x1A00 (only if the "complete access" function is not enabled):

– Switch CMMT to the "Pre-Operational status (PreOp)".
– Set subindex 0x00 to value 0.
– Configure subindex 0x01 … …0x10.
– Set subindex 0x00 to the value of the assigned PDOs.
– Switch CMMT to the "Safe-Operational (SafeOp) and Operational (Op)" status.

11.8.1.3 Function: TxPDO2 mapping, EtherCAT, diagnostic history

The graph shows the fixed setting for the 2rd send PDO mapping TxPDO2 in object 0x1AF0.

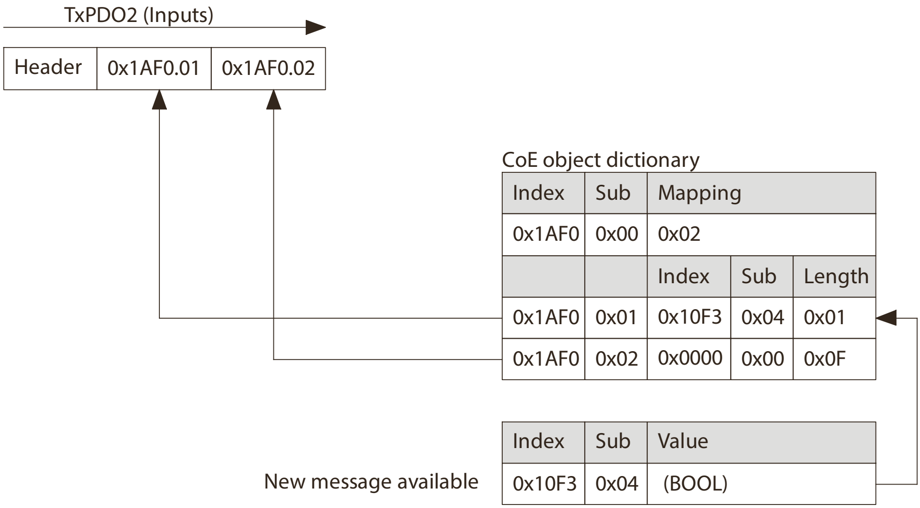

Fig. 114 Overview: default TxPDO2 mapping

11.8.1.4 Function: TxPDO3 mapping, EtherCAT, DC time stamp

The graph shows the fixed setting for the 3rd send PDO mapping TxPDO3 in object 0x1AF1.

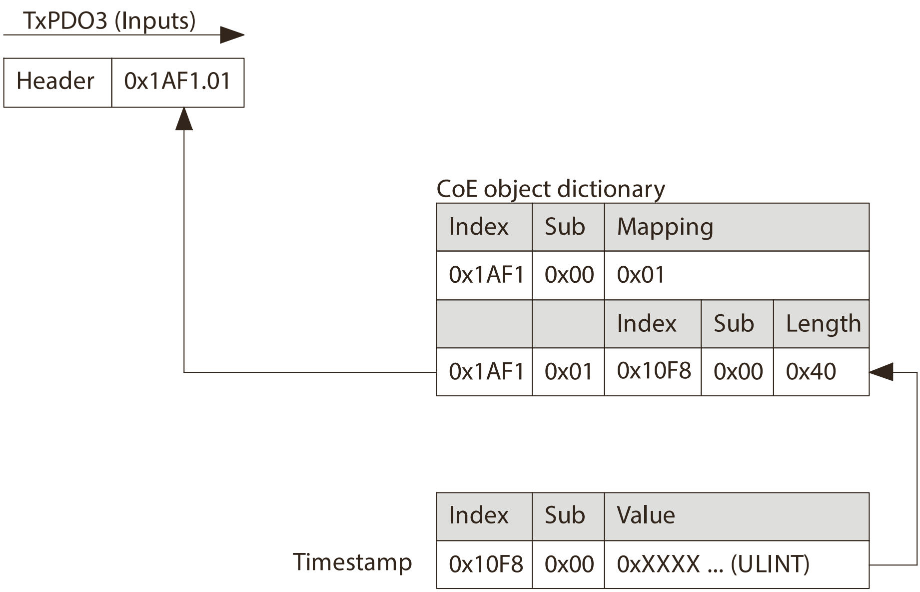

Fig. 115 Overview: default TxPDO3 mapping

11.8.1.5 Parameters and diagnostic messages

ID Px.	Parameters	Description	
760	Receive PDO number of objects EtherCAT	Shows 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	Shows 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 Eth-erCAT	Shows 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. 618 Parameters

Diagnostic messages

No specific diagnostic messages are allocated to the function.

11.8.1.6 CiA 402

PDO Mapping objects

Parameters	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	UINT8
761	0x2214.01 ... 10	Receive PDO Mapped Objects EtherCAT	UINT32
880	0x2126.01	Transmit PDO number of objects EtherCAT	UINT8
881	0x2216.01 ... 10	Transmit PDO mapped objects EtherCAT	UINT32

Tab. 619 Objects

11.9 Mailbox Communication

Mailbox communication (Mailbox communication) is used to exchange service data (e.g. parameter values) or error messages acyclically between the controller and CMMT. In the CMMT 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)
    ➔ 11.9.1 SDO Communication
    The "Complete Access" function is supported.
  - Emergency communication (event-controlled transmission of emergency error messages (Error codes)) ➔ 11.9.2 Emergency Communication
  - SDO information communication (acyclic transmission of object data)
    ➔ Tab. 601 Overview of EtherCAT communication and synchronisation
- Via Ethernet over EtherCAT (EoE)
  - Ethernet communication (acyclic transmission of service data objects via EtherCAT over Ethernet EoE)➔ 11.9.3 Ethernet over EtherCAT Communication (EoE)

11.9.1 SDO Communication

SDO communication supports the following SDO services:

- SDO read command (SDO upload/Upload SDO): acyclic reading of parameter data
  ➔ 11.9.1.2 SDO Read Command (SDO Upload/Upload SDO)
- SDO write command (SDO download/Download SDO): acyclic writing to parameter data
  ➔ 11.9.1.1 SDO Write Command (SDO Download/Download SDO)
- SDO error transmission: event-controlled transmission of SDO error code
  ➔ 11.9.1.3 SDO Error Message (Abort SDO transfer request)

11.9.1.1 SDO Write Command (SDO Download/Download SDO)

Via the SDO write command (SDO write command) the controller (Controller) can acyclically access the CoE object directory CoE OD in the CMMT to write the data of an object (Value). After processing the write command, the CMMT sends an acknowledgement (Acknowledgment) to the controller.

Fig. 116 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. 620 Supported SDO Read Commands

NOTICE!

The controller must not send the next request (request) until the acknowledgement of the write command (download … response) has been received by the controller.

NOTICE!

The request of the write command (download … request) must not use an object that is mapped in the "receive PDO mapping (0x1600)" object. The alternating transmission of process data objects PDO and service data objects SDO would overwrite the data of the object (Value) in an undefined time sequence.

11.9.1.2 SDO Read Command (SDO Upload/Upload SDO)

Via the SDO read command (SDO read command) the controller (Controller) can acyclically access the CoE object directory CoE OD in the CMMT to read the data of an object (Value). After processing the read command, the CMMT sends a response (Answer) to the controller with the requested data.

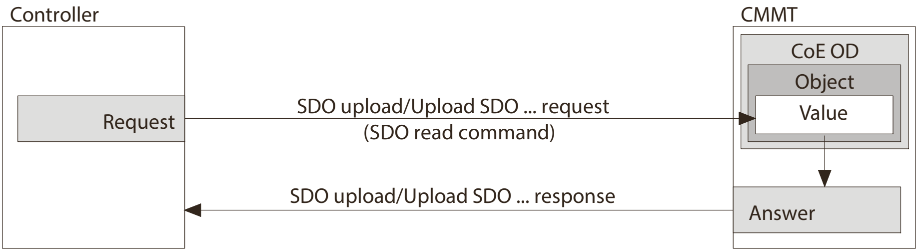

Fig. 117 Read access to object data

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. 621 Supported SDO Read Commands

NOTICE!

The controller must not send the next request (request) until the response to the read command (upload … response) has been received by the controller.

11.9.1.3 SDO Error Message (Abort SDO transfer request)

In the case of an error (SDO Error) when reading, writing or transmitting the SDO the CMMT 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. 118 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
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)

Abort code F3 F2 F1 F0	Description
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. 622 SDO Abort Codes

11.9.2 Emergency Communication

The CMMT 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 CMMT also sends an emergency message when an error acknowledgment has been executed.

Parameters and Diagnostic Messages

ID Px.	Parameter	Description	
7602	Error register CiA402	Shows the error code in accordance with the error register (CiA402).	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 623 Parameter

Diagnostic messages

No specific diagnostic messages are allocated to the function.

11.9.2.1 CiA 402

Emergency communication objects

Parameters	Index.Subindex	Name	Data type
Px.	CiA301: Communication profile		
7602.0.0	0x1001.00	Error register CiA402	UINT8

Parameters	Index.Subindex	Name	Data type
Px.	Manufacturer-specific objects: The user or basic unit defined for the parameter is effective.		
7602	0x2196.01	Error register CiA402	UINT8

Tab. 624 Objects

11.9.2.2 Error Finite State Machine

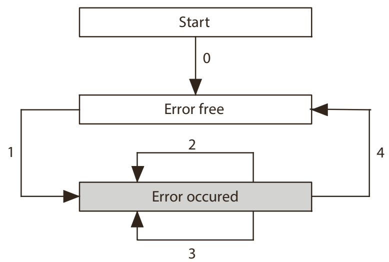

Fig. 119 Diagram: Error finite state machine

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 acknowledgment 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 acknowledgment 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. 625 Error Status Transitions

Error Messages (Error codes)

The following table lists all error messages that can occur in EtherCAT operation.

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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 | 01 | 00010, 01 | 01 | 00011, 01 | 02 | 00012, 01 | 02 | 00013, 01 | 02 | 00014, 01 | 02 | 00015, 01 | 02 | 00016, 01 | 02 | 00017, 01 | 02 | 00018, 01 | 02 | 00258, 01 | 02 | 00259
0x3082	Voltage	0x05	02 | 01 | 00022, 02 | 01 | 00023, 02 | 01 | 00024, 02 | 01 | 00025, 02 | 01 | 00026, 02 | 01 | 00027, 02 | 02 | 00030, 02 | 02 | 00031, 02 | 02 | 00032, 02 | 03 | 00038, 02 | 03 | 00039, 02 | 03 | 00251
0x4083	Temperature	0x09	03 | 01 | 00044, 03 | 01 | 00045, 03 | 01 | 00046, 03 | 01 | 00047, 03 | 02 | 00048, 03 | 02 | 00049, 03 | 02 | 00050, 03 | 02 | 00051
0x508A	Device Hardware	0x21	10 | 01 | 00153, 10 | 01 | 00154, 10 | 01 | 00156, 10 | 01 | 00249

Error code E0 E1	Name	Error register Bit	Festo Automation Suite ID Dx.
0x608B	Device Software	0x21	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,

Error code E0 E1	Name	Error register Bit	Festo Automation Suite ID Dx.
			11 I 05 I 00198, 11 I 05 I 00200, 11 I 05 I 00201, 11 I 05 I 00202, 11 I 06 I 00203, 11 I 06 I 00285, 11 I 06 I 00300, 11 I 07 I 00204, 11 I 07 I 00205, 11 I 07 I 00271, 11 I 08 I 00206, 11 I 08 I 00207
0x6386	Device Software - Data Set	0x81	06 I 00 I 00070, 06 I 00 I 00081, 06 I 00 I 00082, 06 I 00 I 00083, 06 I 00 I 00084, 06 I 00 I 00085, 06 I 00 I 00248, 06 I 00 I 00252, 06 I 00 I 00313, 06 I 02 I 00086, 06 I 02 I 00087, 06 I 02 I 00088, 06 I 02 I 00089, 06 I 02 I 00090, 06 I 02 I 00091, 06 I 02 I 00273, 06 I 02 I 00274, 06 I 02 I 00275, 06 I 05 I 00097, 06 I 05 I 00098, 06 I 05 I 00099, 06 I 05 I 00100, 06 I 05 I 00101, 06 I 05 I 00102, 06 I 05 I 00103, 06 I 05 I 00104, 06 I 05 I 00105, 06 I 05 I 00106,

Error code E0 E1	Name	Error register Bit	Festo Automation Suite ID Dx.
			06 I 05 I 00107, 06 I 05 I 00108, 06 I 05 I 00290, 06 I 05 I 00291
0x7092	Additional Modules	0x21	18 I 00 I 00092, 18 I 00 I 00093, 18 I 00 I 00094, 18 I 00 I 00095, 18 I 00 I 00096, 18 I 00 I 00227, 18 I 00 I 00318, 18 I 03 I 00235, 18 I 03 I 00301, 18 I 05 I 00239, 18 I 07 I 00365, 18 I 07 I 00366, 18 I 07 I 00367, 18 I 07 I 00368, 18 I 07 I 00369, 18 I 07 I 00370, 18 I 07 I 00371, 18 I 07 I 00372
0x8087	Monitoring	0x81	07 I 01 I 00109, 07 I 01 I 00110, 07 I 01 I 00111, 07 I 01 I 00112, 07 I 01 I 00113, 07 I 01 I 00114, 07 I 01 I 00115, 07 I 01 I 00116, 07 I 01 I 00117, 07 I 01 I 00118, 07 I 01 I 00119, 07 I 01 I 00120, 07 I 02 I 00121, 07 I 02 I 00122, 07 I 02 I 00123, 07 I 02 I 00124, 07 I 02 I 00125, 07 I 02 I 00126,

Error code E0 E1	Name	Error register Bit	Festo Automation Suite ID Dx.
			07 I 02 I 00127, 07 I 02 I 00128, 07 I 02 I 00129, 07 I 02 I 00130, 07 I 02 I 00131, 07 I 02 I 00132, 07 I 02 I 00133, 07 I 03 I 00134, 07 I 03 I 00135, 07 I 04 I 00136, 07 I 04 I 00137, 07 I 05 I 00138
0x8188	Monitoring - Communication	0x11	08 I 00 I 00139, 08 I 00 I 00140, 08 I 00 I 00243, 08 I 03 I 00141, 08 I 03 I 00373, 08 I 04 I 00142, 08 I 04 I 00143, 08 I 04 I 00281, 08 I 09 I 00144, 08 I 09 I 00145, 08 I 09 I 00288, 08 I 09 I 00289, 08 I 09 I 00294, 08 I 09 I 00299, 08 I 09 I 00382, 08 I 12 I 00250, 08 I 12 I 00272
0xF085	Additional Function	0x81	05 I 01 I 00056, 05 I 01 I 00057, 05 I 01 I 00058, 05 I 02 I 00059, 05 I 02 I 00060, 05 I 02 I 00061, 05 I 02 I 00062, 05 I 02 I 00064, 05 I 02 I 00065, 05 I 02 I 00066, 05 I 02 I 00067,

Error code E0 E1	Name	Error register Bit	Festo Automation Suite ID Dx.
			05 I 02 I 00068, 05 I 02 I 00069, 05 I 02 I 00071, 05 I 02 I 00072, 05 I 02 I 00073, 05 I 02 I 00074, 05 I 02 I 00075, 05 I 02 I 00076, 05 I 02 I 00077, 05 I 02 I 00078, 05 I 02 I 00079, 05 I 02 I 00080, 05 I 02 I 00278, 05 I 02 I 00279, 05 I 02 I 00280, 05 I 02 I 00282, 05 I 02 I 00283, 05 I 02 I 00284, 05 I 02 I 00364, 05 I 02 I 00396, 05 I 02 I 00397
0xF089	Additional Function	0x21	09 I 00 I 00146, 09 I 00 I 00147, 09 I 01 I 00148, 09 I 01 I 00149, 09 I 01 I 00150, 09 I 02 I 00151, 09 I 02 I 00152
0xF08C	Additional Function	0x81	12 I 01 I 00208, 12 I 01 I 00209, 12 I 01 I 00210, 12 I 01 I 00211, 12 I 01 I 00212, 12 I 01 I 00213
0xF091	Additional Functions	0x21	17 I 01 I 00224, 17 I 01 I 00225, 17 I 01 I 00226

Tab. 626 Emergency error messages

11.9.3 Ethernet over EtherCAT Communication (EoE)

The CMMT supports Ethernet communication within mailbox communication via the EtherCAT interfaces (XF1 IN). 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 CMMT for transmission via EtherCAT communication. The IP address of the CMMT must be configured in the controller to enable the Ethernet data to be routed to the CMMT.

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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 CMMT via the "Ethernet over EtherCAT EoE" protocol.

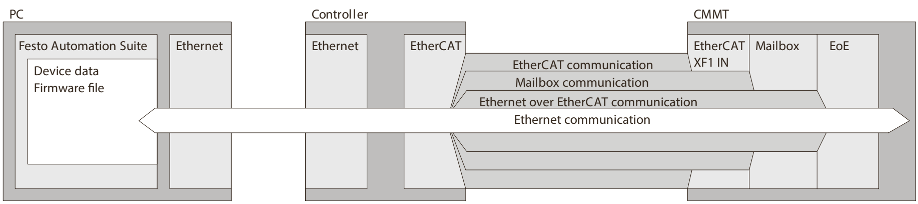

Fig. 120 Communication via the "Ethernet over EtherCAT EoE" protocol

11.9.4 File Access over EtherCAT (FoE)

FoE is a protocol based on TFTP that allows the transfer of any files.
Only the download of files is supported by the CMMT.
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 state machine, except in the state Init. 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 following check determines whether it is a valid file for the CMMT servo drive.
The CMMT 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 CMMT 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.

Firmware Package

The actual firmware update is executed with the change of state from Bootstrapto Initthe EtherCAT state machine.

Parameter Package

The parameter package is loaded with the change of state from Bootstrap to Init of the EtherCAT state machine.

11.10 Objects Reference List

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
CiA301: communication profile					
0x1000.00	Device type CiA402	UINT32	rw	–	P0.7601.0.0
0x1001.00	Error register CiA402	UINT8	rw	–	P0.7602.0.0
0x1008.00	Device name CiA402	STRING(9)	rw	–	P0.7603.0.0 ... 8
0x1009.00	Hardware version CiA402	STRING(6)	rw	–	P0.7604.0.0 ... 5
0x100A.00	Software version CiA402	STRING(6)	rw	–	P0.7605.0.0 ... 5
0x1100.00	Ethercat address CiA402	UINT16	rw	–	P0.7606.0.0
0x1018.01	Vendor ID	UINT32	rw	–	P0.7607.0.0
0x1018.02	Product code	UINT32	rw	–	P0.7608.0.0
0x1018.03	Revision number	UINT32	rw	–	P0.7609.0.0
0x1018.04	Serial number	UINT32	ro	–	P0.246.0.0
0x1C32.01	Synchronisation mode	UINT16	rw	–	P0.1050.0.0
0x1C32.02	Synchronisation process repetition time	UINT32	rw	–	P0.1051.0.0
0x1C32.04	Sync mode supported	UINT16	ro	–	P0.1053.0.0
0x1C32.05	Sync Minimum Cycle Time	UINT32	ro	–	P0.1054.0.0
0x1C32.06	Sync Calc And Copy Time	UINT32	ro	–	P0.1055.0.0
0x1C32.08	Sync Get Cycle Time	UINT16	rw	–	P0.1056.0.0
0x1C32.09	Sync Delay Time	UINT32	ro	–	P0.1057.0.0
0x1C32.0A	Sync0 Cycle Time	UINT32	rw	–	P0.1058.0.0
0x1C32.0B	Sync SM Event Missed	UINT16	ro	–	P0.1059.0.0
0x1C32.0C	Sync cycle time too small	UINT16	ro	–	P0.1060.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x1C32.20	Sync Error	BOOL	ro	–	P0.1061.0.0
0x1C33.01	Synchronisation mode	UINT16	rw	–	P0.1050.0.0
0x1C33.02	Synchronisation process repetition time	UINT32	rw	–	P0.1051.0.0
0x1C33.04	Sync mode supported	UINT16	ro	–	P0.1053.0.0
0x1C33.05	Sync Minimum Cycle Time	UINT32	ro	–	P0.1054.0.0
0x1C33.06	Calc and copy time	UINT32	ro	–	P0.1062.0.0
0x1C33.08	Sync Get Cycle Time	UINT16	rw	–	P0.1056.0.0
0x1C33.09	Maximum delay time	UINT32	ro	–	P0.1063.0.0
0x1C33.0A	Sync0 Cycle Time	UINT32	rw	–	P0.1058.0.0
0x1C33.0B	Sync SM Event Missed	UINT16	ro	–	P0.1059.0.0
0x1C33.0C	Sync cycle time too small	UINT16	ro	–	P0.1060.0.0
0x1C33.20	Sync Error	BOOL	ro	–	P0.1061.0.0
0x1600.00	Receive PDO number of objects EtherCAT	UINT8	rw	–	P0.760.0.0
0x1600.01 ... 10	Receive PDO Mapped Objects EtherCAT	UINT32	rw	–	P0.761.0.0 ... 15
0x1A00.00	Transmit PDO number of objects EtherCAT	UINT8	rw	–	P0.880.0.0
0x1A00.01 ... 10	Transmit PDO mapped objects EtherCAT	UINT32	rw	–	P0.881.0.0 ... 15
0x1AF0.00	Transmit PDO number of objects EtherCAT	UINT8	rw	–	P0.880.1.0
0x1AF0.01 ... 10	Transmit PDO mapped objects EtherCAT	UINT32	rw	–	P0.881.1.0 ... 15
0x1AF1.00	Transmit PDO number of objects EtherCAT	UINT8	rw	–	P0.880.2.0
0x1AF1.01 ... 10	Transmit PDO mapped objects EtherCAT	UINT32	rw	–	P0.881.2.0 ... 15
0x1C00.00 ... 04	Sync manager communication type EtherCAT	UINT8	rw	–	P0.750.0.0 ... 4
0x1C12.00	Sync manager x number of assigned PDOs EtherCAT	UINT8	rw	–	P0.770.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x1C12.01 … 03	PDO mapping object index of assigned PDO EtherCAT	UINT16	rw	–	P0.771.0.0 … 2
0x1C13.00	Sync manager x number of assigned PDOs EtherCAT	UINT8	rw	–	P0.770.1.0
0x1C13.01 … 03	PDO mapping object index of assigned PDO EtherCAT	UINT16	rw	–	P0.771.1.0 … 2
0x10F1.01	Local error reaction	UINT32	rw	–	P0.43543.0.0
0x10F1.02	Sync error counter limit	UINT16	rw	–	P0.43544.0.0
0x10F3.01	Maximum messages	UINT8	rw	–	P0.43545.0.0
0x10F3.02	Newest message	UINT8	rw	–	P0.43546.0.0
0x10F3.03	Newest ack message	UINT8	rw	–	P0.43547.0.0
0x10F3.04	New message available	BOOL	rw	–	P0.43548.0.0
0x10F3.05	Flags	UINT16	rw	–	P0.43549.0.0
0x10F8.00	Timestamp object	UINT64	rw	Tx	P0.43550.0.0
CiA402: the factor group is effective.					
0x6007.00	Abort connection option code	SINT16	rw	Rx	P0.757.0.0
0x603F.00	Currently most serious error	UINT16	ro	–	P0.315.1.0
0x6040.00	Control word CiA402	UINT16	rw	Rx	P1.730.0.0
0x6041.00	Status word CiA402	UINT16	ro	Tx	P1.731.0.0
0x6060.00	Modes of operation CiA402	SINT8	rw	Rx	P1.12234.0.0
0x6061.00	Modes of operation display CiA402	SINT8	ro	Tx	P1.12235.0.0
0x6064.00	Actual value of modulo	SINT32	ro	Tx	P1.113104.0.0
0x606C.00	Actual velocity value	SINT32	ro	Tx	P1.1210.0.0
0x6071.00	Target torque CiA402	SINT16	rw	Rx	P1.526795.0.0
0x6072.00	Maximum torque symmetrical	UINT16	rw	Rx	P1.526796.0.0
0x6073.00	Limit value total current (closed loop controller)	UINT16	rw	Rx	P1.856.0.0
0x6074.00	Setpoint generator output torque	SINT16	ro	Tx	P1.3014.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x6075.00	Current nominal current	UINT32	ro	–	P1.7118.0.0
0x6076.00	Resulting nominal torque	UINT32	ro	–	P1.7139.0.0
0x6077.00	Actual torque value gear shaft	SINT16	ro	Tx	P1.151.0.0
0x6078.00	Actual active current value	SINT16	ro	Tx	P1.814.0.0
0x6079.00	Actual value DC link voltage	UINT32	ro	Tx	P0.480.0.0
0x607A.00	Target position CiA402	SINT32	rw	Rx	P1.8130.0.0
0x607C.00	Axis zero point offset	SINT32	rw	–	P1.8416.0.0
0x6081.00	Profile velocity CiA402	UINT32	rw	Rx	P1.8131.0.0
0x6082.00	End velocity CiA402	UINT32	rw	Rx	P1.8132.0.0
0x6083.00	Profile acceleration CiA402	UINT32	rw	Rx	P1.8133.0.0
0x6084.00	Profile deceleration CiA402	UINT32	rw	Rx	P1.8134.0.0
0x6085.00	Quick stop deceleration CiA402	UINT32	rw	Rx	P1.8135.0.0
0x6087.00	Torque slope CiA402	UINT32	rw	Rx	P1.526799.0.0
0x6098.00	Referencing method	SINT8	rw	Rx	P1.8417.0.0
0x6099.01	Search for reference mark setpoint velocity	UINT32	rw	–	P1.843.0.0
0x6099.02	Setpoint reference mark creeping velocity	UINT32	rw	–	P1.846.0.0
0x6099.03	Move to axis zero point setpoint velocity	UINT32	rw	–	P1.849.0.0
0x609A.01	Search for reference mark setpoint acceleration	UINT32	rw	–	P1.844.0.0
0x609A.02	Setpoint reference mark creeping acceleration	UINT32	rw	–	P1.847.0.0
0x609A.03	Move to axis zero point setpoint acceleration	UINT32	rw	–	P1.8410.0.0
0x60A4.00	Profile jerk CiA402	UINT32	rw	Rx	P1.8136.0.0
0x60A8.00	SI unit position CiA402	UINT32	rw	–	P1.7860.0.0
0x60A9.00	SI unit and velocity CiA402	UINT32	rw	–	P1.7861.0.0
0x60AA.00	SI unit acceleration CiA402	UINT32	rw	–	P1.7862.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x60AB.00	SI unit and jerk CiA402	UINT32	rw	–	P1.7863.0.0
0x60B1.00	Velocity offset CiA402	SINT32	rw	Rx	P1.8138.0.0
0x60B2.00	Torque offset CiA402	SINT16	rw	Rx	P1.8111.0.0
0x60E0.00	Upper limit value torque (closed loop controller)	UINT16	rw	Rx	P1.853.0.0
0x60E1.00	Lower limit value torque (closed loop controller)	UINT16	rw	Rx	P1.852.0.0
0x60F2.00	Positioning option code CiA402	UINT16	rw	Rx	P1.88817.0.0
0x60FD.00	Digital inputs CiA402	UINT32	ro	Tx	P1.1128052.0.0
0x60FE.01	Digital outputs CiA402	UINT32	rw	Rx	P1.1128054.0.0
0x60FE.02	Bit mask digital outputs CiA402	UINT32	rw	Rx	P1.1128055.0.0
0x60FF.00	Target velocity CiA402	SINT32	rw	Rx	P1.8137.0.0
0x6402.00	Motor type CiA402	UINT16	ro	–	P1.1128057.0.0
0x6403.00	Current NOC code motor	STRING(32)	ro	–	P1.7188.0.0 ... 31
0x6502.00	Supported drive modes CiA402	UINT32	ro	Tx	P1.734.0.0
0x6503.00	Device name	STRING(128)	rw	–	P0.902.0.0 ... 127
0x6505.00	URL address	STRING(20)	ro	–	P0.11280052.0.0 ... 19
0x6062.00	Setpoint value position	SINT32	ro	Tx	P1.90.0.0
0x6065.00	Monitoring window position: following error	UINT32	rw	Rx	P1.463.0.0
0x6066.00	Damping time position: following error	UINT16	rw	Rx	P1.462.0.0
0x6067.00	Monitoring window target position	UINT32	rw	Rx	P1.469.0.0
0x6068.00	Damping time target reached	UINT16	rw	Rx	P1.468.0.0
0x60F4.00	Current position: following error	SINT32	ro	Tx	P1.4682.0.0
0x607B.01	Lower limit value modulo	SINT32	rw	Rx	P1.113102.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x607B.02	Upper limit value modulo	SINT32	rw	Rx	P1.113113.0.0
0x607D.01	Negative software limit position	SINT32	rw	Rx	P1.4629.0.0
0x607D.02	Positive software limit position	SINT32	rw	Rx	P1.4630.0.0
0x607E.00	Reversing the direction of rotation	UINT8	rw	Rx	P1.1170.0.0
0x606B.00	Setpoint value velocity	SINT32	ro	Tx	P1.91.0.0
0x606D.00	Monitoring window target speed	UINT16	rw	Rx	P1.4610.0.0
0x606E.00	Damping time target reached	UINT16	rw	Rx	P1.468.0.0
0x606F.00	Monitoring window speed standstill monitoring	UINT16	rw	Rx	P1.466.0.0
0x6070.00	Standstill damping time	UINT16	rw	Rx	P1.465.0.0
0x60F8.00	Monitoring window speed: following error	SINT32	rw	Rx	P1.464.0.0
0x607F.00	Limit value velocity limiting	UINT32	rw	Rx	P1.1304.0.0
0x6080.00	Maximum rpm (user defined)	UINT32	rw	Rx	P1.7123.0.0
0x60C5.00	Limit value acceleration limiting	UINT32	rw	Rx	P1.1305.0.0
0x60C6.00	Limit value deceleration limiting	UINT32	rw	Rx	P1.1306.0.0
0x60E4.01	Actual position value	SINT32	ro	Tx	P1.128.0.0
0x60E5.01	Actual velocity value	SINT32	ro	Tx	P1.1210.0.0
0x60E8.01	Total conversion factor gear unit numerator	UINT32	rw	Rx	P1.1242.0.0
0x60ED.01	Total conversion factor gear unit denominator	UINT32	rw	Rx	P1.1243.0.0
0x60E9.01	Feed constant numerator	UINT32	rw	Rx	P1.1194.0.0
0x60EE.01	Feed constant denominator	UINT32	rw	Rx	P1.1195.0.0
0x67FE.00	CiA402 version	UINT32	ro	–	P1.1128056.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x60B8.00	Touch probe function CiA402	UINT16	rw	Rx	P1.1128060.0.0
0x60B9.00	Touch probe status CiA402	UINT16	ro	Tx	P1.1128061.0.0
0x60D1.00	Time stamp touch probe position positive CiA402	UINT32	ro	Tx	P1.113027.0.0
0x60D2.00	Time stamp touch probe position negative CiA402	UINT32	ro	Tx	P1.113028.0.0
0x60D5.00	Counter initiated trigger events positive edge CiA402	UINT16	ro	Tx	P1.113031.0.0
0x60D6.00	Counter initiated trigger events negative edge CiA402	UINT16	ro	Tx	P1.113032.0.0
0x60BA.00	Touch probe position positive CiA402	SINT32	ro	Tx	P1.113029.0.0
0x60BB.00	Touch probe position negative CiA402	SINT32	ro	Tx	P1.113030.0.0
0x60D3.00	Time stamp touch probe position positive CiA402	UINT32	ro	Tx	P1.113027.1.0
0x60D4.00	Time stamp touch probe position negative CiA402	UINT32	ro	Tx	P1.113028.1.0
0x60D7.00	Counter initiated trigger events positive edge CiA402	UINT16	ro	Tx	P1.113031.1.0
0x60D8.00	Counter initiated trigger events negative edge CiA402	UINT16	ro	Tx	P1.113032.1.0
0x60BC.00	Touch probe position positive CiA402	SINT32	ro	Tx	P1.113029.1.0
0x60BD.00	Touch probe position negative CiA402	SINT32	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	BOOL	rw	Rx	P0.12008.0.0
0x2100.02	Keep-alive-signal wait time	UINT32	rw	Rx	P0.12009.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2100.03	Keep-alive-signal repeat time	UINT32	rw	Rx	P0.12010.0.0
0x2100.04	Maximum number of repetitions	UINT32	rw	Rx	P0.12011.0.0
0x2103.01	Order number	UINT32	ro	Tx	P0.70.0.0
0x2103.02	NOC 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
0x2103.05	Control unit data set ID	UINT32	ro	Tx	P0.269.0.0
0x2103.06	Minor version servo drive	UINT16	ro	Tx	P0.739.0.0
0x2103.07	Compatibility index servo drive	UINT16	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	UINT16	ro	Tx	P0.2214.0.0
0x2103.0C	Expected major version control unit	STRING(2)	ro	Tx	P0.5760.0.0 ... 1
0x2103.0D	Expected minor version control unit	UINT16	ro	Tx	P0.5761.0.0
0x2103.0E	Expected compatibility index control unit	UINT16	ro	Tx	P0.5762.0.0
0x2103.0F	Expected major version communication module	STRING(2)	ro	Tx	P0.5763.0.0 ... 1
0x2103.10	Expected minor version communication module	UINT16	ro	Tx	P0.5764.0.0
0x2103.11	Expected compatibility index communication module	UINT16	ro	Tx	P0.5765.0.0
0x2103.12	Expected major version power output stage	STRING(2)	ro	Tx	P0.5766.0.0 ... 1
0x2103.13	Expected minor version power output stage	UINT16	ro	Tx	P0.5767.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2103.14	Expected compatibility index power output stage	UINT16	ro	Tx	P0.5768.0.0
0x2103.15	Expected major version safety module	STRING(2)	ro	Tx	P0.5769.0.0 ... 1
0x2103.16	Expected minor version safety module	UINT16	ro	Tx	P0.5770.0.0
0x2103.17	Expected compatibility index safety module	UINT16	ro	Tx	P0.5771.0.0
0x2103.18	Compatibility index firmware boot loader	STRING(20)	ro	Tx	P0.5772.0.0 ... 19
0x2103.19	Compatibility index firmware	STRING(20)	ro	Tx	P0.5773.0.0 ... 19
0x2103.1A	Compatibility index firmware EngP	STRING(20)	ro	Tx	P0.5774.0.0 ... 19
0x2103.1B	Compatibility index firmware FPGA	STRING(20)	ro	Tx	P0.5775.0.0 ... 19
0x2103.1C	Compatibility index firmware Comm	STRING(20)	ro	Tx	P0.5776.0.0 ... 19
0x2103.1D	Compatibility index firmware Ext	STRING(20)	ro	Tx	P0.5777.0.0 ... 19
0x2103.1E	URL address	STRING(20)	ro	Tx	P0.11280052.0.0 ... 19
0x2103.1F	Revision	STRING(10)	ro	Tx	P0.72.0.0 ... 9
0x2106.01	Product key	STRING(15)	ro	Tx	P0.710.0.0 ... 14
0x2106.03	NOC code	STRING(32)	ro	Tx	P0.711.0.0 ... 31
0x2106.05	Material number	UINT32	ro	Tx	P0.712.0.0
0x2106.07	Serial number	STRING(20)	ro	Tx	P0.713.0.0 ... 19
0x2106.09	Pole pairs	UINT32	ro	Tx	P0.717.0.0
0x2106.0B	Motor inertia	FLOAT32	ro	Tx	P0.7110.0.0
0x2106.0D	Phase sequence	BOOL	ro	Tx	P0.7113.0.0
0x2106.0F	Nominal current	FLOAT32	ro	Tx	P0.7116.0.0
0x2106.11	Maximum current	FLOAT32	ro	Tx	P0.7119.0.0
0x2106.13	Maximum rpm	FLOAT32	ro	Tx	P0.7122.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2106.15	Nominal rotary speed	FLOAT32	ro	Tx	P0.7125.0.0
0x2106.17	Winding inductance	FLOAT32	ro	Tx	P0.7128.0.0
0x2106.19	Winding resistance	FLOAT32	ro	Tx	P0.7131.0.0
0x2106.1B	Torque constant	FLOAT32	ro	Tx	P0.7134.0.0
0x2106.1D	Time constant I^2t	FLOAT32	ro	Tx	P0.7143.0.0
0x2106.1F	Winding temperature	FLOAT32	ro	Tx	P0.7146.0.0
0x2106.21	Nominal motor voltage	FLOAT32	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	UINT16	ro	Tx	P0.7151.0.0
0x2106.27	Temperature sensor	UINT32	ro	Tx	P0.7152.0.0
0x2106.29	Holding brake	BOOL	ro	Tx	P0.7158.0.0
0x2106.2B	Switch-on delay holding brake	FLOAT32	ro	Tx	P0.7161.0.0
0x2106.2D	Switch-off delay holding brake	FLOAT32	ro	Tx	P0.7164.0.0
0x2106.2F	Continuous current	FLOAT32	ro	Tx	P0.7181.0.0
0x2106.31	Encoder data set ID	UINT32	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	UINT16	ro	Tx	P0.7187.0.0
0x2106.37	Lq inductance	FLOAT32	ro	Tx	P0.7428.0.0
0x2106.39	Ld inductance	FLOAT32	ro	Tx	P0.7429.0.0
0x2106.3B	Motor type	UINT8	ro	Tx	P0.7430.0.0
0x2106.3D	Denominator pole pairs	UINT32	ro	Tx	P0.7171.0.0
0x2107.01	Status LED	UINT16	ro	Tx	P0.160.0.0
0x2107.02	Power LED	UINT16	ro	Tx	P0.161.0.0
0x2107.03	Safety LED	UINT16	ro	Tx	P0.162.0.0
0x2107.04	Application LED	UINT16	ro	Tx	P0.163.0.0
0x2108.01	Debug variable index 0	FLOAT32	rw	Rx	P0.190.0.0
0x2108.02	Debug variable index 1	FLOAT32	rw	Rx	P0.191.0.0
0x2108.03	Debug variable index 2	FLOAT32	rw	Rx	P0.192.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2108.04	Debug variable index 3	FLOAT32	rw	Rx	P0.193.0.0
0x2108.05	Debug variable index 4	FLOAT32	rw	Rx	P0.194.0.0
0x2108.06	Debug variable index 5	FLOAT32	rw	Rx	P0.195.0.0
0x2108.07	Debug variable index 6	FLOAT32	rw	Rx	P0.196.0.0
0x2108.08	Debug variable index 7	FLOAT32	rw	Rx	P0.197.0.0
0x2108.09	Debug variable index 8	FLOAT32	rw	Rx	P0.198.0.0
0x2108.0A	Debug variable index 9	FLOAT32	rw	Rx	P0.199.0.0
0x210A.06	Communication module protocol	UINT32	ro	Tx	P0.245.0.0
0x210A.07	Serial number	UINT32	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	UINT16	ro	Tx	P0.2205.0.0
0x210B.01	Material number control unit	UINT32	ro	Tx	P0.250.0.0
0x210B.02	NOC 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	UINT16	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	UINT16	ro	Tx	P0.2209.0.0
0x210B.0E	Minor version control unit	UINT16	ro	Tx	P0.2212.0.0
0x210D.01	Diagnostic device status	UINT16	ro	Tx	P0.300.0.0
0x210D.02	Maximum number of components in the message buffer	UINT32	ro	Tx	P0.303.0.0
0x210D.03	Actual number of components in the message buffer	UINT32	ro	Tx	P0.304.0.0
0x210F.01	Trace type	UINT32	ro	Tx	P0.340.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x210F.02	Trigger type	UINT32	rw	Rx	P0.341.0.0
0x210F.03	Current trace status	UINT32	ro	Tx	P0.3400.0.0
0x210F.04	Current trigger status	UINT32	ro	Tx	P0.3401.0.0
0x210F.05	Current trace type code	UINT32	ro	Tx	P0.3402.0.0
0x2110.01	Current time without synchronisation	SINT64	ro	Tx	P0.7534.0.0
0x2110.02	Current time with synchronisation	SINT64	ro	Tx	P0.7535.0.0
0x2114.01	Actual value DC link voltage	FLOAT32	ro	Tx	P0.480.0.0
0x2114.06	Diagnostic category	UINT16	rw	Rx	P0.487.0.0
0x2114.07	Storage option in error log	UINT8	rw	Rx	P0.488.0.0
0x2114.08	Diagnostic category	UINT16	rw	Rx	P0.489.0.0
0x2114.0A	Warning thresholds DC link voltage	FLOAT32	rw	Rx	P0.4811.0.0
0x2114.0C	Upper limit value DC link voltage	FLOAT32	rw	Rx	P0.4813.0.0
0x2114.0D	Lower limit value DC link voltage	FLOAT32	rw	Rx	P0.4814.0.0
0x2114.15	Storage option in error log	UINT8	rw	Rx	P0.4890.0.0
0x2114.18	Current warning threshold DC link voltage	FLOAT32	ro	Tx	P0.56799.0.0
0x2114.19	Current upper limit value DC link voltage	FLOAT32	ro	Tx	P0.56800.0.0
0x2114.1A	Current lower limit value DC link voltage	FLOAT32	ro	Tx	P0.56801.0.0
0x2115.02	Load voltage root mean square value	FLOAT32	ro	Tx	P0.491.0.0
0x2115.04	Lower load voltage limit value	FLOAT32	rw	Rx	P0.493.0.0
0x2115.05	Upper load voltage value	FLOAT32	rw	Rx	P0.494.0.0
0x2115.0D	Diagnostic category	UINT16	rw	Rx	P0.519.0.0
0x2115.16	Storage option in error log	UINT8	rw	Rx	P0.5180.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2115.19	Current lower limit value load voltage	FLOAT32	ro	Tx	P0.28151.0.0
0x2115.1A	Current upper limit value load voltage	FLOAT32	ro	Tx	P0.28152.0.0
0x2116.01	Supply voltage 24 V logic	FLOAT32	ro	Tx	P0.520.0.0
0x2117.01	Data trace status	UINT32	ro	Tx	P0.556.0.0
0x2117.02	Trace delay	SINT32	rw	Rx	P0.557.0.0
0x2117.03	Recording length	UINT32	rw	Rx	P0.558.0.0
0x2117.04	Down sampling factor	UINT32	rw	Rx	P0.559.0.0
0x2117.05	Current pre-trigger	SINT32	ro	Tx	P0.5513.0.0
0x2117.06	Current recording length	UINT32	ro	Tx	P0.5514.0.0
0x2117.07	Current downsampling factor	UINT32	ro	Tx	P0.5515.0.0
0x2117.08	Maximum recording length	UINT32	ro	Tx	P0.5516.0.0
0x2117.09	Basic sampling interval	FLOAT32	ro	Tx	P0.5517.0.0
0x2117.0A	Timestamp End trace	SINT64	ro	Tx	P0.5518.0.0
0x2119.01	Number of parameter sets	UINT32	ro	Tx	P0.571.0.0
0x2119.0B	Storage option in error log	UINT8	rw	Rx	P0.5709.0.0
0x2119.0D	Storage option in error log	UINT8	rw	Rx	P0.5711.0.0
0x2119.0F	Storage option in error log	UINT8	rw	Rx	P0.5713.0.0
0x2119.11	Storage option in error log	UINT8	rw	Rx	P0.5715.0.0
0x2119.15	Storage option in error log	UINT8	rw	Rx	P0.5719.0.0
0x2119.17	Storage option in error log	UINT8	rw	Rx	P0.5721.0.0
0x2119.19	Storage option in error log	UINT8	rw	Rx	P0.5723.0.0
0x2119.1B	Storage option in error log	UINT8	rw	Rx	P0.5725.0.0
0x2119.1D	Storage option in error log	UINT8	rw	Rx	P0.5727.0.0
0x2119.1E	Parameter set status	UINT32	ro	Tx	P0.5728.0.0
0x2119.22	Diagnostic category	UINT8	rw	Rx	P0.5781.0.0
0x2119.24	Diagnostic category	UINT8	rw	Rx	P0.5783.0.0
0x211B.01	Axis ID data trigger	UINT16	rw	Rx	P0.6000.0.0
0x211B.02	Data ID data trigger	UINT32	rw	Rx	P0.6001.0.0

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0x211B.03	Data instance ID data trigger	UINT16	rw	Rx	P0.6002.0.0
0x211B.04	Array ID data trigger	UINT16	rw	Rx	P0.6003.0.0
0x211B.05	Trigger event	UINT32	rw	Rx	P0.6004.0.0
0x211B.06	Current axis ID data trigger	UINT16	ro	Tx	P0.6006.0.0
0x211B.07	Current data ID data trigger	UINT32	ro	Tx	P0.6007.0.0
0x211B.08	Current data instance ID data trigger	UINT16	ro	Tx	P0.6008.0.0
0x211B.09	Current array ID data trigger	UINT16	ro	Tx	P0.6009.0.0
0x211B.0A	Current data trigger type	UINT32	ro	Tx	P0.6010.0.0
0x211B.0B	Current trigger threshold	SINT64	ro	Tx	P0.6013.0.0
0x211B.0C	Trigger level	SINT64	rw	Rx	P0.60012.0.0
0x211B.0D	Bit mask data trigger	UINT64	rw	Rx	P0.60013.0.0
0x211E.01	PWM frequency selection	UINT32	ro	Tx	P0.670.0.0
0x2120.01	EtherCAT state machine state (ESM)	UINT32	ro	Tx	P0.720.0.0
0x2122.01	Sync manager 0 PDO assignment EtherCAT	UINT8	ro	Tx	P0.751.0.0
0x2122.02	Sync manager 1 PDO assignment EtherCAT	UINT8	ro	Tx	P0.752.0.0
0x2122.0C	Abort connection option code	SINT16	rw	Rx	P0.757.0.0
0x2122.0D	Diagnostic category	UINT16	rw	Rx	P0.758.0.0
0x2122.0E	Storage option in error log	UINT8	rw	Rx	P0.759.0.0
0x2122.0F	Counter Process data loss	UINT32	ro	Tx	P0.1770.0.0
0x2123.01	Receive PDO number of objects EtherCAT	UINT8	rw	Rx	P0.760.0.0
0x2124.01	Sync manager x number of assigned PDOs EtherCAT	UINT8	rw	Rx	P0.770.0.0
0x2124.02	Sync manager x number of assigned PDOs EtherCAT	UINT8	rw	Rx	P0.770.1.0
0x2125.02	Diagnostic category	UINT16	rw	Rx	P0.801.0.0

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0x2125.03	Storage option in error log	UINT8	rw	Rx	P0.802.0.0
0x2126.01	Transmit PDO number of objects EtherCAT	UINT8	rw	Rx	P0.880.0.0
0x2126.02	Transmit PDO number of objects EtherCAT	UINT8	rw	Rx	P0.880.1.0
0x2126.03	Transmit PDO number of objects EtherCAT	UINT8	rw	Rx	P0.880.2.0
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	FLOAT32	ro	Tx	P0.920.0.0
0x2128.02	Temperature status power output stage	SINT32	ro	Tx	P0.921.0.0
0x2128.03	Diagnostic category	UINT16	rw	Rx	P0.922.0.0
0x2128.04	Storage option in error log	UINT8	rw	Rx	P0.923.0.0
0x2128.07	Diagnostic category	UINT16	rw	Rx	P0.926.0.0
0x2128.08	Storage option in error log	UINT8	rw	Rx	P0.927.0.0
0x2128.0E	Storage option in error log	UINT8	rw	Rx	P0.933.0.0
0x2128.12	Storage option in error log	UINT8	rw	Rx	P0.937.0.0
0x2128.19	Upper limit value warning threshold power output stage temperature	FLOAT32	rw	Rx	P0.9314.0.0
0x2128.1A	Upper limit value power output stage temperature	FLOAT32	rw	Rx	P0.9315.0.0
0x2128.1B	Lower limit value warning threshold power output stage temperature	FLOAT32	rw	Rx	P0.9316.0.0
0x2128.1C	Lower limit value power output stage temperature	FLOAT32	rw	Rx	P0.9317.0.0
0x2128.21	Current upper limit value warning threshold power output stage temperature	FLOAT32	ro	Tx	P0.9322.0.0

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0x2128.22	Current upper limit value power output stage temperature	FLOAT32	ro	Tx	P0.9323.0.0
0x2128.23	Current lower limit value warning threshold power output stage temperature	FLOAT32	ro	Tx	P0.9324.0.0
0x2128.24	Current lower limit value power output stage temperature	FLOAT32	ro	Tx	P0.9325.0.0
0x2129.01	Firmware version	STRING(30)	ro	Tx	P0.960.0.0 … 29
0x2129.02	Major Version Firmware	UINT32	ro	Tx	P0.961.0.0
0x2129.03	Minor Version Firmware	UINT32	ro	Tx	P0.962.0.0
0x2129.04	Patch Version Firmware	UINT32	ro	Tx	P0.963.0.0
0x2129.05	Build Version Firmware	UINT32	ro	Tx	P0.964.0.0
0x2129.06	Firmware status	UINT32	ro	Tx	P0.965.0.0
0x2129.07	Current firmware slot	UINT32	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	UINT32	ro	Tx	P0.9560.0.0
0x2129.0A	Minor version firmware package	UINT32	ro	Tx	P0.9570.0.0
0x2129.0B	Patch version firmware package	UINT32	ro	Tx	P0.9580.0.0
0x2129.0C	Build version firmware package	UINT32	ro	Tx	P0.9590.0.0
0x2129.0E	Storage option in error log	UINT8	rw	Rx	P0.9601.0.0
0x2129.10	Storage option in error log	UINT8	rw	Rx	P0.9603.0.0
0x2129.12	Storage option in error log	UINT8	rw	Rx	P0.9605.0.0
0x2129.14	Storage option in error log	UINT8	rw	Rx	P0.9607.0.0
0x2129.16	Storage option in error log	UINT8	rw	Rx	P0.9609.0.0
0x2129.18	Storage option in error log	UINT8	rw	Rx	P0.9611.0.0
0x2129.1A	Storage option in error log	UINT8	rw	Rx	P0.9613.0.0
0x2129.1C	Storage option in error log	UINT8	rw	Rx	P0.9615.0.0

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0x212E.01	Synchronisation mode	UINT16	rw	Rx	P0.1050.0.0
0x212E.02	Synchronisation process repetition time	FLOAT32	rw	Rx	P0.1051.0.0
0x212E.03	Synchronisation process time shift	FLOAT32	rw	Rx	P0.1052.0.0
0x212E.04	Sync mode supported	UINT16	ro	Tx	P0.1053.0.0
0x212E.05	Sync Minimum Cycle Time	FLOAT32	ro	Tx	P0.1054.0.0
0x212E.06	Sync Calc And Copy Time	FLOAT32	ro	Tx	P0.1055.0.0
0x212E.07	Sync Get Cycle Time	UINT16	rw	Rx	P0.1056.0.0
0x212E.08	Sync Delay Time	FLOAT32	ro	Tx	P0.1057.0.0
0x212E.09	Sync0 Cycle Time	FLOAT32	rw	Rx	P0.1058.0.0
0x212E.0A	Sync SM Event Missed	UINT16	ro	Tx	P0.1059.0.0
0x212E.0B	Sync cycle time too small	UINT16	ro	Tx	P0.1060.0.0
0x212E.0C	Sync Error	BOOL	ro	Tx	P0.1061.0.0
0x212E.0D	Calc and copy time	FLOAT32	ro	Tx	P0.1062.0.0
0x212E.0E	Maximum delay time	FLOAT32	ro	Tx	P0.1063.0.0
0x212F.0A	Digital input X1A.7	UINT32	rw	Rx	P0.11201.0.0
0x212F.0B	Digital input X1A.8	UINT32	rw	Rx	P0.11202.0.0
0x212F.0C	Digital output X1A.9	UINT32	rw	Rx	P0.11203.0.0
0x212F.0D	Digital output X1A.10	UINT32	rw	Rx	P0.11204.0.0
0x212F.0E	Digital input X1C.2	UINT32	rw	Rx	P0.11205.0.0
0x212F.0F	Status word Object 0x60FE	UINT16	rw	Rx	P0.11310.0.0
0x2130.1F	Commutation angle from user configuration	SINT64	rw	Rx	P0.3219.0.0
0x2130.21	Current commutation angle	SINT64	ro	Tx	P0.3220.0.0
0x2130.23	Zero point offset from encoder memory	SINT64	rw	Rx	P0.3221.0.0
0x2130.25	Zero point offset from user configuration	SINT64	rw	Rx	P0.3223.0.0
0x2130.27	Current zero point offset	SINT64	ro	Tx	P0.3224.0.0
0x2130.29	Encoder referencing is valid	BOOL	ro	Tx	P0.3225.0.0

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0x2130.2B	Referencing in user configuration is valid	BOOL	rw	Rx	P0.3226.0.0
0x2130.2D	Current referencing is valid	BOOL	ro	Tx	P0.3227.0.0
0x2130.2F	Valid commutation angle from encoder memory	BOOL	ro	Tx	P0.3228.0.0
0x2130.31	Valid commutation angle from user configuration	BOOL	ro	Tx	P0.3229.0.0
0x2130.33	Current commutation angle valid	BOOL	ro	Tx	P0.3230.0.0
0x2130.39	Electrical angular frequency filtered	FLOAT32	ro	Tx	P0.3234.0.0
0x2130.3D	Deactivation motor change check	BOOL	rw	Rx	P0.3236.0.0
0x2130.3F	Encoder permanently homed	BOOL	rw	Rx	P0.3237.0.0
0x2130.41	Material number motor reference configuration	UINT32	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	BOOL	rw	Rx	P0.3250.0.0
0x2130.5B	Selection gear ratio group	UINT8	rw	Rx	P0.3251.0.0
0x2130.5D	Standardised encoder position	SINT64	ro	Tx	P0.11600.0.0
0x2130.5F	Absolute position in user units	SINT64	ro	Tx	P0.11601.0.0
0x2130.61	Velocity in user units	FLOAT32	ro	Tx	P0.11602.0.0
0x2130.63	Filtered velocity in user units	FLOAT32	ro	Tx	P0.11603.0.0
0x2130.65	Electrical angle	UINT32	ro	Tx	P0.11604.0.0
0x2130.67	Electrical angular frequency	FLOAT32	ro	Tx	P0.11605.0.0

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0x2130.6D	Commutation angle from encoder memory	SINT64	rw	Rx	P0.11608.0.0
0x2130.7B	Current position	SINT64	ro	Tx	P0.11615.0.0
0x2130.7D	Encoder selection	UINT32	rw	Rx	P0.11616.0.0
0x2130.7F	Active encoder	UINT32	ro	Tx	P0.11617.0.0
0x2130.81	Velocity filter filter time constant	FLOAT32	rw	Rx	P0.11618.0.0
0x2130.93	Actual acceleration value unfiltered	FLOAT32	ro	Tx	P0.71500.0.0
0x2130.95	Actual acceleration value filtered	FLOAT32	ro	Tx	P0.71501.0.0
0x2130.97	Filter time constant acceleration filter	FLOAT32	rw	Rx	P0.71502.0.0
0x2133.02	Operating hour counter	FLOAT32	ro	Tx	P0.1423.0.0
0x2136.01	EtherCAT explicit device ID	UINT16	rw	Rx	P0.7600.0.0
0x2136.02	Device type CiA402	UINT32	rw	Rx	P0.7601.0.0
0x2136.04	Device name CiA402	STRING(9)	rw	Rx	P0.7603.0.0 ... 8
0x2136.05	Hardware version CiA402	STRING(6)	rw	Rx	P0.7604.0.0 ... 5
0x2136.06	Software version CiA402	STRING(6)	rw	Rx	P0.7605.0.0 ... 5
0x2136.07	Ethercat address CiA402	UINT16	rw	Rx	P0.7606.0.0
0x2136.08	Vendor ID	UINT32	rw	Rx	P0.7607.0.0
0x2136.09	Product code	UINT32	rw	Rx	P0.7608.0.0
0x2136.0A	Revision number	UINT32	rw	Rx	P0.7609.0.0
0x2138.01	Encoder resolution	UINT16	rw	Rx	P0.10040.0.0
0x2138.04	Raw value position	UINT16	ro	Tx	P0.10041.0.0
0x2138.07	Raw value number of revolutions	SINT16	ro	Tx	P0.10042.0.0
0x2138.0A	Quadrature evaluation	UINT8	rw	Rx	P0.10043.0.0
0x2138.34	Activation inversion zero pulse	BOOL	rw	Rx	P0.10045.0.0
0x2138.35	Zero pulse monitoring window	UINT16	rw	Rx	P0.10047.0.0
0x2138.36	Storage option in error log	UINT8	rw	Rx	P0.10060.0.0

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0x2138.37	Diagnostic category	UINT16	rw	Rx	P0.10061.0.0
0x2139.02	Message counter	UINT32	ro	Tx	P0.100501.0.0
0x2139.03	Current file pointer	UINT32	ro	Tx	P0.100502.0.0
0x2139.04	Current file size	UINT32	ro	Tx	P0.100503.0.0
0x2139.06	Storage option in error log	UINT8	rw	Rx	P0.100505.0.0
0x2139.08	Storage option in error log	UINT8	ro	Tx	P0.100509.0.0
0x2139.09	Current indicator in the message buffer	UINT32	ro	Tx	P0.100510.0.0
0x213D.01	Device interface x1A status	UINT32	ro	Tx	P0.10151.0.0
0x213D.02	Device interface x1C status	UINT32	ro	Tx	P0.10152.0.0
0x213D.03	Internal interface status	UINT32	ro	Tx	P0.10153.0.0
0x213F.01	DC link recovery deactiva-tion	FLOAT32	ro	Tx	P0.10181.0.0
0x213F.02	DC link recovery status	BOOL	ro	Tx	P0.10182.0.0
0x213F.04	Activation automatic voltage determination	BOOL	rw	Rx	P0.10184.0.0
0x213F.05	Power feedback switch-off threshold	FLOAT32	rw	Rx	P0.10185.0.0
0x213F.06	Scaling factor offset of voltage calculation	FLOAT32	rw	Rx	P0.10186.0.0
0x2140.01	Activate PNP input and out-put behaviour	UINT8	rw	Rx	P0.10191.0.0
0x2140.02	Inversion of the inputs act-ive	BOOL	ro	Tx	P0.10192.0.0
0x2140.03	Inversion of the outputs active	BOOL	ro	Tx	P0.10193.0.0
0x2141.01	ExceptionCount	UINT32	ro	Tx	P0.10300.0.0
0x2141.02	ExceptionType	UINT32	ro	Tx	P0.10301.0.0
0x2141.03	PID	UINT32	ro	Tx	P0.10302.0.0
0x2141.04	ErrorCode	UINT32	ro	Tx	P0.10303.0.0
0x2141.05	UserInfo	UINT32	ro	Tx	P0.10304.0.0
0x2141.06	RegR14ex	UINT32	ro	Tx	P0.10305.0.0
0x2141.07	RegMPU	UINT32	ro	Tx	P0.10306.0.0

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0x2141.08	RegState	UINT32	ro	Tx	P0.10307.0.0
0x2141.09	RegIPSR	UINT32	ro	Tx	P0.10308.0.0
0x2141.0A	RegCFSR	UINT32	ro	Tx	P0.10309.0.0
0x2141.0B	RegHFSR	UINT32	ro	Tx	P0.10310.0.0
0x2141.0C	Bus fault address register	UINT32	ro	Tx	P0.10311.0.0
0x2141.0D	MemManage Fault Address Register	UINT32	ro	Tx	P0.10312.0.0
0x2141.0E	Auxiliary Fault Status Register	UINT32	ro	Tx	P0.10313.0.0
0x2141.0F	System Handler Control and State Register	UINT32	ro	Tx	P0.10314.0.0
0x2141.10	Reset status list	UINT32	ro	Tx	P0.10315.0.0
0x2141.11	Operating system-specific	UINT32	ro	Tx	P0.10316.0.0
0x2142.01	Axis ID diagnostic trace	UINT16	rw	Rx	P0.103100.0.0
0x2142.02	Diagnostics ID diagnostic trace	UINT32	rw	Rx	P0.103101.0.0
0x2142.03	Data instance ID diagnostic trace	UINT16	rw	Rx	P0.103102.0.0
0x2142.04	Current axis ID diagnostic trace	UINT16	ro	Tx	P0.103103.0.0
0x2142.05	Current diagnostics ID diagnostic trace	UINT32	ro	Tx	P0.103104.0.0
0x2142.06	Current data instance ID diagnostic trace	UINT16	ro	Tx	P0.103105.0.0
0x2142.07	Diagnostics trigger	UINT32	rw	Rx	P0.103106.0.0
0x2142.08	Current diagnostics trigger	UINT32	ro	Tx	P0.103107.0.0
0x2143.01	Status ReInit	UINT32	ro	Tx	P0.10321.0.0
0x2143.02	Status ReInit requested	BOOL	ro	Tx	P0.10322.0.0
0x2143.03	Status ReInit active	BOOL	ro	Tx	P0.10323.0.0
0x2143.04	Status ReInit device restart	BOOL	ro	Tx	P0.10324.0.0
0x2143.08	Storage option in error log	UINT8	rw	Rx	P0.10328.0.0
0x2143.09	Number ReInit requests	UINT32	ro	Tx	P0.10329.0.0
0x2143.0A	Number activated ReInit	UINT32	ro	Tx	P0.10330.0.0

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0x2143.0B	ID reintialisation	UINT32	ro	Tx	P0.11280019.0.0
0x2145.01	Diagnostic axis status	UINT16	ro	Tx	P0.301.0.0
0x2145.02	Diagnostic axis status	UINT16	ro	Tx	P0.301.1.0
0x2145.03	Diagnostic response axis	UINT16	ro	Tx	P0.302.0.0
0x2145.04	Diagnostic response axis	UINT16	ro	Tx	P0.302.1.0
0x2145.09	Number diagnostics acknowledgements	UINT32	ro	Tx	P0.103401.0.0
0x2145.0A	Number diagnostics acknowledgements	UINT32	ro	Tx	P0.103401.1.0
0x2145.0B	Currently most serious error	UINT32	ro	Tx	P0.315.0.0
0x2145.0C	Currently most serious error	UINT32	ro	Tx	P0.315.1.0
0x214C.03	Test user 10	UINT8	rw	Rx	P0.9303.0.0
0x214C.04	Test user 20	UINT8	rw	Rx	P0.9304.0.0
0x214C.05	Test user 30	UINT8	rw	Rx	P0.9305.0.0
0x214D.01	Activate DHCP	BOOL	rw	Rx	P0.12000.0.0
0x214D.02	Activate DHCP	BOOL	rw	Rx	P0.12000.1.0
0x214D.03	IP address	UINT32	rw	Rx	P0.12001.0.0
0x214D.04	IP address	UINT32	rw	Rx	P0.12001.1.0
0x214D.05	Subnet mask	UINT32	rw	Rx	P0.12002.0.0
0x214D.06	Subnet mask	UINT32	rw	Rx	P0.12002.1.0
0x214D.07	Gateway address	UINT32	rw	Rx	P0.12003.0.0
0x214D.08	Gateway address	UINT32	rw	Rx	P0.12003.1.0
0x214D.09	Active IP address	UINT32	ro	Tx	P0.12004.0.0
0x214D.0A	Active IP address	UINT32	ro	Tx	P0.12004.1.0
0x214D.0B	Active subnet mask	UINT32	ro	Tx	P0.12005.0.0
0x214D.0C	Active subnet mask	UINT32	ro	Tx	P0.12005.1.0
0x214D.0D	Active gateway address	UINT32	ro	Tx	P0.12006.0.0
0x214D.0E	Active gateway address	UINT32	ro	Tx	P0.12006.1.0
0x214F.01	Major version bootloader	UINT32	ro	Tx	P0.1130121.0.0
0x214F.02	Minor version bootloader	UINT32	ro	Tx	P0.1130122.0.0

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0x214F.03	Patch version bootloader	UINT32	ro	Tx	P0.1130123.0.0
0x214F.04	Build version bootloader	UINT32	ro	Tx	P0.1130124.0.0
0x214F.05	Version bootloader	STRING(32)	ro	Tx	P0.1130125.0.0 ... 31
0x2150.01	Switch-on delay holding brake 1	FLOAT32	ro	Tx	P1.20.0.0
0x2150.02	Switch-off delay holding brake 1	FLOAT32	ro	Tx	P1.21.0.0
0x2150.05	Status holding brake 1	UINT32	ro	Tx	P1.24.0.0
0x2150.07	Status holding brakes 1 and 2	UINT32	ro	Tx	P1.26.0.0
0x2150.09	Selection of holding brake (manual opening)	UINT32	ro	Tx	P1.29.0.0
0x2151.0A	Actual phase U current value	FLOAT32	ro	Tx	P1.39.0.0
0x2151.0B	Actual phase V current value	FLOAT32	ro	Tx	P1.310.0.0
0x2151.0C	Voltage limiting filter time constant	FLOAT32	rw	Rx	P1.52679.0.0
0x2151.0D	Voltage limiting Ud active	BOOL	ro	Tx	P1.52680.0.0
0x2151.0E	Voltage limiting Uq active	BOOL	ro	Tx	P1.52681.0.0
0x2151.0F	Diagnostic category	UINT16	rw	Rx	P1.52682.0.0
0x2151.10	Storage option in error log	UINT8	rw	Rx	P1.52683.0.0
0x2152.02	Controller operating status	UINT32	ro	Tx	P1.42.0.0
0x2152.06	Setpoint value active current unfiltered	FLOAT32	ro	Tx	P1.52.0.0
0x2152.09	Velocity limiting active	BOOL	ro	Tx	P1.52675.0.0
0x2152.0A	Current limitation active	BOOL	ro	Tx	P1.52676.0.0
0x2152.0B	Diagnostic category	UINT16	rw	Rx	P1.52677.0.0
0x2152.0C	Storage option in error log	UINT8	rw	Rx	P1.52678.0.0
0x2152.0D	Filter time constant controller limitation	FLOAT32	rw	Rx	P1.526794.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2153.01	Amplification gain current regulator (reactive current)	FLOAT32	rw	Rx	P1.80.0.0
0x2153.02	Integration constant current regulator (reactive current)	FLOAT32	rw	Rx	P1.81.0.0
0x2153.03	Amplification gain current regulator (active current)	FLOAT32	rw	Rx	P1.82.0.0
0x2153.04	Integration constant current regulator (active current)	FLOAT32	rw	Rx	P1.83.0.0
0x2153.05	Setpoint value voltage Ud	FLOAT32	ro	Tx	P1.84.0.0
0x2153.06	Setpoint value voltage Uq	FLOAT32	ro	Tx	P1.85.0.0
0x2153.07	Setpoint value active current	FLOAT32	ro	Tx	P1.86.0.0
0x2153.08	Setpoint value reactive current	FLOAT32	ro	Tx	P1.87.0.0
0x2153.09	Maximum output voltage	FLOAT32	ro	Tx	P1.88.0.0
0x2153.0A	Actual Clarke-Transformation la current value	FLOAT32	ro	Tx	P1.89.0.0
0x2153.0B	Actual Clarke-Transformation lb current value	FLOAT32	ro	Tx	P1.810.0.0
0x2153.0E	Actual reactive current value	FLOAT32	ro	Tx	P1.813.0.0
0x2153.0F	Actual active current value	FLOAT32	ro	Tx	P1.814.0.0
0x2153.14	Control parameter equalisation for active and reactive current regulators	BOOL	rw	Rx	P1.819.0.0
0x2153.15	Reactive current control error	FLOAT32	ro	Tx	P1.824.0.0
0x2153.16	Active current control error	FLOAT32	ro	Tx	P1.825.0.0
0x2154.01	Setpoint value position	SINT64	ro	Tx	P1.90.0.0
0x2154.02	Setpoint value velocity	FLOAT32	ro	Tx	P1.91.0.0
0x2154.03	Setpoint value acceleration	FLOAT32	ro	Tx	P1.92.0.0
0x2154.04	Setpoint value jerk	FLOAT32	ro	Tx	P1.93.0.0

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0x2154.05	Setpoint value torque	FLOAT32	ro	Tx	P1.94.0.0
0x2154.06	Feed forward control current output	FLOAT32	ro	Tx	P1.95.0.0
0x2154.07	Inactive time position setpoint value	UINT32	rw	Rx	P1.957.0.0
0x2154.08	Time constant velocity setpoint value filter	FLOAT32	rw	Rx	P1.958.0.0
0x2154.09	Time constant acceleration setpoint value filter	FLOAT32	rw	Rx	P1.959.0.0
0x2154.0A	Amplification gain velocity feed forward control	FLOAT32	rw	Rx	P1.967.0.0
0x2154.0B	Amplification gain torque feed forward control	FLOAT32	rw	Rx	P1.968.0.0
0x2154.0C	Offset torque	FLOAT32	rw	Rx	P1.969.0.0
0x2154.0D	Total inertia	FLOAT32	rw	Rx	P1.973.0.0
0x2154.0E	Setpoint value friction compensation	FLOAT32	ro	Tx	P1.974.0.0
0x2154.0F	Setpoint value inertia compensation	FLOAT32	ro	Tx	P1.975.0.0
0x2154.10	Number of support points	UINT32	rw	Rx	P1.978.0.0
0x2155.03	Encoder channel 1 position	UINT32	ro	Tx	P1.122.0.0
0x2155.09	Actual position value	SINT64	ro	Tx	P1.128.0.0
0x2155.0B	Actual velocity value	FLOAT32	ro	Tx	P1.1210.0.0
0x2155.0D	Electrical angle	UINT32	ro	Tx	P1.1212.0.0
0x2155.0E	Electrical angular frequency	FLOAT32	ro	Tx	P1.1213.0.0
0x2156.01	Controller parameter set switchover status	BOOL	ro	Tx	P1.44.0.0
0x2157.01	Actual torque value motor shaft	FLOAT32	ro	Tx	P1.150.0.0
0x2157.02	Actual torque value gear shaft	FLOAT32	ro	Tx	P1.151.0.0
0x2158.01	Motion Manager status	UINT32	ro	Tx	P1.171.0.0

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0x2158.02	Active motion task	UINT32	ro	Tx	P1.172.0.0
0x2158.03	Active motion task status	UINT32	ro	Tx	P1.173.0.0
0x2158.0F	Storage option in error log	UINT8	rw	Rx	P1.1733.0.0
0x2159.01	Current record table index	SINT32	ro	Tx	P1.1837.0.0
0x2159.02	Maximum number record links	UINT32	ro	Tx	P1.1839.0.0
0x2159.03	Activate Event table	BOOL	rw	Rx	P1.1840.0.0
0x2159.04	Status of record table	UINT32	ro	Tx	P1.1846.0.0
0x2159.05	Diagnostic category	UINT16	rw	Rx	P1.1850.0.0
0x2159.06	Storage option in error log	UINT8	rw	Rx	P1.1851.0.0
0x2159.07	Diagnostic category	UINT16	rw	Rx	P1.1852.0.0
0x2159.08	Storage option in error log	UINT8	rw	Rx	P1.1853.0.0
0x2159.09	Record table status	SINT32	ro	Tx	P1.526797.0.0
0x2159.0A	Activation background mode	BOOL	rw	Rx	P1.1130224.0.0
0x215B.01	Position controller amplification gain	FLOAT32	rw	Rx	P1.220.0.0
0x215B.02	Dead zone position controller	SINT64	rw	Rx	P1.221.0.0
0x215B.03	Minimum correction velocity	FLOAT32	rw	Rx	P1.222.0.0
0x215B.04	Maximum correction velocity	FLOAT32	rw	Rx	P1.223.0.0
0x215B.05	Velocity controller amplification gain	FLOAT32	rw	Rx	P1.224.0.0
0x215B.06	Velocity controller integration constant	FLOAT32	rw	Rx	P1.225.0.0
0x215B.07	Velocity control error	FLOAT32	ro	Tx	P1.2215.0.0
0x215B.08	Setpoint value velocity controller	FLOAT32	ro	Tx	P1.2216.0.0
0x215B.09	Position control error	SINT64	ro	Tx	P1.2217.0.0
0x215B.0A	Minimum torque	FLOAT32	ro	Tx	P1.2218.0.0
0x215B.0B	Maximum torque	FLOAT32	ro	Tx	P1.2219.0.0

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0x215B.0C	Setpoint value torque	FLOAT32	ro	Tx	P1.2220.0.0
0x215E.0B	Power unit dataset major version	STRING(2)	ro	Tx	P1.2800.0.0 ... 1
0x215E.0C	Minor version power unit dataset	UINT16	ro	Tx	P1.2801.0.0
0x215E.13	Lower limit value minimum DC link voltage	FLOAT32	ro	Tx	P1.2818.0.0
0x215E.14	Upper limit value minimum DC link voltage	FLOAT32	ro	Tx	P1.2819.0.0
0x215E.25	Upper limit value power output stage temperature	FLOAT32	ro	Tx	P1.2850.0.0
0x215E.26	Lower limit value power output stage temperature	FLOAT32	ro	Tx	P1.2851.0.0
0x215E.27	Upper limit value servo drive temperature	FLOAT32	ro	Tx	P1.2852.0.0
0x215E.28	Lower limit value servo drive temperature	FLOAT32	ro	Tx	P1.2853.0.0
0x215E.46	Upper limit value minimum load voltage	FLOAT32	ro	Tx	P1.28120.0.0
0x215E.47	Lower limit value minimum load voltage	FLOAT32	ro	Tx	P1.28121.0.0
0x215E.48	Upper limit value maximum load voltage	FLOAT32	ro	Tx	P1.28130.0.0
0x215E.49	Lower limit value maximum load voltage	FLOAT32	ro	Tx	P1.28131.0.0
0x215E.4A	Lower limit value maximum DC link voltage	FLOAT32	ro	Tx	P1.28180.0.0
0x215E.4B	Upper limit value maximum DC link voltage	FLOAT32	ro	Tx	P1.28181.0.0
0x215E.4C	Upper limit value warning threshold maximum DC link voltage	FLOAT32	ro	Tx	P1.28200.0.0
0x215E.4D	Lower limit value warning threshold maximum DC link voltage	FLOAT32	ro	Tx	P1.28201.0.0

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0x215F.01	Setpoint management output position	SINT64	ro	Tx	P1.290.0.0
0x215F.02	Setpoint management output velocity	FLOAT32	ro	Tx	P1.291.0.0
0x215F.03	Setpoint management output acceleration	FLOAT32	ro	Tx	P1.292.0.0
0x215F.04	Setpoint management output jerk	FLOAT32	ro	Tx	P1.293.0.0
0x215F.05	Setpoint management output torque	FLOAT32	ro	Tx	P1.294.0.0
0x215F.06	Setpoint management output current	FLOAT32	ro	Tx	P1.295.0.0
0x215F.07	Setpoint management control structure	UINT32	ro	Tx	P1.296.0.0
0x215F.08	Setpoint management controller operating status	UINT32	ro	Tx	P1.297.0.0
0x2162.01	Use of user specific motor data	BOOL	rw	Rx	P1.14.0.0
0x2162.02	Current pole pairs	UINT32	ro	Tx	P1.719.0.0
0x2162.03	Current motor inertia	FLOAT32	ro	Tx	P1.7112.0.0
0x2162.04	Current phase sequence	BOOL	ro	Tx	P1.7115.0.0
0x2162.05	Current nominal current	FLOAT32	ro	Tx	P1.7118.0.0
0x2162.06	Current maximum current	FLOAT32	ro	Tx	P1.7121.0.0
0x2162.07	Current maximum velocity	FLOAT32	ro	Tx	P1.7124.0.0
0x2162.08	Current nominal velocity	FLOAT32	ro	Tx	P1.7127.0.0
0x2162.09	Current winding inductance	FLOAT32	ro	Tx	P1.7130.0.0
0x2162.0A	Current winding resistance	FLOAT32	ro	Tx	P1.7133.0.0
0x2162.0B	Current torque constant	FLOAT32	ro	Tx	P1.7136.0.0
0x2162.0C	Resulting nominal torque	FLOAT32	ro	Tx	P1.7139.0.0
0x2162.0D	Resulting maximum torque	FLOAT32	ro	Tx	P1.7142.0.0
0x2162.0E	Current time constant I^2t	FLOAT32	ro	Tx	P1.7145.0.0
0x2162.0F	Current winding temperature	FLOAT32	ro	Tx	P1.7148.0.0

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0x2162.10	Current temperature sensor motor	UINT32	ro	Tx	P1.7154.0.0
0x2162.11	Holding brake	BOOL	ro	Tx	P1.7160.0.0
0x2162.12	Current switch-on delay holding brake	FLOAT32	ro	Tx	P1.7163.0.0
0x2162.13	Current switch-off delay holding brake	FLOAT32	ro	Tx	P1.7166.0.0
0x2162.14	Current NOC code motor	STRING(32)	ro	Tx	P1.7188.0.0 ... 31
0x2162.15	Current database ID motor	UINT32	ro	Tx	P1.7189.0.0
0x2162.16	Current nominal motor voltage	FLOAT32	ro	Tx	P1.71422.0.0
0x2162.17	Current continuous current	FLOAT32	ro	Tx	P1.71425.0.0
0x2162.18	Current Lq inductance	FLOAT32	ro	Tx	P1.71426.0.0
0x2162.19	Current Ld inductance	FLOAT32	ro	Tx	P1.71427.0.0
0x2162.1A	Motor type	UINT8	ro	Tx	P1.71428.0.0
0x2162.1B	Diagnostic category	UINT16	rw	Rx	P1.71429.0.0
0x2162.1C	Storage option in error log	UINT8	rw	Rx	P1.71433.0.0
0x2162.1D	Active denominator Pole pairs	UINT32	ro	Tx	P1.7191.0.0
0x2164.01	STO hysteresis time	FLOAT32	rw	Rx	P1.390.0.0
0x2164.02	STO discrepancy time	FLOAT32	rw	Rx	P1.391.0.0
0x2164.03	STO safety status	UINT32	ro	Tx	P1.392.0.0
0x2164.04	STO error status	UINT32	ro	Tx	P1.393.0.0
0x2164.05	STO signal status	UINT32	ro	Tx	P1.394.0.0
0x2166.01	Movement monitoring status	UINT32	ro	Tx	P1.460.0.0
0x2166.02	Configuration word movement monitoring	UINT32	ro	Tx	P1.461.0.0
0x2166.03	Damping time position: following error	FLOAT32	rw	Rx	P1.462.0.0
0x2166.04	Monitoring window position: following error	FLOAT32	rw	Rx	P1.463.0.0

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0x2166.05	Monitoring window speed: following error	FLOAT32	rw	Rx	P1.464.0.0
0x2166.06	Standstill damping time	FLOAT32	rw	Rx	P1.465.0.0
0x2166.07	Monitoring window speed standstill monitoring	FLOAT32	rw	Rx	P1.466.0.0
0x2166.08	Monitoring window position standstill	FLOAT32	rw	Rx	P1.467.0.0
0x2166.09	Damping time target reached	FLOAT32	rw	Rx	P1.468.0.0
0x2166.0A	Monitoring window target position	FLOAT32	rw	Rx	P1.469.0.0
0x2166.0B	Monitoring window target speed	FLOAT32	rw	Rx	P1.4610.0.0
0x2166.0C	Monitoring window target torque	FLOAT32	rw	Rx	P1.4611.0.0
0x2166.0D	Diagnostic category	UINT16	rw	Rx	P1.4612.0.0
0x2166.0E	Storage option in error log	UINT8	rw	Rx	P1.4613.0.0
0x2166.0F	Diagnostic category	UINT16	rw	Rx	P1.4614.0.0
0x2166.10	Storage option in error log	UINT8	rw	Rx	P1.4615.0.0
0x2166.11	Diagnostic category	UINT16	rw	Rx	P1.4616.0.0
0x2166.12	Storage option in error log	UINT8	rw	Rx	P1.4617.0.0
0x2166.13	Diagnostic category	UINT16	rw	Rx	P1.4618.0.0
0x2166.14	Storage option in error log	UINT8	rw	Rx	P1.4619.0.0
0x2166.15	Diagnostic category	UINT16	rw	Rx	P1.4620.0.0
0x2166.16	Storage option in error log	UINT8	rw	Rx	P1.4621.0.0
0x2166.17	Diagnostic category	UINT16	rw	Rx	P1.4622.0.0
0x2166.18	Storage option in error log	UINT8	rw	Rx	P1.4623.0.0
0x2166.19	Diagnostic category	UINT16	rw	Rx	P1.4624.0.0
0x2166.1A	Storage option in error log	UINT8	rw	Rx	P1.4625.0.0
0x2166.1B	Stop detection limit value	FLOAT32	rw	Rx	P1.4626.0.0
0x2166.1C	Damping time limit detection	FLOAT32	rw	Rx	P1.4627.0.0

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0x2166.1D	Software limit positions active	BOOL	rw	Rx	P1.4628.0.0
0x2166.1E	Negative software limit position	SINT64	rw	Rx	P1.4629.0.0
0x2166.1F	Positive software limit position	SINT64	rw	Rx	P1.4630.0.0
0x2166.20	Activation of automatic stop ramp software limit position	BOOL	rw	Rx	P1.4631.0.0
0x2166.21	Diagnostic category	UINT16	rw	Rx	P1.4632.0.0
0x2166.22	Storage option in error log	UINT8	rw	Rx	P1.4633.0.0
0x2166.23	Diagnostic category	UINT16	rw	Rx	P1.4634.0.0
0x2166.24	Storage option in error log	UINT8	rw	Rx	P1.4635.0.0
0x2166.25	Diagnostic category	UINT16	rw	Rx	P1.4636.0.0
0x2166.26	Storage option in error log	UINT8	rw	Rx	P1.4637.0.0
0x2166.27	Diagnostic category	UINT16	rw	Rx	P1.4638.0.0
0x2166.28	Storage option in error log	UINT8	rw	Rx	P1.4639.0.0
0x2166.30	Maximum speed	FLOAT32	rw	Rx	P1.4660.0.0
0x2166.31	Diagnostic category	UINT16	ro	Tx	P1.4661.0.0
0x2166.33	Monitoring window pushback	FLOAT32	rw	Rx	P1.4663.0.0
0x2166.34	Damping time pushback	FLOAT32	rw	Rx	P1.4664.0.0
0x2166.35	Damping time target range	FLOAT32	rw	Rx	P1.4665.0.0
0x2166.36	Monitoring window position	FLOAT32	rw	Rx	P1.4666.0.0
0x2166.37	Monitoring window velocity	FLOAT32	rw	Rx	P1.4667.0.0
0x2166.38	Monitoring window torque	FLOAT32	rw	Rx	P1.4668.0.0
0x2166.39	Diagnostic category	UINT16	rw	Rx	P1.4669.0.0
0x2166.3A	Storage option in error log	UINT8	rw	Rx	P1.4670.0.0
0x2166.3B	Diagnostic category	UINT16	rw	Rx	P1.4671.0.0
0x2166.3C	Storage option in error log	UINT8	rw	Rx	P1.4672.0.0

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0x2166.3D	Activation of automatic stop ramp stroke limit	BOOL	rw	Rx	P1.4675.0.0
0x2166.3E	Diagnostic category	UINT16	rw	Rx	P1.4676.0.0
0x2166.3F	Storage option in error log	UINT8	rw	Rx	P1.4677.0.0
0x2166.40	Diagnostic category	UINT16	rw	Rx	P1.4678.0.0
0x2166.41	Storage option in error log	UINT8	rw	Rx	P1.4679.0.0
0x2166.42	Current position: following error	FLOAT32	ro	Tx	P1.4682.0.0
0x2166.43	Current velocity: following error	FLOAT32	ro	Tx	P1.4683.0.0
0x2166.44	Actual stroke value	SINT64	ro	Tx	P1.4684.0.0
0x2166.45	Limit value remaining distance monitoring	SINT64	rw	Rx	P1.4685.0.0
0x2166.46	Diagnostic category	UINT16	rw	Rx	P1.4686.0.0
0x2166.47	Storage option in error log	UINT8	rw	Rx	P1.4687.0.0
0x2166.48	Bit mask movement monitoring	UINT32	rw	Rx	P1.4688.0.0
0x2166.49	Movement monitoring (masked)	UINT32	ro	Tx	P1.4689.0.0
0x2166.4A	Damping time velocity: following error	FLOAT32	rw	Rx	P1.4690.0.0
0x2166.4B	Diagnostic category	UINT16	rw	Rx	P1.4691.0.0
0x2166.4C	Storage option in error log	UINT8	rw	Rx	P1.4692.0.0
0x2166.4D	Diagnostic category	UINT16	rw	Rx	P1.4647.0.0
0x2166.4E	Storage option in error log	UINT8	rw	Rx	P1.4648.0.0
0x2166.4F	Diagnostic category	UINT16	rw	Rx	P1.4649.0.0
0x2166.50	Storage option in error log	UINT8	rw	Rx	P1.4650.0.0
0x2166.51	Fixed stop detection damping time	FLOAT32	rw	Rx	P1.4693.0.0
0x2166.52	Limit value following error	FLOAT32	rw	Rx	P1.4694.0.0
0x2166.53	Stroke limit positive for detection of a fixed stop	SINT64	rw	Rx	P1.11280408.0.0

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0x2166.54	Stroke limit negative for detection of a fixed stop	SINT64	rw	Rx	P1.11280409.0.0
0x2166.55	Threshold value torque utilization reached	FLOAT32	rw	Rx	P1.11280410.0.0
0x2166.56	Torque utilization monitoring window	FLOAT32	rw	Rx	P1.11280411.0.0
0x2166.57	Damping time torque utilization	FLOAT32	rw	Rx	P1.11280412.0.0
0x2167.01	Device control status	UINT32	ro	Tx	P1.530.0.0
0x2168.01	Lower limit value velocity (closed loop controller)	FLOAT32	rw	Rx	P1.850.0.0
0x2168.02	Upper limit value velocity (closed loop controller)	FLOAT32	rw	Rx	P1.851.0.0
0x2168.03	Lower limit value torque (closed loop controller)	FLOAT32	rw	Rx	P1.852.0.0
0x2168.04	Upper limit value torque (closed loop controller)	FLOAT32	rw	Rx	P1.853.0.0
0x2168.05	Lower limit value active current (closed loop controller)	FLOAT32	rw	Rx	P1.854.0.0
0x2168.06	Upper limit value active current (closed loop controller)	FLOAT32	rw	Rx	P1.855.0.0
0x2168.07	Limit value total current (closed loop controller)	FLOAT32	rw	Rx	P1.856.0.0
0x2168.08	Resulting lower limit value velocity (closed loop controller)	FLOAT32	ro	Tx	P1.6100.0.0
0x2168.09	Resulting upper limit value velocity (closed loop controller)	FLOAT32	ro	Tx	P1.6101.0.0
0x2168.0C	Resulting lower limit value torque (closed loop controller)	FLOAT32	ro	Tx	P1.6104.0.0

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0x2168.0D	Resulting upper limit value torque (closed loop controller)	FLOAT32	ro	Tx	P1.6105.0.0
0x2168.10	Resulting lower limit value active current (closed loop controller)	FLOAT32	ro	Tx	P1.6108.0.0
0x2168.11	Resulting upper limit value active current (closed loop controller)	FLOAT32	ro	Tx	P1.6109.0.0
0x2168.14	Resulting upper limit value total current (closed loop controller)	FLOAT32	ro	Tx	P1.6112.0.0
0x2168.17	Maximum torque symmetrical	FLOAT32	rw	Rx	P1.526796.0.0
0x2168.18	Clamping torque	FLOAT32	rw	Rx	P1.526801.0.0
0x2168.19	Clamping torque offset	FLOAT32	rw	Rx	P1.11280407.0.0
0x2169.01	Maximum motor or servo drive torque	FLOAT32	ro	Tx	P1.381.0.0
0x2169.02	Maximum motor or servo drive velocity	FLOAT32	ro	Tx	P1.382.0.0
0x2169.03	Maximum current motor	FLOAT32	ro	Tx	P1.620.0.0
0x2169.04	Motor nominal current	FLOAT32	ro	Tx	P1.621.0.0
0x2169.05	Maximum current servo drive	FLOAT32	ro	Tx	P1.622.0.0
0x2169.06	Nominal current servo drive	FLOAT32	ro	Tx	P1.623.0.0
0x2169.07	Resulting maximum current	FLOAT32	ro	Tx	P1.624.0.0
0x2169.08	Resulting minimum current	FLOAT32	ro	Tx	P1.625.0.0
0x2169.09	Resulting nominal current	FLOAT32	ro	Tx	P1.626.0.0
0x216A.01	Scaling factor start value I^2t monitoring motor	FLOAT32	rw	Rx	P1.631.0.0
0x216A.02	Limit value I^2t monitoring motor	FLOAT32	ro	Tx	P1.632.0.0

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0x216A.03	Scaling factor maximum value after switching on	FLOAT32	ro	Tx	P1.633.0.0
0x216A.04	Actual value I^2t monitoring motor	FLOAT32	ro	Tx	P1.634.0.0
0x216A.05	Scaling factor warning limit I^2t monitoring motor	FLOAT32	rw	Rx	P1.635.0.0
0x216A.06	Maximum I^2t time	FLOAT32	ro	Tx	P1.636.0.0
0x216A.07	Scaling factor start value I^2t monitoring power output stage	FLOAT32	ro	Tx	P1.637.0.0
0x216A.08	Limit value I^2t monitoring power output stage	FLOAT32	ro	Tx	P1.638.0.0
0x216A.09	Scaling factor maximum value after switching on	FLOAT32	ro	Tx	P1.639.0.0
0x216A.0A	Actual value I^2t monitoring power output stage	FLOAT32	ro	Tx	P1.6310.0.0
0x216A.0B	Scaling factor warning limit I^2t monitoring power output stage	FLOAT32	rw	Rx	P1.6311.0.0
0x216A.0C	Scaling factor start value I^2t monitoring power output stage at standstill	FLOAT32	ro	Tx	P1.6313.0.0
0x216A.0D	Limit value I^2t monitoring power output stage at standstill	FLOAT32	ro	Tx	P1.6314.0.0
0x216A.0E	Scaling factor maximum value after drive at standstill	FLOAT32	ro	Tx	P1.6315.0.0
0x216A.0F	Actual value I^2t monitoring power output stage at standstill	FLOAT32	ro	Tx	P1.6316.0.0
0x216A.10	Scaling factor warning limit I^2t monitoring drive at standstill	FLOAT32	rw	Rx	P1.6317.0.0
0x216A.11	Diagnostic category	UINT16	rw	Rx	P1.6319.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x216A.12	Storage option in error log	UINT8	rw	Rx	P1.6320.0.0
0x216A.13	Diagnostic category	UINT16	rw	Rx	P1.6321.0.0
0x216A.14	Storage option in error log	UINT8	rw	Rx	P1.6322.0.0
0x216A.15	Diagnostic category	UINT16	rw	Rx	P1.6323.0.0
0x216A.16	Storage option in error log	UINT8	rw	Rx	P1.6324.0.0
0x216A.17	Diagnostic category	UINT16	rw	Rx	P1.6325.0.0
0x216A.18	Storage option in error log	UINT8	rw	Rx	P1.6326.0.0
0x216A.19	Diagnostic category	UINT16	rw	Rx	P1.6327.0.0
0x216A.1A	Storage option in error log	UINT8	rw	Rx	P1.6328.0.0
0x216A.1B	Diagnostic category	UINT16	rw	Rx	P1.6329.0.0
0x216A.1C	Storage option in error log	UINT8	rw	Rx	P1.6330.0.0
0x216A.1D	Actual value relative I^2t monitoring of motor to limit	FLOAT32	ro	Tx	P1.6331.0.0
0x216A.1E	Actual value relative I^2t monitoring of power output stage to limit	FLOAT32	ro	Tx	P1.6332.0.0
0x216A.1F	Actual value relative I^2t monitoring of power output stage at standstill to limit	FLOAT32	ro	Tx	P1.6333.0.0
0x216A.20	Actual value I^2t monitoring of the total current	FLOAT32	ro	Tx	P1.6334.0.0
0x216B.01	Status of state machine commutation finding	UINT32	ro	Tx	P1.660.0.0
0x216B.02	Commutation finding status	UINT32	ro	Tx	P1.661.0.0
0x216B.04	Increments	FLOAT32	rw	Rx	P1.664.0.0
0x216B.06	Mode	UINT32	rw	Rx	P1.668.0.0
0x216B.07	Velocity	FLOAT32	rw	Rx	P1.669.0.0
0x216B.0A	Acceleration	FLOAT32	rw	Rx	P1.6691.0.0
0x216B.0B	Jerk	FLOAT32	rw	Rx	P1.6692.0.0
0x216B.0C	Monitoring window angle	FLOAT32	rw	Rx	P1.6693.0.0

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0x216B.10	Commutation-angle detection damping time	FLOAT32	rw	Rx	P1.545454.0.0
0x216B.11	Commutation angle	SINT64	rw	Rx	P1.545455.0.0
0x216C.01	Pole pairs (user defined)	UINT32	rw	Rx	P1.718.0.0
0x216C.02	Motor inertia (user defined)	FLOAT32	rw	Rx	P1.7111.0.0
0x216C.03	Phase sequence (user defined)	BOOL	rw	Rx	P1.7114.0.0
0x216C.04	Nominal current (user defined)	FLOAT32	rw	Rx	P1.7117.0.0
0x216C.05	Maximum peak current (user defined)	FLOAT32	rw	Rx	P1.7120.0.0
0x216C.06	Maximum rpm (user defined)	FLOAT32	rw	Rx	P1.7123.0.0
0x216C.07	Nominal rotary speed (user defined)	FLOAT32	rw	Rx	P1.7126.0.0
0x216C.08	Winding inductance (user defined)	FLOAT32	rw	Rx	P1.7129.0.0
0x216C.09	Winding resistance (user defined)	FLOAT32	rw	Rx	P1.7132.0.0
0x216C.0A	Torque constant (user defined)	FLOAT32	rw	Rx	P1.7135.0.0
0x216C.0B	Time constant I^2t (user defined)	FLOAT32	rw	Rx	P1.7144.0.0
0x216C.0C	Winding temperature (user defined)	FLOAT32	rw	Rx	P1.7147.0.0
0x216C.0D	Temperature sensor (user defined)	UINT32	rw	Rx	P1.7153.0.0
0x216C.0E	Holding brake (user defined)	BOOL	rw	Rx	P1.7159.0.0
0x216C.0F	Switch-on delay holding brake (user defined)	FLOAT32	rw	Rx	P1.7162.0.0
0x216C.10	Switch-off delay holding brake (user defined)	FLOAT32	rw	Rx	P1.7165.0.0

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0x216C.11	NOC code motor (user defined)	STRING(32)	rw	Rx	P1.7182.0.0 ... 31
0x216C.12	Database ID motor (user defined)	UINT32	rw	Rx	P1.7184.0.0
0x216C.13	Nominal motor voltage (user defined)	FLOAT32	rw	Rx	P1.71421.0.0
0x216C.14	Continuous current (user defined)	FLOAT32	rw	Rx	P1.71424.0.0
0x216C.15	Lq inductance (user defined)	FLOAT32	rw	Rx	P1.71430.0.0
0x216C.16	Ld inductance (user defined)	FLOAT32	rw	Rx	P1.71431.0.0
0x216C.17	Motor type	UINT8	rw	Rx	P1.71432.0.0
0x216C.18	Denominator pole pairs (user-defined)	UINT32	rw	Rx	P1.7185.0.0
0x216D.01	Control word CiA402	UINT16	rw	Rx	P1.730.0.0
0x216D.02	Status word CiA402	UINT16	ro	Tx	P1.731.0.0
0x216D.05	Supported drive modes CiA402	UINT32	ro	Tx	P1.734.0.0
0x216D.06	Internal status state machine profile CiA402	UINT32	ro	Tx	P1.735.0.0
0x216D.07	Internal status state machine profile position mode CiA402	UINT32	ro	Tx	P1.736.0.0
0x216D.08	Internal status state machine profile velocity mode CiA402	UINT32	ro	Tx	P1.737.0.0
0x216D.09	Internal status state machine profile homing CiA402	UINT32	ro	Tx	P1.738.0.0
0x216D.0A	Internal status state machine profile torque mode CiA402	UINT32	ro	Tx	P1.526782.0.0
0x216D.0B	Status record table CiA402	UINT32	ro	Tx	P1.11280055.0.0
0x216D.0C	Modes of operation CiA402	SINT8	rw	Rx	P1.12234.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x216D.0D	Modes of operation display CiA402	SINT8	ro	Tx	P1.12235.0.0
0x216D.0E	Diagnostic category	UINT16	rw	Rx	P1.12236.0.0
0x216D.0F	Storage option in error log	UINT8	rw	Rx	P1.12237.0.0
0x216E.01	User unit position	UINT16	rw	Rx	P1.7851.0.0
0x216E.02	User unit velocity	UINT16	rw	Rx	P1.7852.0.0
0x216E.03	User unit acceleration	UINT16	rw	Rx	P1.7853.0.0
0x216E.04	User unit jerk	UINT16	rw	Rx	P1.7854.0.0
0x216E.05	SI unit position CiA402	UINT32	rw	Rx	P1.7860.0.0
0x216E.06	SI unit and velocity CiA402	UINT32	rw	Rx	P1.7861.0.0
0x216E.07	SI unit acceleration CiA402	UINT32	rw	Rx	P1.7862.0.0
0x216E.08	SI unit and jerk CiA402	UINT32	rw	Rx	P1.7863.0.0
0x216F.01	Torque offset CiA402	FLOAT32	rw	Rx	P1.8111.0.0
0x216F.02	Number homing methods CiA402	UINT8	ro	Tx	P1.8118.0.0
0x216F.03	Target position CiA402	SINT64	rw	Rx	P1.8130.0.0
0x216F.04	Profile velocity CiA402	FLOAT32	rw	Rx	P1.8131.0.0
0x216F.05	End velocity CiA402	FLOAT32	rw	Rx	P1.8132.0.0
0x216F.06	Profile acceleration CiA402	FLOAT32	rw	Rx	P1.8133.0.0
0x216F.07	Profile deceleration CiA402	FLOAT32	rw	Rx	P1.8134.0.0
0x216F.08	Quick stop deceleration CiA402	FLOAT32	rw	Rx	P1.8135.0.0
0x216F.09	Profile jerk CiA402	FLOAT32	rw	Rx	P1.8136.0.0
0x216F.0A	Target velocity CiA402	FLOAT32	rw	Rx	P1.8137.0.0
0x216F.0B	Velocity offset CiA402	FLOAT32	rw	Rx	P1.8138.0.0
0x216F.0C	Positioning option code CiA402	UINT16	rw	Rx	P1.88817.0.0
0x216F.0D	Target torque CiA402	FLOAT32	rw	Rx	P1.526795.0.0
0x216F.0E	Torque slope CiA402	FLOAT32	rw	Rx	P1.526799.0.0
0x216F.0F	Velocity limiting profile torque mode CiA402	FLOAT32	rw	Rx	P1.526800.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x216F.10	Positive stroke limitation CiA402	SINT64	rw	Rx	P1.526802.0.0
0x216F.11	Negative stroke limitation CiA402	SINT64	rw	Rx	P1.526803.0.0
0x216F.12	Velocity actual value CiA402	SINT64	rw	Rx	P1.8140.0.0
0x216F.13	Active CSx mode CiA402	UINT32	ro	Tx	P1.8144.0.0
0x216F.14	Next record table index CiA402	SINT32	rw	Rx	P1.11280053.0.0
0x216F.15	Activate stroke limit CiA402	BOOL	rw	Rx	P1.526804.0.0
0x216F.16	Extended Modulo Mode	UINT8	rw	Rx	P1.88818.0.0
0x2170.01	Functional safety status	UINT32	ro	Tx	P1.820.0.0
0x2170.02	Diagnostic category	UINT16	rw	Rx	P1.821.0.0
0x2170.03	Storage option in error log	UINT8	rw	Rx	P1.822.0.0
0x2170.04	Control word Motion Manager	UINT32	ro	Tx	P1.823.0.0
0x2171.01	Filter time constant noise signal generator	FLOAT32	rw	Rx	P1.8615.0.0
0x2171.02	Amplification gain noise signal generator	FLOAT32	rw	Rx	P1.8616.0.0
0x2171.03	Signal selection noise signal generator	UINT8	rw	Rx	P1.8617.0.0
0x2172.01	Referencing status	UINT32	ro	Tx	P1.840.0.0
0x2172.02	Move to axis zero point after homing	BOOL	rw	Rx	P1.841.0.0
0x2172.03	Homing timeout	FLOAT32	rw	Rx	P1.842.0.0
0x2172.04	Search for reference mark setpoint velocity	FLOAT32	rw	Rx	P1.843.0.0
0x2172.05	Search for reference mark setpoint acceleration	FLOAT32	rw	Rx	P1.844.0.0
0x2172.06	Search for reference mark setpoint jerk	FLOAT32	rw	Rx	P1.845.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2172.07	Setpoint reference mark creeping velocity	FLOAT32	rw	Rx	P1.846.0.0
0x2172.08	Setpoint reference mark creeping acceleration	FLOAT32	rw	Rx	P1.847.0.0
0x2172.09	Setpoint reference mark creeping jerk	FLOAT32	rw	Rx	P1.848.0.0
0x2172.0A	Move to axis zero point setpoint velocity	FLOAT32	rw	Rx	P1.849.0.0
0x2172.0B	Move to axis zero point setpoint acceleration	FLOAT32	rw	Rx	P1.8410.0.0
0x2172.0C	Search for move to axis zero point setpoint jerk	FLOAT32	rw	Rx	P1.8411.0.0
0x2172.0D	Maximum search stroke in positive direction	SINT64	rw	Rx	P1.8412.0.0
0x2172.0E	Maximum search stroke in negative direction	SINT64	rw	Rx	P1.8413.0.0
0x2172.0F	Nominal current limit value scaling factor	FLOAT32	rw	Rx	P1.8414.0.0
0x2172.10	Limit position detection time monitoring window	FLOAT32	rw	Rx	P1.8415.0.0
0x2172.11	Axis zero point offset	SINT64	rw	Rx	P1.8416.0.0
0x2172.12	Referencing method	SINT32	rw	Rx	P1.8417.0.0
0x2172.13	Status state machine homing	UINT32	ro	Tx	P1.8418.0.0
0x2172.19	Diagnostic category	UINT16	rw	Rx	P1.8450.0.0
0x2172.1A	Storage option in error log	UINT8	rw	Rx	P1.8451.0.0
0x2172.1B	Diagnostic category	UINT16	rw	Rx	P1.8452.0.0
0x2172.1C	Storage option in error log	UINT8	rw	Rx	P1.8453.0.0
0x2172.1D	Diagnostic category	UINT16	rw	Rx	P1.8454.0.0
0x2172.1E	Storage option in error log	UINT8	rw	Rx	P1.8455.0.0
0x2173.01	Status auto tuning	UINT8	ro	Tx	P1.860.0.0
0x2173.02	Result amplification gain of position controller	FLOAT32	rw	Rx	P1.8601.0.0

Index. Subindex	Name	Data type	Access	PDO map-ping	Parameter
0x2173.03	Result integration constant of velocity controller	FLOAT32	rw	Rx	P1.8602.0.0
0x2173.04	Result amplification gain of velocity controller	FLOAT32	rw	Rx	P1.8603.0.0
0x2173.06	Storage option in error log	UINT8	rw	Rx	P1.8605.0.0
0x2174.01	Start value position con-troller amplification gain	FLOAT32	rw	Rx	P1.8611.0.0
0x2174.02	Start value velocity control-ler amplification gain	FLOAT32	rw	Rx	P1.8612.0.0
0x2174.03	Start value velocity control-ler integration constant	FLOAT32	rw	Rx	P1.8613.0.0
0x2174.04	Filter time constant velocity controller	FLOAT32	rw	Rx	P1.8614.0.0
0x2174.05	Time delay noise signal for the start identification	FLOAT32	rw	Rx	P1.8618.0.0
0x2174.06	Identification with move-ment	BOOL	rw	Rx	P1.8619.0.0
0x2174.07	Number of identifications for averaging	UINT8	rw	Rx	P1.8620.0.0
0x2174.08	Maximum movement stroke during the identific-ation	SINT64	rw	Rx	P1.8621.0.0
0x2174.09	Maximum velocity during the identification	FLOAT32	rw	Rx	P1.8622.0.0
0x2174.0A	Maximum acceleration dur-ing the identification	FLOAT32	rw	Rx	P1.8623.0.0
0x2174.0B	Maximum deceleration dur-ing the identification	FLOAT32	rw	Rx	P1.8624.0.0
0x2174.0C	Maximum jerk during the identification	FLOAT32	rw	Rx	P1.8625.0.0
0x2174.0D	Number of validation movements	UINT8	rw	Rx	P1.8630.0.0
0x2174.0E	Movement stroke during validation movement	SINT64	rw	Rx	P1.8631.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2174.0F	Maximum velocity during validation movement	FLOAT32	rw	Rx	P1.8632.0.0
0x2174.10	Maximum acceleration during validation movement	FLOAT32	rw	Rx	P1.8633.0.0
0x2174.11	Maximum deceleration during validation movement	FLOAT32	rw	Rx	P1.8634.0.0
0x2174.12	Maximum jerk during validation movement	FLOAT32	rw	Rx	P1.8635.0.0
0x2176.02	Interpolator output position	SINT64	ro	Tx	P1.911.0.0
0x2176.03	Interpolator output velocity	FLOAT32	ro	Tx	P1.912.0.0
0x2176.04	Interpolator output acceleration	FLOAT32	ro	Tx	P1.913.0.0
0x2176.05	Interpolator output jerk	FLOAT32	ro	Tx	P1.914.0.0
0x2176.06	Interpolator output torque	FLOAT32	ro	Tx	P1.915.0.0
0x2176.07	Interpolator output current	FLOAT32	ro	Tx	P1.916.0.0
0x2176.0A	Counter motion task	UINT32	ro	Tx	P1.917.0.0
0x2178.01	SFB error status	UINT32	ro	Tx	P1.950.0.0
0x2178.02	Feedback signals	UINT32	ro	Tx	P1.951.0.0
0x2178.03	STA hysteresis time	FLOAT32	ro	Tx	P1.952.0.0
0x2179.05	Storage option in error log	UINT8	rw	Rx	P1.9914.0.0
0x217A.01	Fine interpolator output position	SINT64	ro	Tx	P1.100.0.0
0x217A.02	Fine interpolator output velocity	FLOAT32	ro	Tx	P1.101.0.0
0x217A.03	Fine interpolator output acceleration	FLOAT32	ro	Tx	P1.102.0.0
0x217A.04	Fine interpolator output jerk	FLOAT32	ro	Tx	P1.103.0.0
0x217A.05	Fine interpolator output torque	FLOAT32	ro	Tx	P1.104.0.0
0x217A.06	Fine interpolator output current	FLOAT32	ro	Tx	P1.105.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x217A.08	Fine interpolator status	UINT32	ro	Tx	P1.107.0.0
0x217B.01	IPO mode position	SINT64	ro	Tx	P1.1140.0.0
0x217B.02	IPO mode velocity	FLOAT32	ro	Tx	P1.1141.0.0
0x217B.03	IPO mode acceleration	FLOAT32	ro	Tx	P1.1142.0.0
0x217B.04	IPO mode jerk	FLOAT32	ro	Tx	P1.1143.0.0
0x217B.05	IPO mode torque	FLOAT32	ro	Tx	P1.1144.0.0
0x217B.06	IPO mode current	FLOAT32	ro	Tx	P1.1145.0.0
0x217B.07	IPO mode active	UINT32	ro	Tx	P1.1146.0.0
0x217B.08	Next IPO mode	UINT32	ro	Tx	P1.1147.0.0
0x217B.09	Current IPO mode	UINT32	ro	Tx	P1.1148.0.0
0x217B.0A	Status next IPO mode	UINT32	ro	Tx	P1.1149.0.0
0x217B.0B	IPO mode (status)	UINT32	ro	Tx	P1.11410.0.0
0x217B.0C	Interpolation step size	UINT32	ro	Tx	P1.11411.0.0
0x217B.0D	Interpolation mode CSP	UINT32	rw	Rx	P1.11412.0.0
0x217B.0E	Interpolation mode CSV	UINT32	rw	Rx	P1.11413.0.0
0x217B.0F	Interpolation mode CST	UINT32	rw	Rx	P1.11414.0.0
0x217B.12	Timing tolerance	SINT32	ro	Tx	P1.11417.0.0
0x217B.13	Interpolation step loss counter	SINT32	ro	Tx	P1.11418.0.0
0x217C.01	Current user unit	UINT32	ro	Tx	P1.1150.0.0
0x217C.02	Selection of next user unit	UINT32	rw	Rx	P1.1151.0.0
0x217C.03	User unit status	UINT32	ro	Tx	P1.1152.0.0
0x217C.04	Current torque constant	FLOAT32	ro	Tx	P1.1153.0.0
0x217C.05	Current pole pairs	UINT32	ro	Tx	P1.1154.0.0
0x217C.06	Diagnostic category	UINT16	ro	Tx	P1.1159.0.0
0x217C.07	Storage option in error log	UINT8	rw	Rx	P1.11590.0.0
0x217D.01	Reversing the direction of rotation	BOOL	rw	Rx	P1.1170.0.0
0x217D.02	Phase rotation	BOOL	rw	Rx	P1.1172.0.0
0x217D.03	Reversing the direction of rotation validation status	BOOL	rw	Rx	P1.1173.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x217D.04	Validation status of phase rotation	BOOL	rw	Rx	P1.1175.0.0
0x217E.01	Database ID of axis	UINT32	rw	Rx	P1.1191.0.0
0x217E.02	Axis NOC code	STRING(50)	rw	Rx	P1.1192.0.0 ... 49
0x217E.03	Load weight / load inertia	FLOAT32	rw	Rx	P1.1193.0.0
0x217E.04	Feed constant numerator	UINT32	rw	Rx	P1.1194.0.0
0x217E.05	Feed constant denominator	UINT32	rw	Rx	P1.1195.0.0
0x217E.06	Working stroke	SINT64	rw	Rx	P1.1196.0.0
0x217E.07	Design axis	UINT32	rw	Rx	P1.1197.0.0
0x217E.08	Length connecting shaft	FLOAT32	rw	Rx	P1.1198.0.0
0x217E.09	Maximum driving torque axis	FLOAT32	rw	Rx	P1.1199.0.0
0x217E.0A	Unlimited axis	BOOL	rw	Rx	P1.2424.0.0
0x217E.0B	Dynamic losses	FLOAT32	rw	Rx	P1.124323.0.0
0x217F.01	Database ID of mounting kit	UINT32	rw	Rx	P1.1200.0.0
0x217F.02	NOC code mounting kit	STRING(37)	rw	Rx	P1.1201.0.0 ... 36
0x217F.03	Database ID connecting shaft / coupling	UINT32	rw	Rx	P1.1202.0.0
0x217F.04	NOC code connecting shaft / coupling	STRING(37)	rw	Rx	P1.1203.0.0 ... 36
0x217F.05	Database ID cable set	UINT32	rw	Rx	P1.1204.0.0
0x217F.06	NOC code cable set	STRING(37)	rw	Rx	P1.1205.0.0 ... 36
0x217F.07	Length motor cable	FLOAT32	rw	Rx	P1.1206.0.0
0x217F.08	Status device configured	BOOL	rw	Rx	P1.1207.0.0
0x217F.09	Cable cross section	FLOAT32	rw	Rx	P1.1208.0.0
0x217F.0A	Inertia coupling	FLOAT32	rw	Rx	P1.124322.0.0
0x217F.0B	Supply voltage	FLOAT32	rw	Rx	P1.1209.0.0
0x2180.01	Stop ramp deceleration	FLOAT32	rw	Rx	P1.12101.0.0
0x2180.02	Stop ramp jerk	FLOAT32	rw	Rx	P1.12111.0.0
0x2180.03	Stop ramp velocity	FLOAT32	rw	Rx	P1.12112.0.0
0x2181.01	Stop position	SINT64	ro	Tx	P1.12201.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2181.02	Stop ramp time	FLOAT32	ro	Tx	P1.12202.0.0
0x2181.05	Status Stop ramp	UINT32	ro	Tx	P1.12205.0.0
0x2181.06	Factor extrapolation stop ramp	FLOAT32	rw	Rx	P1.12206.0.0
0x2182.01	Database ID gear unit 1	UINT32	rw	Rx	P1.1230.0.0
0x2182.02	NOC code gear unit 1	STRING(37)	rw	Rx	P1.1231.0.0 ... 36
0x2182.03	Conversion factor gear unit 1 numerator	UINT32	rw	Rx	P1.1232.0.0
0x2182.04	Conversion factor gear unit 1 denominator	UINT32	rw	Rx	P1.1233.0.0
0x2182.05	Database ID gear unit 2	UINT32	rw	Rx	P1.1234.0.0
0x2182.06	NOC code gear unit 2	STRING(37)	rw	Rx	P1.1235.0.0 ... 36
0x2182.07	Conversion factor gear unit 2 numerator	UINT32	rw	Rx	P1.1236.0.0
0x2182.08	Conversion factor gear unit 2 denominator	UINT32	rw	Rx	P1.1237.0.0
0x2182.09	Database ID gear unit 3	UINT32	rw	Rx	P1.1238.0.0
0x2182.0A	NOC code gear unit 3	STRING(37)	rw	Rx	P1.1239.0.0 ... 36
0x2182.0B	Conversion factor gear unit 3 numerator	UINT32	rw	Rx	P1.1240.0.0
0x2182.0C	Conversion factor gear unit 3 denominator	UINT32	rw	Rx	P1.1241.0.0
0x2182.0D	Total conversion factor gear unit numerator	UINT32	rw	Rx	P1.1242.0.0
0x2182.0E	Total conversion factor gear unit denominator	UINT32	rw	Rx	P1.1243.0.0
0x2182.0F	Inertia Gear	FLOAT32	rw	Rx	P1.124321.0.0
0x2183.01	Velocity limiting status	BOOL	ro	Tx	P1.1301.0.0
0x2183.02	Acceleration limiting status	BOOL	ro	Tx	P1.1302.0.0
0x2183.03	Torque limiting status	BOOL	ro	Tx	P1.1303.0.0
0x2183.04	Limit value velocity limiting	FLOAT32	rw	Rx	P1.1304.0.0
0x2183.05	Limit value acceleration limiting	FLOAT32	rw	Rx	P1.1305.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2183.06	Limit value deceleration limiting	FLOAT32	rw	Rx	P1.1306.0.0
0x2183.07	Upper limit torque limitation	FLOAT32	rw	Rx	P1.1307.0.0
0x2183.08	Lower limit torque limitation	FLOAT32	rw	Rx	P1.1308.0.0
0x2183.09	Velocity override	FLOAT32	rw	Rx	P1.1309.0.0
0x2184.01	Mileage 1	SINT64	rw	Rx	P1.1411.0.0
0x2184.05	Mileage warning threshold	SINT64	rw	Rx	P1.1417.0.0
0x2184.06	Diagnostic category	UINT16	rw	Rx	P1.1419.0.0
0x2184.07	Storage option in error log	UINT8	rw	Rx	P1.14110.0.0
0x2184.08	Mileage error threshold	SINT64	rw	Rx	P1.14111.0.0
0x2184.09	Diagnostic category	UINT16	rw	Rx	P1.14113.0.0
0x2184.0A	Storage option in error log	UINT8	rw	Rx	P1.14114.0.0
0x2184.0B	Mileage 2	SINT64	rw	Rx	P1.1414.0.0
0x2185.01	Load change counter 1	SINT64	rw	Rx	P1.1421.0.0
0x2185.05	Warning threshold load change counter	SINT64	rw	Rx	P1.1427.0.0
0x2185.06	Diagnostic category	UINT16	rw	Rx	P1.1429.0.0
0x2185.07	Storage option in error log	UINT8	rw	Rx	P1.14210.0.0
0x2185.08	Error threshold load change counter	SINT64	rw	Rx	P1.14211.0.0
0x2185.09	Diagnostic category	UINT16	rw	Rx	P1.14213.0.0
0x2185.0A	Storage option in error log	UINT8	rw	Rx	P1.14214.0.0
0x2185.0B	Load change counter 2	SINT64	rw	Rx	P1.1424.0.0
0x2186.01	Jog duration 1 movement	FLOAT32	rw	Rx	P1.1510.0.0
0x2186.02	Slow jog 1 velocity	FLOAT32	rw	Rx	P1.1511.0.0
0x2186.03	Slow jog 1 acceleration	FLOAT32	rw	Rx	P1.1512.0.0
0x2186.04	Slow jog 1 jerk	FLOAT32	rw	Rx	P1.1513.0.0
0x2186.05	Fast jog 1 velocity	FLOAT32	rw	Rx	P1.1514.0.0
0x2186.06	Fast jog 1 acceleration	FLOAT32	rw	Rx	P1.1515.0.0
0x2186.07	Fast jog 1 jerk	FLOAT32	rw	Rx	P1.1516.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2186.08	Jogging state	UINT32	ro	Tx	P1.526917.0.0
0x2186.09	Activation of symmetrical jog	BOOL	rw	Rx	P1.214526.0.0
0x2186.0D	Relative position jog 1	SINT64	rw	Rx	P1.214530.0.0
0x2186.12	Slow jog 2 velocity	FLOAT32	rw	Rx	P1.214535.0.0
0x2186.13	Slow jog 2 acceleration	FLOAT32	rw	Rx	P1.214536.0.0
0x2186.14	Slow jog 2 jerk	FLOAT32	rw	Rx	P1.214537.0.0
0x2186.15	Relative position jog 2.	SINT64	rw	Rx	P1.214538.0.0
0x2186.16	Jog duration 2 movement	FLOAT32	rw	Rx	P1.214539.0.0
0x2186.17	Fast jog 2 velocity	FLOAT32	rw	Rx	P1.214540.0.0
0x2186.18	Fast jog 2 acceleration	FLOAT32	rw	Rx	P1.214541.0.0
0x2186.19	Fast jog 2 jerk	FLOAT32	rw	Rx	P1.214542.0.0
0x2186.1A	Currently used slow jog 1 velocity	FLOAT32	ro	Tx	P1.214543.0.0
0x2186.1B	Currently used slow jog 1 acceleration	FLOAT32	ro	Tx	P1.214544.0.0
0x2186.1C	Currently used slow jog 1 jerk	FLOAT32	ro	Tx	P1.214545.0.0
0x2186.1D	Currently used jog 1 movement duration	FLOAT32	ro	Tx	P1.214546.0.0
0x2186.1E	Currently used fast jog 1 velocity	FLOAT32	ro	Tx	P1.214547.0.0
0x2186.1F	Currently used fast jog 1 acceleration	FLOAT32	ro	Tx	P1.214548.0.0
0x2186.20	Currently used fast jog 1 jerk	FLOAT32	ro	Tx	P1.214549.0.0
0x2186.21	Currently used slow jog 2 velocity	FLOAT32	ro	Tx	P1.214550.0.0
0x2186.22	Currently used slow jog 2 acceleration	FLOAT32	ro	Tx	P1.214551.0.0
0x2186.23	Currently used slow jog 2 jerk	FLOAT32	ro	Tx	P1.214552.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2186.24	Currently used jog 2 movement duration	FLOAT32	ro	Tx	P1.214553.0.0
0x2186.25	Currently used fast jog 2 velocity	FLOAT32	ro	Tx	P1.214554.0.0
0x2186.26	Currently used fast jog 2 acceleration	FLOAT32	ro	Tx	P1.214555.0.0
0x2186.27	Currently used fast jog 2 jerk	FLOAT32	ro	Tx	P1.214556.0.0
0x2188.01	Current ramp	FLOAT32	rw	Rx	P1.1555.0.0
0x2188.02	Conversion factor torque	FLOAT32	rw	Rx	P1.1556.0.0
0x2188.03	Setpoint generator output position	SINT64	ro	Tx	P1.3010.0.0
0x2188.04	Setpoint generator output velocity	FLOAT32	ro	Tx	P1.3011.0.0
0x2188.05	Setpoint generator output acceleration	FLOAT32	ro	Tx	P1.3012.0.0
0x2188.06	Setpoint generator output jerk	FLOAT32	ro	Tx	P1.3013.0.0
0x2188.07	Setpoint generator output torque	FLOAT32	ro	Tx	P1.3014.0.0
0x2188.08	Setpoint generator output current	FLOAT32	ro	Tx	P1.3015.0.0
0x2188.09	Setpoint generator input relative target position	SINT64	ro	Tx	P1.3016.0.0
0x2188.0A	Setpoint generator input relative target velocity	FLOAT32	ro	Tx	P1.3017.0.0
0x2188.0B	Status setpoint generator	UINT32	ro	Tx	P1.3018.0.0
0x2188.0C	Diagnostic category	UINT16	rw	Rx	P1.30127.0.0
0x2188.0D	Storage option in error log	UINT8	rw	Rx	P1.30128.0.0
0x2188.0E	Monitoring window factor	FLOAT32	rw	Rx	P1.30129.0.0
0x2188.1D	Diagnostic category	UINT16	rw	Rx	P1.1130225.0.0
0x2188.1E	Storage option in error log	UINT8	rw	Rx	P1.1130226.0.0
0x2189.01	Configure negative hardware limit switch	UINT32	rw	Rx	P1.101100.0.0

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0x2189.02	Configure positive hardware limit switch	UINT32	rw	Rx	P1.101101.0.0
0x2189.03	Diagnostic category	UINT16	rw	Rx	P1.101102.0.0
0x2189.04	Storage option in error log	UINT8	rw	Rx	P1.101103.0.0
0x2189.05	Diagnostic category	UINT16	rw	Rx	P1.101104.0.0
0x2189.06	Storage option in error log	UINT8	rw	Rx	P1.101105.0.0
0x2189.07	Diagnostic category	UINT16	rw	Rx	P1.101106.0.0
0x2189.08	Storage option in error log	UINT8	rw	Rx	P1.101107.0.0
0x2189.09	Diagnostic category	UINT16	rw	Rx	P1.101108.0.0
0x2189.0A	Storage option in error log	UINT8	rw	Rx	P1.101109.0.0
0x2189.0B	Diagnostic category	UINT16	rw	Rx	P1.101110.0.0
0x2189.0C	Storage option in error log	UINT8	rw	Rx	P1.101111.0.0
0x2189.0D	Negative hardware limit switch detected	BOOL	ro	Tx	P1.101112.0.0
0x2189.0E	Positive hardware limit switch detected	BOOL	ro	Tx	P1.101113.0.0
0x2189.0F	Negative limit switch position detected	SINT64	ro	Tx	P1.101114.0.0
0x2189.10	Positive limit switch position detected	SINT64	ro	Tx	P1.101115.0.0
0x2189.11	Activation of hardware limit switch monitoring	BOOL	rw	Rx	P1.101116.0.0
0x218A.01	Reference switch configuration	UINT32	rw	Rx	P1.101200.0.0
0x218A.02	Reference switch status	BOOL	ro	Tx	P1.101201.0.0
0x218D.01	Active switch-on threshold reactive current braking	FLOAT32	ro	Tx	P1.102101.0.0
0x218D.02	Active end value reactive current braking	FLOAT32	ro	Tx	P1.102102.0.0
0x218D.03	Status reactive current braking	BOOL	ro	Tx	P1.102103.0.0
0x218D.04	Activate reactive current braking	BOOL	rw	Rx	P1.102104.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x218D.05	Maximum reactive current reactive current braking	FLOAT32	ro	Tx	P1.102105.0.0
0x218D.06	Actual value reactive current braking	FLOAT32	ro	Tx	P1.102106.0.0
0x218D.07	Activation automatic voltage determination	BOOL	rw	Rx	P1.102107.0.0
0x218D.08	Switch-on threshold reactive current braking	FLOAT32	rw	Rx	P1.102108.0.0
0x218D.09	End value reactive current braking	FLOAT32	rw	Rx	P1.102109.0.0
0x218E.01	Device status	UINT32	ro	Tx	P1.10231.0.0
0x218E.02	Controller enable selection	UINT32	rw	Rx	P1.10232.0.0
0x218E.03	Controller enable operating mode	UINT32	rw	Rx	P1.10234.0.0
0x218E.04	Target velocity for controller enable (velocity operation)	FLOAT32	rw	Rx	P1.10235.0.0
0x218E.05	Target torque for controller enable (torque operation)	FLOAT32	rw	Rx	P1.10236.0.0
0x218E.06	Maximum velocity for controller enable (torque operation)	FLOAT32	rw	Rx	P1.10237.0.0
0x218E.07	Index for controller enable	SINT32	rw	Rx	P1.10238.0.0
0x218E.08	Torque increase for controller enable	FLOAT32	rw	Rx	P1.11280018.0.0
0x218E.09	Error active	BOOL	ro	Tx	P1.112819.0.0
0x218F.01	Request directional lock	SINT32	rw	Rx	P1.10351.0.0
0x218F.02	Active directional lock	SINT32	ro	Tx	P1.10352.0.0
0x218F.03	Status directional lock	SINT32	ro	Tx	P1.10353.0.0
0x2190.01	Default value target position	SINT64	rw	Rx	P1.10361.0.0
0x2190.02	Default value maximum velocity	FLOAT32	rw	Rx	P1.10362.0.0

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0x2190.03	Default value maximum acceleration	FLOAT32	rw	Rx	P1.10363.0.0
0x2190.04	Default value maximum delay	FLOAT32	rw	Rx	P1.10364.0.0
0x2190.05	Default value maximum jerk	FLOAT32	rw	Rx	P1.10365.0.0
0x2190.06	Default value target velocity	FLOAT32	rw	Rx	P1.10366.0.0
0x2190.07	Default value activation stroke limitation	BOOL	rw	Rx	P1.10367.0.0
0x2190.08	Default value negative stroke limit	SINT64	rw	Rx	P1.10368.0.0
0x2190.09	Default value positive stroke limit	SINT64	rw	Rx	P1.10369.0.0
0x2190.0A	Default value target torque	FLOAT32	rw	Rx	P1.10370.0.0
0x2190.0B	Default value Torque rise ramp	FLOAT32	rw	Rx	P1.10371.0.0
0x2191.01	Valid movement monitoring position control	UINT32	rw	Rx	P1.11280020.0.0
0x2191.02	Valid movement monitoring velocity control	UINT32	rw	Rx	P1.11280021.0.0
0x2191.03	Valid movement monitoring torque regulation	UINT32	rw	Rx	P1.11280022.0.0
0x2191.04	Valid movement monitoring position control analogue	UINT32	rw	Rx	P1.11280023.0.0
0x2191.05	Valid movement monitoring velocity control analogue	UINT32	rw	Rx	P1.11280024.0.0
0x2191.06	Valid movement monitoring torque regulation analogue	UINT32	rw	Rx	P1.11280025.0.0
0x2191.07	Valid movement monitoring CSP	UINT32	rw	Rx	P1.11280026.0.0

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0x2191.08	Valid movement monitoring CSV	UINT32	rw	Rx	P1.11280027.0.0
0x2191.09	Valid movement monitoring CST	UINT32	rw	Rx	P1.11280028.0.0
0x2191.0A	Valid Power Off movement monitoring	UINT32	rw	Rx	P1.11280029.0.0
0x2191.0B	Valid motion monitoring Moving to fixed stop	UINT32	rw	Rx	P1.11280031.0.0
0x2191.0C	Valid motion monitoring AC4 without DSC	UINT32	rw	Rx	P1.11280032.0.0
0x2191.0D	Valid motion monitoring AC4 without DSC	UINT32	rw	Rx	P1.11280033.0.0
0x2192.01	Cam controller mode	UINT16	rw	Rx	P1.112700.0.0
0x2192.02	Cam controller mode	UINT16	rw	Rx	P1.112700.1.0
0x2192.03	Cam controller source	UINT16	rw	Rx	P1.112701.0.0
0x2192.04	Cam controller source	UINT16	rw	Rx	P1.112701.1.0
0x2192.05	Upper limit value modulo	SINT64	rw	Rx	P1.112702.0.0
0x2192.06	Upper limit value modulo	SINT64	rw	Rx	P1.112702.1.0
0x2192.07	Lower limit value modulo	SINT64	rw	Rx	P1.112703.0.0
0x2192.08	Lower limit value modulo	SINT64	rw	Rx	P1.112703.1.0
0x2192.09	Inactive time compensation of first switching point	FLOAT32	rw	Rx	P1.112704.0.0
0x2192.0A	Inactive time compensation of first switching point	FLOAT32	rw	Rx	P1.112704.1.0
0x2192.0B	Inactive time compensation of second switching point	FLOAT32	rw	Rx	P1.112705.0.0
0x2192.0C	Inactive time compensation of second switching point	FLOAT32	rw	Rx	P1.112705.1.0
0x2192.0D	Hysteresis	SINT64	rw	Rx	P1.112706.0.0
0x2192.0E	Hysteresis	SINT64	rw	Rx	P1.112706.1.0
0x2192.0F	Switching time (manual)	FLOAT32	rw	Rx	P1.112707.0.0

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0x2192.10	Switching time (manual)	FLOAT32	rw	Rx	P1.112707.1.0
0x2192.11	Current cam controller mode	UINT16	ro	Tx	P1.112713.0.0
0x2192.12	Current cam controller mode	UINT16	ro	Tx	P1.112713.1.0
0x2192.13	Current cam controller source	UINT16	ro	Tx	P1.112714.0.0
0x2192.14	Current cam controller source	UINT16	ro	Tx	P1.112714.1.0
0x2192.15	Current upper limit value modulo	SINT64	ro	Tx	P1.112715.0.0
0x2192.16	Current upper limit value modulo	SINT64	ro	Tx	P1.112715.1.0
0x2192.17	Current lower limit value modulo	SINT64	ro	Tx	P1.112716.0.0
0x2192.18	Current lower limit value modulo	SINT64	ro	Tx	P1.112716.1.0
0x2192.19	Current inactive time first switching point	FLOAT32	ro	Tx	P1.112717.0.0
0x2192.1A	Current inactive time first switching point	FLOAT32	ro	Tx	P1.112717.1.0
0x2192.1B	Current inactive time second switching point	FLOAT32	ro	Tx	P1.112718.0.0
0x2192.1C	Current inactive time second switching point	FLOAT32	ro	Tx	P1.112718.1.0
0x2192.1D	Current hysteresis	SINT64	ro	Tx	P1.112719.0.0
0x2192.1E	Current hysteresis	SINT64	ro	Tx	P1.112719.1.0
0x2192.1F	Current switching time (manual)	FLOAT32	ro	Tx	P1.112720.0.0
0x2192.20	Current switching time (manual)	FLOAT32	ro	Tx	P1.112720.1.0
0x2192.21	Modulo position for the logic (ON)	SINT64	ro	Tx	P1.112726.0.0

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0x2192.22	Modulo position for the logic (ON)	SINT64	ro	Tx	P1.112726.1.0
0x2192.23	Modulo position for the logic (OFF)	SINT64	ro	Tx	P1.112727.0.0
0x2192.24	Modulo position for the logic (OFF)	SINT64	ro	Tx	P1.112727.1.0
0x2192.25	Cam switch status ON/OFF	BOOL	ro	Tx	P1.112728.0.0
0x2192.26	Cam switch status ON/OFF	BOOL	ro	Tx	P1.112728.1.0
0x2192.27	Status modulo limit reached	BOOL	ro	Tx	P1.112729.0.0
0x2192.28	Status modulo limit reached	BOOL	ro	Tx	P1.112729.1.0
0x2192.29	Status active cam switch	UINT8	ro	Tx	P1.112730.0.0
0x2192.2A	Status active cam switch	UINT8	ro	Tx	P1.112730.1.0
0x2192.2D	Offset modulo position	SINT64	rw	Rx	P1.112732.0.0
0x2192.2E	Offset modulo position	SINT64	rw	Rx	P1.112732.1.0
0x2192.2F	Initialisation of modulo	SINT64	rw	Rx	P1.112733.0.0
0x2192.30	Initialisation of modulo	SINT64	rw	Rx	P1.112733.1.0
0x2192.31	Current offset modulo position	SINT64	ro	Tx	P1.112734.0.0
0x2192.32	Current offset modulo position	SINT64	ro	Tx	P1.112734.1.0
0x2192.33	Counter modulo cycles	UINT32	ro	Tx	P1.112735.0.0
0x2192.34	Counter modulo cycles	UINT32	ro	Tx	P1.112735.1.0
0x2192.35	Modulo hysteresis	SINT64	rw	Rx	P1.112736.0.0
0x2192.36	Modulo hysteresis	SINT64	rw	Rx	P1.112736.1.0
0x2192.37	Current modulo hysteresis	SINT64	ro	Tx	P1.112737.0.0
0x2192.38	Current modulo hysteresis	SINT64	ro	Tx	P1.112737.1.0
0x2193.01	Touch probe mode	UINT16	rw	Rx	P1.113000.0.0
0x2193.02	Touch probe mode	UINT16	rw	Rx	P1.113000.1.0
0x2193.03	Touch probe source	UINT16	rw	Rx	P1.113001.0.0
0x2193.04	Touch probe source	UINT16	rw	Rx	P1.113001.1.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2193.05	Selection trigger event	UINT16	rw	Rx	P1.113002.0.0
0x2193.06	Selection trigger event	UINT16	rw	Rx	P1.113002.1.0
0x2193.07	Upper limit value modulo	SINT64	rw	Rx	P1.113003.0.0
0x2193.08	Upper limit value modulo	SINT64	rw	Rx	P1.113003.1.0
0x2193.09	Lower limit value modulo	SINT64	rw	Rx	P1.113004.0.0
0x2193.0A	Lower limit value modulo	SINT64	rw	Rx	P1.113004.1.0
0x2193.0B	Lower limit value trigger event	SINT64	rw	Rx	P1.113005.0.0
0x2193.0C	Lower limit value trigger event	SINT64	rw	Rx	P1.113005.1.0
0x2193.0D	Upper limit value trigger event	SINT64	rw	Rx	P1.113006.0.0
0x2193.0E	Upper limit value trigger event	SINT64	rw	Rx	P1.113006.1.0
0x2193.0F	Current touch probe mode	UINT16	ro	Tx	P1.113007.0.0
0x2193.10	Current touch probe mode	UINT16	ro	Tx	P1.113007.1.0
0x2193.11	Current touch probe source	UINT16	ro	Tx	P1.113008.0.0
0x2193.12	Current touch probe source	UINT16	ro	Tx	P1.113008.1.0
0x2193.13	Current selection trigger event	UINT16	ro	Tx	P1.113009.0.0
0x2193.14	Current selection trigger event	UINT16	ro	Tx	P1.113009.1.0
0x2193.15	Current upper limit value modulo	SINT64	ro	Tx	P1.113010.0.0
0x2193.16	Current upper limit value modulo	SINT64	ro	Tx	P1.113010.1.0
0x2193.17	Current lower limit value modulo	SINT64	ro	Tx	P1.113011.0.0
0x2193.18	Current lower limit value modulo	SINT64	ro	Tx	P1.113011.1.0
0x2193.19	Current lower limit value trigger event	SINT64	ro	Tx	P1.113012.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2193.1A	Current lower limit value trigger event	SINT64	ro	Tx	P1.113012.1.0
0x2193.1B	Current upper limit value trigger event	SINT64	ro	Tx	P1.113013.0.0
0x2193.1C	Current upper limit value trigger event	SINT64	ro	Tx	P1.113013.1.0
0x2193.1D	Touch probe position	SINT64	ro	Tx	P1.113014.0.0
0x2193.1E	Touch probe position	SINT64	ro	Tx	P1.113014.1.0
0x2193.1F	Time stamp touch probe position	UINT64	ro	Tx	P1.113015.0.0
0x2193.20	Time stamp touch probe position	UINT64	ro	Tx	P1.113015.1.0
0x2193.21	Trigger event initiated	BOOL	ro	Tx	P1.113016.0.0
0x2193.22	Trigger event initiated	BOOL	ro	Tx	P1.113016.1.0
0x2193.23	Trigger event NOT initiated	BOOL	ro	Tx	P1.113017.0.0
0x2193.24	Trigger event NOT initiated	BOOL	ro	Tx	P1.113017.1.0
0x2193.25	Trigger events counter triggered	UINT32	ro	Tx	P1.113018.0.0
0x2193.26	Trigger events counter triggered	UINT32	ro	Tx	P1.113018.1.0
0x2193.27	Trigger events counter NOT triggered	UINT32	ro	Tx	P1.113019.0.0
0x2193.28	Trigger events counter NOT triggered	UINT32	ro	Tx	P1.113019.1.0
0x2193.29	Counter modulo cycles	UINT32	ro	Tx	P1.113020.0.0
0x2193.2A	Counter modulo cycles	UINT32	ro	Tx	P1.113020.1.0
0x2193.2B	Status touch probe input	BOOL	ro	Tx	P1.113021.0.0
0x2193.2C	Status touch probe input	BOOL	ro	Tx	P1.113021.1.0
0x2193.2D	Status modulo limit reached	BOOL	ro	Tx	P1.113022.0.0
0x2193.2E	Status modulo limit reached	BOOL	ro	Tx	P1.113022.1.0
0x2193.2F	Modulo position	SINT64	ro	Tx	P1.113023.0.0

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x2193.30	Modulo position	SINT64	ro	Tx	P1.113023.1.0
0x2193.31	Offset modulo position	SINT64	rw	Rx	P1.113024.0.0
0x2193.32	Offset modulo position	SINT64	rw	Rx	P1.113024.1.0
0x2193.33	Initialisation of modulo	SINT64	rw	Rx	P1.113025.0.0
0x2193.34	Initialisation of modulo	SINT64	rw	Rx	P1.113025.1.0
0x2193.35	Current offset modulo position	SINT64	ro	Tx	P1.113026.0.0
0x2193.36	Current offset modulo position	SINT64	ro	Tx	P1.113026.1.0
0x2193.37	Time stamp touch probe position positive CiA402	UINT64	ro	Tx	P1.113027.0.0
0x2193.38	Time stamp touch probe position positive CiA402	UINT64	ro	Tx	P1.113027.1.0
0x2193.39	Time stamp touch probe position negative CiA402	UINT64	ro	Tx	P1.113028.0.0
0x2193.3A	Time stamp touch probe position negative CiA402	UINT64	ro	Tx	P1.113028.1.0
0x2193.3B	Touch probe position positive CiA402	SINT64	ro	Tx	P1.113029.0.0
0x2193.3C	Touch probe position positive CiA402	SINT64	ro	Tx	P1.113029.1.0
0x2193.3D	Touch probe position negative CiA402	SINT64	ro	Tx	P1.113030.0.0
0x2193.3E	Touch probe position negative CiA402	SINT64	ro	Tx	P1.113030.1.0
0x2193.3F	Counter initiated trigger events positive edge CiA402	UINT32	ro	Tx	P1.113031.0.0
0x2193.40	Counter initiated trigger events positive edge CiA402	UINT32	ro	Tx	P1.113031.1.0
0x2193.41	Counter initiated trigger events negative edge CiA402	UINT32	ro	Tx	P1.113032.0.0

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0x2193.42	Counter initiated trigger events negative edge CiA402	UINT32	ro	Tx	P1.113032.1.0
0x2193.43	Touch probe status CiA402	UINT16	ro	Tx	P1.113033.0.0
0x2193.44	Touch probe status CiA402	UINT16	ro	Tx	P1.113033.1.0
0x2193.45	Modulo hysteresis	SINT64	rw	Rx	P1.113034.0.0
0x2193.46	Modulo hysteresis	SINT64	rw	Rx	P1.113034.1.0
0x2193.47	Current modulo hysteresis	SINT64	ro	Tx	P1.113035.0.0
0x2193.48	Current modulo hysteresis	SINT64	ro	Tx	P1.113035.1.0
0x2193.49	Delay time	FLOAT32	rw	Rx	P1.113036.0.0
0x2193.4A	Delay time	FLOAT32	rw	Rx	P1.113036.1.0
0x2193.4B	Current delay time	FLOAT32	ro	Tx	P1.113037.0.0
0x2193.4C	Current delay time	FLOAT32	ro	Tx	P1.113037.1.0
0x2194.01	Resolution position	SINT8	rw	Rx	P1.7841.0.0
0x2194.02	Resolution velocity	SINT8	rw	Rx	P1.7842.0.0
0x2194.03	Resolution acceleration	SINT8	rw	Rx	P1.7843.0.0
0x2194.04	Resolution jerk	SINT8	rw	Rx	P1.7844.0.0
0x2194.05	Counter overruns 32-bit	SINT32	ro	Tx	P1.11.0.0
0x2194.06	Diagnostic category	UINT16	rw	Rx	P1.45.0.0
0x2194.07	Storage option in error log	UINT8	rw	Rx	P1.46.0.0
0x2195.01	Digital inputs CiA402	UINT32	ro	Tx	P1.1128052.0.0
0x2195.02	Digital outputs CiA402	UINT32	rw	Rx	P1.1128054.0.0
0x2195.03	Bit mask digital outputs CiA402	UINT32	rw	Rx	P1.1128055.0.0
0x2195.04	CiA402 version	UINT32	ro	Tx	P1.1128056.0.0
0x2195.05	Motor type CiA402	UINT16	ro	Tx	P1.1128057.0.0
0x2195.06	Touch probe function CiA402	UINT16	rw	Rx	P1.1128060.0.0
0x2195.07	Touch probe status CiA402	UINT16	ro	Tx	P1.1128061.0.0
0x2196.01	Error register CiA402	UINT8	rw	Rx	P0.7602.0.0
0x2196.02	Local error reaction	UINT32	rw	Rx	P0.43543.0.0
0x2196.03	Sync error counter limit	UINT16	rw	Rx	P0.43544.0.0

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0x2196.04	Maximum messages	UINT8	rw	Rx	P0.43545.0.0
0x2196.05	Newest message	UINT8	rw	Rx	P0.43546.0.0
0x2196.06	Newest ack message	UINT8	rw	Rx	P0.43547.0.0
0x2196.07	New message available	BOOL	rw	Rx	P0.43548.0.0
0x2196.08	Flags	UINT16	rw	Rx	P0.43549.0.0
0x2196.09	Timestamp object	UINT64	rw	Rx	P0.43550.0.0
0x2197.01	Modulo mode	UINT16	rw	Rx	P1.113100.0.0
0x2197.03	Lower limit value modulo	SINT64	rw	Rx	P1.113102.0.0
0x2197.04	Setpoint value modulo	SINT64	ro	Tx	P1.113103.0.0
0x2197.05	Actual value of modulo	SINT64	ro	Tx	P1.113104.0.0
0x2197.06	Current mode of modulo	UINT16	ro	Tx	P1.113105.0.0
0x2197.07	Current upper limit value modulo	SINT64	ro	Tx	P1.113106.0.0
0x2197.08	Current lower limit value modulo	SINT64	ro	Tx	P1.113107.0.0
0x2197.09	Counter modulo cycles	UINT32	ro	Tx	P1.113108.0.0
0x2197.0A	Modulo status	BOOL	ro	Tx	P1.113109.0.0
0x2197.0B	Offset modulo position	SINT64	rw	Rx	P1.113110.0.0
0x2197.0C	Initialisation of modulo	SINT64	rw	Rx	P1.113111.0.0
0x2197.0D	Current offset modulo position	SINT64	ro	Tx	P1.113112.0.0
0x2197.0E	Upper limit value modulo	SINT64	rw	Rx	P1.113113.0.0
0x2198.09	Master control connection ID	UINT32	ro	Tx	P1.10233999.0.0
0x219A.01	Active connection access	UINT16	ro	Tx	P0.12012.0.0
0x219A.02	Maximum connection access	UINT16	ro	Tx	P0.12013.0.0
0x219B.01	Connection active	BOOL	ro	Tx	P0.12014.0.0
0x219B.02	Connection active	BOOL	ro	Tx	P0.12014.1.0
0x219B.03	Connection ID	UINT32	ro	Tx	P0.12015.0.0
0x219B.04	Connection ID	UINT32	ro	Tx	P0.12015.1.0
0x219B.05	Host IP address	UINT32	ro	Tx	P0.12016.0.0

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0x219B.06	Host IP address	UINT32	ro	Tx	P0.12016.1.0
0x219B.07	Port host	UINT16	ro	Tx	P0.12017.0.0
0x219B.08	Port host	UINT16	ro	Tx	P0.12017.1.0
0x219C.02	Setpoint value reactive current	FLOAT32	rw	Rx	P1.270.0.0
0x219C.03	Time current increase	FLOAT32	rw	Rx	P1.662.0.0
0x219C.04	Activation of open loop operation	BOOL	rw	Rx	P1.4001.0.0
0x219C.07	Active control structure	UINT32	ro	Tx	P1.4004.0.0
0x219C.08	Selection of mode of operation open loop/closed loop	UINT32	rw	Rx	P1.4005.0.0
0x219C.09	Selection of mode of operation	UINT32	rw	Rx	P1.4006.0.0
0x219C.0A	Active mode of operation	UINT32	ro	Tx	P1.4007.0.0
0x219C.0B	Velocity switching threshold	FLOAT32	rw	Rx	P1.4008.0.0
0x219C.0D	Current rise time	FLOAT32	rw	Rx	P1.4010.0.0
0x219C.0E	Diagnostic category	UINT16	rw	Rx	P1.4020.0.0
0x219C.0F	Storage option in error log	UINT8	rw	Rx	P1.4021.0.0
0x219C.14	Factor current setpoint value	FLOAT32	rw	Rx	P1.6694.0.0
0x219C.15	Current reduction activation	BOOL	rw	Rx	P1.4026.0.0
0x219C.16	Current reduction delay time	FLOAT32	rw	Rx	P1.4027.0.0
0x219C.17	Current reduction scaling factor	FLOAT32	rw	Rx	P1.4028.0.0
0x219F.01	Activation of field weakening	BOOL	rw	Rx	P1.102201.0.0
0x219F.02	Field weakening status	BOOL	ro	Tx	P1.102202.0.0
0x219F.03	Field weakening reactive current	FLOAT32	ro	Tx	P1.102203.0.0

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0x219F.07	Current maximum reactive current	FLOAT32	ro	Tx	P1.102207.0.0
0x21A1.01	Activation of variable message function	BOOL	rw	Rx	P0.1174200.0.0
0x21A1.02	Axis ID data trigger	UINT16	rw	Rx	P0.1174201.0.0
0x21A1.03	Data ID data trigger	UINT32	rw	Rx	P0.1174202.0.0
0x21A1.04	Data instance ID data trigger	UINT16	rw	Rx	P0.1174203.0.0
0x21A1.05	Array ID data trigger	UINT16	rw	Rx	P0.1174204.0.0
0x21A1.06	Trigger level MELDW.5	SINT64	rw	Rx	P0.1174205.0.0
0x21A1.07	Hysteresis of trigger level	SINT64	rw	Rx	P0.1174206.0.0
0x21A1.08	Data trigger damping time	FLOAT32	rw	Rx	P0.1174207.0.0
0x21A1.09	Variable message function status	BOOL	ro	Tx	P0.1174210.0.0
0x21A1.0A	Current axis ID data trigger	UINT16	ro	Tx	P0.1174211.0.0
0x21A1.0B	Current data ID data trigger	UINT32	ro	Tx	P0.1174212.0.0
0x21A1.0C	Current data instance ID data trigger	UINT16	ro	Tx	P0.1174213.0.0
0x21A1.0D	Current array ID data trigger	UINT16	ro	Tx	P0.1174214.0.0
0x21A1.0E	Current trigger level	SINT64	ro	Tx	P0.1174215.0.0
0x21A1.0F	Current hysteresis of trigger level	SINT64	ro	Tx	P0.1174216.0.0
0x21A1.10	Current data trigger damping time	FLOAT32	ro	Tx	P0.1174217.0.0
0x21A1.11	Data trigger status	BOOL	ro	Tx	P0.1174220.0.0
0x21A1.12	Diagnostic category	UINT16	rw	Rx	P0.1174230.0.0
0x21A1.13	Storage option in error log	UINT8	rw	Rx	P0.1174231.0.0
0x21A2.01	Resolution single turn	UINT32	rw	Rx	P0.3601.0.0
0x21A2.02	Resolution multiturn	UINT32	rw	Rx	P0.3602.0.0
0x21A2.03	Single-turn position	UINT32	ro	Tx	P0.3603.0.0
0x21A2.04	Multi-turn numerator	UINT32	ro	Tx	P0.3604.0.0
0x21A2.0A	CRC BiSS-C	UINT8	ro	Tx	P0.3610.0.0

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0x21A2.0C	Baud rate	UINT32	rw	Rx	P0.3612.0.0
0x21A2.0D	Activation of correction table	BOOL	rw	Rx	P0.3613.0.0
0x21A2.0E	Activation read out extended encoder data	BOOL	rw	Rx	P0.3618.0.0
0x21A2.14	unused	STRING(20)	rw	Rx	P0.3624.0.0 ... 19
0x21A2.15	Encoder serial number	UINT32	ro	Tx	P0.3625.0.0
0x21A2.16	Manufacturer ID BiSS-C	UINT16	ro	Tx	P0.3626.0.0
0x21A2.17	Current encoder ID	UINT64	ro	Tx	P0.3627.0.0
0x21A4.01	Web server activation	BOOL	rw	Rx	P0.11280051.0.0
0x21A5.01	Scaling factor start value I^2t monitoring motor model	FLOAT32	rw	Rx	P1.6301.0.0
0x21A5.02	Actual value I^2T monitoring motor model	FLOAT32	ro	Tx	P1.6302.0.0
0x21A5.03	Maximum start value I^2t monitoring motor model	FLOAT32	ro	Tx	P1.6303.0.0
0x21A5.04	Scaling factor warning limit I^2t monitoring motor model	FLOAT32	rw	Rx	P1.6305.0.0
0x21A5.06	Diagnostic category	UINT16	rw	Rx	P1.63019.0.0
0x21A5.07	Storage option in error log	UINT8	rw	Rx	P1.63020.0.0
0x21A5.08	Diagnostic category	UINT16	rw	Rx	P1.63021.0.0
0x21A5.09	Storage option in error log	UINT8	rw	Rx	P1.63022.0.0
0x21A6.01	Activation of angular feed forward control	BOOL	rw	Rx	P1.204801.0.0
0x21A6.02	Maximum value of the angular feed forward control	FLOAT32	rw	Rx	P1.204802.0.0
0x21A6.03	Scaling factor	FLOAT32	rw	Rx	P1.204803.0.0
0x21A7.01	Activation current reduction holding brake	BOOL	rw	Rx	P1.40001.0.0
0x21A7.02	Delay time	FLOAT32	rw	Rx	P1.40002.0.0
0x21A7.03	Supply voltage holding brake	FLOAT32	rw	Rx	P1.40003.0.0

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0x21A7.04	Holding voltage	FLOAT32	rw	Rx	P1.40004.0.0
0x21A8.01	Status FoE	UINT32	ro	Tx	P0.44550.0.0
0x21A8.02	File type FoE	UINT16	ro	Tx	P0.44551.0.0
0x21A8.03	Counter FoE	UINT32	ro	Tx	P0.44552.0.0
0x21AA.01	Status	SINT32	rw	Rx	P1.103111.0.0
0x21AA.0E	Diagnostic category	UINT16	rw	Rx	P1.103136.0.0
0x21AA.0F	Storage option in error log	UINT8	rw	Rx	P1.103137.0.0
0x21AA.10	Diagnostic category	UINT16	rw	Rx	P1.103138.0.0
0x21AA.11	Storage option in error log	UINT8	rw	Rx	P1.103139.0.0
0x21AA.12	Diagnostic category	UINT16	rw	Rx	P1.103140.0.0
0x21AA.13	Storage option in error log	UINT8	rw	Rx	P1.103141.0.0
0x2202.01 ... 02	Temperature sensor characteristic	FLOAT32	ro	–	P0.7155.0.0 ... 1
0x2203.01 ... 06	MAC address	UINT8	ro	–	P0.247.0.0 ... 5
0x2204.01 ... 06	MAC address	UINT8	ro	–	P0.248.0.0 ... 5
0x2205.01 ... 06	MAC address	UINT8	ro	–	P0.249.0.0 ... 5
0x2206.01 ... 06	MAC address	UINT8	ro	–	P0.265.0.0 ... 5
0x2207.01 ... 08	Trace channel	BOOL	rw	–	P0.5500.0.0 ... 7
0x2208.01 ... 08	Axis ID trace data	UINT16	rw	–	P0.5501.0.0 ... 7
0x2209.01 ... 08	Data ID trace data	UINT32	rw	–	P0.5502.0.0 ... 7
0x220A.01 ... 08	Data instance ID trace data	UINT16	rw	–	P0.5503.0.0 ... 7
0x220B.01 ... 08	Array ID trace data	UINT16	rw	–	P0.5504.0.0 ... 7
0x220C.01 ... 08	Status Trace channel	BOOL	ro	–	P0.5505.0.0 ... 7

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0x220D.01 ... 08	Current axis ID trace data	UINT16	ro	–	P0.5506.0.0 ... 7
0x220E.01 ... 08	Current data ID trace data	UINT32	ro	–	P0.5507.0.0 ... 7
0x220F.01 ... 08	Current data instance ID trace data	UINT16	ro	–	P0.5508.0.0 ... 7
0x2210.01 ... 08	Current array ID trace data	UINT16	ro	–	P0.5509.0.0 ... 7
0x2213.01 ... 05	Sync manager communication type EtherCAT	UINT8	rw	–	P0.750.0.0 ... 4
0x2214.01 ... 10	Receive PDO Mapped Objects EtherCAT	UINT32	rw	–	P0.761.0.0 ... 15
0x2215.01 ... 03	PDO mapping object index of assigned PDO EtherCAT	UINT16	rw	–	P0.771.0.0 ... 2
0x2215.02 ... 04	PDO mapping object index of assigned PDO EtherCAT	UINT16	rw	–	P0.771.1.0 ... 2
0x2215.03 ... 05	PDO mapping object index of assigned PDO EtherCAT	UINT16	rw	–	P0.771.0.0 ... 2
0x2215.05 ... 07	PDO mapping object index of assigned PDO EtherCAT	UINT16	rw	–	P0.771.1.0 ... 2
0x2216.01 ... 10	Transmit PDO mapped objects EtherCAT	UINT32	rw	–	P0.881.0.0 ... 15
0x221A.01 ... 04	Servo drive initialisation status	UINT32	ro	–	P0.10320.0.0 ... 3
0x2220.01 ... 06	MAC address	UINT8	ro	–	P0.12007.0.0 ... 5
0x2220.07 ... 0C	MAC address	UINT8	ro	–	P0.12007.1.0 ... 5
0x2221.01 ... 03	Filter frequency notch filter	FLOAT32	rw	–	P1.40.0.0 ... 2
0x2222.01 ... 03	Band width of notch filter	FLOAT32	rw	–	P1.49.0.0 ... 2
0x2223.01 ... 03	Notch filter output active current	FLOAT32	ro	–	P1.50.0.0 ... 2

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0x2224.01 ... 03	Activation of notch filter	BOOL	rw	–	P1.51.0.0 ... 2
0x2225.01 ... 10	Support point velocity [rad/s]	FLOAT32	rw	–	P1.976.0.0 ... 15
0x2226.01 ... 10	Support point torque [Nm]	FLOAT32	rw	–	P1.977.0.0 ... 15
0x2227.01 ... 03	Amplification gain position controller	FLOAT32	rw	–	P1.226.0.0 ... 2
0x2228.01 ... 03	Velocity controller amplification gain	FLOAT32	rw	–	P1.2210.0.0 ... 2
0x2229.01 ... 03	Velocity controller integration constant	FLOAT32	rw	–	P1.2211.0.0 ... 2
0x222A.01 ... 03	Amplification gain current regulator (active current)	FLOAT32	rw	–	P1.2223.0.0 ... 2
0x222B.01 ... 03	Integration constant current regulator (active current)	FLOAT32	rw	–	P1.2224.0.0 ... 2
0x222C.01 ... 03	Amplification gain current regulator (reactive current)	FLOAT32	rw	–	P1.2225.0.0 ... 2
0x222D.01 ... 03	Integration constant current regulator (reactive current)	FLOAT32	rw	–	P1.2226.0.0 ... 2
0x222E.01 ... 03	Total inertia	FLOAT32	rw	–	P1.2227.0.0 ... 2
0x222F.01 ... 03	Velocity filter filter time constant	FLOAT32	rw	–	P1.2228.0.0 ... 2
0x2230.01 ... 80	Command record type	UINT32	rw	–	P1.1810.0.0 ... 127
0x2231.01 ... 80	Record number	SINT32	rw	–	P1.1811.0.0 ... 127
0x2232.01 ... 80	Record table field 1	SINT64	rw	–	P1.1812.0.0 ... 127
0x2233.01 ... 80	Record table field 2	SINT64	rw	–	P1.1813.0.0 ... 127

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0x2234.01 ... 80	Record table field 3	SINT64	rw	–	P1.1814.0.0 ... 127
0x2235.01 ... 80	Record table field 4	SINT64	rw	–	P1.1815.0.0 ... 127
0x2236.01 ... 80	Record table field 5	SINT64	rw	–	P1.1816.0.0 ... 127
0x2237.01 ... 80	Record table field 6	SINT64	rw	–	P1.1817.0.0 ... 127
0x2238.01 ... 80	Record table field 7	SINT64	rw	–	P1.1818.0.0 ... 127
0x2239.01 ... 80	Record step enabling type	UINT32	rw	–	P1.1831.0.0 ... 127
0x223A.01 ... 80	Record sequencing record number start	SINT32	rw	–	P1.1832.0.0 ... 127
0x223B.01 ... 80	Record sequencing record number target	SINT32	rw	–	P1.1833.0.0 ... 127
0x223C.01 ... 80	Record sequencing field time	FLOAT32	rw	–	P1.1834.0.0 ... 127
0x223D.01 ... 80	Record sequencing field 1	SINT64	rw	–	P1.1835.0.0 ... 127
0x223E.01 ... 80	Record sequencing field 2	SINT64	rw	–	P1.1836.0.0 ... 127
0x223F.01 ... 80	Selection start condition record	UINT32	rw	–	P1.1838.0.0 ... 127
0x2240.01 ... 10	Event type	UINT32	rw	–	P1.1841.0.0 ... 15
0x2241.01 ... 10	Next event target	SINT32	rw	–	P1.1842.0.0 ... 15
0x2242.01 ... 10	Next event field time	FLOAT32	rw	–	P1.1843.0.0 ... 15
0x2243.01 ... 10	Next event field 1	SINT64	rw	–	P1.1844.0.0 ... 15
0x2244.01 ... 10	Next event field 2	SINT64	rw	–	P1.1845.0.0 ... 15

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0x2245.01 ... 80	Record sequencing field 3	SINT64	rw	–	P1.526778.0.0 ... 127
0x2246.01 ... 10	Next event field 3	SINT64	rw	–	P1.526779.0.0 ... 15
0x2247.01 ... 10	Next event field 4	SINT64	rw	–	P1.526786.0.0 ... 15
0x2248.01 ... 10	Next event field 5	SINT64	rw	–	P1.526787.0.0 ... 15
0x2249.01 ... 10	Next event field 6	SINT64	rw	–	P1.526788.0.0 ... 15
0x224A.01 ... 10	Next event field 7	SINT64	rw	–	P1.526789.0.0 ... 15
0x224B.01 ... 80	Record sequencing field 4	SINT64	rw	–	P1.526790.0.0 ... 127
0x224C.01 ... 80	Record sequencing field 5	SINT64	rw	–	P1.526791.0.0 ... 127
0x224D.01 ... 80	Record sequencing field 6	SINT64	rw	–	P1.526792.0.0 ... 127
0x224E.01 ... 80	Record sequencing field 7	SINT64	rw	–	P1.526793.0.0 ... 127
0x2259.01 ... 05	Status setpoint sources	UINT32	ro	–	P1.298.0.0 ... 4
0x225A.01 ... 02	Current temperature sensor characteristic motor	FLOAT32	ro	–	P1.7157.0.0 ... 1
0x225B.01 ... 02	Temperature sensor characteristic (user defined)	FLOAT32	rw	–	P1.7156.0.0 ... 1
0x225C.01 ... 11	Supported homing methods CiA402	SINT8	ro	–	P1.8119.0.0 ... 16
0x2266.01 ... 03	Current counter gear unit	FLOAT32	ro	–	P1.1155.0.0 ... 2
0x2267.01 ... 03	Current denominator gear unit	FLOAT32	ro	–	P1.1156.0.0 ... 2
0x2268.01 ... 03	Current counter feed constant	FLOAT32	ro	–	P1.1157.0.0 ... 2

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0x2269.01 ... 03	Current denominator feed constant	FLOAT32	ro	–	P1.1158.0.0 ... 2
0x226E.01 ... 0A	Invert encoder signal	BOOL	rw	–	P1.1171.0.0 ... 9
0x226F.01 ... 04	Selection of switching function	UINT16	rw	–	P1.112708.0.0 ... 3
0x226F.05 ... 08	Selection of switching function	UINT16	rw	–	P1.112708.1.0 ... 3
0x2270.01 ... 04	Selection of switching characteristics	UINT16	rw	–	P1.112709.0.0 ... 3
0x2270.05 ... 08	Selection of switching characteristics	UINT16	rw	–	P1.112709.1.0 ... 3
0x2271.01 ... 04	First switching point	SINT64	rw	–	P1.112710.0.0 ... 3
0x2271.05 ... 08	First switching point	SINT64	rw	–	P1.112710.1.0 ... 3
0x2272.01 ... 04	Second switching point	SINT64	rw	–	P1.112711.0.0 ... 3
0x2272.05 ... 08	Second switching point	SINT64	rw	–	P1.112711.1.0 ... 3
0x2273.01 ... 04	Switching time (automatic)	FLOAT32	rw	–	P1.112712.0.0 ... 3
0x2273.05 ... 08	Switching time (automatic)	FLOAT32	rw	–	P1.112712.1.0 ... 3
0x2274.01 ... 04	Current selection of switching function	UINT16	ro	–	P1.112721.0.0 ... 3
0x2274.05 ... 08	Current selection of switching function	UINT16	ro	–	P1.112721.1.0 ... 3
0x2275.01 ... 04	Current selection of switching characteristics	UINT16	ro	–	P1.112722.0.0 ... 3
0x2275.05 ... 08	Current selection of switching characteristics	UINT16	ro	–	P1.112722.1.0 ... 3
0x2276.01 ... 04	Current first switching point	SINT64	ro	–	P1.112723.0.0 ... 3

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0x2276.05 ... 08	Current first switching point	SINT64	ro	–	P1.112723.1.0 ... 3
0x2277.01 ... 04	Current second switching point	SINT64	ro	–	P1.112724.0.0 ... 3
0x2277.05 ... 08	Current second switching point	SINT64	ro	–	P1.112724.1.0 ... 3
0x2278.01 ... 04	Current switching time (automatic)	FLOAT32	ro	–	P1.112725.0.0 ... 3
0x2278.05 ... 08	Current switching time (automatic)	FLOAT32	ro	–	P1.112725.1.0 ... 3
0x2279.01 ... 10	Transmit PDO mapped objects EtherCAT	UINT32	rw	–	P0.881.1.0 ... 15
0x2279.11 ... 20	Transmit PDO mapped objects EtherCAT	UINT32	rw	–	P0.881.2.0 ... 15
0x227A.01 ... 0A	Invert encoder signal validation status	BOOL	rw	–	P1.1174.0.0 ... 9
0x227B.01 ... 03	Load weight / load inertia	FLOAT32	rw	–	P1.2229.0.0 ... 2
0x2281.01 ... 02	Damping	FLOAT32	rw	–	P1.144316.0.0 ... 1
0x2282.01 ... 02	Natural frequency	FLOAT32	rw	–	P1.144317.0.0 ... 1
0x2283.01 ... 02	Activation of vibration suppression	BOOL	rw	–	P1.144318.0.0 ... 1
0x2284.01 ... 02	Vibration suppression active	BOOL	ro	–	P1.144319.0.0 ... 1
0x2287.01 ... 08	Memory Value	SINT64	ro	–	P0.34013.0.0 ... 7
0x2288.01 ... 02	Testing phase	UINT16	rw	–	P1.103112.0.0 ... 1
0x2289.01 ... 02	Torque positive limit value	FLOAT32	rw	–	P1.103113.0.0 ... 1
0x228A.01 ... 02	Torque rise ramp Positive limit value	FLOAT32	rw	–	P1.103114.0.0 ... 1

Index. Subindex	Name	Data type	Access	PDO mapping	Parameter
0x228B.01 ... 02	Torque negative limit value	FLOAT32	rw	–	P1.103115.0.0 ... 1
0x228C.01 ... 02	Torque rise ramp Negative limit value	FLOAT32	rw	–	P1.103116.0.0 ... 1
0x228D.01 ... 02	Monitoring window Position	SINT64	rw	–	P1.103117.0.0 ... 1
0x228E.01 ... 02	Torque monitoring window	FLOAT32	rw	–	P1.103118.0.0 ... 1
0x228F.01 ... 02	Holding time Torque	FLOAT32	rw	–	P1.103120.0.0 ... 1
0x2290.01 ... 02	Waiting time	FLOAT32	rw	–	P1.103121.0.0 ... 1
0x2291.01 ... 02	Test result	UINT16	rw	–	P1.103122.0.0 ... 1
0x2292.01 ... 02	Selection of encoder interface	UINT32	rw	–	P1.103123.0.0 ... 1

Tab. 627 Referenzliste Objekte

12 PROFINET

12.1 General

The product is intended for operation in a PROFINET IO network. Data is transmitted on the basis of Industrial Ethernet following the IEEE 802.3 protocol. Communication takes place in real time, using the Real-Time Protocol (RT) or the Isochronous Real-Time Protocol (IRT). The product has two equivalent Ethernet interfaces (RJ45) with integrated switch, and therefore supports both star and line topology. The network can be divided into segments using additional switches and routers. This makes it possible to structure the network and extend it further.

PROFIdrive

PROFIdrive is a modular drive profile for electrical drive devices with PROFIBUS or PROFINET connection.

12.2 Standards

This part of the documentation describes the implemented standards and the communications of the CMMT 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 of the CMMT is based on the following standard:

Standard	Version	Edition
PROFIdrive Profile Technical Specification forPROFIBUS and PROFINET	4.2	Oct. 2015

Tab. 628 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 current device description file is available on the Festo Support Portal ➔ 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	–

ID Px.	Parameter	Description	
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. 629 Parameter

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
11295001	3320.0 … 239	Name of Station	STRING(240)
12004	2999.0	Active IP address	Unsigned32
12005	3001.0	Active subnet mask	Unsigned32
12006	3003.0	Active gateway address	Unsigned32
12007	3005.0 … 5	MAC address	Unsigned8

Tab. 630 PNUs

12.3.5 Connection Characteristics

ID Px.	Parameter	Description	
11280109	Current application class	Displays the current application class.	
		Access	read/–
		Update	effective immediately
		Unit	–
11280201	PZD telegram selection	Specifies the setting of the receive and transmit telegram.	
		Access	read/write
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
11280204	Extended process data	Displays which telegram is used for the Extended process data.	
		Access	read/write
		Update	effective immediately
		Unit	–
11280210	Active telegrams	Displays the active telegram for the respective connection.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 631 Parameter

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
11280201	922.0	PZD telegram selection	Unsigned16
11280204	60104.0	Extended process data	Unsigned16
11280210	60100.0 ... 3	Active telegrams	Unsigned16
Px.	**Manufacturer-specific parameters**		
11280201	3314.0	PZD telegram selection	Unsigned16
11280109	12317.0	Current application class	Unsigned32
11280204	3401.0	Extended process data	Unsigned16
11280210	3402.0 ... 3	Active telegrams	Unsigned16

Tab. 632 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.
0x9000	Microcontroller Hardware or Software	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
0x9001	Mains Supply	02 | 03 | 00038, 02 | 03 | 00039, 02 | 03 | 00251
0x9002	Check Voltage Supply	02 | 01 | 00022, 02 | 01 | 00023, 02 | 01 | 00024, 02 | 01 | 00025, 02 | 01 | 00026, 02 | 01 | 00027
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 | 01 | 00010, 01 | 01 | 00011
0x9007	Motor Overload	01 | 02 | 00012, 01 | 02 | 00013, 01 | 02 | 00258, 01 | 02 | 00259
0x9008	Fieldbus System	08 | 00 | 00139, 08 | 00 | 00140, 08 | 00 | 00243, 08 | 03 | 00141, 08 | 03 | 00373, 08 | 03 | 00391, 08 | 04 | 00142, 08 | 04 | 00143, 08 | 04 | 00281, 08 | 09 | 00288, 08 | 09 | 00289, 08 | 09 | 00294, 08 | 09 | 00299, 08 | 09 | 00382, 11 | 06 | 00285, 11 | 06 | 00300
0x9009	Safety Channel	09 | 00 | 00146, 09 | 00 | 00147, 09 | 01 | 00148, 09 | 01 | 00149, 09 | 01 | 00150, 09 | 02 | 00151, 09 | 02 | 00152

Channel error type	Name	Festo Automation Suite ID Dx.
0x900A	Feedback	18 I 00 I 00092, 18 I 00 I 00093, 18 I 00 I 00094, 18 I 00 I 00095, 18 I 00 I 00096, 18 I 00 I 00227, 18 I 00 I 00318, 18 I 03 I 00235, 18 I 03 I 00301, 18 I 05 I 00239, 18 I 07 I 00365, 18 I 07 I 00366, 18 I 07 I 00367, 18 I 07 I 00368, 18 I 07 I 00369, 18 I 07 I 00370, 18 I 07 I 00371, 18 I 07 I 00372
0x900B	Internal Communication	10 I 01 I 00153, 10 I 01 I 00154, 10 I 01 I 00249, 11 I 06 I 00203
0x900C	Infeed	02 I 02 I 00031
0x9010	Technology	05 I 01 I 00057, 05 I 01 I 00058, 05 I 02 I 00059, 05 I 02 I 00060, 05 I 02 I 00061, 05 I 02 I 00062, 05 I 02 I 00064, 05 I 02 I 00065, 05 I 02 I 00066, 05 I 02 I 00067, 05 I 02 I 00068, 05 I 02 I 00069, 05 I 02 I 00071, 05 I 02 I 00072, 05 I 02 I 00073, 05 I 02 I 00074, 05 I 02 I 00075, 05 I 02 I 00076, 05 I 02 I 00077, 05 I 02 I 00078, 05 I 02 I 00079, 05 I 02 I 00080, 05 I 02 I 00278, 05 I 02 I 00279, 05 I 02 I 00280, 05 I 02 I 00282, 05 I 02 I 00283, 05 I 02 I 00284, 05 I 02 I 00396, 05 I 02 I 00397, 06 I 00 I 00313, 06 I 02 I 00086, 06 I 02 I 00087, 06 I 02 I 00088, 06 I 02 I 00089, 06 I 02 I 00090, 06 I 02 I 00091, 06 I 02 I 00273, 06 I 02 I 00274, 06 I 02 I 00275, 07 I 01 I 00109, 07 I 01 I 00110, 07 I 01 I 00111, 07 I 01 I 00112, 07 I 01 I 00113, 07 I 01 I 00114, 07 I 01 I 00115, 07 I 01 I 00116, 07 I 01 I 00117, 07 I 01 I 00118, 07 I 01 I 00119, 07 I 01 I 00120, 07 I 02 I 00121, 07 I 02 I 00122, 07 I 02 I 00123, 07 I 02 I 00124, 07 I 02 I 00125, 07 I 02 I 00126, 07 I 02 I 00127, 07 I 02 I 00128, 07 I 02 I 00129, 07 I 02 I 00130, 07 I 02 I 00131, 07 I 02 I 00132, 07 I 02 I 00133, 07 I 03 I 00134, 07 I 03 I 00135, 07 I 04 I 00136, 07 I 04 I 00137, 13 I 02 I 00217, 13 I 02 I 00218, 13 I 02 I 00219, 13 I 02 I 00220
0x9011	Engineering	01 I 02 I 00018, 05 I 01 I 00056, 05 I 02 I 00364, 06 I 00 I 00070, 06 I 00 I 00081, 06 I 00 I 00082, 06 I 00 I 00083, 06 I 00 I 00084, 06 I 00 I 00085, 06 I 00 I 00248, 06 I 00 I 00252, 06 I 05 I 00097, 06 I 05 I 00098, 06 I 05 I 00099, 06 I 05 I 00100,

Channel error type	Name	Festo Automation Suite ID Dx.
		06 ǀ 05 ǀ 00101, 06 ǀ 05 ǀ 00102, 06 ǀ 05 ǀ 00103, 06 ǀ 05 ǀ 00104, 06 ǀ 05 ǀ 00105, 06 ǀ 05 ǀ 00106, 06 ǀ 05 ǀ 00107, 06 ǀ 05 ǀ 00108, 06 ǀ 05 ǀ 00290, 06 ǀ 05 ǀ 00291, 08 ǀ 09 ǀ 00144, 08 ǀ 09 ǀ 00145, 08 ǀ 12 ǀ 00250, 08 ǀ 12 ǀ 00272, 11 ǀ 07 ǀ 00205, 11 ǀ 07 ǀ 00271
0x9012	Other	03 ǀ 01 ǀ 00044, 03 ǀ 01 ǀ 00045, 03 ǀ 02 ǀ 00048, 03 ǀ 02 ǀ 00049, 12 ǀ 01 ǀ 00208, 12 ǀ 01 ǀ 00209, 12 ǀ 01 ǀ 00210, 12 ǀ 01 ǀ 00211, 12 ǀ 01 ǀ 00212, 12 ǀ 01 ǀ 00213, 13 ǀ 01 ǀ 00214, 17 ǀ 01 ǀ 00224, 17 ǀ 01 ǀ 00225, 17 ǀ 01 ǀ 00226

Tab. 633 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	1		N2 normalised value (16 bit)	113
Integer8	2		N4 normalised value (32 bit)	114
Integer16	3		V2 bit sequence	115
Integer32	4		L2 nibble	116
Integer64	55		R2 reciprocal time constant	117
Unsigned8	5		T2 time constant (16 bit)	118
Unsigned16	6		T4 time constant (32 bit)	119
Unsigned32	7		D2 time constant	120
Unsigned64	56		E2 fixed point value (16 bit)	121
FloatingPoint	8		C4 fixed point value (32 bit)	122
FloatingPoint64	15		X2 normalised value, variable (16 bit)	123

Standard data types			Profile-specific data types	
Data type	Identifier		Data type	Identifier
VisibleString	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. 634 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
  A supervisor is, for example, an engineering tool used to administer the data, parameters and diagnostic data of 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 synchronization 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.

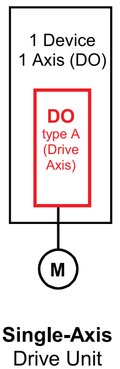

Fig. 121 PROFIdrive class single axis

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	Velocity mode (PV)
3	Positioning mode(PP)

AC	Application class
4	Central motion control (motion)

Tab. 635 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

ID Px.	Parameter	Description	
11280701	Base value speed (user unit)	Specifies the base value for the velocity application class. The base value in user units is multiplied by the normalized value in the process data and then gives the internal speed setpoint.	
		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 velocity application class.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

ID Px.	Parameter	Description	
11280403	Deceleration	Specifies the deceleration value for the velocity application class.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280404	Jerk	Specifies the value for the jerk for the application speed.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 636 Parameter

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
11280701	12345.0	Base value speed (user unit)	FloatingPoint
11280702	12346.0	Base value acceleration	FloatingPoint
11280703	12347.0	Base value deceleration	FloatingPoint
11280402	12325.0	Acceleration	FloatingPoint
11280403	12326.0	Deceleration	FloatingPoint
11280404	12327.0	Jerk	FloatingPoint

Tab. 637 PNUs

12.4.2.2 Application Class 1 – Standard Drive (Velocity Mode)

In application class 1 the drive is controlled by a main setpoint, e.g. velocity setpoint. The velocity 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.

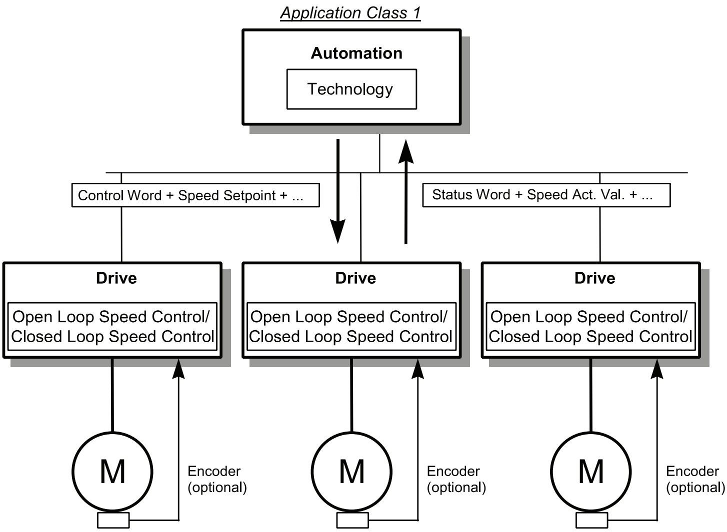

Fig. 122 Application class 1

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 velocity and all time-critical control algorithms. Cyclical synchronous operation is only required for complex tracking tasks with multiple axes.

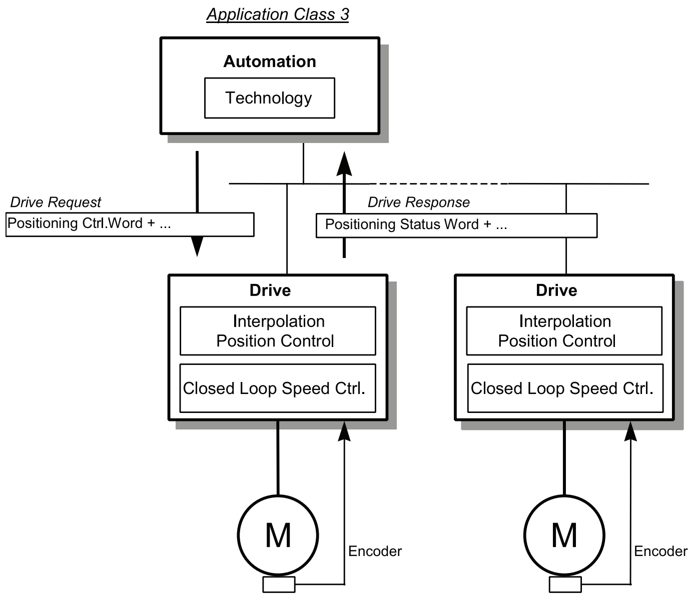

Fig. 123 Application class 3

Sub-mode Record Mode

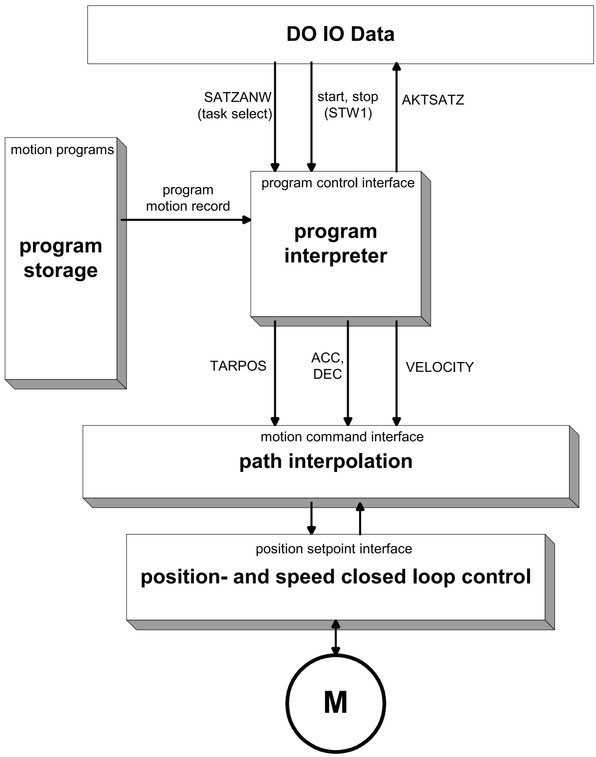

Fig. 124 Record mode

MDI Sub-mode/Target Value Specification

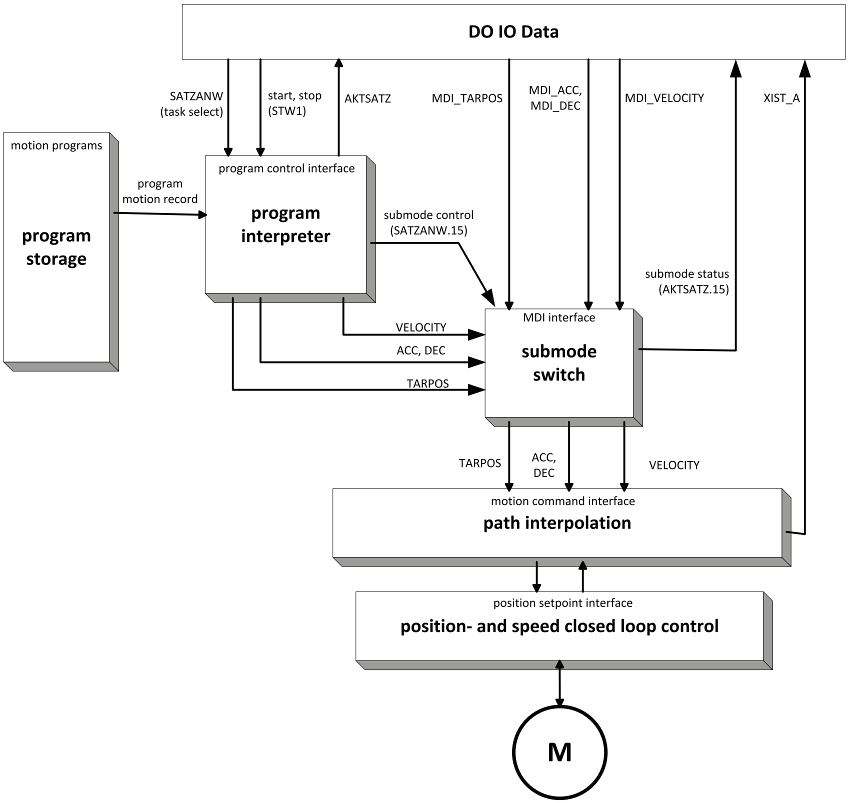

Fig. 125 Target value specification/MDI

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 velocity control of the drives.

Velocity 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 velocity control in the servo drives.

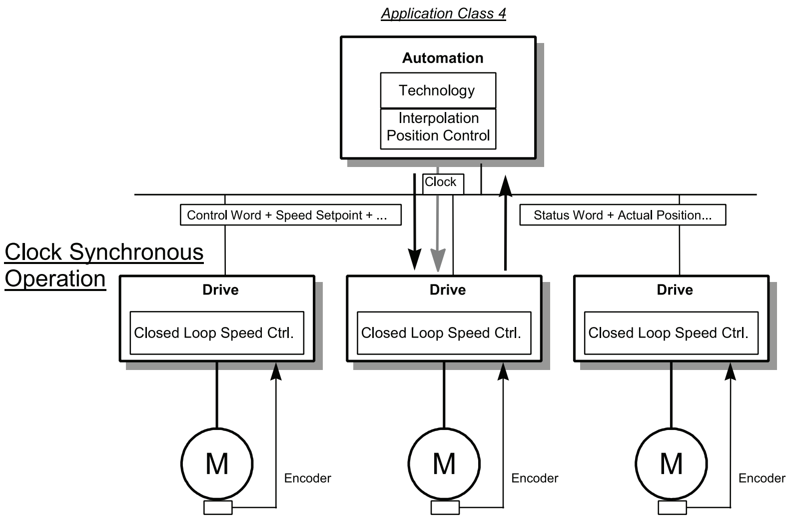

Fig. 126 Application class 4

Basic Controller Structure without DSC

During operation without "Dynamic Servo Control" (DSC), velocity 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 velocity 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).

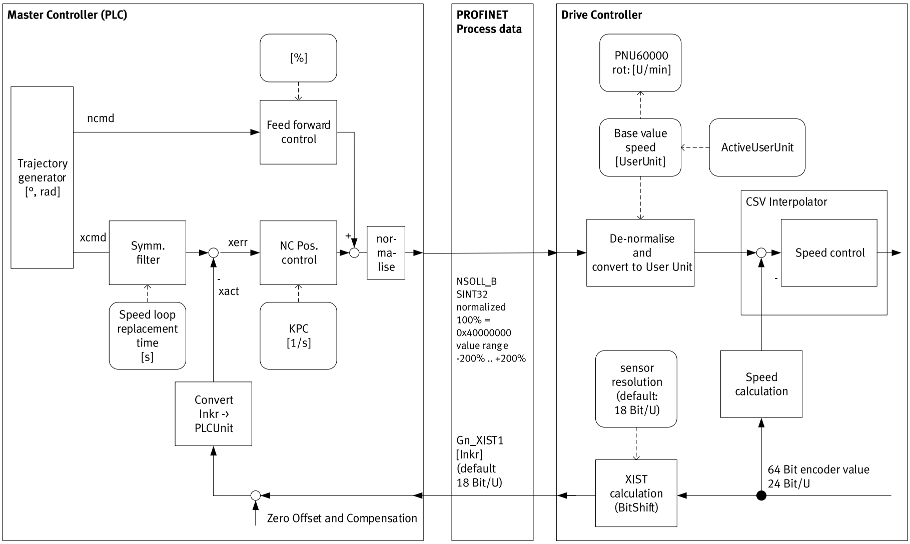

Fig. 127 Basic Controller Structure without DSC

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 velocity 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.

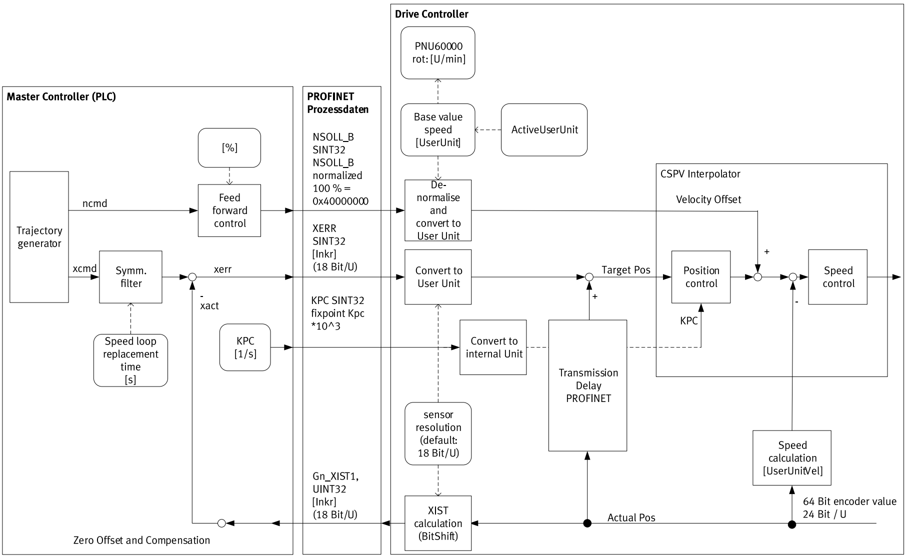

Fig. 128 Basic Controller Structure with DSC

12.4.3 Finite State Machines

12.4.3.1 Basic finite state machine

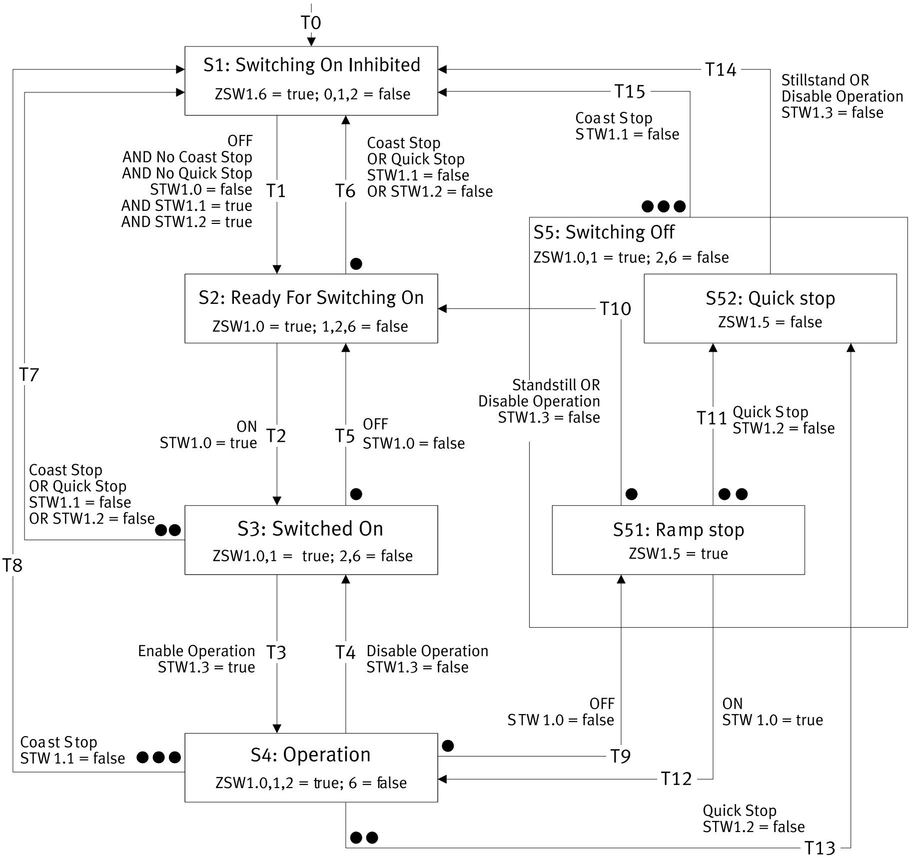

Fig. 129 Basic finite state machine

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. 638 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
		ZSW1.6	= 1
		ZSW2.11	= 0

Tab. 639 Status S1

No.	Conditions		Target status
T1	STW1.0 Power stage enable	= 0	S2 Ready For Switching On
	AND		
	STW1.1 Coast stop	= 1	
	AND		
	STW1.2 Quick stop	= 1	

Tab. 640 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. 641 Status S2

No.	Conditions		Target status
T2	STW1.0 Power stage enable	= 1	S3 Switched On
T6	STW1.1 Coast stop	= 0	S1 Switching On Inhibited
	OR		
	STW1.2 Quick stop	= 0	

Tab. 642 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. 643 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	= 0	S1 Switching On Inhibited
	OR		
	STW1.2 Quick stop	= 0	

Tab. 644 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. 645 Status S4

No.	Conditions		Target status
T4	STW1.3 Enable operation	= 0	S3 Switched On
T8	STW1.1 Coast stop	= 0	S1 Switching On Inhibited
T9	STW1.0 Power stage enable	= 0	S51 Ramp stop

No.	Conditions		Target status
T13	STW1.2 Quick stop	= 0	S52 Quick stop

Tab. 646 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
		ZSW2.10	= 1

Tab. 647 Status S5

No.	Conditions		Target status
T15	STW1.1 Coast stop	= 0	S1 Switching On Inhibited

Tab. 648 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
		ZSW2.10	= 1

Tab. 649 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	= 0	S52 Quick stop
T12	STW1.0 Power stage enable	= 1	S4 Operation

Tab. 650 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
		ZSW1.2	= 0
		ZSW1.5	= 0
		ZSW1.6	= 0
		ZSW2.10	= 1

Tab. 651 Status S52

The value of the status bit is identical to the status S5 Switching off. The status is not from status at the status bit S51 Ramp stop indistinguishable.

No.	Conditions		Target status
T10	Standstill detected	–	S1 Switching On Inhibited
	OR		
	STW1.3 Enable operation	= 0	

Tab. 652 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.

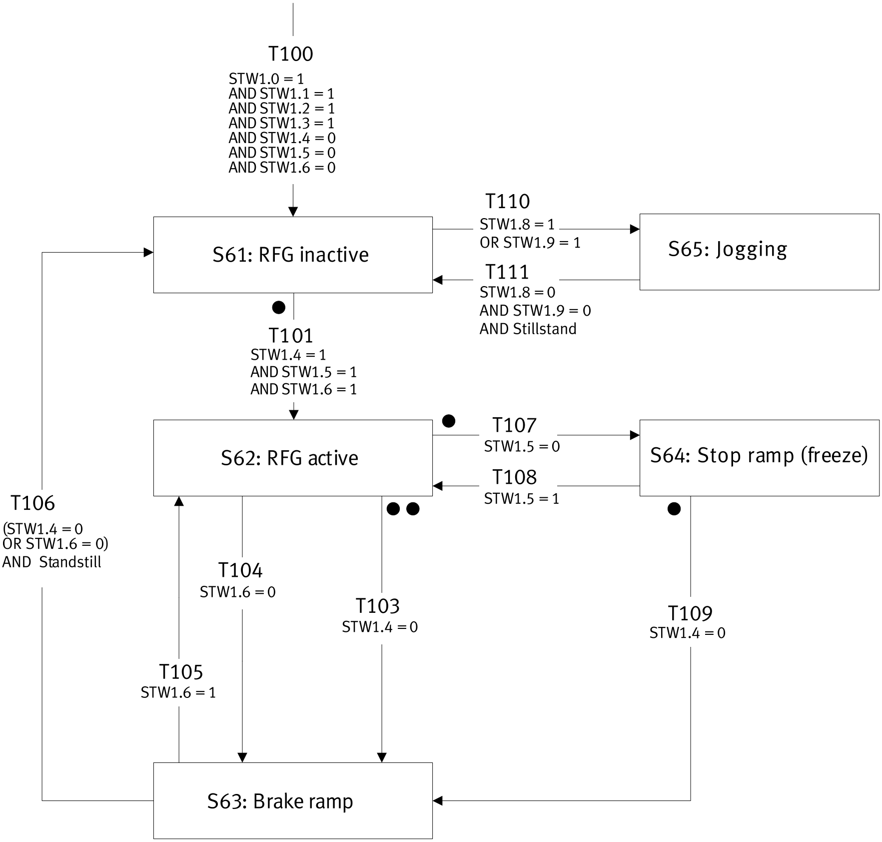

Fig. 130 Finite State Machine Velocity Mode in Application Class 1

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	= 1	
	STW1.2 Quick stop	= 1	
	STW1.3 Enable operation	= 1	
	STW1.4 Enable ramp generator	= 0	
	STW1.5 Unfreeze ramp generator	= 0	

No.	Condition		Target status
T100	STW1.6 Enable setpoint	= 0	S61 RFG inactive

Tab. 653 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. 654 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. 655 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. 656 Status S62

No.	Conditions	Value	Target status
T103	STW1.4 Enable ramp generator (system stop)	= 0	S63

No.	Conditions	Value	Target status
T104	STW1.6 Enable setpoint	= 0	S63 Brake ramp
T107	STW1.5 Unfreeze ramp generator	= 0	S64 Stop ramp (freeze)

Tab. 657 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. 658 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. 659 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. 660 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. 661 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. 662 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. 663 Transitions from Status S64

12.4.3.3 Finite State Machine Positioning Mode in Application Class 3

The finite state machine positioning mode in application class 3 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.

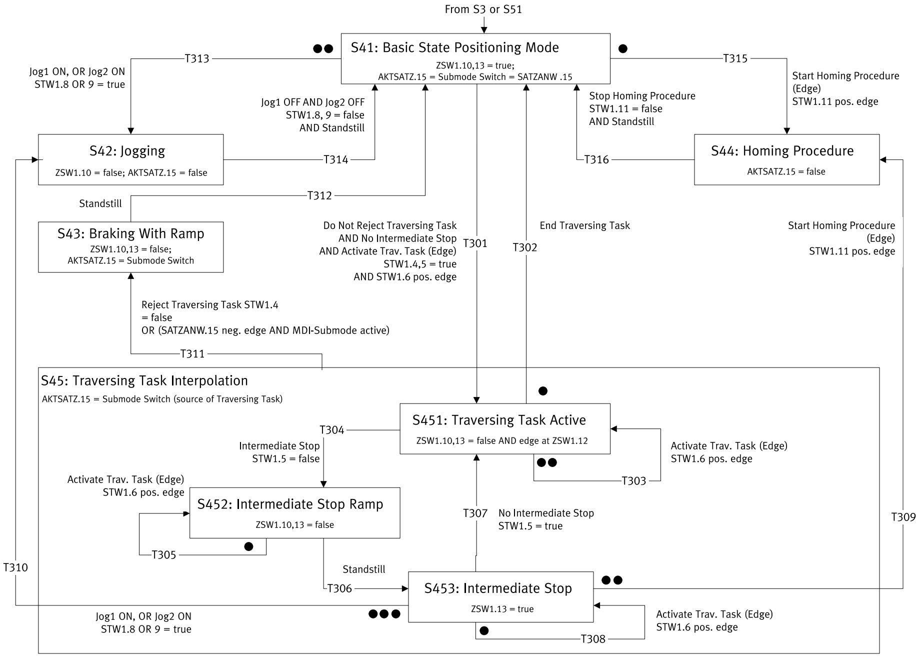

Fig. 131 Finite State Machine Positioning Mode in Application Class 3

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.

Status S41 Basic State Positioning Mode

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 (target value specification switch)	–

Tab. 664 Status S41

Switching 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 Activate traversing task	0→1	
T313	STW1.8 Jogging 1	= 1	S42 Jogging
	OR		
	STW1.9 Jogging 2	=1	
T315	STW1.11 Start Homing procedure	0→1	S441 Homing Procedure Running

Tab. 665 Transitions from Status S42

T313 has higher priority than T301.
T315 has higher priority than T301.
T313 has higher priority than T315.

Status S42 Jogging

Name	Description	Status	Value
S42 Jogging	Jogging	ZSW1.10 Target position reached	= 0
		ZSW1.13 Drive stopped	= x
		AKTSATZ Bit 15	= 0

Tab. 666 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. 667 Transitions from Status S42

The "Standstill detected" condition is an internal condition and is not triggered by the user.

Status S43 Braking With Ramp

Name	Description	Status	Value
S43 Braking With Ramp	Braking ramp	ZSW1.10 Target position reached	= 0
		ZSW1.13 Drive stopped	= 0
		AKTSATZ Bit 15 = setpoint specification switch (source for prior setpoint specification)	

Tab. 668 Status S43

No.	Conditions	Value	Target status
T312	Standstill detected	–	S41 Basic State Positioning Mode

Tab. 669 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.

Status S44 Homing Procedure

Name	Description	Status	Value
S44 Homing Procedure	Homing	ZSW1.10 Target position reached	= x
		ZSW1.11 Home position set	= x
		ZSW1.13 Drive stopped	= x
		AKTSATZ Bit 15	= 0

Tab. 670 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. 671 Transitions from Status S44

The "Standstill detected" condition is an internal condition and is not triggered by the user.

Status S45 Traversing Task Interpolation

Name	Description	Status	Value
S45 Traversing Task Interpolation	Traversing task positioning	ZSW1.10 Target position reached	= x
		ZSW1.12 Traversing task acknowledgement	= x
		ZSW1.13 Drive stopped	= x
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 672 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. 673 Transitions from Status S45

Status S451 Traversing Task Active

Name	Description	Status	Value
S451 Traversing Task Active	Positioning task active	ZSW1.10 Target position reached	= 0
		ZSW1.12 Traversing task acknowledgement	0→1
		ZSW1.13 Drive stopped	= 0
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 674 Status S451

No.	Conditions	Value	Target status
T302	Positioning task complete		S41 Basic State Positioning Mode
T303	STW1.6 Activate traversing task	0→1	S451 Traversing Task Active
T304	STW1.5 Intermediate stop	= 0	S452 Intermediate Stop Ramp

Tab. 675 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.

Status S452 Intermediate Stop Ramp

Name	Description	Status	Value
S452 Intermediate Stop Ramp	Intermediate stop ramp	ZSW1.10 Target position reached	= 0
		ZSW1.12 Traversing task acknow-ledgement	= x
		ZSW1.13 Drive stopped	= 0
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 676 Status S452

No.	Conditions	Value	Target status
T305	STW1.6 Activate traversing task	0→1	S452 Intermediate Stop Ramp
T306	Standstill detected		S453 Intermediate Stop

Tab. 677 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.

Status S453 Intermediate Stop

Name	Description	Status	Value
S453 Intermediate Stop	Intermediate stop	ZSW1.10 Target position reached	= 0
		ZSW1.12 Traversing task acknow-ledgement	= x
		ZSW1.13 Drive stopped	= 1
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 678 Status S453

No.	Conditions	Value	Target status
T307	STW1.5 Intermediate stop	1	S451 Traversing Task Active
T308	STW1.6 Activate traversing task	0→1	S453 Intermediate Stop

No.	Conditions	Value	Target status
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. 679 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.

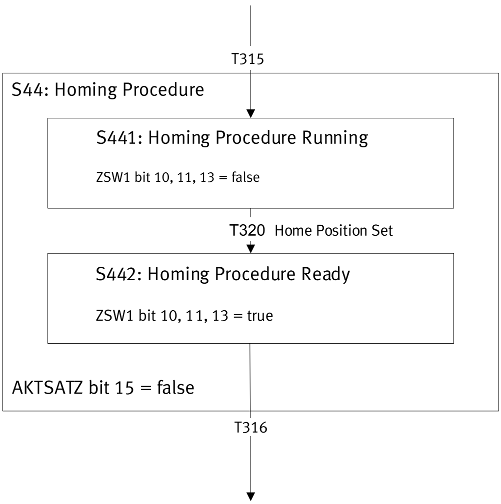

Fig. 132 Finite State Machine Homing Application Class 3

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 Target position reached	= 0
		ZSW1.11 Home position set	= 0
		ZSW1.13 Drive stopped	= 1

Tab. 680 Status S441

No.	Conditions	Value	Target status
T320	Reference point set	–	S442 Homing Procedure Ready

Tab. 681 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 Target position reached	= 1
		ZSW1.11 Home position set	= 1
		ZSW1.13 Drive stopped	= 1

Tab. 682 Status S442

12.4.3.5 Finite state machine application class 4

In application class 4, there is basically no sub-state machine in the basic state. S4 Operation of the basic finite state machine required. 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.

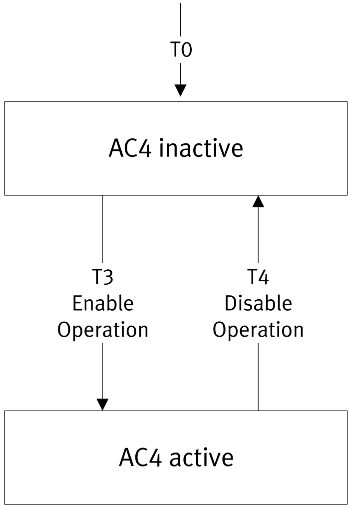

Fig. 133 Finite state machine AC4

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	–

Signal number/PNU	Signal designation	Abbreviation	Bit length (16/32 bit)	With prefix
11	Encoder 1 position actual value 1	G1_XIST1	32	–
12	Encoder 1 position actual 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	MDI target position	MDI_TARPOS	32	•
35	MDI velocity	MDI_VELOCITY	32	–
36	MDI acceleration	MDI_ACC	16	–
37	MDI deceleration	MDI_DEC	16	–
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. 683 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	Meaning	Access	Data type
Px.	Profile-specific parameters			
11280201	922.0	PZD telegram selection	rw	Unsigned16

Tab. 684 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 1 position encoder	AC1 (RT) and AC4 (IRT)
4	Velocity setpoint value 32 bit with 2 position sensors	AC1 (RT) and AC4 (IRT)
5	Rotational speed setpoint value 32 bit with 1 position encoder and DSC (Dynamic Servo Control)	AC4
6	Rotational speed setpoint value 32 bit with 2 position encoders 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 1 position encoder and torque reduction	AC1 (RT) and AC4 (IRT)
103	Rotational speed setpoint value 32 bit with 2 position encoders and torque reduction	AC1 (RT) and AC4 (IRT)
105	Rotational speed setpoint value 32 bit with 1 position encoder, torque reduction and DSC (Dynamic Servo Control)	AC4

Telegram number	Description	Supported application classes
106	Velocity setpoint value 32 bit with 2 position encoders, torque reduction and DSC (Dynamic Servo Control)	AC4
111	Single positioning in the operating mode record selection and direct specification (MDI)	AC3
910	Transmission of additional process data (EPD) ➔ ➔ 12.4.6 Additional Telegram	AC1, AC3 and AC4

Tab. 685 Telegrams

Standard Telegrams for the Rotational Speed Control Operating Mode

Telegram						
No.	1		2		3	
App. class	1		1		1, 4	
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	NSOLL_A	NIST_A	NSOLL_B	NIST_B	NSOLL_B	NIST_B
PZD3						
PZD4			STW2	ZSW2	STW2	ZSW2
PZD5					G1_STW	G1_ZSW
PZD6						G1_XIST1
PZD7						
PZD8						G1_XIST2
PZD9						
PZD10						
PZD11						
PZD12						
PZD13						
PZD14						
PZD15						

Tab. 686 Telegrams for Velocity Control, Standard Telegrams - Part 1

Telegram						
No.	4		5		6	
App. class	1, 4		4 with DSC		4 with DSC	
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B
PZD3						
PZD4	STW2	ZSW2	STW2	ZSW2	STW2	ZSW2
PZD5	G1_STW	G1_ZSW	G1_STW	G1_ZSW	G1_STW	G1_ZSW
PZD6	G2_STW	G1_XIST1	XERR	G1_XIST1	G2_STW	G1_XIST1
PZD7					XERR	
PZD8		G1_XIST2	KPC	G1_XIST2		G1_XIST2
PZD9					KPC	
PZD10		G2_ZSW				G2_ZSW
PZD11		G2_XIST1				G2_XIST1
PZD12						
PZD13		G2_XIST2				G2_XIST2
PZD14						
PZD15						

Tab. 687 Telegrams for Velocity Control, Standard Telegrams - Part 2

Manufacturer-specific Telegrams for the Velocity Control Operating Mode

Telegram								
No.	102		103		105		106	
App. class	1, 4		1, 4		4 with DSC		4 with DSC	
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B
PZD3								
PZD4	STW2	ZSW2	STW2	ZSW2	STW2	ZSW2	STW2	ZSW2
PZD5	MOMRED	MELDW	MOMRED	MELDW	MOMRED	MELDW	MOMRED	MELDW
PZD6	G1_STW	G1_ZSW	G1_STW	G1_ZSW	G1_STW	G1_ZSW	G1_STW	G1_ZSW
PZD7		G1_XIST-1	G2_STW	G1_XIST-1	XERR	G1_XIST-1	G2_STW	G1_XIST-1
PZD8							XERR	
PZD9		G1_XIST-2		G1_XIST-2	KPC	G1_XIST-2		G1_XIST-2
PZD10							KPC	
PZD11				G2_ZSW				G2_ZSW
PZD12				G2_XIST-1				G2_XIST-1
PZD13								
PZD14				G2_XIST-2				G2_XIST-2
PZD15								

Tab. 688 Telegrams for Velocity Control, Manufacturer-specific Telegrams

Telegrams for the Single Position Control Operating Mode

Telegram						
No.	7		9		111	
App. 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_VELOCI-TY		MDI_TARPOS	XIST_A
PZD7						
PZD8			MDI_ACC		MDI_VELOCI-TY	NIST_B
PZD9			MDI_DEC			
PZD10			MDI_MOD		MDI_ACC	FAULT_CODE
PZD11					MDI_DEC	WARN_CODE
PZD12					Reserved	Reserved

Tab. 689 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. 690 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. 691 Standard Telegram 2

Standard Telegram 3

Rotational speed setpoint value 32 bit with 1 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. 692 Standard Telegram 3

Standard Telegram 4

Rotational speed setpoint value 32 bit with 2 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	G2_STW	G1_XIST1
7		
8		G1_XIST2
9		
10		G2_ZSW
11		G2_XIST1
12		
13		G2_XIST2
14		

Tab. 693 Standard Telegram 4

Standard Telegram 5

Rotational speed setpoint value 32 bit with 1 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. 694 Standard Telegram 5

Standard Telegram 6

Rotational speed setpoint value 32 bit with 2 position encoder and DSC

Supported application classes: AC4

PZD	Setpoint value	Actual value
1	STW1	ZSW1
2	NSOLL_B	NIST_B
3		
4	STW2	ZSW2
5	G1_STW	G1_ZSW
6	G2_STW	G1_XIST1
7	XERR	
8		G1_XIST2
9	KPC	
10		G2_ZSW
11		G2_XIST1
12		
13		G2_XIST2
14		

Tab. 695 Standard Telegram 6

Standard Telegram 7

Single positioning

Supported application class: AC3

PZD	Setpoint value	Actual value
1	STW1	ZSW1
2	SATZANW	AKTSATZ

Tab. 696 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. 697 Standard Telegram 9

Standard Telegram 102

Rotational speed setpoint value 32 bit with 1 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. 698 Standard Telegram 102

Standard Telegram 103

Rotational speed setpoint value 32 bit with 2 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	G2_STW	G1_XIST1
8		
9		G1_XIST2
10		
11		G2_ZSW
12		G2_XIST1
13		
14		G2_XIST2
15		

Tab. 699 Standard Telegram 103

Standard Telegram 105

Rotational speed setpoint value 32 bit with 2 position encoder, torque reduction and DSC
Supported application class: AC4

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	XERR	G1_XIST1
8		
9	KPC	G1_XIST2
10		

Tab. 700 Standard Telegram 105

Standard Telegram 106
Rotational speed setpoint value 32 bit with 2 position encoders, torque reduction and DSC
Supported application class: AC4

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	G2_STW	G1_XIST1
8	XERR	
9		G1_XIST2
10	KPC	
11		G2_ZSW
12		G2_XIST1
13		
14		G2_XIST2
15		

Tab. 701 Standard Telegram 106

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. 702 Standard Telegram 111

12.4.6 Additional Telegram

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 read with the CMMT-ST Plug-in can be parameterised.

Telegram number	Description	Supported application classes
Additional Telegram		
910	Transmission of additional process data (EPD)	AC1, AC3 and AC4

Tab. 703 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 access right "read/write" 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		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

Tab. 704 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 actuel number of objects that mapped for Rx data.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242102	Number of bytes Rx	Displays the actuel 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	–

ID Px.	Parameter	Description	
4242115	Current axis ID Rx	Displays the current axis ID of the object mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242116	Current data ID Rx	Displays the current data ID of the object mapped Rx for the extended process data.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242117	Current data instance ID Rx	Displays the current instance no. of the object mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242118	Current array ID Rx	Displays the current array ID of the object mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242119	Current data type Rx	Displays the data type of the objects mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 705 Parameter (Rx data)

ID Px.	Parameter	Description	
4242201	Number of objects Tx	Displays the actuel number of objects that mapped for Tx data.	
		Access	read/–
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
4242202	Number of bytes Tx	Displays the actuel 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	Current axis ID Tx	Displays the current axis ID of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242216	Current data ID Tx	Displays the current data ID of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately

ID Px.	Parameter	Description	
4242216	Current data ID Tx	Unit	–
4242217	Current data instance ID Tx	Displays the current instance number of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242218	Current array ID Tx	Displays the current array ID of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242219	Current data type Tx	Displays the data type of the objects mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 706 Parameter (Tx data)

Extended Process Data Parameter

ID Px.	Parameter	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/write
		Update	effective immediately
		Unit	–

Tab. 707 Extended Process Data Parameter

PNUs Rx and Tx data

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
4242101	12542.0	Number of objects Rx	Unsigned8
4242102	12543.0	Number of bytes Rx	Unsigned8
4242105	12544.0 ... 7	Axis ID Rx	Unsigned16
4242106	12545.0 ... 7	Data ID Rx	Unsigned32
4242107	12546.0 ... 7	Data instance ID Rx	Unsigned16
4242108	12547.0 ... 7	Array ID Rx	Unsigned16
4242115	12548.0 ... 7	Current axis ID Rx	Unsigned16
4242116	12549.0 ... 7	Current data ID Rx	Unsigned32
4242117	12550.0 ... 7	Current data instance ID Rx	Unsigned16
4242118	12551.0 ... 7	Current array ID Rx	Unsigned16
4242119	12552.0 ... 7	Current data type Rx	Unsigned32
4242201	12553.0	Number of objects Tx	Unsigned8
4242202	12554.0	Number of bytes Tx	Unsigned8
4242205	12555.0 ... 7	Axis ID Tx	Unsigned16
4242206	12556.0 ... 7	Data ID Tx	Unsigned32
4242207	12557.0 ... 7	Data instance ID Tx	Unsigned16
4242208	12558.0 ... 7	Array ID Tx	Unsigned16
4242215	12559.0 ... 7	Current axis ID Tx	Unsigned16
4242216	12560.0 ... 7	Current data ID Tx	Unsigned32

Tab. 708 PNUs

PNUs extended process data

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
11280204	60104.0	Extended process data	Unsigned16
Px.	**Manufacturer-specific parameters**		
424213	12541.0	Extended process data active	Boolean
11280204	3401.0	Extended process data	Unsigned16

Tab. 709 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	Unsigned16 Array
60104	Indicates whether the additional telegram is active. This parameter is written by the higher-level controller (master). Here means – 65534 (0xFFFE): Additional telegram not active – 910 (0x038E): Additional telegram 910 is active	rw	Unsigned16

Tab. 710 PNUs

12.4.7 Process Data Signals in Detail

12.4.7.1 Control Word 1 (STW1)

Bit	Meaning	
	Velocity 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.	

Bit	Meaning	
	Velocity mode	Positioning mode
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	
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

Bit	Meaning	
	Velocity mode	Positioning mode
12	Release holding brake – 1: active – 0: inactive	
13	reserved	Start record change – 0→1: active – 0: inactive
14 … 15	reserved	reserved

Tab. 711 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. 712 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 (OFF 2)

Value	Command	Description
1	No coasting	A coasting command is not pending. The motor can be switched on.

Value	Command	Description
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. 713 STW1.1

STW1.2 Quick stop (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. 714 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).

Value	Command	Description
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. 715 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. 716 STW1.7

STW1.8 Jogging 1

Value	Command	Description
1	Jogging 1 on	Execute jogging 1
0	Jogging 1 off	Stop jogging 1

Tab. 717 STW1.8

STW1.9 Jogging 2

Value	Command	Description
1	Jogging 2 on	Execute jogging 2
0	Jogging 2 off	Stop jogging 2

Tab. 718 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. 719 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. 720 STW1.12

PNUs for the General Bits (STW1)

Parameter	PNU	Name	Data type
Px.	**Profile-specific parameters**		
1147990	1.0	STW1	Unsigned16
Px.	**Manufacturer-specific parameters**		
1147000	12226.0	STW1.0 Power stage enable	Boolean
1147010	12227.0	STW1.1 Coast stop	Boolean
1147020	12228.0	STW1.2 Quick stop	Boolean
1147030	12229.0	STW1.3 Enable operation	Boolean
1147070	12236.0	STW1.7 Fault acknowledge	Boolean
1147080	12237.0	STW1.8 Jogging 1	Boolean

Parameter	PNU	Name	Data type
1147090	12238.0	STW1.9 Jogging 2	Boolean
1147100	12239.0	STW1.10 Control by PLC	Boolean
1147120	12242.0	STW1.12 Open holding brake	Boolean
1147990	12250.0	STW1	Unsigned16

Tab. 721 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 stop ramp: Px.11280405.0.0, PNU 12328.0 – Jerk system stop: Px.11280406, PNU 12434.0

Tab. 722 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. 723 STW1.5

STW1.6 Enable setpoint

Value	Command	Description
1	Enable rotational speed setpoint value	The rotational speed setpoint value is enabled.

Value	Command	Description
0	Block rotational speed setpoint value	The input of the ramp generator is set to 0.

Tab. 724 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. 725 STW1.11

PNUs of Special Bits for Velocity Mode (STW1)

Parameter	PNU	Name	Data type
Px.	**Manufacturer-specific parameters**		
1147040	12230.0	STW1.4 Enable ramp generator	Boolean
1147050	12232.0	STW1.5 Unfreeze ramp generator	Boolean
1147060	12234.0	STW1.6 Enable setpoint	Boolean
1147110	12240.0	STW1.11 Invert setpoint	Boolean
1147150	12248.0	STW1.15 Reserved	Boolean

Tab. 726 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. 727 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. 728 STW1. 5

STW1.6 Activate traversing task

Value	Command	Description
0→1	Activate positioning task	The setpoint value is enabled.
0	Do not activate positioning task	No effect

Tab. 729 STW1.6

If the drive is in the S41 Basic State Positioning Mode status and the commands "Do not reject positioning task" (STW1.4) and "No intermediate stop" (see STW1.5) are pending, with rising edge at STW1.6 a positioning task is started (record or direct setpoint value specification).
If the drive is in the S451 Traversing Task Activestatus, with a rising edge a new positioning task is started. 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 Stopstatus, with a rising edge at STW1.6 a new positioning task is started.
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).
With multiple leading edges in the S452 Intermediate Stop Ramp status or the S453 Intermediate Stop status, the last started positioning task is executed with the command "No intermediate stop" (STW1.5) (no save effect).
The command "Activate motion task" is confirmed by a handshake with the status "Acknowledge motion task active".

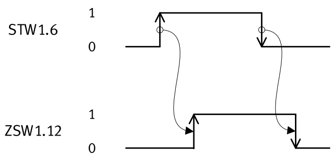

Fig. 134 Activate timing positioning task

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. 730 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. 731 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	Boolean
1147051	12233.0	STW1.5 Intermediate stop	Boolean
1147061	12235.0	STW1.6 Activate traversing task	Boolean

Parameter	PNU	Name	Data type
1147111	12241.0	STW1.11 Start Homing procedure	Boolean
1147131	12245.0	STW1.13 Start block change	Boolean
1147141	12247.0	STW1.14 Reserved	Boolean
1147151	12249.0	STW1.15 Reserved	Boolean

Tab. 732 PNUs

12.4.7.2 Status Word 1 (ZSW1)

Bit	Meaning	
	Velocity 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	Fast 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	

Bit	Meaning	
	Velocity mode	Positioning mode
8	Velocity 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	Velocity 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. 733 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. 734 ZSW1.0

ZSW1.1 Ready to operation

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. 735 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.

Value	Meaning	Description
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. 736 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. 737 ZSW1.3

ZSW1.4 Coast stop activated

Value	Meaning	Description
1	Inactive	The coasting command is inactive.
0	Active (OFF2)	The coasting command is active (OFF2).

Tab. 738 ZSW1.4

ZSW1.5 Quick stop activated

Value	Meaning	Description
1	Inactive	The fast stop command is inactive.
0	Active (OFF3)	The fast stop command is active (OFF3).

Tab. 739 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. 740 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. 741 ZSW1.7

ZSW1.9 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. 742 ZSW1.9

PNUs of General Bits (ZSW1)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
1145990	2.0	ZSW1	Unsigned16
Px.	Manufacturer-specific parameters		
1145990	12220.0	ZSW1	Unsigned16

Parameter	PNU	Name	Data type
1145000	12197.0	ZSW1.0 Ready to switch on	Boolean
1145010	12198.0	ZSW1.1 Ready to operation	Boolean
1145020	12199.0	ZSW1.2 Operation enabled	Boolean
1145030	12200.0	ZSW1.3 Fault present	Boolean
1145040	12201.0	ZSW1.4 Coast stop activated	Boolean
1145050	12202.0	ZSW1.5 Quick stop activated	Boolean
1145060	12203.0	ZSW1.6 Switch on inhibited	Boolean
1145070	12204.0	ZSW1.7 Warning present	Boolean
1145090	12207.0	ZSW1.9 Control requested	Boolean

Tab. 743 PNUs

Significance of the Special Bits for Velocity Mode (STW1)

ZSW1.8 Speed error within tolerance range

Value	Meaning	Description
1	In tolerance range	The rotational speed actual value is within a parameterisable tolerance range. It can be above or below the tolerance range for time $t < t_{max}$. The tolerance range and the time t_{max} can be parameterised: – Monitoring window speed: 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 rotational speed actual value is outside a tolerance range.

Tab. 744 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: $\lvert n_{actual} \rvert \geq n_{threshold}$ The comparison value is defined via a threshold value $n_{threshold\ value}$ and a hysteresis n_{hyst}.

Value	Meaning	Description
		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 delay time speed 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. 745 ZSW1.10

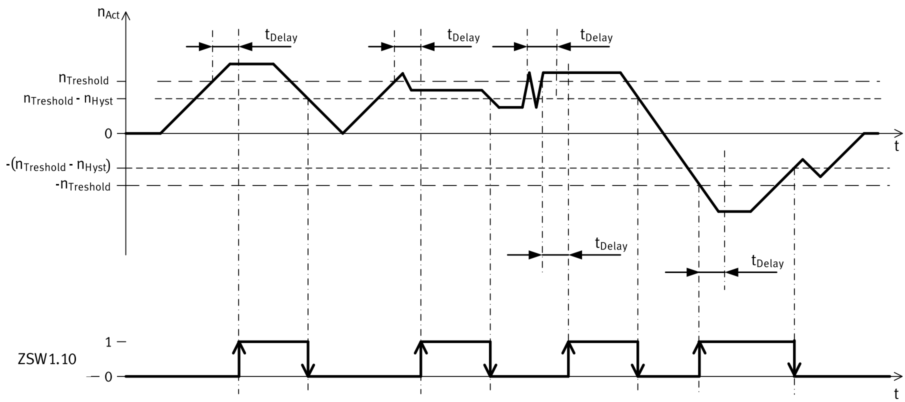

Fig. 135 Rotational speed comparison timing reached

Name	Description	ID Px.
n_{Act}	Actual velocity value (rotational speed)	1210
$n_{threshold}$	Threshold value velocity comparator	11280504
n_{hyst}	Hysteresis threshold value velocity comparator	11280505
t_{Delay}	Switch-on delay time speed comparator	11280506

Tab. 746 Legend for Rotational Speed Comparison Timing Reached

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
1210	6.0	Actual velocity value	FloatingPoint
Px.	Manufacturer-specific parameters		
11280504	12435.0	Threshold value velocity comparator	FloatingPoint
11280505	12436.0	Hysteresis threshold value velocity comparat-or	FloatingPoint
11280506	12437.0	Switch-on delay time speed comparator	FloatingPoint

Tab. 747 Rotational Speed Comparison Timing Reached PNUs

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. 748 ZSW1.11

The motor travels 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. 749 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 temperat-ure warning threshold is exceeded.
0	Motor overtemperature warning effective	A warning is output if the defined motor temperature warning threshold is exceeded.

Tab. 750 ZSW1.13

ZSW1.14 Motor rotation

Value	Meaning	Description
1	Positive	Actual rotational speed value ≥ 0
0	negative	Actual rotational speed value ‹ 0

Tab. 751 ZSW1.14

ZSW1.15 No warning Overtemperature power section

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. 752 ZSW1.15

PNUs of Special Bits for Velocity Mode (ZSW1)

Parameter	PNU	Name	Data type
Px.	Manufacturer-specific parameters		
1145080	12205.0	ZSW1.8 Speed error within tolerance range	Boolean
1145100	12208.0	ZSW1.10 f or n reached or exceeded	Boolean
1145110	12210.0	ZSW1.11 I, M or P limit not reached	Boolean
1145120	12212.0	ZSW1.12 Holding brake open	Boolean
1145130	12214.0	ZSW1.13 No warning Overtemperature motor	Boolean
1145140	12216.0	ZSW1.14 Motor rotation	Boolean
1145150	12218.0	ZSW1.15 No warning Overtemperature power section	Boolean

Tab. 753 PNUs

Significance of the Special Bits for Positioning Mode (ZSW1)

ZSW1.8 Following error within tolerance range

Value	Meaning	Description
1	Following distance in 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

Value	Meaning	Description
		– 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. 754 ZSW1.8

ZSW1.10 Target position reached

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. 755 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. 756 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

Value	Meaning	Description
		– 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. 757 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 speed 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. 758 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. 759 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. 760 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	Boolean
1145101	12209.0	ZSW1.10 Target position reached	Boolean
1145111	12211.0	ZSW1.11 Home position set	Boolean
1145121	12213.0	ZSW1.12 Traversing task acknowledgement	Boolean
1145131	12215.0	ZSW1.13 Drive stopped	Boolean
1145141	12217.0	ZSW1.14 Drive accelerating	Boolean
1145151	12219.0	ZSW1.15 Drive decelerating	Boolean

Tab. 761 PNUs

12.4.7.3 Control Word 2 (STW2)

Bit	Meaning
0 … 6	Reserved
8	Travel to fixed stop – 1: activate travel to fixed stop (must be set before reaching the fixed stop). – 1→0: deactivate travel 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. 762 Control Word 2 (STW2)

STW2.8 Traverse to fixed endstop

Value	Command	Description
1	Activate	Travel to fixed stop is activated with the command. The signal must be set before reaching the fixed stop.
1→0	Deactivate	Travel to the fixed stop is deactivated.

Tab. 763 STW2.8,

For example, with the travel to fixed stop command it can be moved to a workpiece with a specified torque to clamp it securely. Detailed information on the function
➔ 4.1.3.3.1. Travel top 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) ➔ 12.4.7.4 Status Word 2 (ZSW2).

PNUs of Control Word 2 (STW2)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
1148990	3.0	STW2	Unsigned16
Px.	Manufacturer-specific parameters		
1148080	12254.0	STW2.8 Traverse to fixed endstop	Boolean
1148120	12256.0	STW2.12 ... 15 Master sign of life	Unsigned8
1148990	12257.0	STW2	Unsigned16

Tab. 764 PNUs

12.4.7.4 Status Word 2 (ZSW2)

Bit	Meaning
0 … 7	Reserved
8	Travel 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. 765 Status Word 2

ZSW2.8 Move to fixed stop active

Value	Meaning	Description
1	Active	This status bit shows that the positioning task "Travel to fixed stop" is being executed ➔ 4.1.3.3.1. Travel top fixed stop (application class 3).
0	Inactive	Shows the status "Travel to fixed stop is inactive".

Tab. 766 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. 767 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) ➔ 12.4.7.3 Control Word 2 (STW2).

PNUs of Status Word 2 (ZSW2)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
1146990	4.0	ZSW2	Unsigned16
Px.	Manufacturer-specific parameters		
1146080	12222.0	ZSW2.8 Move to fixed stop active	Boolean
1146110	12223.0	ZSW2.11 Power stage active	Boolean
1146120	12224.0	ZSW2.12 ... 15 Slave sign of life	Unsigned8
1146990	12225.0	ZSW2	Unsigned16

Tab. 768 PNUs

12.4.7.5 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 %.

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/NSOLL_B	FloatingPoint
Px.	Manufacturer-specific parameters		
11280502	12334.0	Target velocity NSOLL_A/NSOLL_B	FloatingPoint

Tab. 769 PNUs

12.4.7.6 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
➔ 12.4.7.5 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
➔ 12.4.7.5 Rotational Speed Setpoint Value A, B (NSOLL_A, NSOLL_B).
NIST_A und 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 velocity value	FloatingPoint
	8.0		FloatingPoint
Px.	Manufacturer-specific parameters		
1210	11311.0	Actual velocity value	FloatingPoint

Tab. 770 PNUs

12.4.7.7 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 CMMT 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.

If the Default Setting is Active, the CMMT-internal 24 Bits are Normalised to the Following Values:

– Single-turn information (pulses per revolution): 18 bits (262144)
– Multi-turn 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 multi-turn 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.

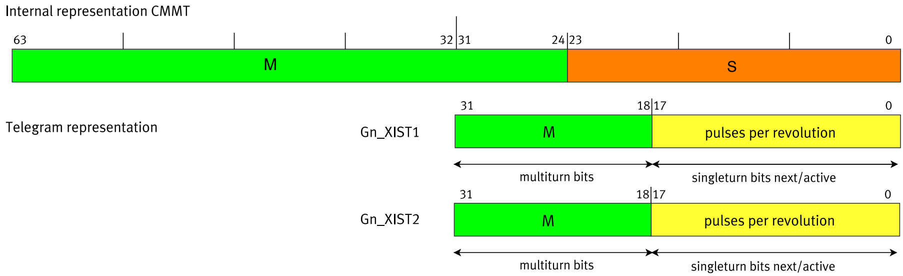

Fig. 136 Display of actual position values (example)

Name	Description
Internal represent-ation of CMMT	Internal representation of position values for CMMT
M	Multi-turn information
Multi-turn bits	Bits for the representation of the multi-turn values
Pulses per revolu-tion	Single-turn information (pulses per revolution)
Single-turn bits next/active	Bits for displaying the single-turn values
Telegram repres-entation	Representation of the position values in the telegram

Tab. 771 Legend for Figure "Actual Position Value 1"

Detailed information on the mode of operation of the encoder interface
➔ 12.4.7.11 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	Current resolution per revolution for Gn_XIST	Unsigned32
231545	12524.0	Resolution per revolution for Gn_XIST	Unsigned32

Tab. 772 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).

12.4.7.8 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
➔ 12.4.7.7 Encoder n Actual Position Value 1 (Gn_XIST1).

The following priorities must be observed for the values in Gn_XIST2:

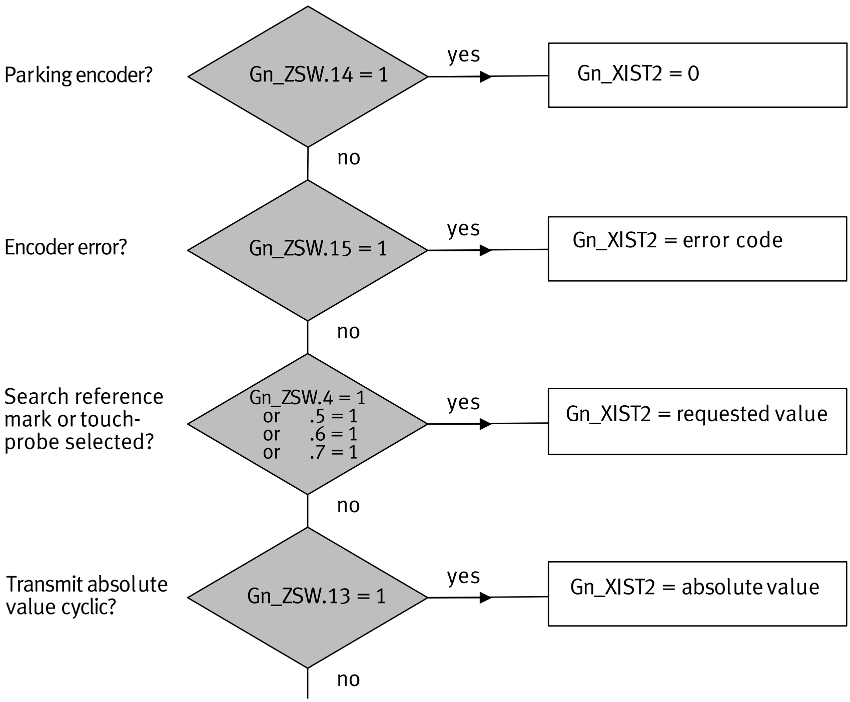

Fig. 137 Priorities for Gn_XIST2 (actual position value 2)

Name	**Description**
Encoder error?	Is there a sensor error?
Search reference mark or touch-probe 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.

Name	Description
Gn_XIST2 = absolute value	Gn_XIST2 contains the cyclically transmitted absolute value.

Tab. 773 Legend for Figure "Priorities for Gn_XIST2 (Actual Position Value 2)"

Detailed information on the mode of operation of the encoder interface
➔ 12.4.7.11 Status Diagram "Position Feedback Interface".

12.4.7.9 Encoder n Control Word (Gn_STW)

The encoder status machine is controlled via the encoder control word. The following functions are implemented in the CMMT 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.

Bit	Meaning
	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. 774 Control Word Gn_STW

Detailed information on the mode of operation of the encoder interface
➔ 12.4.7.11 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	Unsigned16
Px.	Manufacturer-specific parameters		
1149000	12260.0	Gn_STW.0 ... 3 Request function	Unsigned8
1149040	12261.0	Gn_STW.4 ... 6 Request command	Unsigned8
1149070	12262.0	Gn_STW.7 Mode	Boolean
1149110	12263.0	Gn_STW.11 Home position mode	Boolean
1149120	12264.0	Gn_STW.12 Trigger mode homing	Boolean
1149130	12265.0	Gn_STW.13 Request absolute value cyclically	Boolean
1149140	12266.0	Gn_STW.14 Activate parking sensor	Boolean
1149150	12267.0	Gn_STW.15 Acknowledge sensor error	Boolean
1149990	12268.0	Gn_STW	Unsigned16
1149991	12269.0	Gn_STW Cycle-1	Unsigned16

Tab. 775 PNUs

12.4.7.10 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 CMMT 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

Bit	Meaning
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. 776

Detailed information on the mode of operation of the encoder interface
➔ 12.4.7.11 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	Unsigned16
Px.	Manufacturer-specific parameters		
1143000	12187.0	Gn_ZSW.0 ... 3 Function active	Unsigned8
1143040	12188.0	Gn_ZSW.4 ... 7 value	Unsigned8

Parameter	PNU	Name	Data type
1143080	12189.0	Gn_ZSW.8 touch probe 0 deflected	Boolean
1143090	12190.0	Gn_ZSW.9 Touch Probe 1 deflected	Boolean
1143110	12191.0	Gn_ZSW.11 Error acknowledgment active	Boolean
1143120	12192.0	Gn_ZSW.12 Homing mode active	Boolean
1143130	12193.0	Gn_ZSW.13 Transmit absolute value cyclically	Boolean
1143140	12194.0	Gn_ZSW.14 Parking sensor active	Boolean
1143150	12195.0	Gn_ZSW.15 sensor error	Boolean
1143990	12196.0	Gn_ZSW	Unsigned16

Tab. 777 PNUs

12.4.7.11 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. 628 PROFIdrive Implementation specification.

The statuses SD11, SD10 and SD7 are not supported.

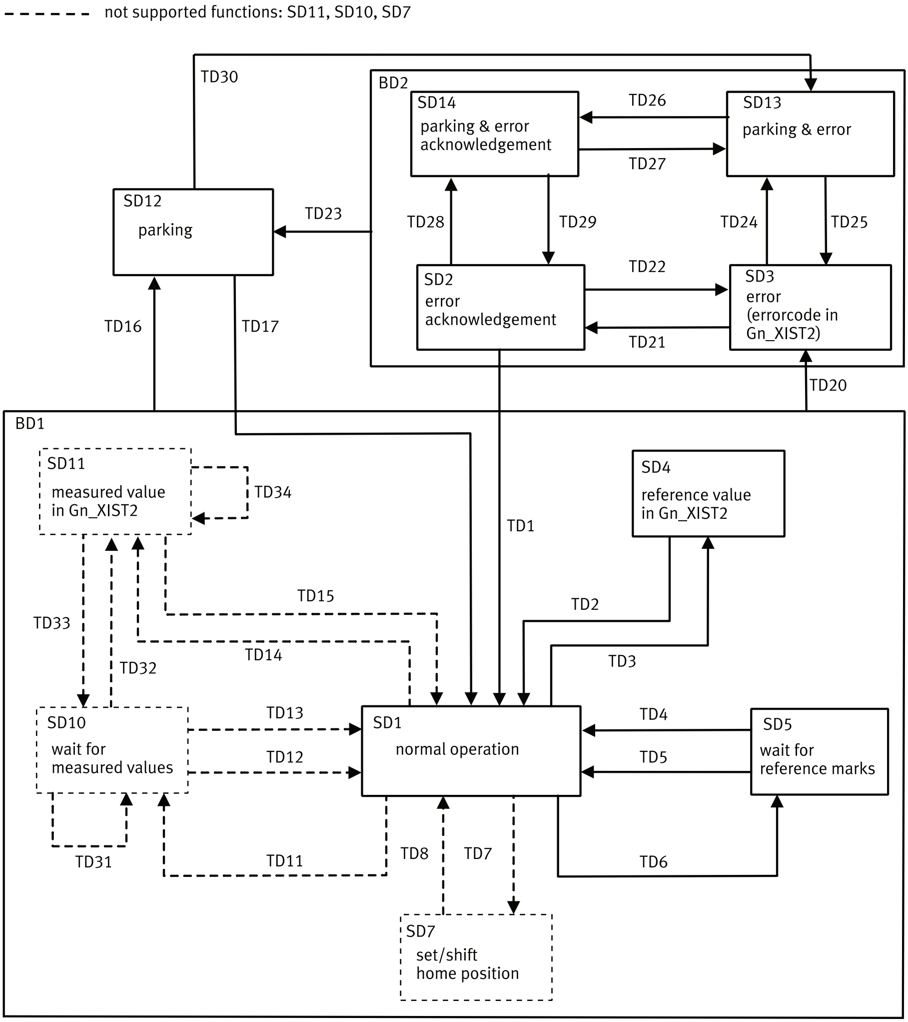

Fig. 138 Status diagram of the position feedback interface

12.4.7.12 Actual Position Value A (XIST_A)

XIST_A Actual value position 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.	Manufacturer-specific parameters		
11280609	12343.0	XIST_A Actual value position	Integer64

Tab. 778 PNUs

12.4.7.13 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
➔ 12.4.7.7 Encoder n Actual Position Value 1 (Gn_XIST1).

12.4.7.14 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.

12.4.7.15 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. 779 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. 780 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.

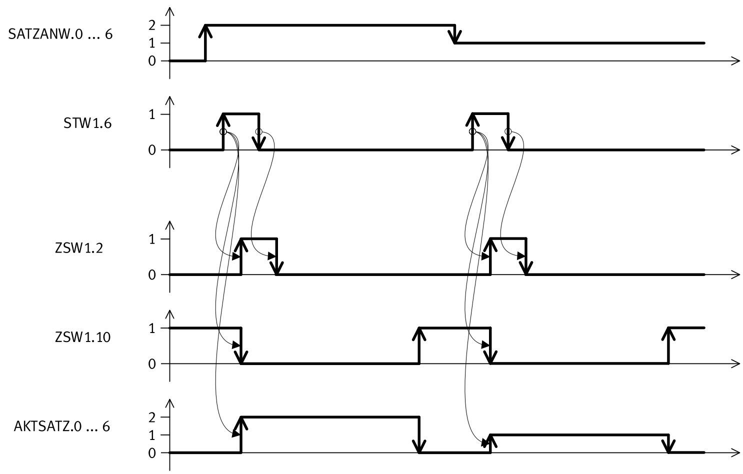

Fig. 139 Record selection timing

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, braked at maximum deceleration and at standstill switches to the S41 Basic State Positioning Mode status. The current task is rejected.

Tab. 781 SATZANW, Bit 15

PNUs of Record Selection (SATZANW)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112415990	32.0	SATZANW	Unsigned16
Px.	Manufacturer-specific parameters		
112415000	12392.0	SATZANW.0 ... 6 Traversing block selection	Unsigned8
112415150	12393.0	SATZANW.15 Activate MDI	Boolean
112415990	12394.0	SATZANW	Unsigned16
112415991	12395.0	SATZANW Cycle-1	Unsigned16

Tab. 782 PNUs

12.4.7.16 Active Record (AKTSATZ)

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 … 14	Reserved

Bit	Meaning
15	MDI active – 1: active – 0: inactive

Tab. 783 AKTSATZ

AKTSATZ.0 ... 6 Active traversing block

Bit	Meaning	Description
0	Active positioning record bit 0 (2^0)	Shows the active positioning record (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 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. 784 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.

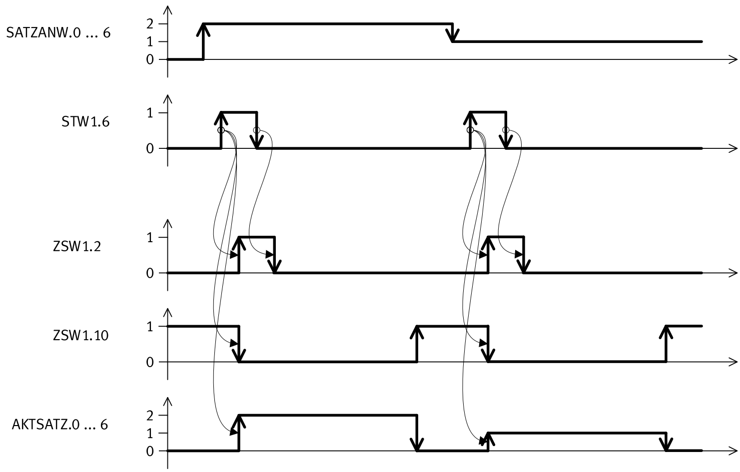

Fig. 140 Record selection timing

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 setpoint 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 setpoint value was specified in record mode and the record number of the active positioning record is shown in bit 0 - 6 (drive is in the status S45 Traversing Task Interpolation or S43 Braking With Ramp).

Tab. 785 AKTSATZ, Bit 15

PNUs of Active Record (AKTSATZ)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112416990	33.0	AKTSATZ	Unsigned16
Px.	Manufacturer-specific parameters		
112416000	12396.0	AKTSATZ.0 ... 6 Active traversing block	Unsigned8
112416150	12397.0	AKTSATZ.15 MDI activated	Boolean
112416990	12398.0	AKTSATZ	Unsigned16

Tab. 786 PNUs

12.4.7.17 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 the 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	Integer64
Px.	Manufacturer-specific parameters		
11280604	12339.0	Target position MDI	Integer64

Tab. 787 PNUs

12.4.7.18 MDI Velocity (MDI_VELOCITY)

This process datum specifies the position 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 the fieldbus ("factor group").

PNUs of MDI Velocity (MDI_VELOCITY)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
11280605	35.0	Profile speed MDI	FloatingPoint
Px.	Manufacturer-specific parameters		
11280605	12340.0	Profile speed MDI	FloatingPoint

Tab. 788 PNUs

12.4.7.19 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	FloatingPoint
Px.	Manufacturer-specific parameters		
11280606	12341.0	Acceleration MDI	FloatingPoint

Tab. 789 PNUs

12.4.7.20 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	FloatingPoint
Px.	Manufacturer-specific parameters		
11280607	12342.0	Deceleration MDI	FloatingPoint

Tab. 790 PNUs

12.4.7.21 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. 791 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. 792 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. 793 MDI_MOD, bit 1 and 2

PNUs for Manual Data Input Mode (MDI_MOD)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112417990	38.0	MDI_MOD	Unsigned16
Px.	Manufacturer-specific parameters		
112417000	12399.0	MDI_MOD.0 Positioning	Boolean

Parameter	PNU	Name	Data type
112417010	12400.0	MDI_MOD.1 ... 2 Direction of movement	Unsigned32
112417990	12401.0	MDI_MOD	Unsigned16
112417991	12402.0	MDI_MOD Cycle-1	Unsigned16

Tab. 794 PNUs

12.4.7.22 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: within the threshold values 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

Bit	Meaning
12	Ready for operation – 1: active – 0: inactive
13	Power stage enable – 1: active – 0: inactive
14 … 15	Reserved

Tab. 795 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. 796 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 utilisation is less than the set torque utilisation threshold or the startup phase is not yet complete.
0	> Threshold value	The current torque utilisation is greater than the set torque utilisation threshold.

Tab. 797 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 can be parameterised.

– Threshold value torque utilization reached: Px.11280410, PNU 12332.0

MELDW.2 Actual speed <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. 798 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 speed = ‹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. 799 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	The monitored signal of a drive system has exceeded the specified threshold value.
0	Within the threshold values or message function not active	The monitored signal of a drive system is within the threshold values or the message function is not active.

Tab. 800 MELDW.5

The function monitors any parameter to check whether it exceeds a threshold value.

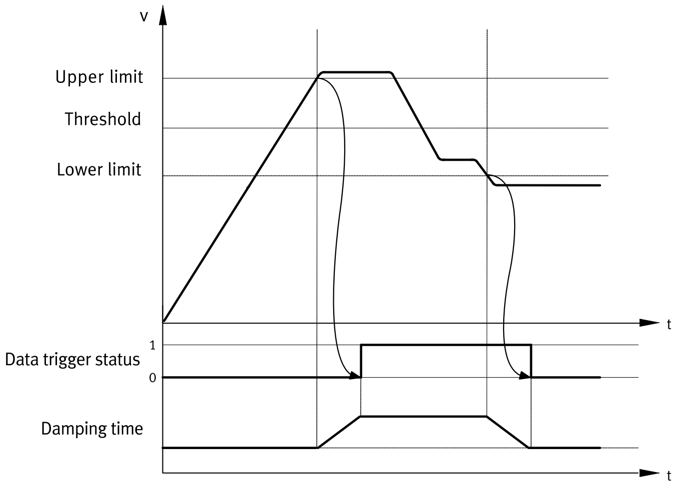

Fig. 141 Variable message function timing (example)

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
Damping time	Data trigger damping time	1174207

Tab. 801 Legend for Variable Message Function Timing Diagram

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 damping 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. 802 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. 803 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 Speed setpoint / actual deviation in tolerance

Value	Message	Description
1	Active	The velocity setpoint/actual deviation as specified is within the tolerance.
0	Inactive	The velocity setpoint/actual deviation as specified is outside the tolerance.

Tab. 804 MELDW.8

– Monitoring window speed: 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. 805 MELDW.11

MELDW.12 Ready for operation

Value	Message	Description
1	Active	Ready for operation reported

Value	Message	Description
0	Inactive	Ready for operation not reported

Tab. 806 MELDW.12

MELDW.13 Power stage active

Value	Message	Description
1	Active	Output stage active reported
0	Inactive	Output stage not active reported

Tab. 807 MELDW.13

PNUs for Status Word Messages (MELDW)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
11249990	102.0	MELDW	Unsigned16
Px.	Manufacturer-specific parameters		
1174205	3296.0	Trigger level MELDW.5	Integer64
11280046	12310.0	Status word MELDW	Unsigned16
11280112	12320.0	Trigger level MELDW.2	FloatingPoint
11280114	12322.0	Trigger level MELDW.3	FloatingPoint
1124900	12178.0	MELDW.0 ramp generator	Boolean
11249010	12279.0	MELDW.1 torque utilization	Boolean
11249020	12280.0	MELDW.2 Actual speed <Threshold1	Boolean
11249030	12281.0	MELDW.3 Actual speed = <Threshold2	Boolean
11249050	12282.0	MELDW.5 Variable reporting function	Boolean
11249060	12283.0	MELDW.6 No warning Overtemperature motor	Boolean
11249070	12284.0	MELDW.7 No warning Overtemperature power output stage	Boolean
11249080	12285.0	MELDW.8 Speed setpoint / actual deviation in tolerance	Boolean
11249110	12286.0	MELDW.11 Controller enable	Boolean
11249120	12287.0	MELDW.12 Ready for operation	Boolean
11249130	12288.0	MELDW.13 Power stage active	Boolean
11249990	12289.0	MELDW	Unsigned16

Tab. 808 PNUs

12.4.7.23 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
– Reference point run
– 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)
Value range CMMT: 0 ...2 (Px.1309)
Values below this range are interpreted as 0 %.
Values above this range are interpreted as 200 %.

PNUs Position Velocity Override (OVERRIDE)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
11280611	205.0	Velocity override	Integer16
Px.	Manufacturer-specific parameters		
1309	12482.0	Velocity override	FloatingPoint
11280611	12534.0	Velocity override	Integer16

Tab. 809 PNUs

12.4.7.24 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	Torque reduction MOMRED	Integer16

Parameter	PNU	Name	Data type
Px.	Manufacturer-specific parameters		
381	11122.0	Specifies the maximum torque of the servo drive for transfer to the configuration tool. The maximum torque must always be set the same on the side of the controller and the servo drive.	FloatingPoint
526796	12166.0	Maximum torque symmetrical	FloatingPoint
1126990	12179.0	Torque reduction MOMRED	Integer16

Tab. 810 PNUs

12.4.7.25 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)
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 … 14	reserved
15	MDI selection – 1: activate MDI – 0: deactivate MDI

Tab. 811 Positioner Control Word 1 (POS_STW1)

POS_STW1.0 ... 6 Traversing block selektion

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. 812 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. 813 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

Value		Description
Bit 10	Bit 9	
1	1	Position absolute on shortest path

Tab. 814 POS_STW1.9...10

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. 815 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	Unsigned16
Px.	Manufacturer-specific parameters		
112411000	12348.0	POS_STW1.0 ... 6 Traversing block selektion	Unsigned8
112411080	12349.0	POS_STW1.8 Absolute positioning	Boolean
112411090	12350.0	POS_STW1.9 ... 10 direction selection	Unsigned32
112411120	12351.0	POS_STW1.12 Setpoint transfer	Boolean
112411140	12352.0	POS_STW1.14 Setting up selected	Boolean
112411150	12353.0	POS_STW1.15 MDI selection	Boolean
112411990	12354.0	POS_STW1	Unsigned16

Tab. 816 PNUs

12.4.7.26 Positioner Status Word 1 (POS_ZSW1)

Bit	Meaning
0	Active positioning record bit 0 (2^0)

Bit	Meaning
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
11	Homing active – 1: active – 0: inactive
12	Reserved
13	Positioning records active – 1: active – 0: inactive
14	Reserved
15	MDI active – 1: active – 0: inactive

Tab. 817 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).
1	Active positioning record bit 1 (2^1)	

Bit	Meaning	Description
2	Active positioning record bit 2 (2^2)	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.
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. 818 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. 819 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. 820 POS_ZSW1.9

POS_ZSW1.10 Jogging active

Value	Meaning	Description
1	Jogging active	Shows whether jogging is active.
0	Jogging inactive	

Tab. 821 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. 822 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. 823 POS_ZSW1.13

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. 824 POS_ZSW1.15

PNUs for Positioner Status Word 1 (POS_ZSW1)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112412990	221.0	POS_ZSW1	Unsigned16
Px.	Manufacturer-specific parameters		
112412000	12357.0	POS_ZSW1.0 ... 6 Traversing block bit	Unsigned8
112412080	12358.0	POS_ZSW1.8 Negative limit switch active	Boolean
112412090	12359.0	POS_ZSW1.9 Positive limit switch active	Boolean
112412100	12360.0	POS_ZSW1.10 Jogging active	Boolean
112412110	12361.0	POS_ZSW1.11 Reference point approach active	Boolean
112412130	12362.0	POS_ZSW1.13 Traversing block active	Boolean

Parameter	PNU	Name	Data type
112412140	12363.0	POS_ZSW1.14 Setup active	Boolean
112412150	12364.0	POS_ZSW1.15 MDI active	Boolean
112412990	12365.0	POS_ZSW1	Unsigned16

Tab. 825 PNUs

12.4.7.27 Positioner Control Word 2 (POS_STW2)

Bit	Meaning
0	Tracking mode – 1: activate – 0: deactivate
1 … 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. 826 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.

Value	Command	Description
0	Deactivate tracking mode	Tracking mode is deactivated.

Tab. 827 POS_STW2.0

POS_STW2.5 Jogging incremental active

Value	Command	Description
1	Incremental jogging	Incremental jogging is activated.
0	Velocity jog	Velocity jog is activated.

Tab. 828 POS_STW2.5

POS_STW2.10 Selection touch probe

Value	Command	Description
1	secondary encoder	Determines the source of the measured values.
0	primary encoder	

Tab. 829 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. 830 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. 831 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. 832 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	Unsigned16
Px.	Manufacturer-specific parameters		
112414000	12382.0	POS_STW2.0 Tracking mode	Boolean
112414010	12383.0	POS_STW2.1 Set reference point	Boolean
112414050	12384.0	POS_STW2.5 Jogging incremental active	Boolean
112414100	12385.0	POS_STW2.10 Selection touch probe	Boolean
112414110	12386.0	POS_STW2.11 Touch probe edge	Boolean
112414140	12387.0	POS_STW2.14 Activate software limit switch	Boolean
112414150	12388.0	POS_STW2.15 Activate hardware limit switch	Boolean
112414990	12389.0	POS_STW2	Unsigned16

Tab. 833 PNUs

12.4.7.28 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 travels forward – 1: drive travels forward – 0: drive does not travel forward
5	Drive travels backwards – 1: drive travels backwards – 0: drive does not travel backwards

Bit	Meaning
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
13	Fixed stop clamping torque reached – 1: reached – 0: not reached
14	Travel to fixed stop active – 1: active – 0: inactive
15	Positioning command active – 1: active – 0: inactive

Tab. 834 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 set-point position value = actual position value).
0	Tracking mode inactive	Tracking mode is inactive.

Tab. 835 POS_ZSW2.0

POS_ZSW2.1 Velocity limiting active

Value	Meaning	Description
1	Velocity limiting active	Shows that velocity limiting is active in the application limiting manager. The current trajectory is run with limited velocity. The velocity limit can be set with the following parameter: – Limit value velocity limiting: Px.1304.0.0, PNU 11334.0
0	Velocity limiting inactive	Shows that velocity limiting is inactive

Tab. 836 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. 837 POS_ZSW2.2

POS_ZSW2.4 Drive moves forward

Value	Meaning	Description
1	Drive travels forward	Shows that the drive travels forward. The internal set-point velocity value according to the trajectory generator is > 0.
0	Drive does not travel forward	Shows that the drive is stopped or travels backwards. The internal setpoint velocity value according to the trajectory generator is ≤ 0.

Tab. 838 POS_ZSW2.4

POS_ZSW2.5 Drive moves backwards

Value	Meaning	Description
1	Drive travels backwards	Shows that the drive is stopped or travels backwards. The internal setpoint velocity value according to the trajectory generator is $\neq 0$.
0	Drive does not travel backwards	Shows that the drive travels forward. The internal setpoint velocity value according to the trajectory generator is > 0.

Tab. 839 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. 840 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. 841 POS_ZSW2.7

POS_ZSW2.8 Position actual value <= cam switch 0

Value	Meaning	Description
1	Actual position $\leq$ as position of cam switch 0	Specifies whether the actual position value $\leq$ or $>$ as cam switch position 0.
0	0: actual position $>$ as position of cam switch 0	

Tab. 842 POS_ZSW2.8

POS_ZSW2.9 Position actual value <= cam 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. 843 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. 844 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. 845 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. 846 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 travel to the fixed stop.
0	Fixed stop clamping torque not reached	

Tab. 847 POS_ZSW2.13

POS_ZSW2.14 Move to fixed stop active

Value	Meaning	Description
1	Travel to fixed stop active	Specifies whether travel to the fixed stop is active.
0	Travel to fixed stop not active	

Tab. 848 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. 849 POS_ZSW2.15

PNUs Positioner Status Word 2 (POS_ZSW2)

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
112413990	223.0	POS_ZSW2	Unsigned16
Px.	Manufacturer-specific parameters		
112413000	12366.0	POS_ZSW2.0 Tracking mode active	Boolean
112413010	12367.0	POS_ZSW2.1 Velocity limiting active	Boolean
112413020	12368.0	POS_ZSW2.2 Setpoint available	Boolean
112413040	12369.0	POS_ZSW2.4 Drive moves forward	Boolean
112413050	12370.0	POS_ZSW2.5 Drive moves backwards	Boolean
112413060	12371.0	POS_ZSW2.6 Software limit switch minus reached	Boolean
112413070	12372.0	POS_ZSW2.7 Software limit switch plus reached	Boolean
112413080	12373.0	POS_ZSW2.8 Position actual value <= cam switch 0	Boolean
112413090	12374.0	POS_ZSW2.9 Position actual value <= cam switch 1	Boolean
112413100	12375.0	POS_ZSW2.10 Direct output 1 via traversing block	Boolean
112413110	12376.0	POS_ZSW2.11 Direct output 2 via traversing block	Boolean
112413120	12377.0	POS_ZSW2.12 Fixed stop reached	Boolean

Parameter	PNU	Name	Data type
112413130	12378.0	POS_ZSW2.13 Fixed stop Clamping torque reached	Boolean
112413140	12379.0	POS_ZSW2.14 Move to fixed stop active	Boolean
112413150	12380.0	POS_ZSW2.15 Traversing command active	Boolean
112413990	12381.0	POS_ZSW2	Unsigned16

Tab. 850 PNUs

12.4.7.29 Active Error (FAULT_CODE)

Active error
Shows the error code of the first entry in the error memory
(➔ 12.4.8.1 PROFIdrive Malfunction / Fault Buffer Mechanism, PNU 947).

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
11280062	12314.0	Active error	Unsigned16
Px.	Manufacturer-specific parameters		
11280062	301.0	Active error	Unsigned16

Tab. 851 PNUs

12.4.7.30 Active Warning (WARN_CODE)

Active warning
Shows the warning code of the first entry in the warning buffer
(➔ 12.4.8.3 PROFIdrive Warnings / Warning Mechanism, PNU 847).

Parameter	PNU	Name	Data type
Px.	Profile-specific parameters		
11280063	303.0	Active warning	Unsigned16
Px.	Manufacturer-specific parameters		
11280063	12315.0	Active warning	Unsigned16

Tab. 852 PNUs

12.4.8 Diagnostics

12.4.8.1 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:

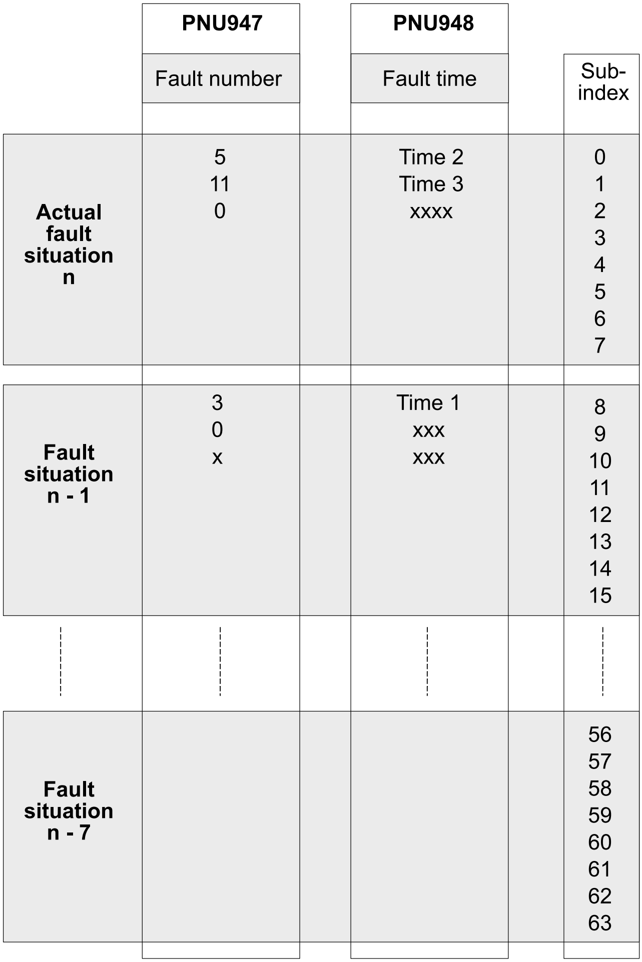

Fig. 142 Fault buffer

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.

12.4.8.2 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 basic status machine switches to the status S1 Switching On Inhibited.

12.4.8.3 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	Unsigned16	rw	P1.1147990.0.0
2.0	ZSW1	Unsigned16	ro	P1.1145990.0.0
3.0	STW2	Unsigned16	rw	P1.1148990.0.0
4.0	ZSW2	Unsigned16	ro	P1.1146990.0.0
5.0	Target speed NSOLL_A/NSOLL_B	FloatingPoint	rw	P1.11280502.0-.0
6.0	Actual velocity value	FloatingPoint	ro	P1.1210.0.0
7.0	Target speed NSOLL_A/NSOLL_B	FloatingPoint	rw	P1.11280502.0-.0
8.0	Actual velocity value	FloatingPoint	ro	P1.1210.0.0
9.0	Gn_STW	Unsigned16	rw	P1.1149990.0.0
10.0	Gn_ZSW	Unsigned16	ro	P1.1143990.0.0
11.0	Position 1 encoder n	Unsigned32	ro	P1.1142990.0.0
12.0	Position 2 encoder n	Unsigned32	ro	P1.1141990.0.0
13.0	Gn_STW	Unsigned16	rw	P1.1149990.1.0
14.0	Gn_ZSW	Unsigned16	ro	P1.1143990.1.0
15.0	Position 1 encoder n	Unsigned32	ro	P1.1142990.1.0
16.0	Position 2 encoder n	Unsigned32	ro	P1.1141990.1.0
25.0	Position deviation XERR	Integer32	rw	P1.1129990.0.0
26.0	DSC gain factor position controller	Integer32	rw	P1.1127990.0.0
28.0	Actual value of modulo	Integer64	ro	P1.113104.0.0
32.0	SATZANW	Unsigned16	rw	P1.112415990.-0.0

PNU	Name	Data type	Access	Parameter
33.0	AKTSATZ	Unsigned16	ro	P1.112416990.-0.0
34.0	Target position MDI	Integer64	rw	P1.11280604.0-.0
35.0	Profile speed MDI	FloatingPoint	rw	P1.11280605.0-.0
36.0	Acceleration MDI	FloatingPoint	rw	P1.11280606.0-.0
37.0	Deceleration MDI	FloatingPoint	rw	P1.11280607.0-.0
38.0	MDI_MOD	Unsigned16	rw	P1.112417990.-0.0
101.0	Torque reduction MOMRED	Integer16	rw	P1.1126990.0.0
102.0	MELDW	Unsigned16	ro	P1.11249990.0-.0
205.0	Velocity override	Integer16	rw	P1.11280611.0-.0
220.0	POS_STW1	Unsigned16	rw	P1.112411990.-0.0
221.0	POS_ZSW1	Unsigned16	ro	P1.112412990.-0.0
222.0	POS_STW2	Unsigned16	rw	P1.112414990.-0.0
223.0	POS_ZSW2	Unsigned16	ro	P1.112413990.-0.0
301.0	Active error	Unsigned16	ro	P1.11280062.0-.0
303.0	Active warning	Unsigned16	ro	P1.11280063.0-.0
800.0	Sync Time	FloatingPoint	rw	P0.31235.0.0
801.0	Status PROFINET request	Integer32	rw	P0.54543.0.0
802.0	Active status PROFINET	Integer32	ro	P0.54544.0.0
803.0	Reduction ratio	Unsigned32	rw	P1.4246.0.0
810.0	Base value acceleration	FloatingPoint	rw	P1.11280702.0-.0

PNU	Name	Data type	Access	Parameter
811.0	Base value deceleration	FloatingPoint	rw	P1.11280703.0-.0
830.0	Activation touch probe Tel. 111	Unsigned16	rw	P1.11280116.0-.0
844.0	Counter warning messages	Unsigned16	ro	P1.11280060.0-.0
847.0 ... 63	Warning number	Unsigned16	ro	P1.11280042.0-.0 ... 63
848.0 ... 63	Release time warning	Unsigned32	ro	P1.11280043.0-.0 ... 63
860.0	Diagnostic value test 1	Unsigned16	rw	P1.66061.0.0
861.0	Diagnostic value test 2	Unsigned16	rw	P1.66062.0.0
922.0	PZD telegram selection	Unsigned16	rw	P0.11280201.0-.0
924.0 ... 1	Assignment controller enable	Unsigned16	ro	P1.24126.0.0 ... 1
925.0	Maximum failure Sign of Life	Unsigned16	rw	P1.4243.0.0
930.0	Operating mode PROFIdrive	Unsigned16	ro	P1.11280002.0-.0
944.0	Counter error messages	Unsigned16	ro	P1.11280061.0-.0
947.0 ... 63	Error number	Unsigned16	ro	P1.11280040.0-.0 ... 63
948.0 ... 63	Casting time error	Unsigned32	ro	P1.11280041.0-.0 ... 63
964.0 ... 5	Drive unit data	Unsigned16	ro	P1.24125.0.0 ... 5
965.0 ... 1	Profile identification number	Unsigned8	ro	P1.11280004.0-.0 ... 1
974.0 ... 2	Parameter channel description PROFIdrive	Unsigned16	ro	P1.11280030.0-.0 ... 2
975.0 ... 7	Drive object data	Unsigned16	ro	P1.24124.0.0 ... 7
972.0	Reset device	Unsigned16	rw	P0.112901.0.0
976.0	Load factory settings	Unsigned16	rw	P0.112902.0.0

PNU	Name	Data type	Access	Parameter
977.0	Save the parameter set	Unsigned16	rw	P0.112903.0.0
979.0 ... 20	Encoder format	Unsigned32	ro	P1.231243.0.0 ... 20
60000.0	Base value speed (user unit)	FloatingPoint	rw	P1.11280701.0-.0
60100.0 ... 3	Active telegrams	Unsigned16	ro	P0.11280210.0-.0 ... 3
60104.0	Extended process data	Unsigned16	rw	P0.11280204.0-.0
Manufacturer specific parameter				
2018.0	Order number	Unsigned32	ro	P0.70.0.0
2019.0 ... 49	NOC code	STRING(50)	ro	P0.71.0.0 ... 49
2020.0 ... 1	Major version servo drive	STRING(2)	ro	P0.73.0.0 ... 1
2032.0	Status LED	Unsigned16	ro	P0.160.0.0
2033.0	Power LED	Unsigned16	ro	P0.161.0.0
2034.0	Safety LED	Unsigned16	ro	P0.162.0.0
2035.0	Application LED	Unsigned16	ro	P0.163.0.0
2040.0	Debug variable index 0	FloatingPoint	rw	P0.190.0.0
2041.0	Debug variable index 1	FloatingPoint	rw	P0.191.0.0
2042.0	Debug variable index 2	FloatingPoint	rw	P0.192.0.0
2043.0	Debug variable index 3	FloatingPoint	rw	P0.193.0.0
2044.0	Debug variable index 4	FloatingPoint	rw	P0.194.0.0
2045.0	Debug variable index 5	FloatingPoint	rw	P0.195.0.0
2046.0	Debug variable index 6	FloatingPoint	rw	P0.196.0.0
2047.0	Debug variable index 7	FloatingPoint	rw	P0.197.0.0
2048.0	Debug variable index 8	FloatingPoint	rw	P0.198.0.0
2049.0	Debug variable index 9	FloatingPoint	rw	P0.199.0.0
2057.0	Communication module protocol	Unsigned32	ro	P0.245.0.0
2058.0	Serial number	Unsigned32	ro	P0.246.0.0
2059.0 ... 5	MAC address	Unsigned8	ro	P0.247.0.0 ... 5

PNU	Name	Data type	Access	Parameter
2060.0 ... 5	MAC address	Unsigned8	ro	P0.248.0.0 ... 5
2061.0 ... 5	MAC address	Unsigned8	ro	P0.249.0.0 ... 5
2062.0	Material number control unit	Unsigned32	ro	P0.250.0.0
2063.0 ... 49	NOC 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	Unsigned16	ro	P0.254.0.0
2075.0 ... 5	MAC address	Unsigned8	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	Unsigned32	ro	P0.269.0.0
2081.0	Diagnostic device status	Unsigned16	ro	P0.300.0.0
2082.0	Diagnostic axis status	Unsigned16	ro	P0.301.0.0
2083.0	Diagnostic axis status	Unsigned16	ro	P0.301.1.0
2084.0	Diagnostic response axis	Unsigned16	ro	P0.302.0.0
2085.0	Diagnostic response axis	Unsigned16	ro	P0.302.1.0
2086.0	Maximum number of components in the message buffer	Unsigned32	ro	P0.303.0.0
2087.0	Actual number of components in the message buffer	Unsigned32	ro	P0.304.0.0
2113.0	Trace type	Unsigned32	ro	P0.340.0.0
2114.0	Trigger type	Unsigned32	rw	P0.341.0.0
2148.0	Actual value DC link voltage	FloatingPoint	ro	P0.480.0.0
2153.0	Diagnostic category	Unsigned16	rw	P0.487.0.0
2154.0	Storage option in error log	Unsigned8	rw	P0.488.0.0
2155.0	Diagnostic category	Unsigned16	rw	P0.489.0.0
2157.0	Load voltage root mean square value	FloatingPoint	ro	P0.491.0.0
2159.0	Lower load voltage limit value	FloatingPoint	rw	P0.493.0.0
2160.0	Upper load voltage value	FloatingPoint	rw	P0.494.0.0

PNU	Name	Data type	Access	Parameter
2168.0	Diagnostic category	Unsigned16	rw	P0.519.0.0
2169.0	Supply voltage 24 V logic	FloatingPoint	ro	P0.520.0.0
2173.0	Data trace status	Unsigned32	ro	P0.556.0.0
2174.0	Trace delay	Integer32	rw	P0.557.0.0
2175.0	Recording length	Unsigned32	rw	P0.558.0.0
2176.0	Down sampling factor	Unsigned32	rw	P0.559.0.0
2180.0	Number of parameter sets	Unsigned32	ro	P0.571.0.0
2211.0	PWM frequency selection	Unsigned32	ro	P0.670.0.0
2215.0 ... 14	Product key	STRING(15)	ro	P0.710.0.0 ... 14
2217.0 ... 31	NOC code	STRING(32)	ro	P0.711.0.0 ... 31
2219.0	Material number	Unsigned32	ro	P0.712.0.0
2221.0 ... 19	Serial number	STRING(20)	ro	P0.713.0.0 ... 19
2223.0	Pole pairs	Unsigned32	ro	P0.717.0.0
2225.0	Minor version servo drive	Unsigned16	ro	P0.739.0.0
2234.0	Compatibility index servo drive	Unsigned16	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	Unsigned16	rw	P0.801.0.0
2239.0	Storage option in error log	Unsigned8	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	FloatingPoint	ro	P0.920.0.0
2247.0	Temperature status power output stage	Integer32	ro	P0.921.0.0

PNU	Name	Data type	Access	Parameter
2248.0	Diagnostic category	Unsigned16	rw	P0.922.0.0
2249.0	Storage option in error log	Unsigned8	rw	P0.923.0.0
2252.0	Diagnostic category	Unsigned16	rw	P0.926.0.0
2253.0	Storage option in error log	Unsigned8	rw	P0.927.0.0
2259.0	Storage option in error log	Unsigned8	rw	P0.933.0.0
2263.0	Storage option in error log	Unsigned8	rw	P0.937.0.0
2266.0 … 29	Firmware version	STRING(30)	ro	P0.960.0.0 … 29
2267.0	Major Version Firmware	Unsigned32	ro	P0.961.0.0
2268.0	Minor Version Firmware	Unsigned32	ro	P0.962.0.0
2269.0	Patch Version Firmware	Unsigned32	ro	P0.963.0.0
2270.0	Build Version Firmware	Unsigned32	ro	P0.964.0.0
2271.0	Firmware status	Unsigned32	ro	P0.965.0.0
2272.0	Current firmware slot	Unsigned32	ro	P0.966.0.0
2318.0	Operating hour counter	FloatingPoint	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	Unsigned16	ro	P0.2205.0.0
2339.0 … 1	Major version control unit data set	STRING(2)	ro	P0.2208.0.0 … 1
2340.0	Minor version control unit data set	Unsigned16	ro	P0.2209.0.0
2341.0	Minor version control unit	Unsigned16	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	Unsigned16	ro	P0.2214.0.0
2408.0	Commutation angle from user configuration	Integer64	rw	P0.3219.0.0
2410.0	Current commutation angle	Integer64	ro	P0.3220.0.0
2412.0	Zero point offset from encoder memory	Integer64	rw	P0.3221.0.0
2414.0	Zero point offset from user configuration	Integer64	rw	P0.3223.0.0
2416.0	Current zero point offset	Integer64	ro	P0.3224.0.0
2418.0	Encoder referencing is valid	Boolean	ro	P0.3225.0.0

PNU	Name	Data type	Access	Parameter
2420.0	Referencing in user configuration is valid	Boolean	rw	P0.3226.0.0
2422.0	Current referencing is valid	Boolean	ro	P0.3227.0.0
2424.0	Valid commutation angle from encoder memory	Boolean	ro	P0.3228.0.0
2426.0	Valid commutation angle from user configuration	Boolean	ro	P0.3229.0.0
2428.0	Current commutation angle valid	Boolean	ro	P0.3230.0.0
2434.0	Electrical angular frequency filtered	FloatingPoint	ro	P0.3234.0.0
2438.0	Deactivation motor change check	Boolean	rw	P0.3236.0.0
2440.0	Encoder permanently homed	Boolean	rw	P0.3237.0.0
2442.0	Material number motor reference configuration	Unsigned32	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	Boolean	rw	P0.3250.0.0
2468.0	Selection gear ratio group	Unsigned8	rw	P0.3251.0.0
2477.0	Current trace status	Unsigned32	ro	P0.3400.0.0
2478.0	Current trigger status	Unsigned32	ro	P0.3401.0.0
2479.0	Current trace type code	Unsigned32	ro	P0.3402.0.0
2533.0	Warning thresholds DC link voltage	FloatingPoint	rw	P0.4811.0.0
2535.0	Upper limit value DC link voltage	FloatingPoint	rw	P0.4813.0.0
2536.0	Lower limit value DC link voltage	FloatingPoint	rw	P0.4814.0.0
2546.0	Storage option in error log	Unsigned8	rw	P0.4890.0.0
2553.0	Storage option in error log	Unsigned8	rw	P0.5180.0.0
2578.0 ... 7	Trace channel	Boolean	rw	P0.5500.0.0 ... 7
2579.0 ... 7	Axis ID trace data	Unsigned16	rw	P0.5501.0.0 ... 7
2580.0 ... 7	Data ID trace data	Unsigned32	rw	P0.5502.0.0 ... 7

PNU	Name	Data type	Access	Parameter
2581.0 ... 7	Data instance ID trace data	Unsigned16	rw	P0.5503.0.0 ... 7
2582.0 ... 7	Array ID trace data	Unsigned16	rw	P0.5504.0.0 ... 7
2583.0 ... 7	Status Trace channel	Boolean	ro	P0.5505.0.0 ... 7
2584.0 ... 7	Current axis ID trace data	Unsigned16	ro	P0.5506.0.0 ... 7
2585.0 ... 7	Current data ID trace data	Unsigned32	ro	P0.5507.0.0 ... 7
2586.0 ... 7	Current data instance ID trace data	Unsigned16	ro	P0.5508.0.0 ... 7
2587.0 ... 7	Current array ID trace data	Unsigned16	ro	P0.5509.0.0 ... 7
2588.0	Current pre-trigger	Integer32	ro	P0.5513.0.0
2589.0	Current recording length	Unsigned32	ro	P0.5514.0.0
2590.0	Current downsampling factor	Unsigned32	ro	P0.5515.0.0
2591.0	Maximum recording length	Unsigned32	ro	P0.5516.0.0
2592.0	Basic sampling interval	FloatingPoint	ro	P0.5517.0.0
2593.0	Timestamp End trace	Integer64	ro	P0.5518.0.0
2605.0	Storage option in error log	Unsigned8	rw	P0.5709.0.0
2607.0	Storage option in error log	Unsigned8	rw	P0.5711.0.0
2609.0	Storage option in error log	Unsigned8	rw	P0.5713.0.0
2611.0	Storage option in error log	Unsigned8	rw	P0.5715.0.0
2615.0	Storage option in error log	Unsigned8	rw	P0.5719.0.0
2617.0	Storage option in error log	Unsigned8	rw	P0.5721.0.0
2619.0	Storage option in error log	Unsigned8	rw	P0.5723.0.0
2621.0	Storage option in error log	Unsigned8	rw	P0.5725.0.0
2623.0	Storage option in error log	Unsigned8	rw	P0.5727.0.0
2624.0	Parameter set status	Unsigned32	ro	P0.5728.0.0
2627.0 ... 1	Expected major version control unit	STRING(2)	ro	P0.5760.0.0 ... 1
2628.0	Expected minor version control unit	Unsigned16	ro	P0.5761.0.0

PNU	Name	Data type	Access	Parameter
2629.0	Expected compatibility index control unit	Unsigned16	ro	P0.5762.0.0
2630.0 ... 1	Expected major version communication module	STRING(2)	ro	P0.5763.0.0 ... 1
2631.0	Expected minor version communication module	Unsigned16	ro	P0.5764.0.0
2632.0	Expected compatibility index communic- ation module	Unsigned16	ro	P0.5765.0.0
2633.0 ... 1	Expected major version power output stage	STRING(2)	ro	P0.5766.0.0 ... 1
2634.0	Expected minor version power output stage	Unsigned16	ro	P0.5767.0.0
2635.0	Expected compatibility index power out- put stage	Unsigned16	ro	P0.5768.0.0
2636.0 ... 1	Expected major version safety module	STRING(2)	ro	P0.5769.0.0 ... 1
2637.0	Expected minor version safety module	Unsigned16	ro	P0.5770.0.0
2638.0	Expected compatibility index safety module	Unsigned16	ro	P0.5771.0.0
2639.0 ... 19	Compatibility index firmware boot load- er	STRING(20)	ro	P0.5772.0.0 ... 19
2640.0 ... 19	Compatibility index firmware	STRING(20)	ro	P0.5773.0.0 ... 19
2641.0 ... 19	Compatibility index firmware EngP	STRING(20)	ro	P0.5774.0.0 ... 19
2642.0 ... 19	Compatibility index firmware FPGA	STRING(20)	ro	P0.5775.0.0 ... 19
2643.0 ... 19	Compatibility index firmware Comm	STRING(20)	ro	P0.5776.0.0 ... 19
2644.0 ... 19	Compatibility index firmware Ext	STRING(20)	ro	P0.5777.0.0 ... 19
2646.0	Axis ID data trigger	Unsigned16	rw	P0.6000.0.0
2647.0	Data ID data trigger	Unsigned32	rw	P0.6001.0.0
2648.0	Data instance ID data trigger	Unsigned16	rw	P0.6002.0.0
2649.0	Array ID data trigger	Unsigned16	rw	P0.6003.0.0

PNU	Name	Data type	Access	Parameter
2650.0	Trigger event	Unsigned32	rw	P0.6004.0.0
2651.0	Current axis ID data trigger	Unsigned16	ro	P0.6006.0.0
2652.0	Current data ID data trigger	Unsigned32	ro	P0.6007.0.0
2653.0	Current data instance ID data trigger	Unsigned16	ro	P0.6008.0.0
2654.0	Current array ID data trigger	Unsigned16	ro	P0.6009.0.0
2655.0	Current data trigger type	Unsigned32	ro	P0.6010.0.0
2656.0	Current trigger threshold	Integer64	ro	P0.6013.0.0
2721.0	Motor inertia	FloatingPoint	ro	P0.7110.0.0
2723.0	Phase sequence	Boolean	ro	P0.7113.0.0
2725.0	Nominal current	FloatingPoint	ro	P0.7116.0.0
2727.0	Maximum current	FloatingPoint	ro	P0.7119.0.0
2729.0	Maximum rpm	FloatingPoint	ro	P0.7122.0.0
2731.0	Nominal rotary speed	FloatingPoint	ro	P0.7125.0.0
2733.0	Winding inductance	FloatingPoint	ro	P0.7128.0.0
2735.0	Winding resistance	FloatingPoint	ro	P0.7131.0.0
2737.0	Torque constant	FloatingPoint	ro	P0.7134.0.0
2739.0	Time constant I^2t	FloatingPoint	ro	P0.7143.0.0
2741.0	Winding temperature	FloatingPoint	ro	P0.7146.0.0
2743.0	Nominal motor voltage	FloatingPoint	ro	P0.7149.0.0
2745.0 … 1	Major version hardware	STRING(2)	ro	P0.7150.0.0 … 1
2747.0	Minor version hardware	Unsigned16	ro	P0.7151.0.0
2749.0	Temperature sensor	Unsigned32	ro	P0.7152.0.0
2751.0 … 1	Temperature sensor characteristic	FloatingPoint	ro	P0.7155.0.0 … 1
2753.0	Holding brake	Boolean	ro	P0.7158.0.0
2755.0	Switch-on delay holding brake	FloatingPoint	ro	P0.7161.0.0
2757.0	Switch-off delay holding brake	FloatingPoint	ro	P0.7164.0.0
2759.0	Continuous current	FloatingPoint	ro	P0.7181.0.0
2761.0	Encoder data set ID	Unsigned32	ro	P0.7183.0.0
2763.0 … 1	Major version motor data set	STRING(2)	ro	P0.7186.0.0 … 1

PNU	Name	Data type	Access	Parameter
2765.0	Minor version motor data set	Unsigned16	ro	P0.7187.0.0
2767.0	Lq inductance	FloatingPoint	ro	P0.7428.0.0
2769.0	Ld inductance	FloatingPoint	ro	P0.7429.0.0
2771.0	Motor type	Unsigned8	ro	P0.7430.0.0
2773.0	Current time without synchronisation	Integer64	ro	P0.7534.0.0
2774.0	Current time with synchronisation	Integer64	ro	P0.7535.0.0
2784.0	Test user 10	Unsigned8	rw	P0.9303.0.0
2785.0	Test user 20	Unsigned8	rw	P0.9304.0.0
2786.0	Test user 30	Unsigned8	rw	P0.9305.0.0
2795.0	Upper limit value warning threshold power output stage temperature	FloatingPoint	rw	P0.9314.0.0
2796.0	Upper limit value power output stage temperature	FloatingPoint	rw	P0.9315.0.0
2797.0	Lower limit value warning threshold power output stage temperature	FloatingPoint	rw	P0.9316.0.0
2798.0	Lower limit value power output stage temperature	FloatingPoint	rw	P0.9317.0.0
2803.0	Current upper limit value warning threshold power output stage temperat-ure	FloatingPoint	ro	P0.9322.0.0
2804.0	Current upper limit value power output stage temperature	FloatingPoint	ro	P0.9323.0.0
2805.0	Current lower limit value warning threshold power output stage temperat-ure	FloatingPoint	ro	P0.9324.0.0
2806.0	Current lower limit value power output stage temperature	FloatingPoint	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	Unsigned32	ro	P0.9560.0.0
2809.0	Minor version firmware package	Unsigned32	ro	P0.9570.0.0
2810.0	Patch version firmware package	Unsigned32	ro	P0.9580.0.0
2811.0	Build version firmware package	Unsigned32	ro	P0.9590.0.0
2813.0	Storage option in error log	Unsigned8	rw	P0.9601.0.0

PNU	Name	Data type	Access	Parameter
2815.0	Storage option in error log	Unsigned8	rw	P0.9603.0.0
2817.0	Storage option in error log	Unsigned8	rw	P0.9605.0.0
2819.0	Storage option in error log	Unsigned8	rw	P0.9607.0.0
2821.0	Storage option in error log	Unsigned8	rw	P0.9609.0.0
2823.0	Storage option in error log	Unsigned8	rw	P0.9611.0.0
2825.0	Storage option in error log	Unsigned8	rw	P0.9613.0.0
2827.0	Storage option in error log	Unsigned8	rw	P0.9615.0.0
2837.0	Encoder resolution	Unsigned16	rw	P0.10040.0.0
2840.0	Raw value position	Unsigned16	ro	P0.10041.0.0
2843.0	Raw value number of revolutions	Integer16	ro	P0.10042.0.0
2846.0	Quadrature evaluation	Unsigned8	rw	P0.10043.0.0
2888.0	Device interface x1A status	Unsigned32	ro	P0.10151.0.0
2889.0	Device interface x1C status	Unsigned32	ro	P0.10152.0.0
2890.0	Internal interface status	Unsigned32	ro	P0.10153.0.0
2891.0	ExceptionCount	Unsigned32	ro	P0.10300.0.0
2892.0	ExceptionType	Unsigned32	ro	P0.10301.0.0
2893.0	PID	Unsigned32	ro	P0.10302.0.0
2894.0	ErrorCode	Unsigned32	ro	P0.10303.0.0
2895.0	UserInfo	Unsigned32	ro	P0.10304.0.0
2896.0	RegR14ex	Unsigned32	ro	P0.10305.0.0
2897.0	RegMPU	Unsigned32	ro	P0.10306.0.0
2898.0	RegState	Unsigned32	ro	P0.10307.0.0
2899.0	RegIPSR	Unsigned32	ro	P0.10308.0.0
2900.0	RegCFSR	Unsigned32	ro	P0.10309.0.0
2901.0	RegHFSR	Unsigned32	ro	P0.10310.0.0
2902.0	Bus fault address register	Unsigned32	ro	P0.10311.0.0
2903.0	MemManage Fault Address Register	Unsigned32	ro	P0.10312.0.0
2904.0	Auxiliary Fault Status Register	Unsigned32	ro	P0.10313.0.0
2905.0	System Handler Control and State Register	Unsigned32	ro	P0.10314.0.0
2906.0	Reset status list	Unsigned32	ro	P0.10315.0.0
2907.0	Operating system-specific	Unsigned32	ro	P0.10316.0.0

PNU	Name	Data type	Access	Parameter
2908.0 … 3	Servo drive initialisation status	Unsigned32	ro	P0.10320.0.0 … 3
2909.0	Status ReInit	Unsigned32	ro	P0.10321.0.0
2910.0	Status ReInit requested	Boolean	ro	P0.10322.0.0
2911.0	Status ReInit active	Boolean	ro	P0.10323.0.0
2912.0	Status ReInit device restart	Boolean	ro	P0.10324.0.0
2916.0	Storage option in error log	Unsigned8	rw	P0.10328.0.0
2917.0	Number ReInit requests	Unsigned32	ro	P0.10329.0.0
2918.0	Number activated ReInit	Unsigned32	ro	P0.10330.0.0
2937.0	Standardised encoder position	Integer64	ro	P0.11600.0.0
2939.0	Absolute position in user units	Integer64	ro	P0.11601.0.0
2941.0	Velocity in user units	FloatingPoint	ro	P0.11602.0.0
2943.0	Filtered velocity in user units	FloatingPoint	ro	P0.11603.0.0
2945.0	Electrical angle	Unsigned32	ro	P0.11604.0.0
2947.0	Electrical angular frequency	FloatingPoint	ro	P0.11605.0.0
2953.0	Commutation angle from encoder memory	Integer64	rw	P0.11608.0.0
2967.0	Current position	Integer64	ro	P0.11615.0.0
2969.0	Encoder selection	Unsigned32	rw	P0.11616.0.0
2971.0	Active encoder	Unsigned32	ro	P0.11617.0.0
2973.0	Velocity filter filter time constant	FloatingPoint	rw	P0.11618.0.0
2991.0	Activate DHCP	Boolean	rw	P0.12000.0.0
2992.0	Activate DHCP	Boolean	rw	P0.12000.1.0
2993.0	IP address	Unsigned32	rw	P0.12001.0.0
2994.0	IP address	Unsigned32	rw	P0.12001.1.0
2995.0	Subnet mask	Unsigned32	rw	P0.12002.0.0
2996.0	Subnet mask	Unsigned32	rw	P0.12002.1.0
2997.0	Gateway address	Unsigned32	rw	P0.12003.0.0
2998.0	Gateway address	Unsigned32	rw	P0.12003.1.0
2999.0	Active IP address	Unsigned32	ro	P0.12004.0.0
3000.0	Active IP address	Unsigned32	ro	P0.12004.1.0
3001.0	Active subnet mask	Unsigned32	ro	P0.12005.0.0

PNU	Name	Data type	Access	Parameter
3002.0	Active subnet mask	Unsigned32	ro	P0.12005.1.0
3003.0	Active gateway address	Unsigned32	ro	P0.12006.0.0
3004.0	Active gateway address	Unsigned32	ro	P0.12006.1.0
3005.0 … 5	MAC address	Unsigned8	ro	P0.12007.0.0 … 5
3006.0 … 5	MAC address	Unsigned8	ro	P0.12007.1.0 … 5
3007.0	Activate keep-alive-signal	Boolean	rw	P0.12008.0.0
3008.0	Keep-alive-signal wait time	Unsigned32	rw	P0.12009.0.0
3009.0	Keep-alive-signal repeat time	Unsigned32	rw	P0.12010.0.0
3010.0	Maximum number of repetitions	Unsigned32	rw	P0.12011.0.0
3011.0	Active connection access	Unsigned16	ro	P0.12012.0.0
3012.0	Maximum connection access	Unsigned16	ro	P0.12013.0.0
3013.0	Connection active	Boolean	ro	P0.12014.0.0
3014.0	Connection active	Boolean	ro	P0.12014.1.0
3015.0	Connection ID	Unsigned32	ro	P0.12015.0.0
3016.0	Connection ID	Unsigned32	ro	P0.12015.1.0
3017.0	Host IP address	Unsigned32	ro	P0.12016.0.0
3018.0	Host IP address	Unsigned32	ro	P0.12016.1.0
3019.0	Port host	Unsigned16	ro	P0.12017.0.0
3020.0	Port host	Unsigned16	ro	P0.12017.1.0
3052.0	Current lower limit value load voltage	FloatingPoint	ro	P0.28151.0.0
3053.0	Current upper limit value load voltage	FloatingPoint	ro	P0.28152.0.0
3065.0	Current warning threshold DC link voltage	FloatingPoint	ro	P0.56799.0.0
3066.0	Current upper limit value DC link voltage	FloatingPoint	ro	P0.56800.0.0
3067.0	Current lower limit value DC link voltage	FloatingPoint	ro	P0.56801.0.0
3071.0	Trigger level	Integer64	rw	P0.60012.0.0
3072.0	Bit mask data trigger	Unsigned64	rw	P0.60013.0.0
3073.0	Actual acceleration value unfiltered	FloatingPoint	ro	P0.71500.0.0
3075.0	Actual acceleration value filtered	FloatingPoint	ro	P0.71501.0.0
3077.0	Filter time constant acceleration filter	FloatingPoint	rw	P0.71502.0.0

PNU	Name	Data type	Access	Parameter
3082.0	Message counter	Unsigned32	ro	P0.100501.0.0
3083.0	Current file pointer	Unsigned32	ro	P0.100502.0.0
3084.0	Current file size	Unsigned32	ro	P0.100503.0.0
3086.0	Storage option in error log	Unsigned8	rw	P0.100505.0.0
3088.0	Storage option in error log	Unsigned8	ro	P0.100509.0.0
3089.0	Current indicator in the message buffer	Unsigned32	ro	P0.100510.0.0
3140.0	Axis ID diagnostic trace	Unsigned16	rw	P0.103100.0.0
3141.0	Diagnostics ID diagnostic trace	Unsigned32	rw	P0.103101.0.0
3142.0	Data instance ID diagnostic trace	Unsigned16	rw	P0.103102.0.0
3143.0	Current axis ID diagnostic trace	Unsigned16	ro	P0.103103.0.0
3144.0	Current diagnostics ID diagnostic trace	Unsigned32	ro	P0.103104.0.0
3145.0	Current data instance ID diagnostic trace	Unsigned16	ro	P0.103105.0.0
3146.0	Diagnostics trigger	Unsigned32	rw	P0.103106.0.0
3147.0	Current diagnostics trigger	Unsigned32	ro	P0.103107.0.0
3158.0	Number diagnostics acknowledgements	Unsigned32	ro	P0.103401.0.0
3159.0	Number diagnostics acknowledgements	Unsigned32	ro	P0.103401.1.0
3284.0	Major version bootloader	Unsigned32	ro	P0.1130121.0.0
3285.0	Minor version bootloader	Unsigned32	ro	P0.1130122.0.0
3286.0	Patch version bootloader	Unsigned32	ro	P0.1130123.0.0
3287.0	Build version bootloader	Unsigned32	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	Boolean	rw	P0.1174200.0.0
3292.0	Axis ID data trigger	Unsigned16	rw	P0.1174201.0.0
3293.0	Data ID data trigger	Unsigned32	rw	P0.1174202.0.0
3294.0	Data instance ID data trigger	Unsigned16	rw	P0.1174203.0.0
3295.0	Array ID data trigger	Unsigned16	rw	P0.1174204.0.0
3296.0	Trigger level MELDW.5	Integer64	rw	P0.1174205.0.0
3297.0	Hysteresis of trigger level	Integer64	rw	P0.1174206.0.0
3298.0	Data trigger damping time	FloatingPoint	rw	P0.1174207.0.0
3299.0	Variable message function status	Boolean	ro	P0.1174210.0.0

PNU	Name	Data type	Access	Parameter
3300.0	Current axis ID data trigger	Unsigned16	ro	P0.1174211.0.0
3301.0	Current data ID data trigger	Unsigned32	ro	P0.1174212.0.0
3302.0	Current data instance ID data trigger	Unsigned16	ro	P0.1174213.0.0
3303.0	Current array ID data trigger	Unsigned16	ro	P0.1174214.0.0
3304.0	Current trigger level	Integer64	ro	P0.1174215.0.0
3305.0	Current hysteresis of trigger level	Integer64	ro	P0.1174216.0.0
3306.0	Current data trigger damping time	FloatingPoint	ro	P0.1174217.0.0
3307.0	Data trigger status	Boolean	ro	P0.1174220.0.0
3312.0	ID reintialisation	Unsigned32	ro	P0.11280019.0-.0
3313.0 … 19	URL address	STRING(20)	ro	P0.11280052.0-.0 … 19
3316.0	Storage option in error log	Unsigned8	rw	P0.11280203.0-.0
3326.0 … 9	Revision	STRING(10)	ro	P0.72.0.0 … 9
3327.0	Resolution single turn	Unsigned32	rw	P0.3601.0.0
3328.0	Resolution multiturn	Unsigned32	rw	P0.3602.0.0
3329.0	Single-turn position	Unsigned32	ro	P0.3603.0.0
3330.0	Multi-turn numerator	Unsigned32	ro	P0.3604.0.0
3336.0	CRC BiSS-C	Unsigned8	ro	P0.3610.0.0
3338.0	Baud rate	Unsigned32	rw	P0.3612.0.0
3339.0	Activation of correction table	Boolean	rw	P0.3613.0.0
3343.0	Activation read out extended encoder data	Boolean	rw	P0.3618.0.0
3349.0 … 19	unused	STRING(20)	rw	P0.3624.0.0 … 19
3352.0	DC link recovery deactivation	FloatingPoint	ro	P0.10181.0.0
3353.0	DC link recovery status	Boolean	ro	P0.10182.0.0
3355.0	Activation automatic voltage determination	Boolean	rw	P0.10184.0.0
3356.0	Power feedback switch-off threshold	FloatingPoint	rw	P0.10185.0.0

PNU	Name	Data type	Access	Parameter
3357.0	Scaling factor offset of voltage calcula-tion	FloatingPoint	rw	P0.10186.0.0
3361.0	Activate PNP input and output beha-viour	Unsigned8	rw	P0.10191.0.0
3362.0	Inversion of the inputs active	Boolean	ro	P0.10192.0.0
3363.0	Inversion of the outputs active	Boolean	ro	P0.10193.0.0
3364.0	Digital input X1A.7	Unsigned32	rw	P0.11201.0.0
3365.0	Digital input X1A.8	Unsigned32	rw	P0.11202.0.0
3366.0	Digital output X1A.9	Unsigned32	rw	P0.11203.0.0
3367.0	Digital output X1A.10	Unsigned32	rw	P0.11204.0.0
3368.0	Digital input X1C.2	Unsigned32	rw	P0.11205.0.0
3371.0	Web server activation	Boolean	rw	P0.11280051.0-.0
3373.0	Diagnostic category	Unsigned8	rw	P0.5781.0.0
3375.0	Diagnostic category	Unsigned8	rw	P0.5783.0.0
3376.0	Currently most serious error	Unsigned32	ro	P0.315.0.0
3377.0	Currently most serious error	Unsigned32	ro	P0.315.1.0
3378.0	Activation inversion zero pulse	Boolean	rw	P0.10045.0.0
3381.0	Zero pulse monitoring window	Unsigned16	rw	P0.10047.0.0
3384.0	Storage option in error log	Unsigned8	rw	P0.10060.0.0
3387.0	Diagnostic category	Unsigned16	rw	P0.10061.0.0
3396.0 … 7	Memory Value	Integer64	ro	P0.34013.0.0 … 7
3399.0	Diagnostic category	Unsigned16	rw	P0.1174230.0.0
3400.0	Storage option in error log	Unsigned8	rw	P0.1174231.0.0
3403.0	Status word Object 0x60FE	Unsigned16	rw	P0.11310.0.0
3404.0	Denominator pole pairs	Unsigned32	ro	P0.7171.0.0
3408.0	Encoder serial number	Unsigned32	ro	P0.3625.0.0
3409.0	Manufacturer ID BiSS-C	Unsigned16	ro	P0.3626.0.0
3410.0	Current encoder ID	Unsigned64	ro	P0.3627.0.0
3414.0	Maximum number of parameters	Unsigned16	ro	P0.303101.0.0
3415.0	Multi-parameter access active	Boolean	ro	P0.303102.0.0

PNU	Name	Data type	Access	Parameter
3416.0	Status EtherNet/IP	Integer32	ro	P0.303302.0.0
3417.0	Telegram selection	Unsigned16	rw	P0.3030101.0.0
3418.0	Extended process data	Boolean	rw	P0.3030104.0.0
11000.0	Counter overruns 32-bit	Integer32	ro	P1.11.0.0
11001.0	Use of user specific motor data	Boolean	rw	P1.14.0.0
11002.0	Switch-on delay holding brake 1	FloatingPoint	ro	P1.20.0.0
11003.0	Switch-off delay holding brake 1	FloatingPoint	ro	P1.21.0.0
11006.0	Status holding brake 1	Unsigned32	ro	P1.24.0.0
11008.0	Status holding brakes 1 and 2	Unsigned32	ro	P1.26.0.0
11011.0	Selection of holding brake (manual opening)	Unsigned32	ro	P1.29.0.0
11021.0	Actual phase U current value	FloatingPoint	ro	P1.39.0.0
11022.0 ... 2	Filter frequency notch filter	FloatingPoint	rw	P1.40.0.0 ... 2
11024.0	Controller operating status	Unsigned32	ro	P1.42.0.0
11026.0	Controller parameter set switchover status	Boolean	ro	P1.44.0.0
11027.0	Diagnostic category	Unsigned16	rw	P1.45.0.0
11028.0	Storage option in error log	Unsigned8	rw	P1.46.0.0
11031.0 ... 2	Band width of notch filter	FloatingPoint	rw	P1.49.0.0 ... 2
11032.0 ... 2	Notch filter output active current	FloatingPoint	ro	P1.50.0.0 ... 2
11033.0 ... 2	Activation of notch filter	Boolean	rw	P1.51.0.0 ... 2
11034.0	Setpoint value active current unfiltered	FloatingPoint	ro	P1.52.0.0
11035.0	Amplification gain current regulator (reactive current)	FloatingPoint	rw	P1.80.0.0
11036.0	Integration constant current regulator (reactive current)	FloatingPoint	rw	P1.81.0.0
11037.0	Amplification gain current regulator (active current)	FloatingPoint	rw	P1.82.0.0
11038.0	Integration constant current regulator (active current)	FloatingPoint	rw	P1.83.0.0

PNU	Name	Data type	Access	Parameter
11039.0	Setpoint value voltage Ud	FloatingPoint	ro	P1.84.0.0
11040.0	Setpoint value voltage Uq	FloatingPoint	ro	P1.85.0.0
11041.0	Setpoint value active current	FloatingPoint	ro	P1.86.0.0
11042.0	Setpoint value reactive current	FloatingPoint	ro	P1.87.0.0
11043.0	Maximum output voltage	FloatingPoint	ro	P1.88.0.0
11044.0	Actual Clarke-Transformation la current value	FloatingPoint	ro	P1.89.0.0
11045.0	Setpoint value position	Integer64	ro	P1.90.0.0
11046.0	Setpoint value velocity	FloatingPoint	ro	P1.91.0.0
11047.0	Setpoint value acceleration	FloatingPoint	ro	P1.92.0.0
11048.0	Setpoint value jerk	FloatingPoint	ro	P1.93.0.0
11049.0	Setpoint value torque	FloatingPoint	ro	P1.94.0.0
11050.0	Feed forward control current output	FloatingPoint	ro	P1.95.0.0
11051.0	Fine interpolator output position	Integer64	ro	P1.100.0.0
11052.0	Fine interpolator output velocity	FloatingPoint	ro	P1.101.0.0
11053.0	Fine interpolator output acceleration	FloatingPoint	ro	P1.102.0.0
11054.0	Fine interpolator output jerk	FloatingPoint	ro	P1.103.0.0
11055.0	Fine interpolator output torque	FloatingPoint	ro	P1.104.0.0
11056.0	Fine interpolator output current	FloatingPoint	ro	P1.105.0.0
11058.0	Fine interpolator status	Unsigned32	ro	P1.107.0.0
11061.0	Encoder channel 1 position	Unsigned32	ro	P1.122.0.0
11067.0	Actual position value	Integer64	ro	P1.128.0.0
11069.0	Actual torque value motor shaft	FloatingPoint	ro	P1.150.0.0
11070.0	Actual torque value gear shaft	FloatingPoint	ro	P1.151.0.0
11071.0	Motion Manager status	Unsigned32	ro	P1.171.0.0
11072.0	Active motion task	Unsigned32	ro	P1.172.0.0
11073.0	Active motion task status	Unsigned32	ro	P1.173.0.0
11080.0	Position controller amplification gain	FloatingPoint	rw	P1.220.0.0
11081.0	Dead zone position controller	Integer64	rw	P1.221.0.0
11082.0	Minimum correction velocity	FloatingPoint	rw	P1.222.0.0
11083.0	Maximum correction velocity	FloatingPoint	rw	P1.223.0.0
11084.0	Velocity controller amplification gain	FloatingPoint	rw	P1.224.0.0

PNU	Name	Data type	Access	Parameter
11085.0	Velocity controller integration constant	FloatingPoint	rw	P1.225.0.0
11086.0 … 2	Amplification gain position controller	FloatingPoint	rw	P1.226.0.0 … 2
11094.0	Setpoint value reactive current	FloatingPoint	rw	P1.270.0.0
11104.0	Setpoint management output position	Integer64	ro	P1.290.0.0
11105.0	Setpoint management output velocity	FloatingPoint	ro	P1.291.0.0
11106.0	Setpoint management output acceleration	FloatingPoint	ro	P1.292.0.0
11107.0	Setpoint management output jerk	FloatingPoint	ro	P1.293.0.0
11108.0	Setpoint management output torque	FloatingPoint	ro	P1.294.0.0
11109.0	Setpoint management output current	FloatingPoint	ro	P1.295.0.0
11110.0	Setpoint management control structure	Unsigned32	ro	P1.296.0.0
11111.0	Setpoint management controller operating status	Unsigned32	ro	P1.297.0.0
11112.0 … 4	Status setpoint sources	Unsigned32	ro	P1.298.0.0 … 4
11113.0	Actual phase V current value	FloatingPoint	ro	P1.310.0.0
11122.0	Maximum motor or servo drive torque	FloatingPoint	ro	P1.381.0.0
11123.0	Maximum motor or servo drive velocity	FloatingPoint	ro	P1.382.0.0
11124.0	STO hysteresis time	FloatingPoint	rw	P1.390.0.0
11125.0	STO discrepancy time	FloatingPoint	rw	P1.391.0.0
11126.0	STO safety status	Unsigned32	ro	P1.392.0.0
11127.0	STO error status	Unsigned32	ro	P1.393.0.0
11128.0	STO signal status	Unsigned32	ro	P1.394.0.0
11144.0	Movement monitoring status	Unsigned32	ro	P1.460.0.0
11145.0	Configuration word movement monitoring	Unsigned32	ro	P1.461.0.0
11146.0	Damping time position: following error	FloatingPoint	rw	P1.462.0.0
11147.0	Monitoring window position: following error	FloatingPoint	rw	P1.463.0.0
11148.0	Monitoring window speed: following error	FloatingPoint	rw	P1.464.0.0
11149.0	Standstill damping time	FloatingPoint	rw	P1.465.0.0

PNU	Name	Data type	Access	Parameter
11150.0	Monitoring window speed standstill monitoring	FloatingPoint	rw	P1.466.0.0
11151.0	Monitoring window position standstill	FloatingPoint	rw	P1.467.0.0
11152.0	Damping time target reached	FloatingPoint	rw	P1.468.0.0
11153.0	Monitoring window target position	FloatingPoint	rw	P1.469.0.0
11154.0	Device control status	Unsigned32	ro	P1.530.0.0
11159.0	Maximum current motor	FloatingPoint	ro	P1.620.0.0
11160.0	Motor nominal current	FloatingPoint	ro	P1.621.0.0
11161.0	Maximum current servo drive	FloatingPoint	ro	P1.622.0.0
11162.0	Nominal current servo drive	FloatingPoint	ro	P1.623.0.0
11163.0	Resulting maximum current	FloatingPoint	ro	P1.624.0.0
11164.0	Resulting minimum current	FloatingPoint	ro	P1.625.0.0
11165.0	Resulting nominal current	FloatingPoint	ro	P1.626.0.0
11168.0	Scaling factor start value I^2t monitoring motor	FloatingPoint	rw	P1.631.0.0
11169.0	Limit value I^2t monitoring motor	FloatingPoint	ro	P1.632.0.0
11170.0	Scaling factor maximum value after switching on	FloatingPoint	ro	P1.633.0.0
11171.0	Actual value I^2t monitoring motor	FloatingPoint	ro	P1.634.0.0
11172.0	Scaling factor warning limit I^2t monitoring motor	FloatingPoint	rw	P1.635.0.0
11173.0	Maximum I^2t time	FloatingPoint	ro	P1.636.0.0
11174.0	Scaling factor start value I^2t monitoring power output stage	FloatingPoint	ro	P1.637.0.0
11175.0	Limit value I^2t monitoring power output stage	FloatingPoint	ro	P1.638.0.0
11176.0	Scaling factor maximum value after switching on	FloatingPoint	ro	P1.639.0.0
11177.0	Status of state machine commutation finding	Unsigned32	ro	P1.660.0.0
11178.0	Commutation finding status	Unsigned32	ro	P1.661.0.0
11179.0	Time current increase	FloatingPoint	rw	P1.662.0.0
11180.0	Increments	FloatingPoint	rw	P1.664.0.0

PNU	Name	Data type	Access	Parameter
11182.0	Mode	Unsigned32	rw	P1.668.0.0
11183.0	Velocity	FloatingPoint	rw	P1.669.0.0
11184.0	Pole pairs (user defined)	Unsigned32	rw	P1.718.0.0
11185.0	Current pole pairs	Unsigned32	ro	P1.719.0.0
11186.0	Actual Clarke-Transformation lb current value	FloatingPoint	ro	P1.810.0.0
11189.0	Actual reactive current value	FloatingPoint	ro	P1.813.0.0
11190.0	Actual active current value	FloatingPoint	ro	P1.814.0.0
11195.0	Control parameter equalisation for act-ive and reactive current regulators	Boolean	rw	P1.819.0.0
11196.0	Functional safety status	Unsigned32	ro	P1.820.0.0
11197.0	Diagnostic category	Unsigned16	rw	P1.821.0.0
11198.0	Storage option in error log	Unsigned8	rw	P1.822.0.0
11199.0	Control word Motion Manager	Unsigned32	ro	P1.823.0.0
11200.0	Reactive current control error	FloatingPoint	ro	P1.824.0.0
11201.0	Active current control error	FloatingPoint	ro	P1.825.0.0
11202.0	Referencing status	Unsigned32	ro	P1.840.0.0
11203.0	Move to axis zero point after homing	Boolean	rw	P1.841.0.0
11204.0	Homing timeout	FloatingPoint	rw	P1.842.0.0
11205.0	Search for reference mark setpoint velo-city	FloatingPoint	rw	P1.843.0.0
11206.0	Search for reference mark setpoint acceleration	FloatingPoint	rw	P1.844.0.0
11207.0	Search for reference mark setpoint jerk	FloatingPoint	rw	P1.845.0.0
11208.0	Setpoint reference mark creeping velo-city	FloatingPoint	rw	P1.846.0.0
11209.0	Setpoint reference mark creeping accel-eration	FloatingPoint	rw	P1.847.0.0
11210.0	Setpoint reference mark creeping jerk	FloatingPoint	rw	P1.848.0.0
11211.0	Move to axis zero point setpoint velocity	FloatingPoint	rw	P1.849.0.0
11212.0	Lower limit value velocity (closed loop controller)	FloatingPoint	rw	P1.850.0.0

PNU	Name	Data type	Access	Parameter
11213.0	Upper limit value velocity (closed loop controller)	FloatingPoint	rw	P1.851.0.0
11214.0	Lower limit value torque (closed loop controller)	FloatingPoint	rw	P1.852.0.0
11215.0	Upper limit value torque (closed loop controller)	FloatingPoint	rw	P1.853.0.0
11216.0	Lower limit value active current (closed loop controller)	FloatingPoint	rw	P1.854.0.0
11217.0	Upper limit value active current (closed loop controller)	FloatingPoint	rw	P1.855.0.0
11218.0	Limit value total current (closed loop controller)	FloatingPoint	rw	P1.856.0.0
11219.0	Status auto tuning	Unsigned8	ro	P1.860.0.0
11222.0	Interpolator output position	Integer64	ro	P1.911.0.0
11223.0	Interpolator output velocity	FloatingPoint	ro	P1.912.0.0
11224.0	Interpolator output acceleration	FloatingPoint	ro	P1.913.0.0
11225.0	Interpolator output jerk	FloatingPoint	ro	P1.914.0.0
11226.0	Interpolator output torque	FloatingPoint	ro	P1.915.0.0
11227.0	Interpolator output current	FloatingPoint	ro	P1.916.0.0
11228.0	Counter motion task	Unsigned32	ro	P1.917.0.0
11239.0	SFB error status	Unsigned32	ro	P1.950.0.0
11240.0	Feedback signals	Unsigned32	ro	P1.951.0.0
11241.0	STA hysteresis time	FloatingPoint	ro	P1.952.0.0
11246.0	Inactive time position setpoint value	Unsigned32	rw	P1.957.0.0
11247.0	Time constant velocity setpoint value fil-ter	FloatingPoint	rw	P1.958.0.0
11248.0	Time constant acceleration setpoint value filter	FloatingPoint	rw	P1.959.0.0
11249.0	Amplification gain velocity feed forward control	FloatingPoint	rw	P1.967.0.0
11250.0	Amplification gain torque feed forward control	FloatingPoint	rw	P1.968.0.0
11251.0	Offset torque	FloatingPoint	rw	P1.969.0.0
11252.0	Total inertia	FloatingPoint	rw	P1.973.0.0

PNU	Name	Data type	Access	Parameter
11253.0	Setpoint value friction compensation	FloatingPoint	ro	P1.974.0.0
11254.0	Setpoint value inertia compensation	FloatingPoint	ro	P1.975.0.0
11255.0 … 15	Support point velocity [rad/s]	FloatingPoint	rw	P1.976.0.0 … 15
11256.0 … 15	Support point torque [Nm]	FloatingPoint	rw	P1.977.0.0 … 15
11257.0	Number of support points	Unsigned32	rw	P1.978.0.0
11267.0	IPO mode position	Integer64	ro	P1.1140.0.0
11268.0	IPO mode velocity	FloatingPoint	ro	P1.1141.0.0
11269.0	IPO mode acceleration	FloatingPoint	ro	P1.1142.0.0
11270.0	IPO mode jerk	FloatingPoint	ro	P1.1143.0.0
11271.0	IPO mode torque	FloatingPoint	ro	P1.1144.0.0
11272.0	IPO mode current	FloatingPoint	ro	P1.1145.0.0
11273.0	IPO mode active	Unsigned32	ro	P1.1146.0.0
11274.0	Next IPO mode	Unsigned32	ro	P1.1147.0.0
11275.0	Current IPO mode	Unsigned32	ro	P1.1148.0.0
11276.0	Status next IPO mode	Unsigned32	ro	P1.1149.0.0
11277.0	Current user unit	Unsigned32	ro	P1.1150.0.0
11278.0	Selection of next user unit	Unsigned32	rw	P1.1151.0.0
11279.0	User unit status	Unsigned32	ro	P1.1152.0.0
11280.0	Current torque constant	FloatingPoint	ro	P1.1153.0.0
11281.0	Current pole pairs	Unsigned32	ro	P1.1154.0.0
11282.0 … 2	Current counter gear unit	FloatingPoint	ro	P1.1155.0.0 … 2
11283.0 … 2	Current denominator gear unit	FloatingPoint	ro	P1.1156.0.0 … 2
11284.0 … 2	Current counter feed constant	FloatingPoint	ro	P1.1157.0.0 … 2
11285.0 … 2	Current denominator feed constant	FloatingPoint	ro	P1.1158.0.0 … 2
11286.0	Diagnostic category	Unsigned16	ro	P1.1159.0.0
11287.0	Reversing the direction of rotation	Boolean	rw	P1.1170.0.0

PNU	Name	Data type	Access	Parameter
11288.0 ... 9	Invert encoder signal	Boolean	rw	P1.1171.0.0 ... 9
11289.0	Phase rotation	Boolean	rw	P1.1172.0.0
11290.0	Reversing the direction of rotation validation status	Boolean	rw	P1.1173.0.0
11291.0 ... 9	Invert encoder signal validation status	Boolean	rw	P1.1174.0.0 ... 9
11292.0	Validation status of phase rotation	Boolean	rw	P1.1175.0.0
11293.0	Database ID of axis	Unsigned32	rw	P1.1191.0.0
11294.0 ... 49	Axis NOC code	STRING(50)	rw	P1.1192.0.0 ... 49
11295.0	Load weight / load inertia	FloatingPoint	rw	P1.1193.0.0
11296.0	Feed constant numerator	Unsigned32	rw	P1.1194.0.0
11297.0	Feed constant denominator	Unsigned32	rw	P1.1195.0.0
11298.0	Working stroke	Integer64	rw	P1.1196.0.0
11299.0	Design axis	Unsigned32	rw	P1.1197.0.0
11300.0	Length connecting shaft	FloatingPoint	rw	P1.1198.0.0
11301.0	Maximum driving torque axis	FloatingPoint	rw	P1.1199.0.0
11302.0	Database ID of mounting kit	Unsigned32	rw	P1.1200.0.0
11303.0 ... 36	NOC code mounting kit	STRING(37)	rw	P1.1201.0.0 ... 36
11304.0	Database ID connecting shaft / coupling	Unsigned32	rw	P1.1202.0.0
11305.0 ... 36	NOC code connecting shaft / coupling	STRING(37)	rw	P1.1203.0.0 ... 36
11306.0	Database ID cable set	Unsigned32	rw	P1.1204.0.0
11307.0 ... 36	NOC code cable set	STRING(37)	rw	P1.1205.0.0 ... 36
11308.0	Length motor cable	FloatingPoint	rw	P1.1206.0.0
11309.0	Status device configured	Boolean	rw	P1.1207.0.0
11310.0	Cable cross section	FloatingPoint	rw	P1.1208.0.0
11311.0	Actual velocity value	FloatingPoint	ro	P1.1210.0.0
11313.0	Electrical angle	Unsigned32	ro	P1.1212.0.0
11314.0	Electrical angular frequency	FloatingPoint	ro	P1.1213.0.0

PNU	Name	Data type	Access	Parameter
11317.0	Database ID gear unit 1	Unsigned32	rw	P1.1230.0.0
11318.0 … 36	NOC code gear unit 1	STRING(37)	rw	P1.1231.0.0 … 36
11319.0	Conversion factor gear unit 1 numerator	Unsigned32	rw	P1.1232.0.0
11320.0	Conversion factor gear unit 1 denominator	Unsigned32	rw	P1.1233.0.0
11321.0	Database ID gear unit 2	Unsigned32	rw	P1.1234.0.0
11322.0 … 36	NOC code gear unit 2	STRING(37)	rw	P1.1235.0.0 … 36
11323.0	Conversion factor gear unit 2 numerator	Unsigned32	rw	P1.1236.0.0
11324.0	Conversion factor gear unit 2 denominator	Unsigned32	rw	P1.1237.0.0
11325.0	Database ID gear unit 3	Unsigned32	rw	P1.1238.0.0
11326.0 … 36	NOC code gear unit 3	STRING(37)	rw	P1.1239.0.0 … 36
11327.0	Conversion factor gear unit 3 numerator	Unsigned32	rw	P1.1240.0.0
11328.0	Conversion factor gear unit 3 denominator	Unsigned32	rw	P1.1241.0.0
11329.0	Total conversion factor gear unit numerator	Unsigned32	rw	P1.1242.0.0
11330.0	Total conversion factor gear unit denominator	Unsigned32	rw	P1.1243.0.0
11331.0	Velocity limiting status	Boolean	ro	P1.1301.0.0
11332.0	Acceleration limiting status	Boolean	ro	P1.1302.0.0
11333.0	Torque limiting status	Boolean	ro	P1.1303.0.0
11334.0	Limit value velocity limiting	FloatingPoint	rw	P1.1304.0.0
11335.0	Limit value acceleration limiting	FloatingPoint	rw	P1.1305.0.0
11336.0	Limit value deceleration limiting	FloatingPoint	rw	P1.1306.0.0
11337.0	Upper limit torque limitation	FloatingPoint	rw	P1.1307.0.0
11338.0	Lower limit torque limitation	FloatingPoint	rw	P1.1308.0.0
11339.0	Mileage 1	Integer64	rw	P1.1411.0.0
11343.0	Mileage warning threshold	Integer64	rw	P1.1417.0.0
11344.0	Diagnostic category	Unsigned16	rw	P1.1419.0.0

PNU	Name	Data type	Access	Parameter
11345.0	Load change counter 1	Integer64	rw	P1.1421.0.0
11349.0	Warning threshold load change counter	Integer64	rw	P1.1427.0.0
11350.0	Diagnostic category	Unsigned16	rw	P1.1429.0.0
11351.0	Jog duration 1 movement	FloatingPoint	rw	P1.1510.0.0
11352.0	Slow jog 1 velocity	FloatingPoint	rw	P1.1511.0.0
11353.0	Slow jog 1 acceleration	FloatingPoint	rw	P1.1512.0.0
11354.0	Slow jog 1 jerk	FloatingPoint	rw	P1.1513.0.0
11355.0	Fast jog 1 velocity	FloatingPoint	rw	P1.1514.0.0
11356.0	Fast jog 1 acceleration	FloatingPoint	rw	P1.1515.0.0
11357.0	Fast jog 1 jerk	FloatingPoint	rw	P1.1516.0.0
11358.0	Current ramp	FloatingPoint	rw	P1.1555.0.0
11359.0	Conversion factor torque	FloatingPoint	rw	P1.1556.0.0
11371.0	Storage option in error log	Unsigned8	rw	P1.1733.0.0
11380.0 ... 127	Command record type	Unsigned32	rw	P1.1810.0.0 ... 127
11381.0 ... 127	Record number	Integer32	rw	P1.1811.0.0 ... 127
11382.0 ... 127	Record table field 1	Integer64	rw	P1.1812.0.0 ... 127
11383.0 ... 127	Record table field 2	Integer64	rw	P1.1813.0.0 ... 127
11384.0 ... 127	Record table field 3	Integer64	rw	P1.1814.0.0 ... 127
11385.0 ... 127	Record table field 4	Integer64	rw	P1.1815.0.0 ... 127
11386.0 ... 127	Record table field 5	Integer64	rw	P1.1816.0.0 ... 127
11387.0 ... 127	Record table field 6	Integer64	rw	P1.1817.0.0 ... 127
11388.0 ... 127	Record table field 7	Integer64	rw	P1.1818.0.0 ... 127
11389.0 ... 127	Record step enabling type	Unsigned32	rw	P1.1831.0.0 ... 127

PNU	Name	Data type	Access	Parameter
11390.0 ... 127	Record sequencing record number start	Integer32	rw	P1.1832.0.0 ... 127
11391.0 ... 127	Record sequencing record number target	Integer32	rw	P1.1833.0.0 ... 127
11392.0 ... 127	Record sequencing field time	FloatingPoint	rw	P1.1834.0.0 ... 127
11393.0 ... 127	Record sequencing field 1	Integer64	rw	P1.1835.0.0 ... 127
11394.0 ... 127	Record sequencing field 2	Integer64	rw	P1.1836.0.0 ... 127
11395.0	Current record table index	Integer32	ro	P1.1837.0.0
11396.0 ... 127	Selection start condition record	Unsigned32	rw	P1.1838.0.0 ... 127
11397.0	Maximum number record links	Unsigned32	ro	P1.1839.0.0
11398.0	Activate Event table	Boolean	rw	P1.1840.0.0
11399.0 ... 15	Event type	Unsigned32	rw	P1.1841.0.0 ... 15
11400.0 ... 15	Next event target	Integer32	rw	P1.1842.0.0 ... 15
11401.0 ... 15	Next event field time	FloatingPoint	rw	P1.1843.0.0 ... 15
11402.0 ... 15	Next event field 1	Integer64	rw	P1.1844.0.0 ... 15
11403.0 ... 15	Next event field 2	Integer64	rw	P1.1845.0.0 ... 15
11404.0	Status of record table	Unsigned32	ro	P1.1846.0.0
11405.0	Diagnostic category	Unsigned16	rw	P1.1850.0.0
11406.0	Storage option in error log	Unsigned8	rw	P1.1851.0.0
11407.0	Diagnostic category	Unsigned16	rw	P1.1852.0.0
11408.0	Storage option in error log	Unsigned8	rw	P1.1853.0.0
11409.0 ... 2	Velocity controller amplification gain	FloatingPoint	rw	P1.2210.0.0 ... 2
11410.0 ... 2	Velocity controller integration constant	FloatingPoint	rw	P1.2211.0.0 ... 2

PNU	Name	Data type	Access	Parameter
11411.0	Velocity control error	FloatingPoint	ro	P1.2215.0.0
11412.0	Setpoint value velocity controller	FloatingPoint	ro	P1.2216.0.0
11413.0	Position control error	Integer64	ro	P1.2217.0.0
11414.0	Minimum torque	FloatingPoint	ro	P1.2218.0.0
11415.0	Maximum torque	FloatingPoint	ro	P1.2219.0.0
11416.0	Setpoint value torque	FloatingPoint	ro	P1.2220.0.0
11419.0 ... 2	Amplification gain current regulator (active current)	FloatingPoint	rw	P1.2223.0.0 ... 2
11420.0 ... 2	Integration constant current regulator (active current)	FloatingPoint	rw	P1.2224.0.0 ... 2
11421.0 ... 2	Amplification gain current regulator (reactive current)	FloatingPoint	rw	P1.2225.0.0 ... 2
11422.0 ... 2	Integration constant current regulator (reactive current)	FloatingPoint	rw	P1.2226.0.0 ... 2
11423.0 ... 2	Total inertia	FloatingPoint	rw	P1.2227.0.0 ... 2
11424.0 ... 2	Velocity filter filter time constant	FloatingPoint	rw	P1.2228.0.0 ... 2
11425.0 ... 2	Load weight / load inertia	FloatingPoint	rw	P1.2229.0.0 ... 2
11426.0	Unlimited axis	Boolean	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	Unsigned16	ro	P1.2801.0.0
11437.0	Lower limit value minimum DC link voltage	FloatingPoint	ro	P1.2818.0.0
11438.0	Upper limit value minimum DC link voltage	FloatingPoint	ro	P1.2819.0.0
11465.0	Upper limit value power output stage temperature	FloatingPoint	ro	P1.2850.0.0
11466.0	Lower limit value power output stage temperature	FloatingPoint	ro	P1.2851.0.0
11467.0	Upper limit value servo drive temperat-ure	FloatingPoint	ro	P1.2852.0.0

PNU	Name	Data type	Access	Parameter
11468.0	Lower limit value servo drive temperat-ure	FloatingPoint	ro	P1.2853.0.0
11498.0	Setpoint generator output position	Integer64	ro	P1.3010.0.0
11499.0	Setpoint generator output velocity	FloatingPoint	ro	P1.3011.0.0
11500.0	Setpoint generator output acceleration	FloatingPoint	ro	P1.3012.0.0
11501.0	Setpoint generator output jerk	FloatingPoint	ro	P1.3013.0.0
11502.0	Setpoint generator output torque	FloatingPoint	ro	P1.3014.0.0
11503.0	Setpoint generator output current	FloatingPoint	ro	P1.3015.0.0
11504.0	Setpoint generator input relative target position	Integer64	ro	P1.3016.0.0
11505.0	Setpoint generator input relative target velocity	FloatingPoint	ro	P1.3017.0.0
11506.0	Status setpoint generator	Unsigned32	ro	P1.3018.0.0
11542.0	Activation of open loop operation	Boolean	rw	P1.4001.0.0
11545.0	Active control structure	Unsigned32	ro	P1.4004.0.0
11546.0	Selection of mode of operation open loop/closed loop	Unsigned32	rw	P1.4005.0.0
11547.0	Selection of mode of operation	Unsigned32	rw	P1.4006.0.0
11548.0	Active mode of operation	Unsigned32	ro	P1.4007.0.0
11549.0	Velocity switching threshold	FloatingPoint	rw	P1.4008.0.0
11551.0	Current rise time	FloatingPoint	rw	P1.4010.0.0
11552.0	Diagnostic category	Unsigned16	rw	P1.4020.0.0
11553.0	Storage option in error log	Unsigned8	rw	P1.4021.0.0
11558.0	Current reduction activation	Boolean	rw	P1.4026.0.0
11559.0	Current reduction delay time	FloatingPoint	rw	P1.4027.0.0
11560.0	Current reduction scaling factor	FloatingPoint	rw	P1.4028.0.0
11564.0	Maximum failure Sign of Life	Unsigned16	rw	P1.4243.0.0
11565.0	Monitoring window target speed	FloatingPoint	rw	P1.4610.0.0
11566.0	Monitoring window target torque	FloatingPoint	rw	P1.4611.0.0
11567.0	Diagnostic category	Unsigned16	rw	P1.4612.0.0
11568.0	Storage option in error log	Unsigned8	rw	P1.4613.0.0
11569.0	Diagnostic category	Unsigned16	rw	P1.4614.0.0

PNU	Name	Data type	Access	Parameter
11570.0	Storage option in error log	Unsigned8	rw	P1.4615.0.0
11571.0	Diagnostic category	Unsigned16	rw	P1.4616.0.0
11572.0	Storage option in error log	Unsigned8	rw	P1.4617.0.0
11573.0	Diagnostic category	Unsigned16	rw	P1.4618.0.0
11574.0	Storage option in error log	Unsigned8	rw	P1.4619.0.0
11575.0	Diagnostic category	Unsigned16	rw	P1.4620.0.0
11576.0	Storage option in error log	Unsigned8	rw	P1.4621.0.0
11577.0	Diagnostic category	Unsigned16	rw	P1.4622.0.0
11578.0	Storage option in error log	Unsigned8	rw	P1.4623.0.0
11579.0	Diagnostic category	Unsigned16	rw	P1.4624.0.0
11580.0	Storage option in error log	Unsigned8	rw	P1.4625.0.0
11581.0	Stop detection limit value	FloatingPoint	rw	P1.4626.0.0
11582.0	Damping time limit detection	FloatingPoint	rw	P1.4627.0.0
11583.0	Software limit positions active	Boolean	rw	P1.4628.0.0
11584.0	Negative software limit position	Integer64	rw	P1.4629.0.0
11585.0	Positive software limit position	Integer64	rw	P1.4630.0.0
11586.0	Activation of automatic stop ramp software limit position	Boolean	rw	P1.4631.0.0
11587.0	Diagnostic category	Unsigned16	rw	P1.4632.0.0
11588.0	Storage option in error log	Unsigned8	rw	P1.4633.0.0
11589.0	Diagnostic category	Unsigned16	rw	P1.4634.0.0
11590.0	Storage option in error log	Unsigned8	rw	P1.4635.0.0
11591.0	Diagnostic category	Unsigned16	rw	P1.4636.0.0
11592.0	Storage option in error log	Unsigned8	rw	P1.4637.0.0
11593.0	Diagnostic category	Unsigned16	rw	P1.4638.0.0
11594.0	Storage option in error log	Unsigned8	rw	P1.4639.0.0
11602.0	Diagnostic category	Unsigned16	rw	P1.4647.0.0
11603.0	Storage option in error log	Unsigned8	rw	P1.4648.0.0
11604.0	Diagnostic category	Unsigned16	rw	P1.4649.0.0
11605.0	Storage option in error log	Unsigned8	rw	P1.4650.0.0
11606.0	Maximum speed	FloatingPoint	rw	P1.4660.0.0
11607.0	Diagnostic category	Unsigned16	ro	P1.4661.0.0

PNU	Name	Data type	Access	Parameter
11609.0	Monitoring window pushback	FloatingPoint	rw	P1.4663.0.0
11610.0	Damping time pushback	FloatingPoint	rw	P1.4664.0.0
11611.0	Damping time target range	FloatingPoint	rw	P1.4665.0.0
11612.0	Monitoring window position	FloatingPoint	rw	P1.4666.0.0
11613.0	Monitoring window velocity	FloatingPoint	rw	P1.4667.0.0
11614.0	Monitoring window torque	FloatingPoint	rw	P1.4668.0.0
11615.0	Diagnostic category	Unsigned16	rw	P1.4669.0.0
11616.0	Storage option in error log	Unsigned8	rw	P1.4670.0.0
11617.0	Diagnostic category	Unsigned16	rw	P1.4671.0.0
11618.0	Storage option in error log	Unsigned8	rw	P1.4672.0.0
11619.0	Activation of automatic stop ramp stroke limit	Boolean	rw	P1.4675.0.0
11620.0	Diagnostic category	Unsigned16	rw	P1.4676.0.0
11621.0	Storage option in error log	Unsigned8	rw	P1.4677.0.0
11622.0	Diagnostic category	Unsigned16	rw	P1.4678.0.0
11623.0	Storage option in error log	Unsigned8	rw	P1.4679.0.0
11624.0	Current position: following error	FloatingPoint	ro	P1.4682.0.0
11625.0	Current velocity: following error	FloatingPoint	ro	P1.4683.0.0
11626.0	Actual stroke value	Integer64	ro	P1.4684.0.0
11627.0	Limit value remaining distance monitor-ing	Integer64	rw	P1.4685.0.0
11628.0	Diagnostic category	Unsigned16	rw	P1.4686.0.0
11629.0	Storage option in error log	Unsigned8	rw	P1.4687.0.0
11630.0	Bit mask movement monitoring	Unsigned32	rw	P1.4688.0.0
11631.0	Movement monitoring (masked)	Unsigned32	ro	P1.4689.0.0
11632.0	Damping time velocity: following error	FloatingPoint	rw	P1.4690.0.0
11633.0	Diagnostic category	Unsigned16	rw	P1.4691.0.0
11634.0	Storage option in error log	Unsigned8	rw	P1.4692.0.0
11635.0	Fixed stop detection damping time	FloatingPoint	rw	P1.4693.0.0
11636.0	Limit value following error	FloatingPoint	rw	P1.4694.0.0
11640.0	Resulting lower limit value velocity (closed loop controller)	FloatingPoint	ro	P1.6100.0.0

PNU	Name	Data type	Access	Parameter
11641.0	Resulting upper limit value velocity (closed loop controller)	FloatingPoint	ro	P1.6101.0.0
11644.0	Resulting lower limit value torque (closed loop controller)	FloatingPoint	ro	P1.6104.0.0
11645.0	Resulting upper limit value torque (closed loop controller)	FloatingPoint	ro	P1.6105.0.0
11648.0	Resulting lower limit value active current (closed loop controller)	FloatingPoint	ro	P1.6108.0.0
11649.0	Resulting upper limit value active current (closed loop controller)	FloatingPoint	ro	P1.6109.0.0
11652.0	Resulting upper limit value total current (closed loop controller)	FloatingPoint	ro	P1.6112.0.0
11655.0	Actual value I^2t monitoring power output stage	FloatingPoint	ro	P1.6310.0.0
11656.0	Scaling factor warning limit I^2t monitoring power output stage	FloatingPoint	rw	P1.6311.0.0
11657.0	Scaling factor start value I^2t monitoring power output stage at standstill	FloatingPoint	ro	P1.6313.0.0
11658.0	Limit value I^2t monitoring power output stage at standstill	FloatingPoint	ro	P1.6314.0.0
11659.0	Scaling factor maximum value after drive at standstill	FloatingPoint	ro	P1.6315.0.0
11660.0	Actual value I^2t monitoring power output stage at standstill	FloatingPoint	ro	P1.6316.0.0
11661.0	Scaling factor warning limit I^2t monitoring drive at standstill	FloatingPoint	rw	P1.6317.0.0
11662.0	Diagnostic category	Unsigned16	rw	P1.6319.0.0
11663.0	Storage option in error log	Unsigned8	rw	P1.6320.0.0
11664.0	Diagnostic category	Unsigned16	rw	P1.6321.0.0
11665.0	Storage option in error log	Unsigned8	rw	P1.6322.0.0
11666.0	Diagnostic category	Unsigned16	rw	P1.6323.0.0
11667.0	Storage option in error log	Unsigned8	rw	P1.6324.0.0
11668.0	Diagnostic category	Unsigned16	rw	P1.6325.0.0
11669.0	Storage option in error log	Unsigned8	rw	P1.6326.0.0

PNU	Name	Data type	Access	Parameter
11670.0	Diagnostic category	Unsigned16	rw	P1.6327.0.0
11671.0	Storage option in error log	Unsigned8	rw	P1.6328.0.0
11672.0	Diagnostic category	Unsigned16	rw	P1.6329.0.0
11673.0	Storage option in error log	Unsigned8	rw	P1.6330.0.0
11674.0	Actual value relative I^2t monitoring of motor to limit	FloatingPoint	ro	P1.6331.0.0
11675.0	Actual value relative I^2t monitoring of power output stage to limit	FloatingPoint	ro	P1.6332.0.0
11676.0	Actual value relative I^2t monitoring of power output stage at standstill to limit	FloatingPoint	ro	P1.6333.0.0
11677.0	Actual value I^2t monitoring of the total current	FloatingPoint	ro	P1.6334.0.0
11682.0	Acceleration	FloatingPoint	rw	P1.6691.0.0
11683.0	Jerk	FloatingPoint	rw	P1.6692.0.0
11684.0	Monitoring window angle	FloatingPoint	rw	P1.6693.0.0
11685.0	Factor current setpoint value	FloatingPoint	rw	P1.6694.0.0
11686.0	Motor inertia (user defined)	FloatingPoint	rw	P1.7111.0.0
11687.0	Current motor inertia	FloatingPoint	ro	P1.7112.0.0
11688.0	Phase sequence (user defined)	Boolean	rw	P1.7114.0.0
11689.0	Current phase sequence	Boolean	ro	P1.7115.0.0
11690.0	Nominal current (user defined)	FloatingPoint	rw	P1.7117.0.0
11691.0	Current nominal current	FloatingPoint	ro	P1.7118.0.0
11692.0	Maximum peak current (user defined)	FloatingPoint	rw	P1.7120.0.0
11693.0	Current maximum current	FloatingPoint	ro	P1.7121.0.0
11694.0	Maximum rpm (user defined)	FloatingPoint	rw	P1.7123.0.0
11695.0	Current maximum velocity	FloatingPoint	ro	P1.7124.0.0
11696.0	Nominal rotary speed (user defined)	FloatingPoint	rw	P1.7126.0.0
11697.0	Current nominal velocity	FloatingPoint	ro	P1.7127.0.0
11698.0	Winding inductance (user defined)	FloatingPoint	rw	P1.7129.0.0
11699.0	Current winding inductance	FloatingPoint	ro	P1.7130.0.0
11700.0	Winding resistance (user defined)	FloatingPoint	rw	P1.7132.0.0
11701.0	Current winding resistance	FloatingPoint	ro	P1.7133.0.0

PNU	Name	Data type	Access	Parameter
11702.0	Torque constant (user defined)	FloatingPoint	rw	P1.7135.0.0
11703.0	Current torque constant	FloatingPoint	ro	P1.7136.0.0
11704.0	Resulting nominal torque	FloatingPoint	ro	P1.7139.0.0
11705.0	Resulting maximum torque	FloatingPoint	ro	P1.7142.0.0
11706.0	Time constant I^2t (user defined)	FloatingPoint	rw	P1.7144.0.0
11707.0	Current time constant I^2t	FloatingPoint	ro	P1.7145.0.0
11708.0	Winding temperature (user defined)	FloatingPoint	rw	P1.7147.0.0
11709.0	Current winding temperature	FloatingPoint	ro	P1.7148.0.0
11710.0	Temperature sensor (user defined)	Unsigned32	rw	P1.7153.0.0
11711.0	Current temperature sensor motor	Unsigned32	ro	P1.7154.0.0
11712.0 ... 1	Temperature sensor characteristic (user defined)	FloatingPoint	rw	P1.7156.0.0 ... 1
11713.0 ... 1	Current temperature sensor characteristic motor	FloatingPoint	ro	P1.7157.0.0 ... 1
11714.0	Holding brake (user defined)	Boolean	rw	P1.7159.0.0
11715.0	Holding brake	Boolean	ro	P1.7160.0.0
11716.0	Switch-on delay holding brake (user defined)	FloatingPoint	rw	P1.7162.0.0
11717.0	Current switch-on delay holding brake	FloatingPoint	ro	P1.7163.0.0
11718.0	Switch-off delay holding brake (user defined)	FloatingPoint	rw	P1.7165.0.0
11719.0	Current switch-off delay holding brake	FloatingPoint	ro	P1.7166.0.0
11720.0 ... 31	NOC code motor (user defined)	STRING(32)	rw	P1.7182.0.0 ... 31
11721.0	Database ID motor (user defined)	Unsigned32	rw	P1.7184.0.0
11722.0 ... 31	Current NOC code motor	STRING(32)	ro	P1.7188.0.0 ... 31
11723.0	Current database ID motor	Unsigned32	ro	P1.7189.0.0
11724.0	Resolution position	Integer8	rw	P1.7841.0.0
11725.0	Resolution velocity	Integer8	rw	P1.7842.0.0
11726.0	Resolution acceleration	Integer8	rw	P1.7843.0.0
11727.0	Resolution jerk	Integer8	rw	P1.7844.0.0

PNU	Name	Data type	Access	Parameter
11728.0	Move to axis zero point setpoint acceleration	FloatingPoint	rw	P1.8410.0.0
11729.0	Search for move to axis zero point setpoint jerk	FloatingPoint	rw	P1.8411.0.0
11730.0	Maximum search stroke in positive direction	Integer64	rw	P1.8412.0.0
11731.0	Maximum search stroke in negative direction	Integer64	rw	P1.8413.0.0
11732.0	Nominal current limit value scaling factor	FloatingPoint	rw	P1.8414.0.0
11733.0	Limit position detection time monitoring window	FloatingPoint	rw	P1.8415.0.0
11734.0	Axis zero point offset	Integer64	rw	P1.8416.0.0
11735.0	Referencing method	Integer32	rw	P1.8417.0.0
11736.0	Status state machine homing	Unsigned32	ro	P1.8418.0.0
11742.0	Diagnostic category	Unsigned16	rw	P1.8450.0.0
11743.0	Storage option in error log	Unsigned8	rw	P1.8451.0.0
11744.0	Diagnostic category	Unsigned16	rw	P1.8452.0.0
11745.0	Storage option in error log	Unsigned8	rw	P1.8453.0.0
11746.0	Diagnostic category	Unsigned16	rw	P1.8454.0.0
11747.0	Storage option in error log	Unsigned8	rw	P1.8455.0.0
11748.0	Result amplification gain of position controller	FloatingPoint	rw	P1.8601.0.0
11749.0	Result integration constant of velocity controller	FloatingPoint	rw	P1.8602.0.0
11750.0	Result amplification gain of velocity controller	FloatingPoint	rw	P1.8603.0.0
11752.0	Storage option in error log	Unsigned8	rw	P1.8605.0.0
11753.0	Start value position controller amplification gain	FloatingPoint	rw	P1.8611.0.0
11754.0	Start value velocity controller amplification gain	FloatingPoint	rw	P1.8612.0.0
11755.0	Start value velocity controller integration constant	FloatingPoint	rw	P1.8613.0.0

PNU	Name	Data type	Access	Parameter
11756.0	Filter time constant velocity controller	FloatingPoint	rw	P1.8614.0.0
11757.0	Filter time constant noise signal generator	FloatingPoint	rw	P1.8615.0.0
11758.0	Amplification gain noise signal generator	FloatingPoint	rw	P1.8616.0.0
11759.0	Signal selection noise signal generator	Unsigned8	rw	P1.8617.0.0
11760.0	Time delay noise signal for the start identification	FloatingPoint	rw	P1.8618.0.0
11761.0	Identification with movement	Boolean	rw	P1.8619.0.0
11762.0	Number of identifications for averaging	Unsigned8	rw	P1.8620.0.0
11763.0	Maximum movement stroke during the identification	Integer64	rw	P1.8621.0.0
11764.0	Maximum velocity during the identification	FloatingPoint	rw	P1.8622.0.0
11765.0	Maximum acceleration during the identification	FloatingPoint	rw	P1.8623.0.0
11766.0	Maximum deceleration during the identification	FloatingPoint	rw	P1.8624.0.0
11767.0	Maximum jerk during the identification	FloatingPoint	rw	P1.8625.0.0
11768.0	Number of validation movements	Unsigned8	rw	P1.8630.0.0
11769.0	Movement stroke during validation movement	Integer64	rw	P1.8631.0.0
11770.0	Maximum velocity during validation movement	FloatingPoint	rw	P1.8632.0.0
11771.0	Maximum acceleration during validation movement	FloatingPoint	rw	P1.8633.0.0
11772.0	Maximum deceleration during validation movement	FloatingPoint	rw	P1.8634.0.0
11773.0	Maximum jerk during validation movement	FloatingPoint	rw	P1.8635.0.0
11798.0	Storage option in error log	Unsigned8	rw	P1.9914.0.0
11800.0	Device status	Unsigned32	ro	P1.10231.0.0
11801.0	Controller enable selection	Unsigned32	rw	P1.10232.0.0
11802.0	Controller enable operating mode	Unsigned32	rw	P1.10234.0.0

PNU	Name	Data type	Access	Parameter
11803.0	Target velocity for controller enable (velocity operation)	FloatingPoint	rw	P1.10235.0.0
11804.0	Target torque for controller enable (torque operation)	FloatingPoint	rw	P1.10236.0.0
11805.0	Maximum velocity for controller enable (torque operation)	FloatingPoint	rw	P1.10237.0.0
11806.0	Index for controller enable	Integer32	rw	P1.10238.0.0
11807.0	Request directional lock	Integer32	rw	P1.10351.0.0
11808.0	Active directional lock	Integer32	ro	P1.10352.0.0
11809.0	Status directional lock	Integer32	ro	P1.10353.0.0
11812.0	Default value target position	Integer64	rw	P1.10361.0.0
11813.0	Default value maximum velocity	FloatingPoint	rw	P1.10362.0.0
11814.0	Default value maximum acceleration	FloatingPoint	rw	P1.10363.0.0
11815.0	Default value maximum delay	FloatingPoint	rw	P1.10364.0.0
11816.0	Default value maximum jerk	FloatingPoint	rw	P1.10365.0.0
11817.0	Default value target velocity	FloatingPoint	rw	P1.10366.0.0
11818.0	Default value activation stroke limitation	Boolean	rw	P1.10367.0.0
11819.0	Default value negative stroke limit	Integer64	rw	P1.10368.0.0
11820.0	Default value positive stroke limit	Integer64	rw	P1.10369.0.0
11821.0	Default value target torque	FloatingPoint	rw	P1.10370.0.0
11822.0	Default value Torque rise ramp	FloatingPoint	rw	P1.10371.0.0
11823.0	IPO mode (status)	Unsigned32	ro	P1.11410.0.0
11824.0	Interpolation step size	Unsigned32	ro	P1.11411.0.0
11827.0	Timing tolerance	Integer32	ro	P1.11417.0.0
11828.0	Interpolation step loss counter	Integer32	ro	P1.11418.0.0
11829.0	Storage option in error log	Unsigned8	rw	P1.11590.0.0
11834.0	Stop ramp deceleration	FloatingPoint	rw	P1.12101.0.0
11835.0	Stop ramp jerk	FloatingPoint	rw	P1.12111.0.0
11836.0	Stop ramp velocity	FloatingPoint	rw	P1.12112.0.0
11837.0	Stop position	Integer64	ro	P1.12201.0.0
11838.0	Stop ramp time	FloatingPoint	ro	P1.12202.0.0

PNU	Name	Data type	Access	Parameter
11841.0	Status Stop ramp	Unsigned32	ro	P1.12205.0.0
11842.0	Factor extrapolation stop ramp	FloatingPoint	rw	P1.12206.0.0
11843.0	Storage option in error log	Unsigned8	rw	P1.14110.0.0
11844.0	Mileage error threshold	Integer64	rw	P1.14111.0.0
11845.0	Diagnostic category	Unsigned16	rw	P1.14113.0.0
11846.0	Storage option in error log	Unsigned8	rw	P1.14114.0.0
11847.0	Storage option in error log	Unsigned8	rw	P1.14210.0.0
11848.0	Error threshold load change counter	Integer64	rw	P1.14211.0.0
11849.0	Diagnostic category	Unsigned16	rw	P1.14213.0.0
11850.0	Storage option in error log	Unsigned8	rw	P1.14214.0.0
11851.0 … 7	Drive object data	Unsigned16	ro	P1.24124.0.0 … 7
11852.0 … 5	Drive unit data	Unsigned16	ro	P1.24125.0.0 … 5
11853.0 … 1	Assignment controller enable	Unsigned16	ro	P1.24126.0.0 … 1
11857.0	Upper limit value minimum load voltage	FloatingPoint	ro	P1.28120.0.0
11858.0	Lower limit value minimum load voltage	FloatingPoint	ro	P1.28121.0.0
11859.0	Upper limit value maximum load voltage	FloatingPoint	ro	P1.28130.0.0
11860.0	Lower limit value maximum load voltage	FloatingPoint	ro	P1.28131.0.0
11861.0	Lower limit value maximum DC link voltage	FloatingPoint	ro	P1.28180.0.0
11862.0	Upper limit value maximum DC link voltage	FloatingPoint	ro	P1.28181.0.0
11863.0	Upper limit value warning threshold maximum DC link voltage	FloatingPoint	ro	P1.28200.0.0
11864.0	Lower limit value warning threshold maximum DC link voltage	FloatingPoint	ro	P1.28201.0.0
11872.0	Diagnostic category	Unsigned16	rw	P1.30127.0.0
11873.0	Storage option in error log	Unsigned8	rw	P1.30128.0.0
11874.0	Monitoring window factor	FloatingPoint	rw	P1.30129.0.0
11889.0	Velocity limiting active	Boolean	ro	P1.52675.0.0
11890.0	Current limitation active	Boolean	ro	P1.52676.0.0

PNU	Name	Data type	Access	Parameter
11891.0	Diagnostic category	Unsigned16	rw	P1.52677.0.0
11892.0	Storage option in error log	Unsigned8	rw	P1.52678.0.0
11893.0	Voltage limiting filter time constant	FloatingPoint	rw	P1.52679.0.0
11894.0	Voltage limiting Ud active	Boolean	ro	P1.52680.0.0
11895.0	Voltage limiting Uq active	Boolean	ro	P1.52681.0.0
11896.0	Diagnostic category	Unsigned16	rw	P1.52682.0.0
11897.0	Storage option in error log	Unsigned8	rw	P1.52683.0.0
11898.0	UINT8	Unsigned8	rw	P1.66003.0.0
11899.0	UINT16	Unsigned16	rw	P1.66008.0.0
11900.0	UINT32	Unsigned32	rw	P1.66009.0.0
11901.0	INT8	Integer8	rw	P1.66010.0.0
11902.0	INT16	Integer16	rw	P1.66012.0.0
11903.0	INT32	Integer32	rw	P1.66013.0.0
11904.0	BOOL	Boolean	rw	P1.66015.0.0
11905.0 ... 4	UINT8 (Array)	Unsigned8	rw	P1.66016.0.0 ... 4
11906.0 ... 4	UINT16 (Array)	Unsigned16	rw	P1.66017.0.0 ... 4
11907.0 ... 4	UINT32 (Array)	Unsigned32	rw	P1.66018.0.0 ... 4
11908.0 ... 4	INT8 (Array)	Integer8	rw	P1.66019.0.0 ... 4
11909.0 ... 4	INT16 (Array)	Integer16	rw	P1.66053.0.0 ... 4
11910.0 ... 4	INT32 (Array)	Integer32	rw	P1.66055.0.0 ... 4
11911.0 ... 4	BOOL (Array)	Boolean	rw	P1.66056.0.0 ... 4
11916.0	Diagnostic value test 1	Unsigned16	rw	P1.66061.0.0
11917.0	Diagnostic value test 2	Unsigned16	rw	P1.66062.0.0
11918.0	Nominal motor voltage (user defined)	FloatingPoint	rw	P1.71421.0.0
11919.0	Current nominal motor voltage	FloatingPoint	ro	P1.71422.0.0
11920.0	Continuous current (user defined)	FloatingPoint	rw	P1.71424.0.0

PNU	Name	Data type	Access	Parameter
11921.0	Current continuous current	FloatingPoint	ro	P1.71425.0.0
11922.0	Current Lq inductance	FloatingPoint	ro	P1.71426.0.0
11923.0	Current Ld inductance	FloatingPoint	ro	P1.71427.0.0
11924.0	Motor type	Unsigned8	ro	P1.71428.0.0
11925.0	Diagnostic category	Unsigned16	rw	P1.71429.0.0
11926.0	Lq inductance (user defined)	FloatingPoint	rw	P1.71430.0.0
11927.0	Ld inductance (user defined)	FloatingPoint	rw	P1.71431.0.0
11928.0	Motor type	Unsigned8	rw	P1.71432.0.0
11929.0	Storage option in error log	Unsigned8	rw	P1.71433.0.0
11930.0	Configure negative hardware limit switch	Unsigned32	rw	P1.101100.0.0
11931.0	Configure positive hardware limit switch	Unsigned32	rw	P1.101101.0.0
11932.0	Diagnostic category	Unsigned16	rw	P1.101102.0.0
11933.0	Storage option in error log	Unsigned8	rw	P1.101103.0.0
11934.0	Diagnostic category	Unsigned16	rw	P1.101104.0.0
11935.0	Storage option in error log	Unsigned8	rw	P1.101105.0.0
11936.0	Diagnostic category	Unsigned16	rw	P1.101106.0.0
11937.0	Storage option in error log	Unsigned8	rw	P1.101107.0.0
11938.0	Diagnostic category	Unsigned16	rw	P1.101108.0.0
11939.0	Storage option in error log	Unsigned8	rw	P1.101109.0.0
11940.0	Diagnostic category	Unsigned16	rw	P1.101110.0.0
11941.0	Storage option in error log	Unsigned8	rw	P1.101111.0.0
11942.0	Negative hardware limit switch detected	Boolean	ro	P1.101112.0.0
11943.0	Positive hardware limit switch detected	Boolean	ro	P1.101113.0.0
11944.0	Negative limit switch position detected	Integer64	ro	P1.101114.0.0
11945.0	Positive limit switch position detected	Integer64	ro	P1.101115.0.0
11946.0	Activation of hardware limit switch monitoring	Boolean	rw	P1.101116.0.0
11947.0	Reference switch configuration	Unsigned32	rw	P1.101200.0.0
11948.0	Reference switch status	Boolean	ro	P1.101201.0.0
11949.0	Activation of field weakening	Boolean	rw	P1.102201.0.0
11950.0	Field weakening status	Boolean	ro	P1.102202.0.0

PNU	Name	Data type	Access	Parameter
11951.0	Field weakening reactive current	FloatingPoint	ro	P1.102203.0.0
11955.0	Current maximum reactive current	FloatingPoint	ro	P1.102207.0.0
11960.0	Cam controller mode	Unsigned16	rw	P1.112700.0.0
11961.0	Cam controller mode	Unsigned16	rw	P1.112700.1.0
11962.0	Cam controller source	Unsigned16	rw	P1.112701.0.0
11963.0	Cam controller source	Unsigned16	rw	P1.112701.1.0
11964.0	Upper limit value modulo	Integer64	rw	P1.112702.0.0
11965.0	Upper limit value modulo	Integer64	rw	P1.112702.1.0
11966.0	Lower limit value modulo	Integer64	rw	P1.112703.0.0
11967.0	Lower limit value modulo	Integer64	rw	P1.112703.1.0
11968.0	Inactive time compensation of first switching point	FloatingPoint	rw	P1.112704.0.0
11969.0	Inactive time compensation of first switching point	FloatingPoint	rw	P1.112704.1.0
11970.0	Inactive time compensation of second switching point	FloatingPoint	rw	P1.112705.0.0
11971.0	Inactive time compensation of second switching point	FloatingPoint	rw	P1.112705.1.0
11972.0	Hysteresis	Integer64	rw	P1.112706.0.0
11973.0	Hysteresis	Integer64	rw	P1.112706.1.0
11974.0	Switching time (manual)	FloatingPoint	rw	P1.112707.0.0
11975.0	Switching time (manual)	FloatingPoint	rw	P1.112707.1.0
11976.0 ... 3	Selection of switching function	Unsigned16	rw	P1.112708.0.0 ... 3
11977.0 ... 3	Selection of switching function	Unsigned16	rw	P1.112708.1.0 ... 3
11978.0 ... 3	Selection of switching characteristics	Unsigned16	rw	P1.112709.0.0 ... 3
11979.0 ... 3	Selection of switching characteristics	Unsigned16	rw	P1.112709.1.0 ... 3
11980.0 ... 3	First switching point	Integer64	rw	P1.112710.0.0 ... 3
11981.0 ... 3	First switching point	Integer64	rw	P1.112710.1.0 ... 3

PNU	Name	Data type	Access	Parameter
11982.0 ... 3	Second switching point	Integer64	rw	P1.112711.0.0 ... 3
11983.0 ... 3	Second switching point	Integer64	rw	P1.112711.1.0 ... 3
11984.0 ... 3	Switching time (automatic)	FloatingPoint	rw	P1.112712.0.0 ... 3
11985.0 ... 3	Switching time (automatic)	FloatingPoint	rw	P1.112712.1.0 ... 3
11986.0	Current cam controller mode	Unsigned16	ro	P1.112713.0.0
11987.0	Current cam controller mode	Unsigned16	ro	P1.112713.1.0
11988.0	Current cam controller source	Unsigned16	ro	P1.112714.0.0
11989.0	Current cam controller source	Unsigned16	ro	P1.112714.1.0
11990.0	Current upper limit value modulo	Integer64	ro	P1.112715.0.0
11991.0	Current upper limit value modulo	Integer64	ro	P1.112715.1.0
11992.0	Current lower limit value modulo	Integer64	ro	P1.112716.0.0
11993.0	Current lower limit value modulo	Integer64	ro	P1.112716.1.0
11994.0	Current inactive time first switching point	FloatingPoint	ro	P1.112717.0.0
11995.0	Current inactive time first switching point	FloatingPoint	ro	P1.112717.1.0
11996.0	Current inactive time second switching point	FloatingPoint	ro	P1.112718.0.0
11997.0	Current inactive time second switching point	FloatingPoint	ro	P1.112718.1.0
11998.0	Current hysteresis	Integer64	ro	P1.112719.0.0
11999.0	Current hysteresis	Integer64	ro	P1.112719.1.0
12000.0	Current switching time (manual)	FloatingPoint	ro	P1.112720.0.0
12001.0	Current switching time (manual)	FloatingPoint	ro	P1.112720.1.0
12002.0 ... 3	Current selection of switching function	Unsigned16	ro	P1.112721.0.0 ... 3
12003.0 ... 3	Current selection of switching function	Unsigned16	ro	P1.112721.1.0 ... 3
12004.0 ... 3	Current selection of switching characteristics	Unsigned16	ro	P1.112722.0.0 ... 3

PNU	Name	Data type	Access	Parameter
12005.0 ... 3	Current selection of switching characteristics	Unsigned16	ro	P1.112722.1.0 ... 3
12006.0 ... 3	Current first switching point	Integer64	ro	P1.112723.0.0 ... 3
12007.0 ... 3	Current first switching point	Integer64	ro	P1.112723.1.0 ... 3
12008.0 ... 3	Current second switching point	Integer64	ro	P1.112724.0.0 ... 3
12009.0 ... 3	Current second switching point	Integer64	ro	P1.112724.1.0 ... 3
12010.0 ... 3	Current switching time (automatic)	FloatingPoint	ro	P1.112725.0.0 ... 3
12011.0 ... 3	Current switching time (automatic)	FloatingPoint	ro	P1.112725.1.0 ... 3
12012.0	Modulo position for the logic (ON)	Integer64	ro	P1.112726.0.0
12013.0	Modulo position for the logic (ON)	Integer64	ro	P1.112726.1.0
12014.0	Modulo position for the logic (OFF)	Integer64	ro	P1.112727.0.0
12015.0	Modulo position for the logic (OFF)	Integer64	ro	P1.112727.1.0
12016.0	Cam switch status ON/OFF	Boolean	ro	P1.112728.0.0
12017.0	Cam switch status ON/OFF	Boolean	ro	P1.112728.1.0
12018.0	Status modulo limit reached	Boolean	ro	P1.112729.0.0
12019.0	Status modulo limit reached	Boolean	ro	P1.112729.1.0
12020.0	Status active cam switch	Unsigned8	ro	P1.112730.0.0
12021.0	Status active cam switch	Unsigned8	ro	P1.112730.1.0
12024.0	Offset modulo position	Integer64	rw	P1.112732.0.0
12025.0	Offset modulo position	Integer64	rw	P1.112732.1.0
12026.0	Initialisation of modulo	Integer64	rw	P1.112733.0.0
12027.0	Initialisation of modulo	Integer64	rw	P1.112733.1.0
12028.0	Current offset modulo position	Integer64	ro	P1.112734.0.0
12029.0	Current offset modulo position	Integer64	ro	P1.112734.1.0
12030.0	Counter modulo cycles	Unsigned32	ro	P1.112735.0.0
12031.0	Counter modulo cycles	Unsigned32	ro	P1.112735.1.0
12032.0	Modulo hysteresis	Integer64	rw	P1.112736.0.0

PNU	Name	Data type	Access	Parameter
12033.0	Modulo hysteresis	Integer64	rw	P1.112736.1.0
12034.0	Current modulo hysteresis	Integer64	ro	P1.112737.0.0
12035.0	Current modulo hysteresis	Integer64	ro	P1.112737.1.0
12036.0	Error active	Boolean	ro	P1.112819.0.0
12037.0	Touch probe mode	Unsigned16	rw	P1.113000.0.0
12038.0	Touch probe mode	Unsigned16	rw	P1.113000.1.0
12039.0	Touch probe source	Unsigned16	rw	P1.113001.0.0
12040.0	Touch probe source	Unsigned16	rw	P1.113001.1.0
12041.0	Selection trigger event	Unsigned16	rw	P1.113002.0.0
12042.0	Selection trigger event	Unsigned16	rw	P1.113002.1.0
12043.0	Upper limit value modulo	Integer64	rw	P1.113003.0.0
12044.0	Upper limit value modulo	Integer64	rw	P1.113003.1.0
12045.0	Lower limit value modulo	Integer64	rw	P1.113004.0.0
12046.0	Lower limit value modulo	Integer64	rw	P1.113004.1.0
12047.0	Lower limit value trigger event	Integer64	rw	P1.113005.0.0
12048.0	Lower limit value trigger event	Integer64	rw	P1.113005.1.0
12049.0	Upper limit value trigger event	Integer64	rw	P1.113006.0.0
12050.0	Upper limit value trigger event	Integer64	rw	P1.113006.1.0
12051.0	Current touch probe mode	Unsigned16	ro	P1.113007.0.0
12052.0	Current touch probe mode	Unsigned16	ro	P1.113007.1.0
12053.0	Current touch probe source	Unsigned16	ro	P1.113008.0.0
12054.0	Current touch probe source	Unsigned16	ro	P1.113008.1.0
12055.0	Current selection trigger event	Unsigned16	ro	P1.113009.0.0
12056.0	Current selection trigger event	Unsigned16	ro	P1.113009.1.0
12057.0	Current upper limit value modulo	Integer64	ro	P1.113010.0.0
12058.0	Current upper limit value modulo	Integer64	ro	P1.113010.1.0
12059.0	Current lower limit value modulo	Integer64	ro	P1.113011.0.0
12060.0	Current lower limit value modulo	Integer64	ro	P1.113011.1.0
12061.0	Current lower limit value trigger event	Integer64	ro	P1.113012.0.0
12062.0	Current lower limit value trigger event	Integer64	ro	P1.113012.1.0
12063.0	Current upper limit value trigger event	Integer64	ro	P1.113013.0.0

PNU	Name	Data type	Access	Parameter
12064.0	Current upper limit value trigger event	Integer64	ro	P1.113013.1.0
12065.0	Touch probe position	Integer64	ro	P1.113014.0.0
12066.0	Touch probe position	Integer64	ro	P1.113014.1.0
12067.0	Time stamp touch probe position	Unsigned64	ro	P1.113015.0.0
12068.0	Time stamp touch probe position	Unsigned64	ro	P1.113015.1.0
12069.0	Trigger event initiated	Boolean	ro	P1.113016.0.0
12070.0	Trigger event initiated	Boolean	ro	P1.113016.1.0
12071.0	Trigger event NOT initiated	Boolean	ro	P1.113017.0.0
12072.0	Trigger event NOT initiated	Boolean	ro	P1.113017.1.0
12073.0	Trigger events counter triggered	Unsigned32	ro	P1.113018.0.0
12074.0	Trigger events counter triggered	Unsigned32	ro	P1.113018.1.0
12075.0	Trigger events counter NOT triggered	Unsigned32	ro	P1.113019.0.0
12076.0	Trigger events counter NOT triggered	Unsigned32	ro	P1.113019.1.0
12077.0	Counter modulo cycles	Unsigned32	ro	P1.113020.0.0
12078.0	Counter modulo cycles	Unsigned32	ro	P1.113020.1.0
12079.0	Status touch probe input	Boolean	ro	P1.113021.0.0
12080.0	Status touch probe input	Boolean	ro	P1.113021.1.0
12081.0	Status modulo limit reached	Boolean	ro	P1.113022.0.0
12082.0	Status modulo limit reached	Boolean	ro	P1.113022.1.0
12083.0	Modulo position	Integer64	ro	P1.113023.0.0
12084.0	Modulo position	Integer64	ro	P1.113023.1.0
12085.0	Offset modulo position	Integer64	rw	P1.113024.0.0
12086.0	Offset modulo position	Integer64	rw	P1.113024.1.0
12087.0	Initialisation of modulo	Integer64	rw	P1.113025.0.0
12088.0	Initialisation of modulo	Integer64	rw	P1.113025.1.0
12089.0	Current offset modulo position	Integer64	ro	P1.113026.0.0
12090.0	Current offset modulo position	Integer64	ro	P1.113026.1.0
12091.0	Time stamp touch probe position posit- ive CiA402	Unsigned64	ro	P1.113027.0.0
12092.0	Time stamp touch probe position posit- ive CiA402	Unsigned64	ro	P1.113027.1.0

PNU	Name	Data type	Access	Parameter
12093.0	Time stamp touch probe position negat-ive CiA402	Unsigned64	ro	P1.113028.0.0
12094.0	Time stamp touch probe position negat-ive CiA402	Unsigned64	ro	P1.113028.1.0
12095.0	Touch probe position positive CiA402	Integer64	ro	P1.113029.0.0
12096.0	Touch probe position positive CiA402	Integer64	ro	P1.113029.1.0
12097.0	Touch probe position negative CiA402	Integer64	ro	P1.113030.0.0
12098.0	Touch probe position negative CiA402	Integer64	ro	P1.113030.1.0
12099.0	Counter initiated trigger events positive edge CiA402	Unsigned32	ro	P1.113031.0.0
12100.0	Counter initiated trigger events positive edge CiA402	Unsigned32	ro	P1.113031.1.0
12101.0	Counter initiated trigger events negative edge CiA402	Unsigned32	ro	P1.113032.0.0
12102.0	Counter initiated trigger events negative edge CiA402	Unsigned32	ro	P1.113032.1.0
12103.0	Touch probe status CiA402	Unsigned16	ro	P1.113033.0.0
12104.0	Touch probe status CiA402	Unsigned16	ro	P1.113033.1.0
12105.0	Modulo hysteresis	Integer64	rw	P1.113034.0.0
12106.0	Modulo hysteresis	Integer64	rw	P1.113034.1.0
12107.0	Current modulo hysteresis	Integer64	ro	P1.113035.0.0
12108.0	Current modulo hysteresis	Integer64	ro	P1.113035.1.0
12109.0	Delay time	FloatingPoint	rw	P1.113036.0.0
12110.0	Delay time	FloatingPoint	rw	P1.113036.1.0
12111.0	Current delay time	FloatingPoint	ro	P1.113037.0.0
12112.0	Current delay time	FloatingPoint	ro	P1.113037.1.0
12113.0	Modulo mode	Unsigned16	rw	P1.113100.0.0
12115.0	Lower limit value modulo	Integer64	rw	P1.113102.0.0
12116.0	Setpoint value modulo	Integer64	ro	P1.113103.0.0
12117.0	Actual value of modulo	Integer64	ro	P1.113104.0.0
12118.0	Current mode of modulo	Unsigned16	ro	P1.113105.0.0
12119.0	Current upper limit value modulo	Integer64	ro	P1.113106.0.0
12120.0	Current lower limit value modulo	Integer64	ro	P1.113107.0.0

PNU	Name	Data type	Access	Parameter
12121.0	Counter modulo cycles	Unsigned32	ro	P1.113108.0.0
12122.0	Modulo status	Boolean	ro	P1.113109.0.0
12123.0	Offset modulo position	Integer64	rw	P1.113110.0.0
12124.0	Initialisation of modulo	Integer64	rw	P1.113111.0.0
12125.0	Current offset modulo position	Integer64	ro	P1.113112.0.0
12126.0	Activation of symmetrical jog	Boolean	rw	P1.214526.0.0
12127.0	Relative position jog 1	Integer64	rw	P1.214530.0.0
12128.0	Slow jog 2 velocity	FloatingPoint	rw	P1.214535.0.0
12129.0	Slow jog 2 acceleration	FloatingPoint	rw	P1.214536.0.0
12130.0	Slow jog 2 jerk	FloatingPoint	rw	P1.214537.0.0
12131.0	Relative position jog 2.	Integer64	rw	P1.214538.0.0
12132.0	Jog duration 2 movement	FloatingPoint	rw	P1.214539.0.0
12133.0	Fast jog 2 velocity	FloatingPoint	rw	P1.214540.0.0
12134.0	Fast jog 2 acceleration	FloatingPoint	rw	P1.214541.0.0
12135.0	Fast jog 2 jerk	FloatingPoint	rw	P1.214542.0.0
12136.0	Currently used slow jog 1 velocity	FloatingPoint	ro	P1.214543.0.0
12137.0	Currently used slow jog 1 acceleration	FloatingPoint	ro	P1.214544.0.0
12138.0	Currently used slow jog 1 jerk	FloatingPoint	ro	P1.214545.0.0
12139.0	Currently used jog 1 movement duration	FloatingPoint	ro	P1.214546.0.0
12140.0	Currently used fast jog 1 velocity	FloatingPoint	ro	P1.214547.0.0
12141.0	Currently used fast jog 1 acceleration	FloatingPoint	ro	P1.214548.0.0
12142.0	Currently used fast jog 1 jerk	FloatingPoint	ro	P1.214549.0.0
12143.0	Currently used slow jog 2 velocity	FloatingPoint	ro	P1.214550.0.0
12144.0	Currently used slow jog 2 acceleration	FloatingPoint	ro	P1.214551.0.0
12145.0	Currently used slow jog 2 jerk	FloatingPoint	ro	P1.214552.0.0
12146.0	Currently used jog 2 movement duration	FloatingPoint	ro	P1.214553.0.0
12147.0	Currently used fast jog 2 velocity	FloatingPoint	ro	P1.214554.0.0
12148.0	Currently used fast jog 2 acceleration	FloatingPoint	ro	P1.214555.0.0
12149.0	Currently used fast jog 2 jerk	FloatingPoint	ro	P1.214556.0.0
12150.0 … 20	Encoder format	Unsigned32	ro	P1.231243.0.0 … 20

PNU	Name	Data type	Access	Parameter
12153.0 ... 127	Record sequencing field 3	Integer64	rw	P1.526778.0.0 ... 127
12154.0 ... 15	Next event field 3	Integer64	rw	P1.526779.0.0 ... 15
12157.0 ... 15	Next event field 4	Integer64	rw	P1.526786.0.0 ... 15
12158.0 ... 15	Next event field 5	Integer64	rw	P1.526787.0.0 ... 15
12159.0 ... 15	Next event field 6	Integer64	rw	P1.526788.0.0 ... 15
12160.0 ... 15	Next event field 7	Integer64	rw	P1.526789.0.0 ... 15
12161.0 ... 127	Record sequencing field 4	Integer64	rw	P1.526790.0.0 ... 127
12162.0 ... 127	Record sequencing field 5	Integer64	rw	P1.526791.0.0 ... 127
12163.0 ... 127	Record sequencing field 6	Integer64	rw	P1.526792.0.0 ... 127
12164.0 ... 127	Record sequencing field 7	Integer64	rw	P1.526793.0.0 ... 127
12165.0	Filter time constant controller limitation	FloatingPoint	rw	P1.526794.0.0
12166.0	Maximum torque symmetrical	FloatingPoint	rw	P1.526796.0.0
12167.0	Record table status	Integer32	ro	P1.526797.0.0
12168.0	Clamping torque	FloatingPoint	rw	P1.526801.0.0
12169.0	Jogging state	Unsigned32	ro	P1.526917.0.0
12170.0	Commutation-angle detection damping time	FloatingPoint	rw	P1.545454.0.0
12171.0	Commutation angle	Integer64	rw	P1.545455.0.0
12178.0	MELDW.0 ramp generator	Boolean	ro	P1.1124900.0.0
12179.0	Torque reduction MOMRED	Integer16	rw	P1.1126990.0.0
12180.0	DSC gain factor position controller	Integer32	rw	P1.1127990.0.0
12181.0	Position deviation XERR	Integer32	rw	P1.1129990.0.0
12182.0	Activation background mode	Boolean	rw	P1.1130224.0.0
12183.0	Diagnostic category	Unsigned16	rw	P1.1130225.0.0

PNU	Name	Data type	Access	Parameter
12184.0	Storage option in error log	Unsigned8	rw	P1.1130226.0.0
12185.0	Position 2 encoder n	Unsigned32	ro	P1.1141990.0.0
12186.0	Position 1 encoder n	Unsigned32	ro	P1.1142990.0.0
12187.0	Gn_ZSW.0 ... 3 Function active	Unsigned8	ro	P1.1143000.0.0
12188.0	Gn_ZSW.4 ... 7 value	Unsigned8	ro	P1.1143040.0.0
12189.0	Gn_ZSW.8 touch probe 0 deflected	Boolean	ro	P1.1143080.0.0
12190.0	Gn_ZSW.9 Touch Probe 1 deflected	Boolean	ro	P1.1143090.0.0
12191.0	Gn_ZSW.11 Error acknowledgment active	Boolean	ro	P1.1143110.0.0
12192.0	Gn_ZSW.12 Homing mode active	Boolean	ro	P1.1143120.0.0
12193.0	Gn_ZSW.13 Transmit absolute value cyclically	Boolean	ro	P1.1143130.0.0
12194.0	Gn_ZSW.14 Parking sensor active	Boolean	ro	P1.1143140.0.0
12195.0	Gn_ZSW.15 sensor error	Boolean	ro	P1.1143150.0.0
12196.0	Gn_ZSW	Unsigned16	ro	P1.1143990.0.0
12197.0	ZSW1.0 Ready to switch on	Boolean	ro	P1.1145000.0.0
12198.0	ZSW1.1 Ready to operation	Boolean	ro	P1.1145010.0.0
12199.0	ZSW1.2 Operation enabled	Boolean	ro	P1.1145020.0.0
12200.0	ZSW1.3 Fault present	Boolean	ro	P1.1145030.0.0
12201.0	ZSW1.4 Coast stop activated	Boolean	ro	P1.1145040.0.0
12202.0	ZSW1.5 Quick stop activated	Boolean	ro	P1.1145050.0.0
12203.0	ZSW1.6 Switch on inhibited	Boolean	ro	P1.1145060.0.0
12204.0	ZSW1.7 Warning present	Boolean	ro	P1.1145070.0.0
12205.0	ZSW1.8 Speed error within tolerance range	Boolean	ro	P1.1145080.0.0
12206.0	ZSW1.8 Following error within tolerance range	Boolean	ro	P1.1145081.0.0
12207.0	ZSW1.9 Control requested	Boolean	ro	P1.1145090.0.0
12208.0	ZSW1.10 f or n reached or exceeded	Boolean	ro	P1.1145100.0.0
12209.0	ZSW1.10 Target position reached	Boolean	ro	P1.1145101.0.0
12210.0	ZSW1.11 I, M or P limit not reached	Boolean	ro	P1.1145110.0.0
12211.0	ZSW1.11 Home position set	Boolean	ro	P1.1145111.0.0

PNU	Name	Data type	Access	Parameter
12212.0	ZSW1.12 Holding brake open	Boolean	ro	P1.1145120.0.0
12213.0	ZSW1.12 Traversing task acknowledgement	Boolean	ro	P1.1145121.0.0
12214.0	ZSW1.13 No warning Overtemperature motor	Boolean	ro	P1.1145130.0.0
12215.0	ZSW1.13 Drive stopped	Boolean	ro	P1.1145131.0.0
12216.0	ZSW1.14 Motor rotation	Boolean	ro	P1.1145140.0.0
12217.0	ZSW1.14 Drive accelerating	Boolean	ro	P1.1145141.0.0
12218.0	ZSW1.15 No warning Overtemperature power section	Boolean	ro	P1.1145150.0.0
12219.0	ZSW1.15 Drive decelerating	Boolean	ro	P1.1145151.0.0
12220.0	ZSW1	Unsigned16	ro	P1.1145990.0.0
12221.0	ZSW2.7 Drive parked	Boolean	ro	P1.1146070.0.0
12222.0	ZSW2.8 Move to fixed stop active	Boolean	ro	P1.1146080.0.0
12223.0	ZSW2.11 Power stage active	Boolean	ro	P1.1146110.0.0
12224.0	ZSW2.12 ... 15 Slave sign of life	Unsigned8	ro	P1.1146120.0.0
12225.0	ZSW2	Unsigned16	ro	P1.1146990.0.0
12226.0	STW1.0 Power stage enable	Boolean	ro	P1.1147000.0.0
12227.0	STW1.1 Coast stop	Boolean	ro	P1.1147010.0.0
12228.0	STW1.2 Quick stop	Boolean	ro	P1.1147020.0.0
12229.0	STW1.3 Enable operation	Boolean	ro	P1.1147030.0.0
12230.0	STW1.4 Enable ramp generator	Boolean	ro	P1.1147040.0.0
12231.0	STW1.4 Reject traversing task	Boolean	ro	P1.1147041.0.0
12232.0	STW1.5 Unfreeze ramp generator	Boolean	ro	P1.1147050.0.0
12233.0	STW1.5 Intermediate stop	Boolean	ro	P1.1147051.0.0
12234.0	STW1.6 Enable setpoint	Boolean	ro	P1.1147060.0.0
12235.0	STW1.6 Activate traversing task	Boolean	ro	P1.1147061.0.0
12236.0	STW1.7 Fault acknowledge	Boolean	ro	P1.1147070.0.0
12237.0	STW1.8 Jogging 1	Boolean	ro	P1.1147080.0.0
12238.0	STW1.9 Jogging 2	Boolean	ro	P1.1147090.0.0
12239.0	STW1.10 Control by PLC	Boolean	ro	P1.1147100.0.0
12240.0	STW1.11 Invert setpoint	Boolean	ro	P1.1147110.0.0

PNU	Name	Data type	Access	Parameter
12241.0	STW1.11 Start Homing procedure	Boolean	ro	P1.1147111.0.0
12242.0	STW1.12 Open holding brake	Boolean	ro	P1.1147120.0.0
12244.0	STW1.13 Increase the motorized potentiometer setpoint	Boolean	ro	P1.1147130.0.0
12245.0	STW1.13 Start block change	Boolean	ro	P1.1147131.0.0
12246.0	STW1.14 Reduce motor potentiometer setpoint	Boolean	ro	P1.1147140.0.0
12247.0	STW1.14 Reserved	Boolean	ro	P1.1147141.0.0
12248.0	STW1.15 Reserved	Boolean	ro	P1.1147150.0.0
12249.0	STW1.15 Reserved	Boolean	ro	P1.1147151.0.0
12250.0	STW1	Unsigned16	rw	P1.1147990.0.0
12253.0	STW2.7 Drive parking	Boolean	ro	P1.1148070.0.0
12254.0	STW2.8 Traverse to fixed endstop	Boolean	ro	P1.1148080.0.0
12255.0	STW2.11 Motor changeover	Boolean	ro	P1.1148110.0.0
12256.0	STW2.12 ... 15 Master sign of life	Unsigned8	ro	P1.1148120.0.0
12257.0	STW2	Unsigned16	rw	P1.1148990.0.0
12260.0	Gn_STW.0 ... 3 Request function	Unsigned8	ro	P1.1149000.0.0
12261.0	Gn_STW.4 ... 6 Request command	Unsigned8	ro	P1.1149040.0.0
12262.0	Gn_STW.7 Mode	Boolean	ro	P1.1149070.0.0
12263.0	Gn_STW.11 Home position mode	Boolean	ro	P1.1149110.0.0
12264.0	Gn_STW.12 Trigger mode homing	Boolean	ro	P1.1149120.0.0
12265.0	Gn_STW.13 Request absolute value cyclically	Boolean	ro	P1.1149130.0.0
12266.0	Gn_STW.14 Activate parking sensor	Boolean	ro	P1.1149140.0.0
12267.0	Gn_STW.15 Acknowledge sensor error	Boolean	ro	P1.1149150.0.0
12268.0	Gn_STW	Unsigned16	rw	P1.1149990.0.0
12269.0	Gn_STW Cycle-1	Unsigned16	ro	P1.1149991.0.0
12270.0	Master control connection ID	Unsigned32	ro	P1.10233999.0-.0
12279.0	MELDW.1 torque utilization	Boolean	ro	P1.11249010.0-.0
12280.0	MELDW.2 Actual speed <Threshold1	Boolean	ro	P1.11249020.0-.0

PNU	Name	Data type	Access	Parameter
12281.0	MELDW.3 Actual speed = <Threshold2	Boolean	ro	P1.11249030.0-.0
12282.0	MELDW.5 Variable reporting function	Boolean	ro	P1.11249050.0-.0
12283.0	MELDW.6 No warning Overtemperature motor	Boolean	ro	P1.11249060.0-.0
12284.0	MELDW.7 No warning Overtemperature power output stage	Boolean	ro	P1.11249070.0-.0
12285.0	MELDW.8 Speed setpoint / actual deviation in tolerance	Boolean	ro	P1.11249080.0-.0
12286.0	MELDW.11 Controller enable	Boolean	ro	P1.11249110.0-.0
12287.0	MELDW.12 Ready for operation	Boolean	ro	P1.11249120.0-.0
12288.0	MELDW.13 Power stage active	Boolean	ro	P1.11249130.0-.0
12289.0	MELDW	Unsigned16	ro	P1.11249990.0-.0
12290.0	Parameter List	Unsigned16	ro	P1.11280001.0-.0
12291.0	Operating mode PROFIdrive	Unsigned16	ro	P1.11280002.0-.0
12292.0	Error message counter PROFIdrive	Unsigned16	ro	P1.11280003.0-.0
12293.0 … 1	Profile identification number	Unsigned8	ro	P1.11280004.0-.0 … 1
12294.0	Torque increase for controller enable	FloatingPoint	rw	P1.11280018.0-.0
12295.0	Valid movement monitoring position control	Unsigned32	rw	P1.11280020.0-.0
12296.0	Valid movement monitoring velocity control	Unsigned32	rw	P1.11280021.0-.0
12297.0	Valid movement monitoring torque regulation	Unsigned32	rw	P1.11280022.0-.0
12298.0	Valid movement monitoring position control analogue	Unsigned32	rw	P1.11280023.0-.0

PNU	Name	Data type	Access	Parameter
12299.0	Valid movement monitoring velocity control analogue	Unsigned32	rw	P1.11280024.0-.0
12300.0	Valid movement monitoring torque regulation analogue	Unsigned32	rw	P1.11280025.0-.0
12301.0	Valid movement monitoring CSP	Unsigned32	rw	P1.11280026.0-.0
12302.0	Valid movement monitoring CSV	Unsigned32	rw	P1.11280027.0-.0
12303.0	Valid movement monitoring CST	Unsigned32	rw	P1.11280028.0-.0
12304.0	Valid Power Off movement monitoring	Unsigned32	rw	P1.11280029.0-.0
12305.0 … 2	Parameter channel description PROFIdrive	Unsigned16	ro	P1.11280030.0-.0 … 2
12306.0 … 63	Error number	Unsigned16	ro	P1.11280040.0-.0 … 63
12307.0 … 63	Casting time error	Unsigned32	ro	P1.11280041.0-.0 … 63
12308.0 … 63	Warning number	Unsigned16	ro	P1.11280042.0-.0 … 63
12309.0 … 63	Release time warning	Unsigned32	ro	P1.11280043.0-.0 … 63
12310.0	Status word MELDW	Unsigned16	ro	P1.11280046.0-.0
12312.0	Counter warning messages	Unsigned16	ro	P1.11280060.0-.0
12313.0	Counter error messages	Unsigned16	ro	P1.11280061.0-.0
12314.0	Active error	Unsigned16	ro	P1.11280062.0-.0
12315.0	Active warning	Unsigned16	ro	P1.11280063.0-.0
12316.0	Status base state machine PROFIdrive	Unsigned32	ro	P1.11280102.0-.0
12317.0	Current application class	Unsigned32	ro	P1.11280109.0-.0

PNU	Name	Data type	Access	Parameter
12319.0	Storage Option in error log	Unsigned8	rw	P1.11280111.0-.0
12320.0	Trigger level MELDW.2	FloatingPoint	rw	P1.11280112.0-.0
12321.0	Hysteresis trigger level	FloatingPoint	rw	P1.11280113.0-.0
12322.0	Trigger level MELDW.3	FloatingPoint	rw	P1.11280114.0-.0
12323.0	Hysteresis trigger level	FloatingPoint	rw	P1.11280115.0-.0
12324.0	Activation touch probe Tel. 111	Unsigned16	rw	P1.11280116.0-.0
12325.0	Acceleration	FloatingPoint	rw	P1.11280402.0-.0
12326.0	Deceleration	FloatingPoint	rw	P1.11280403.0-.0
12327.0	Jerk	FloatingPoint	rw	P1.11280404.0-.0
12328.0	Deceleration stop ramp	FloatingPoint	rw	P1.11280405.0-.0
12329.0	Clamping torque offset	FloatingPoint	rw	P1.11280407.0-.0
12330.0	Stroke limit positive for detection of a fixed stop	Integer64	rw	P1.11280408.0-.0
12331.0	Stroke limit negative for detection of a fixed stop	Integer64	rw	P1.11280409.0-.0
12332.0	Threshold value torque utilization reached	FloatingPoint	rw	P1.11280410.0-.0
12333.0	Status Application Class 1	Unsigned32	ro	P1.11280501.0-.0
12334.0	Target speed NSOLL_A/NSOLL_B	FloatingPoint	rw	P1.11280502.0-.0
12335.0	Settling time Direction of rotation detection	FloatingPoint	rw	P1.11280503.0-.0
12336.0	Status Application Class 4	Unsigned32	ro	P1.11280531.0-.0

PNU	Name	Data type	Access	Parameter
12337.0	Speed comparator time window	FloatingPoint	rw	P1.11280533.0-.0
12338.0	Status Application Class 3	Unsigned32	ro	P1.11280601.0-.0
12339.0	Target position MDI	Integer64	rw	P1.11280604.0-.0
12340.0	Profile speed MDI	FloatingPoint	rw	P1.11280605.0-.0
12341.0	Acceleration MDI	FloatingPoint	rw	P1.11280606.0-.0
12342.0	Deceleration MDI	FloatingPoint	rw	P1.11280607.0-.0
12343.0	XIST_A Actual value position	Integer64	ro	P1.11280609.0-.0
12345.0	Base value speed (user unit)	FloatingPoint	rw	P1.11280701.0-.0
12346.0	Base value acceleration	FloatingPoint	rw	P1.11280702.0-.0
12347.0	Base value deceleration	FloatingPoint	rw	P1.11280703.0-.0
12348.0	POS_STW1.0 ... 6 Traversing block selektion	Unsigned8	ro	P1.112411000.-0.0
12349.0	POS_STW1.8 Absolute positioning	Boolean	ro	P1.112411080.-0.0
12350.0	POS_STW1.9 ... 10 direction selection	Unsigned32	ro	P1.112411090.-0.0
12351.0	POS_STW1.12 Setpoint transfer	Boolean	ro	P1.112411120.-0.0
12352.0	POS_STW1.14 Setting up selected	Boolean	ro	P1.112411140.-0.0
12353.0	POS_STW1.15 MDI selection	Boolean	ro	P1.112411150.-0.0
12354.0	POS_STW1	Unsigned16	rw	P1.112411990.-0.0
12357.0	POS_ZSW1.0 ... 6 Traversing block bit	Unsigned8	ro	P1.112412000.-0.0

PNU	Name	Data type	Access	Parameter
12358.0	POS_ZSW1.8 Negative limit switch act- ive	Boolean	ro	P1.112412080.-0.0
12359.0	POS_ZSW1.9 Positive limit switch active	Boolean	ro	P1.112412090.-0.0
12360.0	POS_ZSW1.10 Jogging active	Boolean	ro	P1.112412100.-0.0
12361.0	POS_ZSW1.11 Reference point approach active	Boolean	ro	P1.112412110.-0.0
12362.0	POS_ZSW1.13 Traversing block active	Boolean	ro	P1.112412130.-0.0
12363.0	POS_ZSW1.14 Setup active	Boolean	ro	P1.112412140.-0.0
12364.0	POS_ZSW1.15 MDI active	Boolean	ro	P1.112412150.-0.0
12365.0	POS_ZSW1	Unsigned16	ro	P1.112412990.-0.0
12366.0	POS_ZSW2.0 Tracking mode active	Boolean	ro	P1.112413000.-0.0
12367.0	POS_ZSW2.1 Velocity limiting active	Boolean	ro	P1.112413010.-0.0
12368.0	POS_ZSW2.2 Setpoint available	Boolean	ro	P1.112413020.-0.0
12369.0	POS_ZSW2.4 Drive moves forward	Boolean	ro	P1.112413040.-0.0
12370.0	POS_ZSW2.5 Drive moves backwards	Boolean	ro	P1.112413050.-0.0
12371.0	POS_ZSW2.6 Software limit switch minus reached	Boolean	ro	P1.112413060.-0.0
12372.0	POS_ZSW2.7 Software limit switch plus reached	Boolean	ro	P1.112413070.-0.0
12373.0	POS_ZSW2.8 Position actual value <= cam switch 0	Boolean	ro	P1.112413080.-0.0
12374.0	POS_ZSW2.9 Position actual value <= cam switch 1	Boolean	ro	P1.112413090.-0.0
12375.0	POS_ZSW2.10 Direct output 1 via tra- versing block	Boolean	ro	P1.112413100.-0.0

PNU	Name	Data type	Access	Parameter
12376.0	POS_ZSW2.11 Direct output 2 via traversing block	Boolean	ro	P1.112413110.-0.0
12377.0	POS_ZSW2.12 Fixed stop reached	Boolean	ro	P1.112413120.-0.0
12378.0	POS_ZSW2.13 Fixed stop Clamping torque reached	Boolean	ro	P1.112413130.-0.0
12379.0	POS_ZSW2.14 Move to fixed stop active	Boolean	ro	P1.112413140.-0.0
12380.0	POS_ZSW2.15 Traversing command active	Boolean	ro	P1.112413150.-0.0
12381.0	POS_ZSW2	Unsigned16	ro	P1.112413990.-0.0
12382.0	POS_STW2.0 Tracking mode	Boolean	ro	P1.112414000.-0.0
12383.0	POS_STW2.1 Set reference point	Boolean	ro	P1.112414010.-0.0
12384.0	POS_STW2.5 Jogging incremental active	Boolean	ro	P1.112414050.-0.0
12385.0	POS_STW2.10 Selection touch probe	Boolean	ro	P1.112414100.-0.0
12386.0	POS_STW2.11 Touch probe edge	Boolean	ro	P1.112414110.-0.0
12387.0	POS_STW2.14 Activate software limit switch	Boolean	ro	P1.112414140.-0.0
12388.0	POS_STW2.15 Activate hardware limit switch	Boolean	ro	P1.112414150.-0.0
12389.0	POS_STW2	Unsigned16	rw	P1.112414990.-0.0
12392.0	SATZANW.0 ... 6 Traversing block selection	Unsigned8	ro	P1.112415000.-0.0
12393.0	SATZANW.15 Activate MDI	Boolean	ro	P1.112415150.-0.0
12394.0	SATZANW	Unsigned16	rw	P1.112415990.-0.0
12395.0	SATZANW Cycle-1	Unsigned16	ro	P1.112415991.-0.0

PNU	Name	Data type	Access	Parameter
12396.0	AKTSATZ.0 ... 6 Active traversing block	Unsigned8	ro	P1.112416000.-0.0
12397.0	AKTSATZ.15 MDI activated	Boolean	ro	P1.112416150.-0.0
12398.0	AKTSATZ	Unsigned16	ro	P1.112416990.-0.0
12399.0	MDI_MOD.0 Positioning	Boolean	ro	P1.112417000.-0.0
12400.0	MDI_MOD.1 ... 2 Direction of movement	Unsigned32	ro	P1.112417010.-0.0
12401.0	MDI_MOD	Unsigned16	rw	P1.112417990.-0.0
12402.0	MDI_MOD Cycle-1	Unsigned16	ro	P1.112417991.-0.0
12404.0	Scaling factor start value I²t monitoring motor model	FloatingPoint	rw	P1.6301.0.0
12405.0	Actual value I²T monitoring motor model	FloatingPoint	ro	P1.6302.0.0
12406.0	Maximum start value I²t monitoring motor model	FloatingPoint	ro	P1.6303.0.0
12407.0	Scaling factor warning limit I²t monitor-ing motor model	FloatingPoint	rw	P1.6305.0.0
12409.0	Activation current reduction holding brake	Boolean	rw	P1.40001.0.0
12410.0	Delay time	FloatingPoint	rw	P1.40002.0.0
12411.0	Supply voltage holding brake	FloatingPoint	rw	P1.40003.0.0
12412.0	Holding voltage	FloatingPoint	rw	P1.40004.0.0
12413.0	Diagnostic category	Unsigned16	rw	P1.63019.0.0
12414.0	Storage option in error log	Unsigned8	rw	P1.63020.0.0
12415.0	Diagnostic category	Unsigned16	rw	P1.63021.0.0
12416.0	Storage option in error log	Unsigned8	rw	P1.63022.0.0
12417.0	Active switch-on threshold reactive cur-rent braking	FloatingPoint	ro	P1.102101.0.0
12418.0	Active end value reactive current brak-ing	FloatingPoint	ro	P1.102102.0.0

PNU	Name	Data type	Access	Parameter
12419.0	Status reactive current braking	Boolean	ro	P1.102103.0.0
12420.0	Activate reactive current braking	Boolean	rw	P1.102104.0.0
12421.0	Maximum reactive current reactive current braking	FloatingPoint	ro	P1.102105.0.0
12422.0	Actual value reactive current braking	FloatingPoint	ro	P1.102106.0.0
12423.0	Activation automatic voltage determination	Boolean	rw	P1.102107.0.0
12424.0	Switch-on threshold reactive current braking	FloatingPoint	rw	P1.102108.0.0
12425.0	End value reactive current braking	FloatingPoint	rw	P1.102109.0.0
12429.0	Activation of angular feed forward control	Boolean	rw	P1.204801.0.0
12430.0	Maximum value of the angular feed forward control	FloatingPoint	rw	P1.204802.0.0
12431.0	Scaling factor	FloatingPoint	rw	P1.204803.0.0
12432.0	Storage option in error log	Unsigned16	rw	P1.11280117.0.0
12433.0	Diagnostic category	Unsigned8	rw	P1.11280118.0.0
12434.0	Jerk system stop	FloatingPoint	rw	P1.11280406.0.0
12435.0	Threshold value velocity comparator	FloatingPoint	rw	P1.11280504.0.0
12436.0	Hysteresis threshold value velocity comparator	FloatingPoint	rw	P1.11280505.0.0
12437.0	Switch-on delay time speed comparator	FloatingPoint	rw	P1.11280506.0.0
12440.0	Reduction ratio	Unsigned32	rw	P1.4246.0.0
12442.0	Status sensor state machine	Integer32	ro	P1.34234.0.0
12448.0	Inertia Gear	FloatingPoint	rw	P1.124321.0.0
12449.0	Inertia coupling	FloatingPoint	rw	P1.124322.0.0
12450.0	Dynamic losses	FloatingPoint	rw	P1.124323.0.0
12451.0 ... 1	Damping	FloatingPoint	rw	P1.144316.0.0 ... 1

PNU	Name	Data type	Access	Parameter
12452.0 ... 1	Natural frequency	FloatingPoint	rw	P1.144317.0.0 ... 1
12453.0 ... 1	Activation of vibration suppression	Boolean	rw	P1.144318.0.0 ... 1
12454.0 ... 1	Vibration suppression active	Boolean	ro	P1.144319.0.0 ... 1
12481.0	Valid motion monitoring Moving to fixed stop	Unsigned32	rw	P1.11280031.0-.0
12482.0	Velocity override	FloatingPoint	rw	P1.1309.0.0
12483.0	Mileage 2	Integer64	rw	P1.1414.0.0
12484.0	Load change counter 2	Integer64	rw	P1.1424.0.0
12485.0	Status Sign of Life	Integer32	ro	P1.3424.0.0
12486.0	Sign of Life Cycle-1	Unsigned8	ro	P1.4277.0.0
12487.0	Error counter Sign of Life	Integer32	ro	P1.4278.0.0
12520.0	Current Error ID	Unsigned32	ro	P1.231250.0.0
12522.0	Current resolution per revolution for Gn_XIST	Unsigned32	ro	P1.231544.0.0
12524.0	Resolution per revolution for Gn_XIST	Unsigned32	rw	P1.231545.0.0
12530.0	Valid motion monitoring AC4 without DSC	Unsigned32	rw	P1.11280032.0-.0
12531.0	Valid motion monitoring AC4 without DSC	Unsigned32	rw	P1.11280033.0-.0
12532.0	Torque utilization monitoring window	FloatingPoint	rw	P1.11280411.0-.0
12533.0	Damping time torque utilization	FloatingPoint	rw	P1.11280412.0-.0
12534.0	Velocity override	Integer16	rw	P1.11280611.0-.0
12535.0	Conversion factor velocity	FloatingPoint	ro	P1.11290701.0-.0
12538.0	Diagnostic category	Unsigned16	rw	P1.424201.0.0
12539.0	Storage option in error log	Unsigned8	rw	P1.424202.0.0
12540.0	Activation Extended process data	Boolean	rw	P1.424203.0.0
12541.0	Extended process data active	Boolean	ro	P1.424213.0.0

PNU	Name	Data type	Access	Parameter
12542.0	Number of objects Rx	Unsigned8	ro	P1.4242101.0.0
12543.0	Number of bytes Rx	Unsigned8	ro	P1.4242102.0.0
12544.0 ... 7	Axis ID Rx	Unsigned16	rw	P1.4242105.0.0 ... 7
12545.0 ... 7	Data ID Rx	Unsigned32	rw	P1.4242106.0.0 ... 7
12546.0 ... 7	Data instance ID Rx	Unsigned16	rw	P1.4242107.0.0 ... 7
12547.0 ... 7	Array ID Rx	Unsigned16	rw	P1.4242108.0.0 ... 7
12548.0 ... 7	Current axis ID Rx	Unsigned16	ro	P1.4242115.0.0 ... 7
12549.0 ... 7	Current data ID Rx	Unsigned32	ro	P1.4242116.0.0 ... 7
12550.0 ... 7	Current data instance ID Rx	Unsigned16	ro	P1.4242117.0.0 ... 7
12551.0 ... 7	Current array ID Rx	Unsigned16	ro	P1.4242118.0.0 ... 7
12552.0 ... 7	Current data type Rx	Unsigned32	ro	P1.4242119.0.0 ... 7
12553.0	Number of objects Tx	Unsigned8	ro	P1.4242201.0.0
12554.0	Number of bytes Tx	Unsigned8	ro	P1.4242202.0.0
12555.0 ... 7	Axis ID Tx	Unsigned16	rw	P1.4242205.0.0 ... 7
12556.0 ... 7	Data ID Tx	Unsigned32	rw	P1.4242206.0.0 ... 7
12557.0 ... 7	Data instance ID Tx	Unsigned16	rw	P1.4242207.0.0 ... 7
12558.0 ... 7	Array ID Tx	Unsigned16	rw	P1.4242208.0.0 ... 7
12559.0 ... 7	Current axis ID Tx	Unsigned16	ro	P1.4242215.0.0 ... 7
12560.0 ... 7	Current data ID Tx	Unsigned32	ro	P1.4242216.0.0 ... 7

PNU	Name	Data type	Access	Parameter
12561.0 ... 7	Current data instance ID Tx	Unsigned16	ro	P1.4242217.0.0 ... 7
12562.0 ... 7	Current array ID Tx	Unsigned16	ro	P1.4242218.0.0 ... 7
12563.0 ... 7	Current data type Tx	Unsigned32	ro	P1.4242219.0.0 ... 7
12564.0	Status	Integer32	rw	P1.103111.0.0
12565.0 ... 1	Testing phase	Unsigned16	rw	P1.103112.0.0 ... 1
12566.0 ... 1	Torque positive limit value	FloatingPoint	rw	P1.103113.0.0 ... 1
12567.0 ... 1	Torque rise ramp Positive limit value	FloatingPoint	rw	P1.103114.0.0 ... 1
12568.0 ... 1	Torque negative limit value	FloatingPoint	rw	P1.103115.0.0 ... 1
12569.0 ... 1	Torque rise ramp Negative limit value	FloatingPoint	rw	P1.103116.0.0 ... 1
12570.0 ... 1	Monitoring window Position	Integer64	rw	P1.103117.0.0 ... 1
12571.0 ... 1	Torque monitoring window	FloatingPoint	rw	P1.103118.0.0 ... 1
12572.0 ... 1	Holding time Torque	FloatingPoint	rw	P1.103120.0.0 ... 1
12573.0 ... 1	Waiting time	FloatingPoint	rw	P1.103121.0.0 ... 1
12574.0 ... 1	Test result	Unsigned16	rw	P1.103122.0.0 ... 1
12575.0 ... 1	Selection of encoder interface	Unsigned32	rw	P1.103123.0.0 ... 1
12588.0	Diagnostic category	Unsigned16	rw	P1.103136.0.0
12589.0	Storage option in error log	Unsigned8	rw	P1.103137.0.0
12590.0	Diagnostic category	Unsigned16	rw	P1.103138.0.0
12591.0	Storage option in error log	Unsigned8	rw	P1.103139.0.0
12592.0	Diagnostic category	Unsigned16	rw	P1.103140.0.0
12593.0	Storage option in error log	Unsigned8	rw	P1.103141.0.0

PNU	Name	Data type	Access	Parameter
12594.0	Denominator pole pairs (user-defined)	Unsigned32	rw	P1.7185.0.0
12595.0	Active denominator Pole pairs	Unsigned32	ro	P1.7191.0.0
12637.0	Supply voltage	FloatingPoint	rw	P1.1209.0.0
12638.0	Upper limit value modulo	Integer64	rw	P1.113113.0.0
12639.0	Extended Modulo Mode	Unsigned8	rw	P1.11280612.0-.0

Tab. 853 Referenzliste PNUs

13 EtherNet/IP

13.1 General

This part of the documentation describes the implemented standards and the communications of the CMMT in an EtherNet/IP network. It is targeted at 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.

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. 854 OVDA Standards

Additional information on the user organisation can be found at ODVA (Open DeviceNet Vendor Association) ➔ 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.
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

Work with the CMMT-ST plug-in, settings of the EtherNet/IP interface can be read and parameterised. The goal is to configure the EtherNet/IP interface in such a way that the servo drive can build up EtherNet/IP communication with an EtherNet/IP controller.

Setting the IP Address

A unique IP address must be assigned to each device in the network. Assignment of already used IP addresses can result in temporary overloading of your network.

Static Addressing

Work with the CMMT-ST plug-in, the values for IP address, subnet mask and gateway address can be assigned on the fieldbus page.

- For manual assigning of a permitted IP address, contact the network administrator.

Dynamic Addressing

Work with the CMMT-ST plug-in, dynamic addressing can be activated or deactivated.
For dynamic addressing, there is the option of addressing either through DHCP or BOOTP. Both protocols are standard and are supported by the CMMT.
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/–
		Update	effective immediately
		Unit	–

Tab. 855 Parameter

13.3.4 Connection Characteristics

ID Px.	Parameter	Description	
3030101	Telegram selection	Specifies the telegram selection for EtherNet/IP.	
		Access	read/write
		Update	effective immediately
		Unit	–
11280109	Current application class	Displays the current application class.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 856 Parameter

13.3.5 Configuring the EtherNet/IP Master

Electronic Data Sheet (EDS)

To permit fast and simple commissioning, the capabilities of the EtherNet/IP interface of the device are described in an EDS file.
By using a suitable configuration software for the higher-level controller, it is possible to integrate the CMMT into the network by means of an EDS file. The way in which the network is configured depends on the configuration software used.
For the most up-to-date version of the EDS file, see ➔ www.festo.com/sp

Festo provides modules and application notes to facilitate the commissioning of the servo drive with controllers from various manufacturers ➔ www.festo.com/sp.

Device Identification

Characteristics	Contents
Vendor code	26
Vendor Name	Festo SE & Co. KG
Product Name	Festo CMMT
Product Type	43 (Generic Device)
Product code	65282

Tab. 857 Device Identification

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. 858 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
		7	Max. Instance Attribute
1	Instance Attrib-utes	1	Vendor ID
		2	Device Type
		3	Product Code
		4	Major Revision
			Minor Revision
		5	Status
		6	Serial Number

Instance	Name	Attribute ID	Name
1	Instance Attributes	7	Product Name
		8	State

Tab. 859 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 ➔ 13.4.3 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. 860 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
1	Instance Attributes	2	Network Status – 0 indicates Normal – 1 indicates Ring Fault – 2 indicates Unexpected Loop Detected – 3 indicates Partial Network Fault

Instance	Name	Attribute ID	Name
1	Instance Attributes		– 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
		10	Active Supervisor Address
		11	Active Supervisor Precendance
		12	Capability Flags

Tab. 861 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. 862 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. 863 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

Instance	Name	Attribute ID	Name
1	Instance Attributes	8	Interface State
		9	Admin State
		10	Interface Label

Tab. 864 Ethernet Link Object - 0xF6

13.4 Drive Profile

The drive profile supports velocity and position operating modes divided into application classes.

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Motion control is carried out via the functions as with PROFIDRIVE.
The device parameters Px. are accessed via the additional telegram (extended process data).

13.4.1 Application Classes

13.4.1.1 Basic Values and Reference Values in the Application Classes

ID Px.	Parameter	Description	
11280701	Base value speed (user unit)	Specifies the base value for the velocity application class. The base value in user units is multiplied by the normalized value in the process data and then gives the internal speed setpoint.	
		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

ID Px.	Parameter	Description	
11280402	Acceleration	Specifies the acceleration value for the velocity application class.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280403	Deceleration	Specifies the deceleration value for the velocity application class.	
		Access	read/write
		Update	effective immediately
		Unit	user defined
11280404	Jerk	Specifies the value for the jerk for the application speed.	
		Access	read/write
		Update	effective immediately
		Unit	user defined

Tab. 865 Parameter

13.4.1.2 Application Class 1 – Standard Drive (Velocity Mode)

In application class 1 the drive is controlled by a main setpoint, e.g. velocity setpoint. The velocity 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.

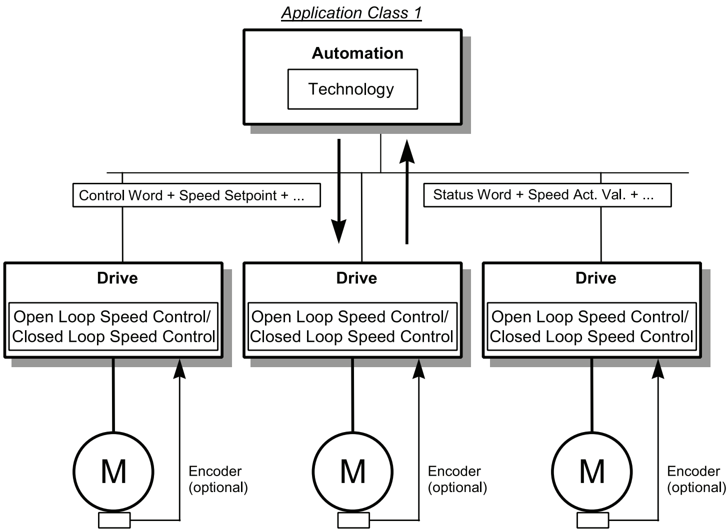

Fig. 143 Application class 1

13.4.1.3 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 velocity and all time-critical control algorithms. Cyclical synchronous operation is only required for complex tracking tasks with multiple axes.

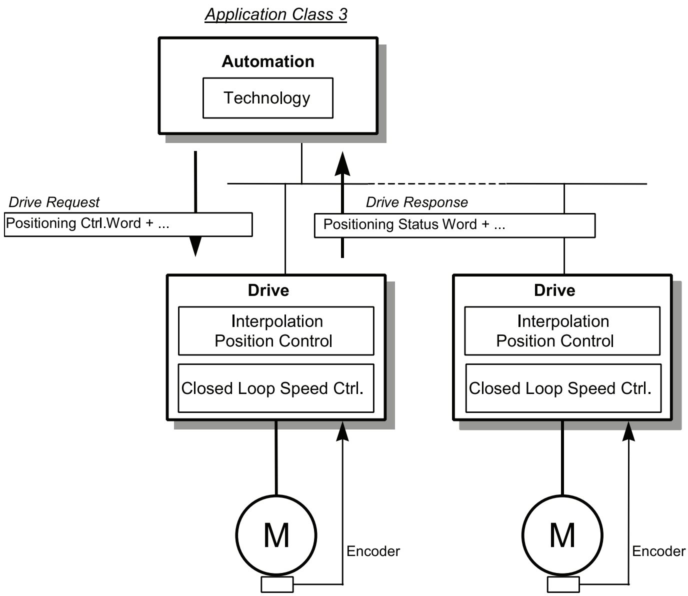

Fig. 144 Application class 3

Sub-mode Record Mode

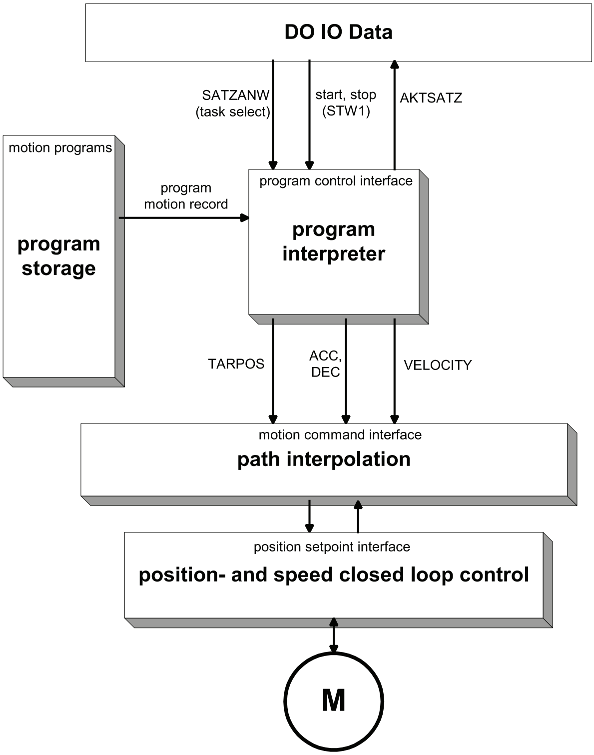

Fig. 145 Record mode

MDI Sub-mode/Target Value Specification

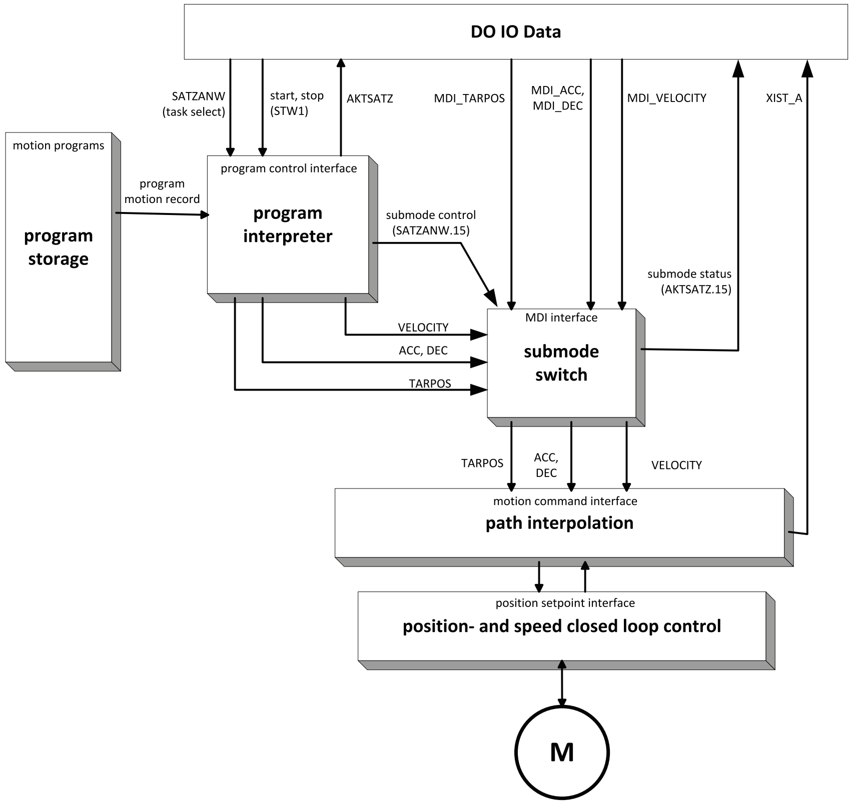

Fig. 146 Target value specification/MDI

13.4.2 Finite State Machines

13.4.2.1 Basic finite state machine

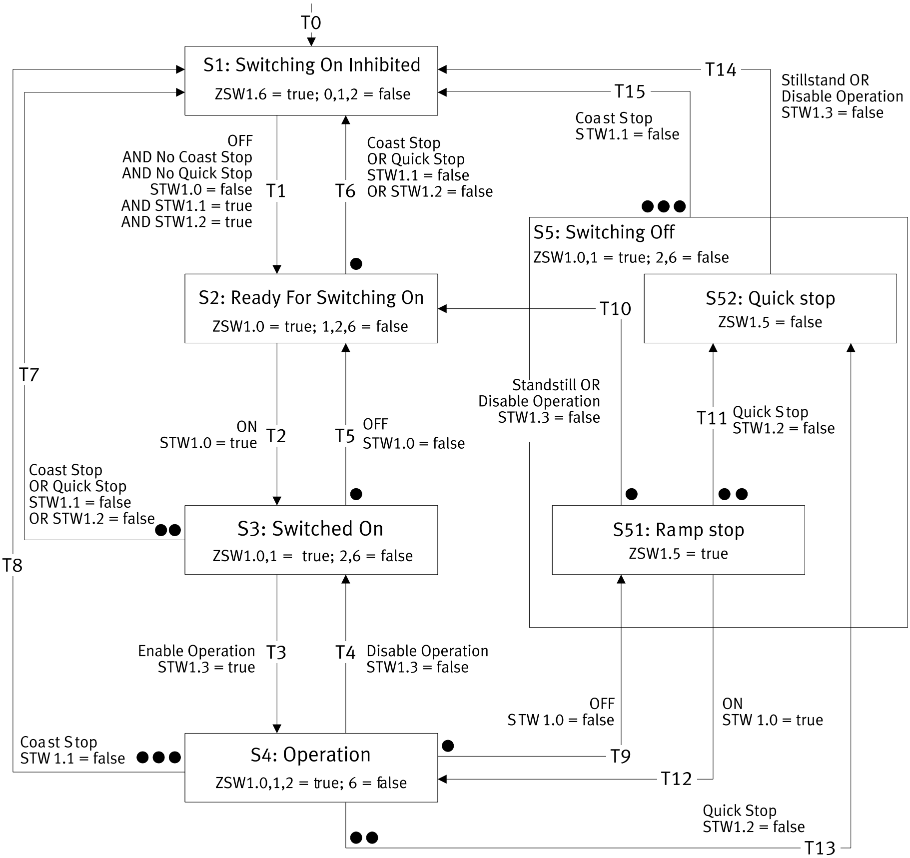

Fig. 147 Basic finite state machine

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. 866 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
		ZSW1.6	= 1
		ZSW2.11	= 0

Tab. 867 Status S1

No.	Conditions		Target status
T1	STW1.0 Power stage enable	= 0	S2 Ready For Switching On
	AND		
	STW1.1 Coast stop	= 1	
	AND		
	STW1.2 Quick stop	= 1	

Tab. 868 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. 869 Status S2

No.	Conditions		Target status
T2	STW1.0 Power stage enable	= 1	S3 Switched On
T6	STW1.1 Coast stop	= 0	S1 Switching On Inhibited
	OR		
	STW1.2 Quick stop	= 0	

Tab. 870 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. 871 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	= 0	S1 Switching On Inhibited
	OR		
	STW1.2 Quick stop	= 0	

Tab. 872 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. 873 Status S4

No.	Conditions		Target status
T4	STW1.3 Enable operation	= 0	S3 Switched On
T8	STW1.1 Coast stop	= 0	S1 Switching On Inhibited
T9	STW1.0 Power stage enable	= 0	S51 Ramp stop

No.	Conditions		Target status
T13	STW1.2 Quick stop	= 0	S52 Quick stop

Tab. 874 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
		ZSW2.10	= 1

Tab. 875 Status S5

No.	Conditions		Target status
T15	STW1.1 Coast stop	= 0	S1 Switching On Inhibited

Tab. 876 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
		ZSW2.10	= 1

Tab. 877 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	= 0	S52 Quick stop
T12	STW1.0 Power stage enable	= 1	S4 Operation

Tab. 878 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
		ZSW1.2	= 0
		ZSW1.5	= 0
		ZSW1.6	= 0
		ZSW2.10	= 1

Tab. 879 Status S52

The value of the status bit is identical to the status S5 Switching off. The status is not from status at the status bit S51 Ramp stop indistinguishable.

No.	Conditions		Target status
T10	Standstill detected	–	S1 Switching On Inhibited
	OR		
	STW1.3 Enable operation	= 0	

Tab. 880 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.

13.4.2.2 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.

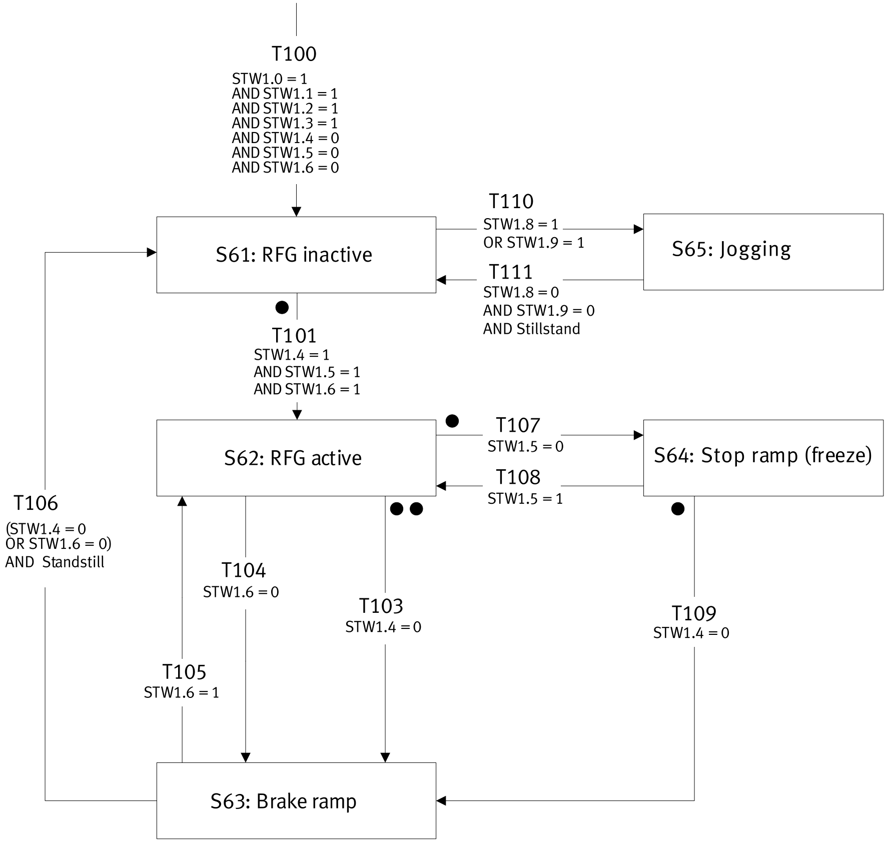

Fig. 148 Finite State Machine Velocity Mode in Application Class 1

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	= 1	
	STW1.2 Quick stop	= 1	
	STW1.3 Enable operation	= 1	
	STW1.4 Enable ramp generator	= 0	
	STW1.5 Unfreeze ramp generator	= 0	

No.	Condition		Target status
T100	STW1.6 Enable setpoint	= 0	S61 RFG inactive

Tab. 881 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. 882 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. 883 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. 884 Status S62

No.	Conditions	Value	Target status
T103	STW1.4 Enable ramp generator (system stop)	= 0	S63

No.	Conditions	Value	Target status
T104	STW1.6 Enable setpoint	= 0	S63 Brake ramp
T107	STW1.5 Unfreeze ramp generator	= 0	S64 Stop ramp (freeze)

Tab. 885 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. 886 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. 887 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. 888 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. 889 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. 890 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. 891 Transitions from Status S64

13.4.2.3 Finite State Machine Positioning Mode in Application Class 3

The finite state machine positioning mode in application class 3 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.

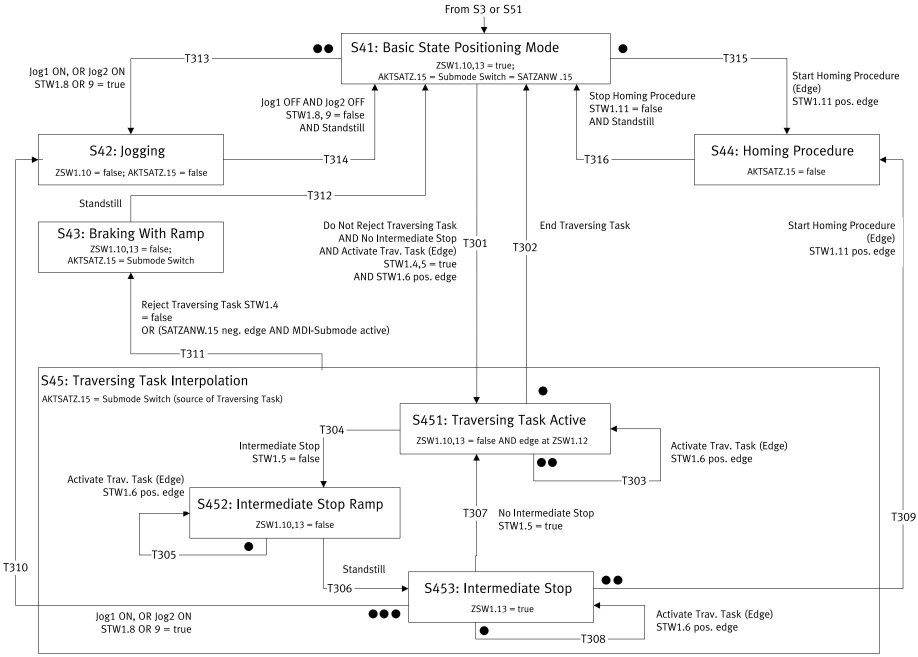

Fig. 149 Finite State Machine Positioning Mode in Application Class 3

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.

Status S41 Basic State Positioning Mode

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 (target value specification switch)	–

Tab. 892 Status S41

Switching 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 Activate traversing task	0→1	
T313	STW1.8 Jogging 1	= 1	S42 Jogging
	OR		
	STW1.9 Jogging 2	=1	
T315	STW1.11 Start Homing procedure	0→1	S441 Homing Procedure Running

Tab. 893 Transitions from Status S42

T313 has higher priority than T301.

T315 has higher priority than T301.

T313 has higher priority than T315.

Status S42 Jogging

Name	Description	Status	Value
S42 Jogging	Jogging	ZSW1.10 Target position reached	= 0
		ZSW1.13 Drive stopped	= x
		AKTSATZ Bit 15	= 0

Tab. 894 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. 895 Transitions from Status S42

The "Standstill detected" condition is an internal condition and is not triggered by the user.

Status S43 Braking With Ramp

Name	Description	Status	Value
S43 Braking With Ramp	Braking ramp	ZSW1.10 Target position reached	= 0
		ZSW1.13 Drive stopped	= 0
		AKTSATZ Bit 15 = setpoint specification switch (source for prior setpoint specification)	

Tab. 896 Status S43

No.	Conditions	Value	Target status
T312	Standstill detected	–	S41 Basic State Positioning Mode

Tab. 897 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.

Status S44 Homing Procedure

Name	Description	Status	Value
S44 Homing Procedure	Homing	ZSW1.10 Target position reached	= x
		ZSW1.11 Home position set	= x
		ZSW1.13 Drive stopped	= x
		AKTSATZ Bit 15	= 0

Tab. 898 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. 899 Transitions from Status S44

The "Standstill detected" condition is an internal condition and is not triggered by the user.

Status S45 Traversing Task Interpolation

Name	Description	Status	Value
S45 Traversing Task Interpolation	Traversing task positioning	ZSW1.10 Target position reached	= x
		ZSW1.12 Traversing task acknowledgement	= x
		ZSW1.13 Drive stopped	= x
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 900 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. 901 Transitions from Status S45

Status S451 Traversing Task Active

Name	Description	Status	Value
S451 Traversing Task Active	Positioning task active	ZSW1.10 Target position reached	= 0
		ZSW1.12 Traversing task acknowledgement	0→1
		ZSW1.13 Drive stopped	= 0
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 902 Status S451

No.	Conditions	Value	Target status
T302	Positioning task complete		S41 Basic State Positioning Mode
T303	STW1.6 Activate traversing task	0→1	S451 Traversing Task Active
T304	STW1.5 Intermediate stop	= 0	S452 Intermediate Stop Ramp

Tab. 903 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.

Status S452 Intermediate Stop Ramp

Name	Description	Status	Value
S452 Intermediate Stop Ramp	Intermediate stop ramp	ZSW1.10 Target position reached	= 0
		ZSW1.12 Traversing task acknowledgement	= x
		ZSW1.13 Drive stopped	= 0
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 904 Status S452

No.	Conditions	Value	Target status
T305	STW1.6 Activate traversing task	0→1	S452 Intermediate Stop Ramp
T306	Standstill detected		S453 Intermediate Stop

Tab. 905 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.

Status S453 Intermediate Stop

Name	Description	Status	Value
S453 Intermediate Stop	Intermediate stop	ZSW1.10 Target position reached	= 0
		ZSW1.12 Traversing task acknowledgement	= x
		ZSW1.13 Drive stopped	= 1
		AKTSATZ Bit 15 = setpoint specification switch (source for setpoint specification)	

Tab. 906 Status S453

No.	Conditions	Value	Target status
T307	STW1.5 Intermediate stop	1	S451 Traversing Task Active
T308	STW1.6 Activate traversing task	0→1	S453 Intermediate Stop

No.	Conditions	Value	Target status
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. 907 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.

13.4.2.4 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.

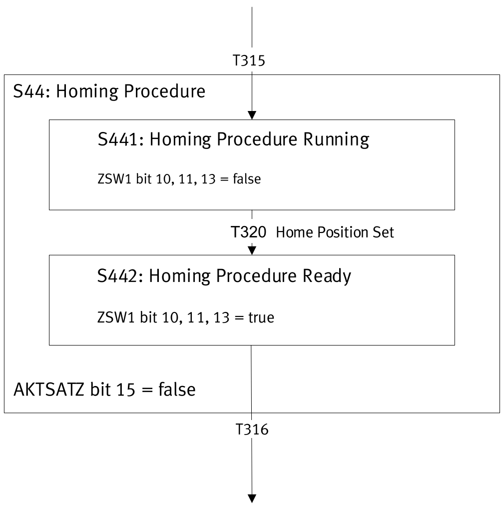

Fig. 150 Finite State Machine Homing Application Class 3

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 Target position reached	= 0
		ZSW1.11 Home position set	= 0
		ZSW1.13 Drive stopped	= 1

Tab. 908 Status S441

No.	Conditions	Value	Target status
T320	Reference point set	–	S442 Homing Procedure Ready

Tab. 909 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 Target position reached	= 1
		ZSW1.11 Home position set	= 1
		ZSW1.13 Drive stopped	= 1

Tab. 910 Status S442

13.4.3 Process Data

13.4.3.1 Process Data Signals

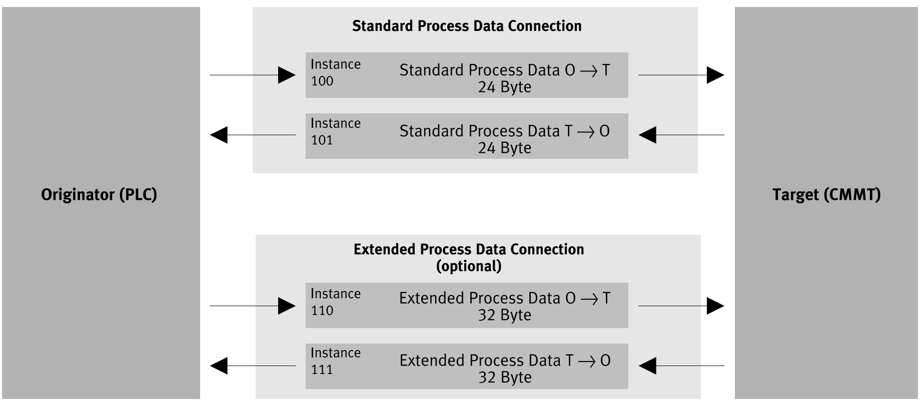

Fig. 151 Connections

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).

13.4.3.2 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).

Parameter	Meaning
Px.	
3030101	Telegram selection

Tab. 911 Process Data Configuration

13.4.4 Telegrams

Telegram number	Description	Supported application classes
Telegrams		
1	Rotational speed setpoint value 16 bit	Velocity
102	Rotational speed setpoint value 32 bit with 1 position encoder and torque reduction	Velocity
111	Single positioning in the operating mode record selection and direct specification (MDI)	Positioning
910	Transmission of additional process data (EPD) ➔ ➔ 13.4.5 Additional Telegram	Independent of the application class

Tab. 912 Telegrams

Telegram						
No.	1		102		111	
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	NSOLL_A	NIST_A	NSOLL_B	NIST_B	POS_STW1	POS_ZSW1
PZD3					POS_STW2	POS_ZSW2
PZD4			STW2	ZSW2	STW2	ZSW2
PZD5			MOMRED	MELDW	OVERRIDE	MELDW
PZD6			G1_STW	G1_ZSW	MDI_TARPOS	XIST_A
PZD7				G1_XIST- 1		
PZD8					MDI_VELOCI-TY	NIST_B
PZD9				G1_XIST- 2		
PZD10					MDI_ACC	FAULT_CODE
PZD11					MDI_DEC	WARN_CODE
PZD12					Reserved	Reserved

Tab. 913 Telegrams

13.4.5 Additional Telegram

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 read with the CMMT-ST Plug-in can be parameterised.

Telegram number	Description	Supported application classes
Additional Telegram		
910	Transmission of additional process data (EPD)	Independent of the application class

Tab. 914 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 access right "read/write" 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).

With the help of the CMMT plug-in up to 8 parameters can be mapped in the tabular view of the "Fieldbus" screen in the input and output data.

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. 915 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 actuel number of objects that mapped for Rx data.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242102	Number of bytes Rx	Displays the actuel 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	–

ID Px.	Parameter	Description	
4242115	Current axis ID Rx	Displays the current axis ID of the object mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242116	Current data ID Rx	Displays the current data ID of the object mapped Rx for the extended process data.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242117	Current data instance ID Rx	Displays the current instance no. of the object mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242118	Current array ID Rx	Displays the current array ID of the object mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242119	Current data type Rx	Displays the data type of the objects mapped for the extended process data Rx.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 916 Parameter (Rx data)

ID Px.	Parameter	Description	
4242201	Number of objects Tx	Displays the actuel number of objects that mapped for Tx data.	
		Access	read/–
		Update	effective immediately
		Unit	–

ID Px.	Parameter	Description	
4242202	Number of bytes Tx	Displays the actuel 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	Current axis ID Tx	Displays the current axis ID of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242216	Current data ID Tx	Displays the current data ID of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately

ID Px.	Parameter	Description	
4242216	Current data ID Tx	Unit	–
4242217	Current data instance ID Tx	Displays the current instance number of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242218	Current array ID Tx	Displays the current array ID of the object mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–
4242219	Current data type Tx	Displays the data type of the objects mapped for the extended process data Tx.	
		Access	read/–
		Update	effective immediately
		Unit	–

Tab. 917 Parameter (Tx data)

Extended Process Data Parameter

ID Px.	Parameter	Description	
3030101	Telegram selection	Specifies the telegram selection for EtherNet/IP.	
		Access	read/write
		Update	effective immediately
		Unit	–
3030104	Extended process data	Displays which telegram is used for the Extended process data.	
		Access	read/write
		Update	effective immediately
		Unit	–

Tab. 918 Extended Process Data Parameter

13.4.6 Process Data Signals in Detail

13.4.6.1 Control Word 1 (STW1)

Bit	Meaning	
	Velocity 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	
9	Jogging 2 – 1: active (jogging with the dynamic values of jogging 2) – 0: inactive	

Bit	Meaning	
	Velocity mode	Positioning mode
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. 919 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. 920 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 (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. 921 STW1.1

STW1.2 Quick stop (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. 922 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

Value	Command	Description
		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. 923 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. 924 STW1.7

STW1.8 Jogging 1

Value	Command	Description
1	Jogging 1 on	Execute jogging 1
0	Jogging 1 off	Stop jogging 1

Tab. 925 STW1.8

STW1.9 Jogging 2

Value	Command	Description
1	Jogging 2 on	Execute jogging 2
0	Jogging 2 off	Stop jogging 2

Tab. 926 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. 927 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. 928 STW1.12

Parameters for the General Bits (STW1)

Parameter Px.	Name
1147000	STW1.0 Power stage enable
1147010	STW1.1 Coast stop
1147020	STW1.2 Quick stop

Parameter Px.	Name
1147030	STW1.3 Enable operation
1147070	STW1.7 Fault acknowledge
1147080	STW1.8 Jogging 1
1147090	STW1.9 Jogging 2
1147100	STW1.10 Control by PLC
1147120	STW1.12 Open holding brake
1147990	STW1

Tab. 929 Parameter

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 stop ramp: Px.11280405.0.0 – Jerk system stop: Px.11280406

Tab. 930 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. 931 STW1.5

STW1.6 Enable setpoint

Value	Command	Description
1	Enable rotational speed set-point 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. 932 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. 933 STW1.11

Parameters of Special Bits for Velocity Mode (STW1)

Parameter Px.	Name
1147040	STW1.4 Enable ramp generator
1147050	STW1.5 Unfreeze ramp generator
1147060	STW1.6 Enable setpoint
1147110	STW1.11 Invert setpoint
1147150	STW1.15 Reserved

Tab. 934 Parameter

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. 935 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. 936 STW1. 5

STW1.6 Activate traversing task

Value	Command	Description
0→1	Activate positioning task	The setpoint value is enabled.
0	Do not activate positioning task	No effect

Tab. 937 STW1.6

If the drive is in the S41 Basic State Positioning Mode status and the commands "Do not reject positioning task" (STW1.4) and "No intermediate stop" (see STW1.5) are pending, with rising edge at STW1.6 a positioning task is started (record or direct setpoint value specification).
If the drive is in the S451 Traversing Task Activestatus, with a rising edge a new positioning task is started. 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 Stopstatus, with a rising edge at STW1.6 a new positioning task is started.
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).
With multiple leading edges in the S452 Intermediate Stop Ramp status or the S453 Intermediate Stop status, the last started positioning task is executed with the command "No intermediate stop" (STW1.5) (no save effect).
The command "Activate motion task" is confirmed by a handshake with the status "Acknowledge motion task active".

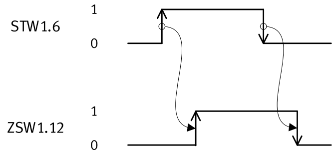

Fig. 152 Activate timing positioning task

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. 938 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. 939 STW1.13

Parameters of Special Bits for Positioning Mode (STW1)

Parameter Px.	Name
1147041	STW1.4 Reject traversing task
1147051	STW1.5 Intermediate stop
1147061	STW1.6 Activate traversing task
1147111	STW1.11 Start Homing procedure

Parameter Px.	Name
1147131	STW1.13 Start block change
1147141	STW1.14 Reserved
1147151	STW1.15 Reserved

Tab. 940 Parameter

13.4.6.2 Status Word 1 (ZSW1)

Bit	Meaning	
	Velocity 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	Fast 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	Velocity 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

Bit	Meaning	
	Velocity mode	Positioning mode
9	Guide required – 1: active – 0: inactive	
10	Velocity 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. 941 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

Value	Meaning	Description
		– S5 Switching off.
0	inactive (not ready to be switched on)	The drive is in the status S1 Switching On Inhibited.

Tab. 942 ZSW1.0

ZSW1.1 Ready to operation

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. 943 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. 944 ZSW1.2

ZSW1.3 Fault present

Value	Meaning	Description
1	Active	At least one not acknowledged or not acknowledge-able 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. 945 ZSW1.3

ZSW1.4 Coast stop activated

Value	Meaning	Description
1	Inactive	The coasting command is inactive.
0	Active (OFF2)	The coasting command is active (OFF2).

Tab. 946 ZSW1.4

ZSW1.5 Quick stop activated

Value	Meaning	Description
1	Inactive	The fast stop command is inactive.
0	Active (OFF3)	The fast stop command is active (OFF3).

Tab. 947 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 com-mand 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. 948 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. 949 ZSW1.7

ZSW1.9 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. 950 ZSW1.9

Parameters of the General Bits (ZSW1)

Parameter Px.	Name
1145990	ZSW1
1145000	ZSW1.0 Ready to switch on
1145010	ZSW1.1 Ready to operation
1145020	ZSW1.2 Operation enabled
1145030	ZSW1.3 Fault present
1145040	ZSW1.4 Coast stop activated
1145050	ZSW1.5 Quick stop activated
1145060	ZSW1.6 Switch on inhibited
1145070	ZSW1.7 Warning present
1145090	ZSW1.9 Control requested

Tab. 951 Parameter

Significance of the Special Bits for Velocity Mode (STW1)

ZSW1.8 Speed error within tolerance range

Value	Meaning	Description
1	In tolerance range	The rotational speed actual value is within a parameterisable tolerance range. It can be above or below the tolerance range for time $t < t_{max}$. The tolerance range and the time t_{max} can be parameterised: – Monitoring window speed: following error: Px.464.0.0 – Damping time velocity: following error: Px.4690.0.0
0	Not in tolerance range	The rotational speed actual value is outside a tolerance range.

Tab. 952 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: $\lvert n_{actual} \rvert \geq n_{threshold}$ 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 – Hysteresis threshold value velocity comparator: Px.11280505 – Switch-on delay time speed comparator: Px.11280506
0	Inactive	Rotational speed comparison value not reached or below setpoint value: $\lvert n_{act} \rvert < (n_{threshold} - n_{hyst})$

Tab. 953 ZSW1.10

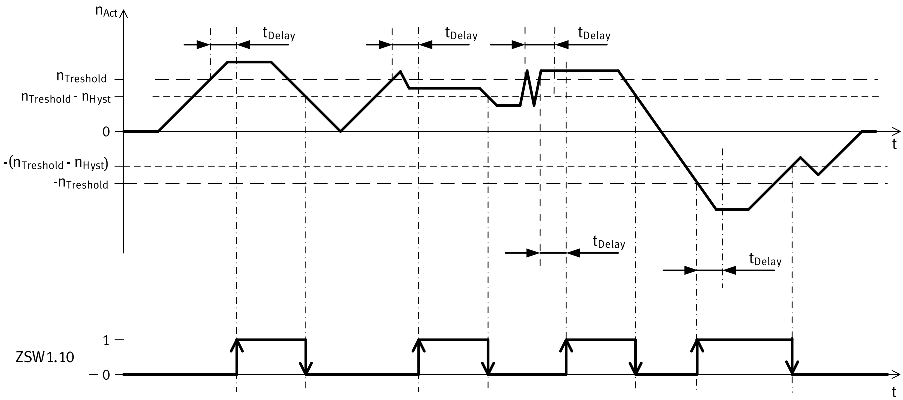

Fig. 153 Rotational speed comparison timing reached

Name	Description	ID Px.
n_{Act}	Actual velocity value (rotational speed)	1210
$n_{threshold}$	Threshold value velocity comparator	11280504
n_{hyst}	Hysteresis threshold value velocity comparator	11280505
t_{Delay}	Switch-on delay time speed comparator	11280506

Tab. 954 Legend for Rotational Speed Comparison Timing Reached

Parameter Px.	Name
1210	Actual velocity value
11280504	Threshold value velocity comparator
11280505	Hysteresis threshold value velocity comparator
11280506	Switch-on delay time speed comparator

Tab. 955 Parameters of 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. 956 ZSW1.11

The motor travels 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. 957 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. 958 ZSW1.13

ZSW1.14 Motor rotation

Value	Meaning	Description
1	Positive	Actual rotational speed value ≥ 0
0	negative	Actual rotational speed value < 0

Tab. 959 ZSW1.14

ZSW1.15 No warning Overtemperature power section

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. 960 ZSW1.15

Parameters of Special Bits for Velocity Mode(ZSW1)

Parameter	Name	Data type
1145080	ZSW1.8 Speed error within tolerance range	Boolean
1145100	ZSW1.10 f or n reached or exceeded	Boolean
1145110	ZSW1.11 I, M or P limit not reached	Boolean
1145120	ZSW1.12 Holding brake open	Boolean
1145130	ZSW1.13 No warning Overtemperature motor	Boolean

Parameter	Name	Data type
1145140	ZSW1.14 Motor rotation	Boolean
1145150	ZSW1.15 No warning Overtemperature power section	Boolean

Tab. 961 Parameter

Significance of the Special Bits for Positioning Mode (ZSW1)

ZSW1.8 Following error within tolerance range

Value	Meaning	Description
1	Following distance in 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. – Monitoring window position: following error: Px.463.0.0
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. 962 ZSW1.8

ZSW1.10 Target position reached

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 – Monitoring window target position: Px.469.0.0
0	Inactive	The actual position value is not within the target position window.

Tab. 963 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. 964 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. 965 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 – Monitoring window speed standstill monitoring: Px.466.0.0 – Damping time target reached: Px.468.0.0 – Monitoring window target position: Px.469.0.0
0	Inactive	The drive moves.

Tab. 966 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. 967 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. 968 ZSW1.15

Parameters of Special bits for Positioning mode (ZSW1)

Parameter Px.	Name
1145081	ZSW1.8 Following error within tolerance range
1145101	ZSW1.10 Target position reached
1145111	ZSW1.11 Home position set
1145121	ZSW1.12 Traversing task acknowledgement
1145131	ZSW1.13 Drive stopped
1145141	ZSW1.14 Drive accelerating
1145151	ZSW1.15 Drive decelerating

Tab. 969 Parameter

13.4.6.3 Control Word 2 (STW2)

Bit	Meaning
0 … 6	Reserved
8	Travel to fixed stop – 1: activate travel to fixed stop (must be set before reaching the fixed stop). – 1→0: deactivate travel to fixed stop
9 … 15	Reserved

Tab. 970 Control Word 2 (STW2)

STW2.8 Traverse to fixed endstop

Value	Command	Description
1	Activate	Travel to fixed stop is activated with the command. The signal must be set before reaching the fixed stop.
1→0	Deactivate	Travel to the fixed stop is deactivated.

Tab. 971 STW2.8,

For example, with the travel to fixed stop command it can be moved to a workpiece with a specified torque to clamp it securely. Detailed information on the function
➔ 4.1.3.3.1. Travel top fixed stop (application class 3).

Parameters of Control Word 2 (STW2)

Parameter	Name
Px.	
1148080	STW2.8 Traverse to fixed endstop
1148120	STW2.12 ... 15 Master sign of life
1148990	STW2

Tab. 972 Parameter

13.4.6.4 Status Word 2 (ZSW2)

Bit	Meaning
0 … 7	Reserved
8	Travel to fixed stop – 1: active – 0: inactive
9 … 10	Reserved
11	Output stage active – 1: active – 0: inactive
12 … 15	Reserved

Tab. 973 Status Word 2

ZSW2.8 Move to fixed stop active

Value	Meaning	Description
1	Active	This status bit shows that the positioning task "Travel to fixed stop" is being executed ➔ 4.1.3.3.1. Travel top fixed stop (application class 3).
0	Inactive	Shows the status "Travel to fixed stop is inactive".

Tab. 974 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. 975 ZSW2.11

Parameters of Status word 2 (ZSW2)

Parameter	Name
Px.	
1146080	ZSW2.8 Move to fixed stop active
1146110	ZSW2.11 Power stage active
1146990	ZSW2

Tab. 976 Parameter

13.4.6.5 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 velocity is normalised via parameter Px.11280701.
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 velocity is normalised via parameter Px.11280701.
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	Name
Px.	
11280502	Target velocity NSOLL_A/NSOLL_B

Tab. 977 Parameter

13.4.6.6 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
➔ 13.4.6.5 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
➔ 13.4.6.5 Rotational Speed Setpoint Value A, B (NSOLL_A, NSOLL_B).
NIST_A und NIST_B are mapped to the same parameter (Px.1210).

Parameters for Rotational Speed Actual Value A, B (NIST_A, NIST_B).

Parameter	Name
Px.	
1210	Actual velocity value

Tab. 978 Parameter

13.4.6.7 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 CMMT 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.

If the Default Setting is Active, the CMMT-internal 24 Bits are Normalised to the Following Values:

- Single-turn information (pulses per revolution): 18 bits (262144)
- Multi-turn 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 multi-turn 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.

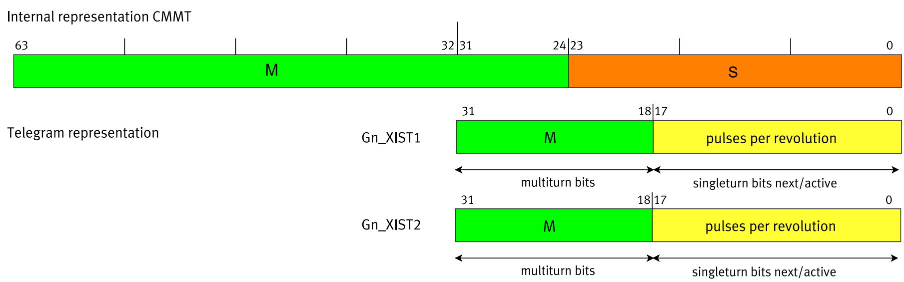

Fig. 154 Display of actual position values (example)

Name	Description
Internal represent-ation of CMMT	Internal representation of position values for CMMT
M	Multi-turn information
Multi-turn bits	Bits for the representation of the multi-turn values
Pulses per revolu-tion	Single-turn information (pulses per revolution)
Single-turn bits next/active	Bits for displaying the single-turn values
Telegram repres-entation	Representation of the position values in the telegram

Tab. 979 Legend for Figure "Actual Position Value 1"

Detailed information on the mode of operation of the encoder interface
➔ 13.4.6.10 Status Diagram "Position Feedback Interface".

Encoder n Position Actual Value 1 Parameter (Gn_XIST1)

Parameter	Name
Px.	
231544	Current resolution per revolution for Gn_XIST
231545	Resolution per revolution for Gn_XIST

Tab. 980 Parameter

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).

13.4.6.8 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
➔ 13.4.6.7 Encoder n Actual Position Value 1 (Gn_XIST1).
The following priorities must be observed for the values in Gn_XIST2:

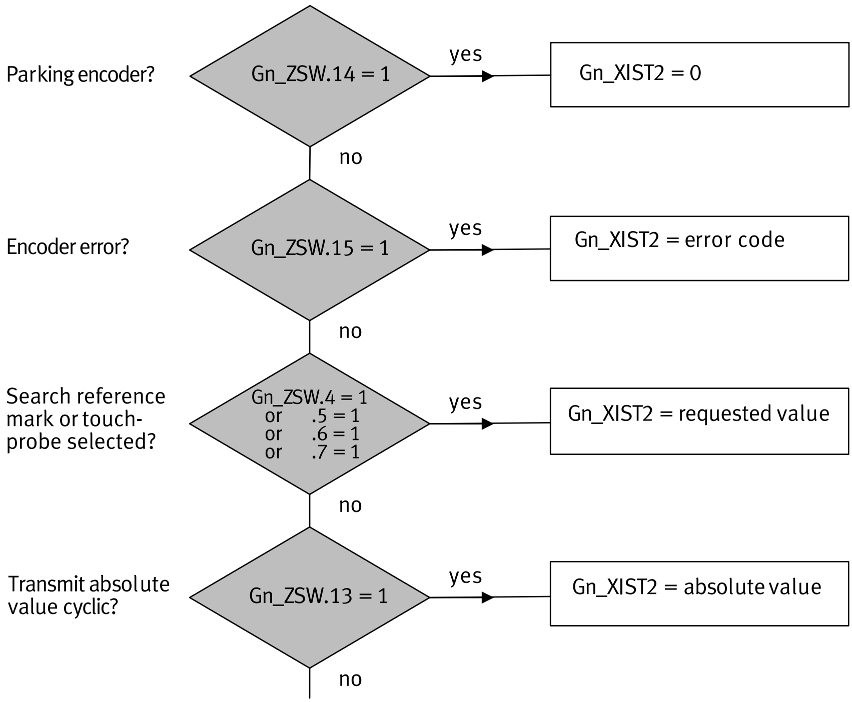

Fig. 155 Priorities for Gn_XIST2 (actual position value 2)

Name	Description
Encoder error?	Is there a sensor error?
Search reference mark or touch-probe 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. 981 Legend for Figure "Priorities for Gn_XIST2 (Actual Position Value 2)"

Detailed information on the mode of operation of the encoder interface
➔ 13.4.6.10 Status Diagram "Position Feedback Interface".

13.4.6.9 Encoder n Control Word (Gn_STW)

The encoder status machine is controlled via the encoder control word. The following functions are implemented in the CMMT 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

Bit	Meaning
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. 982 Control Word Gn_STW

Detailed information on the mode of operation of the encoder interface
➔ 13.4.6.10 Status Diagram "Position Feedback Interface".

Encoder n Control Word Parameter (Gn_STW)

Parameter	Name
Px.	
1149000	Gn_STW.0 ... 3 Request function
1149040	Gn_STW.4 ... 6 Request command
1149070	Gn_STW.7 Mode
1149110	Gn_STW.11 Home position mode
1149120	Gn_STW.12 Trigger mode homing
1149130	Gn_STW.13 Request absolute value cyclically
1149140	Gn_STW.14 Activate parking sensor
1149150	Gn_STW.15 Acknowledge sensor error
1149990	Gn_STW
1149991	Gn_STW Cycle-1

Tab. 983 Parameter

13.4.6.10 Status Diagram "Position Feedback Interface"

The statuses SD11, SD10 and SD7 are not supported.

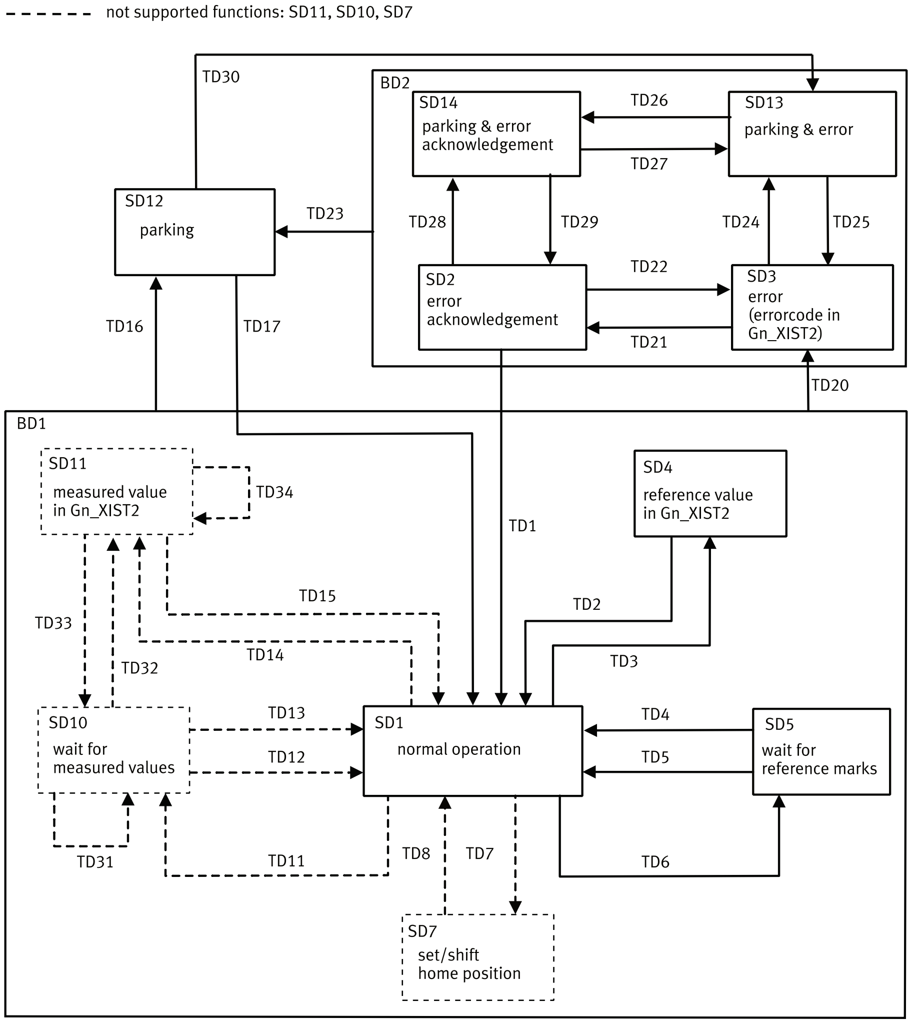

Fig. 156 Status diagram of the position feedback interface

13.4.6.11 Actual Position Value A (XIST_A)

XIST_A Actual value position shows the actual position value based on the scaling that is set in the factor group.

Parameter Actual Position Value A (XIST_A)

Parameter	Name
Px.	
11280609	XIST_A Actual value position

Tab. 984 Parameter

13.4.6.12 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

The scalability is limited to the power of 10
➔ 3.2.4.3 Scaling of internal units for the fieldbus ("factor group").

Parameter MDI target Position (MDI_TARPOS)

Parameter	Name
Px.	
11280604	Target position MDI

Tab. 985 Parameter

13.4.6.13 MDI Velocity (MDI_VELOCITY)

This process datum specifies the position with MDI.
Scaling is analogous to the CiA402 factor group via the following parameter:

– Resolution velocity: Px.7842

The scalability is limited to the power of 10
➔ 3.2.4.3 Scaling of internal units for the fieldbus ("factor group").

Parameters of MDI Velocity (MDI_VELOCITY)

Parameter	Name
Px.	
11280605	Profile speed MDI

Tab. 986 Parameter

13.4.6.14 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 %.

Parameters of MDI Acceleration (MDI_ACC)

Parameter	Name
Px.	
11280606	Acceleration MDI

Tab. 987 Parameter

13.4.6.15 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 %.

Parameters of MDI Deceleration (MDI_DEC)

Parameter	Name
Px.	
11280607	Deceleration MDI

Tab. 988 Parameter

13.4.6.16 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: within the threshold values or message function not active

Bit	Meaning
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. 989 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. 990 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 utilisation is less than the set torque utilisation threshold or the startup phase is not yet complete.
0	> Threshold value	The current torque utilisation is greater than the set torque utilisation threshold.

Tab. 991 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 can be parameterised.
– Threshold value torque utilization reached: Px.11280410

MELDW.2 Actual speed ‹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. 992 MELDW.2

The threshold can be parameterised.
– Trigger level MELDW.2: Px.11280112
– Hysteresis trigger level: Px.11280113

MELDW.3 Actual speed = ‹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. 993 MELDW.3

The message is parameterisable and is used for monitoring the rotational speed:
– Trigger level MELDW.3: Px.11280114
– Hysteresis trigger level: Px.11280115

MELDW.5 Variable reporting function

Value	Message	Description
1	Threshold value exceeded	The monitored signal of a drive system has exceeded the specified threshold value.
0	Within the threshold values or message function not active	The monitored signal of a drive system is within the threshold values or the message function is not active.

Tab. 994 MELDW.5

The function monitors any parameter to check whether it exceeds a threshold value.

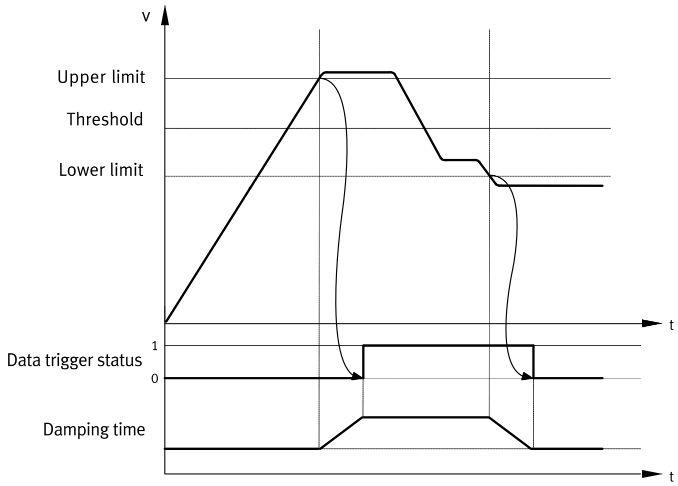

Fig. 157 Variable message function timing (example)

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
Damping time	Data trigger damping time	1174207

Tab. 995 Legend for Variable Message Function Timing Diagram

The monitored parameters are specified with the following parameters:

– Axis ID data trigger: P0.1174201.0.0
– Data ID data trigger: P0.1174202.0.0
– Data instance ID data trigger: P0. 1174203.0.0
– Array ID data trigger: P0.1174204

The resolution is specified with the following parameters:

– Trigger level MELDW.5: P0.1174205.0.0
– Hysteresis of trigger level: P0.1174206.0.0
– Data trigger damping time: P0.1174207.0.0

The input values must be specified in the correct format for trigger level and hysteresis (data type of the monitored parameter).

Hysteresis and damping 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

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

MELDW.6 No warning Overtemperature motor

Value	Message	Description
1	No warning of motor overtem-perature	The temperature in the motor is within the permissible range
0	Warning of motor overtemperat-ure	The temperature in the motor is outside the permiss-ible range

Tab. 996 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
– Hysteresis lower limit value warning threshold motor temperature: Px.946.0.0
– Upper limit value warning threshold motor temperature: Px.949.0.0
– Hysteresis upper limit value warning threshold motor temperature: Px.9410.0.0

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. 997 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
– Upper limit value warning threshold power output stage temperature: Px.9314.0.0

A difference between warning and error cannot be distinguished with this bit. Temperature outside the permissible range means warning and/or error.

MELDW.8 Speed setpoint / actual deviation in tolerance

Value	Message	Description
1	Active	The velocity setpoint/actual deviation as specified is within the tolerance.
0	Inactive	The velocity setpoint/actual deviation as specified is outside the tolerance.

Tab. 998 MELDW.8

– Monitoring window speed: following error: Px.464.0.0
– Damping time velocity: following error: Px.4690.0.0

MELDW.11 Controller enable

Value	Message	Description
1	Active	Controller enable reported
0	Inactive	Controller enable not reported

Tab. 999 MELDW.11

MELDW.12 Ready for operation

Value	Message	Description
1	Active	Ready for operation reported
0	Inactive	Ready for operation not reported

Tab. 1000 MELDW.12

MELDW.13 Power stage active

Value	Message	Description
1	Active	Output stage active reported
0	Inactive	Output stage not active reported

Tab. 1001 MELDW.13

Parameters of Status Word Messages (MELDW)

Parameter Px.	Name
1174205	Trigger level MELDW.5
11280046	Status word MELDW
11280112	Trigger level MELDW.2
11280114	Trigger level MELDW.3
1124900	MELDW.0 ramp generator

Parameter Px.	Name
11249010	MELDW.1 torque utilization
11249020	MELDW.2 Actual speed ‹Threshold1
11249030	MELDW.3 Actual speed = ‹Threshold2
11249050	MELDW.5 Variable reporting function
11249060	MELDW.6 No warning Overtemperature motor
11249070	MELDW.7 No warning Overtemperature power output stage
11249080	MELDW.8 Speed setpoint / actual deviation in tolerance
11249110	MELDW.11 Controller enable
11249120	MELDW.12 Ready for operation
11249130	MELDW.13 Power stage active
11249990	MELDW

Tab. 1002 Parameter

13.4.6.17 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
- Reference point run
- 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)
Value range CMMT: 0 ...2 (Px.1309)
Values below this range are interpreted as 0 %.
Values above this range are interpreted as 200 %.

Parameters of Position Velocity Override (OVERRIDE)

Parameter Px.	Name
1309	Velocity override
11280611	Velocity override

Tab. 1003 Parameter

13.4.6.18 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.

Parameters of Torque Reduction (MOMRED)

Parameter Px.	Name
381	Specifies the maximum torque of the servo drive for transfer to the configuration tool. The maximum torque must always be set the same on the side of the controller and the servo drive.
526796	Maximum torque symmetrical
1126990	Torque reduction MOMRED

Tab. 1004 Parameter

13.4.6.19 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
10	Telegram 111, modulo direction selection negative – 1: negative direction Bit 9 and bit 10 identical (0 or 1): shortest path
11 … 14	reserved

Bit	Meaning
15	MDI selection – 1: activate MDI – 0: deactivate MDI

Tab. 1005 Positioner Control Word 1 (POS_STW1)

POS_STW1.0 ... 6 Traversing block selektion

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. 1006 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. 1007 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. 1008 POS_STW1.9...10

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. 1009 POS_STW1.15

Parameters of Positioner Control Word 1 (POS_STW1)

Parameter Px.	Name
112411000	POS_STW1.0 ... 6 Traversing block selektion
112411080	POS_STW1.8 Absolute positioning
112411090	POS_STW1.9 ... 10 direction selection
112411120	POS_STW1.12 Setpoint transfer
112411140	POS_STW1.14 Setting up selected
112411150	POS_STW1.15 MDI selection
112411990	POS_STW1

Tab. 1010 Parameter

13.4.6.20 Positioner Status Word 1 (POS_ZSW1)

Bit	Meaning
0	Active positioning record bit 0 (2^0)

Bit	Meaning
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
11	Homing active – 1: active – 0: inactive
12	Reserved
13	Positioning records active – 1: active – 0: inactive
14	Reserved
15	MDI active – 1: active – 0: inactive

Tab. 1011 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).
1	Active positioning record bit 1 (2^1)	

Bit	Meaning	Description
2	Active positioning record bit 2 (2^2)	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.
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. 1012 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. 1013 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. 1014 POS_ZSW1.9

POS_ZSW1.10 Jogging active

Value	Meaning	Description
1	Jogging active	Shows whether jogging is active.
0	Jogging inactive	

Tab. 1015 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. 1016 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. 1017 POS_ZSW1.13

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. 1018 POS_ZSW1.15

Parameters of Positioner Status Word 1 (POS_ZSW1)

Parameter Px.	Name
112412000	POS_ZSW1.0 ... 6 Traversing block bit
112412080	POS_ZSW1.8 Negative limit switch active
112412090	POS_ZSW1.9 Positive limit switch active
112412100	POS_ZSW1.10 Jogging active
112412110	POS_ZSW1.11 Reference point approach active
112412130	POS_ZSW1.13 Traversing block active
112412140	POS_ZSW1.14 Setup active
112412150	POS_ZSW1.15 MDI active
112412990	POS_ZSW1

Tab. 1019 Parameter

13.4.6.21 Positioner Control Word 2 (POS_STW2)

Bit	Meaning
0	Tracking mode – 1: activate – 0: deactivate
1 … 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. 1020 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. 1021 POS_STW2.0

POS_STW2.5 Jogging incremental active

Value	Command	Description
1	Incremental jogging	Incremental jogging is activated.

Value	Command	Description
0	Velocity jog	Velocity jog is activated.

Tab. 1022 POS_STW2.5

POS_STW2.10 Selection touch probe

Value	Command	Description
1	secondary encoder	Determines the source of the measured values.
0	primary encoder	

Tab. 1023 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. 1024 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. 1025 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. 1026 POS_STW2.15

Parameters of Positioner Control Word 2 (POS_STW2)

Parameter Px.	Name
112414000	POS_STW2.0 Tracking mode
112414010	POS_STW2.1 Set reference point
112414050	POS_STW2.5 Jogging incremental active

Parameter Px.	Name
112414100	POS_STW2.10 Selection touch probe
112414110	POS_STW2.11 Touch probe edge
112414140	POS_STW2.14 Activate software limit switch
112414150	POS_STW2.15 Activate hardware limit switch
112414990	POS_STW2

Tab. 1027 Parameter

13.4.6.22 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 travels forward – 1: drive travels forward – 0: drive does not travel forward
5	Drive travels backwards – 1: drive travels backwards – 0: drive does not travel backwards
6	Negative software limit switch active – 1: active – 0: inactive
7	Positive software limit switch active – 1: active – 0: inactive
8	Actual position $\leq$ cam switch 0 – 1: actual position $\leq$ as position of cam switch 0 – 0: actual position $>$ as position of cam switch 0

Bit	Meaning
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	Travel to fixed stop active – 1: active – 0: inactive
15	Positioning command active – 1: active – 0: inactive

Tab. 1028 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. 1029 POS_ZSW2.0

POS_ZSW2.1 Velocity limiting active

Value	Meaning	Description
1	Velocity limiting active	Shows that velocity limiting is active in the application limiting manager. The current trajectory is run with limited velocity. The velocity limit can be set with the following parameter: – Limit value velocity limiting: Px.1304.0.0
0	Velocity limiting inactive	Shows that velocity limiting is inactive

Tab. 1030 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. 1031 POS_ZSW2.2

POS_ZSW2.4 Drive moves forward

Value	Meaning	Description
1	Drive travels forward	Shows that the drive travels forward. The internal setpoint velocity value according to the trajectory generator is > 0.
0	Drive does not travel forward	Shows that the drive is stopped or travels backwards. The internal setpoint velocity value according to the trajectory generator is ≤ 0.

Tab. 1032 POS_ZSW2.4

POS_ZSW2.5 Drive moves backwards

Value	Meaning	Description
1	Drive travels backwards	Shows that the drive is stopped or travels backwards. The internal setpoint velocity value according to the trajectory generator is $\neq 0$.

Value	Meaning	Description
0	Drive does not travel backwards	Shows that the drive travels forward. The internal setpoint velocity value according to the trajectory generator is > 0.

Tab. 1033 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. 1034 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. 1035 POS_ZSW2.7

POS_ZSW2.8 Position actual value <= cam 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. 1036 POS_ZSW2.8

POS_ZSW2.9 Position actual value <= cam 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. 1037 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. 1038 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. 1039 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. 1040 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 travel to the fixed stop.
0	Fixed stop clamping torque not reached	

Tab. 1041 POS_ZSW2.13

POS_ZSW2.14 Move to fixed stop active

Value	Meaning	Description
1	Travel to fixed stop active	Specifies whether travel to the fixed stop is active.
0	Travel to fixed stop not active	

Tab. 1042 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. 1043 POS_ZSW2.15

Parameters of Positioner Status Word 2 (POS_ZSW2)

Parameter Px.	Name
112413000	POS_ZSW2.0 Tracking mode active
112413010	POS_ZSW2.1 Velocity limiting active
112413020	POS_ZSW2.2 Setpoint available
112413040	POS_ZSW2.4 Drive moves forward
112413050	POS_ZSW2.5 Drive moves backwards
112413060	POS_ZSW2.6 Software limit switch minus reached
112413070	POS_ZSW2.7 Software limit switch plus reached
112413080	POS_ZSW2.8 Position actual value <= cam switch 0
112413090	POS_ZSW2.9 Position actual value <= cam switch 1
112413100	POS_ZSW2.10 Direct output 1 via traversing block
112413110	POS_ZSW2.11 Direct output 2 via traversing block
112413120	POS_ZSW2.12 Fixed stop reached
112413130	POS_ZSW2.13 Fixed stop Clamping torque reached
112413140	POS_ZSW2.14 Move to fixed stop active
112413150	POS_ZSW2.15 Traversing command active
112413990	POS_ZSW2

Tab. 1044 Parameter

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