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# ServoOne CM with ServoOne CM-P

Device Help

## Multi-Axis System

Multiple axis automation system SystemOne CM



## **Description of the software functionality**

### **Axis Controller ServoOne CM with Supply unit ServoOne CM-P**

ID No.: 1400.209B.7-01

Information valid as of: 10.2020

Effective as of firmware version V3.00-xx

The German version is the original version of this documentation.

# Legal information

## **Subject to technical change without notice.**

This Operation Manual was drawn up on the basis of DIN EN 82079-1. The content was compiled with the greatest care and attention and reflects the latest information available to us.

We should nevertheless point out that this document cannot always be updated in line with ongoing technical developments in our products.

Information and specifications may be subject to change at any time. For information on the latest version please visit [www.keba.com](http://www.keba.com).

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# 1 General information

The KEBA Industrial Automation Germany GmbH product DVD contains the complete documentation belonging to the respective product series. The documentation of a product series includes Operation Manual (hardware description), Device Help (software description) and other User manuals (e.g. fieldbus description) and Specifications. They are available in PDF format.

## 1.1 Target Group

**Dear user,**

the documentation is an integral part of the device and contains important information on operation and service. It is aimed at everyone who performs mounting, set-up, commissioning and service tasks on the product.

## 1.2 Requirements

Requirements for using KEBA Industrial Automation Germany GmbH devices:

- The documentation for the devices must be legible, accessible at all times and kept for the product's entire service life.
- Read and understand the documentation for your device.
- Qualification: To avoid bodily injury and property damage, only qualified personnel with electrical training may work with/on the device.
- Required skills and knowledge:
  - national accident prevention rules (e.g. DGUV V3 in Germany)
  - How to set up, install, commission and operate the device

Work related to other specialized areas, such as transportation, storage and disposal must be performed exclusively by appropriately trained personnel.



### NOTE

- This Device Help is valid for the servo controller ServoOne CM (referred to as ServoOne CM or SO CM for short below) in combination with of the Supply unit ServoOne CM-P (referred to as ServoOne CM-P or SO CMP for short below). These instructions are not meant as a replacement for the Operation Manuals for the ServoOne CM or ServoOne CM-P.
-

## 1.3 Applicable documentation



All of the further applicable documents for this device can be found on our website:

[www.keba.com](http://www.keba.com) in the DOCU-PORTAL.

## 1.4 Pictograms

The pictograms used in this Device Help have the following meaning for the user:



### NOTE

- Useful information.



- Reference to applicable documents.

Step	Action
1. (Number)	<b>HANDLING INSTRUCTIONS</b> Operating step performed by either the user or the system.

For the pictograms for "safety information and warnings" used in this Device Help, see the Section "Safety information and warnings" on page 16.

## 1.5 Exclusion of liability

Observing all the instructions and information in the documentation for KEBA Industrial Automation Germany GmbH devices is a prerequisite:

- for safe operation and
- to attain the performance characteristics and product characteristics described.

KEBA Industrial Automation Germany GmbH accepts no liability for personal injury, material damage or financial losses arising from failing to observe the documentation.

## 1.6 Support

Our Technical Helpline helps you quickly and expertly if you have any technical questions concerning project planning or commissioning your device.

---

Street address :    KEBA Industrial Automation Germany GmbH  
                         Gewerbestrasse 5-9  
                         35633 Lahnau  
                         Germany

The Technical Helpline can be reached by email or telephone:

Opening hours:    Mon–Fri: 8 am–5 pm (CET)

Email:              helpline@keba.de

Phone:              +49 6441 966-180

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### NOTE

- For detailed information on our services, please visit our website, [www.keba.com](http://www.keba.com), under ► Service.
-

## 2 Safety

### 2.1 Overview

Our devices are designed and built with the latest technology and comply with all recognized safety rules and standards. Nevertheless, there are potential hazards that may arise during their use. In this chapter:

- We provide information regarding the residual risks and hazards posed by our devices when they are used as intended.
- We warn you about foreseeable misuse of our devices.
- We point out that it is necessary to exercise due care and caution and go over measures designed to minimize risk.

### 2.2 For your own safety



#### NOTE

- When installing and commissioning your device, you must observe the documentation for the relevant device family!



#### NOTE

- Please also observe the safety information and warnings in the respective applicable operation manual, especially when commissioning the drive!



#### NOTE


- Pay attention to special safety information and warnings which are presented here in the document directly before a specific activity is described and which warn the user of a specific hazard!


Our devices are fast and safe to operate. For your own safety and to ensure reliable operation of your machine, take note of the following:


Step	Action
1.	<b>Precautions to avoid injury and damage to property</b> Ensure there is no possibility of bodily injury or damage to the machine when testing and commissioning the device.

### 2.3 Safety information and warnings

Our devices may pose certain hazards. Therefore, always observe the following safety information and warnings.

<b>WARNING!</b>	<b>Risk of injury posed by uncontrolled rotation!</b>
	<b>Improper conduct can lead to serious injury or death.</b> <ul style="list-style-type: none"><li>• Before commissioning motors with feather key on the shaft end it must be secured to prevent it from being ejected, if this is not prevented by drive elements such as pulleys, couplings or similar.</li></ul>

<b>CAUTION!</b>	<b>Your system/motor may be damaged if put into operation in an uncontrolled or inappropriate manner.</b>
	<b>Improper conduct can cause damage to your system / machine.</b> <ul style="list-style-type: none"><li>• Before the “Start” step, make absolutely sure that a valid setpoint has been entered, as the configured setpoint will be immediately transmitted to the motor after the motor control function starts, which may result in the motor accelerating unexpectedly.</li></ul>

CAUTION!	Damage to the device as a result of incorrect operation!
	<p><b>Failure to exercise caution or follow proper working procedures may result in damage to the device.</b></p> <ul style="list-style-type: none"> <li>The mains voltage for the power supply must not be switched on until after the available mains voltage setting has been configured in the device firmware and the device is restarted (in the event that the mains voltage or the switching frequency has been changed).</li> </ul>

- To provide an emergency-stop function (emergency-stop function: movement stopped by “switching off the electrical power supply” or STO Safe Torque Off).

## 2.4 Responsibility

Electronic devices are not fail-safe. The company setting up and/or operating a complete machine or system is responsible:

- For ensuring that the motor will be brought to a safe state if the device fails.
- For the safety of persons and machinery.
- For proper functional capability of the complete machine.
- For the risk assessment of the complete machine or system acc. to DIN EN 12100:2011 and EN ISO 13849-1.

Observe the topic “Electrical equipment of machines” in EN 60204-1:2006 “Safety of machinery”. The safety requirements defined there to be met by electrical machinery are intended to ensure personal safety and the safety of machinery or systems.

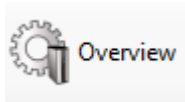
The emergency-stop function (to EN 60204) shuts down the power supply of a machine, which leads to uncontrolled rundown of drives. In order to prevent hazards, check whether the following will be required:

- Keeping individual motors running.
- To initiate certain safety procedures.

# 3 Device setting

## Chapter overview

### Pictogram



### Navigation

► Project tree ► Axis adjustment

### Brief description

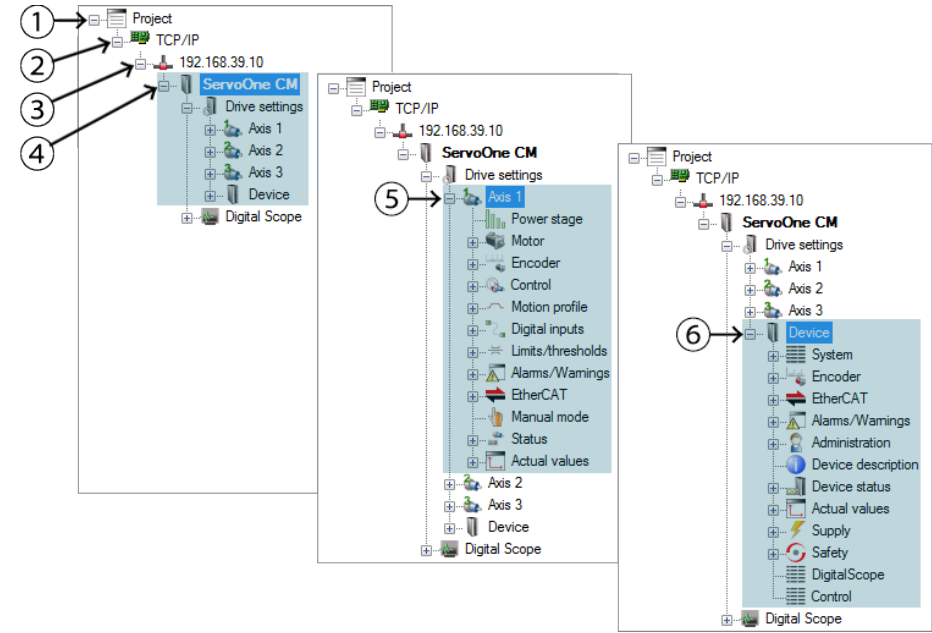
This chapter describes the basic procedure for parametrization of the Axis Controller ServoOne CM.

### Contents

3.1 Project tree	18
3.2 Connections Axis Controller	19
3.3 Service and diagnostics	19
3.4 EtherCAT® interface	26
3.5 Ethernet over EtherCAT® (EoE)	27
3.6 Information about parameters	31
3.7 Electronic rating plate	32
3.8 Firmware in the axis group	33
3.9 File system	34

## 3.1 Project tree

The following diagram explains the structure of the project tree in DriveManager 5.



- ① Project name
- ② Communication (TCP/IP)
- ③ IP address of device
- ④ System name, parameter access to the axes 1 to 3
- ⑤ Subject areas for each separate axis
- ⑥ Subject areas for whole device

Table 3.1: Description of structure of the project tree

## 3.2 Connections Axis Controller



### NOTE

- For a complete description of Axis Controller connections (label, position, function) please refer to the ServoOne CM Operation Manual Axis Controller (ID No.: 1400.200B.x), chapter “Installation” on page 23.
- For a complete description of the DIL switch bank for configuring SD0 functionality (position, function, configuration) please refer to the ServoOne CMSpecification SD0 (ID No.: 1400.402B.x), chapter “Overview of connections” on page 11.
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com) in the DOCU-PORTAL.

## 3.3 Service and diagnostics

### 3.3.1 Communication connections

Each Axis Controller has two ports for establishing an EtherCAT network: X5.1 ECAT IN and X5.2 ECAT OUT. Connection X5.1 ECAT IN is the input and the connection X5.2 ECAT OUT is the output. With the last Axis Controller in the axis group, the output ECAT OUT remains free.

The Supply unit does not have any connections with RJ-45 ports. It is indirectly provided with data via the first Axis Controller of the axis group via the connection X3 XC OUT on the Supply unit and the connection X4 XC IN on the Axis Controller.

The X5.1 ports can also be switched into the “service and diagnostics” mode. They function as TCP/IP ports.

A PC with a DriveManager 5 installed can be connected to the axis group. In this way it is possible to perform initial configuration and tests on the entire axis group (Supply unit, Axis Controller, motors and encoders).

In the EtherCAT group, this is possible via the Ethernet over EtherCAT function or in the service and diagnostics mode by directly connecting the service PC to the X5.1 ECATin port of the axis controller.

The cable assignment (1:1 or cross-over) is detected automatically.

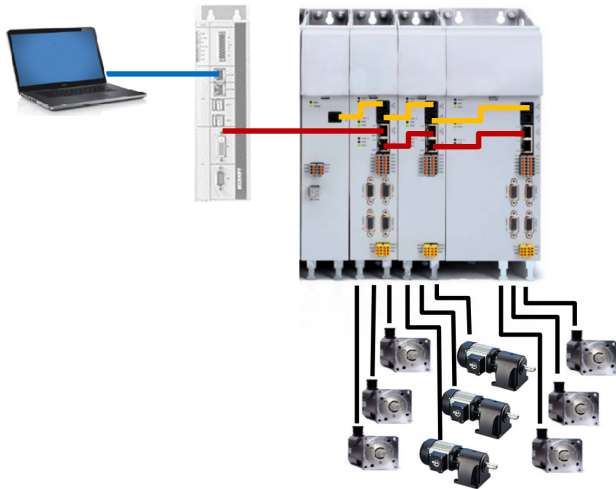


Fig. 3.1: EtherCAT Mode

### 3.3.2 EtherCAT® connection

Real-time data (PDO) and service data (SDO) are exchanged between the controller and the drives in an EtherCAT® network.

If you want to send Ethernet data (TCP/IP) data in an EtherCAT® network, the EtherCAT® master must support the Ethernet-over EtherCAT® (EoE) function in order to tunnel Ethernet data to the Axis Controller.

See also Section "Ethernet over EtherCAT® (EoE)" on page 27.

### 3.3.3 EtherCAT® Slave Information (ESI)

The ESI file in XML format enables commissioning of the Axis Controller on the EtherCAT® bus.

It contains information about the device properties, such as:

- Manufacturer information (EtherCAT® vendor ID, vendor name)
- Device information (device type and device name, FMMU, SM, process data, mailbox, synchronisation mode)

### 3.3.4 Service and diagnostics mode (TCP/IP)

From FW V2.20-02

#### 3.3.4.1 Activating the Ethernet interface's service and diagnostics mode

The Ethernet interfaces "X5.1 ECAT IN" and "X5.2 ECAT OUT" of the ServoOne CM are in the EtherCAT® operating mode by default after the first power up.

The EtherCAT® interfaces of the axis controllers must be set to the "service and diagnostics mode" in order to be able to establish a connection to the axis controllers via this interface using the PC and the installed DriveManager 5 even without a controller.

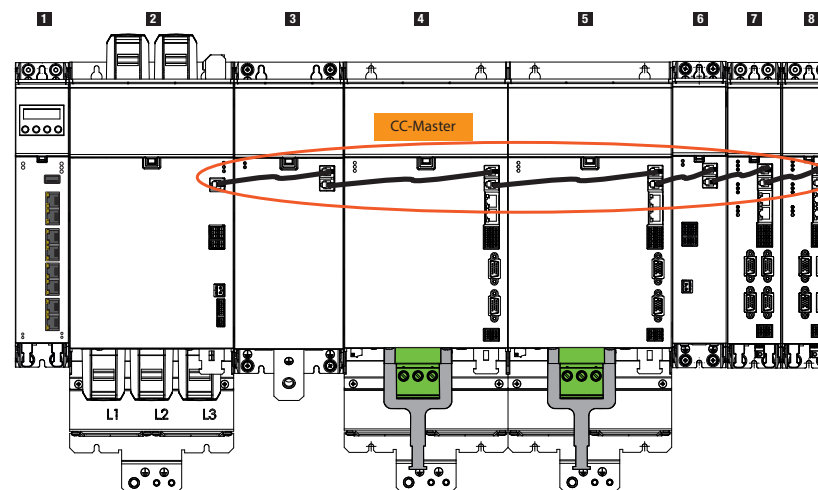




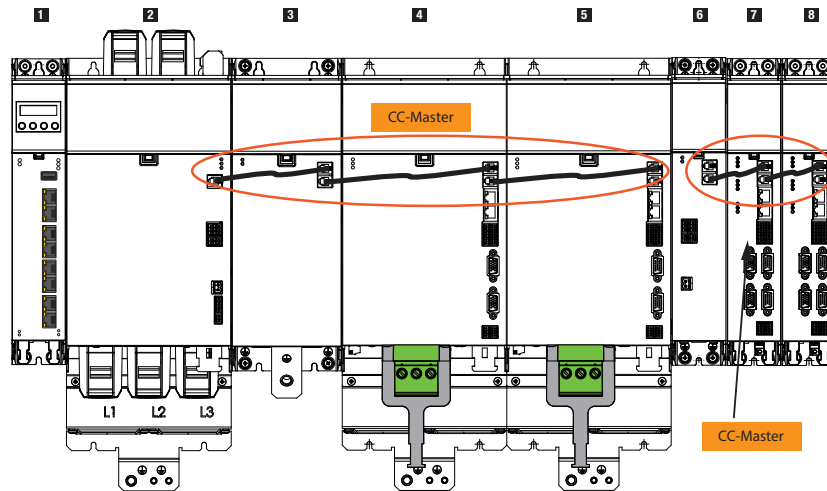
**NOTE** In order to activate the “service and diagnostics mode”, the first axis controller (cross communication master) on the right side of the power supply within the cross communication must be identified. Depending on the combination of with or without expansion or capacity modules and the necessary number of axes, it is possible for the cross communication to be interrupted on one expansion module. In this case, the next axis controller after the expansion module is a new cross communication master (CC master) and opens a new cross communication system. For this, the service and diagnostics mode must then be switched on separately.

Proceed as follows to switch over the EtherCAT® interface:

1. Determine the first axis controller after the supply unit, expansion module or capacity module.



Axis group with one supply unit and a maximum of 8 additional nodes --> **A cross-communication group**  
**1:** Controller **2:** Supply unit **3:** Capacity module  
**4:** Axis controller (CC master) **5:** Axis controller **6:** Expansion module **7:** Axis controller **8:** Axis controller  
 CC: Cross-Communication



Expanded axis group with supply unit, capacity module and axis controllers of sizes 3 and 4 as well as axis modules of sizes 1 and 2 connected via an expansion module --> **Two cross-communication groups**

**Cross-communication group 1:**

Axis group with one supply unit and a maximum of 8 additional nodes

**Cross-communication group 2:**

Expansion module and a maximum of 8 additional nodes **1:** Controller **2:**

Supply unit **3:** Capacity module **4:** Axis controller (CC master) **5:** Axis

controller **6:** Expansion module **7:** Axis controller **8:** Axis controller CC:

cross-communication

2. Switch system off.
3. After the next power up, depending on the number of axes, up to three yellow LEDs of the first axis controller light up briefly and then, after about 14 seconds, are on continuously for approx. **4 seconds**. This procedure repeats for every power up operation.  
**The only exception:** After a firmware update, it is possible that an update of the upstream supply unit could also take place on the restart. This can cause

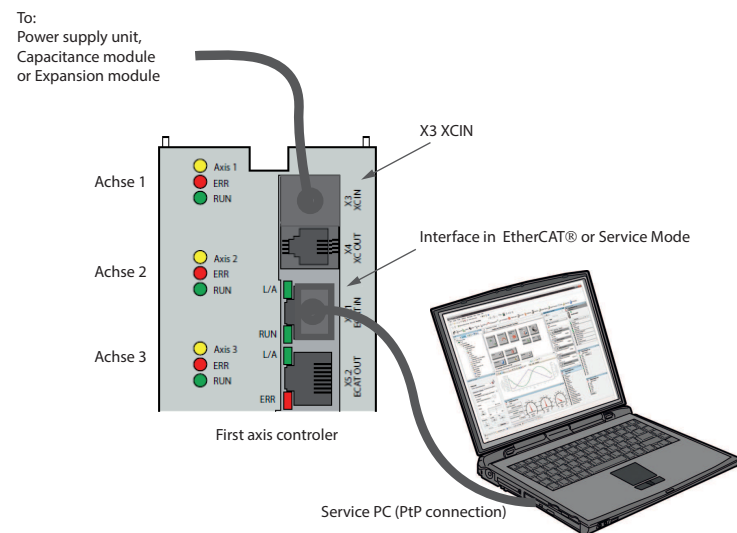
a one-time delay of the start-up operation by about 2 minutes. The loading of the firmware for the supply unit is indicated by the two supply unit LEDs blinking (0.5s/0.5s).

4. If, within the **4 second** time period, the cross communication connector (first axis controller - X3 XCIN) is disconnected and then reconnected, the interface will be put into the service and diagnostics mode the next time it is powered up. The activation of the interface switch-over is indicated by fast blinking of the yellow LEDs (0.1s/0.1s) on all of the axis controllers connected via the cross communication.
5. Switch the system off and then on again.  
All axis controllers operate in the service and diagnosis mode (standard Ethernet). This is indicated by slow blinking of the yellow LEDs (0.8s/0.8s). The IP, subnet mask and gateway are only configured in the first axis controller and are then incremented or applied for subsequent devices that are also connected via cross communication (e.g. 192.168.39.5 - 192.168.39.6 - 192.168.39.7 or 192.168.222.100 - 192.168.222.101 - 192.168.222.102 etc.).
6. The devices remain in this mode after a restart as well. The EtherCAT operating mode only becomes continuously operative again after the service and diagnostics mode is exited as described in Section "Exiting the "service and diagnostics" mode" on page 23.



#### NOTE

- An interface switchover as well as the activation of new IP configuration settings only become effective after a restart. When an axis controller in the group detects a change of the current configuration, the rapid blinking (0.1s/0.1s) of the yellow LED indicates that a restart is required. This also applies for exiting the service and diagnosis mode (*see also section "Exiting the "service and diagnostics" mode" on page 23*).
- A stable operating status has been reached when none of the yellow LEDs of the axis group are blinking rapidly (0.1s/0.1s)!



## NOTE

- The axis controllers cannot be energized while the cross communication to the supply unit is interrupted!

### 3.3.4.2 Exiting the “service and diagnostics” mode

Once the initial commissioning has been completed, the “service and diagnostics” mode must be exited. The Ethernet interface is switched back to the EtherCAT® operating mode.

Proceed as follows:

1. Select the DriveManager 5

Project → All devices → Exit service / diagnostics mode after mains power off/on.

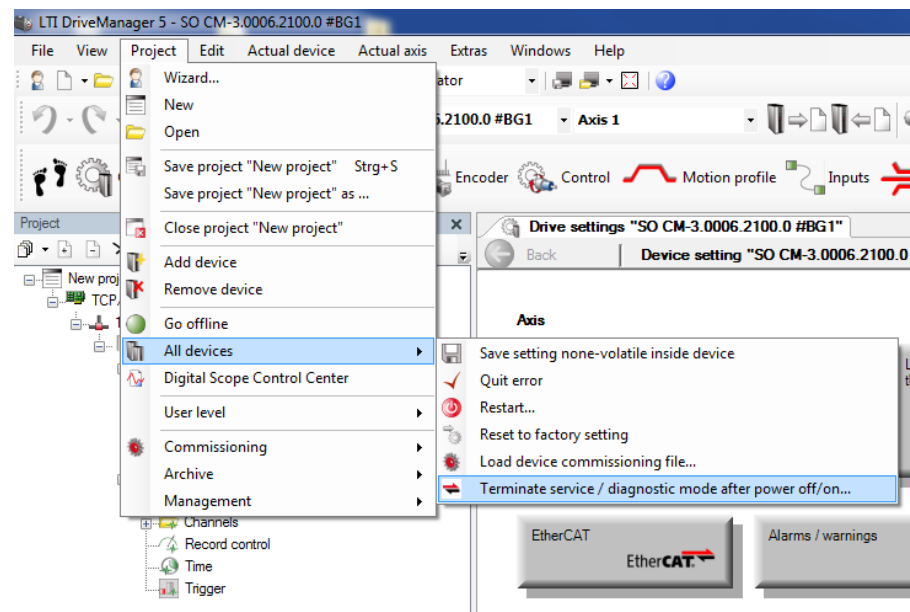


Fig. 3.2: Exiting the Service and Diagnostics mode

The axes affected by the switchover (into the EtherCAT® operating mode) are displayed in a dialog. The user can select which axes are to be switched into the EtherCAT® operating mode. Configuration can still be performed for those axes that are not selected.

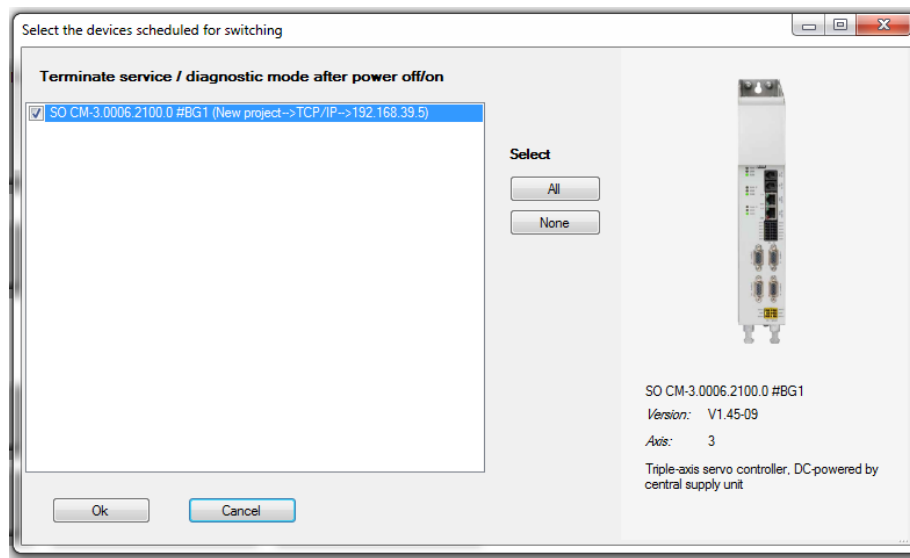


Fig. 3.3: Selection of the axes to be switched over

The selected switchover of the interface on the next power up is indicated again by rapid blinking (0.1s/0.1s) of the yellow LEDs.

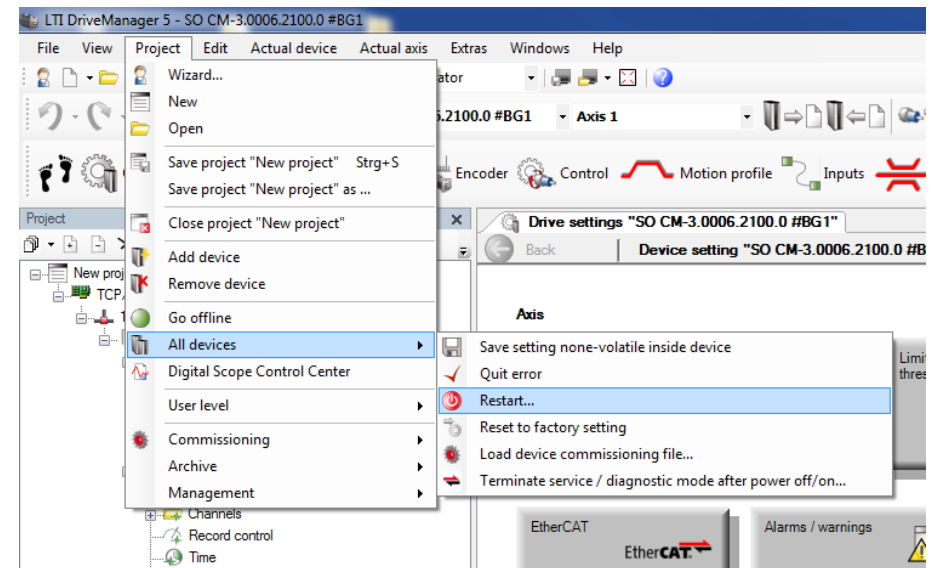


Fig. 3.4: Restart after selected switchover

A subsequent restart of the drive system leads to a direct start of the interface controller with EtherCAT® functionality. The yellow LEDs are switched off; the RUN LED behaves in compliance with EtherCAT®.

### 3.3.5 Reset to factory settings

#### 3.3.5.1 DriveManager 5

Step	Action
1.	Selection of the axis via the DriveManager 5 project tree
2.	<p>►Menu ►Active device ►Reset to factory setting</p> <ol style="list-style-type: none"> <li>1. Clicking ►Yes <b>without</b> ticking the checkbox resets the device to the factory settings <b>without</b> resetting the network settings.</li> <li>2. Clicking ►Yes <b>with</b> the checkbox ticked resets the device to the factory settings including the network settings.</li> <li>3. Clicking on ►No closes the window without a reset.</li> </ol>

**0x2014 PARA\_SetCmd, Subindex 3 Reset = (0)Ready**

automatically after end of saving

Reset time ≤ 10 s

This operation is for monitoring the timing of the function.

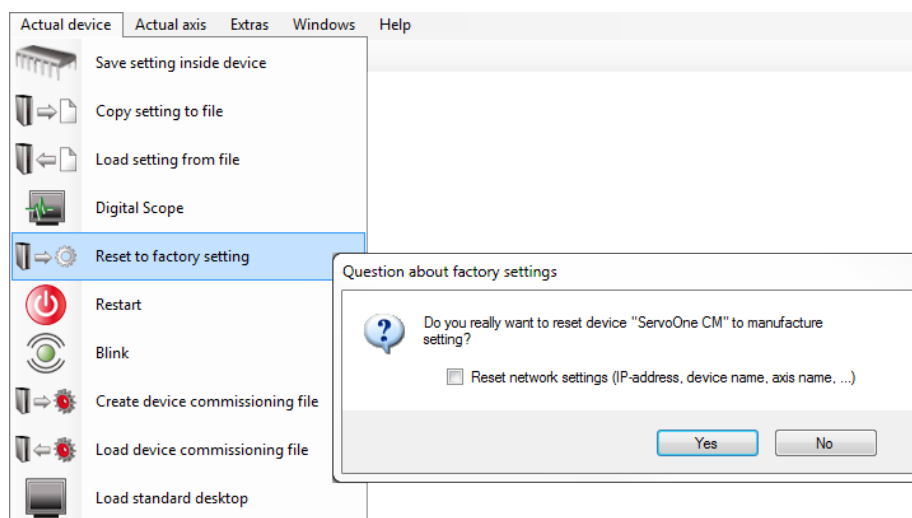


Fig. 3.5: Menu: Reset to factory settings

## 3.3.5.2 Fieldbus (EtherCAT®)

**0x2014 PARA\_SetCmd, Subindex 3(Reset) = (1)Start**

## 3.4 EtherCAT® interface



### NOTE

- For a basic description of EtherCAT® connections (name, position, function, specification) please refer to the ServoOne CM Operation Manual Axis Controller (ID No.: 1400.200B.x), chapter “EtherCAT® interface specification” from page 46.
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com) in the DOCU-PORTAL.

### 3.4.1 Pin assignment

Pin	Description
1	TransmitData+
2	TransmitData-
3	ReceiveData+
4	reserved
5	reserved
6	ReceiveData-
7	reserved
8	reserved

Table 3.2: RJ-45 plug assignment

### 3.4.2 Status LEDs

Information about behaviour and meaning of the LEDs on the EtherCAT® ports can be found in Section “Diagnostics and LED code” on page 526

### 3.4.3 Additional information



### NOTE

- Connection to other devices is by means of CAT5e patch cables.
- An open output on a slave will result internally in a logical short circuit on the transmit (Tx) and receive (Rx) lines.
- The EtherCAT® network topology corresponds to a logical ring.
- Use EtherCAT® and Ethernet nodes in separate physical networks to avoid malfunctions.
- Always use different cable colours for EtherCAT® and Ethernet cables to avoid confusion.

## 3.5 Ethernet over EtherCAT® (EoE)

The EtherCAT® master must meet the following requirement:

- support for the “Ethernet over EtherCAT®” (EoE) protocol
- Exchange of cyclic process data and acyclic standard Ethernet frames between EtherCAT® nodes using EoE
- Optimisation of the Ethernet communication without affecting the process data communication (“tunnelling” of the standard Ethernet frames in the EtherCAT® protocol).

### 3.5.1 EtherCAT® master

The EtherCAT® master acts as a virtual network card. The master’s operating system undertakes the routing of the IP frames such that these can be transported to the EtherCAT® nodes.

### 3.5.2 EtherCAT® slave

The configuration of the virtual Ethernet port is undertaken during operation by the EtherCAT® master. The master assigns the virtual MAC ID. The subnet mask and the default gateway must be selected manually. The IP address for the Ethernet network can be assigned via DHCP or manually.

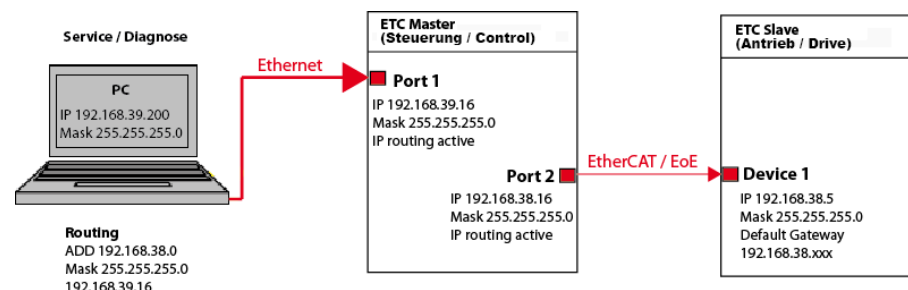


Fig. 3.6: EoE Routing configuration

Open the “cmd window” with administrator rights on your PC and follow the input prompt.

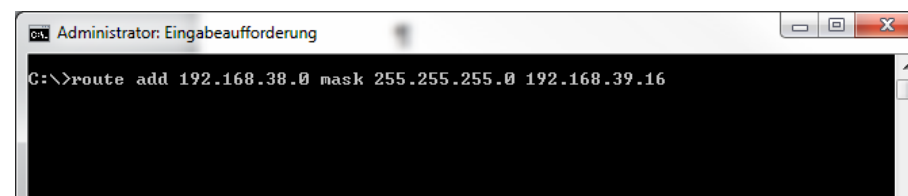


Fig. 3.7: Input prompt in cmd window

The configuration of the virtual Ethernet port is displayed in DriveManager 5 in the **object 0x2088 EoESettings**.

Object	Name	Example/Creation	Function (virtual)
0x2088	EoESettings		EoE settings
[1]	MAC	02:01:05:10:03:e9	MAC-ID
[2]	IP	192.168.38.5	IP address
[3]	SubNetMask	255.255.255.0	Subnet mask
[4]	DefaultGateway	192.168.38.99	Gateway
[5]	DNSServer	000.000.000.000	DNS Server
[6]	DNSName	ServoOne_CM	DNS Name

Table 3.3: Object 0x2088 EoE Settings



## NOTE

- The address range must match the address range of the EtherCAT® adapter in the master!

### 3.5.3 Configuration example Motion One CM Controller

Configuration of the “virtual Ethernet port” of a KEBA-Axis Controller in a network with a Motion One CM Controller is performed using MotionCenter.

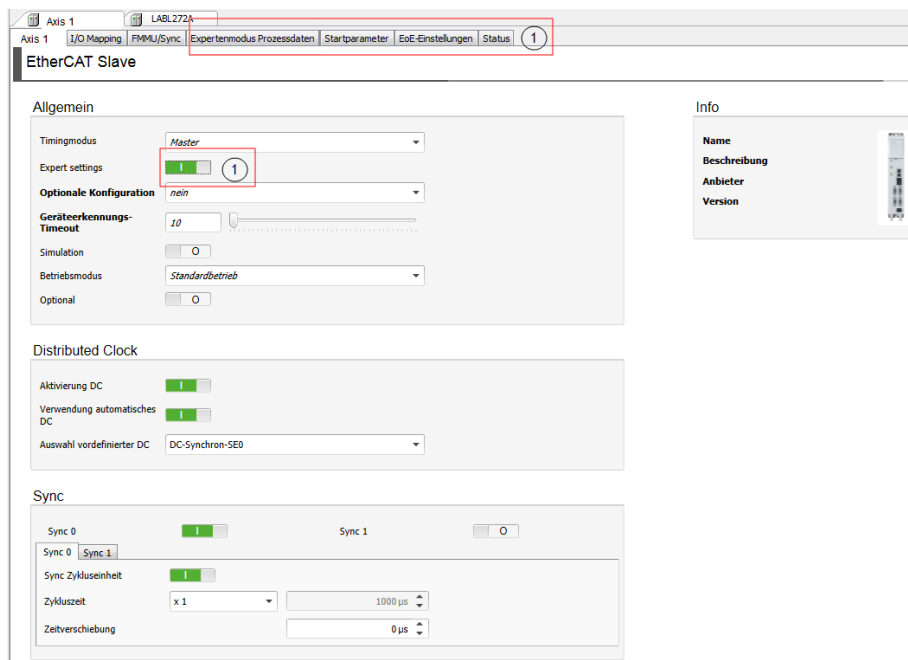
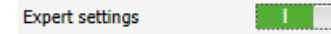


Fig. 3.8: "Expert setting"

- Set "Expert setting" to 1



① The following additional tabs can then be seen:

1. Expertenmodus Prozessdaten
2. EoE-Einstellungen

Table 3.4: "Expert setting"

### EoE settings

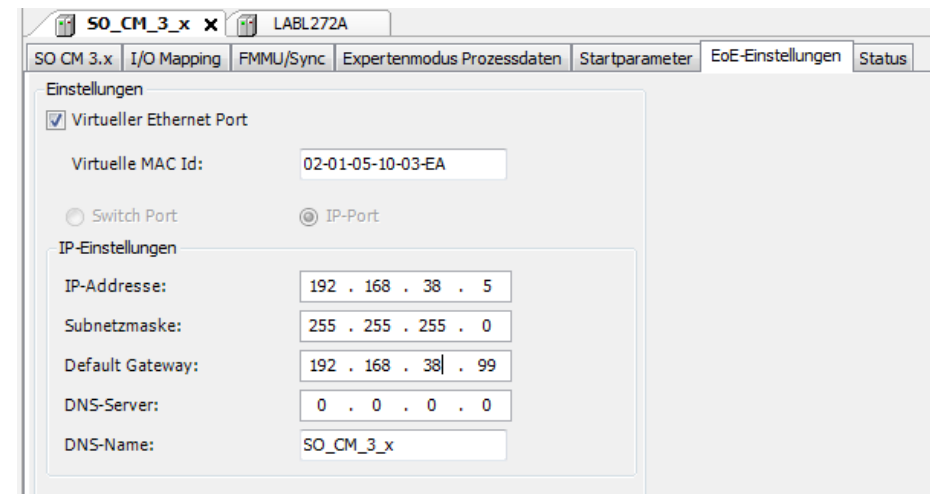


Fig. 3.9: Example for EoE settings

- **IP address**  
The setting corresponds to the default address of an KEBA axis controller.
- **Default gateway**  
The setting is dependent on the IP address of the controller.



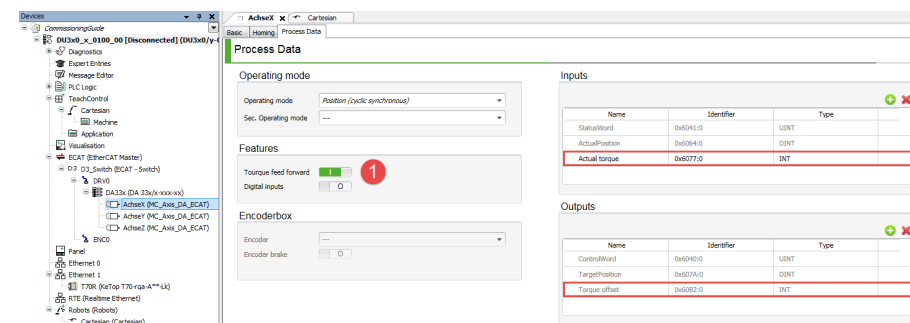
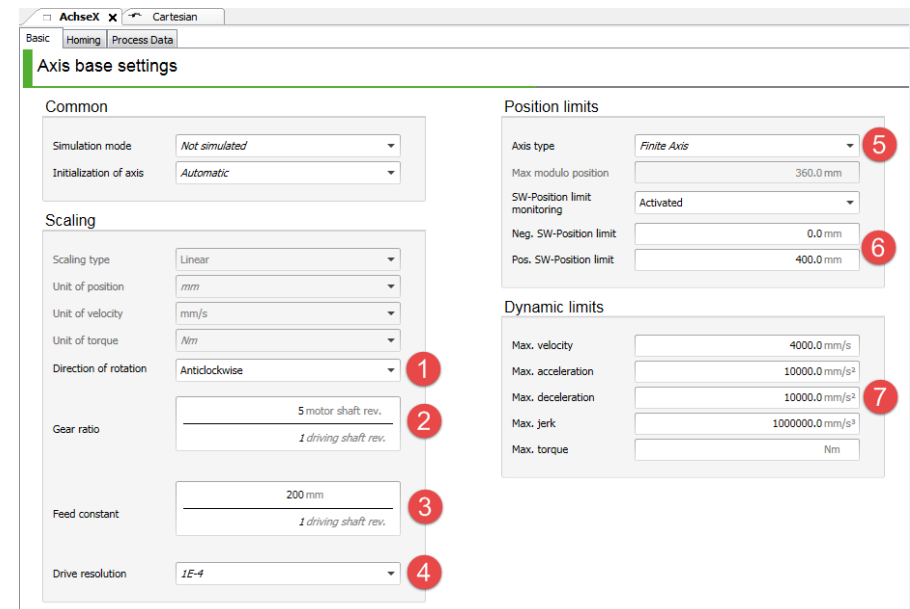
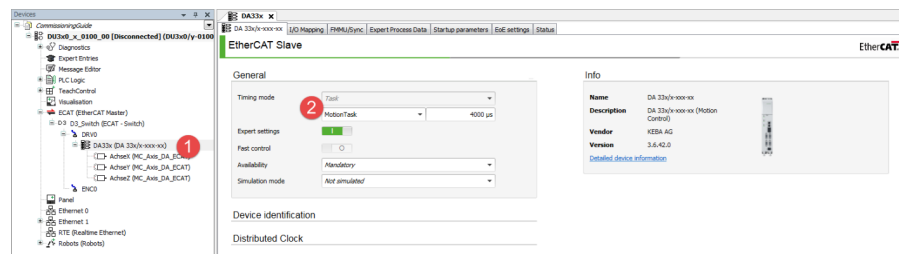
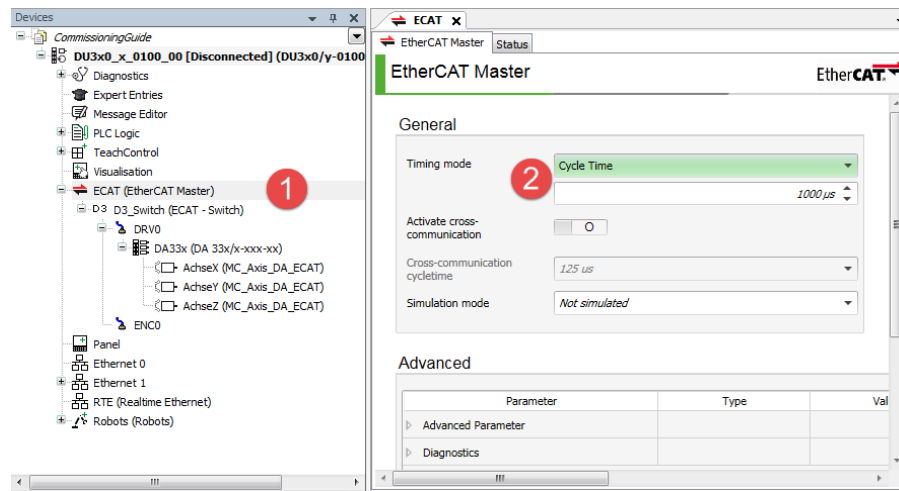
# 3 Device setting



ID No.: 1400.209B.7-01 Date: 10.2020

ServoOne CM with ServoOne CM-P - Device Help

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### 3.5.4 Configuration example Beckhoff Industry PC

The following figure shows the configuration of the virtual Ethernet port for a drive on the TwinCAT software system from Beckhoff. The EoE in the TwinCAT is configured in the advanced settings for the drive's EtherCAT® port. The corresponding IP address of the EtherCAT® adapter in the Beckhoff industrial PC is in the range of 192.168.38.xxx.

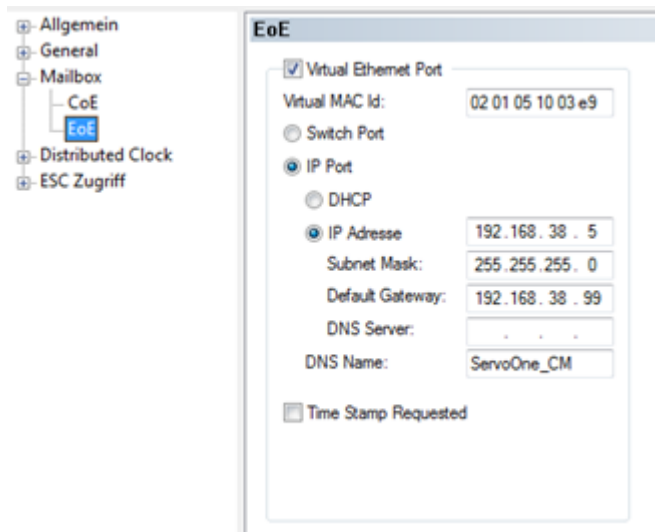


Fig. 3.10: Example: "Configuration of virtual Ethernet port" with a Beckhoff industrial PC.

## 3.6 Information about parameters

### 3.6.1 Number ranges

The ServoOne CMAxis Controller are used as a one-, two- or three-axis controller with a separate Supply unit. Depending on the number of axes, the parameters can be present in the device up to three times. To differentiate, the parameters of axes A1, A2 and A3 have a numerical offset of 2048 each. However, only the parameter number for axis 1 is indicated for better readability. Parameter lists in which the numbers are indicated for three axes, each separated by a slash, are an exception to this rule.

Parameter type	Parameter no. / object no.
System parameter (only present once in the device)	P 1...P 2047 [0x0001]...[0x7FFh]
Parameter Supply unit	P 0650...P 0710 [0x028A]...[0x02C6]
Parameter Axis Controller 1	P 2048...P 4095
Parameter Axis Controller 2	P 4096...P 6143
Parameter Axis Controller 3	P 6144...P 8191
EtherCAT® object no. CiA402	P 4096 [0x1000]...P 24576 [0x6000]

Table 3.5: Parameter no. / object no.

### 3.6.2 Representation of parameters in this Help

Parameter names are composed as follows:

1. Capital P
2. Space
3. Parameter number
4. Index (in square brackets)
5. Parameter name (separated from name / index by a hyphen)

To increase visibility in running text, parameter names are always written in **bold** type, e.g. **P 2652[0] - INom**. Parameter lists in which the initial capital P is *not* included and normal type is used are an exception to this rule.

### 3.6.3 Representation of EtherCAT® objects in this Help

The Help refers to EtherCAT® objects instead of parameters above all in Section "EtherCAT®" on page 451. For this reason, EtherCAT® objects are presented in hexadecimal notation in this chapter, e.g. **0x6040 - Controlword**.



#### NOTE

- In DriveManager 5 it is possible to toggle the display between parameter number (default) and EtherCAT® object ID:
  - ▶ Parameters in list view
  - ▶ Right-click in the parameter list
  - ▶ Display of the Object ID

## 3.7 Electronic rating plate

<b>Device:</b>		<b>Axis 1:</b>	
Type:	SO_CM_Xxxxxxxx	Control mode:	PCON
Number of axis:	3	Operational mode:	None
Serial number:		Motor:	
Device family:	ServoOne	Encoder: Torque	CH1
Manufacturer:		Speed	CH1
		Position	CH1
<b>Hardware:</b>		<b>Axis 2:</b>	
Control card Id:	SD0_REV_1	Control mode:	PCON
		Operational mode:	None
<b>Software:</b>		<b>Motor:</b>	
SW-version:	V1.40-11	Encoder: Torque	CH1
BIOS version:	V10.25-03	Speed	CH1
		Position	CH1
<b>Operational time:</b>		<b>Axis 3:</b>	
Total:	9 d 7 h 23 m 53 s	Control mode:	PCON
Power stage axis 1:	0 d 0 h 0 m 0 s	Operational mode:	None
Power stage axis 2:	0 d 0 h 0 m 0 s	Motor:	
Power stage axis 3:	0 d 0 h 0 m 0 s	Encoder: Torque	CH1
		Speed	CH1
		Position	CH1

Fig. 3.11: Electronic rating plate (example)

The electronic rating plate is displayed via ►Project tree ►Axis adjustment ►Device ►Drive data. It can return information about the device (serial number, type, revision status of hardware/software, operating hours) and the main axis configurations.

P No.	Index	Name	Unit	Description
21	0	DV_BiosVersion		BIOS version
22	0	DV_BiosVersionId		BIOS version ID
1	0	DV_DeviceId		Device ID
2	0	DV_DeviceName		Device name
3	0	DV_DeviceAliasName		Device name alias
4	0	DV_SwVersion		Firmware version
5	0	DV_DeviceFamilyName		Device series name
6	0	DV_SwVersionId		Software version number
7		DV_SwModulVersion		Software versions of the individual modules
7	0	Device		Software version of the entire device
7	1	Parameter meta data		Software version of metadata exchange of parameters
7	2	Digital scope		Software version of Scope interface
7	3	File system		Software version of the internal file system
8	0	DV_VendorName		Name of device manufacturer
9	0	DV_SerialNumber		Device (int.) Serial number
10	0	DV_OEM_SerialNumber		Device OEM serial number
11	0	DV_ArticleNumber		Device part number
12		DV_AxisAlias		Name of individual axis
12	0	DV_AxisAlias		
12	1	DV_AxisAlias		
12	2	DV_AxisAlias		
17		DV_HwVersion		Hardware version
17	0	Revision		
17	1	Variant		
17	2	Partnumber		Control board part number
19		DV_HMI		LED control word
19	0	KeyPad		Yellow LED
19	1	LedCtrl		LED on axis flashing
50		DV_PSTC_Info		Power stage controller information
50	0	C0_ID		Controller #0 Silicon ID
50	1	C0_SW		Controller #0 Software Version
50	2	C0_CHK		Controller #0 Software Checksum

Table 3.6: Parameter list – Device drive data

P No.	Index	Name	Unit	Description
50	3	C1_ID		Controller #1 Silicon ID
50	4	C1_SW		Controller #1 Software Version
50	5	C1_CHK		Controller #1 Software Checksum
51		DV_IdentVal		Hardware identification
51	0	PST0	V	Power stage 0 identification
51	1	PST1	V	Power stage 1 identification
546	0	DV_OEM_VendorId		Customer-spec. Vendor ID
547		DV_OEM_ProductCode		Customer-spec. Product-Code
547	0	DV_OEM_ProductCode		
547	1	DV_OEM_ProductCode		
547	2	DV_OEM_ProductCode		
550	0	DV_OEM_RevisionNumber		Customer specific revision number (part of OEM-dataset)
551		DV_CAL_ProdData		Production data – for internal use only
551	0	Bits		
551	1	Info		

Table 3.6: Parameter list – Device drive data (continue)

## 3.8 Firmware in the axis group



### NOTE

- All devices in an axis group must have the same firmware. When replacing a device, the firmware must be adjusted manually or via the controller.
- Please also note the information in the DriveManager 5 program help in the chapter "Loading firmware".

### 3.8.1 ServoOne CM-P Firmware

For every ServoOne CM firmware version, there is an associated ServoOne CM-P firmware version. If the subsequent ServoOne CM detects an incorrect ServoOne CM-P firmware version after the system start, a firmware update of the ServoOne CM-P is carried out automatically. The ServoOne CM-P firmware update can be recognized by a blinking code (see the Operation Manual concerning this). The 24V supply voltage must not be interrupted during this time.

### 3.8.2 ServoOne CM firmware

All devices of an ServoOne CM axis group must have the same firmware version. The firmware is provided as a .tftpcom or .comdvarc file (e.g. V002\_15\_00.tftpcom).

The following options for a firmware update are available:

#### From the service PC:

- Update all devices:  
DriveManager 5: Menu → Project → All  
Devices → Load device commissioning file

- Update individual device:  
DriveManager 5: Menu → Extras → Load firmware  
LTI Commissioning Loader: Select Connection → Select file for device commissioning

## 3.9 File system

ServoOne CM has an internal file system that can be read and written to by a controller via the TFTP protocol. This function allows for automatic backup and reimport of the configuration.

The files only differ in terms of their name because the TFTP protocol does not support a directory tree.

The files are text files in the **comma separated values (csv)** format. The syntax is:

**P<Parameter-Number>[Subindex];"<Value>"**

Example:

P3[0];"SO\_CM\_3"

### 3.9.1 Parameter backup

File	Contents	Comments
_SE_DO_DS_DB_BD_Drive.csv	Motor data sets of all axes	Writing deletes the backup data
_SE_DO_DS_DB_BS_System.csv	Other settings of all axes and of the system	Writing deletes the backup data
_SE_DO_DS_DB_BI_Diagnosis.csv	DigitalScope settings	

*Table 3.7: Parameter backup*

The backup files are used for non-volatile storage of the parametrization. They are always written by the drive itself when the "Save parameters in the device" function is called.

The controller obtains the configuration that was last saved when it reads these files. Only those parameters appear which differ from the default configuration.

Writing these files makes a background update possible, which only takes effect after the next reboot of the axis module.

With some files, writing deletes the backup data for the encoder special function (for more on this, see 7.11 Advanced encoder function).

## 3.9.2 Current parameter values

File	Contents	Comments
_SE_DO_DS_DA_AF_All.csv	All parameters of all axes and of the system	
_SE_DO_DS_DA_AL_All.csv	All parameters of all axes and of the system	Only those settings which differ are written
_SE_DO_DS_DA_AD_Drive.csv	Motor data sets of all axes	
_SE_DO_DS_DA_AS_System.csv	All other settings of all axes and of the system	
_SE_DO_DS_DA_AI_Diagnosis.csv	DigitalScope settings	
_SE_DO_DX_X0_T0_A0_All.csv	All parameters of the axis (1, 2, 3)	Parameter numbers adapted
_SE_DO_DX_X1_T1_A1_All.csv		
_SE_DO_DX_X2_T2_A2_All.csv		
_SE_DO_DX_X0_T0_D0_Drive.csv	Motor data set of the axis (1, 2, 3)	Parameter numbers adapted
_SE_DO_DX_X1_T1_D1_Drive.csv		
_SE_DO_DX_X2_T2_D2_Drive.csv		
_SE_DO_DX_X0_T0_S0_System.csv	Other settings of the axis (1, 2, 3)	Parameter numbers adapted
_SE_DO_DX_X1_T1_S1_System.csv		
_SE_DO_DX_X2_T2_S2_System.csv		

Table 3.8: Current parameter values

The files indicated are not saved as files, but are instead mapped to the parameters of the axis module. When read, a complete list of the current configuration is read. When writing, any number of settings can be indicated; these are written directly to the parameters.

The parameters of the individual axes are distinguished in the device by an offset of the parameter number of 2048 (0x800). When accessing the parameters of individual axes, these are shifted to the number range of the first axis. This means the files can be used to copy the configuration to a different axis.

## 3.9.3 Compensation tables

_SE_DO_DS_DF_TB_*	/Settings/DV_MO/DeviceSetting/Files/COMPTAB/*
-------------------	---

The data of the compensation tables are stored in a separate data format (for more on this, see 8.11 Compensation function).

All compensation data are stored with the prefix \_SE\_DO\_DS\_DF\_TB\_ and an individual name. The name corresponds to the contents of parameter **P 3000.1** (and those corresponding).

## 3.9.4 Backup & Restore

File	Contents
_MD_CM_FirmwareAndSettingFiles.txt	Complete device functionality
_MD_CM_FirmwareFiles.txt	Only firmware
_MD_CM_SettingFiles.txt	Only configuration

Table 3.9: Backup & Restore

An important use case for the file system is saving and reimporting the device configuration via the controller. A differentiation is made between the firmware, settings and complete functionality.

The above-mentioned files each contain a complete directory of the configuration files which are to be backed up from this axis module for the respective use case.

## 4 Central supply unit

### Chapter overview

#### Pictogram



#### Navigation

► Central supply unit

#### Brief description

This chapter describes the parametrization of the Supply unit ServoOne CM-P.

#### Contents

4.1 Supply unit .....36

### 4.1 Supply unit

The Supply unit provides the Axis Controlern with supply voltage for drives (325 V - 678 V DC) and optionally the supply voltage for control electronics and motor brakes (24 V DC). It also manages the brake chopper and mains power supply.

Because the Supply unit has no direct connection to a service or fieldbus interface, parametrization, diagnostics and status display are realized by means of the Axis Controller with which the Supply unit is directly connected by cross-communication. The parameters are displayed in the other Axis Controlern but cannot be edited there.

On the front of the Supply unit there are outputs (TP00, TP01) that provide an OSSD output signal with which to check the wiring of the STO inputs of the Axis Controller for short-circuit and cross-circuit. It is also possible to parametrize two relays (1x normally open contact, 1x changeover contact) with regard to switching condition and state.

Two LEDs indicate the status of the supply unit, for details see Section "Status LEDs " on page 38

As of production year 2018, the serial number and the operating time in hours of the Supply unit can be queried using parameter **P 704**.

ID	Index	Name	Unit	Description
704	39	sernr		Serial number of the VSU
704	40	top	h	Operating time of the VSU

Table 4.1: Parameter - Serial number and operating time





## NOTE

- For a complete description of connectionsSupply unit (label, position, function) please refer to the ServoOne CM-P Operation Manual Supply unit(ID No.: 1400.201B.x), chapter "Installation" on page 21.
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com) in the DOCU-PORTAL.

## 4.1.1 Configuration

Integrated busbar elements coming from the Supply unit provide the Axis Controller with DC link voltage. If the Supply unit has an integrated switched-mode power supply, it also provides 24 V control voltage with which a Motion One CM Controller can also be supplied. The configurable digital outputs display the status of the Supply unit.



## NOTE

**Voltage supply "1 x 230 V" and  
Voltage supply "3 x 200 V (Japan)"**

- When selecting the mains voltage, please bear in mind that the mains supply "1x230(1) = 1 x 230 V" and "3x200(5) = 3 x 200 V (Japan)" represent special applications. Only use this type of mains voltage after consulting with your LTI sales representative or application engineer.

Voltage supply selection	User(0) = User		
Number of phases	three-phase(1) = Three-phase		
Actual DC-voltage	565	Vdc	
Undervoltage at	400	V	Delay from undervoltage to SwitchOnDisabled
Operational at	425	V	
Overvoltage at	687	V	
Activation of brake chopper at	652	V	

Caution: After entering a new voltage level the supply unit will be automatically restarted. The selected voltage will be activated and the voltage levels will be recalculated.

## Digital standard outputs:

X5 / REL Output	CT271(18) = on, if bit 0 in para 271 is set	Options ...
X6 / State	ERR(2) = on, if any error on vsu is active	

Select chopper type	INT(0) = internal brake chopper selected, klixon watch off, pxt watch on			
Rated resistor	56	Ohm	<b>Chopper efficiency:</b>	
Continuous power	75	W		
Peak power for one second	1500	Ws		
			Actual value	0 %
			Prewarning threshold	80 %

Fig. 4.1: "Setting the Supply unit" dialog box

## Select brake chopper

Use parameter **P 713** to select and configure the brake chopper of the VSU.

Generally, there are VSUs with brake choppers installed internally as well as those with an external brake chopper.

With an **internal** brake chopper, the data are selected based on the VSU type ID (parameter **P 702[6] - typcd**) and on start-up, the values are entered in parameter **P 653[0-2]** and are transmitted to the VSU. There is no provision for a Klixon temperature switch here.

With an **external** brake chopper, the data are taken from parameter **P 712[0-2]**.

The resistance value indicated is important because the chopper performance is calculated using the DC-link voltage and the resistance value indicated.

Parameter **P 653[1] / P 712[1]** specifies the permissible continuous power of the brake chopper. Index 2 specifies by how many watts the continuous power rating can be exceeded for 1 second. For less power, the time until there is a fault switch-off is extended accordingly. All of this only takes effect when pxt watch is selected in parameter (**P 713[0] - ExdtIntSel**).

**Parameter P 713 offers the following selection options:**

ID	Index	Name	Unit	Description
713		SUPPLY_BrakeChopperGlobal		Brake chopper protection function settings
713	0	ExtIntSel		INT = 0: Internal brake chopper, Klixon test ON, pxt monitoring ON
				EXT = 1: External brake chopper, Klixon test ON, pxt monitoring ON
				EXT_NOPXT = 2: External brake chopper, Klixon test ON, pxt monitoring OFF
				EXT_NOSWITCH = 3: External brake chopper, Klixon test OFF, pxt monitoring ON
				EXT_NOPROT = 4: External brake chopper, Klixon test OFF, pxt monitoring OFF

Table 4.2: Parameter "P 713 - undervoltage"

## 4.1.2 Status LEDs

Behaviour	Green LED (operating display)	Red LED (error display)
Off	-	No error and no warning.
Flashes slowly	Ready, DC link is not connected to mains power supply.	There is a pending warning but the Supply unit is ready. For details on warnings, see Table 12.2: Supply unit warnings and Table 12.3: Parameter list - Axis warnings/errors.
Flashes quickly	Supply unit is pre-loading, may take a few seconds.	-
On	Supply unit is pre-loaded and connected to mains power supply.	There is an error, the DC link is disconnected from the mains. Error message is displayed in the axis modules.

Table 4.3: Meaning of status LEDs on supply unit

## 4.1.3 Power failure bridging

There are 2 ways of operating the supply unit:

1. The two-phase mains connection for the 24 V must be operated with an additional mains filter in order to comply with the EMC guidelines of the mains provider.
2. A second possibility is for the two-phase mains connection for the 24 V to be connected via a contactor after the mains filter of the main supply. The contactor must disconnect both phases as soon as the supply unit has started up. It is important that both of these phases be disconnected before one of the drives is energized.

**Moreover, the current output to the 24 V power supply unit must not be more than 10 A!**



### NOTE

- This section only applies if using a Supply unit with a 24 V switched-mode power supply **with 24 V backup** (Product No. 145x.xxxx.2xxx.x, product name SO CM-P.0xxx.2xxx.x).

The **P 711[0] - SUPPLY\_DcLinkCoupling** = CPLDIR(3) setting couples the DC link of the power supply and the DC link of the 24 V switched-mode power supply after successful pre-loading. Both stay coupled until the Supply unit is switched off. This is useful, for example, to bridge brief power outages without shutting down the system.

Other settings for **P 711[0]** are not allowed and lead to an error message.



### NOTE

- Further information see also section "Power failure management" on page 175

## 4.1.4 Undervoltage



### NOTE

- This function requires a Supply unit with "24 V backup for power failure" (Product No. 145x.xxxx.2xxx.x), otherwise the 24 V power supply to the control components cannot be maintained. For details please refer to Operation Manual ServoOne CM-P Supply unit(ID No.: 1400.201B.x) in chapter "24 V backup for power failure" from page 41.
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com) in the DOCU-PORTAL.
- The 24 V supply voltage can also be maintained by an uninterruptible power supply (UPS).

If the mains supply fails, then the DC link voltage in the multi-axis system drops. If it falls below the minimum value, error 15-1 Undervoltage is triggered on all axes that were switched on at that point in time. However, it is not possible for the axes to remain in continuous operation when the mains voltage is restored.

In the "Setting of the Supply unit" screen, you can define a delay time (0..2000 ms) in the "Delay between undervoltage and controller shut-down" field (**P 1003[0] - MON\_UnderVoltTime**) before the drive is locked with an error message. This allows you to initiate a specific reaction during this time even before the undervoltage error reaction locks the power stage (see Section "Error reactions" on page 225).

ID	Index	Name	Unit	Description
1003	0	MON_UnderVoltTime	ms	Delay between undervoltage and shut-down of the controller

Table 4.4: "Supply unit – Undervoltage" parameters

#### 4.1.4.1 Reaction of the axes when there is an undervoltage

Braking of the axis if there is an undervoltage can be achieved most easily by setting the error reaction for error 15 (see chapter 12.2 Error reactions) to ServoStop. Using (P 1003[0] - MON\_UnderVoltTime), reserve the longest amount of time that the axes of this device require until they are braked.

The power failure management (see chapter 8.12 Power failure management) offers additional features for synchronous shutting down of the axes.

#### 4.1.4.2 Saving the backup data

The necessary backup data for the advanced encoder function (see 7.11 Advanced encoder function) are not saved reliably in the event of an undervoltage.

To ensure safe storage of these, the system must be supplied with control voltage (24 V) for 15 seconds.

#### 4.1.5 Parameter

ID	Index	Name	Unit	Description
270		MPRO_OUTPUT_FS		Supply unit: Relay selector
270	0	OUTPUT_X5		Supply unit: Relay X5 settings
270	1	OUTPUT_X6		Supply unit: Relay X6 settings
271	0	MPRO_OUTPUT_CT		Supply unit: Control relay
		DC link		Settings and actual values for DC voltage, DC switching, brake circuit, and axis readiness. Read the operating instructions.
200	0	MPRO_DRVCOM_SystemState		DriveCom: System status
201	0	MPRO_DRVCOM_Supply		DriveCom: Supply unit
602		PST_VoltageSupply		Voltage supply data
602	0	NomVoltage	Vdc	Nominal voltage

Table 4.5: Parameter central Supply unit

ID	Index	Name	Unit	Description
602	1	SupplySel		Voltage supply selection
602	2	Phase		Number of phases
602	3	WideRange		Enables autodetection of mains voltage in range 380 to 480V
653		SUPPLY_BrakeChopperInternData		Description of internal brake chopper. The three values are factory-set and must not be changed.
653	0	r_bci	Ohm	Value of internal brake chopper
653	1	pwsti	W	Rated power of brake chopper
653	2	pw1si	Ws	Maximum brake chopper energy (power * time)
711	0	SUPPLY_DcLinkCoupling		DC link coupling setting
712		SUPPLY_BrakeChopperExternData		Description of external brake chopper
712	0	r_bce	Ohm	Value of external brake chopper
712	1	pwste	W	Rated power of brake chopper
712	2	pw1se	Ws	Maximum braking energy in short time
713		SUPPLY_BrakeChopperGlobal		Brake chopper protection function settings
713	0	ExtIntSel		Brake chopper protection function settings
713	1	pxtlv	%	Brake chopper pxt: Warning threshold
		Debug		Do not use
613		PST_VoltageLevels		Axis controller voltage level
613	0	DCUV	V	DC link under voltage
613	1	DCOK	V	DC link OK
613	2	DCOV	V	DC link over voltage
613	3	CHOP	V	Braking chopper threshold
613	4	RELAY	V	Relay

Table 4.5: Parameter central Supply unit (continue)

#### 4.1.6 Displaying actual values

Actual values of the Supply unit can be displayed using the scope function. Display of the scope variables listed below only works with the first Axis Controller of the axis group.

The locations indicated are defined as follows:

1. = mains side before rectifier
2. = DC link

## 3. = brake chopper

Location	Scope variable No.	Scope variable name	Explanation	Unit
	1904	P4_P0_OutState	State of VSU outputs BC and IGBT	
	1905	P10_OutState	State of VSU outputs K100 to K102	
	1917	vlsta_ram	state of charging	
	1927	PreChargeRelay	1 - VL relay closed	
	1928	StatusBits	Internal status bits	
1.	1913	MaxPhaseVolt	Max. grid volt. from all phases	V
1.	1914	MaxPhaseVolt	maximum grid voltage L1	V
1.	1915	MaxPhaseVolt	maximum grid voltage L2	V
1.	1916	MaxPhaseVolt	maximum grid voltage L3	V
1.	1921	IeffLine1	Grid current line1 Vsu	A
1.	1922	IeffLine2	Grid current line2 Vsu	A
1.	1923	IeffLine3	Grid current line3 Vsu	A
1.	1924	I2T_CountLine1	I2T counter line 1	%
1.	1925	I2T_CountLine2	I2T counter line 2	%
1.	1926	I2T_CountLine3	I2T counter line 3	%
1.	1934	I2T_MaxValue	I2T max	%

Table 4.6: Scope variables central Supply unit

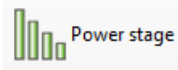
Location	Scope variable No.	Scope variable name	Explanation	Unit
			value L1 to L3	
2.	1906	AverageCurrent	Average current value in the DC link DC link average current	A
2.	1911	RmsCurrent	Rms current over one period	A
2.	1912	i16Filter_ZK_ME	DC Link voltage	V
2.	1919	I_LADE	dc link current Vsu	A
2.	1920	VsuPower	Power consumption on DC link	kW
3.	1918	i16Filter_I_BW	Brake chopper current	A
3.	1933	pxtbc_ram	Overload counter, brake chopper overload counter brake chopper	%
3.	1907	BcPower	brake chopper power	kW
3.	1935	BcPowerFilter	Filter power indicator, brake chopper brake chopper power; long term filter	kW

Table 4.6: Scope variables central Supply unit (continue)

# 5 Power Stage

## Chapter overview

### Pictogram



### Navigation

► Project tree ► Axis adjustment ► X axis ► Power stage

**Brief description** This chapter describes power stage switching frequency and automatic switching frequency switchover.

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## 5.1 Setting for the switching frequency

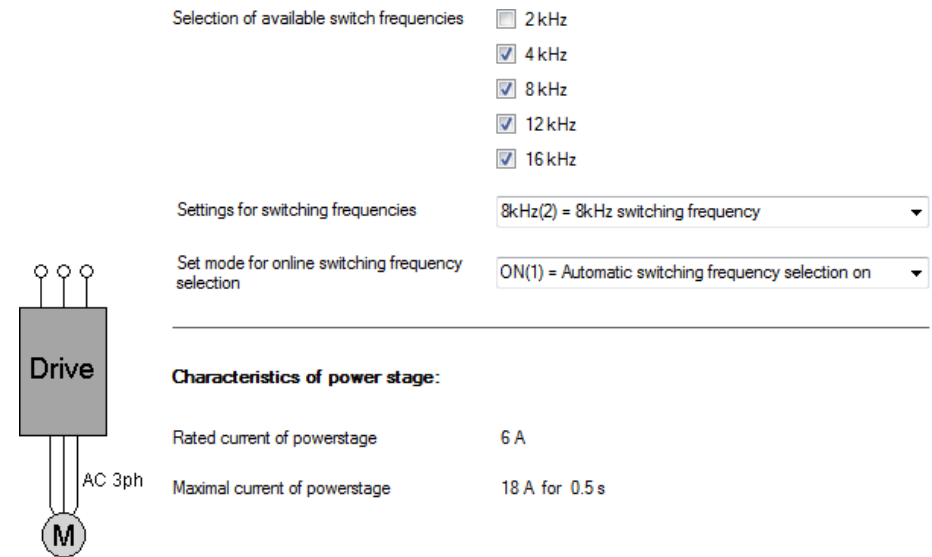


Fig. 5.1: "Power stage settings" dialog box Axis Controller

### 5.1.1 Automatic switching frequency selection

The setting **P 3060[0] - Mode** = "ON" (factory setting) switches the selected switching frequencies over in consideration of the current load states. The switchover takes place on the basis of defined switching criteria (see below), and switchover can also be performed manually via **P 3060[1] - Frequency**. The starting point for switchover and the highest switching frequency is the value configured in **P 3060[1] - Frequency**.

A selection of switching frequencies between which switching is performed can be made via the list view. To do so, right-click on the dialog box, then “Switch to graphical view”.

- Switchover is only performed between the configured switching frequencies from **P 3062[0] - CON\_SwitchFreqMask\_Sel** and never higher than **P 3060[1] - Frequency**.
- The possible switching frequencies that can be set can be seen in **P 3061[0] - CON\_SwitchFreqMask**.

Switchover criteria	Condition	Action
Actual value monitoring of the current phasor	I <sub>Phasor</sub> > 110% I <sub>Max</sub>	switch down to next possible switching frequency
	I <sub>Phasor</sub> < 110% I <sub>Max</sub>	switch up step by step after 2 s
Actual value monitoring of the current phasor < 5 Hz	I <sub>Phasor</sub> > I <sub>maxDC</sub>	switch down to next possible switching frequency
	I <sub>Phasor</sub> < I <sub>maxDC</sub>	switch up step by step after 2 s
I* <sub>t</sub> < 5 Hz P 3049[5]	P 3049[5] > 80 % P 3049[5] > 55 %	switch down to lowest switching frequency switch down to second-lowest switching frequency

Table 5.1: Switchover criteria

Switchover criteria	Condition	Action
	P 3049[5] < 45 % P 3049[5] < 20 %	switch up to second-lowest switching frequency switch up to highest switching frequency
I <sub>2t</sub> P 3049[1]	P 3049[1] > 80 % P 3049[1] < 55 %	switch down to lowest switching frequency switch down to second-lowest switching frequency
	P 3049[1] < 45 % P 3049[1] < 20 %	switch up to second-lowest switching frequency switch up to highest switching frequency

Table 5.1: Switchover criteria (continue)



## NOTE

- If the frequency switchover is to be carried out by an external controller, the “Automatic online switching frequency switchover” function must be switched off. Switchover can then be performed via **P 3061[1] - Frequency**.

## 5.1.2 Setting the switching frequency manually

With the setting **P 3060[0] - Mode** = “OFF” it is necessary to select the switching frequency using **P 3060[1] - Frequency** (factory setting = 8 kHz(2)).

A high switching frequency can lead to a temperature-dependent loss of power. Switching frequency noises will decrease with increasing switching frequency (audible range < 12 kHz).

### 5.1.3 Parameter



P No.	Index	Name / Setting	Unit	Function
3060 / 5108 / 7156		CON_SwitchFreq		Axis 1 / 2 / 3: Switching frequency setting
	0	Mode		Factory setting: ON
		(0) OFF		Function not active
		(1) ON		Automatic Switching frequency switchover active.
	1	Frequency (0) 2 kHz (1) 4 kHz (2) 8 kHz (3) 12 kHz (4) 16 kHz		Setting the switching frequency, factory setting: 8 kHz  <div>  <b>NOTE</b>            The bits must be set in <b>P 3061[0]</b>            - <b>CON_SwitchFreqMask</b> and  <b>P 3062[0]</b> - <b>CON_SwitchFreqMask_Sel!</b> </div>
3061 / 5109 / 7157	0	CON_SwitchFreqMask		Axis 1 / 2 / 3: Permissible switching frequencies: Bit 0 (2 kHz) Bit 1 (4 kHz) Bit 2 (8 kHz) Bit 3 (12 kHz) Bit 4 (16 kHz)
3062 / 5110 / 7158	0	CON_SwitchFreqMask_Sel		Axis 1 / 2 / 3: Selection of switching frequencies for automatic switchover: Bit 0 (2 kHz) Bit 1 (4 kHz) Bit 2 (8 kHz) Bit 3 (12 kHz) Bit 4 (16 kHz)  <div>  <b>NOTE</b>            Selection only possible if the switching frequencies are also set in <b>P 3062[0]</b> - <b>CON_SwitchFreqMask_Sel.</b> </div>
3064 / 5112 / 7160	0	MON_OperationEnTime	s	Axis 1 / 2 / 3: Time in "power stage active" state

Table 5.2: Parameter "Power stage"



# 6 Motor

## Chapter overview

### Pictogram



### Navigation

► Project tree ► Axis adjustment ► X axis ► Motor

### Brief description

The following chapter describes the steps used to calculate parameters for, identify, and configure motors, as well as their protection mechanisms and brake.

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## 6.1 Connections and pin assignments



### NOTE

- Only the main connections and pin assignments are listed here in order to simplify commissioning.
- For a complete description of the motor connections of the Axis Controller (designation, position, pin assignment, function) for correct installation of devices, please refer to the Operation Manual ServoOne CM Axis Controller chapter “Overview of connections” and “Motor connection”.
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com) in the DOCU-PORTAL.

### 6.1.1 Axis Controller: Plug-in connectors X12, X13 and X14

Depending on the Axis Controller used, the following plug-in connectors are available for the motor connection.

Axis Controller	Plug-in connector		
	X12	X13	X14
Single-axis controller	X	-	-
Double-axis controller	X	X	-
Three-axis controller	X	X	X

Table 6.1: Plug-in connectors X12, X13, X14 motor connection

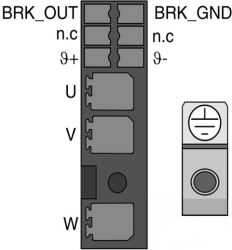
	X12 X13 X14	Function	Specification
<b>X12/X13/X14</b>  	1 (9+ / DSL-) 2 (9- / DSL+)	Motor temperature sensor connection or Hiperface DSL one-cable solution	Cross-section: 0.14 - 1.5 mm <sup>2</sup> AWG 24-16
	3 (BRK_OUT) 4 (BRK_GND)	Connection of motor holding brake I <sub>br</sub> = max. 2A	
	U / V / W	Motor phases connection	Cross-section: 6 mm <sup>2</sup> max.
	PE screw terminal	Connection for PE of the motor power cable	M4 screw

Table 6.2: Specification of the motor connections X12/X13/X14


## 6.2 Motor, general

### 6.2.1 Motor data

The basic suitability for operation with KEBA controllers must be checked based on the motor data of the motor used and the data of the encoder. The value for the parameters for adapting the controller must be determined for every motor by calculation or through identification. These two methods differ in that when the motor data set is calculated, the impedances and inductances must be taken from the data sheet. Impedances and inductances are automatically measured for identification. Both methods cause the motor's control parameters to be set to a basic setting.

The motor data sets also contain parameters for maximum current (**P 2964[6] - MOT\_CMax**) and maximum speed (**P 2964[18] - MOT\_SMax**) of the drive. Both parameters define an absolute limit that cannot be exceeded even by adjusting the limitations (see Section "Limitations and Thresholds" on page 214). Maximum motor current is also monitored in operation. If this level is exceeded, error 10-7 is triggered. Maximum current and maximum speed can also be set to zero, in which case they have no function. Parameters are configured in the dialog boxes of the various motor types (see Section "Synchronous motor" on page 48, Section "Linear motor" on page 51 and Section "Asynchronous motor" on page 55).

### Motor data and control settings



Motor name

Motor type

Select motor

---

### Manual control data setting

Motor type

Linear motor ☐

Calculate control settings subject to motor data sheet

Calculate control settings subject to motor data identification

---

### Further settings

Fig. 6.1: Motor configuration dialog box

## 6.2.2 Usage of a KEBA standard motor

The following procedure and sequence are recommended for commissioning a KEBA motor:

Step	Action
1.	Read motor dataset
2.	Read encoder dataset
3.	Consider optional motor brake
4.	Define limitations
5.	Parametrize control locations, setpoint structure, scalings
6.	Test system
7.	Save data



### NOTE

- A servomotor can only be operated highly dynamically with a suitable field model and optimally configured control circuits.

## 6.3 Synchronous motor

There are two ways to create a motor data set for the rotary synchronous motor.


- Calculation
- Identification

P No.	Index	Name	Unit	Description
2964 / 5012 / 7060		MOT_Para		Axis 1 / 2 / 3: Motor settings
2964 / 5012 / 7060	0	MOT_Type		Motor type
2964 / 5012 / 7060	1	MOT_PolePairs		Number of pole pairs
2964 / 5012 / 7060	2	MOT_SNom	rpm	Rated motor speed
2964 / 5012 / 7060	3	MOT_FNom	Hz	Rated motor frequency
2964 / 5012 / 7060	4	MOT_TNom	Nm	Rated torque
2964 / 5012 / 7060	5	MOT_CNom	Arms	Rated motor current
2964 / 5012 / 7060	6	MOT_CMax	Arms	Maximum current
2964 / 5012 / 7060	7	MOT_Rs	Ohm	Stator resistance
2964 / 5012 / 7060	8	MOT_Rr	Ohm	Rotor resistance (only for ASM)
2964 / 5012 / 7060	9	MOT_Lsd	mH	d axis stator inductance (PSM) or leakage inductance (ASM)
2964 / 5012 / 7060	10	MOT_Lsq	mH	Stator inductance Q axis
2964 / 5012 / 7060	11	MOT_J	kg m*m	Mass inertia
2964 / 5012 / 7060	12	MOT_Ke	Vrms/ (1000 rpm)	Motor EMF
2964 / 5012 / 7060	13	MOT_Km	Nm/Arms	Torque/force constant
2964 / 5012 / 7060	14	MOT_Name		Motor name
2964 / 5012 / 7060	15	MOT_CosPhi		Power factor
2964 / 5012 / 7060	16	MOT_VNom	Vrms	Nominal motor voltage
2964 / 5012 / 7060	17	MOT_PNom	kW	Rated motor power
2964 / 5012 / 7060	18	MOT_SMax	rpm	Maximum motor speed

Table 6.3: Parameter list – Motor axis – Elec. data synchronous motor

### 6.3.1 Calculation of the data for the synchronous motor

**Calculation of control settings**

Motor name:  

**Rating plate data**

Rated current:  Arms      Maximal current:  Arms

Rated speed:  rpm      Maximal speed:  rpm

Rated voltage:  Vrms

☒ Pole pairs:       OR      ☐ Rated frequency:  Hz      [Info ...](#)

☒ Rated torque:  Nm      OR      ☐ Rated power:  kW      [Info ...](#)

Motor inertia:  kg m\*m      Total inertia:  kg m\*m      [Info ...](#)

**Motor impedances ▶ See note!**      **Stator inductance ▶ See note!**

Stator resistance:  Ohm      Lsd:  mH      [Info ...](#)

Lsq:  mH

Fig. 6.2: Dialog box for calculation of synchronous motor control settings




#### NOTE

- The values for motor impedance and stator inductance are single-phase (phase against neutral point).
- The “save” operation overwrites all previous motor parameters.

The following procedure is recommended:

Step	Action
1.	Take motor data from data sheet and enter in appropriate fields of dialog box. If the motor's exact moment of inertia is not known, a value must be entered that approximates the motor's mass inertia.
2.	Left-click the "Start calculating control settings" button. The calculation process can be monitored in DriveManager 5 via the menu ►View ►Messages.
3.	Calculation of the working point: Rated flux and magnetizing current
4.	Calculation of: current, speed and position control parameters
5.	Save setting

## 6.3.2 Identification of synchronous motor data

**Identification of control settings** 

**Motor name**

**Rating plate data**

Rated current  Ams      Maximal current  Ams

Rated speed  rpm      Maximal speed  rpm

---

☒ Pole pairs       OR      ☐ Rated frequency  Hz      [Info ...](#)

☒ Rated torque  Nm      OR      ☐ Rated power  kW      [Info ...](#)

Motor inertia  kg m²m      Total inertia  kg m²m      [Info ...](#)

☒ Hold brake applied

Fig. 6.3: Dialog box for identification of synchronous motor control settings

The following procedure is recommended:

Step	Action
1.	Take motor data from data sheet and enter in appropriate fields of dialog box. If the motor's exact moment of inertia is not known, a value must be entered that approximates the motor's mass inertia.
2.	Left-click the "Start identifying control settings" button. The rotor resistance and the stator inductance are now measured automatically. The identification process can be monitored in DriveManager 5 via the menu ► View ► Messages.
3.	Current controller tuning: Basic configuration of the current controller is performed automatically, manual optimisations are possible.
4.	Measurement of the saturation characteristic (table values of the stator inductance): The measurement is made up to the maximum motor current inasmuch as the power stage maximum current allows for this at a standstill. If this is not the case, the measurement is made using a correspondingly smaller current.
5.	The default value for the speed tracking error monitoring corresponds to 50% of the rated speed.
6.	V/Hz characteristic curve is adjusted.



#### NOTE

- The motor identification changes the motor and control settings of the axis. If the axis is already configured, backup an axis data set and compare/restore it after identifying the axis.
- The synchronous motor is aligned during identification. This is necessary to determine the inductance of the flow axis (Ld) and the inductance of the cross axis (Lq) separately. If the movement is blocked, the difference between the two inductances is not determined, which can cause problems in sensorless control (see Section "Channel 4: Sensorless control (virtual encoder)" on page 99). Check whether the motor can be decoupled from the application and whether the holding brake is to stay closed during identification (see dialog box).

The "Motor Phase Test" button carries out a wiring test; see chapter 6.9 Motor phase test

### 6.3.3 Magnetic saturation: Compensation

Magnetic saturation causes a reduction of the motor's torque/force constant **MOT\_Km** when current is rising.

A compensation can be defined in **P 3018 - MOT\_TorqueSat** as a table of five pairs of values consisting of torque and current. If the table remains in the default configuration, the compensation is not active. As soon as at least one pair of values is defined, the compensation is activated. If a value for current is set to zero, the table ends with this entry even if there are still current entries not equal to zero after it. The highest table values for current and torque replace the usual limit values.

It is not easily possible to automatically determine the value pairs for saturation compensation. Refer to the motor manufacturer's data sheet for these values.

An exact calculation of torque influences feed forward control, torque compensation, torque scaling and the exact display of actual values. It does not affect the speed control loop.

P No.	Index	Name	Unit	Description
3018 / 5066 / 7114		MOT_TorqueSat		Axis 1 / 2 / 3: KT characteristic curve
3018 / 5066 / 7114	0	Torque_at_I0	Nm	Torque at current I0
3018 / 5066 / 7114	1	Torque_at_I1	Nm	Torque at current I1
3018 / 5066 / 7114	2	Torque_at_I2	Nm	Torque at current I2
3018 / 5066 / 7114	3	Torque_at_I3	Nm	Torque at current I3
3018 / 5066 / 7114	4	Torque_at_IMax	Nm	Torque at current IMax
3018 / 5066 / 7114	5	CurrentI0	Arms	Current I0
3018 / 5066 / 7114	6	CurrentI1	Arms	Current I1
3018 / 5066 / 7114	7	CurrentI2	Arms	Current I2
3018 / 5066 / 7114	8	CurrentI3	Arms	Current I3
3018 / 5066 / 7114	9	CurrentIMax	Arms	Current IMax

Table 6.4: Parameter list – Motor axis – Elec. data synchronous motor – MOT\_TorqueSat

### 6.3.4 Magnetic saturation: Adjustment of current control

Magnetic saturation causes a reduction of stator inductance. This requires a reduction of current control gain by the same factor.

The characteristic of stator inductance can be defined in **P 2980 - MOT\_LsigDiff** as a table of four pairs of values consisting of inductance and current. This is also performed automatically in the course of motor identification.



#### NOTE

- For safety reasons, motor identification does not use currents larger than allowed by the usual limit values. If the limit value for maximum motor current is increased, repeat motor identification to account completely for the extended current range.

P No.	Index	Name	Unit	Description
2980 / 5028 / 7076		MOT_LsigDiff		Axis 1 / 2 / 3: Stator inductance saturation
2980 / 5028 / 7076	0	Lsig_q_I0	%	Inductance @ current 0
2980 / 5028 / 7076	1	Lsig_q_I1	%	Inductance @ current 1
2980 / 5028 / 7076	2	Lsig_q_I2	%	Inductance @ current 2
2980 / 5028 / 7076	3	Lsig_q_I3	%	Inductance @ current 3
2980 / 5028 / 7076	4	CurrentI0	%	Current 0 (in % rated motor current)
2980 / 5028 / 7076	5	CurrentI1	%	Current 1 (in % rated motor current)
2980 / 5028 / 7076	6	CurrentI2	%	Current 2 (in % rated motor current)
2980 / 5028 / 7076	7	CurrentI3	%	Current 3 (in % rated motor current)

Table 6.5: Parameter list – Motor axis – Elec. data synchronous motor – MOT\_LsigDiff

## 6.4 Linear motor

There are two methods of creating a motor data set for the linear synchronous motor.

- Calculation
- Identification

The software handles a linear motor like a rotary motor. A change of the mass inertia in a rotary system corresponds to the change of the motor mass of a linear system.

- Activate the “Linear motor” option (**P 2990[0] - MOT\_isLinear = 1**) in the “Motor data” dialog box (see Section “Motor, general” on page 46)
- The data of the linear motor are transferred to the corresponding data of the rotary motor.
- Any previously set data of the rotary motor are overwritten.

### 6.4.1 Calculation of the data for the linear motor

**Calculation of control settings**

**Motor name**

**Rating plate data**

Rated current	<input type="text" value="0.1"/> Ams	Maximal current	<input type="text" value="0.1"/> Ams
Rated force	<input type="text" value="0.001"/> N	Magnet pitch (NN)	<input type="text" value="20000"/> um
Rated speed	<input type="text" value="0.01"/> m/s	Maximal speed	<input type="text" value="0"/> rpm
		Rated voltage	<input type="text" value="330"/> Vms

**Weight**

Motor weight (coil)	<input type="text" value="1E-06"/> kg	Total weight	<input type="text" value="0"/> kg	<input type="button" value="Info ..."/>
---------------------	---------------------------------------	--------------	-----------------------------------	---

**Motor impedances ▶ See note!**

Stator resistance	<input type="text" value="10"/> Ohm	<b>Stator inductance ▶ See note!</b>		
		Lsd	<input type="text" value="10"/> mH	<input type="button" value="Info ..."/>
<b>Encoder</b>		Lsq	<input type="text" value="10"/> mH	
Encoder period	<input type="text" value="0"/> nm			

Fig. 6.4: Dialog box for calculation of linear motor control settings



#### NOTE

- The values for stator resistance and stator inductance are single-phase (phase against neutral point).
- The “save” operation overwrites all previous motor parameters.

The following procedure is recommended:

Step	Action
1.	Take motor data from data sheet and enter in appropriate fields of dialog box.
2.	Enter weight of winding in <b>P 2991[3] - Mot_Lin_M</b> and total weight of motor in <b>P 2993[0] - SCD_MSum</b> .
3.	Left-click the “Start calculating control settings” button. The calculation process can be monitored in DriveManager 5 via the menu ▶ View ▶ Messages.
4.	The control parameters are set after the calculation.
5.	Save setting

Internal calculation of the data for the linear motor is as follows:

- Translation of the linear nominal quantities into virtual rotary nominal quantities
- Default values for the autocommutation
- The control settings for current controller, speed controller, and position controller are calculated internally and set to a basic setting.
- The default value for speed tracking error monitoring corresponds to 50% of the nominal speed.
- V/Hz characteristic curve is adjusted.



## 6.4.2 Identification of the linear motor data

**Calculation of control settings**

Motor name

**Rating plate data**

Rated current  Ams      Maximal current  Ams

Rated force  N      Magnet pitch (NN)  um

Rated speed  m/s      Maximal speed  m/s

Rated voltage  Vrms

**Weight**

Motor weight (coil)  kg      Total weight  kg      Info ...

**Motor impedances**

Stator resistance  Ohm

**Encoder**

Encoder period  nm

**Stator inductance**

Lsd  mH      Info ...

Lsq  mH

Fig. 6.5: Dialog box for identification of linear motor control settings



### NOTE

- The “save” operation overwrites all previous motor parameters.

The following procedure is recommended:

Step	Action
1.	Take motor data from data sheet and enter in appropriate fields of dialog box.
2.	Enter weight of winding in <b>P 2991[3] - Mot_Lin_M</b> and total weight of motor in <b>P 2993[0] - SCD_MSum</b> .
3.	Left-click the “Start identifying control settings” button. The identification process can be monitored in DriveManager 5 via the menu ►View ►Messages.
4.	The control parameters are set after completion of the identification.
5.	Save setting

The identification of the linear motor data is as follows:

- Translation of the linear nominal quantities into virtual rotary nominal quantities
- Default values for the autocommutation
- The control settings for current controller, speed controller, and position controller are calculated internally and set to a basic setting.
- The default value for speed tracking error monitoring corresponds to 50% of the nominal speed.
- V/Hz characteristic curve is adjusted.

P No.	Index	Name	Unit	Description
2990 / 5038 / 7086	0	MOT_isLinear		Axis 1 / 2 / 3: Linear motor yes / no
SUBJECT AREA		Linear motor		Synchronous linear motor settings
2980 / 5028 / 7076		MOT_LsigDiff		Axis 1 / 2 / 3: Stator inductance saturation
2980 / 5028 / 7076	0	Lsig_q_l0	%	Inductance @ current 0
2980 / 5028 / 7076	1	Lsig_q_l1	%	Inductance @ current 1

Table 6.6: Parameter list – Motor axis – Linear motor

P No.	Index	Name	Unit	Description
2980 / 5028 / 7076	2	Lsig_q_I2	%	Inductance @ current 2
2980 / 5028 / 7076	3	Lsig_q_I3	%	Inductance @ current 3
2980 / 5028 / 7076	4	CurrentI0	%	Current 0 (in % rated motor current)
2980 / 5028 / 7076	5	CurrentI1	%	Current 1 (in % rated motor current)
2980 / 5028 / 7076	6	CurrentI2	%	Current 2 (in % rated motor current)
2980 / 5028 / 7076	7	CurrentI3	%	Current 3 (in % rated motor current)
2991 / 5039 / 7087		MOT_Lin_Para		Axis 1 / 2 / 3: Linear motor parameters
2991 / 5039 / 7087	0	MOT_Lin_MagnetPitch	um	Magnet pitch
2991 / 5039 / 7087	1	MOT_Lin_SNom	m/s	Linear motor rated speed
2991 / 5039 / 7087	2	MOT_Lin_ForceNom	N	Rated force
2991 / 5039 / 7087	3	MOT_Lin_M	kg	Motor mass / weight
2991 / 5039 / 7087	4	MOT_Lin_Ke	Vrms/ (m/s)	Motor EMF
2991 / 5039 / 7087	5	MOT_Lin_Km	N/Arms	Force constant
2991 / 5039 / 7087	6	MOT_Lin_SMax	m/s	Maximum speed of linear motor
3018 / 5066 / 7114		MOT_TorqueSat		Axis 1 / 2 / 3: KT characteristic curve
3018 / 5066 / 7114	0	Torque_at_I0	Nm	Torque at current I0
3018 / 5066 / 7114	1	Torque_at_I1	Nm	Torque at current I1
3018 / 5066 / 7114	2	Torque_at_I2	Nm	Torque at current I2
3018 / 5066 / 7114	3	Torque_at_I3	Nm	Torque at current I3
3018 / 5066 / 7114	4	Torque_at_IMax	Nm	Torque at current IMax
3018 / 5066 / 7114	5	CurrentI0	Arms	Current I0
3018 / 5066 / 7114	6	CurrentI1	Arms	Current I1
3018 / 5066 / 7114	7	CurrentI2	Arms	Current I2
3018 / 5066 / 7114	8	CurrentI3	Arms	Current I3
3018 / 5066 / 7114	9	CurrentIMax	Arms	Current IMax
SUBJECT AREA		Electrical data of linear synchronous motors		Electrical data of linear synchronous motors
2964 / 5012 / 7060		MOT_Para		Axis 1 / 2 / 3: Motor settings
2964 / 5012 / 7060	0	MOT_Type		Motor type
2964 / 5012 / 7060	1	MOT_PolePairs		Number of pole pairs
2964 / 5012 / 7060	2	MOT_SNom	rpm	Rated motor speed
2964 / 5012 / 7060	3	MOT_FNom	Hz	Rated motor frequency
2964 / 5012 / 7060	4	MOT_Tnom	Nm	Rated torque

Table 6.6: Parameter list – Motor axis – Linear motor (continue)

P No.	Index	Name	Unit	Description
2964 / 5012 / 7060	5	MOT_CNom	Arms	Rated motor current
2964 / 5012 / 7060	6	MOT_CMax	Arms	Maximum current
2964 / 5012 / 7060	7	MOT_Rs	Ohm	Stator resistance
2964 / 5012 / 7060	8	MOT_Rr	Ohm	Rotor resistance (only for ASM)
2964 / 5012 / 7060	9	MOT_Lsd	mH	d axis stator inductance (PSM) or leakage inductance (ASM)
2964 / 5012 / 7060	10	MOT_Lsq	mH	Stator inductance Q axis
2964 / 5012 / 7060	11	MOT_J	kg m²	Mass inertia
2964 / 5012 / 7060	12	MOT_Ke	Vrms/ (1000 rpm)	Motor EMF
2964 / 5012 / 7060	13	MOT_Km	Nm/Arms	Force constant
2964 / 5012 / 7060	14	MOT_Name		Motor name
2964 / 5012 / 7060	15	MOT_CosPhi		Power factor
2964 / 5012 / 7060	16	MOT_VNom	Vrms	Nominal motor voltage
2964 / 5012 / 7060	17	MOT_PNom	kW	Rated motor power
2964 / 5012 / 7060	18	MOT_SMax	rpm	Maximum motor speed

Table 6.6: Parameter list – Motor axis – Linear motor (continue)


P No.	Index	Name	Unit	Description
2993 / 5041 / 7089	0	SCD_MSum	kg	Axis 1 / 2 / 3: Total weight / mass
2994 / 5042 / 7090		CON_SCON_LinActMax		Axis 1: Limitation of the actual values
2994 / 5042 / 7090	0	ActMax_LinSpeed	m/s	Maximum speed
2994 / 5042 / 7090	1	ActMax_LinForce	N	Maximum force

Table 6.7: additional parameters for linear motor calculation

## 6.5 Asynchronous motor

### 6.5.1 Identification of asynchronous motor data

**Identification of control settings**

**Motor name**  

**Rating plate data**

Rated current	<input type="text" value="1.5"/> Ams	Maximal current	<input type="text" value="4.5"/> Ams
Rated speed	<input type="text" value="3000"/> rpm	Maximal speed	<input type="text" value="3300"/> rpm
Rated voltage	<input type="text" value="330"/> Vrms	Rated frequency	<input type="text" value="150"/> Hz

☒ Rated torque  Nm
 **OR**
☐ Rated power  kW
 Info ...

kg m²m
  kg m²m
 Info ...

☒ Hold brake applied

Fig. 6.6: Dialog box for identification of asynchronous motor control settings

The following procedure is recommended:

Step	Action
1.	Take motor data from data sheet and enter in appropriate fields of dialog box. If the motor's exact moment of inertia is not known, a value must be entered that approximates the motor's mass inertia.
2.	Left-click the "Start identifying control settings" button. The rotor resistance and the stator inductance are now measured automatically. The identification process can be monitored in DriveManager 5 via the menu ► View ► Messages.
3.	The control settings for current controller, speed controller, and position controller are calculated internally and set to a basic setting.
4.	Measurement of the saturation characteristic (table values of the stator inductance): The measurement is made up to the maximum motor current inasmuch as the power stage maximum current allows for this at a standstill. If this is not the case, the measurement is made using a correspondingly smaller current.



#### NOTE

- The motor identification changes the motor and control settings of the axis. If the axis is already configured, backup an axis data set and compare/restore it after identifying the axis.
- The motor may perform minor movements during identification. These movements impair the result. If the asynchronous motor has a holding brake, keep it closed during identification (see dialog box).

The "Motor Phase Test" button carries out a wiring test; see chapter 6.9 Motor phase test

P No.	Index	Name	Unit	Description
2964 / 5012 / 7060		MOT_Para		Axis 1 / 2 / 3: Motor settings
2964 / 5012 / 7060	0	MOT_Type		Motor type
2964 / 5012 / 7060	1	MOT_PolePairs		Number of pole pairs
2964 / 5012 / 7060	2	MOT_SNom	rpm	Rated motor speed
2964 / 5012 / 7060	3	MOT_FNom	Hz	Rated motor frequency
2964 / 5012 / 7060	4	MOT_Tnom	Nm	Rated torque
2964 / 5012 / 7060	5	MOT_CNom	Arms	Rated motor current
2964 / 5012 / 7060	6	MOT_CMax	Arms	Maximum current
2964 / 5012 / 7060	7	MOT_Rs	Ohm	Stator resistance
2964 / 5012 / 7060	8	MOT_Rr	Ohm	Rotor resistance (only for ASM)
2964 / 5012 / 7060	9	MOT_Lsd	mH	d axis stator inductance (PSM) or leakage inductance (ASM)
2964 / 5012 / 7060	10	MOT_Lsq	mH	Stator inductance Q axis
2964 / 5012 / 7060	11	MOT_J	kg m²	Mass inertia
2964 / 5012 / 7060	12	MOT_Ke	Vrms/ (1000 rpm)	Motor EMF
2964 / 5012 / 7060	13	MOT_Km	Nm/Arms	Force constant
2964 / 5012 / 7060	14	MOT_Name		Motor name
2964 / 5012 / 7060	15	MOT_CosPhi		Power factor
2964 / 5012 / 7060	16	MOT_VNom	Vrms	Nominal motor voltage
2964 / 5012 / 7060	17	MOT_PNom	kW	Rated motor power
2964 / 5012 / 7060	18	MOT_SMax	rpm	Maximum motor speed
2988 / 5036 / 7084		MOT_ActVal		Axis 1 / 2 / 3: Actual motor values
2988 / 5036 / 7084	0	Lsh	H	Main inductance (with magnet current / ASM only)
2988 / 5036 / 7084	1	FluxNom	Vs	Motor flux linkage
3013 / 5061 / 7109		CON_FM_IMag		Axis 1 / 2 / 3: Magnetising current
3013 / 5061 / 7109	0	IMag		Magnetizing current
3013 / 5061 / 7109	1	IMagMax		Max. magnetizing current (LshTab)
3013 / 5061 / 7109	2	ImagSLim	%	Field weakening start speed
2989 / 5037 / 7085		MOT_LshTab		Axis 1 / 2 / 3: Main inductance (ASM only)
2989 / 5037 / 7085	0	MOT_LshTab	mH	
2989 / 5037 / 7085	1	MOT_LshTab	mH	

Table 6.8: Parameter list – Motor axis – Electrical data of asynchronous motors


P No.	Index	Name	Unit	Description
2989 / 5037 / 7085	2	MOT_LshTab	mH	
2989 / 5037 / 7085	3	MOT_LshTab	mH	
2989 / 5037 / 7085	4	MOT_LshTab	mH	
2989 / 5037 / 7085	5	MOT_LshTab	mH	
2989 / 5037 / 7085	6	MOT_LshTab	mH	
2989 / 5037 / 7085	7	MOT_LshTab	mH	
2989 / 5037 / 7085	8	MOT_LshTab	mH	
2989 / 5037 / 7085	9	MOT_LshTab	mH	
2989 / 5037 / 7085	10	MOT_LshTab	mH	

Table 6.8: Parameter list – Motor axis – Electrical data of asynchronous motors (continue)

## 6.6 Motor simulation

To be able to simulate a motor, all of the relevant data for the motor, encoder and control must be present. The set motor parameters are applied in the simulation model. Control structures and motion sequences are simulated by Axis Controller. The simulation delivers realistic feedback values for an upstream motion controller. A connected physical motor is not moved.

Activate the motor simulation using **P 2965[0] - MOT\_Sim = 1**.

<b>CAUTION!</b>	<b>Your system/motor may be damaged if put into operation in an uncontrolled or inappropriate manner.</b>
	<p><b>Improper conduct can cause damage to your system / machine.</b></p> <ul style="list-style-type: none"> <li>• During the motor simulation, care must be taken to ensure that the mechanism is not damaged by the movement of other axes.</li> <li>• Please take note of the motor brake when working with suspended loads.</li> </ul>

P No.	Index	Name	Unit	Description
2965 / 5013 / 7061	0	MOT_Sim		Axis 1 / 2 / 3: Motor simulation settings
2987 / 5035 / 7083		MOT_SIM_Tune		Axis 1 / 2 / 3: Motor simulation parameters
2987 / 5035 / 7083	0	Damping	mNm/rpm	
2987 / 5035 / 7083	1	EncoderOffset	DEG	Simulated encoder offset (must match the actual encoder offset of the commutation encoder)
2987 / 5035 / 7083	2	VDC		DC-link simulated
2987 / 5035 / 7083	3	LoadTorque	Nm	Load torque simulated
2987 / 5035 / 7083	4	Jsum	kgm2	Inertia simulated
2987 / 5035 / 7083	5	Cogging_Torque	Nm	Actual cogging torque
2987 / 5035 / 7083	6	Cogging_Freq		Cogging torque frequency

Table 6.9: Parameter list – Motor axis – Motor simulation

## 6.7 Motor protection

The motor is protected by both hardware and software features. The hardware protection is implemented by means of various temperature sensors, the software protection by an  $I^2t$  integrator and a thermal time constant. The settings for the motor protection are a part of the motor data set.

The following temperature sensors are supported:

- PTC-
- drillings PTC
- Klixon switch
- KTY84-130
- KTY83-110
- PT1000
- own characteristic curve with interpolation points

### Temperature monitoring:

Type: KTY84\_130(4) = KTY84-130 motor temperature sensor

Source: MOTCON(0) = Temperature sensor on motor connector

Maximum temperature (X5) (only KTY 84): 100 degC

### $I^2t$ monitoring

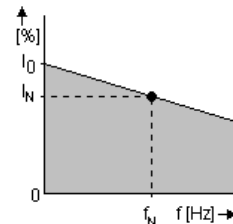
$I^2t$  type: FREQ(0) = Frequency-dependent  $I^2t$

**Permitted continuous current:**

Rated motor current ( $I_N$ ): 100 %

Rated motor frequency ( $f_N$ ): 250 Hz

1. current interpol. point ( $I_0$ ): 108 %



**Point of switch off:**

216 %  $I_N$  for 5 s

Thermal time constant: 5400 s

Error reactions ...

Fig. 6.7: Synchronous motor protection dialog box

## Temperature monitoring:

Type

Source

Maximum temperature (X5) (only KTY 84)  degC

## I<sub>t</sub> monitoring

I<sub>t</sub> type

**Permitted continuous current:**

Rated motor current (I<sub>N</sub>)  %

Rated motor frequency (f<sub>N</sub>)  Hz

1. current interpol. point (I0)  %

2. current interpol. point (I1)  %

2. frequency interpol. point (F1)  Hz

**Point of switch off:**

% IN for  s

Thermal time constant  s

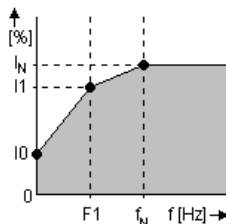


Fig. 6.8: Asynchronous motor protection dialog box

## 6.7.1 Motor protection by hardware (temperature sensor)

Selection of temperature sensor via **P 3063[0]** - **Select**.

P No.	Index	Name	Unit	Description
3063 / 5111 / 7159		MON_MotorTemp		Axis 1 / 2 / 3: Motor protection settings
3063 / 5111 / 7159	0	Select		Motor temperature sensor type
3063 / 5111 / 7159	1	Tmax	degC	Max. permissible motor temperature
3063 / 5111 / 7159	2	TVal1	°C	Interpolation point 1
3063 / 5111 / 7159	3	TVal2	°C	Interpolation point 2
3063 / 5111 / 7159	4	TVal3	°C	Interpolation point 3
3063 / 5111 / 7159	5	TVal4	°C	Interpolation point 4
3063 / 5111 / 7159	6	RVal1	Ohm	Resistance @ interpolation point 1
3063 / 5111 / 7159	7	RVal2	Ohm	Resistance @ interpolation point 2
3063 / 5111 / 7159	8	RVal3	Ohm	Resistance @ interpolation point 3
3063 / 5111 / 7159	9	RVal4	Ohm	Resistance @ interpolation point 4
3063 / 5111 / 7159	10	Source		Select motor temperature source. MOTCON (0): Motor temperature via digital protocol of the HDSL encoder or analogue sensor evaluation on the drive beside the motor connector ENC_CH1(1): Motor temperature via digital protocol of CH1 (e.g. EnDat 2.2 with sensor evaluation on the encoder) ENC_MCON(2): All external sensor evaluations (EtherCAT encoder, digital protocol of CH1, HDSL) ENC_ANALOG(3): Sensor evaluation on the CH1 analogue input (only with SDC option). See also Table 6.11: Temperature sensor connection

Table 6.10: Parameter list – Motor axis – Protection – Temperature sensors

The following table shows the settings for the selection of the temperature sensor with **P 3063[10]** - **Source**.

Seq. No.	Connection Temperature sensor	Setting P 3063[10] - Source	Notes concerning hardware and software
1	Motor plug, analogue evaluation	(0) MOTCON	<b>NOT</b> for devices with the version Hiperface <sup>®</sup> DSL
2	Via digital protocol Hiperface <sup>®</sup> DSL (Channel 3 = Motor plug)	(0) MOTCON or (2) ENC_MCON *	<b>ONLY</b> for devices with the version Hiperface <sup>®</sup> DSL
3	Via digital protocol ENDAT 2.2 (Channel 1 = Multi-encoder plug)	(1) ENC_CH1 or (2) ENC_MCON*	
4	Multi-encoder plug, Analogue evaluation Temp + on pin 12 Temp - on pin 13	(3) ENC_Analogue	As of firmware 1.40-16 As of hardware SDC_REV0
5	Incremental encoder plug, Analogue evaluation Temp + on pin 12 Temp - on pin 13	(4) ENC_Analog_CH2	As of firmware 2.10-xx As of hardware SDC_REV2

\* The setting (2) ENC\_MCON automatically selects 2 or 3 when the corresponding encoder is set as the motor encoder.

Table 6.11: Temperature sensor connection

## 6.7.1.1 PTC evaluation

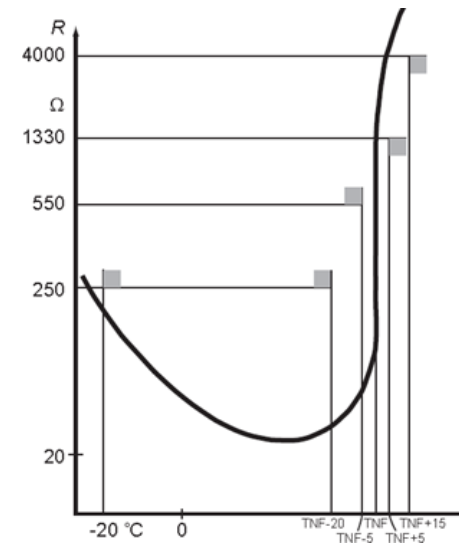


Fig. 6.9: Resistance diagram as function of the temperature of a DIN PTC

- Threshold on: approx. 3600  $\Omega$
- Threshold off: approx. 1500  $\Omega$
- Short circuit: <50  $\Omega$
- E-OTM: Error Overtemperature Motor



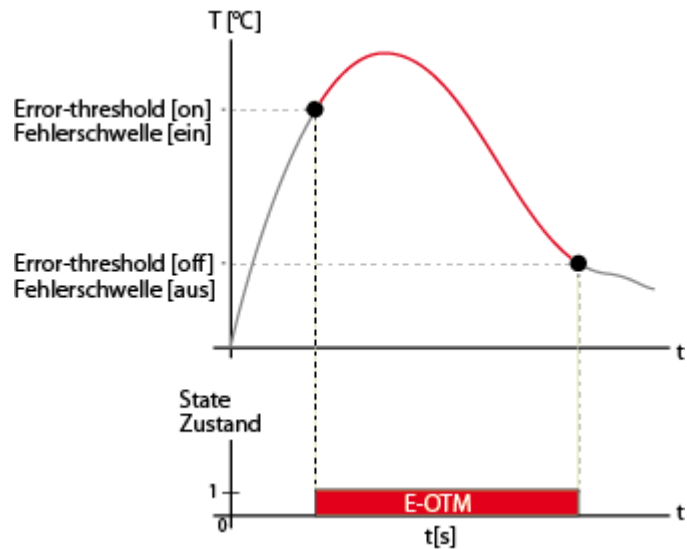


Fig. 6.10: Trigger diagram for the PTC evaluation (E-OTM = Error Overtemperature Motor)

### 6.7.1.2 Temperature sensor KTY (KTY84-130, KTY83\_110, PT1000)

Sensor	Setting P 3063[0]
KTY84-130	KTY84_130(4)
KTY83-110	KTY83_110(6)
PT1000	PT1000(7)

Table 6.12: Options for KTY

Maximum temperature is defined by **P 3063[1] - Tmax**.

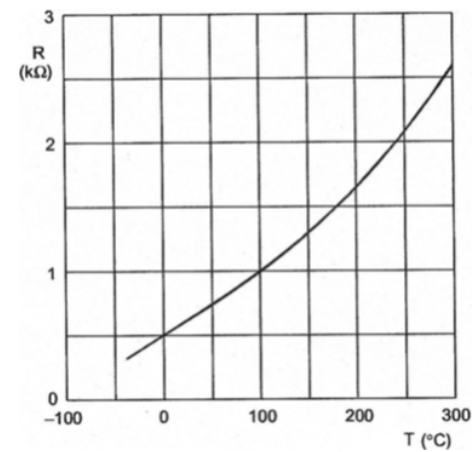


Fig. 6.11: Temperature curve KTY

### 6.7.1.3 Temperature sensor "user"

- The characteristic of the temperature curve is defined via 4 interpolation points in **P 3063 - MON\_MotorTemperature [1] to [9]**.
- Maximum temperature **P 3063[1] - Tmax**
- Actual value indication for current motor temperature: **P 3049[9] - Temp\_Motor**

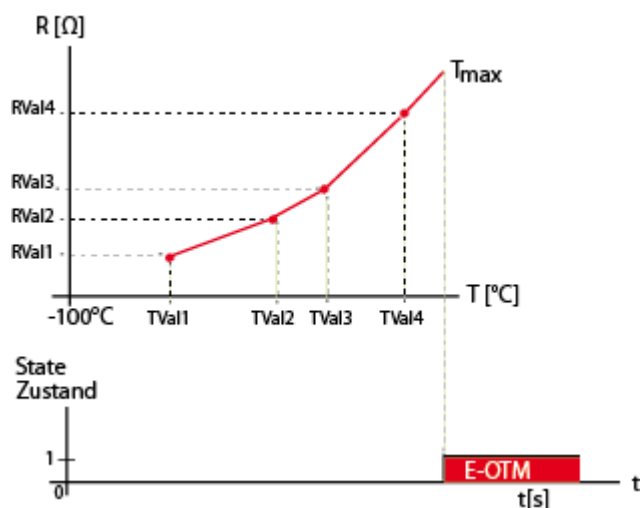


Fig. 6.12: Temperature curve "user" (E-OTM = Error Overtemperature Motor)

## 6.7.2 Motor protection by software

P No.	Index	Name	Unit	Description
3050 / 5098 / 7146		MON_MotorI2t		Axis 1 / 2 / 3: Motor I2T protection
3050 / 5098 / 7146	0	Type		Selection of I2T monitoring method
3050 / 5098 / 7146	1	INom	%	Rated current @ FNom
3050 / 5098 / 7146	2	I0	%	Rated current @ 0Hz
3050 / 5098 / 7146	3	I1	%	Current @ F1 (% of INom)
3050 / 5098 / 7146	4	F1	Hz	Interpolation point
3050 / 5098 / 7146	5	FNom	Hz	Rated frequency
3050 / 5098 / 7146	6	IMax	%	Maximum current
3050 / 5098 / 7146	7	Time	s	Max. overload duration
3050 / 5098 / 7146	8	TTherm	s	Thermal time constant
3050 / 5098 / 7146	9	IMax2	%	Motor max. current @ T2

Table 6.13: Parameter list – Motor axis – Protection – I<sup>2</sup>t characteristic curve

P No.	Index	Name	Unit	Description
3050 / 5098 / 7146	10	Time2	s	Max. time for max. current @ T2
3050 / 5098 / 7146	11	D1	degC	Temperature for operating point #1 (IMax, Time)
3050 / 5098 / 7146	12	T2	degC	Temperature for operating point #2 (IMax2, Time2)

Table 6.13: Parameter list – Motor axis – Protection – I<sup>2</sup>t characteristic curve (continue)

<b>CAUTION!</b>	<b>Your system/motor may be damaged if put into operation in an uncontrolled or inappropriate manner.</b>
	<p><b>Improper conduct can cause damage to your system / machine.</b></p> <ul style="list-style-type: none"> <li>Motor protection can be parametrized. The user is responsible for adequate motor protection at all working points.</li> <li>The user is responsible for ensuring that any additional load caused by the stop ramp does not destroy the motor, that is already subject to thermal overload.</li> <li>If the motor has been operated at overload, it needs time to cool down. This is taken into account by the various algorithms, including if there are errors or if the controller is switched off. However, changing the parameters or a system reset do reset the internal variables and the cooling down time is no longer monitored. In these cases, wait long enough before switching the controller back on so that the machine is not destroyed!</li> </ul>

### 6.7.2.1 I<sup>2</sup>t monitoring

Classical I<sup>2</sup>t monitoring is a model for motor winding warming and is activated by **P 3050[0] - Type = FREQ(0)**. It is defined by

- a nominal state as a function of the rotational frequency at which the motor is thermally stable and S1 operation is possible (**P 3050[1] - INom**, **P 3050[2] - I0**, **P 3050[3] - I1**, **P 3050[4] - F1**, **P 3050[5] - FNom**).
- a maximum current **P 3050[6] - IMax** and an overload time **P 3050[7] - Time** that define the maximum energy that can be stored in the thermal capacity of the motor.

#### 6.7.2.1.1 S1 operation

The nominal state is implemented as a characteristic curve with three interpolation points as a function of the rotational frequency. Internally, a reserve of 10% is included in the calculation to enable safe operation at the rated current. The curve is interpolated between the interpolation points; above the last point, the curve remains constant.

The following points define the maximum possible current for S1 operation:

	Frequency	Current
1.	0 Hz	$2964[5] - \text{MOT\_CNom} * 3050[1] \text{ INom} * 3050[2] \text{ I0} * 110 \%$
2.	$3050.4 \text{ F1}$	$2964[5] - \text{MOT\_CNom} * 3050[1] \text{ INom} * 3050[3] \text{ I1} * 110 \%$
3.	$3050.5 \text{ FNom}$	$2964[5] - \text{MOT\_CNom} * 3050[1] \text{ INom} * 110 \%$

This method is implemented the same way for all motor types.

The interpolation points can be used to represent the following properties:

- A permanently excited synchronous motor tolerates a higher current at standstill than at the nominal speed because the core losses increase with the frequency. This is stored and parametrised in the KEB A motor data sets

in such a way that  $I0 > 100\%$ . F1 is parametrized to be greater than FNom so that the 2nd interpolation point is not taken into account.

- Self-cooled motors tolerate more current the higher the speed. This is common, especially for asynchronous standard motors. Typical characteristic curve values are  $I0 = 50\%$ ,  $I1 = 80\%$ ,  $F1 = \text{FNom}/2$

The error reaction of the I<sup>2</sup>t monitoring system can be parametrized to a stop ramp.

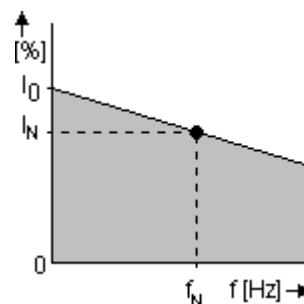


Fig. 6.13: I<sup>2</sup>t characteristic curve synchronous motor

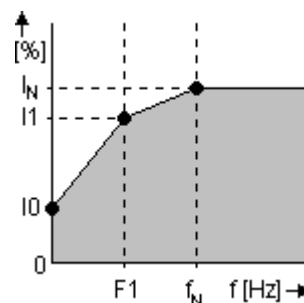


Fig. 6.14: I<sup>2</sup>t characteristic curve asynchronous motor



#### NOTE

- I<sup>2</sup>t monitoring must be modified depending on the motor type (PSM, ASM).

### 6.7.2.1.2 Overload operation

In overload operation, the squared difference between the actual current and the nominal current is added up.

$$S(t) = \text{integral} (i_{\text{act}}^2 - i_{\text{nom}}(f)^2) \times dt$$

$$S_{\text{max}} = ((2964[5] - \text{MOT\_CNom} * 3050[6] \text{ IMax})^2 - (2964[5] - \text{MOT\_CNom} * 3050[1] \text{ INom} * 110\%)^2) * (3050[7] \text{ Time})$$

Here,  $i_{\text{act}}$  represents the actual motor current,  $i_{\text{nom}}(f)$  the characteristic curve value at the momentary rotational frequency; if  $S(t)$  exceeds  $S_{\text{max}}$ , an error is triggered.

After the error has occurred or when operating in the S1 range, the same algorithm is used to de-integrate the sum. The bottom limit of the sum is zero.

### 6.7.2.1.3 Example

An internally cooled asynchronous standard motor has a rated current of 15 A. The motor has a rated frequency of 50 Hz and at this frequency, it can be operated at 30 A for 120 seconds.

Parametrize as follows:

P No.	Index	Name		Unit
2964	5	MOT_CNom	15	A
3050 / 5098 / 7146	0	Type	FREQ	
3050 / 5098 / 7146	1	INom	100	%
3050 / 5098 / 7146	2	I0	50	%
3050 / 5098 / 7146	3	I1	80	%
3050 / 5098 / 7146	4	F1	25	Hz
3050 / 5098 / 7146	5	FNom	50	Hz
3050 / 5098 / 7146	6	IMax	200	%
3050 / 5098 / 7146	7	Time	120	s

Table 6.14: ....Parameter list – Motor axis – Protection –  $I^2t$  characteristic curve

At a standstill (0 Hz), the motor can be operated at 30 A for 90 seconds. This results from the above- mentioned algorithms and cannot be set separately.

$$S_{\text{max}} = (30 \text{ A})^2 - (15 \text{ A} * 110 \%)^2 * 120 \text{ s} = 75330 \text{ A}^2\text{s}$$

$$S_{\text{max}} / ((30 \text{ A})^2 - (7.5 \text{ A} * 110 \%)^2) = 90 \text{ s}$$

### 6.7.2.2 Thermal model

The thermal model is a delay model of the first order. It is a good model for thermal behaviour of the iron and magnets of a motor and a good alternative if a motor temperature sensor is not available. It is activated by **P 3050 [0] - Type = TTHERM (1)** and defined by

- the time constant **P 3050[8] - TTherm**
- the fact that the motor reaches its maximum permissible temperature at rated current in a steady state. Here, the rated current is specified by the frequency curve of  $I^2t$ . See Fig. 6.14:  $I^2t$  characteristic curve asynchronous motor

As soon as maximum permissible temperature is exceeded, an error is output.

The thermal model is not suitable for simulating applications with high overloads. In these cases, the motor winding warms up much more quickly than the motor's iron.

### 6.7.2.3 Combined model ( $I^2t$ + Thermal)

The combination of  $I^2t$  monitoring and thermal model enables a representation of the complete thermal behaviour of the motor, e.f. motor winding and iron. Both algorithms are calculated independently of each other.

This model is activated by **P 3050[0] - Type = FREQ\_TTHERM(2)**.

Parametrize  $I^2t$  monitoring in accordance with the motor winding and the thermal model in accordance with the thermal time constant of the motor iron.

#### 6.7.2.4 Temperature-dependent I<sup>2</sup>t monitoring

The temperature-dependent I<sup>2</sup>t monitoring maps the situation that arises from the fact that with a cold motor there can be a higher overload than when the same motor is already operating near the maximum temperature. The motor must have a temperature sensor for this which determines the temperature as a measured value: under these circumstances, the temperature-dependent I<sup>2</sup>t monitoring offers optimal protection. The function is activated by **P 3050[0] - Type = FREQ\_TEMP** (3).

Two operating points must be specified:

- A maximum current **P 3050[6] - I<sub>Max</sub>** and an overload time **P 3050[7] - Time**, which specify the maximum energy that can be stored in the thermal capacity of the motor at temperature **P 3050.11 T1**
- A maximum current **P 3050[9] - I<sub>Max2</sub>** and an overload time **P 3050[10] - Time2**, which specify the maximum energy that can be stored in the thermal capacity of the motor at temperature **P 3050.12 T2**

The protective function interpolates and extrapolates the two value pairs and weights the overload according to the current temperature. Otherwise, all of the properties of the I<sup>2</sup>t motor protection apply. See Section "I<sup>2</sup>t monitoring" on page 63.



##### NOTE

- Above T2, the temperature characteristic of the motor protection can reach zero so that even without any current, an I<sup>2</sup>t excess is reported. The exact behaviour depends on the parametrized values.
- Parametrize T2 to be greater or equal to the maximum temperature of the motor **P 3063[1] - T<sub>max</sub>** (see temperature sensor) to create properly defined conditions.

#### 6.7.2.5 Combined model (temperature-dependent I<sup>2</sup>t+ thermal)

The combination of the temperature-dependent I<sup>2</sup>t monitoring and the thermal model is activated by **P 3050[0] - Type = FREQ\_TEMP\_TTHERM** (4).

#### 6.7.2.6 Motor maximum current protection

The motor maximum current protection is defined by the maximum permissible motor current (**P 2964[6] - MOT\_C<sub>Max</sub>**). The current motor current (**P 2967[2] - iphasor**) is compared with **MOT\_C<sub>Max</sub>**.

As soon as **iphasor** exceeds 120 % of **MOT\_C<sub>Max</sub>**, the power stage is switched off. This protects against overshoot and oscillation of the current controller.

Keep sufficient distance to maximum permissible motor current or optimize current control to avoid shut-down.

Avoid setting **MOT\_C<sub>max</sub>** to zero!

## 6.8 Motor brake

A holding brake built into the motor (optional) offers protection against unintentional movement. It takes effect when the unit is de-energized or there is a fault. Settings can be made in the “Motor Brake” dialog box independently of the control mode.

### 6.8.1 Motor brake output

Activation via **P 2318[0] - MPRO\_OUTPUT\_FS\_MOTBRK\_AX1**

- Current monitoring for motor brake active
- Settings for the brake can be made when the output is set to “INT(1) = Motor brake connected to drive”.



#### NOTE

- The settings EXT, FEEDB, INT\_FEEDB serve to activate the holding brakes via EtherCAT (see Section “Motor brake via EtherCAT®” on page 69”). The SDC setting is for switching the brake output out of the safety controller as a safe output; it is not suitable for a holding brake. See ServoOne CM Specification SDC (ID No.:1400.206B.x).
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com) in the DOCU-PORTAL.

<b>CAUTION!</b>	<b>Your system/motor may be damaged if put into operation in an uncontrolled or inappropriate manner.</b>
	<b>Improper conduct can cause damage to your system / machine.</b> <ul style="list-style-type: none"> <li>• If the brake is attached to the axis mechanism and not directly to the shaft, application of the brake without a delay causes high torsional forces.</li> </ul>



#### NOTE

- Please check the settings for the stop ramps if a holding brake is used.
- Do not control the brake output if no brake is connected. This causes error 35-22 in the SBC diagnostics function.

P No.	Index	Name/Setting	Unit	Description
2310 / 4358 / 6406	0	MPRO_BRK_Lock		Axis 1 / 2 / 3: Brake man. Vent
		0 (Off)		Function not active
		1 (Lock)		Motor brake locked
		2 (Open)		Motor brake vented
2311 / 4359 / 6407	0	MPRO_BRK_WireBreak		Axis 1 / 2 / 3: Motor brake wire break monitoring
		0 (False)		False
		1 (True)		True
2308 / 4356 / 6404		MPRO_BRK_Times		Axis 1 / 2 / 3: Motor brake times setting
2308 / 4356 / 6404	0	CloseTime	ms	Motor brake close time
2308 / 4356 / 6404	1	LiftTime	ms	Motor brake lift time
2308 / 4356 / 6404	2	FadeTime	ms	Torque fade time
2308 / 4356 / 6404	3	RiseTime	ms	Torque rise time
2309 / 4357 / 6405		MPRO_BRK_Torque		Axis 1 / 2 / 3: Motor brake torque setting (-pre-load)
2309 / 4357 / 6405	0	StartTorque	Nm	Initialisation torque
2309 / 4357 / 6405	1	LastTorqueFac	%	Last torque scaling factor saved
2312 / 4360 / 6408	0	MPRO_BRK_LastTorque	Nm	Axis 1 / 2 / 3: Motor brake last torque saved Torque (from last close)
2313 / 4361 / 6409	0	MPRO_BRK_Status		Axis 1 / 2 / 3: Motor brake status
2318 / 4366 / 6414	0	MPRO_OUTPUT_FS_MOTBRK		Axis 1 / 2 / 3: Motor brake selector
		NONE (0)		No function
		1 (INT)		Motor brake connected to drive
		2 (EXT)		External motor brake without feedback

Table 6.15: Parameter list – Motor axis – Motor brake and motor brakes details

P No.	Index	Name/Setting	Unit	Description
		3 (FEEDB)		External motor brake with feedback
		4 (INT_FEEDB)		Internal motor brake and external brake with feedback
		5 (SDC)		Internal motor brake is controlled by SDC option

Table 6.15: Parameter list – Motor axis – Motor brake and motor brakes details (continue)

**LiftTime** and **CloseTime** define the lift and close time required by the brake for its mechanical movement. Control is active during both times, but setpoints are locked.



#### NOTE

- Refer to Section "Motor brake check" on page 179 for details on how to test and monitor the motor brake.

## 6.8.2 Advanced motor brake function

In the advanced motor brake function, torque is built up in a defined manner before lifting the brake and reduced after closing the brake. This prevents noise build-up and "slip" when switching on.

When the brake closes, the current torque is scanned and saved to **P 2312[0] - MPRO\_BRK\_LastTorque**. **P 2309[1] - LastTorqueFac** defines a percentage of this value that is built up before switching on next time. A fixed start torque can also be pre-set in **P 2309[0] - StartTorque**.

If the movement ends with an error, the stored torque is reset to zero.

$M(\text{target})$  is calculated using the following formula:


$$M(\text{target}) = \text{Last saved pre-load} \times \text{factor (last pre-load)} + \text{constant initial value}$$

See also Fig. 6.15: Setting the motor brake.

#### Motor brake

Motor brake output X13/X20:

Wire break detection:

 Motor brake open ☐ Allow opening the motor brake

#### Caution!

This function can have the following consequences:  
The settings of the drive will be temporarily changed. The motor brake will be energized. The motor brake will be activated or deactivated. The motor will be able to be moved.

Ensure, that drive and motor don't make hazard before you continue operation!

#### Motor brake details

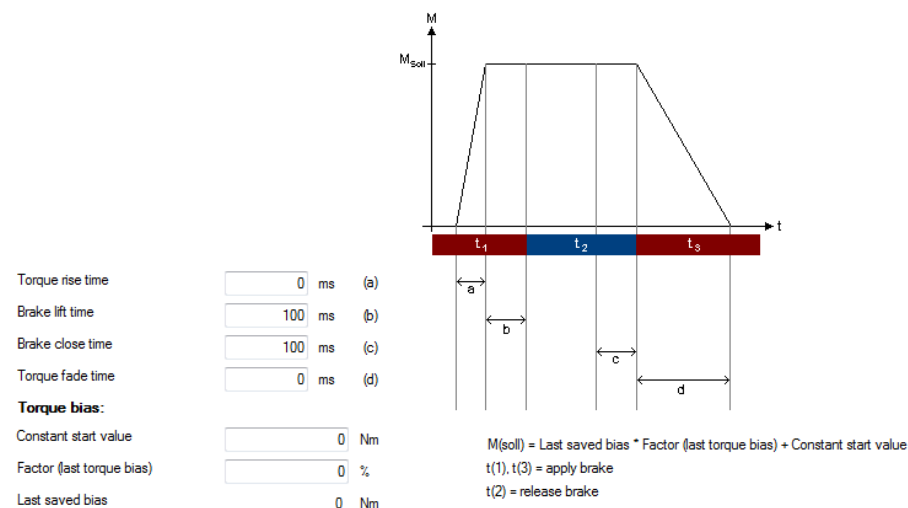


Fig. 6.15: Setting the motor brake

### 6.8.3 Wire break detection

Activation via **P 2311[0] - MPRO\_BRK\_WireBreak**

- Monitoring of brake wire break active

### 6.8.4 SBC function selector switch



#### NOTE

- Only the two permissible switch settings are listed here in order to simplify commissioning.
- Please refer to ServoOne CM Specification SD0 (ID No.: 1400.402B.x) for a complete description of the SBC function (description of function, connections, configuration, wiring and commissioning, validation).
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com) in the DOCU-PORTAL.




Switch position DIL switches S-ADR	Function
<p>SBC active</p> 	<p>STO axis 1-3* SBC offSBC Axis 1-3*</p>
<p>SBC off</p> 	<p>STO axis 1-3* SBC offSBC off</p>
*depending on STO setting	

Table 6.16: SBC pre-setting



## 6.8.5 Motor brake via EtherCAT®

WARNING!	Risk of injury due to unintentional motion!
	<b>Improper conduct can lead to serious injury or death.</b> <ul style="list-style-type: none"> <li>Use the brake function with feedback as the motor brake is a safety-critical function. When using motor brake via EtherCAT®, the customer is responsible for correct exchange of data between drive and motor brake.</li> </ul>

The request to lift the brake is output by Axis Controller in **P 2332[0] - MPRO\_INPUT\_StatusWord** bit 7. The higher-level controller must map this parameter and forward the information so that the remote motor brake is lifted as soon as bit 7 = 1. If the brake is open, the other side should send feedback and map bit 7 in **P 2333[0] - MPRO\_INPUT\_ControlWord** (bit 7 = 1 if the brake is open). The Axis Controller waits for feedback when lifting and closing plus a defined delay before continuing to switch the drive's state machine.

The remote brake can also be controlled parallel to a motor brake connected directly. The following settings of **P 2318[0] - MPRO\_OUTPUT\_FS\_MOTBRK** are available for this purpose:

P 2318[0] - MPRO_OUTPUT_FS_MOTBRK	Directly connected motor brake	Remote motor brake
NONE(0)	-	-
INT(1)	Yes	None or: yes, without feedback
EXT(2)	-	yes, without feedback
FEEDB(3)	-	yes, with feedback
INT_FEEDB(4)	Yes	yes, with feedback

Table 6.17: P 2318[0] - MPRO\_OUTPUT\_FS\_MOTBRK settings

P No.	Index	Name	Unit	Description
2318 / 4366 / 6414	0	MPRO_OUTPUT_FS_MOTBRK		Axis 1 / 2 / 3: Motor brake selector
2332 / 4380 / 6428	0	MPRO_INPUT_StatusWord		Axis 1 / 2 / 3: Configurable status word
2333 / 4381 / 6429	0	MPRO_INPUT_ControlWord		Axis 1 / 2 / 3: Control word for special functions

Table 6.18: Parameter list – Motion profile axis for motor brake via EtherCAT®

## 6.8.6 Brake contactor

A three-phase load resistor can be connected directly to the motor terminals via a braking contactor in order to brake a motor quickly in case of a power failure: see Fig. 6.16: Brake contactor. The brake contactor is "normally closed" (nc) and is actuated by the output function **P 2318[0] - MPRO\_OUTPUT\_FS\_MOTBRK = RELAY (6)**. The resistors are defined on the basis of the maximum possible speed and the permissible currents.

When the control starts, the relay is opened and the time **P 2308.1 LiftTime** is waited. When the control is switched off, the relay is closed at the same time.

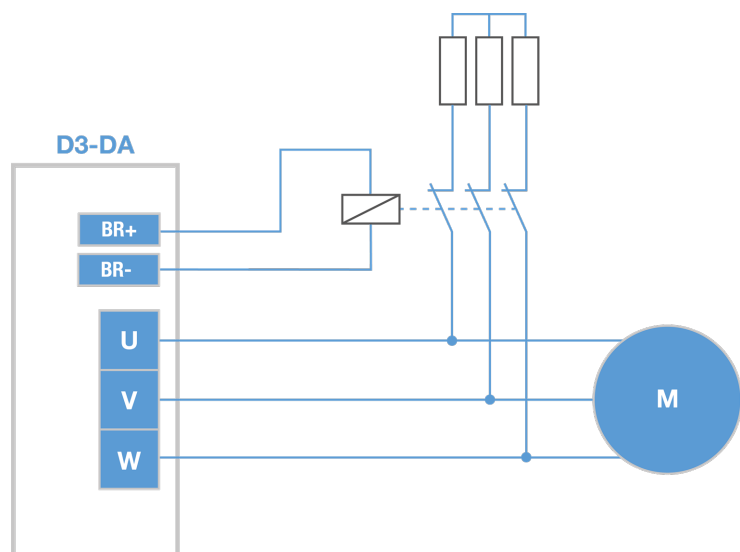


Fig. 6.16: Brake contactor

## 6.9 Motor phase test

The motor phase test offers an easy way to check the wiring of the motor during commissioning. All phases are energized and the motor is aligned several times. When doing so, the encoder position is checked.

<b>CAUTION!</b>	<b>The holding brake of the motor is released. Risk of injury due to unintentional motion!</b>
	<b>Improper conduct can result in severe bodily injury or death and damage to your system / machine.</b> <ul style="list-style-type: none"> <li>Do not use this function for axes with suspended loads.</li> </ul>

The preconditions for the motor phase test are:

- a basic setting of the current control
- correct parametrization of the encoder

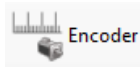
The following errors will be detected:

- motor phase not connected or wrong phase sequence
- holding brake not parametrized
- wrong pulses per revolution or connection error on the incremental encoder
- wrong bit number of SSI encoder
- incorrect direction of encoder

# 7 Encoder

## Chapter overview

### Pictogram



### Navigation

► Project tree ► Axis adjustment ► X axis ► Encoder

**Brief description** This chapter describes the selectable encoder types, their configuration and compensation and special functions.

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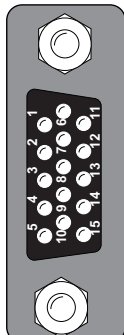
## 7.1 Connections and pin assignments



### NOTE

- Only the main connections and pin assignments are listed here in order to simplify commissioning.
- For a complete description of the encoder connections of the Axis Controller (label, position, pin assignment, function) for correct installation of devices, please refer to the Operation Manual ServoOne CMAxis Controller chapter “Overview of connections” and “Encoder connections”.
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com).

### 7.1.1 Single-axis controller

Fig.	X7 Pin	SinCos and TTL	EnDat / SSI	HIPERFACE®	BISS <sup>5)</sup>	Resolver
<b>X7</b> 	1	A-		REFCOS	-	S3 / COS- (A-)
	2	A+		+COS	-	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>		(+5 V <sup>3)</sup> <sup>4)</sup>	+5 V <sup>3)</sup>	-
	4	R+		Data +	SL+	-
	5	R-		Data -	SL-	-
	6	B-		REFSIN	-	S4 / SIN- (B-)
	7	(10 V / 110 mA <sup>4)</sup> )		10 V / 110 mA	(10 V / 110 mA <sup>4)</sup> )	-
	8	GND				-
	9	-	-	-		R2 (Resolver excit.-)
	10	-	-	-		R1 (Resolver excit. +)
	11	B+		+SIN		S2 / SIN+ (B+)
	12	nc / Temp+ <sup>1) 2)</sup>				
	13	nc / Temp- <sup>1) 2)</sup>				
	14	-	CLK+	-	MA+	-
	15	-	CLK-	-	MA-	-

1) Pin has no function in all devices up to revision status "F" / Motor temperature sensor in all devices as of revision status "F", as of FW 2.20-08

2) The motor temperature sensor must have reinforced insulation acc. to EN 61800-5-1 relative to the motor winding when connected to the encoder connector.

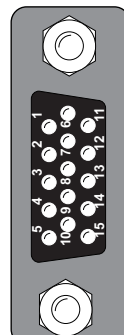
3) typ. 3 V, max. 5.25 V, 250 mA max.

4) Alternative voltage supply for certain encoder types.

5) Possible as of FW status 2.10-03

6) Additional resolver connection to X8 in all devices as of revision status "F", as of FW 2.10-03. Only one resolver per axis!

Table 7.1: Pin assignment of connector X7 (Enc1) **single-axis controller**

Fig.	X8 Pin	SinCos and TTL	Resolver <sup>6)</sup>
<b>X8</b> 	1	A-	S3 / COS- (A-)
	2	A+	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>	-
	4	R+	-
	5	R-	-
	6	B-	S4 / SIN- (B-)
	7	(10 V / 110 mA <sup>4) 7)</sup> )	
	8	GND	-
	9	-	R2 (Resolver excit.-)
	10	-	R1 (Resolver excit. +)
	11	B+	S2 / SIN+ (B+)
	12	nc / Temp+ <sup>1) 2)</sup>	
	13	nc / Temp- <sup>1) 2)</sup>	
	14	-	-
	15	-	-

1) Pin has no function in all devices up to revision status "F" / Motor temperature sensor in all devices as of revision status "F", as of FW 2.20-08

2) The motor temperature sensor must have reinforced insulation acc. to EN 61800-5-1 relative to the motor winding when connected to the encoder connector.

3) typ. 3 V, max. 5.25 V, 250 mA max.

4) Alternative voltage supply for certain encoder types.

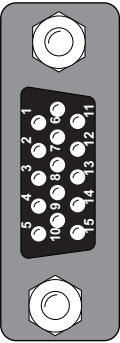
5) Possible as of FW status 2.10-03

6) Additional resolver connection to X8 in all devices as of revision status "F", as of FW 2.10-03. Only one resolver per axis!

7) As of revision status "F"

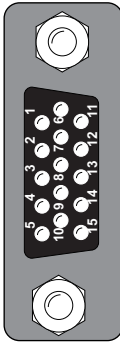
Table 7.2: Pin assignment of connector X8 (Enc2) **single-axis controller**

## 7.1.2 Double-axis controller

Fig.	X7 Pin	SinCos and TTL	EnDat / SSI	HIPERFACE®	BISS <sup>5)</sup>	Resolver
<b>X7</b> 	1	A-		REFCOS	-	S3 / COS- (A-)
	2	A+		+COS	-	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>		(+5 V <sup>3) 4)</sup>	+5 V <sup>3)</sup>	-
	4	R+		Data +	SL+	-
	5	R-		Data -	SL-	-
	6	B-		REFSIN	-	S4 / SIN-(B-)
	7	(10 V / 110 mA <sup>4)</sup> )		10 V / 110 mA	(10 V / 110 mA <sup>4)</sup> )	
	8	GND				-
	9	-	-	-		R2 (Resolver excit. -)
	10	-	-	-		R1 (Resolver excit. +)
	11	B+		+SIN		S2 / SIN+ (B+)
	12	nc / Temp+ <sup>1) 2)</sup>				
	13	nc / Temp- <sup>1) 2)</sup>				
	14	-	CLK+	-	MA+	-
	15	-	CLK-	-	MA-	-

- 1) Pin has no function in all devices up to revision status "F" / Motor temperature sensor in all devices as of revision status "F", as of FW 2.20-08  
2) The motor temperature sensor must have reinforced insulation acc. to EN 61800-5-1 relative to the motor winding when connected to the encoder connector.  
3) typ. 3 V, max. 5.25 V, 250 mA max.  
4) Alternative voltage supply for certain encoder types.  
5) Possible as of FW status 2.10-03  
6) Additional resolver connection to X8 in all devices as of revision status "F", as of FW 2.10-03. Only one resolver per axis!  
7) As of revision status "F"

Table 7.3: Pin assignment of connector X7 (Enc1) **double-axis controller** Axis 1

Fig.	X8 Pin	SinCos and TTL	Resolver <sup>6)</sup>
<b>X8</b> 	1	A-	S3 / COS- (A-)
	2	A+	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>	-
	4	R+	-
	5	R-	-
	6	B-	S4 / SIN-(B-)
	7	(10 V / 110 mA <sup>4) 7)</sup>	
	8	GND	-
	9	-	R2 (Resolver excit. -)
	10	-	R1 (Resolver excit. +)
	11	B+	S2 / SIN+ (B+)
	12	nc / Temp+ <sup>1) 2)</sup>	
	13	nc / Temp- <sup>1) 2)</sup>	
	14	-	-
	15	-	-

- 1) Pin has no function in all devices up to revision status "F" / Motor temperature sensor in all devices as of revision status "F", as of FW 2.20-08  
2) The motor temperature sensor must have reinforced insulation acc. to EN 61800-5-1 relative to the motor winding when connected to the encoder connector.  
3) typ. 3 V, max. 5.25 V, 250 mA max.  
4) Alternative voltage supply for certain encoder types.  
5) Possible as of FW status 2.10-03  
6) Additional resolver connection to X8 in all devices as of revision status "F", as of FW 2.10-03. Only one resolver per axis!  
7) As of revision status "F"

Table 7.4: Pin assignment of connector X8 (Enc2) **double-axis controller** Axis 1

Fig.	X9 Pin	SinCos and TTL	EnDat / SSI	HIPERFACE®	BISS <sup>5)</sup>	Resolver
<b>X9</b>	1	A-		REFCOS	-	S3 / COS- (A-)
	2	A+		+COS	-	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>		(+5 V <sup>3)</sup> <sup>4)</sup>	+5 V <sup>3)</sup>	-
	4	R+		Data +	SL+	-
	5	R-		Data -	SL-	-
	6	B-		REFSIN	-	S4 / SIN- (B-)
	7	(10 V / 110 mA <sup>4)</sup> )		10 V / 110 mA	(10 V / 110 mA <sup>4)</sup> )	-
	8	GND				-
	9	-	-	-		R2 (Resolver excit.-)
	10	-	-	-		R1 (Resolver excit. +)
	11	B+		+SIN		S2 / SIN+ (B+)
	12	nc / Temp+ <sup>1) 2)</sup>				
	13	nc / Temp- <sup>1) 2)</sup>				
	14	-	CLK+	-	MA+	-
	15	-	CLK-	-	MA-	-

- 1) Pin has no function in all devices up to revision status "F" / Motor temperature sensor in all devices as of revision status "F", as of FW 2.20-08  
2) The motor temperature sensor must have reinforced insulation acc. to EN 61800-5-1 relative to the motor winding when connected to the encoder connector.  
3) typ. 3 V, max. 5.25 V, 250 mA max.  
4) Alternative voltage supply for certain encoder types.  
5) Possible as of FW status 2.10-03  
6) Additional resolver connection to X8 in all devices as of revision status "F", as of FW 2.10-03. Only one resolver per axis!  
7) As of revision status "F"

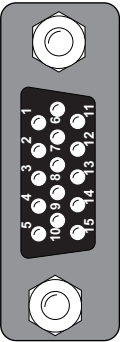
Table 7.5: Pin assignment of connector X9 (Enc1) **double-axis controller Axis 2**

Fig.	X10 Pin	SinCos and TTL	Resolver <sup>6)</sup>
<b>X10</b>	1	A-	S3 / COS- (A-)
	2	A+	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>	-
	4	R+	-
	5	R-	-
	6	B-	S4 / SIN- (B-)
	7	(10 V / 110 mA <sup>4)</sup> )	(10 V / 110 mA <sup>4) 7)</sup> )
	8	GND	-
	9	-	R2 (Resolver excit.-)
	10	-	R1 (Resolver excit. +)
	11	B+	S2 / SIN+ (B+)
	12	nc / Temp+ <sup>1) 2)</sup>	
	13	nc / Temp- <sup>1) 2)</sup>	
	14	-	-
	15	-	-

- 1) Pin has no function in all devices up to revision status "F" / Motor temperature sensor in all devices as of revision status "F", as of FW 2.20-08  
2) The motor temperature sensor must have reinforced insulation acc. to EN 61800-5-1 relative to the motor winding when connected to the encoder connector.  
3) typ. 3 V, max. 5.25 V, 250 mA max.  
4) Alternative voltage supply for certain encoder types.  
5) Possible as of FW status 2.10-03  
6) Additional resolver connection to X8 in all devices as of revision status "F", as of FW 2.10-03. Only one resolver per axis!  
7) As of revision status "F"

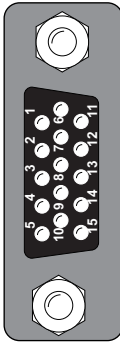
Table 7.6: Pin assignment of connector X10 (Enc2) **double-axis controller Axis 2**

### 7.1.3 Three-axis controller

Fig.	X7 Pin	SinCos and TTL	EnDat / SSI	HIPERFACE®	BISS <sup>5)</sup>	Resolver
<b>X7</b> 	1	A-		REFCOS	-	S3 / COS- (A-)
	2	A+		+COS	-	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>		(+5 V <sup>3)</sup> <sup>4)</sup>	+5 V <sup>3)</sup>	-
	4	R+		Data +	SL+	-
	5	R-		Data -	SL-	-
	6	B-		REFSIN	-	S4 / SIN- (B-)
	7	(10 V / 110 mA <sup>4)</sup> )		10 V / 110 mA	(10 V / 110 mA <sup>4)</sup> )	
	8	GND				-
	9	-	-	-		R2 (Resolver excit. -)
	10	-	-	-		R1 (Resolver excit. +)
	11	B+		+SIN		S2 / SIN+ (B+)
	12	nc / Temp+ <sup>1) 2)</sup>				
	13	nc / Temp- <sup>1) 2)</sup>				
	14	-	CLK+	-	MA+	-
	15	-	CLK-	-	MA-	-

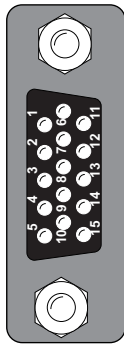
- 1) Pin has no function in all devices up to revision status "F" / Motor temperature sensor in all devices as of revision status "F", as of FW 2.20-08  
2) The motor temperature sensor must have reinforced insulation acc. to EN 61800-5-1 relative to the motor winding when connected to the encoder connector.  
3) typ. 3 V, max. 5.25 V, 250 mA max.  
4) Alternative voltage supply for certain encoder types.  
5) Possible as of FW status 2.10-03  
6) Additional resolver connection to X8 in all devices as of revision status "F", as of FW 2.10-03. Only one resolver per axis!  
7) As of revision status "F"

Table 7.7: Pin assignment of connector X7 (Enc1) **three-axis controller Axis 1**

Fig.	X8 Pin	SinCos and TTL	Resolver <sup>6)</sup>
<b>X8</b> 	1	A-	S3 / COS- (A-)
	2	A+	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>	-
	4	R+	-
	5	R-	-
	6	B-	S4 / SIN- (B-)
	7	(10 V / 110 mA <sup>4)</sup> <sup>7)</sup> )	
	8	GND	-
	9	-	R2 (Resolver excit. -)
	10	-	R1 (Resolver excit. +)
	11	B+	S2 / SIN+ (B+)
	12	nc / Temp+ <sup>1) 2)</sup>	
	13	nc / Temp- <sup>1) 2)</sup>	
	14	-	-
	15	-	-

- 1) Pin has no function in all devices up to revision status "F" / Motor temperature sensor in all devices as of revision status "F", as of FW 2.20-08  
2) The motor temperature sensor must have reinforced insulation acc. to EN 61800-5-1 relative to the motor winding when connected to the encoder connector.  
3) typ. 3 V, max. 5.25 V, 250 mA max.  
4) Alternative voltage supply for certain encoder types.  
5) Possible as of FW status 2.10-03  
6) Additional resolver connection to X8 in all devices as of revision status "F", as of FW 2.10-03. Only one resolver per axis!  
7) As of revision status "F"

Table 7.8: Pin assignment of connector X8 (Enc2) **three-axis controller Axis 1**

Fig.	X9 Pin	SinCos and TTL	EnDat / SSI	HIPERFACE®	BISS <sup>5)</sup>	Resolver
<b>X9</b> 	1	A-		REFCOS	-	S3 / COS- (A-)
	2	A+		+COS	-	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>		(+5 V <sup>3)</sup> <sup>4)</sup>	+5 V <sup>3)</sup>	-
	4	R+	Data +	SL+	-	-
	5	R-	Data -	SL-	-	-
	6	B-		REFSIN	-	S4 / SIN- (B-)
	7	(10 V / 110 mA <sup>4)</sup> )		10 V / 110 mA	(10 V / 110 mA <sup>4)</sup> )	
	8	GND				-
	9	-	-	-		R2 (Resolver excit. -)
	10	-	-	-		R1 (Resolver excit. +)
	11	B+		+SIN		S2 / SIN+ (B+)
	12	nc / Temp+ <sup>1) 2)</sup>				
	13	nc / Temp- <sup>1) 2)</sup>				
	14	-	CLK+	-	MA+	-
	15	-	CLK-	-	MA-	-

1) Pin has no function in all devices up to revision status "F" / Motor temperature sensor in all devices as of revision status "F", as of FW 2.20-08

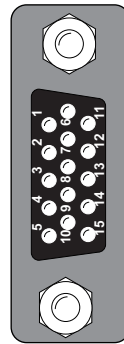
2) The motor temperature sensor must have reinforced insulation acc. to EN 61800-5-1 relative to the motor winding when connected to the encoder connector.

3) typ. 3 V, max. 5.25 V, 250 mA max.

4) Alternative voltage supply for certain encoder types.

5) Possible as of FW status 2.10-03

Table 7.9: Pin assignment of connector X9 (Enc1) **three-axis controller Axis 2**

Fig.	X10 Pin	SinCos and TTL	EnDat / SSI	HIPERFACE®	BISS <sup>5)</sup>	Resolver
<b>X10</b> 	1	A-		REFCOS	-	S3 / COS- (A-)
	2	A+		+COS	-	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>		(+5 V <sup>3)</sup> <sup>4)</sup>	+5 V <sup>3)</sup>	-
	4	R+	Data +	SL+	-	-
	5	R-	Data -	SL-	-	-
	6	B-		REFSIN	-	S4 / SIN- (B-)
	7	(10 V / 110 mA <sup>4)</sup> )		10 V / 110 mA	(10 V / 110 mA <sup>4)</sup> )	
	8	GND				-
	9	-	-	-		R2 (Resolver excit. -)
	10	-	-	-		R1 (Resolver excit. +)
	11	B+		+SIN		S2 / SIN+ (B+)
	12	nc / Temp+ <sup>1) 2)</sup>				
	13	nc / Temp- <sup>1) 2)</sup>				
	14	-	CLK+	-	MA+	-
	15	-	CLK-	-	MA-	-

1) Pin has no function in all devices up to revision status "F" / Motor temperature sensor in all devices as of revision status "F", as of FW 2.20-08

2) The motor temperature sensor must have reinforced insulation acc. to EN 61800-5-1 relative to the motor winding when connected to the encoder connector.

3) typ. 3 V, max. 5.25 V, 250 mA max.

4) Alternative voltage supply for certain encoder types.

5) Possible as of FW status 2.10-03

Table 7.10: Pin assignment of connector X10 (Enc1) **three-axis controller Axis 3**



## 7.2 Basic settings

Encoder settings:

Encoder settings:

☒ Single encoder ☐ Multiple encoder system

Select encoder channel: CH1(0) = Multi encoder interface

Select encoder: SINCOS(2) = Sincos encoder

Encoder temperature limit to generate error (0 = function off): 0 degC

Encoder temperature limit to generate warning (0 = function off): 0 degC

Encoder motor

Select encoder

Start encoder initialization

Encoder special function

Selection of absolut value information

NONE(0) =

☒ rotative ☒ linear

Sine/Cosine - motor and position encoder

Line count: 1

Encoder offset: 0 deg

Commutation setting

Gear ratio:

n1: 1

n2: 1

Track signal correction (GPOC): OFF(0) = No track error compensation

Fig. 7.1: Encoder settings dialog box

Encoder settings:

Encoder settings:

☒ Single encoder ☐ Multiple encoder system

Select encoder channel: CH1(0) = Multi encoder interface

Select encoder: SINCOS(2) = Sincos encoder

Encoder temperature limit to generate error (0 = function off): 0 degC

Encoder temperature limit to generate warning (0 = function off): 0 degC

Encoder motor

Select encoder

Start encoder initialization

Encoder special function

Selection of absolut value information

NONE(0) =

☐ rotative ☒ linear

Sine/Cosine - motor and position encoder

Encoder offset: 0 deg

Commutation setting

Configuration linear encoder

period length: 20000 nm

digital resolution: 0 nm

gear ratio numerator: 1

Track signal correction (GPOC): OFF(0) = No track error compensation

Fig. 7.2: Changing the dialog box for a linear encoder

### 7.2.1 Evaluation

There are different configurations available for users to choose from. The settings are made using DriveManager 5 or via the parameter interface (e.g. fieldbus).

The evaluation can be performed for

- one encoder per axis
- multiple encoders per axis (e.g. one motor encoder and a separate encoder)
- Motor connector (HIPERFACE® DSL)
- virtual encoder interface (e.g. EtherCAT® encoder).

Multi-encoder interface (CH1)				
Device	Encoder type	Axis 1	Axis 2	Axis 3
1-axis module	<ul style="list-style-type: none"> <li>Resolver</li> <li>SinCos</li> <li>EnDAT</li> <li>HIPERFACE®</li> <li>TTL</li> <li>SSI</li> </ul>	X7	-	-
2-axis module		X7	X9	-
3-axis module		X7	X9	X10

Table 7.11: Allocation of multi-encoder interface

Incremental encoder interface (CH2)				
Device	Encoder type	Axis 1	Axis 2	Axis 3
1-axis module	<ul style="list-style-type: none"> <li>SINCOS</li> <li>TTL</li> <li>Resolver <sup>2)</sup></li> <li>HTL for axis 1 <sup>3)</sup></li> </ul>	X8	-	-
2-axis module		X8	X10	-
3-axis module		X8	-	-

<sup>2)</sup> as of controller card ID SDC\_REV02, FW V2.20. Only one resolver per axis.  
<sup>3)</sup> on the touch probe inputs for axis 1. For pin assignments, see Operation Manual ServoOne CM.

Table 7.12: Allocation of incremental encoder interface

Optional channel 3 (CH3)				
Device	Encoder type	Axis 1	Axis 2	Axis 3
1-axis module	<ul style="list-style-type: none"> <li>HIPERFACE® DSL</li> </ul>	-	-	-
2-axis module		-	-	-
3-axis module		-	-	-

Table 7.13: Allocation of HDSL interface

## 7.2.2 Several encoders per axis module

P No.	Designation	Setting	Function
3057	ENC_CH_Sel		Allocation of the encoder channels
(0)	ENC SCon Evaluation for the speed actual value...	(0) CH1	... via the multi-encoder interface
		(1) CH2	... via the incremental encoder interface
		(2) CH3	... via the HIPERFACE® DSL interface on the motor connector
		(3) EC1	... via EtherCAT encoder 1
		(4) EC2	... via EtherCAT encoder 2
		(5) EC3	... via EtherCAT encoder 3
(1)	ENC PCon Evaluation for the position actual value...	(0) CH1	... via the multi-encoder interface
		(1) CH2	... via the incremental encoder interface
		(2) CH3	... via the HIPERFACE® DSL interface on the motor connector
		(3) EC1	... via EtherCAT encoder 1
		(4) EC2	... via EtherCAT encoder 2
		(5) EC3	... via EtherCAT encoder 3
(2)	ENC_MCon	(0) CH1	... via the multi-encoder interface

Table 7.14: Channel selection with ENC\_CH\_Sel

P No.	Designation	Setting	Function
	Evaluation for the commutation angle		
		(1) CH2	...via the incremental encoder interface
		(2) CH3	...via the HIPERFACE® DSL interface on the motor connector
		(3) EC1	... via EtherCAT encoder 1
		(4) EC2	... via EtherCAT encoder 2
		(5) EC3	... via EtherCAT encoder 3

Table 7.14: Channel selection with ENC\_CH\_Sel (continue)

The encoder information is required for various tasks in the drive:

- Commutation angle for the field-orientated control
- Speed actual value for the speed control loop
- Actual position value for the position control loop

Multiple encoders can be connected per axis. The encoders are selected for the particular tasks via **P 3057 - ENC\_CH\_Sel**. Encoder evaluation is activated and disabled on a per-channel basis.



#### NOTE

- SinCos encoder: Voltage level = 1 V<sub>ss</sub>
- If encoders are used that do not have KEBA approval, please contact Helpline.
- Activated encoders whose information is not used for any task are nevertheless active and operate the parameter **P 2851 - ENC\_CH1\_ActVal**.
- Evaluating unused encoders can cause errors.

## 7.2.3 Rotative and linear encoders

ServoOne CM supports rotative and linear versions of most encoder systems. This is determined by **P 2848[1] - IsLinear** for the respective encoder system. It is also possible to configure a linear or rotative motor in the motor settings (see Section "Synchronous motor" on page 48 or Section "Linear motor" on page 51). As a general rule, rotative motors are operated with rotative encoders and linear motors with linear encoders. It is also possible to operate a rotative motor with a linear (secondary) encoder, e.g. for linear toothed belt carriages or ball thread spindles. In this case, **P 2991[0] - MOT\_Lin\_MagnetPitch** must be set to the length on the linear encoder that corresponds to one motor revolution.

Rotative encoders are parameterized by means of a pulses per revolution and/or resolution per revolution in bits. Additionally, it is possible to parametrize a gear ratio "Numerator : Denominator" if the encoder is not mounted directly on the motor shaft. The gear counter can also be configured negatively if the direction of movement does not match the direction of movement of the motor.

Linear encoders are parametrized by means of the length of the sine period (**P 2848 [14] - PeriodLen** in nm) and / or the length of a digital increment (**P 2848[15] - DigitalResolution** in nm). The gear counter can also be used here to modify the direction of the encoder.

## 7.2.4 Temperature evaluation

HIPERFACE® DSL encoders, EnDat encoders and EtherCAT® encoders as well as some SmartAbs encoders allow you to evaluate encoder temperature and motor temperature via a temperature sensor connected to the motor.

Evaluation of encoder temperature is parametrized via **P 2848[36] - TemperatureLimit** and **P 2848[37] - TemperatureWarning**. If **TemperatureWarning**

is exceeded, the appropriate warning bit of the axis is set. The warning bit is disabled again once the **TemperatureWarning** drops 5 °C below the threshold. If **TemperatureLimit** is exceeded, an encoder error is output.

With regard to evaluating motor temperature, see Section "Motor protection" on page 58.

## 7.2.5 Encoder gearing

The use of the gear ratio makes it possible to adjust an encoder mounted on the load side to suit the motor shaft. A gear ratio for the encoder can be set for channels 1, 2 and 3 respectively. The transmission factor counter can also be set negatively. Specifically, a gear ratio of -1:1 is used to invert the encoder direction.

P No.	Index	Name	Unit	Description
2848 / 4896 / 6944		ENC_CH1_Settings		Axis 1 / 2 / 3: Channel 1 multi-encoder interface settings
2848 / 4896 / 6944	11	Numerator		Encoder gearing numerator
2848 / 4896 / 6944	12	Denominator		Encoder gearing denominator
2868 / 4916 / 6964		ENC_CH2_Settings		Axis 1 / 2 / 3: Incremental encoder interface channel 2 settings
2868 / 4916 / 6964	11	Numerator		Encoder gearing numerator
2868 / 4916 / 6964	12	Denominator		Encoder gearing denominator
2890 / 4938 / 6986		ENC_CH3_Backup_User		Axis 1 / 2 / 3: Channel 2 position backup in user units
2874 / 4922 / 6970	11	Numerator		Encoder gearing numerator
2874 / 4922 / 6970	12	Denominator		Encoder gearing denominator

Table 7.15: Parameter list – Encoder axis (excerpt for gear)

## 7.3 Encoder offset

### 7.3.1 Motor commutation

If the zero point for motor commutation position does not match the zero point of the encoder (angle offset), this can be compensated via **P 2966 - CON\_FM\_Offset**.



#### NOTE

- Encoders without an absolute position (e.g. TTL encoders) must determine motor commutation position at every system start. Auto commutation must be used for this purpose (for details see Section "Synchronous motor autocommutation" on page 152). This overwrites **P 2966 - CON\_FM\_Offset** after every calculation.
- The offset always relates to the encoder that has been selected as commutation encoder for the axis.

### 7.3.2 Position information

#### 7.3.2.1 Position value range

The multiturn position information of an encoder is interpreted such that position "0" is in the middle of the usable area (signed integer). The overflow is at  $\pm 2^{Multiturn-1}$ . The overflow does not cause any problems as long as the drive stays switched on. However, if a multiturn absolute value encoder moves outside the usable range and the drive is switched off and back on, the position is restored with an offset of  $2^{Multiturn}$  revolutions. This problem can be handled in various ways:

- For applications with a limited positioning range, the system must remain inside the usable area.
- For infinite positioning applications without gearing or with gearing  $2^N:1$  ( $N = 1, 2, 3, \dots$ ) the effect does not matter.

- For infinite positioning applications with a different gear ratio, activate Overflow compensation.

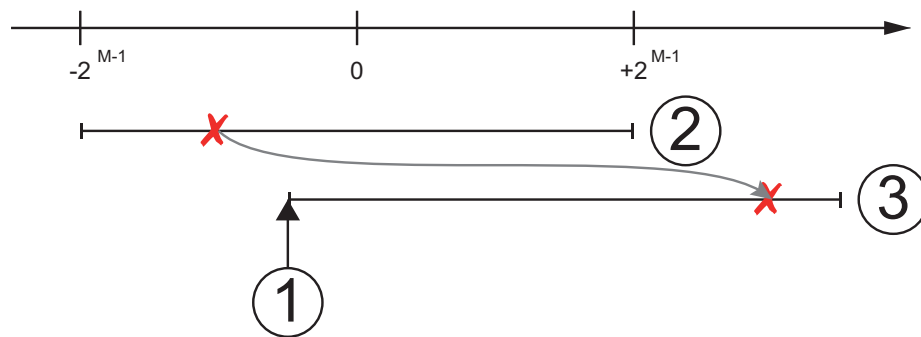


Fig. 7.3: Representation MTBase

- ① MTBase
- ② Native positioning range
- ③ Positioning range of MTBase

Legend for Representation of MTBase

The range of values can be offset using **P 2848[31] - MtBase** (see Section "Position offset" on page 81). It defines the lowest position represented by the encoder. Lower positions are mirrored at the top end of the range.

### 7.3.2.2 Position offset

In **P 2848[27] - OffsetMT** and **P 2848[26] - OffsetST** an offset can be set that is added to the native position. This only applies for positioning but not for determining commutation position.



#### NOTE

- P 2882[1] - MtBase = SET\_xxx** can be used to define a position offset so that the current position is approx. zero and represents the middle of the usable range of values. This is typically used to "zero" a motor with a multiturn encoder at the current position.

### 7.3.3 Parameters

P No.	Index	Name	Unit	Description
2966 / 5014 / 7062	0	CON_FM_EncOffset	deg	Axis 1 / 2 / 3: Encoder offset
2848 / 4896 / 6944	26	OffsetST	incr	Singleturn offset at original encoder position
2848 / 4896 / 6944	27	OffsetMT	incr	Multiturn offset at original encoder position
2848 / 4896 / 6944	31	MTBase		Multiturn zero point shift
2882 / 4930 / 6978		ENC_CH_Action		Axis 1 / 2 / 3: Actions for encoder system
2882 / 4930 / 6978	1	MtBase		Set overflow point based on current position

Table 7.16: Encoder offset parameters

## 7.4 Wire break detection

All encoder types include wire break detection. When the encoders are initialized, there must be no wire break, otherwise the axis outputs an error.

A wire break while the controller is switched on outputs error 22-xx (see Section "Error list" on page 231). The drive switches internally to sensorless quick stop (see Section "Quick stop without sensor" on page 134) and tries to brake using the configured ramp (see Section "Error reactions" on page 225).

A wire break while the controller is switched off outputs error 36-xx. It is also possible to suppress errors while it is switched off. To do so, set the error reaction of **P 2153 [24]** to "Ignore". The axis state machine can no longer achieve the "Ready for starting" state. This is only possible again by reinitialising the encoder system.

P No.	Index	Name / Setting	Unit	Description
2153 / 4201 / 6249	24	EncoderIdle		Reaction to error 36 'Encoder error while switched off'
		Ignore(0)		Ignore error
		FaultReactionOptionCode (1)		Reaction as per FaultReactionOptionCode
		ServoStop(2)		Perform quick stop and shut down power stage
		ServoStopAndLock(3)		Perform quick stop and shut down power stage
		ServoHalt(4)		Shut down power stage
		ServoHaltAndLock(5)		Shut down power stage
		WaitERSAndReset(6)		Shut down power stage, only reset by a system reset
2848 / 4896 / 6944	13	EncObsMin	100%	Encoder monitoring limit (root of a <sup>2</sup> +b <sup>2</sup> )
2848 / 4896 / 6944	34	EncObsTf	ms	Filter time constant of signal sqrt(a <sup>2</sup> +b <sup>2</sup> ) for wire break detection
2848 / 4896 / 6944	38	ErrorTol		Tolerate small number of errors in digital protocol

Table 7.17: Parameter list – Encoder axis (excerpt for wire break detection)

### 7.4.1 Wire break on encoders without digital protocol (Resolver, SinCos, TTL)

Wire break detection is based on the vector length of the sine or rectangular signal  $\sqrt{a^2 + b^2}$ . Vector length is calculated cyclically and filtered with the time constant **P 2848[34] - EncObsTf** to increase robustness. If the result is less than **P 2848[13] - EncObsMin**, a wire break is detected. **EncObsMin** is specified as a percentage of standard vector length (see respective encoder system). The actual signal amplitude of the encoder can be verified in the DigitalScope using variables 43, 49 "Encoder monitoring actual value".

### 7.4.2 Wire break on digital encoders

The digital encoders EnDat and HIPERFACE® DSL set internal status bits. The status word is output in the scope variable 51, 52, 74 CHx\_Status. Any deviation of a relevant bit generates a wire break error.

SSI encoders are monitored by the EncObs bit.

To increase robustness, a small number of errors can be ignored using **P 2848[38] - ErrorTol**. Monitoring is then implemented by means of a forward/backward counter. If the counter state reaches the threshold, a wire break is detected. The actual position is extrapolated with the last speed for this time.

## 7.5 Channel 1: Multi-Encoder Interface



### NOTE

- For a complete description of the encoder connections of the Axis Controller (label, position, pin assignment, function) please refer to the Operation Manual ServoOne CM Axis Controller, chapter "Overview of connections" on page 25 and "Encoder connections" on page 43.
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com) in the DOCU-PORTAL.
- When operating a synchronous motor with an incremental encoder, autocommutation must be performed.

The multi-encoder interface is defined as channel 1 (Channel 1 = CH1) for the Axis Controller. The encoder is selected via **P 2848[0] - Select**. Different settings are to be made depending on the type of encoder.

P No.	Parameter name / Setting	Function
2848 / 4896 / 6944	ENC_CH1_Settings	Settings for channel 1
(0)	(0) OFF	No encoder connected
	(1) TTL	Encoder TTL
	(2) SinCos	Sine cosine encoder with 1 Vpp signal, possibly with digital interface for absolute position
	(3) Resolver	Resolver
	(4) EnDat22	Digital encoder EnDat 2.2
	(5) SSI	Digital encoder SSI
	(6) HDLSL CH3	Reserved
	(7) Motor model	Simulated encoder via motor model (not implemented)
	(8) SDENC	not implemented
	(13) TMGW	Smart ABS Encoder
	(14) PANA	Panasonic Absolute Encoder

Table 7.18: ENC\_CH1 settings

### 7.5.1 TTL encoder

- Select encoder type
- Set pulses per revolution

P No.	Parameter name / Setting	Description
2848 / 4896 / 6944	ENC_CH1_Settings	Settings for channel x
(0)	(1) TTL	Selection of TTL encoder
(6)	Lines	Number of track periods per turn (pulses per revolution)
(16)	Signal Type AB	Standard evaluation as cosine (A) and sine (B) signal

Table 7.19: ENC\_CH1\_Settings for TTL encoder

A TTL encoder is parametrized via pulses per revolution (Lines) and signal type (SignalType). Signal type AB designates the usual two tracks with a 90° phase shift. In addition, the zero track signal is read and can be used in the appropriate homing operations.

A linear TTL encoder is parametrized via PeriodLen.

A TTL encoder is a purely incremental system. When used as a commutation encoder, autocommutation should be used (see Section "Motor commutation" on page 80). The zero pulse is used for certain homing operations (see Section "Homing / homing mode" on page 470) or can be read via the touchprobe interface (see Section "Touch probe" on page 523).

The TTL encoder evaluation system includes wire break detection. To do so, the squares of the amplitude of both signals are added, filtered using **P 2848[34] - EncObsTf** and compared with the threshold value **P 2848[13] - EncObsMin**. **EncObsMin** refers to a standard value of 5 V differential (20 V<sub>SS</sub>). The actual signal amplitude of the encoder can be verified in the DigitalScope using the variable 43 "Encoder monitoring actual value". Additionally, invalid state transitions of the TTL encoder (e.g. due to EMC events) can lead to fault switch-off.

The evaluation of the analogue signals is optimized for a common-mode voltage of 2.5 V, which is typical for most encoder types. This is a necessary precondition especially for the correct evaluation of the zero pulses on Axis 1 - CH1 and Axis 2 - CH1. If the common-mode voltage of the zero track deviates significantly from 2.5 V, this deviation must be compensated using parameter ENC\_CH1\_Settings.EncZMcms (P 2848[44] / P 4896[44]).

$$\text{Value} = (U_{\text{CommonMode}} - 1V) / 0.05$$

$$\text{Default (30)} = (2.5V - 1V) / 0.05$$

## 7.5.2 SinCos encoder

### 7.5.2.1 Analog tracks

P No.	Designation	Setting	Function
2848 / 4896 / 6944	ENC_CH1_Settings		Settings for channel 1
(0)		(2) SinCos	Evaluation of a SinCos encoder
(2)	AbsEncoder	(0) OFF	No evaluation of a digital interface
		(1) SSI	As per SSI protocol
		(2) EnDat	Evaluation of the digital interface as per EnDat protocol
		(3) HIPERFACE	Evaluation of the digital interface as per HIPERFACE protocol
(3)	AbsIntMode		Absolute value initialisation mode
		(0) STD default	For the initialisation of the internal position, both the analogue and the digital information are used. <b>CAUTION:</b> The quadrant assignment must match the manufacturer's format.

Table 7.20: ENC\_CH1\_Settings for SinCos encoder

P No.	Designation	Setting	Function
		(1) DIG	For the initialisation of the internal position, only the digital information from the absolute value interface is used.
(4)	Multiturn		Number of multiturn bits of the absolute value interface
(5)	Singleturn		Number of singleturn bits of the absolute value interface
(6)	Lines		Pulses per revolution / number of pole pairs
(10)	fc_override		A/D converter cut-off frequency override
(13)	EncObsMin		Encoder monitoring limit (root of $a^2+b^2$ )
(18)	GrayCode		Graycode / binary code
(19)	ParityOdd		Parity odd/even
(20)	ParityEnable		Evaluate parity bit
(21)	EncObsbitEnable		Enable encoder monitoring bit
(22)	PreBits		Number of bits before position
(23)	PostBits		Number of bits after position
(24)	PostParityPosition		Position of parity bit (in postbits)
(25)	PostEncObsPosition		Position of encoder monitoring bit (in postbits)
(34)	EncObsTf		Filter time constant of the signal $\sqrt{a^2+b^2}$ for the wire break detection
(44)	EncZMcms		Compensation of the common-mode voltage of the zero pulse track
(48)	EncErrBitEnable		Evaluate encoder error bit (in pre-bits)
(49)	PreEncErrPosition		Encoder error bit position (in pre-bits)

Table 7.20: ENC\_CH1\_Settings for SinCos encoder (continue)

For the SinCos encoder with a 1 V<sub>ss</sub> analogue signal, the number of sine wave periods per motor revolution (Lines) must be set in the parameters.

A linear SinCos encoder is parametrized via PeriodLen.



A SinCos encoder without an absolute interface is a purely incremental system. When used as a commutation encoder, autocommutation should be used (see Section "Synchronous motor autocommutation" on page 152). The zero pulse is used for certain homing operations (see Section "Homing" on page 202) or can be read via the touchprobe interface (see Section "Touch probe" on page 523).

If the encoder has a digital interface for absolute value initialisation, this interface is to be selected. If **AbsEncoder** = (0)OFF, an encoder with zero track signal is assumed. The zero track signal is read and can be used in the appropriate homing operations.

Homing methods are also available for encoders with distance-coded zero pulses (see Section "Method (-6) and Method (-7): Homing to encoders with distance-coded zero pulses in the negative direction" on page 477).

The ServoOne CM automatically adjusts filtering of the encoder signal in accordance with maximum signal frequency, i.e. maximum speed and pulses per revolution. With Sine-Cosine encoders (SinCos encoders) with a very small number of tracks ( $\leq 16$ ), however, signal interference sometimes occurs in the range of a few kilohertz. To attenuate this interference effectively, filtering threshold frequency **P 2848[10] - fc\_override** can be reduced to approx. 1 kHz.

The evaluation system for SinCos encoders includes wire break detection. To do so, the squares of the amplitude of both signals are added, filtered using **P 2848[34] - EncObsTf** and compared with the threshold value **P 2848[13] - EncObsMin**. **EncObsMin** refers to a standard value of  $1 V_{SS}$ , the actual signal amplitude of the encoder can be verified in DigitalScope with variable 43 "Encoder monitoring actual value". Additionally, invalid state transitions of the SinCos encoder (e.g. due to EMC events) can lead to fault switch-off.

The evaluation of the analogue signals is optimized for a common-mode voltage of 2.5 V, which is typical for most encoder types. This is a necessary precondition especially for the correct evaluation of the zero pulses on Axis 1 - CH1 and Axis 2 -

CH1. If the common-mode voltage of the zero track deviates significantly from 2.5 V, this deviation must be compensated using parameter ENC\_CH1\_Settings.EncZMcms (**P 2848[44] / P 4896[44]**).

$$\text{Value} = (U_{\text{CommonMode}} - 1V) / 0.05$$

$$\text{Default (30)} = (2.5V - 1V) / 0.05$$

### 7.5.2.2 Configuration of the absolute interface

If an encoder outputs an additional absolute value signal, it is parametrized in **P 2848[2] - AbsEncoder**:

1. Selection "AbsEncoder = (1) SSI"
2. Selection "AbsEncoder = (2) EnDat"
3. Selection "AbsEncoder = (3) HIPERFACE"

No settings should be made for the EnDat and HIPERFACE selection. The parameter settings are read from the encoder during the restart and are applied automatically in the drive controller.

Because the SSI encoder type does not provide an exact definition, the data telegram of the SSI encoder must be parametrized by the user (see Section "SSI encoder fully digital" on page 88).

The digital interfaces ENDAT and SSI are polled cyclically and monitored for wire break, even if they are only configured as the absolute interface of a SinCos encoder. These encoders can also be evaluated fully digitally (see Section "EnDat 2.2 encoder fully digital" on page 86 and Section "SSI encoder fully digital" on page 88). The analog tracks are then no longer used.

The parameter **AbsInitMode** is relevant for HIPERFACE® encoders with a small number of pulses per revolution. In STD(0) setting, the absolute position is calculated from a combination of digital and analog information. This increases

reproducible positioning accuracy substantially. However, this function relies on correct allocation of the digital information regarding the position of the analog tracks, as defined in the HIPERFACE® protocol. If this allocation was destroyed (e.g. due to manual zeroing of the encoder), the function will generate errors depending on the start position.

In DIG(1) setting, the start position is calculated from the digital information only. Then, the system continues to work differentially with the analog information.

### 7.5.3 Resolver

P No.	Parameter name / Setting	Description
2848 / 4896 / 6944	ENC_CH1_Settings	Settings for channel 1
(0)	(3) Resolver	Selection of resolver
(6)	Lines	Number of track periods per turn (number of pole pairs of the resolver)
(8)	Amplitude	Amplitude of the resolver signal [%]
(33)	ResolverFexec	Resolver excitation frequency 4 kHz or 8 kHz (default)

Table 7.21: ENC\_CH1\_Settings for resolver

The number of sine wave periods per motor revolution must be set for the resolver, i.e. the number of pole pairs of the resolver. It must be equal to 1 (in which case the resolver is a singleturn absolute value encoder) or equal to the number of pole pairs of the motor. Other combinations lead to an error message.

The excitation frequency of the resolver can be switched using the **ResolverFexec** parameter. The "8 kHz" setting returns optimum results at a switching frequency of 8–16 kHz. At a switching frequency of 4 or 2 kHz smoothness can be improved noticeably by reducing excitation to 4 kHz. This setting does not work at 8 kHz and more, however.

The resolver evaluation system includes wire break detection. The squares of the amplitude of both signals are added, filtered (using **P 2848[34] - EncObsTf**) and compared with the threshold value **P 2848[13] - EncObsMin**. **EncObsMin** refers to a standard value of 1 V<sub>SS</sub>, the actual signal amplitude of the resolver can be verified in DigitalScope with variable 43 "Encoder monitoring actual value".

### 7.5.4 EnDat 2.2 encoder fully digital

P No.	Parameter name / Setting	Description
2848 / 4896 / 6944	ENC_CH1_Settings	Settings for channel 1
(0)	(4) EnDat 2.2	Digital EnDat encoder with EnDat 2.2. Log
(17)	CycleCountMax	Absolute interface sampling rate (n x 0.125 ms)


Table 7.22: ENC\_CH1\_Settings for EnDat 2.2

The ENDAT encoder does not require any additional parametrization as the relevant parameters are read from the encoder system itself.

Some ENDAT 2.1 linear encoders cannot provide the absolute position in 125 µs. For these encoders the **CycleCountMax** parameter can be used to reduce the frequency of requests. **CycleCountMax** defines a multiple of 125 µs.

#### 7.5.4.1 Battery buffered ENDAT encoder

Some ENDAT encoders do not generate the multiturn information conventionally via gearing, but instead via battery buffered electronics. For encoders like these, the connector cable must be split out and a battery must be connected which supplies the electronics when the drive ServoOne CM is not supplied with 24 V. Please contact the motor manufacturer for the exact circuit configuration.

<b>WARNING!</b>	<b>Damage to the device and hazards to persons as a result of incorrect operation!</b>
	<b>Improper conduct can lead to the destruction of the system and serious injury or death.</b> <ul style="list-style-type: none"> <li>In the case of battery buffered encoders, the multiturn information is lost or takes on arbitrary values when the battery voltage is insufficient. If the system is configured improperly, the drive can move to incorrect positions and thereby destroy the system and endanger persons.</li> </ul>

If the battery voltage approaches the critical value, the warning **P 2151 Bit 22: BatteryAlarm** is triggered. The battery must then be changed while the ServoOne CM is in operation so that the encoder functions without a fault. The warning resets itself after two restarts.

Set the parameter **P 2848.32 - Mode = 0x400**, in order to use the encoder as a singleturn encoder. The multiturn information is then not displayed and the battery monitoring is suppressed.

### 7.5.4.2 Cyclical encoder information

Some EnDat encoders support cyclical encoder information for

- Diagnostics
- Encoder temperature
- Motor temperature

In order to use this function, the clock rate for the EnDat interface must be at least 2 MHz. For compatibility reasons, this function is disabled by default and the clock rate is set to 1 MHz.

### Activating the cyclical encoder data

The cyclical encoder data for EnDat can be activated using the configuration of the mode parameter in the encoder settings.

The activation is done using parameter **P 2848[32] Mode Bit 12 - 14**

Bit No.	Description
Bit 12:	Activate internal encoder temperature
Bit 13:	Activate external motor temperature resistor
Bit 14:	Activate diagnostics data

When one of these bits is set, the clock rate for EnDat is set to 2 MHz regardless of whether the cyclical data feature is supported by the encoder. If a desired functionality is not supported by the encoder hardware, but the corresponding bit is set, then the data are omitted during the transfer.

### Encoder temperature

The encoder temperature is displayed in parameter **P 2851.11 - EncoderTemp** (degC).

*see also section "Temperature evaluation" on page 79.*

### Motor temperature

Use **P 3063[10] - Source** to set the source to **ENC\_CH1** = Via digital protocol of the multi-encoder interface.

Use **P 3063[0] - Select** to select the type of the temperature sensor used.

P No.	Index	Parameter name / Setting	Description
3063 / 5111 / 7159		MON_MotorTemp	Motor protection settings
	0	Select	0 (NONE) = No sensor selected 1 (PTC) = PTC DIN 44081 2 (PTC1) = PTC Motor temperature sensor without short-circuit test 3 (TSS) = Temperature switch / Klixon 4 (KTY84_130) = Temperature sensor KTY84-130 5 (USER) = characteristic curve with interpolation points 6 (KTY83_110) = Temperature sensor KTY83-110 7 (PT1000) = PT1000 Motor temperature sensor
	10	Source	1 (ENC_CH1) = Via digital protocol of the multi-sensor interface

Table 7.23: MON\_MotorTemp - Motor protection settings

The temperature from the motor temperature sensor (external) is displayed in parameter **P 2851.10 - MotorTempR** as a resistance value.

P No.	Index	Parameter name / Setting	Description
2851 / 4899 / 6947		MON_MotorTemp	Motor protection settings
	10	MotorTemp	Display of the motor temperature

Table 7.24: MON\_MotorTemp - Motor temperature display

**NOTE**

- Heidenhain EnDat encoders are designed for a KTY84-130 resistor and send a temperature value via protocol. The drive controller back calculates this temperature to a resistance value so that all common temperature sensors can be supported.

**Diagnostics data**

The diagnostics data are displayed in parameter **P 2851 [13-19]**.

DiagData 1-6 represents the EnDat "Valuation number 1-6" as described in the Heidenhain documentation.

DiagData 0 is a counter for each valid record of diagnostics data. The incrementation of the counter reveals whether the diagnostics data are being transmitted continuously.

P No.	Index	Parameter name / Setting	Description
2851 / 4899 / 6947		ENC_CH1_ActVal	Actual encoder values channel 1
	13	DiagData0	Counter for each valid record of diagnostics data
	14	DiagData1	EnDat "Valuation number 1"
	15	DiagData2	EnDat "Valuation number 2"
	16	DiagData3	EnDat "Valuation number 3"
	17	DiagData4	EnDat "Valuation number 4"
	18	DiagData5	EnDat "Valuation number 5"
	19	DiagData6	EnDat "Valuation number 6"

Table 7.25: ENC\_CH1\_Settings for EnDat 2.2

**NOTE**

- Only valuation numbers which are supported by the encoder hardware are transmitted and displayed.

**7.5.5 SSI encoder fully digital**

P No.	Parameter name / Setting	Description
2848 / 4896 / 6944	ENC_CH1_Settings	Settings for channel 1
(0)	(5) SSI	SSI evaluation of a digital interface
(4)	Multiturn	Number of multiturn bits of the absolute value interface
(5)	Singleturn	Number of singleturn bits of the absolute value interface
(17)	CycleCountMax	Absolute interface sampling rate (n x 0.125 ms)
(18)	Graycode	TRUE = Graycode
[19]	ParityOdd	Parity odd/even
(20)	ParityEnable	Evaluate parity bit

Table 7.26: ENC\_CH1\_Settings for SSI encoder

P No.	Parameter name / Setting	Description
(21)	EncObsbitEnable	Evaluate encoder monitoring bit (in post-bits)
(22)	PreBits	Number of bits before position
(23)	PostBits	Number of bits after position
(24)	PostParityPosition	Position of parity bit (in postbits)
(25)	PostEncObsPosition	Position of encoder monitoring bit (in postbits)
(48)	EncErrBitEnable	Evaluate encoder error bit (in pre-bits)
(49)	PreEncErrPosition	Encoder error bit position (in pre-bits)

Table 7.26: ENC\_CH1\_Settings for SSI encoder (continue)

Because the SSI encoder type does not provide an exact definition, the data telegram of the SSI encoder must be parametrized by the user.

To begin with, the SSI data stream consists of the SSI position information. The general principle here is "most significant bit first". If the encoder transmits additional data (e.g. temperature information or redundant information for reliable position evaluation), it must be sent but not evaluated by the ServoOne CM. This requires the **PreBits** (bits to be ignored BEFORE the position information) and **PostBits** (bits to be ignored AFTER the position information). If the SSI encoder is operated fully digitally, the entire data stream can be read and processed by a controller from the parameters **P 2851[4] - RawDataLow** and **P 2851[5] - RawDataHigh**.

In both operation modes (fully digital and SinCos+SSI absolute), up to 16 bits each of the pre-bits and post-bits are additionally made available in parameters **P 2851[13] - DiagData0** and **P 2851[14] - DiagData1** for further processing by a controller. The meaning of these pre-bits and post-bits is encoder-dependent and can be found in the encoder data sheet.

P No.	Index	Parameter name / Setting	Description
2851 / 4899 / 6947		ENC_CH1_ActVal	Actual encoder values channel 1
	4	RawDataLow	Lower 32 bits of the SSI encoder data stream (only in "fully digital" operation mode)
	5	RawDataHigh	Upper 32 bits of the SSI encoder data stream (only in "fully digital" operation mode)
	13	DiagData0	PostBits (max 16 bits)
	14	DiagData1	PreBits (max 16 bits)

Table 7.27: ENC\_CH1\_Actual\_Value for SSI

Some SSI encoders provide a parity bit in the PostBits to safeguard transmission of the position data. If necessary, this can be evaluated by the drive controller to detect transmission errors. For this purpose, evaluation must be activated using parameter **P 2848[20] - ParityEnable** and the type of parity and the position of the parity bit in the PostBit data must be configured using parameters **P 2848[19] - ParityOdd** and **P 2848[24] - PostParityPosition**.

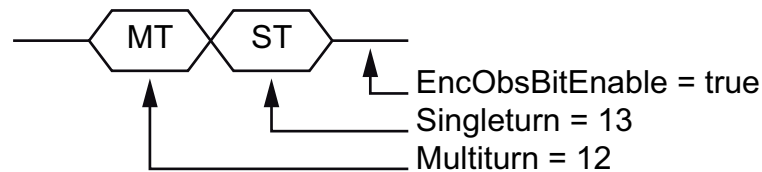
The evaluation of an encoder monitoring bit in the PostBits or an encoder error bit in the PreBits can also be activated to trigger an error reaction of the drive controller. To do so, **Parameters P 2848[21] - EncObsbitEnable** and **P 2848[25] - PostEncObsPosition** for the encoder monitoring bit or parameters **P 2848[28] - EncErrBitEnable** and **P 2848[49] - PreEncErrPosition** for the encoder error bit must be parametrized accordingly.

Some SSI encoders cannot provide the absolute position in 125 µs. For these encoders the **CycleCountMax** parameter can be used to reduce the frequency of requests. **CycleCountMax** defines a multiple of 125 µs.

With regard to parametrization of the number of bits, see the following examples:

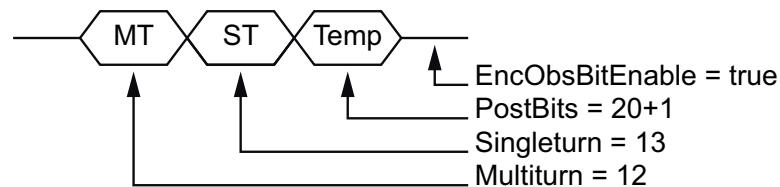
## 7.5.5.1 Example 1 (rotative SSI encoder):

- 12 bit multiturn information
- 13 bit singleturn information



## 7.5.5.2 Example 2 (rotative SSI encoder with additional information)

- 12 bit multiturn information
- 13 bit singleturn information
- 20 bit additional temperature information

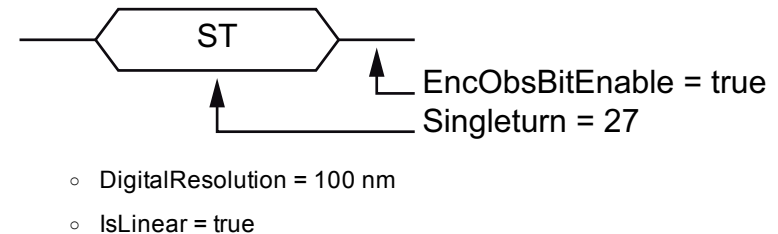


### NOTE

- With the PostBits, an additional bit must be parametrized for encoder monitoring (**EncObs**).

## 7.5.5.3 Example 3 (linear SSI encoder)

- 27 bit position information, 100 nm resolution



## 7.5.6 Smart ABS/Panasonic Absolute Geber

P No.	Parameter name / Setting	Description	
2848 / 4896 / 6944	ENC_CH1_Settings	Settings for channel 1	
(0)	(13) TMGW	Smart ABS digital interface	
	(14) PANA	Panasonic Absolute Encoder	
(4)	Multiturn		Number of multiturn bits of the absolute value interface
(5)	Singleturn		Number of singleturn bits of the absolute value interface

Table 7.28: ENC\_CH1\_Setting for smart ABS encoders

The SmartAbs and Panasonic encoders make it possible to read both singleturn and multiturn positions via a serial interface. If multiturn information is available, it is usually 16 bits wide, while the singleturn bits can vary from 17 to 23 bits.



#### NOTE

- The counting direction of the Smart ABS runs anti-clockwise (but not the Panasonic encoder).

Some Smart ABS encoders can provide the temperature of the encoder.

see also section "Temperature evaluation" on page 79.

The multiturn position of the Smart ABS and Panasonic encoders can be buffered by a battery. This situation requires the use of an external battery box.

The battery voltage is monitored. A battery warning is issued when the battery voltage becomes too low. In this case the battery must be replaced promptly!



#### NOTE

- In contrast to the SmartAbs encoder, the Panasonic absolute encoder does not reset the BatteryAlarm when the voltage is once again applied.
- After a battery replacement, set the parameter **ENC\_CH\_Action P 2882[2] - WarnReset = RESET** to reset the warning.

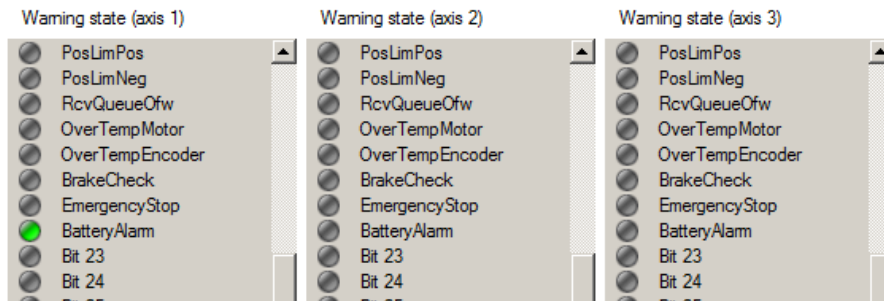


Fig. 7.4: Warning, battery alarm

### 7.5.6.1 Encoder GUI

#### Encoder settings:

☒ Single encoder
 ☐ Multiple encoder system

Select encoder channel: CH1(0) = Multi encoder interface

Select encoder: TMGW(13) = SmartAbs encoder

Select encoder

Start encoder initialization

Encoder special function

Encoder temperature limit to generate error (0 = function off)

0 degC

Encoder temperature limit to generate warning (0 = function off)

0 degC

Encoder offset: 191.755 deg

Detect encoder offset ...

**Gear ratio:**

n1: 1

n2: 1

Singleturn Bits: 0

Reset singleturn

Multiturn Bits: 0

Reset multiturn

Fig. 7.5: Encoder settings dialog box, Tamagawa encoder

**Encoder settings:**

☒ Single encoder
 ☐ Multiple encoder system

Select encoder channel: CH1(0) = Multi encoder interface

Select encoder: PANA(14) = Panasonic absolute encoder

Encoder motor

Encoder temperature limit to generate error (0 = function off): 0 degC

Encoder temperature limit to generate warning (0 = function off): 0 degC

Select encoder  
 Start encoder initialization  
 Encoder special function

Encoder offset: 191.755 deg

Detect encoder offset ...

**Gear ratio:**

n1: 1

n2: 1

Singletum Bits: 0  
 Multitum Bits: 0

Reset singletum  
 Reset multitum  
 Reset battery alarm

Fig. 7.6: Encoder settings dialog box, Panasonic encoder

The buttons "Reset Singletum" and "Reset Multitum" can be used to separately reset the singletum and multitum values inside the encoder.

The singletum value can be reset in order to obtain a commutation angle of zero for PSM. For this purpose, the motor should have a DC link from the phase U to the phases V and W in order to adapt the rotor position.

Resetting the multiturn position is necessary especially in order to adapt the zero position of a machine during initial commissioning or after a motor or encoder replacement.

When the respective button is pressed, the encoder initialization is carried out and a restart of the device is subsequently performed automatically.

For the Panasonic encoder, it is still possible to reset the battery alarm directly using the "Reset Battery Alarm" button.

## 7.5.7 BiSS

BiSS is an 'open' digital encoder interface, meaning it is not manufacturer-specific.

Nonetheless, in the present case, only selected encoder types are supported.

More details on BiSS can be found at [www.biss-interface.com](http://www.biss-interface.com).

A point-to-point connection from the master to a single-slave device is supported. The protocols "BiSS B" and "BiSS C unidirectional" are supported there. Moreover, the protocol "BiSS C" is supported with some restrictions, depending on what the operation of the selected encoder demands.



### NOTE

- As there are various protocol modes available for BiSS encoders (BiSS B, BiSS C, BiSS C unidirectional), make sure to consult with your project supervisor or the Helpline from KEBA before using BiSS encoders with special BiSS protocol modes.



### 7.5.7.1 Encoder GUI

Encoder settings:

☒ Single encoder
 ☐ Multiple encoder system

Select encoder channel: CH1(0) = Multi encoder interface

Select encoder: BISS(15) = BISS B/C and C-unidirectional encoder

TemperatureLimit: 0 degC

TemperatureWarning: 0 degC

Encoder offset: 0.384693 deg

☒ rotative
 ☐ linear

Gear ratio:
 

n1: -1
 n2: 1

Singleturn Bits: 20

Multiturn Bits: 16

Protocol settings:
 

Protocol type: BISS\_C\_UNI(3) = Use BISS C (unidirectional) Protocol Type
 CRC polynomial: 0021h
 CRC inversion: 1

Error mask (BISS-C only):
 

Error-ID: 22 30
 BISS-C protocol bit n-warning: ☐ ☐
 BISS-C protocol bit n-error: ☐ ☐

Fig. 7.7: Screen for Encoder settings, BiSS encoders

The encoder is selected via **P 2848[0] - Select - BISS(15)**.

P No.	Parameter name / Setting	Description
2848 / 4896 / 6944	ENC_CH1_Settings	Settings for channel 1
(0)	(15) BiSS	BISS encoder

Table 7.29: ENC\_CH1\_Settings for BiSS encoder

### Configuring the encoder protocol

The protocol type is set using **P 2848[41]-BISS\_Protocol\_Type**.

The following settings are possible:

P No.	Parameter name / Setting	Description
2848 / 4896 / 6944	ENC_CH1_Settings	Axis 1 / 2 / 3: Multi-encoder interface settings
	AUTO(0)	Automatic determination of the BISS protocol type (if unknown)
	BISS_B(1)	Use BISS B protocol
	BISS_C(2)	Use BISS C protocol (preset).
	BISS_C_UNI(3)	Use explicitly the BISS C protocol unidirectional

Table 7.30: Configuring the encoder protocol

With the setting **P 2848[41] - BISS\_C(2)**, the device attempts to establish a connection to a fully fully-fledged BiSS C encoder.

Some BiSS C encoders from the manufacturer Hengstler are supported for directly reading multi-turn and single-turn resolutions.

If the encoder is unknown to the firmware, the values in parameter ENC\_CH1\_Settings **P 2848[4] - Multiturn(4)** and ENC\_CH1\_Settings **P 2848[5] -Singleturn(5)** are used.

If a unidirectional BiSS\_C encoder is connected, the settings for **P 2848[42] - BISS\_CRC\_Polynomial** and **P 2848[43] - BISS\_CRC\_Invert** are also used.

To skip over the connection test for a fully functional BiSS\_C-Encoder, use the protocol type **P 2848[41] - BISS\_C\_UNI (3)**.

### An error and a warning bit

The BiSS C protocol delivers an error and a warning bit. The meaning of these bits depends on the encoder type. A masking mechanism is employed to allow flexible use of the two bits.

The parameter ENC\_CH1\_Settings **P 2848[32] - Mode(32)** is used for this masking.

P No.	Parameter name / Setting	Description
2484 / 4896 / 6944/	ENC_CH1_Settings	Axis 1 / 2 / 3: Multi-encoder interface settings
	Bit 0	activates the nWarning bit of the BiSS-C protocol to generate an error 22-250
	Bit 1	activates the nError bit of the BiSS-C protocol, error 22-250
	Bit 2	activates the nWarning bit of the BiSS-C protocol, error 30-40
	Bit 3	activates the nError bit of the BiSS-C protocol, error 30-40

Table 7.31: Masking error and warning bit

This makes it possible to define different error reactions for the two protocol bits.

### Evaluation of selected BiSS encoders

The slave address range is defined in only a very limited manner for BiSS (across all BiSS): it merely includes a so-called slave device ID (also called type ID) which is defined in a range of 8 bytes as of address 78 hex (6 bytes for the assembly and 2 bytes for the manufacturer). Other address ranges are only specified in a manufacturer-specific manner. The servo controller BiSS interface under consideration therefore only identifies selected types of BiSS encoders automatically. The respective special properties of these encoders are implicitly known to the interface to a sufficient extent.

### Evaluation of unknown BiSS encoders

In order to support unknown BiSS encoders, the ability to configure them manually has been implemented. If a BiSS-C encoder is identified during initialisation that is not known implicitly, then the encoder data cannot be read from the encoder via the interface. In this case, the parameters of the encoder data are also not overwritten with the data from the encoder. Instead, the interface is initialized explicitly with the

configured data from the parameters. The data must be taken from the data sheet of the BiSS encoder. This allows the cyclical transmission of the position to be initialized correctly in an alternative manner.

The specified values are taken from the following parameters:

ENC\_CH1\_Settings **P 2848[4] - Multiturn(4)**, ENC\_CH1\_Settings **P 2848[5] - Singleturn(5)**, **P 2848[42] - BISS\_CRC\_Polynomial** and **P 2848[43] - BISS\_CRC\_Invert**.

## 7.6 Channel 2: Incremental encoder interface



### NOTE

- For a complete description of the encoder connections of the Axis Controller (label, position, pin assignment, function) please refer to the Operation Manual ServoOne CM Axis Controller, chapter “Overview of connections” on page 25 and “Encoder connections” on page 43.
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com) in the DOCU-PORTAL.

The incremental encoder interface is defined to be channel 2 (Channel 2 = CH2) for Axis Controller. The encoder type is selected via **P 2868[0] - Select**. The HTL encoder can only be used on axis 1 (configuration as for TTL encoder).

P No.	Index	Name	Unit	Description
2889 / 4937 / 6985		ENC_CH2_Backup_User		Axis 1 / 2 / 3: Channel 2 position backup in user units
2889 / 4937 / 6985	0	Pos	PosUnit	Backup position in user units
2889 / 4937 / 6985	1	EncVal_PosDiff	PosUnit	Validation of position difference
2893 / 4941 / 6989		ENC_CH2_Comp		Axis 1 / 2 / 3: Channel 2 encoder compensation
2893 / 4941 / 6989	0	GpocMode		GPOC mode
2893 / 4941 / 6989	1	Kr		GPOC controller: Gain / phase
2893 / 4941 / 6989	2	Kr_off		GPOC controller: Offset
2893 / 4941 / 6989	3	TrackA_offset		Track A: Offset
2893 / 4941 / 6989	4	TrackB_offset		Track B: Offset
2893 / 4941 / 6989	5	TrackA_gain		Track A: Gain
2893 / 4941 / 6989	6	TrackB_gain		Track B: Gain
2893 / 4941 / 6989	7	TrackAB_phase		Track A/B: Phase

Table 7.32: Parameter list – Encoder axis – Channel 2

P No.	Index	Name	Unit	Description
2868 / 4916 / 6964		ENC_CH2_Settings		Axis 1 / 2 / 3: Incremental encoder interface channel 2 settings
2868 / 4916 / 6964	0	Select		Encoder selection channel 2
2868 / 4916 / 6964	1	IsLinear		Linear encoder yes/no
2868 / 4916 / 6964	2	AbsEncoder		Absolute interface selector
2868 / 4916 / 6964	3	AbsIntMode		Absolute value initialisation mode
2868 / 4916 / 6964	4	Multiturn		Number of multiturn bits
2868 / 4916 / 6964	5	Singleturn		Number of singleturn bits
2868 / 4916 / 6964	6	Lines		Pulses per revolution / number of pole pairs
2868 / 4916 / 6964	7	LineDelay	us	Phase shift compensation
2868 / 4916 / 6964	8	Amplitude	%	Amplitude of the resolver signal
2868 / 4916 / 6964	9	Corr		Signal correction selector
2868 / 4916 / 6964	10	Fc_override	kHz	A/D converter cut-off frequency override
2868 / 4916 / 6964	11	Numerator		Encoder gearing numerator
2868 / 4916 / 6964	12	Denominator		Encoder gearing denominator
2868 / 4916 / 6964	13	EncObsMin	100%	Encoder monitoring limit (root of a2+b2)
2868 / 4916 / 6964	14	PeriodLen	nm	Analog signal period (linear encoder)
2868 / 4916 / 6964	15	DigitalResolution	nm	Dig. increment (linear encoder)
2868 / 4916 / 6964	16	TTL_SignalType		TTL encoder signal type
2868 / 4916 / 6964	17	CycleCountMax		Absolute interface sampling rate (n x 0.125ms)
2868 / 4916 / 6964	18	Graycode		Graycode / binary code
2868 / 4916 / 6964	19	ParityOdd		Parity odd/even
2868 / 4916 / 6964	20	ParityEnable		Evaluate parity bit
2868 / 4916 / 6964	21	EncObsBitEnable		Enable encoder monitoring bit
2868 / 4916 / 6964	22	PreBits		Number of bits before position
2868 / 4916 / 6964	23	PostBits		Number of bits after position
2868 / 4916 / 6964	24	PostParityPosition		Position of parity bit (in postbits)
2868 / 4916 / 6964	25	PostEncObsPosition		Position of encoder monitoring bit (in postbits)
2868 / 4916 / 6964	26	OffsetST	incr	Multiturn offset at original encoder position
2868 / 4916 / 6964	27	OffsetMT	incr	Multiturn offset at original encoder position
2868 / 4916 / 6964	28	AbsSim_Enable		Absolute encoder simulation
2868 / 4916 / 6964	29	EncVal_Enable		Encoder validation
2868 / 4916 / 6964	30	EncVal_PosDiffLim	PosUnit	Max. encoder validation position

P No.	Index	Name	Unit	Description
2868 / 4916 / 6964	31	MTBase		
2868 / 4916 / 6964	32	unused1		unused sub parameter
2868 / 4916 / 6964	33	unused2		unused sub parameter
2868 / 4916 / 6964	34	EncObsTf	ms	Filter time constant of signal $\sqrt{a^2+b^2}$ for wire break detection
2868 / 4916 / 6964	35	InitDelay	steps	Encoder initialisation delay
2868 / 4916 / 6964	36	ErrorTol		Tolerate small number of errors in digital protocol
2871 / 4919 / 6967		ENC_CH2_ActVal		Axis 1 / 2 / 3: Actual encoder values channel 2
2871 / 4919 / 6967	0	ActPosST		Current singleturn position
2871 / 4919 / 6967	1	ActPosMT		Current multiturn position
2871 / 4919 / 6967	2	InitPosST		Singleturn init position
2871 / 4919 / 6967	3	InitPosMT		Multiturn init position
2871 / 4919 / 6967	4	RawDataLow		Encoder raw data: Low-word
2871 / 4919 / 6967	5	RawDataHigh		Encoder raw data: High-word
2871 / 4919 / 6967	6	Speed	RPM	Speed from encoder module unfiltered
2871 / 4919 / 6967	7	ZmDetect		Zero pulse
2871 / 4919 / 6967	8	ZmPosST		Singleturn position zero pulse
2871 / 4919 / 6967	9	ZmPosMT		Multiturn position zero pulse
2871 / 4919 / 6967	10	ActPosInc	INCR	Actual position in increments. For example, current actual position of the HTL encoder for the controller.
2871 / 4919 / 6967	11	ActErrorCnt		Actual encoder error counter (active if ErrorTol > 0)
2877 / 4925 / 6973		ENC_CH2_Backup		Axis 1 / 2 / 3: Channel 2 position backup
2877 / 4925 / 6973	0	PosST		Singleturn backup position
2877 / 4925 / 6973	1	PosMT		Multiturn backup position
2877 / 4925 / 6973	2	Valid		Backup
2877 / 4925 / 6973	3	EncSerialNum		Encoder serial number
2880 / 4928 / 6976		ENC_CH2_Info		Axis 1 / 2 / 3: Encoder information
2880 / 4928 / 6976	0	SerialNumber		Serial number
2880 / 4928 / 6976	1	FirmwareVersion		Firmware version
2880 / 4928 / 6976	2	EncoderType		Encoder type
2880 / 4928 / 6976	3	Flags		Encoder information
2880 / 4928 / 6976	4	Delay	ms	Internal dead time of the position

Table 7.32: Parameter list – Encoder axis – Channel 2 (continue)

The following encoders can be evaluated:

- TTL encoder with zero pulse
- SinCos encoder with zero pulse
- Resolver (only channel 1 or channel 2; from HW SDC\_Rev02, FW2.20)
- HTL encoder (only on axis 1) <sup>2)</sup>

The settings correspond to the setting of the multi-encoder interface (see Section "Channel 1: Multi-Encoder Interface" on page 83).

<sup>2)</sup> on the touch probe inputs for axis 1. For pin assignments, see Operation Manual ServoOne CM.

## 7.7 Channel 3: HIPERFACE® DSL encoder (optional)

With the one-cable solution, the encoder signal is also conducted via the power cable. The encoder and motor connection is located on the underside of the controller. Encoder data and settings are read from the encoder and applied.

Encoder settings:

Fig. 7.8: Encoder settings channel 3 HIPERFACE® DSL dialog box

P No.	Index	Name	Unit	Description
2890 / 4938 / 6986		ENC_CH3_Backup_User		Axis 1 / 2 / 3: Channel 2 position backup in user units
2890 / 4938 / 6986	0	Pos	PosUnit	Backup position in user units
2890 / 4938 / 6986	1	EncVal_PosDiff	PosUnit	Validation of position difference
2874 / 4922 / 6970		ENC_CH3_Settings		Axis 1 / 2 / 3: Channel 3 HIPERFACE® DSL settings
2874 / 4922 / 6970	0	Select		Channel 3 encoder selection

Table 7.33: Parameter list – Encoder axis – Channel 3

P No.	Index	Name	Unit	Description
2874 / 4922 / 6970	1	IsLinear		Linear encoder yes/no
2874 / 4922 / 6970	2	AbsEncoder		Absolute interface selector
2874 / 4922 / 6970	3	AbsIntMode		Absolute value initialisation mode
2874 / 4922 / 6970	4	Multiturn		Number of multiturn bits
2874 / 4922 / 6970	5	Singleturn		Number of singleturn bits
2874 / 4922 / 6970	6	Lines		Pulses per revolution / number of pole pairs
2874 / 4922 / 6970	7	LineDelay	us	Phase shift compensation
2874 / 4922 / 6970	8	Amplitude	+-%	Amplitude of the resolver signal
2874 / 4922 / 6970	9	Corr		Signal correction selector
2874 / 4922 / 6970	10	reserved		
2874 / 4922 / 6970	11	Numerator		Encoder gearing numerator
2874 / 4922 / 6970	12	Denominator		Encoder gearing denominator
2874 / 4922 / 6970	13	EncObsMin	100%	Encoder monitoring limit (root of a2+b2)
2874 / 4922 / 6970	14	PeriodLen	nm	Analog signal period (linear encoder)
2874 / 4922 / 6970	15	DigitalResolution	nm	Dig. increment (linear encoder)
2874 / 4922 / 6970	16	TTL_SignalType		TTL encoder signal type
2874 / 4922 / 6970	17	CycleCountMax		Absolute interface sampling rate (n x 0.125ms)
2874 / 4922 / 6970	18	Graycode		Graycode / binary code
2874 / 4922 / 6970	19	ParityOdd		Parity odd/even
2874 / 4922 / 6970	20	ParityEnable		Evaluate parity bit
2874 / 4922 / 6970	21	EncObsBitEnable		Enable encoder monitoring bit
2874 / 4922 / 6970	22	PreBits		Number of bits before position
2874 / 4922 / 6970	23	PostBits		Number of bits after position
2874 / 4922 / 6970	24	PostParityPosition		Position of parity bit (in postbits)
2874 / 4922 / 6970	25	PostEncObsPosition		Position of encoder monitoring bit (in postbits)
2874 / 4922 / 6970	26	AbsSim_Enable		Absolute encoder simulation
2874 / 4922 / 6970	27	EncVal_Enable		Encoder validation
2874 / 4922 / 6970	28	EncVal_PosDiffLim	PosUnit	Max. encoder validation position
2874 / 4922 / 6970	29	MTBase		Multiturn zero point shift
2874 / 4922 / 6970	30	TemperatureLimit	degC	Encoder temperature error threshold (0 = no function)
2874 / 4922 / 6970	31	TemperatureWarning	degC	Encoder temperature warning threshold (0 = no function)

P No.	Index	Name	Unit	Description
2874 / 4922 / 6970	32	ErrorTol		Tolerate small number of errors in digital protocol
2874 / 4922 / 6970	33	HdslFilter	rpm	Cut-off frequency for deep pass filter (0 = no function); value is written to encoder and stored if available in encoder <sup>1)</sup>
2875 / 4923 / 6971		ENC_CH3_ActVal		Axis 1 / 2 / 3: Channel 3 HIPERFACE® DSL actual values
2875 / 4923 / 6971	0	ActPosST		Current singleturn position
2875 / 4923 / 6971	1	ActPosMT		Current multiturn position
2875 / 4923 / 6971	2	InitPosST		Singleturn init position
2875 / 4923 / 6971	3	InitPosMT		Multiturn init position
2875 / 4923 / 6971	4	RawDataLow		Encoder raw data: Low-word
2875 / 4923 / 6971	5	RawDataHigh		Encoder raw data: High-word
2875 / 4923 / 6971	6	Speed	RPM	Speed from encoder module unfiltered
2875 / 4923 / 6971	7	ZmDetect		Zero pulse
2875 / 4923 / 6971	8	ZmPosST		Singleturn position zero pulse
2875 / 4923 / 6971	9	ZmPosMT		Multiturn position zero pulse
2875 / 4923 / 6971	10	MotorTempR	Ohm	Resistance of motor temperature sensor read from digital protocol.
2875 / 4923 / 6971	11	EncoderTemp	degC	Encoder temperature read from digital protocol
2875 / 4923 / 6971	12	DiagData		Status of HDSL signal
2875 / 4923 / 6971	13	HdslFilter	rpm	HDSL position filter of encoder Rid 0x10A, 0 if it does not exist
2875 / 4923 / 6971	14	ActPosInc		Actual position in increments
2875 / 4923 / 6971	15	ActErrorCnt		Actual HDSL error counter (active if ErrorTol > 0)
2878 / 4926 / 6974		ENC_CH3_Backup		Axis 1 / 2 / 3: Channel 3 position backup
2878 / 4926 / 6974	0	PosST		Singleturn backup position
2878 / 4926 / 6974	1	PosMT		Multiturn backup position
2878 / 4926 / 6974	2	Valid		Backup
2878 / 4926 / 6974	3	EncSerialNum		Encoder serial number
2881 / 4929 / 6977		ENC_CH3_Info		Axis 1 / 2 / 3: Encoder information
2881 / 4929 / 6977	0	SerialNumber		Serial number
2881 / 4929 / 6977	1	FirmwareVersion		Firmware version

Table 7.33: Parameter list – Encoder axis – Channel 3 (continue)

P No.	Index	Name	Unit	Description
2881 / 4929 / 6977	2	EncoderType		Encoder type
2881 / 4929 / 6977	3	Flags		Encoder information
2881 / 4929 / 6977	4	Delay	ms	Internal dead time of the position
2881 / 4929 / 6977	5	EncoderTypeCode		Name of the encoder type
2881 / 4929 / 6977	6	EncoderIndex		HDSL encoder index

Table 7.33: Parameter list – Encoder axis – Channel 3 (continue)

The internal signal processing of the Hiperface DSL encoder uses a filter which is parametrized with a limit speed in rpm. The limit speed can be set in the node POSFILT (RID 10Ah) and is saved in the encoder persistently. Please observe the documentation of your encoder is this regard.

The current filter value is read by the axis module and is shown in parameter ENC\_CH3\_ActVal.HdslFilter. If the encoder does not support the node POSFILT, then 0 is shown. The filter value can be changed using the parameter **P2874/4922/6970 (axis dependent) ENC\_CH3\_Settings - HdslFilter**. The new value is written to the encoder on encoder initialization and is saved there persistently. The parameter is also saved persistently in the axis module in case a motor replacement is made.

Moreover, the Hiperface DSL encoder provides information concerning the mounting accuracy of the encoder in node AXIALPOS (RID 0D4h). Here, the value 0 means optimal mounting, +-1 slightly shifted and +-2 considerably shifted mounting. Please observe the documentation of your encoder is this regard. This value is retrieved by the axis module cyclically and is output in the scope variables 1126/3126/5126. Check this value if the encoder issues errors. If the scope variable shows +-2, please contact Support.

**NOTE**

- The filter value is only entered in certain HDSL encoder models; see the description of the HDSL encoder in use for information on this.

The HIPERFACE® DSL encoder does not require any additional parametrization as the relevant parameters are read from the encoder system itself.



#### NOTE

- For devices with a HIPERFACE® DSL design, the temperature sensor connected to the HIPERFACE® DSL encoder in the motor is used in the motor protection (see Section "Motor protection" on page 58).

## 7.8 Channel 4: Sensorless control (virtual encoder)

### 7.8.1 Sensorless control for synchronous motors

Encoder settings:

☒ Single encoder
 ☐ Multiple encoder system

Select encoder channel: CH4(6) = Sensorless control

Select encoder: Kalman(10) = kalman filter sensorless control for sync

Encoder motor

☒ rotative
 ☐ linear

**Automatic dimensioning of sensorless control:**

1. Design of noise parameter:

2. Initializing filter model:

3. Selection of starting method and design of signal injection:

**Manual settings of test signal:**

☒ off
 ☐ closed loop
 ☐ open loop (l/f)

Full signal injection over speed range:  rpm

Linear increasing signal Amplitude:  rpm

d-current offset of injected signal:  A

Frequency of injected sinus:  Hz

Reference d-Amplitude of injected sinus:  A

Time for next PRBS-value:  ms

Referenced d-Amplitude of injected prbs:  A

Fig. 7.9: Sensorless control (virtual encoder) screen

### 7.8.1.1 Activation of sensorless control for synchronous motors

Sensorless control for synchronous motors can be activated in channel 4. Proceed as follows:

1. If available, load the motor data set in DriveManager 5. Alternatively, you can also perform motor identification. Details on both procedures can be found in Section "Motor, general" on page 46.
2. Select the "CH4(6) = Sensorless control" setting in "Encoder channel selection" in the graphical view.
3. Select the "Kalman(10)=" setting in "Encoder settings" in the graphical view.
4. Press the "Options..." button. The list view is displayed.
5. Set **P 2900[0] - ENC\_CH4\_Kalman\_Ctrl** = CalcQR. The design parameters of the Kalman filter are calculated.
6. Set **P 2900[0] - ENC\_CH4\_Kalman\_Ctrl** = SetSigInj. This defines the parameters for signal injection according to the motor data. This version is suitable for positioning tasks with low accuracy requirements, but requires a motor with a considerable inductance difference between d and q axis (e.g. IPM interior permanent magnet motor). A strong signal injection (**P 2886.4 - sine amplitude**) improves stability in the low speed range but increases noise development.

or

Set **P2900 ENC\_CH4\_Kalman\_Ctrl** = SetSigInjFF. This designs the parameters for signal injection so that no test signal is used in the low speed range and the motor is run in current / frequency mode. This method is suitable for speed-controlled drives with low start torque, does not require an inductance difference, and is very robust.

7. In the low speed range, d current can be increased in both methods (**P2886.7 Offset**) in order to improve stability.



#### NOTE

- Sensorless control is based in part on setpoint speed. This is particularly true for the low speed range. Use suitable ramps to prevent excessive deviations between setpoint and actual speed.

ID	Index	Name	Unit	Description
2884 / 4932 / 6980		ENC_CH4_Settings		Axis 1/2/3: Channel 4 virtual encoder interface settings
2884 / 4932 / 6980	0	Select		Encoder selection
2886 / 4934 / 6982		ENC_CH4_SignalInjection		Axis 1/2/3: Channel 4 signal injection
2886 / 4934 / 6982	0	Switch		Current injection
2886 / 4934 / 6982	1	FullSignalRange	rpm	SC test signal: Full test signal amplitude range
2886 / 4934 / 6982	2	IncreasingSignalRange	rpm	SC test signal: Linear transition range up until which the test signal is reduced to 0
2886 / 4934 / 6982	3	SinusFrequency	Hz	SC test signal: Sinusoidal signal frequency
2886 / 4934 / 6982	4	SinusAmplitude	A	SC test signal: d current amplitude of sinusoidal signal
2886 / 4934 / 6982	5	PRBStime	ms	SC test signal: PRBS signal time
2886 / 4934 / 6982	6	PRBSAmplitude	A	Amplitude of PBRs signal
2886 / 4934 / 6982	7	Offset	A	Current injection: D-current offset
2887 / 4935 / 6983		ENC_CH4_Backup		Axis 1 / 2 / 3: Channel 4 position backup
2887 / 4935 / 6983	0	PosST		Singleturn backup position
2887 / 4935 / 6983	1	PosMT		Multiturn backup position
2887 / 4935 / 6983	2	Valid		Backup
2900 / 4948 / 6996	0	ENC_CH4_Kalman_Ctrl		Axis 1 / 2 / 3: Control parameter for Kalman filter
2901 / 4949 / 6997		ENC_CH4_Kalman		Axis 1 / 2 / 3: Kalman filter settings
2901 / 4949 / 6997	0	Q00		Q-matrix: weighting factor fault voltage/inductance d-axis
2901 / 4949 / 6997	1	Q11		Q-matrix: Weighting factor fault voltage/inductance q-axis
2901 / 4949 / 6997	2	Q22		Q-matrix: Weighting factor torque/moment of inertia
2901 / 4949 / 6997	3	Q33		Q-matrix: Weighting factor of model position error
2901 / 4949 / 6997	4	Q44		Q-matrix: Weighting factor of Q11 and kmot
2901 / 4949 / 6997	5	R		R-matrix: Weighting factor of current measuring noise

Table 7.34: Sensorless synchronous motor control parameters



### 7.8.1.2 Auto commutation

Sensorless control does not require autocommutation. At start, the motor performs a brief uncontrolled movement in order to adjust to the commutation position assumed at start.

To replace this uncontrolled movement with a defined movement, it is possible to use the commutation methods IENCC (see Section "Commutation position by alignment (IENCC)" on page 152) and IECON (see Section "Commutation position by alignment with minimized movement (IECON)" on page 154).

Motionless initialization is achieved using the LHMEAS method, see Section "Commutation position by inductance measurement (LHMEAS)" on page 155.

## 7.8.2 Sensorless control for asynchronous motors



#### NOTE

The functions described in chapters 7.8.2.1 Activation of sensorless control for asynchronous motors and 7.8.2.2 Start-up of a sensorless-controlled asynchronous motor are currently under development. Not all asynchronous motors are suitable for this operation mode. Asynchronous standard motors in a power range of 1.5 kW to 10 kW have proven to be suitable.

- The speed accuracy that can be achieved must be determined experimentally.
- The torque displayed is generally inaccurate.

### 7.8.2.1 Activation of sensorless control for asynchronous motors

In sensorless mode, the other variables (position, speed, torque) are calculated based on characteristic motor data and the measured currents and voltages on the motor. A problem is determining position at standstill or at low speed.

Sensorless control of asynchronous motors is suitable for motors of medium power in speed mode. The target speed should be set using appropriate ramps. The drive should also be able to maintain the target speed and, especially, should not be continuously braked by a load torque that is too high.

For a more accurate analysis, please contact your service partner. To do so, the electrical parameters of the motor's equivalent circuit or of the motor itself are required. If needed, carry out a motor identification and save the resulting data set.

Proceed as follows:

No.	Step
1	Copy the motor variables from the rating plate into the appropriate input box.
2	Start motor identification to identify other motor parameters.
3	In the "Encoder Settings" dialog box (see Section "Basic settings" on page 77), set <b>P 3057[2] - MCon</b> to "CH4(6) = Sensorless control" in "Encoder channel selection" (single-encoder system) or in "Encoder for commutation and torque control" (multi-encoder systems).
4	In the same dialog box, set ( <b>P 2884[0] - Select</b> ) to "FluxModelAsm (12) = Sensorless control for asynchronous motors" in "Encoder selection".
5	In the "Basic Control Settings" dialog box (see Section "Basic setting" on page 121), set "Speed filter TF" ( <b>P 2949[0] - CON_SCALC_Tf</b> ) to 10 ms.
6	In the same dialog box, set <b>P 3059[1] - Stiffness</b> to 10% in "Control adaptation of rigidity" and press the "Activate" button (sets <b>P 3068[0] - command</b> to <b>CALC_SCON</b> (12)).
7	In the "Asynchronous motor control settings identification" dialog box (see Section "Asynchronous motor" on page 55) enter the "Total inertia" of the system ( <b>P 2992[0] - SCD_JSum</b> ). Enter a value that is too small rather than too big to avoid a tendency to oscillate. Automatic detection is <i>not</i> advisable due to the control dynamics and accuracy required.

Table 7.35: Commissioning a sensorless-controlled asynchronous motor

The torque displayed is generally inaccurate and unusable for monitoring or the like. This is also the reason that the motor might not reach the expected torque although the current is significantly lower than expected. Set the torque limit 2968[2] - LimFac\_Torque to the maximum of 1000% and use the current limit 2968[1] - LimFac\_Current to protect the motor.

## Additional parameter settings

ID	Index	Name	Unit	Description
3028/5076/7124		CON_FM_SfcAsm		Axis 1/Axis 2/ Axis 3: Setting for sensorless control of asynchronous motors (SFC)
3028/5076/7124	0	TF_is	ms	Stator current filter. Use the 1...10 fold of the motor rotor time constant.
3028/5076/7124	1	K_ov	%	Limiting factor against tipping. Decreasing this factor improves model stability, but reduces available current, esp. in flux weakening range.
3028/5076/7124	2	K_isd	%	d-axis, scaling of the current control; reducing this factor improves the model stability but increases the deviation of the d-axis current.
3028/5076/7124	3	T_start	ms	Start-up time (flux setting)
3034/5082/7130		CON_FM_VoltageError		Axis 1/2/3: Settings for SFC voltage errors model. low-voltagecharacteristic: Must be set during the motor identification; may require some coordination effort.
3034/5082/7130	0	I_err	A	low-voltage characteristic: corner current
3034/5082/7130	1	V_err	V	low-voltage characteristic: corner voltage
2886/4934/6982		ENC_CH4_Kalman_SignalInjection		Axis 1/Axis 2/ Axis 3: Channel 4 signal injection
2886/4934/6982	0	Switch		Current injection; Choose flux boost or voltage/frequency (I/f) control at low speed.
2886/4934/6982	1	Full signal range	rpm	SR test signal: Range of the full test signal amplitude = lowspeedrange
2886/4934/6982	2	Increasing signal range	rpm	SC test signal: Linear transition range up until which the test signal is reduced to 0. = transition range
2886/4934/6982	7	Offset		Current injection: D-current offset SC test signal: d-current offset of the sinusoidal signal
2949/4997/7045		CON_SCALC_Tf		Axis 1/Axis 2/ Axis 3: Set velocity value filter time constant to 10 ms or more.

Table 7.36: Sensorless control of asynchronous motor

### 7.8.2.2 Start-up of a sensorless-controlled asynchronous motor

P No.	Index	Name	Unit	Description
2886 / 4934 / 6982		ENC_CH4_SignalInjection		Axis 1 / 2 / 3: Channel 4 signal injection
2886 / 4934 / 6982	0	Switch		Current injection
2886 / 4934 / 6982	1	FullSignalRange	rpm	SC test signal: Full test signal amplitude range
2886 / 4934 / 6982	2	IncreasingSignalRange	rpm	SC test signal: Linear transition range up until which the test signal is reduced to 0
2886 / 4934 / 6982	7	Offset	A	Current injection: D-current offset

*Table 7.37: Parameters for start-up of a sensorless-controlled asynchronous motor in I/f mode*

An asynchronous motor is not suitable for sensorless positioning due to its design because the rotor does not have a fixed magnetic pole. Moreover, asynchronous motors controlled without sensors tend to have unstable behaviour at low speeds and low torques in generator mode.

#### 7.8.2.2.1 Starting the asynchronous motor in SFC

First attempt to use the SFC controller in the proximity of the standstill. (**P 2886[0] signal = 0**). This allows gentle operation and an optimal torque utilization. The standstill behaviour can be set with the error voltage model **P 3034[1] V\_err**; generally, a setting of 50% of the original setting yields good results. Higher settings can improve the accuracy of the set speed, however they decrease the stability.

It is possible that a flux boost may improve the results at low speeds when a large load is set in motion from a standstill. Set **P 2886[0] signal = 1**, **P 2886[1]** to 50 . . . 200 rpm, **P 2886[2]** to 200 . . . 500 rpm and **P 2886[7]** to the d-current required for starting. If the motor tends to tip, then attempt to limit the permissible slip using **P 3028[1] K\_ov**.

#### 7.8.2.2.2 Starting the asynchronous motor in I/f mode

If the stability and the torque in the proximity of standstill are inadequate, use the current/frequency mode (I/f).

Set **P 2886[0] signal = 3**. Set the speed limits **P 2886[1]** and **P 2886[2]** lower than for the use of flux boost. The d-current **P 2886[7]** must be adequate to set the maximum possible load in motion when starting. Bear in mind that a certain control gain **P 3028[2] K\_isd** is required for the momentary current; for this purpose, observe the scope signals of Isd and Isdref during acceleration.

## 7.9 Electronic rating plate encoder

### 7.9.1 Basic settings

Load nameplate now

Fig. 7.10: Encoder button – Electronic rating plate

The function of the electronic rating plate causes the motor data to be loaded from motor encoder memory when the motor is first connected or replaced. This facilitates commissioning and service (motor replacement). Check whether your system motors already have an electronic rating plate.

Leave the default settings if you are using system motors. This adheres to the commissioning and service concept of KEB A.

Set **P 2896[1] - Mode** = 0 to prevent the rating plate from loading.

The **Mode** parameter is bit-coded. A basic distinction is made between general motor data and unit-specific motor data.



#### NOTE

- The data are loaded from the encoder every time it is initialized. This takes time and is error-prone. It is better to save the data in the axis module once after commissioning.



#### NOTE

- When rating plate processing is enabled in **Mode** and the axis evaluates an EtherCAT encoder, the axis module expects a handshake or the download of the rating plate data. The axis remains in the state "Not ready to start" until the rating plate data are present. Set the bit NOWAIT (6) in Mode to deactivate the handshake - the axis then also starts without the rating plate data.

Bit No.	Name	Description
0	BASEINIT	All rating plate data are loaded if no motor is selected (device has factory settings)
1	MOTCHG	All rating plate data are loaded if the motor type has changed. The motor type is stored in the electronic rating plate. This function requires reading the rating plate every time the device starts up and prolongs start-up time.
2	ENC SN (Default ON)	Unit-specific motor data are loaded if the serial number of the encoder has changed.
3	ENPSN	Unit-specific motor data are loaded if the serial number (stored in the electronic rating plate) has changed. This function requires reading the rating plate every time the device starts up and prolongs start-up time.
4	CHGERR	Detailed error messages for motor replacement. When replacing with a motor of the same type, the unit-specific data are loaded; when replacing with a motor of a different type, an error is reported.
5	AUTOENC	Automatic encoder selection depending on device type if no encoder is selected. Only HIPERFACE®, HIPERFACE DSL® and EtherCAT® encoders are supported. Use the functions AUTOENC and BASEINIT for a predominantly automatic configuration of the basic settings at first power up with a motor connected (Plug&Play).

Table 7.38: Bits of P 2896[1] - Mode

The bits **ENC SN** and **ENPSN** refer to the serial numbers of the encoder and motor. These are written to **P 2899** when the rating plate is loaded. If a "Save in the device" is now triggered, both the serial numbers and the item-specific data are permanently stored. The rating plate is no longer read during subsequent restarts. However, if the motor is replaced, this is registered and the data are read in again.

If there is no saving in the device, the device recognizes a "new" motor at each start and reads in the item-specific data again.

P No.	Index	Name	Unit	Description
2896 / 4944 / 6992		ENC_ENP_Settings		Axis 1 / 2 / 3: ENP settings, electronic rating plate
2896 / 4944 / 6992	0	Select		Selection of encoder channel for ENP
2896 / 4944 / 6992	1	Mode		ENP mode
2896 / 4944 / 6992	2	Blocks		ENP individual block selection
2897 / 4945 / 6993		ENC_ENP_Action		Axis 1 / 2 / 3: ENP action parameters
2897 / 4945 / 6993	0	Load		Load motor rating plate now. Requires encoder initialisation.
2897 / 4945 / 6993	1	Blocks		ENP individual block selection
2897 / 4945 / 6993	2	Service		do not use
2898 / 4946 / 6994		ENC_ENP_Info		Axis 1 / 2 / 3: ENP information
2898 / 4946 / 6994	0	DatasetRev		Version of ENP data set (read by encoder)
2898 / 4946 / 6994	1	FirmwareRev		Version of ENP firmware (stored in firmware)
2898 / 4946 / 6994	2	DateOfMotorProduction		Format yyyymmdd. Read from motor rating plate
2898 / 4946 / 6994	3	ManufacturingPlantID		Loaded from motor rating plate
2898 / 4946 / 6994	4	EncoderSerialNumber		Serial number of the encoder that is connected.
2898 / 4946 / 6994	5	MotorModelID		Motor model ID as read off the rating plate.
2898 / 4946 / 6994	6	MotorSerialNumber		Motor serial number as read off the rating plate.
2899 / 4947 / 6995		ENC_ENP_Backup		Axis 1 / 2 / 3: ENP information
2899 / 4947 / 6995	0	MotorModelID		Loaded from motor rating plate
2899 / 4947 / 6995	1	MotorSerialNumber		Loaded from motor rating plate
2899 / 4947 / 6995	2	EncoderSerialNum		Manufacturer's serial number of encoder
2257 / 4305 / 6353	0	MPRO_DRVCOM_Init		Axis 1 / 2 / 3: Initialisation

Table 7.39: Parameter list – Encoder axis – Electronic rating plate

## 7.9.2 User data fields (UserData)

The parameters **P 2904 - ENC\_ENP\_UserDataF32** and **P 2905 - ENC\_ENP\_UserDataF32** represent user data per axis which can be saved in the electronic rating plate of the encoder. They have no meaning for the firmware, the data might

have to be written and evaluated by the controller.

Proceed as follows to write the user data fields:

1. Write the desired values to the parameters **P 2904** and **P 2905**. The two parameters are not saved in the device.
2. Set **P 2897[3] - WriteUserData = WRITE**
3. Start the axis.
4. If **P 2897[3] - WriteUserData = PASS**, the write operation was completed successfully.  
If **P 2897[3] - WriteUserData = FAIL**, there has been an error. In this case, observe the system messages in the DriveManager (View/ Messages)
5. Use **P 2896[1] - Mode** to set **bit 7 (USERDATA)** and restart the drive. Now the parameters are read out of the motor and can be queried by the controller.

## 7.10 EtherCAT® encoder

The EtherCAT® encoder provides the position information about the control of the drive. Up to three EtherCAT® encoders can be evaluated on one drive

- **P 800 - ENC\_EC1\_Settings**
- **P 802 - ENC\_EC2\_Settings**
- **P 804 - ENC\_EC2\_Settings**



### NOTE

- In a system with one Motion One CM Controller, configure the encoder box and EtherCAT encoder in KeStudio. The relevant parameters are set automatically.

### 7.10.1 Configuration of third-party encoders

The EtherCAT® encoder channels are designed for encoder systems that are evaluated on the controller and whose position is sent to the ServoOne CM via a fast channel.

Configure the third-party encoder for your controller. Send the position information cyclically to the **RawDataLow** parameter of the respective encoder channel. The position information must be right aligned there and must not exceed a width of 31 bits. Use Sync manager 4 with a sampling rate of 125 µs. Bit 31 of **RawDataLow** or bit 0 of **RawDataHigh** is evaluated as an "encoder OK" message. At the same time, Sync manager 2 and Sync manager 4 are monitored. If one of the criteria fails, it is considered a cable break. Wire break detection can be enabled/disabled via the **StatusCheck** parameter of the respective encoder channel (de).

The position information in **RawDataLow** is defined by the **Multiturn** and **Singleturn** parameters, similar to an SSI encoder (see Section "SSI encoder fully digital" on page 88). These parameters should be written every time the controller starts up.


They do not lead to a loss of homing (see Section "Advanced encoder function" on page 108). The sum of the multiturn and singleturn must lie between 4 and 31. Singleturn must not be zero.


The EtherCAT® encoder can also be configured as linear. In this case, parametrize as follows:

- **IsLinear** = true
- **Multiturn** = 0
- **Singleturn** = number of bits of the linear encoder
- **DigitalResolution** = resolution of the linear position.

The delay that arises on the fieldbus can be entered in the **Delay** parameter. Then it is compensated with regard to electrical frequency, so that no loss of torque occurs at high speed.

EtherCAT® encoders can evaluate encoder temperature and motor temperature (by means of a temperature sensor connected to the encoder). This is implemented for the special cases of a remote HIPERFACE® DSL encoder and an ENDAT encoder. Set the encoder type in the **EncoderType** parameter for these two cases. Send the data words for motor and encoder temperature by means of SDO transfer to the parameters **MotorTempRaw** and **EncoderTempRaw**, the drive calculates the resulting encoder temperature and resistance. With regard to temperature evaluation, see Section "Temperature evaluation" on page 79 and Section "Motor protection" on page 58.

<b>CAUTION!</b>	<b>Damage to the device as a result of incorrect operation!</b>
	<p><b>Failure to exercise caution or follow proper working procedures may result in damage to the device.</b></p> <ul style="list-style-type: none"> <li>In a use case with an EtherCat encoder and external brake via the encoder box, the brake is applied immediately if the fieldbus connection is lost. A possible quick-stop ramp would then work against the closed brake and the system could be destroyed. In this case the response for "Error 4 "EtherCat Error"" must be set to "ServoHalt(4) = Switch off Power Stage".</li> </ul>

	<p><b>NOTE</b></p> <ul style="list-style-type: none"> <li>The axis module expects a handshake or the download of the rating plate data. The axis remains in the state "Not ready to start" until the rating plate data are present. See Section "Electronic rating plate encoder" on page 104 for deactivating the handshake. Contact your service partner if you would like to support rating plate data.</li> </ul>
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P No.	Index	Name	Unit	Description
800		ENC_EC1_Settings		EtherCAT encoder 1: Settings
800	0	IsLinear		Linear encoder yes/no
800	1	Multiturn		Number of multiturn bits
800	2	Singleturn		Number of singleturn bits
800	3	Delay	ms	Compensation of the fieldbus delay
800	4	Numerator		Encoder gearing numerator
800	5	Denominator		Encoder gearing denominator
800	6	DigitalResolution	nm	Dig. increment (linear encoder)
800	7	OffsetST	incr	Multiturn offset at original encoder position
800	8	OffsetMT	incr	Multiturn offset at original encoder position

Table 7.40: Parameter list – Encoder device


P No.	Index	Name	Unit	Description
800	9	MTBase		Multiturn zero point shift
800	10	StatusCheck		Status bit check on/off
800	11	AbsSim_Enable		Absolute encoder simulation
800	12	EncVal_Enable		Encoder validation
800	13	EncVal_PosDiffLim	POS	Max. encoder validation position
800	14	EncoderType		Type of remote encoder
800	15	TemperatureLimit	degC	Encoder temperature error threshold (0 = no function)
800	16	TemperatureWarning	degC	Encoder temperature warning threshold (0 = no function)
800	17	ErrorTol		Tolerate small number of errors in digital protocol
801		ENC_EC1_ActVal		EtherCAT encoder 1: Actual values
801	0	ActPosST		Current singleturn position
801	1	ActPosMT		Current multiturn position
801	2	InitPosST		Singleturn init position
801	3	InitPosMT		Multiturn init position
801	4	RawDataLow		Encoder raw data: Low-word
801	5	RawDataHigh		Encoder raw data: High-word
801	6	Speed	RPM	Speed from encoder module unfiltered
801	7	MotorTempRaw		Raw value of motor temperature (written by master)
801	8	EncoderTempRaw		Raw value of encoder temperature (written by master)
801	9	MotorTempR	Ohm	Temperature sensor resistance (power stage)
801	10	EncoderTemp	degC	Encoder temperature
806		ENC_EC1_Backup		Fieldbus encoder #1 backup values
806	0	PosST		Singleturn backup position
806	1	PosMT		Multiturn backup position
806	2	Valid		Backup
806	3	EncSerialNum		Encoder serial number
809		ENC_EC1_Backup_User		Fieldbus encoder #1 backup values in user units
809	0	Pos	POS	Backup position in user units
809	1	EncVal_PosDiff	POS	Validation of position difference

P No.	Index	Name	Unit	Description
812		ENC_EC1_Info		Encoder information of fieldbus encoder #1
812	0	SerialNumber		Serial number
812	1	FirmwareVersion		Firmware version
812	2	EncoderType		Encoder type
812	3	Flags		Encoder information Encoder information flagword
802		ENC_EC2_Settings		Settings see P 800
803		ENC_EC2_ActVal		Settings see P 801
807		ENC_EC2_Backup		Settings see P 806
810		ENC_EC2_Backup_User		Settings see P 809
813		ENC_EC2_Info		Settings see P 812
804		ENC_EC3_Settings		Settings see P 800
805		ENC_EC3_ActVal		Settings see P 801
808		ENC_EC3_Backup		Settings see P 806
811		ENC_EC3_Backup_User		Settings see P 809
814		ENC_EC3_Info		Settings see P 812

Table 7.40: Parameter list – Encoder device (continue)

## 7.11 Advanced encoder function

Principally speaking, a positioning application must be equipped with a multiturn absolute value encoder and/or be referenced with a suitable method at each start. This chapter describes functions that replace multiturn information or homing by storing information in the axis module. The advanced encoder functions are used to store position and homing information in the device's ROM. The information is verified and restored on restart.

WARNING!	Risk of injury posed by uncontrolled rotation!
	<p><b>Improper conduct can lead to serious injury or death.</b></p> <ul style="list-style-type: none"> <li>If the advanced functions are used wrongly, the drive may start with "HomingAttained" and an incorrect absolute position. This can lead to damage to the system and injury when subsequent moving operations are performed.</li> </ul>



### NOTE

- Storing positions and homing information in the device takes up to 15 seconds. This is indicated by bit 19 (AutoSave) and 20 (AutoSaveEnc) of the **P 281[0] - MPRO\_INPUT\_SysAllStatus** parameter. If one of these bits is set, the voltage supply must not be interrupted.
- No information can be saved within the first 30 seconds after starting the device because a consistency check of the flash memory is carried out.
- The validation function and multiturn encoder simulation do *not* cater for applications where operating voltage is lost while the axis is powered on. If this is necessary, please use a multiturn encoder and serial number validation or the PowerOff validation function.



**Encoder special function for position encoder (CH3)**

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**Multiturn simulation of singleturn encoder**  
 (Saving the absolute position and encoder data at switching off)

OFF(0) = Encoder simulation inactive

Saved encoder position in user-units

Saved encoder serialnumber

☒ Encoder position and serialnumber saved and valid

---

**Encoder validation**  
 (Plausibility check of actual position to saved position and detection of encoder changing at restart)

Force ☐ Auto ☒

☐ ☒ Enable position singleturn validation (Single turn validation is enabled with Encoder special function.)

☐ ☐ Enable position multiturn validation

☐ ☒ Enable encoder serial number validation (Serial number validation is automatically enabled if any special function is used.)

☐ ☐ Enable validation encoder error (Checking the encoder initialization will be activated when a special function was selected)

☐ ☐ Enable validation power off (Checking the device state at Power Off will be activated when a special function was selected)

mdeg Hysteresis singleturn position (User unit)

deg Hysteresis singleturn position (Motor shaft)

mdeg Actual single position difference

---

**Homing special function**  
 (Restore the last absolute position and homing attained message at switch on)

OFF(0) = Homing simulation inactive

Status Homing-Simulation

---

**Encoder overrun compensation**  
 (The overrun compensation displaces the actual position to compensate overrun effects of the encoder.)

OFF(0) = No compensation

Number of overrun since last homing

---

Fig. 7.11: Advanced encoder function

P No.	Index	Name	Unit	Description
2281 / 4329 / 6377		MC_HOMING_Settings		Axis 1 / 2 / 3: "Homing" settings
2281 / 4329 / 6377	0	SimEnable		Homing simulation
2281 / 4329 / 6377	1	EncMode		Homing start
2282 / 4330 / 6378		MC_HOMING_Backup		Axis 1 / 2 / 3: Position backup
2282 / 4330 / 6378	0	HomeDiffST		Singleturn position backup
2282 / 4330 / 6378	1	HomeDiffMT		Multiturn position backup
2282 / 4330 / 6378	2	Valid		Backup
2284 / 4332 / 6380	0	MC_HOMING_SimState		Axis 1 / 2 / 3: Homing simulation state
2848 / 4896 / 6944		ENC_CH1_Settings		Axis 1 / 2 / 3: Channel 1 multi-encoder interface settings
2848 / 4896 / 6944	0	Select		Encoder selection channel 1
2848 / 4896 / 6944	1	IsLinear		Linear encoder yes/no
2848 / 4896 / 6944	2	AbsEncoder		Absolute interface selector
2848 / 4896 / 6944	3	AbsIntMode		Absolute value initialisation mode
2848 / 4896 / 6944	4	Multiturn		Number of multiturn bits
2848 / 4896 / 6944	5	Singleturn		Number of singleturn bits
2848 / 4896 / 6944	6	Lines		Pulses per revolution / number of pole pairs
2848 / 4896 / 6944	7	LineDelay	us	Phase shift compensation
2848 / 4896 / 6944	8	Amplitude	%	Amplitude of the resolver signal
2848 / 4896 / 6944	9	Corr		Signal correction selector
2848 / 4896 / 6944	10	Fc_override	kHz	A/D converter cut-off frequency override
2848 / 4896 / 6944	11	Numerator		Encoder gearing numerator
2848 / 4896 / 6944	12	Denominator		Encoder gearing denominator
2848 / 4896 / 6944	13	EncObsMin	100%	Encoder monitoring limit (root of a2+b2)
2848 / 4896 / 6944	14	PeriodLen	nm	Analog signal period (linear encoder)
2848 / 4896 / 6944	15	DigitalResolution	nm	Dig. increment (linear encoder)
2848 / 4896 / 6944	16	TTL_SignalType		TTL encoder signal type
2848 / 4896 / 6944	17	CycleCountMax		Absolute interface sampling rate (n x 0.125ms)
2848 / 4896 / 6944	18	Graycode		Graycode / binary code
2848 / 4896 / 6944	19	ParityOdd		Parity odd/even
2848 / 4896 / 6944	20	ParityEnable		Evaluate parity bit
2848 / 4896 / 6944	21	EncObsBitEnable		Enable encoder monitoring bit
2848 / 4896 / 6944	22	PreBits		Number of bits before position

Table 7.41: Parameter list – Encoder axis – Encoder homing backup

P No.	Index	Name	Unit	Description
2848 / 4896 / 6944	23	PostBits		Number of bits after position
2848 / 4896 / 6944	24	PostParityPosition		Position of parity bit (in postbits)
2848 / 4896 / 6944	25	PostEncObsPosition		Position of encoder monitoring bit (in postbits)
2848 / 4896 / 6944	26	OffsetST	incr	Singleturn offset at original encoder position
2848 / 4896 / 6944	27	OffsetMT	incr	Multiturn offset at original encoder position
2848 / 4896 / 6944	28	AbsSim_Enable		Absolute encoder simulation
2848 / 4896 / 6944	29	EncVal_Enable		Encoder validation
2848 / 4896 / 6944	30	EncVal_PosDiffLim	PosUnit	Max. encoder validation position
2848 / 4896 / 6944	31	MTBase		Multiturn zero point shift
2848 / 4896 / 6944	32	Mode		Encoder mode
2848 / 4896 / 6944	33	ResolverFexec		Resolver excitation frequency
2848 / 4896 / 6944	34	EncObsTf	ms	Filter time constant of signal $\sqrt{a^2+b^2}$ for wire break detection
2848 / 4896 / 6944	35	InitDelay	steps	Encoder initialisation delay
2848 / 4896 / 6944	36	TemperatureLimit	degC	Encoder temperature error threshold (0 = no function)
2848 / 4896 / 6944	37	TemperatureWarning	degC	Encoder temperature warning threshold (0 = no function)
2848 / 4896 / 6944	38	ErrorTol		Tolerate small number of errors in digital protocol
2848 / 4896 / 6944	39	DistCodeA		Distance-coded zero pulses: Fundamental period. Zero if no distance coding
2848 / 4896 / 6944	40	DistCodeB		Distance-coded zero pulses: Changed periods (B > A)
2876 / 4924 / 6972		ENC_CH1_Backup		Axis 1 / 2 / 3: Channel 1 position backup
2876 / 4924 / 6972	0	PosST		Singleturn backup position
2876 / 4924 / 6972	1	PosMT		Multiturn backup position
2876 / 4924 / 6972	2	Valid		Backup
2876 / 4924 / 6972	3	EncSerialNum		Encoder serial number
2888 / 4936 / 6984		ENC_CH1_Backup_User		Axis 1 / 2 / 3: Channel 1 position backup in user units
2888 / 4936 / 6984	0	Pos	PosUnit	Backup position in user units
2888 / 4936 / 6984	1	EncVal_PosDiff	PosUnit	Validation of position difference
2868 / 4916 / 6964		ENC_CH2_Settings		Axis 1 / 2 / 3: Incremental encoder interface channel 2 settings

Table 7.41: Parameter list – Encoder axis – Encoder homing backup (continue)

P No.	Index	Name	Unit	Description
2868 / 4916 / 6964	0	Select		Encoder selection channel 1
2868 / 4916 / 6964	1	IsLinear		Linear encoder yes/no
2868 / 4916 / 6964	2	AbsEncoder		Absolute interface selector
2868 / 4916 / 6964	3	AbsIntMode		Absolute value initialisation mode
2868 / 4916 / 6964	4	Multiturn		Number of multiturn bits
2868 / 4916 / 6964	5	Singleturn		Number of singleturn bits
2868 / 4916 / 6964	6	Lines		Pulses per revolution / number of pole pairs
2868 / 4916 / 6964	7	LineDelay	us	Phase shift compensation
2868 / 4916 / 6964	8	Amplitude	%	Amplitude of the resolver signal
2868 / 4916 / 6964	9	Corr		Signal correction selector
2868 / 4916 / 6964	10	Fc_override	kHz	A/D converter cut-off frequency override
2868 / 4916 / 6964	11	Numerator		Encoder gearing numerator
2868 / 4916 / 6964	12	Denominator		Encoder gearing denominator
2868 / 4916 / 6964	13	EncObsMin	100%	Encoder monitoring limit (root of a2+b2)
2868 / 4916 / 6964	14	PeriodLen	nm	Analog signal period (linear encoder)
2868 / 4916 / 6964	15	DigitalResolution	nm	Dig. increment (linear encoder)
2868 / 4916 / 6964	16	TTL_SignalType		TTL encoder signal type
2868 / 4916 / 6964	17	CycleCountMax		Absolute interface sampling rate (n x 0.125ms)
2868 / 4916 / 6964	18	Graycode		Graycode / binary code
2868 / 4916 / 6964	19	ParityOdd		Parity odd/even
2868 / 4916 / 6964	20	ParityEnable		Evaluate parity bit
2868 / 4916 / 6964	21	EncObsBitEnable		Enable encoder monitoring bit
2868 / 4916 / 6964	22	PreBits		Number of bits before position
2868 / 4916 / 6964	23	PostBits		Number of bits after position
2868 / 4916 / 6964	24	PostParityPosition		Position of parity bit (in postbits)
2868 / 4916 / 6964	25	PostEncObsPosition		Position of encoder monitoring bit (in postbits)
2868 / 4916 / 6964	26	OffsetST	incr	Multiturn offset at original encoder position
2868 / 4916 / 6964	27	OffsetMT	incr	Multiturn offset at original encoder position
2868 / 4916 / 6964	28	AbsSim_Enable		Absolute encoder simulation
2868 / 4916 / 6964	29	EncVal_Enable		Encoder validation
2868 / 4916 / 6964	30	EncVal_PosDiffLim	PosUnit	Max. encoder validation position
2868 / 4916 / 6964	31	MTBase		

P No.	Index	Name	Unit	Description
2868 / 4916 / 6964	32	unused1		unused sub parameter
2868 / 4916 / 6964	33	unused2		unused sub parameter
2868 / 4916 / 6964	34	EncObsTf	ms	Filter time constant of signal $\sqrt{a^2+b^2}$ for wire break detection
2868 / 4916 / 6964	35	InitDelay	steps	Encoder initialisation delay
2868 / 4916 / 6964	36	ErrorTol		Tolerate small number of errors in digital protocol
2868 / 4916 / 6964	37	DistCodeA		Distance-coded zero pulses: Fundamental period. Zero if no distance coding
2868 / 4916 / 6964	38	DistCodeB		Distance-coded zero pulses: Changed periods ( $B > A$ )
2877 / 4925 / 6973		ENC_CH2_Backup		Axis 1 / 2 / 3: Channel 2 position backup
2877 / 4925 / 6973	0	PosST		Singleturn backup position
2877 / 4925 / 6973	1	PosMT		Multiturn backup position
2877 / 4925 / 6973	2	Valid		Backup
2877 / 4925 / 6973	3	EncSerialNum		Encoder serial number
2889 / 4937 / 6985		ENC_CH2_Backup_User		Axis 1 / 2 / 3: Channel 2 position backup in user units
2889 / 4937 / 6985	0	Pos	PosUnit	Backup position in user units
2889 / 4937 / 6985	1	EncVal_PosDiff	PosUnit	Validation of position difference
2874 / 4922 / 6970		ENC_CH3_Settings		Axis 1 / 2 / 3: Channel 3 HIPERFACE DSL® settings
2874 / 4922 / 6970	0	Select		Channel 3 encoder selection
2874 / 4922 / 6970	1	IsLinear		Linear encoder yes/no
2874 / 4922 / 6970	2	AbsEncoder		Absolute interface selector
2874 / 4922 / 6970	3	AbsIntMode		Absolute value initialisation mode
2874 / 4922 / 6970	4	Multiturn		Number of multiturn bits
2874 / 4922 / 6970	5	Singleturn		Number of singleturn bits
2874 / 4922 / 6970	6	Lines		Pulses per revolution / number of pole pairs
2874 / 4922 / 6970	7	LineDelay	us	Phase shift compensation
2874 / 4922 / 6970	8	Amplitude	+-%	Amplitude of the resolver signal
2874 / 4922 / 6970	9	Corr		Signal correction selector
2874 / 4922 / 6970	10	reserved		
2874 / 4922 / 6970	11	Numerator		Encoder gearing numerator

Table 7.41: Parameter list – Encoder axis – Encoder homing backup (continue)

P No.	Index	Name	Unit	Description
2874 / 4922 / 6970	12	Denominator		Encoder gearing denominator
2874 / 4922 / 6970	13	EncObsMin	100%	Encoder monitoring limit (root of $a^2+b^2$ )
2874 / 4922 / 6970	14	PeriodLen	nm	Analog signal period (linear encoder)
2874 / 4922 / 6970	15	DigitalResolution	nm	Dig. increment (linear encoder)
2874 / 4922 / 6970	16	TTL_SignalType		TTL encoder signal type
2874 / 4922 / 6970	17	CycleCountMax		Absolute interface sampling rate ( $n \times 0.125\text{ms}$ )
2874 / 4922 / 6970	18	Graycode		Graycode / binary code
2874 / 4922 / 6970	19	ParityOdd		Parity odd/even
2874 / 4922 / 6970	20	ParityEnable		Evaluate parity bit
2874 / 4922 / 6970	21	EncObsBitEnable		Enable encoder monitoring bit
2874 / 4922 / 6970	22	PreBits		Number of bits before position
2874 / 4922 / 6970	23	PostBits		Number of bits after position
2874 / 4922 / 6970	24	PostParityPosition		Position of parity bit (in postbits)
2874 / 4922 / 6970	25	PostEncObsPosition		Position of encoder monitoring bit (in postbits)
2874 / 4922 / 6970	26	AbsSim_Enable		Absolute encoder simulation
2874 / 4922 / 6970	27	EncVal_Enable		Encoder validation
2874 / 4922 / 6970	28	EncVal_PosDiffLim	PosUnit	Max. encoder validation position
2874 / 4922 / 6970	29	MTBase		Multiturn zero point shift
2874 / 4922 / 6970	30	TemperatureLimit	degC	Encoder temperature error threshold (0 = no function)
2874 / 4922 / 6970	31	TemperatureWarning	degC	Encoder temperature warning threshold (0 = no function)
2874 / 4922 / 6970	32	ErrorTol		Tolerate small number of errors in digital protocol
2874 / 4922 / 6970	33		rpm	Hiperface DSL encoder: cut-off frequency in rpm
2878 / 4926 / 6974		ENC_CH3_Backup		Axis 1 / 2 / 3: Channel 3 position backup
2878 / 4926 / 6974	0	PosST		Singleturn backup position
2878 / 4926 / 6974	1	PosMT		Multiturn backup position
2878 / 4926 / 6974	2	Valid		Backup
2878 / 4926 / 6974	3	EncSerialNum		Encoder serial number
2890 / 4938 / 6986		ENC_CH3_Backup_User		Axis 1 / 2 / 3: Channel 2 position backup in user units

P No.	Index	Name	Unit	Description
2890 / 4938 / 6986	0	Pos	PosUnit	Backup position in user units
2890 / 4938 / 6986	1	EncVal_PosDiff	PosUnit	Validation of position difference
2882 / 4930 / 6978		ENC_CH_Action		Axis 1 / 2 / 3: Actions for encoder system
2882 / 4930 / 6978	0	BackupLatch		Save encoder backup values
2882 / 4930 / 6978	1	MtBase		Set overflow point based on current position
2882 / 4930 / 6978	2	WarnReset		Reset Battery Alarm
800		ENC_EC1_Settings		EtherCAT encoder 1: Settings
800	0	IsLinear		Linear encoder yes/no
800	1	Multiturn		Number of multiturn bits
800	2	Singleturn		Number of singleturn bits
800	3	Delay	ms	Compensation of the fieldbus delay
800	4	Numerator		Encoder gearing numerator
800	5	Denominator		Encoder gearing denominator
800	6	DigitalResolution	nm	Dig. increment (linear encoder)
800	7	OffsetST	incr	Multiturn offset at original encoder position
800	8	OffsetMT	incr	Multiturn offset at original encoder position
800	9	MTBase		Multiturn zero point shift
800	10	StatusCheck		Status bit check on/off
800	11	AbsSim_Enable		Absolute encoder simulation
800	12	EncVal_Enable		Encoder validation
800	13	EncVal_PosDiffLim	PosUnit	Max. encoder validation position
800	14	EncoderType		Type of remote encoder
800	15	TemperatureLimit	degC	Encoder temperature error threshold (0 = no function)
800	16	TemperatureWarning	degC	Encoder temperature warning threshold (0 = no function)
800	17	ErrorTol		Tolerate small number of errors in digital protocol
806		ENC_EC1_Backup		Fieldbus encoder #1 backup values
806	0	PosST		Singleturn backup position
806	1	PosMT		Multiturn backup position
806	2	Valid		Backup
806	3	EncSerialNum		Encoder serial number
809		ENC_EC1_Backup_User		Fieldbus encoder #1 backup values in user units

Table 7.41: Parameter list – Encoder axis – Encoder homing backup (continue)

P No.	Index	Name	Unit	Description
809	0	Pos	PosUnit	Backup position in user units
809	1	EncVal_PosDiff	PosUnit	Validation of position difference
812		ENC_EC1_Info		Encoder information of fieldbus encoder #1
812	0	SerialNumber		Serial number
812	1	FirmwareVersion		Firmware version
812	2	EncoderType		Encoder type
812	3	Flags		Encoder information flagword
802		ENC_EC2_Settings		EtherCAT encoder 2: Settings
802	0	IsLinear		Linear encoder yes/no
802	1	Multiturn		Number of multiturn bits
802	2	Singleturn		Number of singleturn bits
802	3	Delay	ms	Compensation of the fieldbus delay
802	4	Numerator		Encoder gearing numerator
802	5	Denominator		Encoder gearing denominator
802	6	DigitalResolution	nm	Dig. increment (linear encoder)
802	7	OffsetST	incr	Multiturn offset at original encoder position
802	8	OffsetMT	incr	Multiturn offset at original encoder position
802	9	MTBase		Multiturn zero point shift
802	10	StatusCheck		Status bit check
802	11	AbsSim_Enable		Absolute encoder simulation
802	12	EncVal_Enable		Encoder validation
802	13	EncVal_PosDiffLim	PosUnit	Max. encoder validation position
802	14	EncoderType		Type of remote encoder
802	15	TemperatureLimit	degC	Encoder temperature error threshold (0 = no function)
802	16	TemperatureWarning	degC	Encoder temperature warning threshold (0 = no function)
802	17	ErrorTol		Tolerate small number of errors in digital protocol
807		ENC_EC2_Backup		Fieldbus encoder #2 backup values
807	0	PosST		Singleturn backup position
807	1	PosMT		Multiturn backup position
807	2	Valid		Backup
807	3	EncSerialNum		Encoder serial number

P No.	Index	Name	Unit	Description
810		ENC_EC2_Backup_User		Fieldbus encoder #2 backup values in user units
810	0	Pos	PosUnit	Backup position in user units
810	1	EncVal_PosDiff	PosUnit	Validation of position difference
813		ENC_EC2_Info		Encoder information of fieldbus encoder #1
813	0	SerialNumber		Serial number
813	1	FirmwareVersion		Firmware version
813	2	EncoderType		Encoder type
813	3	Flags		Encoder information flags
804		ENC_EC3_Settings		EtherCAT encoder 3: Settings
804	0	IsLinear		Linear encoder yes/no
804	1	Multiturn		Number of multiturn bits
804	2	Singleturn		Number of singleturn bits
804	3	Delay	ms	Compensation of the fieldbus delay
804	4	Numerator		Encoder gearing numerator
804	5	Denominator		Encoder gearing denominator
804	6	DigitalResolution	nm	Dig. increment (linear encoder)
804	7	OffsetST	incr	Multiturn offset at original encoder position
804	8	OffsetMT	incr	Multiturn offset at original encoder position
804	9	MTBase		Multiturn zero point shift
804	10	StatusCheck		Activate status bit check
804	11	AbsSim_Enable		Absolute encoder simulation
804	12	EncVal_Enable		Encoder validation
804	13	EncVal_PosDiffLim	PosUnit	Max. encoder validation position
804	14	EncoderType		Type of remote encoder
804	15	TemperatureLimit	degC	Encoder temperature error threshold (0 = no function)
804	16	TemperatureWarning	degC	Encoder temperature warning threshold (0 = no function)
804	17	ErrorTol		Tolerate small number of errors in digital protocol
808		ENC_EC3_Backup		Fieldbus encoder #3 backup values
808	0	PosST		Singleturn backup position
808	1	PosMT		Multiturn backup position

Table 7.41: Parameter list – Encoder axis – Encoder homing backup (continue)

P No.	Index	Name	Unit	Description
808	2	Valid		Backup
808	3	EncSerialNum		Encoder serial number
811		ENC_EC3_Backup_User		Fieldbus encoder #3 backup values in user units
811	0	Pos	PosUnit	Backup position in user units
811	1	EncVal_PosDiff	PosUnit	Validation of position difference
814		ENC_EC3_Info		Encoder information of fieldbus encoder #1
814	0	SerialNumber		Serial number
814	1	FirmwareVersion		Firmware version
814	2	EncoderType		Encoder type
814	3	Flags		Encoder information bits
2884 / 4932 / 6980		ENC_CH4_Settings		Axis 1 / 2 / 3: Channel 4 virtual encoder interface settings
2884 / 4932 / 6980	0	Select		Encoder selection
2884 / 4932 / 6980	1	IsLinear		Linear encoder yes/no
2884 / 4932 / 6980	2	AbsEncoder		Absolute interface selector
2884 / 4932 / 6980	3	AbsIntMode		Absolute value initialisation mode
2884 / 4932 / 6980	4	Multiturn		Number of multiturn bits
2884 / 4932 / 6980	5	Singleturn		Number of singleturn bits
2884 / 4932 / 6980	6	Lines		Pulses per revolution / number of pole pairs
2884 / 4932 / 6980	7	LineDelay	us	Phase shift compensation
2884 / 4932 / 6980	8	Amplitude	+-%	Amplitude of the resolver signal
2884 / 4932 / 6980	9	Corr		Signal correction selector
2884 / 4932 / 6980	10	reserved		
2884 / 4932 / 6980	11	Numerator		Encoder gearing numerator
2884 / 4932 / 6980	12	Denominator		Encoder gearing denominator
2884 / 4932 / 6980	13	EncObsMin	100%	Encoder monitoring limit (root of a2+b2)
2884 / 4932 / 6980	14	PeriodLen	nm	Analog signal period (linear encoder)
2884 / 4932 / 6980	15	DigitalResolution	nm	Dig. increment (linear encoder)
2884 / 4932 / 6980	16	TTL_SignalType		TTL encoder signal type
2884 / 4932 / 6980	17	CycleCountMax		Absolute interface sampling rate (n x 0.125ms)
2884 / 4932 / 6980	18	Graycode		Graycode / binary code
2884 / 4932 / 6980	19	ParityOdd		Parity odd/even

P No.	Index	Name	Unit	Description
2884 / 4932 / 6980	20	ParityEnable		Evaluate parity bit
2884 / 4932 / 6980	21	EncObsBitEnable		Enable encoder monitoring bit
2884 / 4932 / 6980	22	PreBits		Number of bits before position
2884 / 4932 / 6980	23	PostBits		Number of bits after position
2884 / 4932 / 6980	24	PostParityPosition		Position of parity bit (in postbits)
2884 / 4932 / 6980	25	PostEncObsPosition		Position of encoder monitoring bit (in postbits)
2884 / 4932 / 6980	26	AbsSim_Enable		Absolute encoder simulation
2884 / 4932 / 6980	27	EncVal_Enable		Encoder validation
2884 / 4932 / 6980	28	EncVal_PosDiffLim	PosUnit	Max. encoder validation position
2884 / 4932 / 6980	29	MTBase		Multiturn zero point shift
2887 / 4935 / 6983		ENC_CH4_Backup		Axis 1 / 2 / 3: Channel 4 position backup
2887 / 4935 / 6983	0	PosST		Singleturn backup position
2887 / 4935 / 6983	1	PosMT		Multiturn backup position
2887 / 4935 / 6983	2	Valid		Backup
2891 / 4939 / 6987		ENC_CH4_Backup_ User		Axis 1 / 2 / 3: Channel 3 position backup in user units
2891 / 4939 / 6987	0	Pos	PosUnit	Backup position in user units
2891 / 4939 / 6987	1	EncVal_PosDiff	PosUnit	Validation of position difference

Table 7.41: Parameter list – Encoder axis – Encoder homing backup (continue)

### 7.11.1 Basic procedure

Always follow this procedure when using these functions:

1. Set the relevant setting parameters.
2. Initialize the encoder and ensure that there is no error.
3. Save the settings to the device.
4. Home the axis.
5. The axis can now be moved, the absolute position should be preserved when the drive is restarted.

The axis backup data are automatically deleted by a number of events:

- A setting parameter was changed that requires initialisation of the controller. Deleting the backup ensures that an axis does not start with incorrect homing if the settings are changed. Reconfiguration of the EtherCAT® encoders deletes the backup data of all axes.
- Validation of the position and/or serial number or another validation function has failed (see below).
- A different encoder type was selected.
- The user modified the backup via the **ENC\_CH\_Action** or **ENC\_EC\_Action** parameter.
- Homing completed with an error.
- When writing the backup files for setting the device (for more on this, see 3.9 File system)

After deletion, the encoder backup data (for validation and multiturn encoder simulation, see below) are reinitialized and stored as soon as possible without issuing a message.

The backup data of the homing function are deleted and HomingAttained is set to zero. The homing backup data can only be generated again by means of a new homing operation.

### 7.11.2 Encoder validation

The validation function checks the current encoder data against the backup values at start. The check functions are configured in the bit array **P 2848[29] EncVal\_Enable**.

The following functions can be used:

Bit No.	Function
Bit 0 (PosST)	Validation of singleturn position; only makes sense for absolute value encoders. The difference between current and recorded singleturn position is compared with the EncVal_PosDiffLim threshold.
Bit 1 (PosMT)	Validation of multiturn position; only makes sense for multiturn absolute value encoders. The difference between current and recorded multiturn position is compared with the EncVal_PosDiffLim threshold. If PosMT is set, PosST is ignored.
Bit 2 (EncSN)	The serial number of the encoder is compared with the number stored.
Bit 3 (EncErr)	Forces deletion of the referencing if a re-initialisation of the encoder system becomes necessary due to an error reaction. (This is carried out immediately upon occurrence of the error.)
Bit 4 (PowOff)	Validation of the device state; checks to be sure that in the event of a power failure or PowerOff of the device, the controller was not in the state <b>OperationEnabled</b> .
Bit 5 (AutoPosST)	For functionality, see PosST. o. This function is only activated if multiturn encoder simulation is enabled.
Bit 7 (AutoEncSN)	For functionality, see EncSN. This function is only activated if one of the advanced encoder functions is enabled.
Bit 8 (AutoEncErr)	For functionality, see EncErr. This function is only activated if multiturn encoder simulation is enabled.
Bit 9 (AutoPowOff)	For functionality, see PowOff. This function is only activated if multiturn encoder simulation is enabled.
Bit 6 (AutoPosMT)	reserved, do not use
Bit 10 (KBCK_LIMV)	reserved, do not use
Bit 11 (KBCK_SNV)	reserved, do not use

Table 7.42: Bits from EncVal\_Enable

Every error during a test sets an error and deletes the backup data so that the system does not start with a potentially incorrect absolute position.

- Backup data are automatically written when the controller is switched on or off (DS402 transitions 4, 5, 6, 8, 9, 10, 12, 14, 16 – see Section "Device states and transitions" on page 509).
- The backup data are written automatically every 30 s.
- You can trigger manual backup by setting **P 2882[0] - BackupLatch** = Latch (1).

### 7.11.3 Multiturn encoder simulation

During operation a singleturn absolute value encoder that has been homed once behaves like a multiturn encoder as the multiturn information is counted internally. The "Multiturn encoder simulation" function saves the multiturn component and restores it on restart. The function is activated with **AbsSim\_Enable** = SIM\_ENC.



#### NOTE

- Use this function only on motors with singleturn absolute value encoders, including single pole-pair resolvers. The axis must have a holding brake.
- This function does not cater for the application "Switching off operating voltage". Preserving the multiturn position when the operating voltage is switched off requires a multiturn encoder.

WARNING!	Risk of injury posed by uncontrolled rotation!
	<p><b>Improper conduct can lead to serious injury or death.</b></p> <ul style="list-style-type: none"> <li>• Only use this function in combination with the validation of singleturn position and serial number in order to prevent the system from being modified while the drive is switched off. This is automatically activated if the bits <b>AutoPosST</b> and <b>AutoEncSN</b> are set.</li> <li>• Use the PowerOff (PowOff) validation function to protect against the use case "Switching off operating voltage". This is activated automatically if the <b>AutoPowOff</b> bit is set.</li> <li>• A residual risk remains, however: If the drive is switched off, the axis is moved by a few revolutions and (by chance or as a result of manipulation) stops at the same singleturn position, this is not detected.</li> <li>• Use this function only on axes with a holding brake.</li> </ul>



The multiturn encoder simulation provides 32-bit multiturn information.

### 7.11.4 Persistent homing


This function saves the calculated position correction when homing is performed once. On restart, the offset is restored and "HomingAttained" is set.

Set parameter 2281.0 SimEnable = SIM\_AUTO to activate persistent homing.



#### NOTE

- This function can be used with all homing methods. If the homing method itself includes a function at device start-up (e.g. 37 and -5), this is disabled.
- The "HomingAttained" flag is deleted when a device commissioning file is loaded (clone, general or settings).

WARNING!	Risk of injury posed by uncontrolled rotation!
	<b>Improper conduct can lead to serious injury or death.</b> <ul style="list-style-type: none"> <li>• Only use this function in combination with the validation of the serial number in order to prevent the system from being modified while the drive is switched off. This is automatically activated if the <b>AutoEncSN</b> bit is set.</li> </ul>

### 7.11.5 Overrun correction of the position

This function was developed for round table axes (see Scaling / Units Setting options: Process format) and is of interest for the following scenario:

- Gear between motor and round table application with a transmission ratio other than 1:2<sup>N</sup> (N = 1, 2, 3...). For a 1:2<sup>N</sup> gear the drive works without any problems even without this function.

- Multiturn motor encoder
- No detection of position in round table application

If a round table application is run in the same direction for prolonged period, this causes an overflow of the encoder's multiturn value range. This works without any problems as long as the application is not switched off. Once the application is switched off and restarted, however, and it reads the encoder's position, this creates an offset of the round table application's position. In order to compensate this offset, it is necessary to activate **P 2305[0] - MPRO\_FG\_ModuloComp** with the ON (1)=correction ON setting.

The overrun correction of the position also works for axes with path limitation (without modulo position correction). This allows use of a positioning range which exceeds the multiturn range of the position encoder.

#### WARNING!

**Risk of injury posed by uncontrolled rotation!**  
**Improper conduct can lead to serious injury or death.**



- For a correct reconstruction of the overflow correction, it must be ensured that the position value is saved to the backup data at least twice per overflow. The data are saved every 30 seconds. With a typical multiturn resolution of 12 bits, a speed of 4096 rpm must not be exceeded.
- Use the overflow correction in combination with the validation function PowOff. Set bit 4 (PowOff) in the parameter EncVal\_Enable of the position encoder



## 7.12 GPOC (Gain Phase Offset Correction)

The resolver and SinCos incremental encoder demonstrate systematic errors that are reflected in the measured position and in the speed calculated from this (gain and phase errors, offset components of the tracking signal). The GPOC method for track signal correction compensates systematic errors. GPOC is available on all 4 channels.

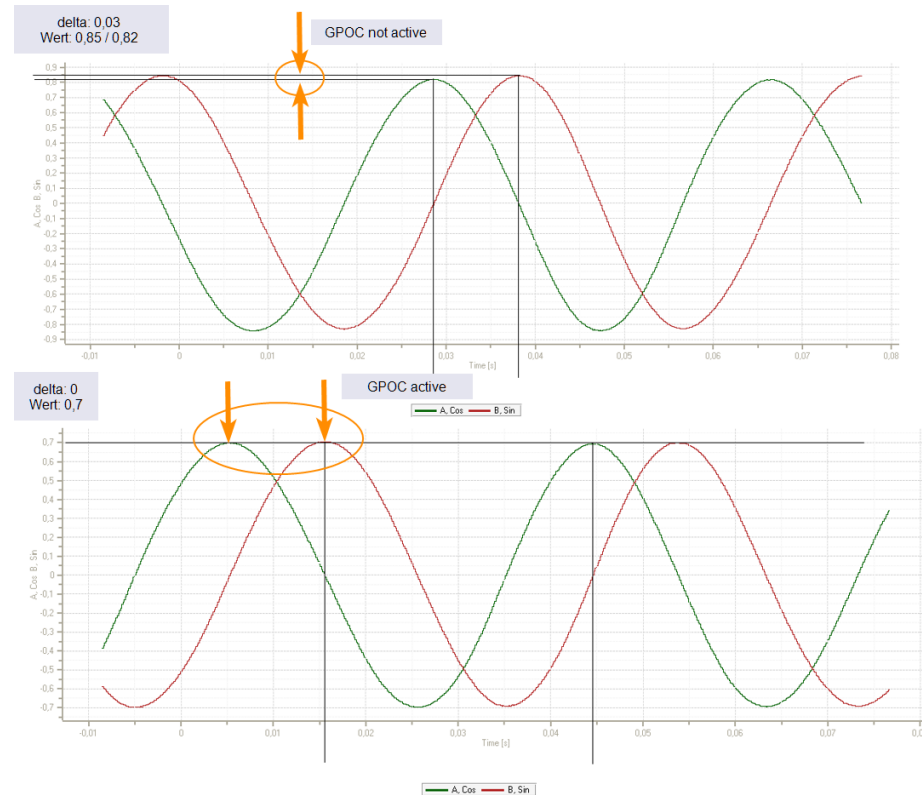


Fig. 7.12: Signal traces A and B with and without GPOC

### Procedure

1. Run the motor at a constant speed so as to achieve a frequency of between 10 and 100 Hz for the SinCos signals (the GPOC method works as of approx. 5 Hz).
2. Set **P 2892[0] - GpocMode** to "ONLINE(2)=Adaptive correction".
3. Wait approx. 1–3 minutes until the compensation algorithms have settled. Speed ripple should decrease after about 1 minute.
4. Set **P 2892[0] - GpocMode** to "STATIC(1)=Static compensation of tracking errors". The values determined are adopted.
5. Save in the device.

The routine can also be kept enabled permanently. However, this approach is less robust and requires careful testing to determine whether the improved encoder evaluation quality will actually be maintained during continuous operation.



### NOTE

- The GPOC routine will determine the parameters individually for each encoder. If the motor is replaced, the GPOC routine must be activated again.

P No.	Index	Name	Unit	Description
2892 / 4940 / 6988		ENC_CH1_Comp		Axis 1 / 2 / 3: Channel 1 encoder compensation
2892 / 4940 / 6988	0	GpocMode		GPOC mode
2892 / 4940 / 6988	1	Kr		GPOC controller: Gain / phase
2892 / 4940 / 6988	2	Kr_off		GPOC controller: Offset
2892 / 4940 / 6988	3	TrackA_offset		Track A: Offset
2892 / 4940 / 6988	4	TrackB_offset		Track B: Offset
2892 / 4940 / 6988	5	TrackA_gain		Track A: Gain
2892 / 4940 / 6988	6	TrackB_gain		Track B: Gain
2892 / 4940 / 6988	7	TrackAB_phase		Track A/B: Phase

Table 7.43: GPOC parameter list

# 8 Control

## Chapter overview

### Pictogram



**Navigation** ► Project tree ► Axis adjustment ► X axis ► Control

**Brief description** This chapter describes the various control types, settings and optimisation options and recommended procedures.

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## Chapter overview

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## 8.1 Overview of control structure

The following figure shows an overview of the control structure in ServoOne CM.

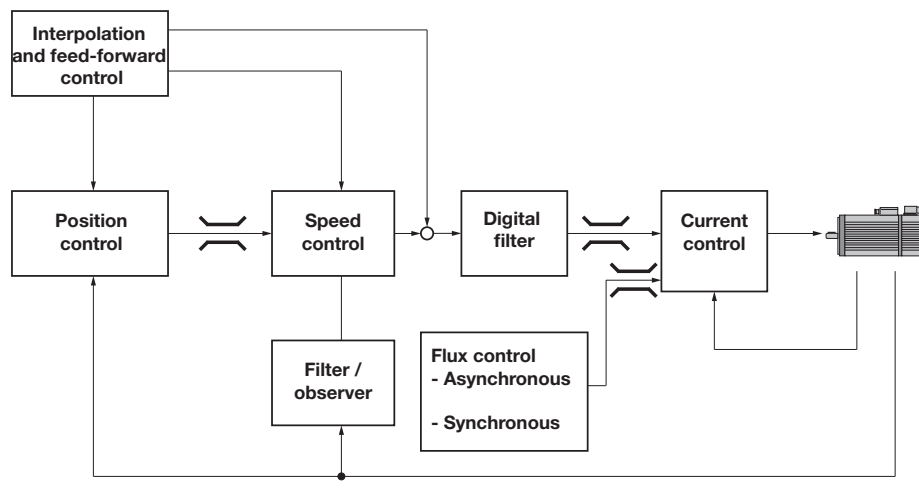


Fig. 8.1: Control structure

Legend for Figure 1.1: Control structure	
Position Controller/Feed Forward Control	see 8.5 Position Controller/Feed Forward Control
Position controller	see 8.5 Position Controller/Feed Forward Control
Speed controller	see 8.4 Speed controller
Digital filter	see 8.4.3 Digital filter
Current Controller	see 8.3 Current Controller
Filter/observer	see 8.4.4 Advanced speed control see 8.4.3 Digital filter
Field weakening, asynchronous	see 8.6 Asynchronous motor field weakening
Field weakening, synchronous	see 8.7 Field weakening synchronous machine PSM

The scanning times are dependent on the switching frequency:

- Current controller = 62.5  $\mu$ s
- Speed controller = 125  $\mu$ s
- Position controller = 125  $\mu$ s



### NOTE

- Feed forward control (nref\_FF and isq\_FF) is only active in position control mode.

## 8.2 Operating concept and motor control

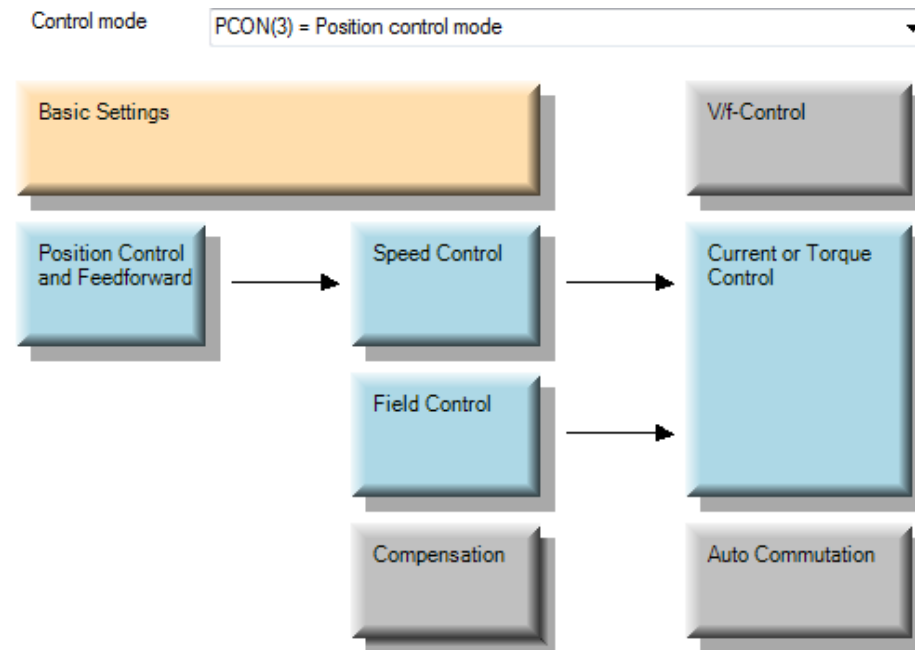




Fig. 8.2: Control dialog box

The first step is to select the basic control mode from a dropdown menu (**P 2962[0] - CON\_CfgCon**, applies to the graphical view and list view of the DriveManager 5).

<b>CAUTION!</b>	<b>Your system/motor may be damaged if put into operation in an uncontrolled or inappropriate manner.</b>
	<b>Improper conduct can cause damage to your system / machine.</b> <ul style="list-style-type: none"> <li>The control mode setting in <b>P 2962[0] - CON_CfgCon</b> has an “online” effect. This can cause an unintentional speed increase or overcurrent which can destroy the system.</li> </ul>

	<b>NOTE</b> <ul style="list-style-type: none"> <li>If the axis is connected to a fieldbus master, the control mode is determined by the master based on the ModeOfOperation.</li> <li>The ICON control mode is for testing purpose only.</li> </ul>
---	---

The light orange “Basic setting” button takes you to the basic parameters and functions that are relevant for initial commissioning of the selected control mode. These include:

- Determination of mass inertia
- automatic control configuration (speed and position controller) using the stiffness wizard
- Configuration of position and speed control

The blue buttons take you to detailed dialog boxes for the various control circuits, with which you can optimize drive settings. These include:

- Position Controller/Feed Forward Control and Friction torque compensation (friction)
- Speed controller, speed-dependent gain and adaptation to the mechanical system
- Current Controller

- Field control (Field weakening synchronous machine PSM and Asynchronous motor field weakening)

The grey buttons take you to additional control functions. Including:

- Detent torque compensation
- Commutation method for synchronous motors with incremental encoder
- VFC functions for controlled operation of asynchronous motors
- Compensation functions

### 8.2.1 Basic setting

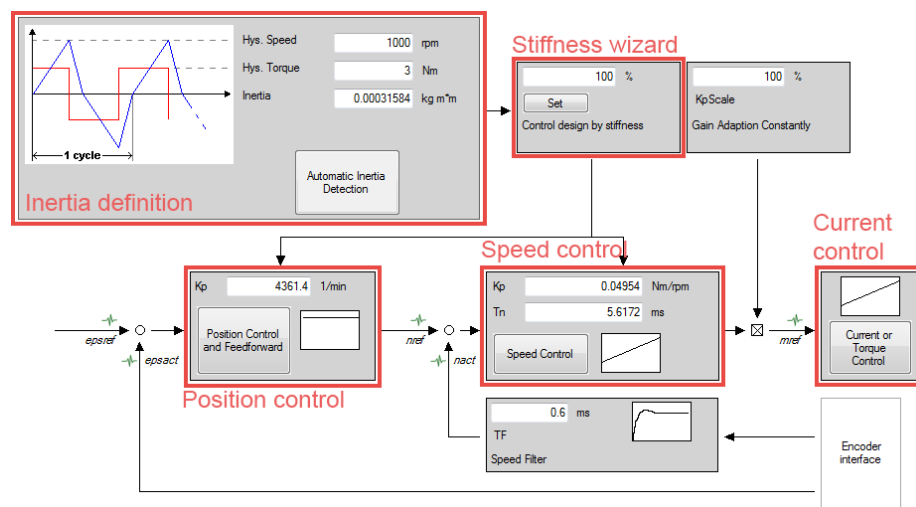


Fig. 8.3: Basic control setting dialog box

The basic approach is to optimize control from the inside out. First the current controller, then the speed controller and if necessary the position controller.

If a motor has been calculated or identified, the control circuits are already preconfigured. The current controller is usually sufficiently configured, often no additional optimisation of the current controller is necessary for simple applications.

The speed controller must be optimized as the external mass inertia (mechanism, gear, etc.) is not included in the motor data set. If mass inertia is known from the machine plan, it can be entered directly in **P 2992[0] – SCD\_JSum**. Otherwise, it can be determined using the automatic mass inertia definition function.

### 8.2.2 Automatic mass inertia definition

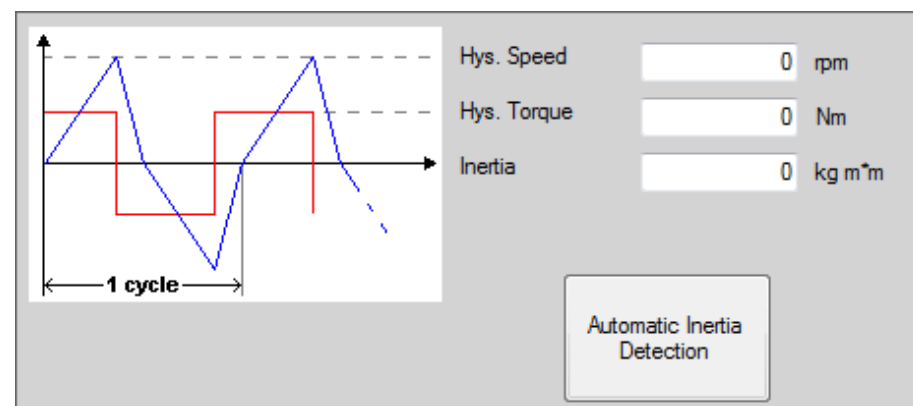



Fig. 8.4: Mass inertia definition dialog box

This is a controlled procedure in which a reversing speed is output to the motor. Speed is always reversed when the motor has reached the preset speed. The condition for this function is a functioning encoder system.

With variable inertia, the largest possible value should be captured; the control then behaves robustly for smaller values. For robotic systems, for example, the inertia of an axis depends on the position of the slave axis. To determine the greatest possible inertia, the kinematics should be in the extended position. Proceed iteratively if need be.

With automatic inertia determination, there should be a significant movement at about 0.5..1 Hz on the load side. This prevents friction effects and natural oscillation in the mechanism from causing faulty measurements. Repeat the measurement and verify the result. The overall inertia of the axis is typically 2..10 times greater than the inertia of the motor.

If no values have been preset for speed (**P 3020[0] - SconHysSpeed**) and torque (**P 3020[1] - SconHysTorq**), the function selects 20% of the rated values for speed and torque. For an optimal definition of mass inertia, the movement should reverse roughly  $\pm 90^\circ$  at a frequency of 1–2 Hz. In any case, the frequency must be well below the resonant frequency of the mechanism. The more accurately mass inertia is defined, the better the values calculated by the stiffness wizard will fit (see following section).

<b>CAUTION!</b>	<b>Damage to your system/machine caused by uncontrolled or non-customized commissioning.</b>
	<p><b>Improper conduct can cause damage to your system / machine.</b></p> <ul style="list-style-type: none"> <li>If the chosen speed is too high or the torque too low, the motor can move several mechanical revolutions and possibly damage any mechanical limits. To be on the safe side, start at low speed and high torque.</li> <li>For axes that are affected by gravity, the torque should be set to at least the rated torque of the axis to prevent the axis from falling down.</li> </ul>



#### NOTE

- Automatic mass inertia definition configures speed and position control depending on the calculated inertia and the currently configured stiffness (see rigidity wizard). If the controller settings have already been manually optimized, save the data set first.

P No.	Index	Name	Unit	Description
3020 / 5068 / 7116	0	SConHysSpeed	rpm	Moment of inertia autotuning, speed limit
	1	SConHysTorq	Nm	Moment of inertia autotuning, torque limit
2992 / 5040 / 7088	0	SCD_JSum	kg m²	Total mass inertia

Table 8.1: Mass inertia definition parameters

## 8.2.3 Rigidity wizard

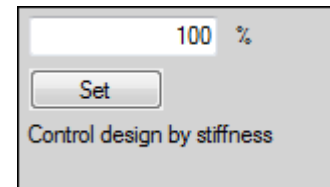


Fig. 8.5: Rigidity wizard dialog box

Click the “Activate” button for the wizard to automatically calculate the speed/position controller. This is done dependent on

- the inertia (see Section "Automatic mass inertia definition" on page 121).
- filtering of the actual speed value
- the configured current control.

A setting of **P 3059[1] - Stiffness** less than 100 % corresponds to a “soft” controller setting (e.g. for a toothed belt drive). A setting greater than 100 % corresponds to a “hard” controller setting (little backlash and low elasticity of the mechanism).

Negative values may also be entered. When commissioning robotic systems, a “soft” controller setting should be used initially (e.g. -50%).

P No.	Index	Name	Unit	Description
3059 / 5107 / 7155	1	Stiffness	%	Rigidity of path <=> performance of speed control

Table 8.2: Rigidity wizard parameters

## 8.2.4 Speed filter

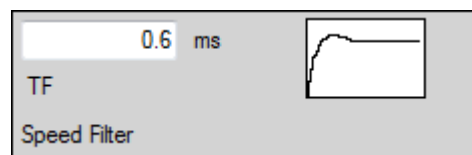


Fig. 8.6: Speed filter dialog box

The time constant (**P 2949[0] - CON\_SCALC\_Tf**) filters the encoder signal of the actual speed value. The following settings are recommended:

- Resolver: 1 ms
- SinCos: 0,3-0,6 ms

P No.	Index	Name	Unit	Description
2949 / 4997 / 7045	0	CON_SCALC_Tf	ms	Filter time constant actual speed value

Table 8.3: Parameters for filter time constant actual speed value

## 8.3 Current Controller

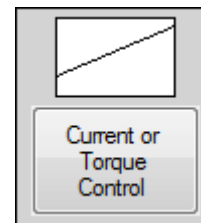


Fig. 8.7: Current and torque control button

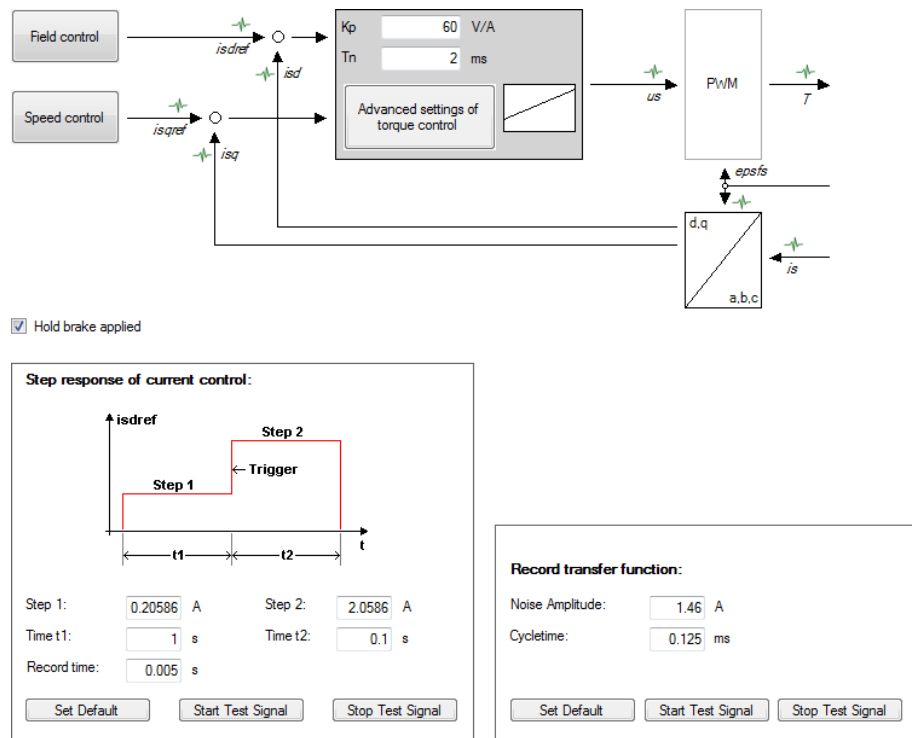


Fig. 8.8: Current and torque control dialog box

The current controller is a PI controller. Gain ( $K_p$ ) can be configured via **P 2952[0] - CON\_CCON\_Kp**, integral-action time ( $T_n$ ) via **P 2952[1] - CON\_CCON\_Tn**.

The current controller is preconfigured by the drive controller based on motor winding inductance (calculated or identified). The values of the PI controller are chosen so that the replacement time constant of the motor winding is compensated by the replacement time constant of the current controller (optimum amount). In this case, the current controller overshoots at a new setpoint of approx. 10 % and is steady after a single undershoot.

Further optimisation is usually not necessary. If it is necessary, it is possible to optimize the current controller with the aid of step responses. Alternatively, it is also possible to configure the current controller based on noise development.

At high currents, the motor winding is subject to saturation effects. According to the theory, this must be compensated so that the proportional gain of the current controller is also reduced proportionally to reduced inductance; otherwise overshoot gets too severe. This can lead to overcurrent shutdown if maximum current of the device or motor is controlled stepwise. The adjustment is implemented by the saturation characteristic in **P 2980 - MOT\_LsigDiff** (in DriveManager 5 under ► Project tree ► Axis adjustment ► X axis ► Motor ► Motor identification ► Electrical motor parameters). This characteristic curve is determined by synchronous motor identification or is part of the motor data set. It has a direct effect on current controller gain and can be adjusted by hand.

If the saturation characteristic cannot be determined, the current controller should be optimized with the aid of a step response to the currents usually observed in operation.

### Optimisation with step response

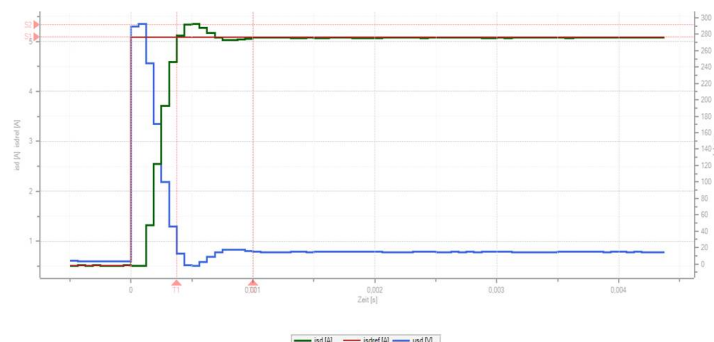
To add a step response, set the appropriate times and currents. This usually only requires changing the current in "Level 2". The currents are peak values ( $I_{rms} \cdot \sqrt{2}$ ).

For a typical application, the current controller is configured so that the setpoint is first reached within 500  $\mu$ s, the curve overshoots approx. 10 % and is steady after 1 ms.



**NOTE**

- Optimize current control at approx. 1/3 if rated current. Start with low gain and high integral-action time. Gradually increase gain until the step response first touches the setpoint. Then reduce integral-action time until you see a curve as indicated in the following diagram. It may be necessary to adjust gain afterwards.



- With regard to behaviour in the overload range, also refer to Section "Magnetic saturation: Adjustment of current control" on page 51.

**Analysis with Bode diagram**

With the aid of the transfer function wizard you can output a noise signal (PRBS signal) to the current controller. The DriveManager 5 calculates the current controller transfer function and depicts it as a Bode diagram.

P No.	Index	Name	Unit	Description
2952 / 5000 / 7048		CON_CCON_Ctrl		Setting for the current controller
	0	CON_CCON_Kp		Gain
	1	CON_CCON_Tn		Integral-action time
2953 / 5001 / 7049		CON_CCON_Fact		Scaling Factor: Adjustment of the current controller in dependence on the switching

Table 8.4: Current controller parameters

P No.	Index	Name	Unit	Description
				frequencies
	0	Kscale2		Adjustment of the current controller at 2 kHz
	1	Kscale4		Adjustment of the current controller at 4 kHz
	2	Kscale8		Adjustment of the current controller at 8 kHz
	3	Kscale12		Adjustment of the current controller at 12 kHz
	4	Kscale16		Adjustment of the current controller at 16 kHz
2973 / 5021 / 7069		CON_CCON_Tune		Axis 1: Controller settings current control
	0	VDC_TF		DC link voltage measurement: Filter time constant
	1	VDC_Weight		DC link voltage measurement: Weighting
	2	Mode		Limitation mode
	3	V_resv		Voltage reserve for current control
	4	ObsMode		Current observer selection
	5	ObsTf		Current observer time constant
	6	sat_mode		Select saturation system

Table 8.4: Current controller parameters (continue)

**NOTE**

- The step response can be determined using the scope in DriveManager 5 by recording the two variables  $I_{sd}$  and  $I_{sdref}$ .
- If the gain or integral-action time is changed, a new curve must be recorded to make an assessment.
- The faster the actual value approaches the setpoint, the more dynamically the controller is set.
- The overshoot of the actual value should not be more than 5-10% of the setpoint during the settling process.

Adjustment of current control always depends on switching frequency. Therefore, current control is adjusted when switching over switching frequency. The factors used are stored in **P 2953 - CON\_CCON\_Fact**. The default setting is correct if a motor data set is used from KEBA or if the motor was identified in ServoOne CM. The

user can customize the factors for different constellations. To do so, set switching frequency to different stationary values and optimize current control based on step response.

Speed and position control are not adjusted. They must be set so that they still work stably at the lowest switching frequency.

### 8.3.1 Advanced current control

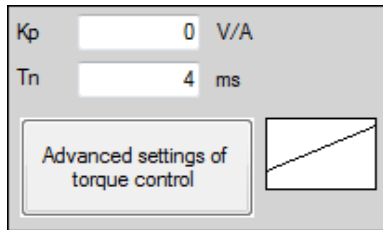


Fig. 8.9: Button: Advanced settings for torque control

P No.	Index	Name	Unit	Description
2973 / 5021 / 7069		CON_CCON_Tune		Axis 1 / 2 / 3: Controller settings current control
2973 / 5021 / 7069	0	VDC_TF	ms	DC link voltage measurement: Filter time constant
2973 / 5021 / 7069	1	VDC_Weight	%	DC link voltage measurement: Weighting
2973 / 5021 / 7069	2	Mode		Limitation mode
2973 / 5021 / 7069	3	V_resv	%	Voltage reserve for current control
2973 / 5021 / 7069	4	ObsMode		Current observer selection
2973 / 5021 / 7069	5	ObsTf	ms	Current observer time constant
2973 / 5021 / 7069	6	sat_mode		Select saturation system
2984 / 5032 / 7080		CON_CCON_Settings		Axis 1 / 2 / 3: Controller settings current control
2984 / 5032 / 7080	0	I_TF	µs	Current filter time

Table 8.5: Parameter – Control axis – Advanced current control

#### 8.3.1.1 Filtering

The filter time constant of current measurement can be configured with **P 2984[0] - I\_TF**. A change takes effect after restarting the controller.

Choose a higher time constant (stronger filtering) for axes with low inductance, high power and/or low switching frequency.

Choose a lower time constant for highly dynamic (direct) drives at 8–16 kHz switching frequency.

#### 8.3.1.2 Current observer

In the current control circuit, the calculation of voltage setpoints and PWM runtime appears as dead time. This is the main factor determining the possible performance of current control. The current observer eliminates this dead time to the greatest possible extent by predicting current by means of a scanning step. In addition, many synchronous servomotors exhibit harmonic components in the current control circuit. The current observer suppresses these harmonic components so that they cannot be passed on to the current controller. The disadvantage of the current observer is a possible deviation between actual current and observed current. This can lead to overcurrent shutdown if maximum current of the device or motor is controlled stepwise.

The current observer is activated by **P 2973[4] - ObsMode = ON**. Adjust the time constant **P 2973[5] - ObsTf** in the range from 0.062 ms to 0.5 ms. The higher the time constant, the greater the smoothing effect of the observer – however, the greater the possible deviations between actual current and observed current.

Another peripheral condition is that the electrical data of the motor must be well defined.

- Synchronous motors: see Section "Identification of synchronous motor data" on page 49.
- Asynchronous motor: see Section "Identification of asynchronous motor data" on page 55.

Motor inductance (if necessary in connection with the saturation characteristic) should be parametrized slightly too high.

### 8.3.1.3 Scaling with switching frequency

When the switching frequency is changed (see Section "Setting for the switching frequency" on page 42), the current control gain must be adjusted. This is implemented using the factors in **P 2953[0-4] - CON\_CCON\_Fact**. Current controller gain  $K_p$  is multiplied by the factor of the current switching frequency. The default is suitable for all motor data sets or for motors identified with ServoOne CM, but can also be manually edited.

### 8.3.1.4 Current controller limitation mode

Current is controlled in the components  $d$  and  $q$  by means of two independent PI controllers. If the voltage limit is reached, the question is how to distribute the available voltage among the  $d$  and  $q$  current controllers. This is configured in **P 2973 [2] - Mode**.

Setting	Function
0 (PRIO) = Changing priority	This setting is normally used and is suitable for standard motors, it should be chosen for asynchronous motors.
4 (HPRIO) = Changing priority / hexagon modulation	
1 (DPRIO) = D-axes priority	For synchronous motors, particularly in the field-weakening range, this settings produces better results. It ensures that the field-forming current is always set correctly first.
5 (HDPRIO) = D-Axes priority / hexagon modulation	
2 (PHASE) = In-phase limitation (both axes)	This setting is suitable for all applications. It is very robust, but generally does not produce time-optimal behaviour.
6 (HPHASE) = In-phase limitation (both axes) / hexagon modulation	

Table 8.6: Settings P 2973[2] - Mode

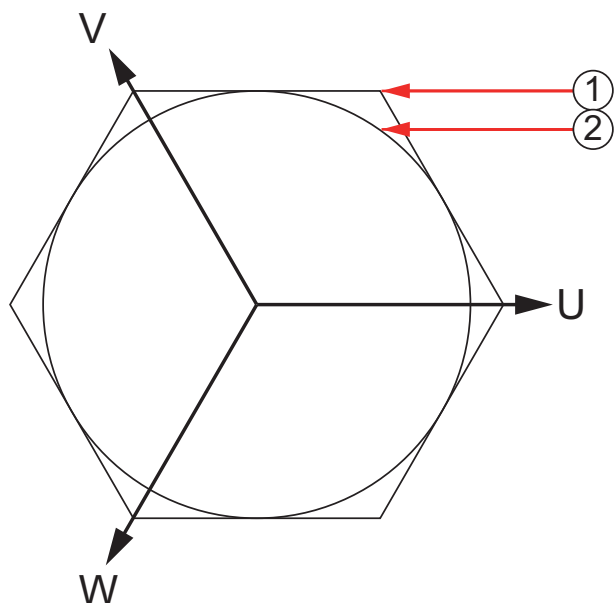


Fig. 8.10: Vector diagram of available voltage

① Maximum available voltage (hexagon); max.  $\frac{2}{3}U_{DC}$

② Incircle radius;  $\frac{U_{DC}}{\sqrt{3}}$

Legend for Vector diagram of available voltage

Available voltage takes the form of a hexagon in a vector diagram. Only the incircle of the hexagon is usually used (with setting 0..2).

With setting 4..6 the full available voltage is used, the gain is up to 10 %. However, this can lead to voltage and current distortions. A component with the 6th multiple of the electrical frequency on the d current and/or q current is typical. If necessary, use the current observer.

In setting 0, 1, 4 and 5 the parameter **P 2973[3] - V\_resv** defines how much voltage remains as control reserve for the non-prioritized branch. The default setting is generally sufficient.

### 8.3.1.5 Taking current DC link voltage into account

In order to convert the setpoint voltage requested by the current controller into a PWM duty factor, the actual value of the DC link voltage is used. This is the optimal procedure with regard to smooth running of the drive; in relation to DC link voltage, however, destabilisation is possible. Also, in case of a tendency to oscillate, filtering the DC link voltage is crucial.

Weighting of the current DC link voltage is configured in **P 2973[1] - VDC\_Weight**. Filtering of the DC link voltage is configured in **2973[0] - VDC\_TF**. The default setting is suitable for most applications.

## 8.4 Speed controller

The speed controller subject area is for optimizing the performance of the speed control.

The speed control is active in positioning applications and in the speed control mode. Information about the corresponding fieldbus modes and their timing *see also* section "Modes of Operation CiA402" on page 458).

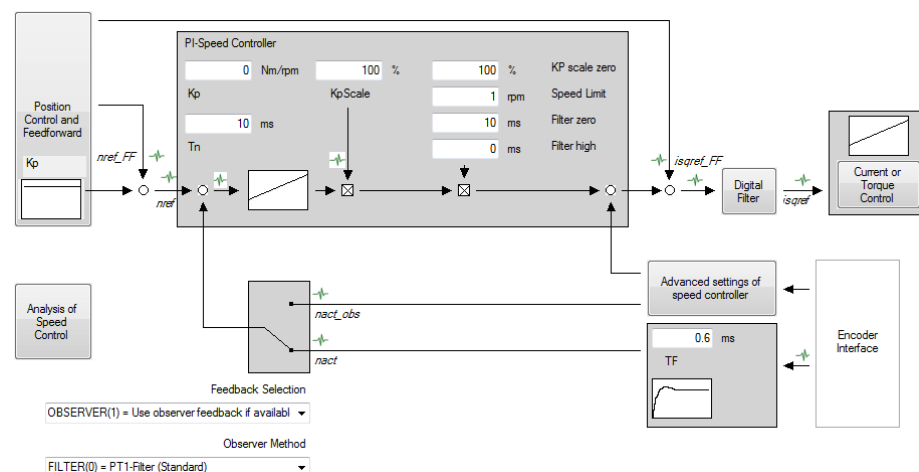


Fig. 8.11: Speed control dialog box

The motor model must be fine-tuned to the motor. The task of the speed controller is to keep the drive at a preset speed. Proportional gain must be adjusted to suit the moment of inertia of the system. The task of the integral component is to compensate the unknown load torque. A mechanical tendency of the system to oscillate limits the possible gain of the speed controller. Also, a tendency to oscillate can also be attenuated by means of the digital filter (Section "Digital filter" on page 131) or speed determination.

In the default motor data set, the speed controller is pre-set for a moderately rigid mechanism and twice the moment of inertia of the motor.

This dialog box provides advanced configuration options for the speed controller. Gain is set via **P 2951[0] - Kp**, integral-action time via **P 2951[1] - Tn**. Tn can be set to zero to disable the integral component of the speed controller. **P 2951[2] - Scale** is redundant to **P 2951[0] - Kp** and can also be used to modify the system.

The integral component of the speed controller is stored in **P 3029[0] - CON\_SCON\_PiIntegral**. It is particularly useful to zero the integral component, for example, when the axis moves against a rigid obstacle and you want it to move away from it again.

P No.	Index	Name	Unit	Description
2949 / 4997 / 7045	0	CON_SCALC_Tf	ms	Axis 1 / 2 / 3: Filter time constant actual speed value
2951 / 4999 / 7047		CON_SCON_Ctrl		Axis 1 / 2 / 3: Controller settings speed control
2951 / 4999 / 7047	0	Kp	Nm/rpm	Speed controller gain
2951 / 4999 / 7047	1	Tn	ms	Speed controller integral-action time
2951 / 4999 / 7047	2	Scale	%	Scale speed controller gain
2959 / 5007 / 7055		CON_IP_RefFil		Axis 1 / 2 / 3: Filter time constants feed forward control (prediction)
2959 / 5007 / 7055	0	CON_IP_RefTf	ms	Speed setpoint filter
2959 / 5007 / 7055	1	CON_IP_EpsDly	ms	Position controller deceleration time (n x 0.125 ms)
2959 / 5007 / 7055	2	CON_IP_SFFTf	ms	Filter time speed feed forward control
2959 / 5007 / 7055	3	CON_IP_AccFFTf	ms	Filter time acceleration feed forward control
3029 / 5077 / 7125	0	CON_SCON_PiIntegral	A	Axis 1 / 2 / 3: Current integral value of the speed controller

Table 8.7: List of parameters – Speed control

## 8.4.1 Reduction at low speeds

When a speed controller is set dynamically, undesirable oscillation of the speed controller occurs at low speeds or at zero speed. An appropriate setting of parameter **P 2983 CON\_SCON\_KpScale** can reduce control gain at low speeds and the tendency to oscillate. In optimized positioning applications, it is then necessary to reduce position controller gain too (see Section "Position Controller/Feed Forward Control" on page 139).

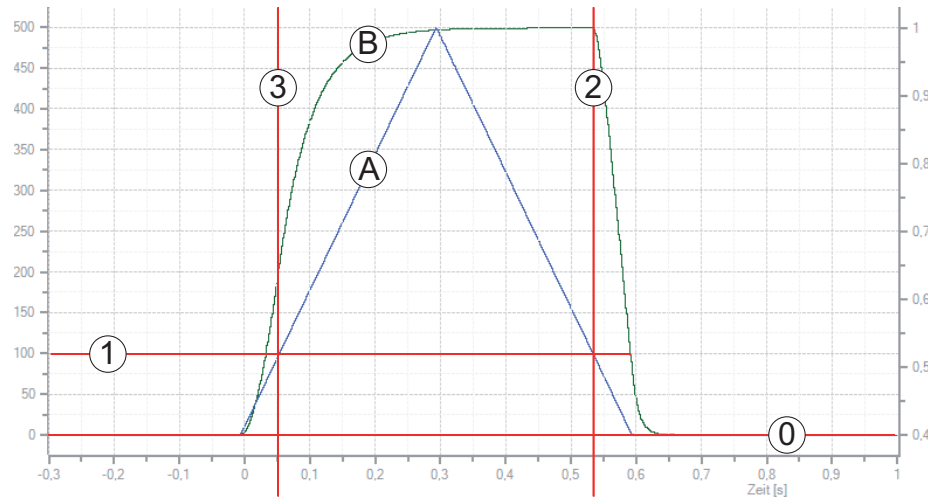


Fig. 8.12: Reduction of the speed gain at low speed

P No.	Index	Name	Unit	Description	Value in diagram	Name in diagram
2983 / 5031 / 7079	0	KpScaleScon	%	Scaling of speed control gain	40	④
2983 / 5031 / 7079	1	SpeedLimit	rpm	Speed threshold for scaling	100	①
2983 / 5031 / 7079	2	FilterZero	ms	Filter time for change from high to low speed	10	②

Table 8.8: Parameter list – Control axis and diagram key

P No.	Index	Name	Unit	Description	Value in diagram	Name in diagram
2983 / 5031 / 7079	3	FilterHigh	ms	Filter time for change from low to high speed	50	③
2983 / 5031 / 7079	4	KpScalePcon	%	Position controller gain scaling	40	
2983 / 5031 / 7079	5	KpScaleSconConst	%	Scaling of general speed control gain (adjustment to J)	100	
Scope signal 1007	0	Nref_FF		Setpoint speed, feed forward control scaled		①
Scope signal 1077		KpScaleScon		Speed Control Scaling		④

Table 8.8: Parameter list – Control axis and diagram key (continue)



### NOTE

- All parameters have a direct effect on control.

## 8.4.2 Additional feedbacks (oscillation damping)

In addition to the PI speed controller, other feedback paths are available to enable oscillation damping.

P No.	Index	Name	Unit	Description
3030 / 5078 / 7126		CON_SCON_ExtFeedb		Axis 1/2/3: Speed control mode: Setting the enhanced feedback
3030 / 5078 / 7126	0	K_acc	kg m2	Gain: Acceleration (dN/dt)
3030 / 5078 / 7126	1	Tf	ms	Filtering the enhanced feedback
3030 / 5078 / 7126	2	K_sdiff	Nm min	Gain: Differential speed from two-encoder system
3030 / 5078 / 7126	3	Tf	ms	Filtering the enhanced feedback
3030 / 5078 / 7126	4	K_load	1	Gain: Estimated load torque
3030 / 5078 / 7126	5	Tf	ms	Filtering the enhanced feedback
3030 / 5078 / 7126	6	K_sdiff_obs		Gain: estimated difference speed (unknown unit)
3030 / 5078 / 7126	7	Tf	ms	Filtering the enhanced feedback

Table 8.9: List of parameters – Additional feedbacks

**P 3030[4] - K\_load** feeds back an estimation of the current load torque. The condition is that the single-mass observer is enabled (see Section "Observer" on page 133). This is always possible with a gain of 0..1 and improves the disturbance behaviour of the PI controller. Set filter time to roughly the same value configured as the integral component of the speed controller **Tn**. If you set **K\_load** = 1, the integral component of the PI speed controller can be removed ( $T_n = 0$ ). The control circuit still retains stationary accuracy as load estimation and feedback have a similar effect. Compared with the classical solution, this improves phasing of the control circuit. **K\_load** represents a scaling and has no unit.

**P 3030[2] - K\_sdiff** feeds back the differential speed of an oscillatory dual-mass system. The condition for this is that you are using an oscillatory system with two encoders. Speed control is implemented on the motor encoder, position control on the load-side encoder. The unit of **K\_sdiff** is Nm / (1/min).

**P 3030[6] - K\_sdiff\_obs** feeds back the estimated differential speed of an observer. The condition is that the single-mass observer is enabled (see Section "Observer" on page 133), a second encoder is not required. The unit is unknown and depends on the observer design.

To use a differential speed feedback, increase the gain of the speed control points and/or reduce the integration time constant until the axis is almost oscillating. Then increase **K\_sdiff** until the system calms down again. This procedure can be performed iteratively. Using the feedback filter attenuates noise build-up but is counterproductive for oscillation damping.

**P 3030[0] - K\_acc** enables feedback of actual acceleration. The structure differs from a PID controller in that target acceleration is not fed back. This corresponds to a virtual additional moment of inertia in the axis, therefore **K\_acc** has a unit of kg m<sup>2</sup>.

### 8.4.3 Digital filter

A digital filter of the fourth order can be inserted in the output of the speed controller. It filters the setpoint current from both control and feed forward control. The digital filter is usually used when the axis displays resonant frequencies above the bandwidth of speed control. These frequencies are filtered out of the setpoint current spectrum in order to prevent excitation.

Select Filter NOTCH\_NOTCH(3) = 1st\_freq: band stop; 2nd\_freq: band stop

**1. Filter**

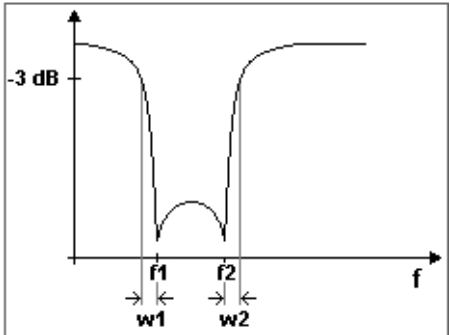
center / cut off (f1)  Hz

width (w1)  Hz

**2. Filter**

center / cut off (f2)  Hz

width (w2)  Hz



**Coefficients**

$b_0 * x(k)$	
$b_1 * x(k-1)$	$a_1 * x(k-1)$
$b_2 * x(k-2)$	$a_2 * x(k-2)$
$b_3 * x(k-3)$	$a_3 * x(k-3)$
$b_4 * x(k-4)$	$a_4 * x(k-4)$

Fig. 8.13: Digital filter dialog box

Configure the appropriate filter method using the “Filter selection” dropdown menu.

The filter can be configured by ServoOne CM as band-stop filter (NOTCH), deep pass filter (PTn) or a combination of both. A deep pass filter requires setting the cut-off frequency. A band lock filter requires setting the middle frequency and width. Width is the total width of the band lock between the two frequencies at which damping is 3 dB.

A large bandwidth will result in inadequate attenuation of the cut-off frequency. It is usually necessary to optimize the middle frequency and bandwidth iteratively as the band lock filter changes the phase response of the control circuit in the middle frequency range.

The filter can also be set as a BiQuad filter (inverse transfer function of a two-mass system). The resonant and antiresonant frequency of the two-mass system must be known for this purpose. The easiest way to determine them is by means of a Bode diagram of the system’s transfer function (see Section "Speed control analysis" on page 135). Enter the system’s antiresonant frequency in  $fc\_1$ , it is used as the filter’s resonant frequency. Enter the system’s resonant frequency in  $fc\_2$ , this is the filter’s antiresonant frequency. Then define the damping of the resonant and antiresonant point in the parameters **P 2981[2] - val\_f1** and **P 2981[4] - val\_f2**. The guide value is 0.1.

Finally, the filter can also be configured by the user. This is an expert option, as incorrect settings can cause the controller to behave unpredictably. Calculate a digital filter of the fourth order with a sampling rate of 125  $\mu$ s in separate software. Set the **P 2981[0] - Type** parameter to USER(1) and copy the coefficients to **P 2982 - CON\_SCON\_DigFilPara**. Switch to list view if necessary. If possible, copy the data automatically and do not round the coefficients!

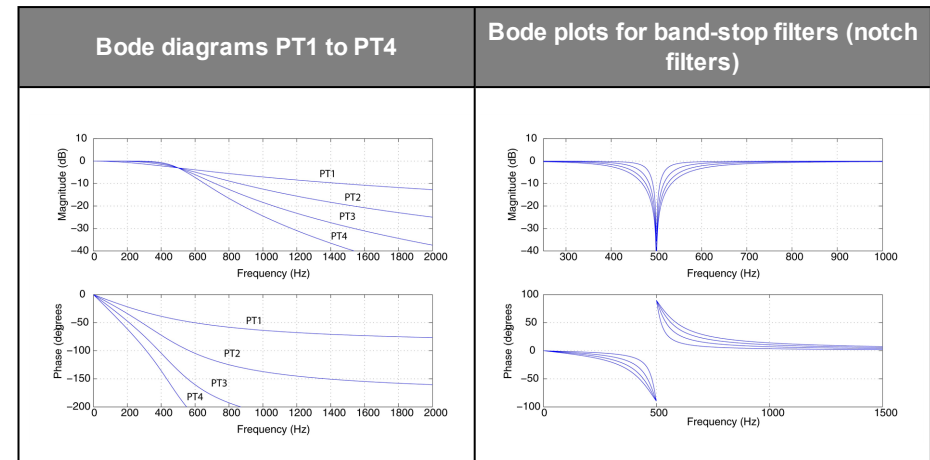


Table 8.10: Bode diagrams of filters

P No.	Index	Name	Unit	Description
2981 / 5029 / 7077		CON_SCON_DigFilSettings		Axis 1 / 2 / 3: Digital filter settings
2981 / 5029 / 7077	0	Type		Filter type selection
2981 / 5029 / 7077	1	fc_1	Hz	1st filter: Centre frequency / cut-off frequency
2981 / 5029 / 7077	2	val_f1		1st filter: Bandwidth / damping
2981 / 5029 / 7077	3	fc_2	Hz	2nd filter: Centre frequency / cut-off frequency
2981 / 5029 / 7077	4	val_f2	Hz	value for 2nd frequency: band width [Hz] or damping[1]
2982 / 5030 / 7078		CON_SCON_DigFilPara		Axis 1 / 2 / 3: Digital filter parameters
2982 / 5030 / 7078	0	b0		$b0 * x(k)$
2982 / 5030 / 7078	1	b1		$b1 * x(k-1)$
2982 / 5030 / 7078	2	b2		$b2 * x(k-2)$
2982 / 5030 / 7078	3	b3		$b3 * x(k-3)$
2982 / 5030 / 7078	4	b4		$b4 * x(k-4)$
2982 / 5030 / 7078	5	a1		$a1 * y(k-1)$
2982 / 5030 / 7078	6	a2		$a2 * y(k-2)$
2982 / 5030 / 7078	7	a3		$a3 * y(k-3)$
2982 / 5030 / 7078	8	a4		$a4 * y(k-4)$

Table 8.11: Parameter list – Control axis – digital filter



### 8.4.4 Advanced speed control

In the Advanced Speed Control area, the following functions can be set:

- [Observer](#)
- [Quick stop without sensor](#)
- [Speed/position controller gain scaling](#)

eingestellt werden.

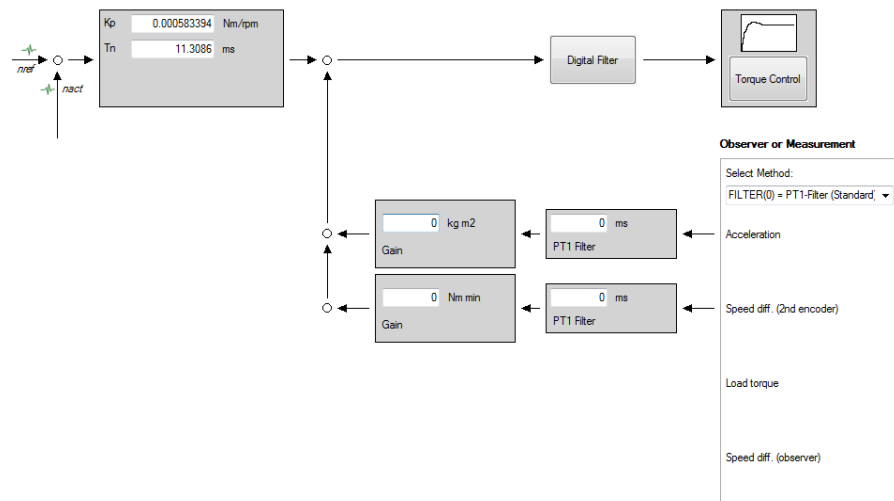


Fig. 8.14: Advanced Speed Control dialog box

P No.	Index	Name	Unit	Description
2974 / 5022 / 7070		CON_SCALC_SLStop		Axis 1 / 2 / 3: Quick stop without sensor settings
2974 / 5022 / 7070	0	LowSpeedLimit	%	Speed limit for I/F control (in % of SNom)
2974 / 5022 / 7070	1	LowSpeedCurrent	%	D-current for IF control (in % of INom)
2974 / 5022 / 7070	2	KpScale	%	Scaling of speed control gain
2974 / 5022 / 7070	3	KppScale	%	Position control gain scaling
2977 / 5025 / 7073		CON_SCALC_ObsSel		Axis 1 / 2 / 3: Observer / feedback method selection
2977 / 5025 / 7073	0	MethodSel		Selection of the observer method
2977 / 5025 / 7073	1	OnlineSel		
2978 / 5026 / 7074		CON_SCALC_ObsDesign		Axis 1 / 2 / 3: Observer design parameter
2978 / 5026 / 7074	0	DesignAssist		Observer configuration wizard
2978 / 5026 / 7074	1	Tf	ms	Observer time constant
2978 / 5026 / 7074	2	Alpha		Damping coefficient
2978 / 5026 / 7074	3	Tf1	ms	Speed filter time constant
2978 / 5026 / 7074	4	Tf2	ms	Acceleration time constant
2978 / 5026 / 7074	5	J	kgm2	Moment of inertia of observed mass (0 = same as total moment of inertia of axis)
2983 / 5031 / 7079		CON_SCON_KpScale		Axis 1 / 2 / 3: Speed / position controller gain scaling
2983 / 5031 / 7079	0	KpScaleScon	%	Scaling of speed control gain
2983 / 5031 / 7079	1	SpeedLimit	rpm	Speed threshold for scaling
2983 / 5031 / 7079	2	FilterZero	ms	Filter time for change from high to low speed
2983 / 5031 / 7079	3	FilterHigh	ms	Filter time for change from low to high speed
2983 / 5031 / 7079	4	KpScalePcon	%	Position controller gain scaling
2983 / 5031 / 7079	5	KpScaleSconConst	%	Scaling of general speed control gain (adjustment to J)

Table 8.12: Parameter list – Control axis – Advanced speed control

#### 8.4.4.1 Observer

The speed observer is a simple model of the path with motor current as input, as estimation of load torque and feedback of the estimated error from encoder position for speed control. The observer generates an estimation of motor speed that is used

as an alternative to the measured, filtered speed of the axis.

### Procedure for using the observer

- Make sure that the mass inertia of the system (**P 2992[0] - SCD\_JSum**) is known. To do so, determine the inertia of the system (see Section "Automatic mass inertia definition" on page 121), if you haven't already done so.
- Another criterion for a reliable knowledge of mass inertia is functioning torque feed forward control (see Section "Position Controller/Feed Forward Control" on page 139). Multiply the currently configured value of **P 2992[0] - SCD\_JSum** by **P 2971[1] - Torque** and reset **P 2971[1] - Torque** to 100 %.
- Set **P 2977[0] - MethodSel** = OBS1(1) and **P 2978[0] - DesignAssist** = DR (1)
- Start the control.

The setting parameter for the observer is the time constant **P 2978[1] - Tf**. Use twice the time constant of the previously used speed filter **P 2949[0] - CON\_SCALC\_Tf** as an initial value. Configuration is also a compromise between input signal smoothing and phase shift in the control circuit. However, the observer does not have such a great effect on phase shift in the speed control circuit as a filter.

### 8.4.4.2 Quick stop without sensor

**Sensorless stop is executed if reaction on encoder error is stop**

Reaction on error 22 'Encoder cyclic error'

**Hold current in low speed range**

Low Speed Limit for IF control in % of SNom  %

d-current for IF control in % of INom  %

**Reduced control gain**

Scaling of speed control gain  %

scaling of position control gain  %

Fig. 8.15: Sensorless Stop dialog box

In case of encoder malfunction, the axis switches to sensorless control. Use the error reaction (see Section "Error reactions" on page 225) to define a stop ramp. It is then implemented in the previously activated control mode in sensorless mode.

Sensorless mode is configured via the motor parameters. At low speeds, sensorless mode only works inadequately. Therefore, **P 2974[0] - LowSpeedLimit** and **P 2974[1] - LowSpeedCurrent** can be used to set a positive current in the d axis. This keeps the machine in position. Set 100% of the rated current as a guide value for **P 2974[1] - LowSpeedCurrent**  $\sqrt{2} \cdot \text{Nennstrom des Motors}$ .

For sensorless mode, the gains of the speed controller and position controller are scaled with the values in **P 2974[2] - KpScale** and **P 2974[3] - KppScale**. This is necessary as the quality of sensorless control does not reach the quality of an encoder system.

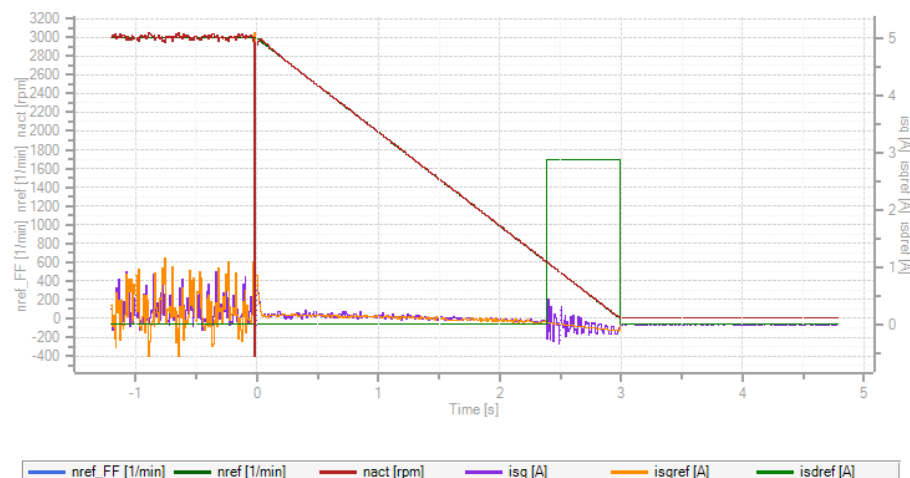


Fig. 8.16: Quick stop without sensor

Sensorless control can become unstable with very high currents. Use approximately the rated current of the motor for the quick-stop. Use the torque limit in the quick-stop (see also section "Stop ramps" on page 502).

#### CAUTION!

Your system/motor may be damaged if put into operation in an uncontrolled or inappropriate manner.



Improper conduct can cause damage to your system / machine.

- If the sensorless quick stop does not work properly, the motor can accelerate uncontrolled. This can lead to damage to the mechanical system.
- Test the sensorless quick stop thoroughly. Test at different working points.
- Activate speed tracking error monitoring (see Section "Error reactions" on page 225, **P 2153[10] - SpeedDiff**). This offers a certain protection against uncontrolled movement.

### 8.4.5 Speed control analysis

The analysis of the speed control is accomplished by applying a test signal to the controller and measuring the system response. This is especially important for speed control because mechanical effects manifest themselves in this control loop.

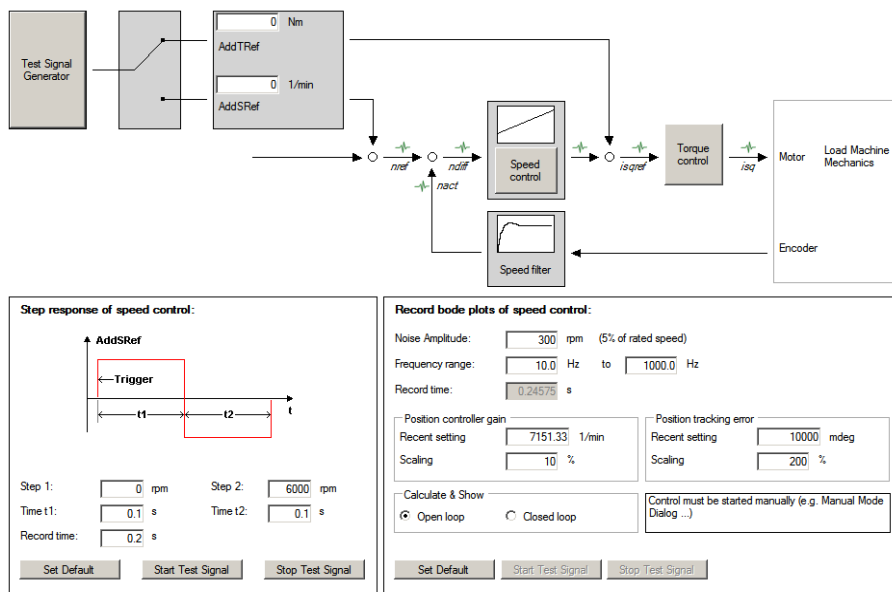


Fig. 8.17: Speed control analysis dialog box

This dialog box provides a test signal generator for analysing speed control. **P 3052 [0] - AddTRef** and **P 2950[0] - AddSRef** can be used to specify a constant speed as setpoint for the controller.

Details on the test signal generator can be found in Section "Commissioning" on page 157

ID	Index	Name	Unit	Description
2950	0	AddSRef	1/min	Axis 1: Additive speed setpoint (without ramp)
3052	0	AddTRef	Nm	Axis 1: Additive torque setpoint (without ramp)

Table 8.13: Parameter

### 8.4.5.1 Step response

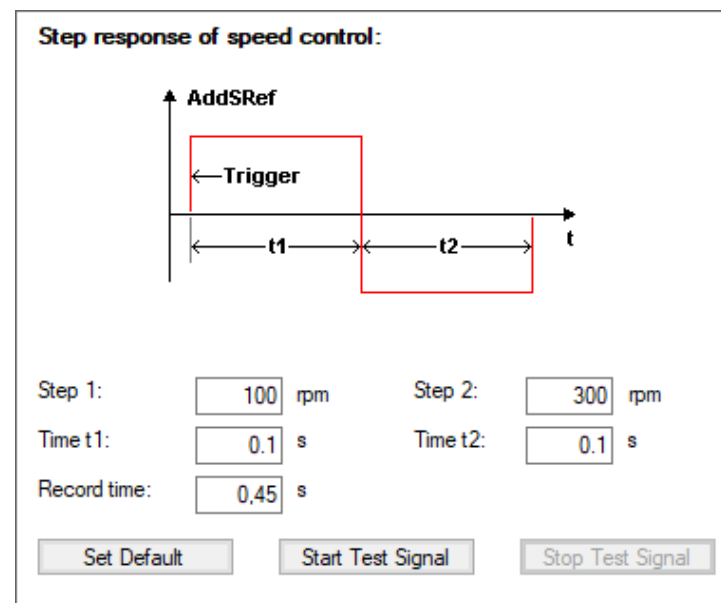


Fig. 8.18: Step response of the speed control

This function is for recording a step response of the speed control loop.

Ensure that the axis can be moved freely and does not reach any mechanical limits.

Set the two speed levels. Neither of the two levels should be zero because the step from and to speed zero could cause non-linear effects due to adhesion and friction. Optionally, the times can also be adapted.

Pressing "Start test signal" switches on the axis and the two speeds are used. The step response of the speed control loop is recorded.

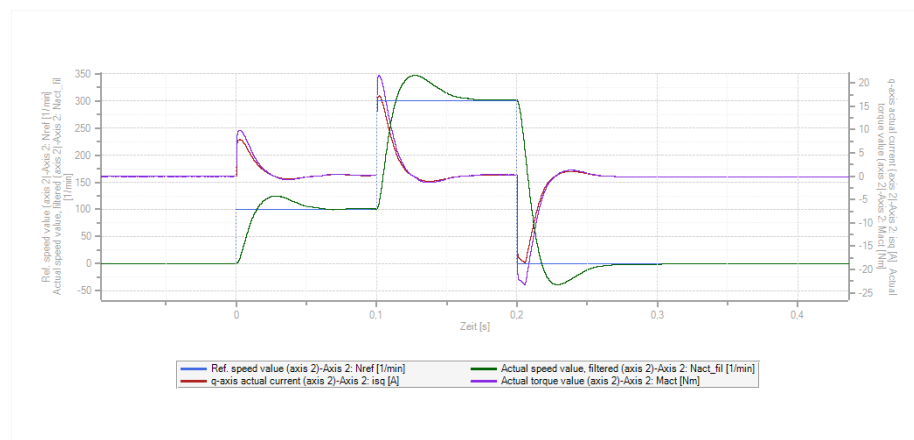


Fig. 8.19: Example step response

The speed control loop can be evaluated easily based on the step response:

- Increase the gain if the actual speed does not settle in to the new setpoint fast enough.
- Reduce the gain and increase the integration time constant if the actual speed overshoots the new setpoint by too much.
- Decrease the integration time constant if the actual speed initially approaches the new setpoint quickly, but then takes too long to actually reach it.

**NOTE**

- The speed control loop should be evaluated in the linear range. Check to be sure that the torque in the recording does not reach the limitation.
- An overshoot of 40% is customary for dynamic applications. ("Symmetrical optimum")

## 8.4.5.2 Transfer function

**Record bode plots of speed control:**

Noise Amplitude:  rpm (5% of rated speed)

Frequency range:  Hz to  Hz

Record time:  s

<b>Position controller gain</b> Actual setting <input type="text" value="1000"/> 1/min Scaling <input type="text" value="10"/> %	<b>Position tracking error</b> Actual setting <input type="text" value="10000"/> mdeg Scaling <input type="text" value="200"/> %
--	--

Calculate & Show  
☒ Open loop    ☐ Closed loop

Control must be started manually (e.g. Manual Mode Dialog ...)

Fig. 8.20: Transfer function

Measurement of the transfer function is conducted superimposed onto the movement of the axis. Control the movement with the superimposed controller or in manual mode (for more on this, see 14.1 Manual mode window). An oscillation between two positions is advantageous, with no standstill to the greatest extent possible.

The movement is superimposed on a sweep signal which moves between the frequencies set under **Frequency range**.

The **noise amplitude** is a measure of how strongly the frequencies are excited. Check this value before the first measurement. Start with a low value and increase it step by step until the frequency response contains enough information. Listen for noises from the mechanical parts to avoid damage.

During the superimposed axis movement, press the **“Start test signal”** button to initiate the measurement. The duration required for the measurement is shown in the dialog.

It is helpful to reduce the gain of the position controller (for more on this, see 8.5 Position Controller/Feed Forward Control) during the measurement because it otherwise partially compensates the test signal. The threshold for the tracking error must be increased accordingly. In the screen, set both in percent.

Two important characteristic curves can be output on the basis of the measurement: The transfer function of the open speed control loop and the transfer function of the closed speed control loop.

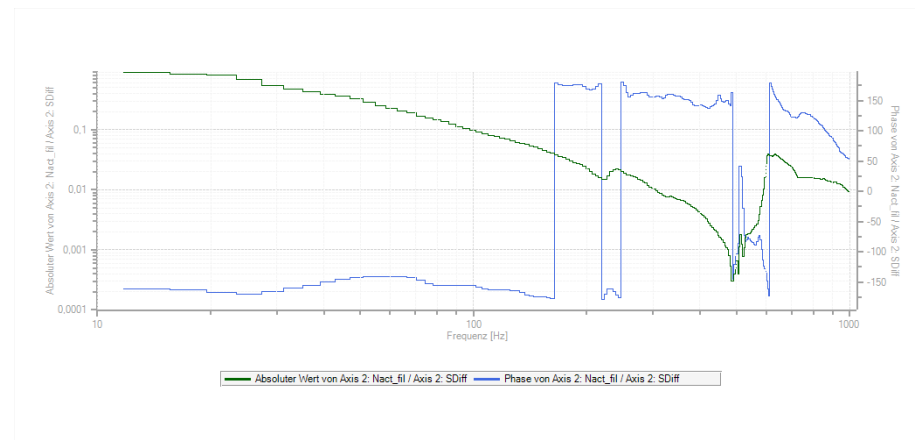


Fig. 8.21: Example Bode plot for open loop

For an easy analysis, use the transfer function of the open speed control loop. Note the frequency at which the amplitude curve crosses 0 dB and configure the control loop in such a way that the phase curve here is significantly higher than  $-180^\circ$ .

The point of intersection with 0dB is also referred to as the bandwidth of the control loop. The distance above  $-180^\circ$  is called the phase reserve. A large phase reserve increases the stability.

In addition, the measurement depicts the mechanical resonance points of the system. Check to see whether the resonances lead to problems in your application. If yes, use digital filters for compensation (for more, see 8.4.3 Digital filter) or the methods of “enhanced speed control” (for more, see 8.4.4 Advanced speed control).

## 8.5 Position Controller/Feed Forward Control

The subject areas position control and feed forward control are for optimizing the performance of position control. The aim is usually to minimize tracking error during movement.

Position control is only active for positioning applications. Information about the corresponding fieldbus modes and their timing (*see also section "Modes of Operation CiA402" on page 458*).

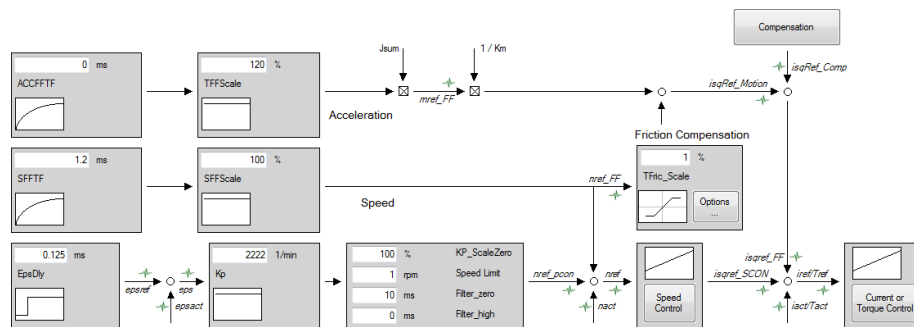


Fig. 8.22: Position control dialog box

### 8.5.1 Position controller

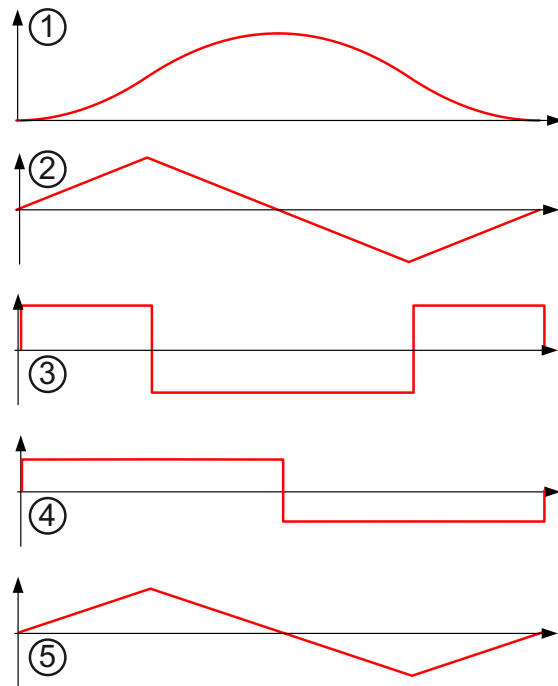
The position controller is a pure proportional element. Gain can be configured in **P 2957[0] - CON\_PCON\_Kp**.

If gain scaling was specified for the speed controller (see Section "Reduction at low speeds" on page 130) at low speeds, this is usually necessary for the position controller as well. Otherwise, the position controller must be configured for stationary case and does not realise the optimal dynamics.

P No.	Index	P name	Unit	Function
2955 / 5003 / 7051	0	CON_PCON_ActPosition	incr	Axis 1 / 2 / 3: Actual position
2957 / 5005 / 7053	0	CON_PCON_Kp	1/min	Axis 1 / 2 / 3: Position controller gain

Table 8.14: Position controller parameters

## 8.5.2 Feed forward control of speed and acceleration



- ① Position
- ② Speed
- ③ Acceleration and braking torque
- ④ Dry friction
- ⑤ Viscous friction

*Legend for Courses during a positioning procedure*

If an axis is moved in positioning mode, speed and torque setpoints (from acceleration and mass inertia) also result from position setpoints. The aim of feed forward control is to bring these setpoints directly and not via the higher-level controller to the speed and torque controller. Speed feed forward control is necessary to run a stable positioning controller. Torque feed forward control serves to optimize controller performance. If torque feed forward control is well adjusted, the controller works dynamically to a large extent via torque feed forward control and the current control circuit.

The feed forward control can be undertaken internally by the controller or by an external controller for motion control (also see Section "External feed forward control" on page 458). By means of the internal feed forward control of the acceleration torque, the load on the speed controller is reduced and the behaviour of the drive optimized. To be able to pre-control the acceleration torque, the mass inertia referred to the motor shaft must be known **P 2964[11] - MOT\_J**. The feed forward control of the acceleration torque is optimized via **P 2971[1] - CON\_IP\_FFScale**. The tracking error is reduced by the predictive feed forward control of torque and speed.

Normally, the feed forward control variables are calculated from the 1st and 2nd derivation of the position target reference. This requires the interpolation mode **P 2969[0] - CON\_IP\_Sel = CUBIC** (see Section "Motion profile basic settings" on page 195).

The general rule for optimisation is whether the precontrolled q current isqref\_FF represents (to a large extent) the actual value of the q current; also for speed feed forward control. The aim, however, is to optimize tracking error. Specifically, the tracking error should not contain any components that are systematically dependent on the course of motion.



Proceed as follows to optimize feed forward control:

- Select the following variables in DigitalScope:

Scope variable / parameter	Name	Meaning / function
1026	nact_fil	Actual speed value
1007	nref_FF	Reference speed, feed forward control, scaled
24	isq	Q current actual value
1071	isqref_FF	Q current setpoint from feed forward control
<b>P 2303[4]</b>	<b>PosDiff</b>	Position tracking error in user units

- Configure a cyclical movement, e.g. using the manual mode window (see the Section "Manual mode window" on page 541)
- Scale torque feed forward control **P 2971[1] - Torque** so that isqref\_FF and isq largely coincide.
- Scaling of speed feed forward control **P 2971[0] - Speed** is generally correct at 100 %, a slight variation in the range of 90–110 % may improve results further.
- Use the deceleration **P 2959[1] - CON\_IP\_EpsDly**, **P 2959[2] - CON\_IP\_SFFTf** and **P 2959[39] CON\_IP\_AccFFTf** to eliminate systematic components of the tracking error.

Optimize feed forward control together with friction torque compensation. (see Section "Friction torque compensation (friction)" on page 144).

P No.	Index	Name	Unit	Description
2959 / 5007 / 7055		CON_IP_RefFil		Axis 1 / 2 / 3: Filter time constants feed forward control (prediction)
2959 / 5007 / 7055	0	CON_IP_RefTf	ms	Speed setpoint filter
2959 / 5007 / 7055	1	CON_IP_EpsDly	ms	Position controller deceleration time (n x 0.125 ms)
2959 / 5007 / 7055	2	CON_IP_SFFTf	ms	Filter time speed feed forward control

Table 8.15: Parameter list – Control axis

P No.	Index	Name	Unit	Description
2959 / 5007 / 7055	3	CON_IP_AccFFTf	ms	Filter time acceleration feed forward control
2969 / 5017 / 7065	0	CON_IP_Sel		Axis 1 / 2 / 3: Interpolation method
2970 / 5018 / 7066		CON_IP_FFMode		Axis 1 / 2 / 3: Feed forward control mode
2970 / 5018 / 7066	0	Speed		Speed feed forward control mode
2970 / 5018 / 7066	1	Torque		Torque feed forward control mode
2971 / 5019 / 7067		CON_IP_FFScale		Axis 1 / 2 / 3: Scaling of the feed forward control
2971 / 5019 / 7067	0	Speed	%	Speed feed forward control scaling
2971 / 5019 / 7067	1	Torque	%	Torque feed forward control scaling
2971 / 5019 / 7067	2	ExtSpeed	%	Additional scaling of external speed feed forward control
2971 / 5019 / 7067	3	ExtTorque	%	Additional scaling of external torque/power feed forward control

Table 8.15: Parameter list – Control axis (continue)



#### NOTE

- Torque feed-forward control will be disabled if linear interpolation is used.
- Changing the total moment of inertia will change other settings in the controller!
- In multiaxis applications in which the precise co-ordination of axes in relation to each other is important (trajectories), the delay on the position signal must be set the same on all axes via the parameter **P 2959(1)-IP\_EpsDly**.

Modifications of parameters **P 2959[2] - SFFTF** and **P 2959[3] - AccFFTf** take effect after a few ms. Modifications do not cause a fault of the control if the new value selected is appropriate. Modifications of the parameters **P 2970** and **P 2971** take effect in real time; abrupt changes of the feed forward control values can cause a one-time fault of the control. It may be necessary to implement a ramp function or filtering in the higher-level control. A change of parameter **P 2959[1] - EpsDly** disturbs the control circuit over the course of several fieldbus cycles.

### 8.5.3 Feed forward control of force due to weight

**P 2986 - CON\_SCON\_TConst** is used to configure feed forward control of a constant force due to weight (in % of rated motor torque). This function has no advantage in terms of control as a constant load is compensated very effectively by the integral component of the speed controller. However, it is helpful for verifying the correlation of precontrolled torque and actual torque in DigitalScope.

### 8.5.4 External feed forward control

Some controllers can output feed forward control of speed and torque in addition to paths. This must be written synchronously to the EtherCAT® objects **0x60B1 - VelocityOffset** and **0x60B2 - TorqueOffset**.

External feed forward control is visible in the DigitalScope in the variables 1107.0 Nref\_EXT and 1108.0 Mref\_EXT. Record these variables and adjust scaling with **P 2971[2] - ExtSpeed** and **P 2971[3] - ExtTorque**. The scaling parameters **P 2971[0-1]** apply to internal and external feed forward control. Use them to optimize the control system. The feed forward control currently in use is toggled in **P 2970 - CON\_IP\_FFMode**, the switchover is active immediately.

At stop ramps, drive-guided homing operations, and in jog mode the system switches back to internal feed forward control.



#### NOTE

- Optimisation using the manual mode window (see Section "Manual mode window" on page 541) and test signal in interpolating mode no longer work if external feed forward control is selected. Use a test signal from your controller.
- An exception is axes with suspended load and holding brake in which the controller precontrols force due to weight. For this purpose, use the setting **P 2970[1] - Torque = EXT2** to achieve more fluid transitions to brake control at standstill.

### 8.5.5 Compensation of synchronisation error

In a fieldbus group the controller specifies the system cycle, the internal cycles of the ServoOne CM are adjusted to match. For this purpose, cycle time is varied slightly in ServoOne CM. In demanding applications, this can already lead to an increased tracking error:

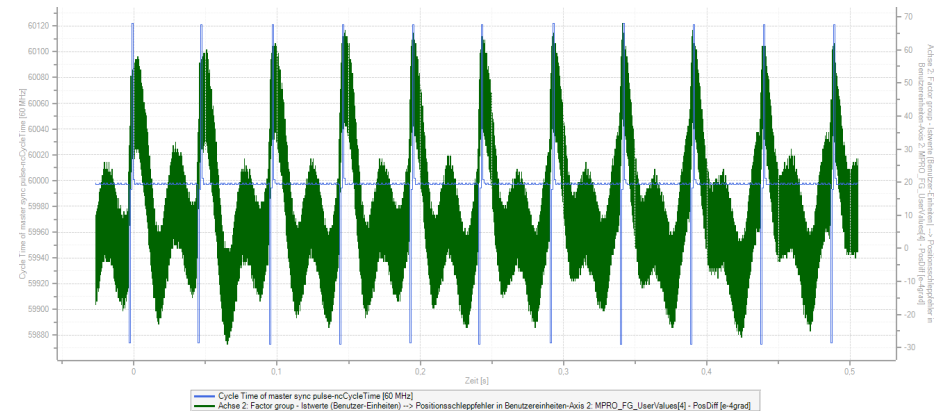


Fig. 8.23: Synchronisation without compensation measures

Compensation is activated with **P 902[0] - active** for this error. For this purpose, the position setpoints are slightly adjusted internally in the case of synchronisation procedures. The mean of cycle deviation between controller and drive is recorded with a deep pass filter configured in **P 902[1] - TimeConst** and factored in. The guide value is 100 ms.

This setting is only made once per Axis Controller and applies to all axes.

P No.	Index	Name	Unit	Description
902		CON_PCON_SyncComp		Error compensation by post-synching (for high accuracy at high speed)
902	0	active		ON/OFF
902	1	TimeConst	ms	Compensation time constant

Table 8.16: Parameter list – Device control

## 8.5.6 Encoder overlay

Position control on axes with elastic coupling of motor and load is often implemented with the aid of an additional load-side encoder used for position control. This is useful to increase the accuracy of position control. From the point of view of oscillation damping, this structure is not always ideal. If the connection between the motor and load is lost, control is no longer possible.

To improve the behaviour in terms of control technology, it is possible to implement an overlay of both encoders for position control. In the low-frequency range, the information of the load-side encoder is used to achieve stationary accuracy. This range is limited by the filter time constant **P 3031[0] - Tf\_EncOvr**. The missing high-frequency information is taken from the motor-side encoder. Parametrize the cut-off frequency of the filter below the resonance frequency of the system.

P No.	Index	Name	Unit	Description
3031 / 5079 / 7127		CON_PCON_Tune		Axis 1 / 2 / 3: Advanced position control functions
3031 / 5079 / 7127	0	f_EncOvr	Hz	Cut-off frequency of position overlay (0 = function disabled)

Table 8.17: “Encoder overlay” parameters

### Example:

In a test setup, power is transmitted from the motor to the load by means of a chain. The chain tension was reduced for test purposes so much that the chain had about 2 cm of sag. The motor encoder is connected to channel 1, the encoder on the load side to channel 2.

### Encoder selection

Encoder for commutation and torque control loop:

CH1(0) = Multi encoder interface ▼

Encoder for speed control loop:

CH1(0) = Multi encoder interface ▼

Encoder for position control loop:

CH1(0) = Multi encoder interface ▼

1. If the feedback for position, speed and commutation angle are put on channel 1, the motor can be controlled well, but the position on the load side is undefined.
2. If the feedback for the position is put on the load-side encoder on channel 2 – as is usually the case in practice – then the position control must be reduced considerably. In this state, a recording was made of the motor-side speed **P 2851[6] - Speed** and the load-side speed **P 2871[6] - Speed**. The “transfer function” between these two variables can then be displayed as a Bode plot. The plot must be interpreted with a certain scepticism because the sagging chain operates with backlash and therefore non-linearly. What can be ascertained, however, is that as of about 2 Hz, a resonance between the two values becomes evident.
3. Consequently, f\_EncOvr was set to 1-2 Hz. This allows the control to operate stably as in 1. and the position of the load is controlled to the setpoint value

as in 2. The smoothing of the travel profile, however, should also lie in the range of at least 1/2 Hz to 1/1 Hz = 500 ms..1000 ms.

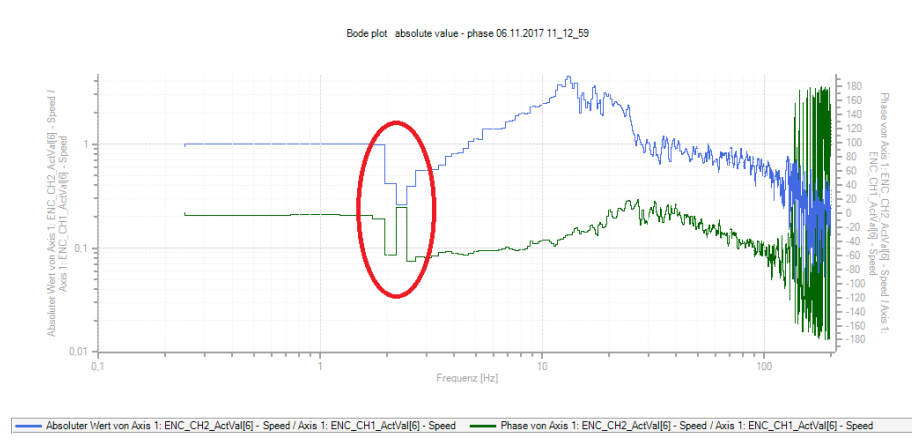


Fig. 8.24: Example: Bode plot of a transfer function

In order to control an alternating connection between motor and load, the position evaluation can be switched over during operation via the bit-coded parameter **P 3032 CON\_PCON\_Ctrl**.

Bit	Meaning
PGSEL(0)	0: The position and speed encoders are interchanged. 1: Function as parametrized
PDIFFW (1)	The position of the position and speed encoders is synchronized and evaluated on edge 0->1 as long as the bit =1. If the deviation between the position and speed encoder becomes greater than P3033, error 17-1 is triggered.
ENCOV (2)	0: Control only by the position sensor 1: Encoder overlay (if f_EncOvr > 0)

Table 8.18: What the bits mean

## 8.5.7 Friction torque compensation (friction)

Two types of friction influence the variables of the position tracking error:

- Dry friction (grip), which acts depending on the direction of motion, but independently of the speed's magnitude.
- Fluid friction (viscosity), which acts proportionally to speed.

Friction torque compensation can be used for both types of friction. Both types of friction are described in the compensation table by a function starting from speed = 0 or force = 0 up to a defined speed or force. Above the specified limit, the speed or force remains constant. Compensation is performed as a percentage of rated motor torque and power.

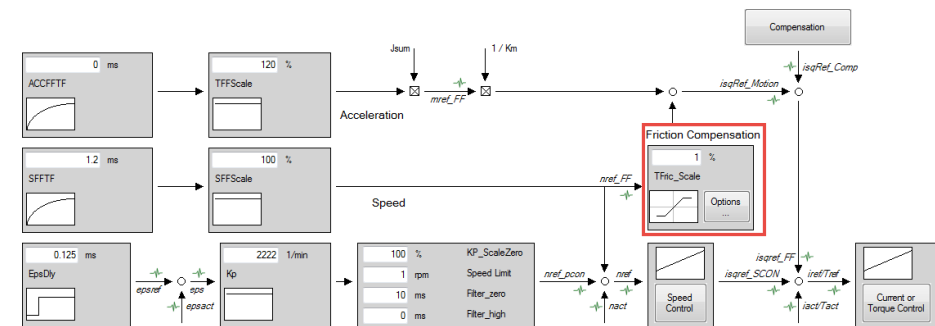


Fig. 8.25: Position control dialog box

P No.	P name	Function
P 2985	CON_SCON_TFric	Axis 1: Friction torque compensation settings The table values 0 to 5 are always applicable while table values 6 to 9 only take effect in the acceleration range.
	(0)Torque_1	Characteristic power_1
	(1)Speed_1	Characteristic speed limit_1

Table 8.19: Friction torque compensation parameters

P No.	P name	Function
	(2)Torque_2	Characteristic power_2
	(3)Speed_2	Characteristic speed limit_2
	(4)Torque_3	Characteristic power_3
	(5)Speed_3	Characteristic speed limit_3
	(6)Torque_4	Characteristic power_4
	(7)Speed_4	Characteristic speed limit_4
	(8)Torque_5	Characteristic power_5
	(9)Speed_5	Characteristic speed limit_5
P 2986	CON_SCON_TConst	Axis 1: Compensation for gravity
	(0)Const	Friction torque compensation: Constant (independent of direction)
	(1)reserved	Not used

Table 8.19: Friction torque compensation parameters (continue)

### 8.5.7.1 Setting friction torque compensation

P No.	Index	Name	Value	Unit	Function
2985 / 5033 / 7081		CON_SCON_TFric			Axis 1: Friction torque compensation settings
2985 / 5033 / 7081	0	Torque_1	5	[%]	Characteristic curve for friction (blue in the diagram)
2985 / 5033 / 7081	1	Speed_1	10	[rpm]	
2985 / 5033 / 7081	2	Torque_2	5	[%]	Characteristic curve for viscous friction (green in the diagram)
2985 / 5033 / 7081	3	Speed_2	1000	[rpm]	
2985 / 5033 / 7081	4	Torque_3	0	[%]	These characteristic curves only have an effect in the acceleration range. This is only displayed incompletely in DigitalScope.
2985 / 5033 / 7081	5	Speed_3	0	[rpm]	
2985 / 5033 / 7081	6	Torque_4	0	[%]	
2985 / 5033 / 7081	7	Speed_4	0	[rpm]	
2985 / 5033 / 7081	8	Torque_5	0	[%]	
2985 / 5033 / 7081	9	Speed_5	0	[rpm]	

Table 8.20: Friction torque compensation parameters – EXAMPLE

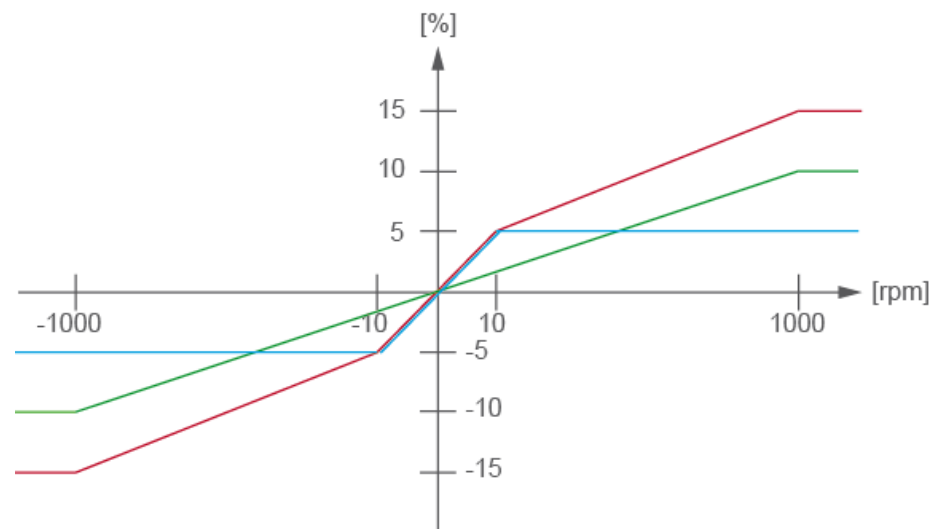


Fig. 8.26: Friction torque compensation for position control

The friction torque compensation is derived from the forward-fed speed **nref\_FF**. It has five basic functions, each having the **Torque** and **Speed** parameters. The basic function runs proportionally up to the point (Speed, Torque), the function value remains constant at higher speeds.

Optimize friction torque compensation together with feed forward control (see Section "Position Controller/Feed Forward Control" on page 139). Proceed as follows:

- Select the following variables in DigitalScope:

Scope variable / parameter	Name	Meaning / function
1026	nact_fil	Actual speed value
1007	nref_FF	Reference speed, feed forward control, scaled
24	isq	Q current actual value
1071	isqref_FF	Q current setpoint from feed forward control
<b>P 2303[4]</b>	<b>PosDiff</b>	Position tracking error in user units

- Configure a cyclical movement, e.g. using the manual mode window (see the Section "Manual mode window" on page 541)
- Set **P 2985[1] - Speed** so that the direction-dependent component of isq is represented in isqref\_FF (dry friction).
- Set **P 2985[3] - Speed** to the rated speed of the drive.
- Set the value for **P 2985[2] - Torque** in such a way that the component of isq that is proportional to speed is reproduced in isqref\_FF (fluid friction).
- Optimize **P 2985[0] - Torque** to as small a tracking error as possible at start-up point.
- In the case of applications with high friction, it can be useful to use the dry friction at the target point for quickly settling into the target. For testing purposes, set **P 2985[1] - Speed** = 0 and check whether this improves run-in to target point. If so, copy **P 2985[0] - Torque** to **P 2985[6] - Torque** and **P 2985[1] - Speed** to **P 2985[7] - Speed**. The compensation will now only act at the starting point.
- If appropriate, use the other terms to improve detailed modelling of friction.

## 8.5.8 Backlash compensation

P No.	Index	Name	Unit	Description	Type
3044 / 5092 / 7140		CON_PCON_BacklashComp		Axis 1 / 2 / 3: Friction compensation	List of subparameters
3044 / 5092 / 7140	0	Distance	POS	Backlash requiring compensation (+-)	float32
3044 / 5092 / 7140	1	Speed	SPEED	Speed for determining direction	float32

Table 8.21: Backlash compensation parameters

With a position-controlled axis, the backlash causes the axis to lag behind the target position in dependence on the direction. If the system does not have an encoder on the load side, this behaviour cannot be detected by the control system.

In this case, measure the backlash using external aids.

Enter the path requiring compensation in **P 3044 [0] - Distance**. The actual position is shifted by this distance either positively or negatively.

Enter the speed at which a direction should be detected in **P 3044 [1] - Speed** to define the determination of the direction. The transition at lower speeds is realized using a combination of hysteresis and interpolation; at a standstill, the last compensation value is retained.

## 8.6 Asynchronous motor field weakening

An asynchronous motor allows you to adjust the magnetic flux of the machine by specifying the current forming the field (on the d- axis). This allows you to generate constantly high torque per current in the low speed range. When the voltage limit is reached, the flux is reduced antiproportionally to speed. This results in operation with constant power (per current).

An asynchronous motor is usually put into operation with the aid of motor identification (see Section "Identification of asynchronous motor data" on page 55).

Configure the subsidiary current controller (see Section "Current Controller" on page 123) as dynamically as possible. Otherwise it will introduce additional degrees of freedom into the system. If overcurrent errors occur in the field-weakening range, use a different current control limitation method (see Section "Advanced current control" on page 126).

P No.	Index	Name / Setting	Unit	Description
3012 / 5060 / 7108		CON_FM_VCon		Axis 1 / 2 / 3: Voltage controller (ASM / field weakening PSM)
3012 / 5060 / 7108	0	Kp	A/V	Gain
3012 / 5060 / 7108	1	Tn	ms	Integral-action time
3012 / 5060 / 7108	2	Tf	ms	Filter time
3012 / 5060 / 7108	3	Vref	%	Setpoint (max.)
3013 / 5061 / 7109		CON_FM_IMag		Axis 1 / 2 / 3: Magnetising current
3013 / 5061 / 7109	0	IMag		Magnetizing current
3013 / 5061 / 7109	1	IMagMax		Max. magnetizing current (LshTab)
3013 / 5061 / 7109	2	ImagSLim	%	Field weakening start speed
3013 / 5061 / 7109	3	IMag0		individual magnetizing current
3014 / 5062 / 7110		CON_FM_FW		Axis 1 / 2 / 3: Field weakening settings
3014 / 5062 / 7110	0	SelMode		Field weakening method
		OFF(0)		no function
		TABLE(1)		Modified 1/n characteristic, Tabular values and voltage controller

Table 8.22: Parameter list – Control axis

P No.	Index	Name / Setting	Unit	Description
		PARA(2)		1/n characteristic curve, calculation of the motor data and voltage controller
3014 / 5062 / 7110	1	SpeedScale	%	Speed scaling (PARA mode)
3014 / 5062 / 7110	2	CurrentScale	%	Current scaling (PARA mode)
3015 / 5063 / 7111		CON_FM_FW_Tab		Axis 1 / 2 / 3: Field weakening table
3015 / 5063 / 7111	0	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	1	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	2	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	3	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	4	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	5	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	6	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	7	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	8	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	9	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	10	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	11	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	12	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	13	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	14	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	15	STab	%	Speed (in % of nom. speed)

Table 8.22: Parameter list – Control axis (continue)

### 8.6.1 Feed forward control with 1/n characteristic curve and voltage controller

This method is activated if **P 3013[2] - ImagSLim** > 0. This is the default setting after motor identification. **P 3013[0] - IMag** defines the rated flux (at low speed). Above the threshold defined by **P 3013[2] - ImagSLim** (in % of rated speed) the magnetizing current is reduced so that the flux is adjusted antiproportionally to speed, taking saturation into account.

The rated flux is configured by motor identification so as to develop optimal torque per current at low speed and DC link voltage.

## 8.6.2 Voltage controller

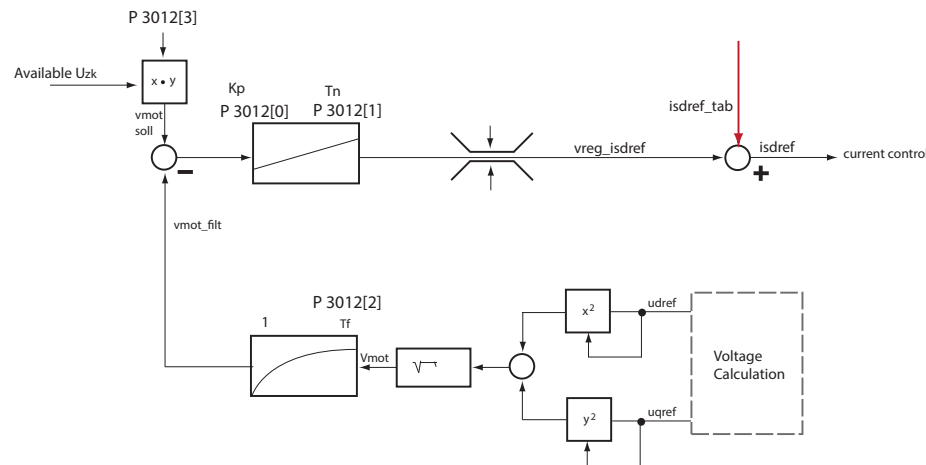


Fig. 8.27: Structure of the voltage controller

The voltage controller is superimposed onto the selected characteristic curve.

**P 3012[3] - Vref** defines a setpoint for the voltage required by the motor depending on available voltage. It is less than 100%, typically 80%–97%. The difference is used as a control reserve for fast current changes. The more dynamic the application, the more control reserve is required.

The voltage controller is always active after motor identification; the default controller setting is sufficient for most applications. If optimisation is necessary, an acceleration operation is used as a test case for the voltage controller. Proceed as follows:

- Select the following variables in DigitalScope:

ID	Name	Description
22	isdref	d-axis reference current (field weakening)
25	isd	d-axis current
23	isqref	q-axis reference current (torque forming)
24	isq	q-axis current
P 2967[5]	vmot	Motor voltage
1026	nact_fil	Speed value

- Configure the controller more dynamically (increase **P 3012[3] - Vref** and **P 3012[0] - Kp** and/or reduce **P 3012[1] - Tn**) if the acceleration operation is delayed too long and the torque-forming current isq fails to reach the setpoint isqref.
- Configure the controller less dynamically (reduce **P 3012[0] - Kp** and/or increase **P 3012[1] - Tn**) if the setpoint of the field-forming current isdref has excessive disturbances.
- Increase **P 3012[3] - Vref** if the motor needs too much current.
- The voltage controller must not display a similar dynamics to the speed controller (see Section "Speed controller" on page 129). This leads to limit cycles of speed and field-forming current in the field-weakening range. The voltage controller is usually configured much slower.

**P 3012[0] - Kp = 0** or **P 3012[3] - Vref > 100 %** disables the voltage controller.

## 8.6.3 Feed forward control with user-parametrized characteristic curve and voltage controller

This method is activated if **P 3013[2] - ImagSLim = 0**. This allows you to use a characteristic curve parametrized by the user instead of the automatically calculated 1/n characteristic curve. However, this is only necessary in exceptional cases.



The characteristic curve is defined in **P 3015 - CON\_FM\_FW\_Tab** in percentage values of rated speed and **P 3013[0] - IMag**. Start with the application point of field weakening (not with speed 0!). A table point with speed 0 % ends the table. The voltage controller is also superimposed when using this method.


### 8.6.4 Magnetizing current at start-up

When the asynchronous motor is switched on, the rotor flux is built up, depending on the motor specifications, comparably slowly based on an e-function. By configuring a larger, field-forming current, it is possible to accelerate torque build-up and thus readiness for switching on.

A custom magnetizing current can be set in **P 3013[3] - IMag0**. If the value is 0, the value from **P 3013[0] - IMag** is used.

## 8.7 Field weakening synchronous machine PSM

A synchronous motor can be operated above its rated speed. The voltage required is reduced by injecting a current component into the axis of the magnetic field (d axis). To be able to effectively reduce the voltage required, the stator inductance **P 2964[9] - MOT\_Lsd** multiplied by the rated current **P 2964[5] - MOT\_CNom** must be large relative to the flux. The flux is derived from  $K_m$  and displayed in **P 2988[1] - FluxNom**.

CAUTION!	Damage to the device as a result of incorrect operation!
	<p><b>Failure to exercise caution or follow proper working procedures may result in damage to the device.</b></p> <ul style="list-style-type: none"> <li>If current is suddenly removed from a field-weakened synchronous machine, the full electromotor force of the machine is applied to the servo controller. This can lead to overvoltage on the DC link capacitors and thus to destruction of the axis group. Therefore, speed must only be so high that the electromotor force of the machine is not greater than maximum voltage of the capacitors at maximum speed. Speed limitation (Section "Limitations" on page 214) is automatically limited to this value if the parametrization is correct.  <b><math>P\ 2964[12] - MOT\_Ke \cdot P\ 2968[0] - LimFac\_Speed \cdot P\ 2964[2] - MOT\_SNom \cdot \sqrt{2} &lt; 800\ V</math></b></li> <li>Use an external brake chopper on the Supply unit. This reduces voltage in the event of an error.</li> <li>Excessive field-weakening current can destroy the magnets of your machine. Then, the motor fails to reach its rated TORQUE at the rated current. Check the motor data sheet to see whether there is a limitation for field-weakening current and reduce <b>P 3013[0] - IMag</b> to this limit value.</li> </ul>

There are two methods available for field weakening that can be selected via **P 3014[0] - SelMode**.

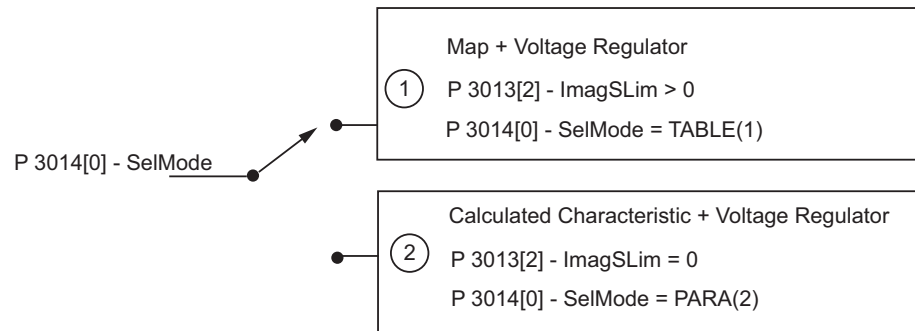


Fig. 8.28: Methods of field weakening

**P 3014[0] - SelMode** = OFF is the default setting in which no field weakening takes place.

**P 3013[0] - Imag** limits the field-weakening current. The voltage controller cannot request more current either.

Configure the subsidiary current controller (see Section "Current Controller" on page 123) as dynamically as possible. Otherwise it will introduce additional degrees of freedom into the system. If overcurrent errors occur in the field-weakening range, use a different current control limitation method (see Section "Advanced current control" on page 126).

## 8.7.1 Feed forward control with calculated characteristic diagram and voltage controller

With **P 3014[0] - SelMode** = PARA selects the calculated characteristic diagram. In this field weakening method, the magnetizing current is calculated dependent on speed and torque-forming current from the motor data. To compensate inaccuracies from the motor data, a voltage controller is superimposed.

Use this mode if the machine was identified or if you have a motor data set from the manufacturer.

If the voltage controller has to compensate inaccuracies and this limits the dynamics of the application, it is possible to modify the table.

- Select the following variables in DigitalScope:

Scope variable / parameter	Name	Meaning / Function
1026	nact_fil	Actual speed value
22	isdref	d-axis reference current (field weakening)
25	isd	d-axis current
23	isqref	q-axis reference current (torque forming)
24	isq	q-axis current
P 2967[5]	vmot	Motor voltage

- If field weakening is not adequate in fast acceleration operations and the reference current isdref has not yet reached the limit  $-\text{Imag} \cdot \sqrt{2}$ , increase **P 3014[1] - SpeedScale**.
- If field weakening is not sufficient for torque demand and the setpoint current isdref has not yet reached the limitation, increase **P 3014[2] - CurrentScale**.
- Reduce these two values if an unnecessary amount of field-weakening current is requested and motor voltage is not yet at the limitation.

## 8.7.2 Voltage controller

See Section "Voltage controller" on page 148

### 8.7.3 Feed forward control with user-parametrized characteristic curve and voltage controller

The user-parametrized table is selected with **P 3014[0] - SelMode** = TABLE.

This method allows you to use a characteristic curve parametrized by the user instead of the automatically calculated characteristic curve. This is only necessary in exceptional cases.

The characteristic curve is defined in **P 3015[0-15] - CON\_FM\_FW\_Tab** in percentage values of rated speed and **P 3013[0] - Imag**. Start with the application point of field weakening (not with speed 0!). A table point with speed 0 % ends the table. Enter the values for current in the d axis as positive values, the negative sign is added automatically. The voltage controller is still superimposed.

#### NOTE



Use this setting and leave the table at Default (0) to perform field weakening only via the voltage controller.

P No.	Index	Name	Unit	Description
3012 / 5060 / 7108		CON_FM_VCon		Axis 1 / 2 / 3: Voltage controller (ASM / field weakening PSM)
3012 / 5060 / 7108	0	Kp	A/V	Gain
3012 / 5060 / 7108	1	Tn	ms	Integral-action time
3012 / 5060 / 7108	2	Tf	ms	Filter time
3012 / 5060 / 7108	3	Vref	%	Setpoint (max.)
3013 / 5061 / 7109		CON_FM_IMag		Axis 1 / 2 / 3: Magnetising current
3013 / 5061 / 7109	0	IMag		Magnetizing current
3013 / 5061 / 7109	1	IMagMax		Max. magnetizing current (LshTab)
3013 / 5061 / 7109	2	ImagSLim	%	Field weakening start speed
3014 / 5062 / 7110		CON_FM_FW		Axis 1 / 2 / 3: Field weakening settings
3014 / 5062 / 7110	0	SelMode		Field weakening method

Table 8.23: Parameter list – Control axis – Field weakening

P No.	Index	Name	Unit	Description
3014 / 5062 / 7110	1	SpeedScale	%	Speed scaling (PARA mode)
3014 / 5062 / 7110	2	CurrentScale	%	Current scaling (PARA mode)
3015 / 5063 / 7111		CON_FM_FW_Tab		Axis 1 / 2 / 3: Field weakening table
3015 / 5063 / 7111	0	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	1	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	2	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	3	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	4	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	5	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	6	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	7	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	8	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	9	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	10	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	11	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	12	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	13	STab	%	Speed (in % of nom. speed)
3015 / 5063 / 7111	14	ITab	%	Current (in % of IMag)
3015 / 5063 / 7111	15	STab	%	Speed (in % of nom. speed)

Table 8.23: Parameter list – Control axis – Field weakening (continue)


## 8.8 Synchronous motor autocommutation

For the field-orientated control of permanently excited synchronous motors with a purely incremental measuring system, on starting the control the commutation position must be determined once. The following procedures are available:

- IENCC: Current injection
- IENCON: Current injection with angle encoder
- LHMEAS: Measurement of the inductance differences

P No.	Index	Name	Unit	Description
2972 / 5020 / 7068		CON_ICOM		Axis 1 / 2 / 3: Autocommutation settings
2972 / 5020 / 7068	0	AutoOn		Automatic autocommutation after event
2972 / 5020 / 7068	1	Mode		Method
2972 / 5020 / 7068	2	KpScale	%	Angle encoder gain scaling factor
2972 / 5020 / 7068	3	Time0	ms	Time
2972 / 5020 / 7068	4	Time1	ms	Time
2972 / 5020 / 7068	5	Time2	ms	Time
2972 / 5020 / 7068	6	Time3	ms	Time
2972 / 5020 / 7068	7	Current0	A	Current
2972 / 5020 / 7068	8	Current1	A	Current
2972 / 5020 / 7068	9	Nref	rpm	Speed setpoint
2972 / 5020 / 7068	10	Limit	degree	Autocommutation: Angle error limit
2972 / 5020 / 7068	11	ActVal	degree	Current angle error
2972 / 5020 / 7068	12	Frequency	Hz	Measuring frequency for LHMEAS
2972 / 5020 / 7068	13	KlmTime	ms	Settling time for Kalman filter after position detection

Table 8.24: Parameter list – Control axis – Autocommutation

CAUTION!	Damage to the device as a result of incorrect operation!
	<p><b>Failure to exercise caution or follow proper working procedures may result in damage to the device.</b></p> <ul style="list-style-type: none"> <li>• The motor can move suddenly during the auto commutation. The mechanism coupled must be designed for this movement.</li> <li>• If the commutation position is not determined correctly, the motor will accelerate in an uncontrolled manner. This can lead to damage to the mechanical system.</li> <li>• Make sure to carefully test the auto commutation function. Vary the start position. Even if autocommutation has not been performed, the drive can be "made to rotate" in up to 50 % of cases.</li> <li>• Enable speed tracking error monitoring (<b>P 2972[0] - SDiffMax</b>, Section "Limitations" on page 214). This monitoring function provides extensive protection against uncontrolled movement.</li> </ul>

### 8.8.1 Commutation position by alignment (IENCC)

The rotor position is determined by aligning the motor.

- The current is injected twice as a test signal with a 90° electrical offset in each case.
- The motor moves up to one half of a pole pitch.
- The two measurements are compared. The calculated angle error (in degrees electrical) is displayed in **P 2972[11] - ActVal**. The tolerance threshold of error monitoring is parametrized in **P 2972[10] - Limit**.
- The calculated offset between commutation position and encoder angle is stored in **P 2966[0] - CON\_FM\_EncOffset**.

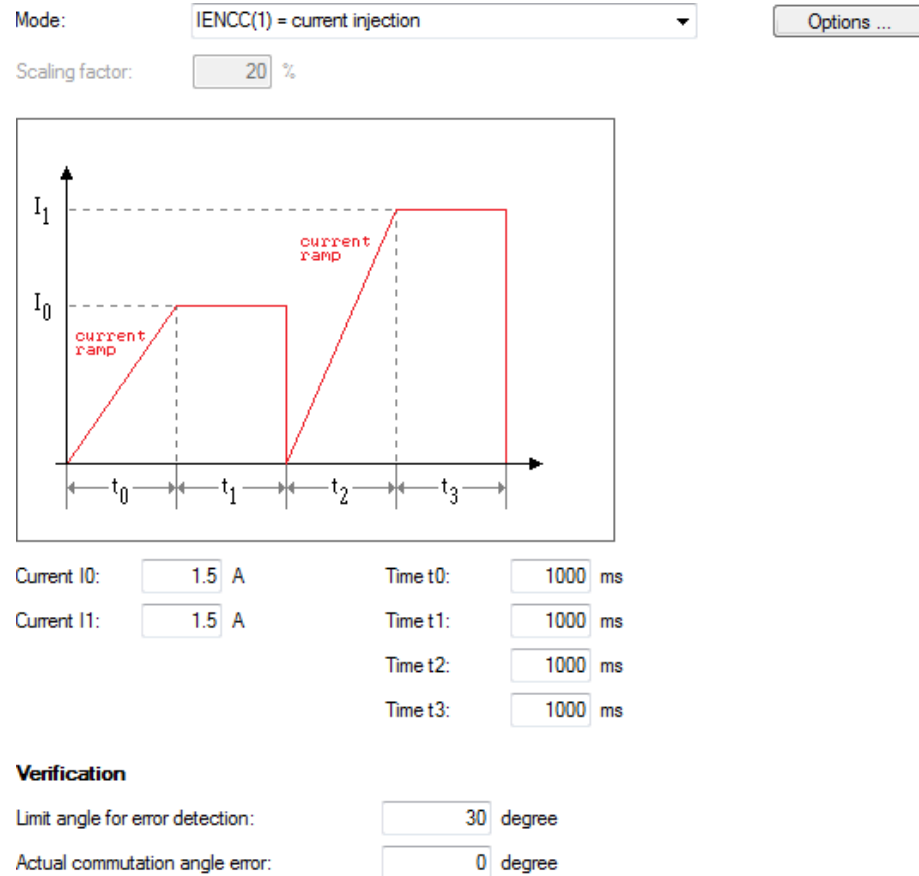


Fig. 8.29: Autocommutation with current injection

As a guide value for the injected current it is recommended to use the rated current  $I_{rated}$ . The time is to be selected so that the rotor is stationary at the end of the measurement (indicated by epsRS).

Select the following variables in DigitalScope to analyse autocommutation:

Scope variable/parameter	Name	Meaning/function
21	epsFSM	Angle for current feed
24	isq	Actual q-current value
25	isd	Actual d-current value
1009	epsRS	electrical angle from incremental encoder

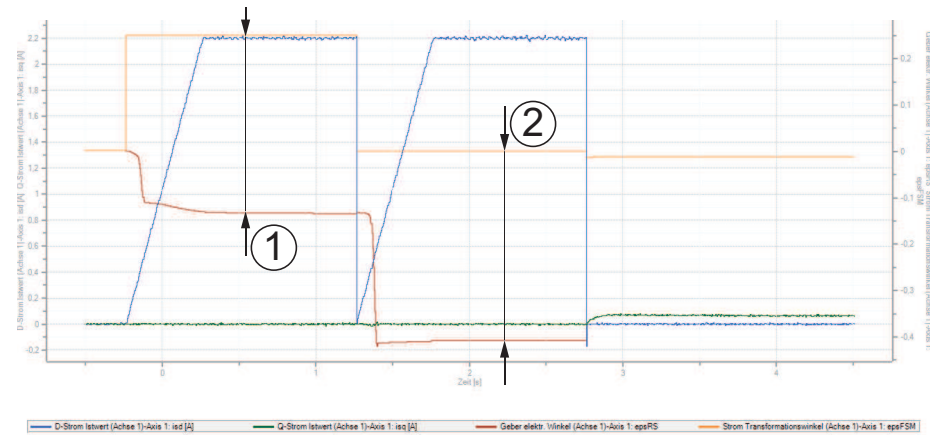


Fig. 8.30: Autocommutation analysis IENCC

① Offset 1

② Offset 2

Legend for Autocommutation analysis IENCC

Because the IENCC auto commutation method moves the axis, using it on a controller may require a retraction movement (for details see Section "Advanced functions of motion profile" on page 206).

## 8.8.2 Commutation position by alignment with minimized movement (IECON)

The rotor position is determined by aligning the motor. The same procedure applies as described for IENCC. Additionally, drive movement is minimized by aligning the current feed angle opposite to motor movement (virtual movement).

A PI controller takes care of aligning the current feed angle. It is configured on the basis of the speed controller with a scaling factor of **P 2972[2] - KpScale**. The higher KpScale is set, the more virtual and the less real movement is performed.

In systems with a high level of friction, autocommutation is often unreliable. The reason is that the axis cannot be caused to move if the current feed angle is already close to the correct current feed angle by coincidence. In this case, a movement of the current feed angle during auto commutation can be parametrized. Set **P 2972[9] - Nref** = 1..5 rpm or much lower on multi-pole direct drives.

Because the IECON auto commutation method moves the axis, using it on a controller may require a retraction movement (for details see Section "Advanced functions of motion profile" on page 206).

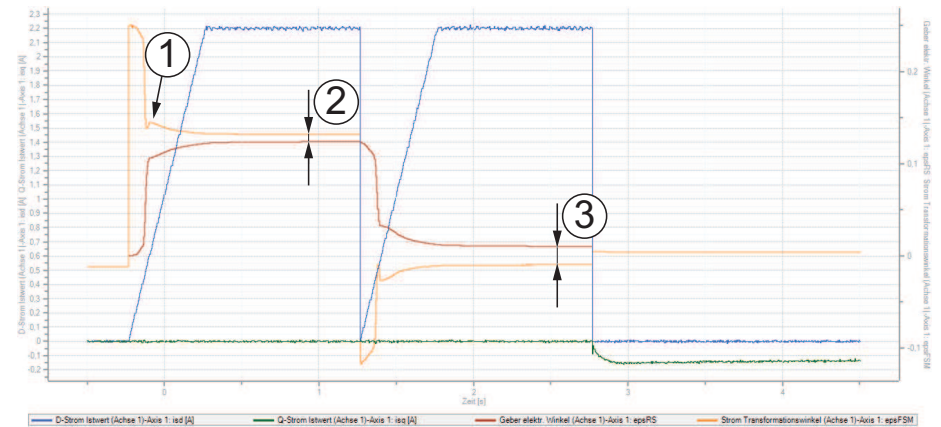


Fig. 8.31: Autocommutation analysis IECON

- ① Virtual movement of the transformation angle
- ② Offset 1
- ③ Offset 2

Legend for Autocommutation analysis IECON

### 8.8.2.1 Commutation position by alignment with minimized movement (IECON) with suspended load

The IECON method can also be used for axes with suspended load and holding brake (z axis). The holding brake is vented as of the start of auto commutation. Set the current ramps so that current feed “takes over” from the opening holding brake and quickly reaches high values that can reliably hold the axis.

Despite all measures, a systematic calculation error can be expected when working with suspended load:


$$P\ 2964[13] - MOT\_Km / \sqrt{2} * I_0 * \sin(\delta) = \text{load torque}$$

delta = error angle

### 8.8.2.2 Commutation position by alignment with minimized movement (IECON) at end stop

If the axis may be near an end stop during autocommutation, use a speed setpoint. Parametrize t1 much longer than t3 and set the sign of the speed setpoint so that the drive moves away from the end stop.

If the axis may be near the right or left end stop during autocommutation, methods involving movement are not suitable.

CAUTION!	Damage to the device as a result of incorrect operation!
	<p><b>Failure to exercise caution or follow proper working procedures may result in damage to the device.</b></p> <ul style="list-style-type: none"> <li>The motor can move suddenly during the auto commutation. The mechanism coupled must be designed for this movement.</li> <li>If the axis is jammed, i.e. the rotor cannot align itself freely, the process will not function correctly. As a consequence the commutation angle will be determined incorrectly and the motor will move in an uncontrolled manner. This method is not to be used particularly at end stops or limit switches!</li> </ul>

### 8.8.3 Commutation position by inductance measurement (LHMEAS)

With a conventional synchronous motor, inductance is minimal in the direction of the magnetic flux (d axis) as the iron is presaturated by the flux. In addition, inductance drops on the d axis if a positive d current is set. The LHMEAS method determines

rotor position by measuring the difference in inductance. The motor should have a holding brake or be braked by the mechanism. The holding brake is only opened after autocommutation has finished. This method is recommended for motors that display a difference in inductance of at least 10 % between d and q axis. If the method itself determines a difference of less than 1 %, the measurement is regarded as invalid.

The parameters are used as follows:

Parameters	Index	Name	Description	Guide value
2972 / 5020 / 7068	3	Time0	Settling time per measurement	1..10 / Frequency
2972 / 5020 / 7068	4	Time1	Measurement duration per measurement	5..50 / Frequency
2972 / 5020 / 7068	7	Current0	Measuring current for measuring inductance	approx. 10..30 % of rated motor current
2972 / 5020 / 7068	8	Current1	Offset current for determining direction	approx. rated motor current
2972 / 5020 / 7068	12	Frequency	Measuring frequency	50..500 Hz; the smaller the motor, the higher the frequency
2972 / 5020 / 7068	13	KlmTime	Settling time for Kalman filter after position detection	

All parameters can also be set to 0 and are then given a sensible default value. If the measurement is inconclusive, it is repeated up to two times. In each case, measuring current is increased by 40 %, offset current stays the same. The total time required for measurement (without any repetitions) is  $11 * (\text{Time0} + \text{Time1})$ . For

troubleshooting autocommutation by means of measuring inductance, please observe the device messages. These output the results of measurement, the difference in inductance ascertained, and the final result.

If LHMEAS is used in combination with a Kalman filter, autocommutation is triggered every time the motor starts up and not only after the encoder has been initialized. The LHMEAS method initializes the Kalman filter with the new angle values after determining the position. This enables implementation of jolt-free switching on again with Kalman position finding, even if the motor was moved while off. In order to allow the Kalman filter to settle, it is necessary to define a waiting time in **P 2972[13] - KImTime**.

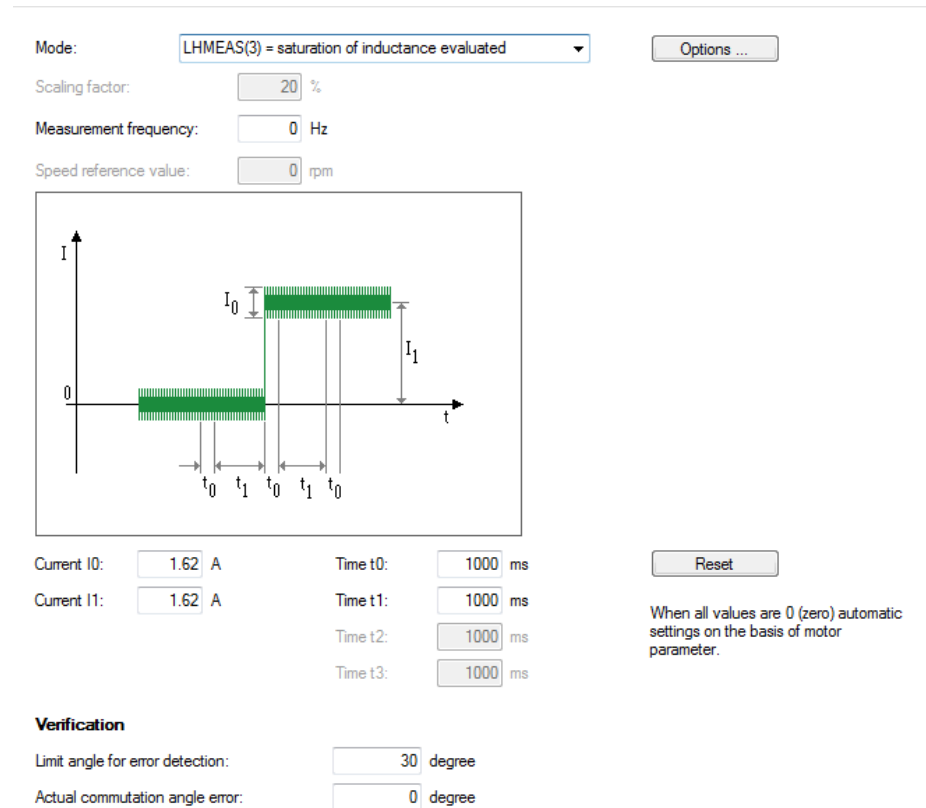


Fig. 8.32: Commutation position by inductance measurement (LHMEAS)



## 8.9 Commissioning

### 8.9.1 Test signal generator

The test signal generator makes it possible to optimize the control circuits based on different excitation signals (setpoint sequence). Different signal types can be formed and transmitted to the control. This function is independent of the control mode and has a direct effect on the control.

The duration of the test signal cycle is made up of the times of the rectangular signal (Time\_0 + Time\_1). The number of cycles can be set in **P 3054[5] - Cycles**.

Use the output selector **P 3054[0] - OutSel** to choose between different setpoints (current, speed, etc.). The test signal generator can be started and stopped using the control word **P 3053[0] - CON\_TSIG\_Ctrl**.

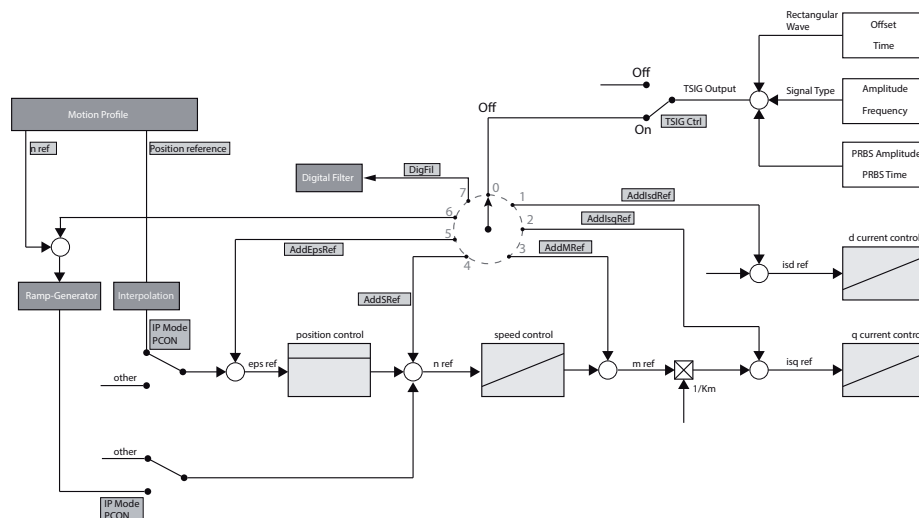


Fig. 8.33: Diagram of the test signal generator

#### CAUTION!

Your system/motor may be damaged if put into operation in an uncontrolled or inappropriate manner.



Improper conduct can cause damage to your system / machine.

- Test signals lead to axis movement. Risk of destruction of the mechanism.

P No.	Index	Name	Unit	Description
2950 / 4998 / 7046	0	AddSRef	1/min	Axis 1 / 2 / 3: Additive speed setpoint (without ramp)
2954 / 5002 / 7050		AddIsRef		Axis 1 / 2 / 3: Additive current setpoint
2954 / 5002 / 7050	0	AddIsdRef	A	Additive d-current setpoint
2954 / 5002 / 7050	1	AddIsqRef	A	Additive q-current setpoint
2954 / 5002 / 7050	2	SetPhase	deg	Set phase (V/Hz and current mode)
3052 / 5100 / 7148	0	AddTRef	Nm	Axis 1 / 2 / 3: Additive torque setpoint (without ramp)
3053 / 5101 / 7149	0	CON_TSIG_Ctrl		Axis 1 / 2 / 3: Control word test signal generator
3054 / 5102 / 7150		CON_TSIG_Settings		Axis 1 / 2 / 3: Test signal generator settings
3054 / 5102 / 7150	0	OutSel		Output signal selector
3054 / 5102 / 7150	1	Offset_0	var	Rectangle: Offsets
3054 / 5102 / 7150	2	Offset_1	var	Rectangle: Offsets
3054 / 5102 / 7150	3	Time_0	s	Rectangle: Times
3054 / 5102 / 7150	4	Time_1	s	Rectangle: Times
3054 / 5102 / 7150	5	Cycles		Number of cycles
3054 / 5102 / 7150	6	SignalType		Sine / triangle: Selector
3054 / 5102 / 7150	7	Amplitude	var	Sine / triangle: Amplitude
3054 / 5102 / 7150	8	Frequency	Hz	Sine / triangle: Frequency
3054 / 5102 / 7150	9	SymVal	var	Sine / triangle: Symmetry
3054 / 5102 / 7150	10	PRBS_Amplitude	var	PRBS: Amplitude
3054 / 5102 / 7150	11	PRBS_Time	ms	PRBS: min. cycle time
3054 / 5102 / 7150	12	BreakTime0	ms	Pause time after a signal period (1/freq)

Table 8.25: Parameter list – Control axis – Commissioning

P No.	Index	Name	Unit	Description
3054 / 5102 / 7150	13	BreakTime1	ms	Pause time after a half signal period (1/freq)
3054 / 5102 / 7150	14	Frequency2	Hz	2nd frequency fpor chirp signal
3056 / 5104 / 7152		CON_TSIG_Correlation		Axis 1 / 2 / 3: Test signal generator correlation
3056 / 5104 / 7152	0	Corrlp1Cos		Result correlation: Input 1 + cos
3056 / 5104 / 7152	1	Corrlp1Sin		Result correlation: Input 1 + sin
3056 / 5104 / 7152	2	Corrlp2Cos		Result correlation: Input 2 + cos
3056 / 5104 / 7152	3	Corrlp2Sin		Correlation of input signal 2 and sine
3056 / 5104 / 7152	4	Rs	Ohm	Result correlation: Stator resistance
3056 / 5104 / 7152	5	Ls	mH	Result correlation: Stator inductance
3058 / 5106 / 7154		SCD_SetCCON		Axis 1 / 2 / 3: Current controller control configuration
3058 / 5106 / 7154	0	Mode		Calculate current control
3058 / 5106 / 7154	1	Bandwidth	Hz	Current control bandwidth
3059 / 5107 / 7155		SCD_SetSCON		Axis 1 / 2 / 3: Control configuration for speed / position / feed forward control
3059 / 5107 / 7155	0	Mode		Control configuration mode
3059 / 5107 / 7155	1	Stiffness	%	Rigidity of path <=> performance of speed control
3020 / 5068 / 7116		SCD_AT_JSum_Settings		Axis 1 / 2 / 3: Total moment of inertia autotuning
3020 / 5068 / 7116	0	SConHysSpeed	rpm	Moment of inertia autotuning, speed limit
3020 / 5068 / 7116	1	SConHysTorq	Nm	Moment of inertia autotuning, torque limit
3020 / 5068 / 7116	2	TFric	Nm	Friction torque, calculated by autotuning
3020 / 5068 / 7116	3	TConst	Nm	Constant torque (weight), calculated by autotuning
3068 / 5116 / 7164		SCD_MotorIdent		Axis 1 / 2 / 3: Motor identification
3068 / 5116 / 7164	0	command		Motor identification
3068 / 5116 / 7164	1	settings		Identification settings
3070 / 5118 / 7166		SCD_State		Axis 1 / 2 / 3: Identification state
3070 / 5118 / 7166	0	State		Identification state
3070 / 5118 / 7166	1	ActCmdSrv		Current command server task

Table 8.25: Parameter list – Control axis – Commissioning (continue)

### 8.9.1.1 Configurable test signal

Use the parameter SignalType to define a periodic test signal. Use **P 3054[7] - Amplitude** to set the amplitude and **P 3054[8] - Frequency** to set the frequency. The choices are a sine wave signal (Sinus) and a sawtooth signal (Triangle).

Use SignalType = Sweep to generate a sine wave signal with a configurable frequency. Use **P 3054[8] Frequency** to define the lower frequency and **P 3054[14] Frequency2** to define the upper frequency. Set Time\_0 to be equal to the desired signal duration and Time\_1 = 0. One pass from the lower frequency to the upper frequency is carried out. As an alternative, you can set Time\_1 = Time\_0, to carry out a pass from the lower frequency to the upper frequency and back down again. Use the Cycles parameter for repetitions.

Use SignalType = TriSweep to generate a sawtooth signal with the same frequency behaviour.

### 8.9.1.2 PRBS test signal

The PRBS signal is suitable for system excitation with high bandwidth using a test signal. With the aid of a shift register fed back, a binary output sequence with an amplitude **P 3054[10] - PRBS\_Amplitude** that can be set in the parameters and a "random" alternating frequency is generated. Minimum cycle time can be set in **P 3054[11] - PRBS\_Time**.

The PRBS signal can be combined with the configurable test signal because the test signal output is always additive.



Fig. 8.34: PRBS-Signal: Amplitude = 150 rpm, Time = 20 ms

## 8.9.2 Self-setting routines

The ServoOne CM has several routines for self-setting. They are activated by **P 3068 [0] - command. P 3070[0] - State** jumps to RUNNING and then to READY if the function was performed without any errors and from RUNNING to ERROR if the function triggered an error. Detailed feedback from the routines is displayed in the message window (see ).

The following routines are suitable for use by the user; the others should not be used:

Value	Function	Activates the power stage	Motor movement required
1 (CC_AT)	Simple current controller tuning.	Yes	No
5 (CALC_KE_AND_KM)	Calculation of motor data from rated data (see Section "Calculation of the data for the synchronous motor" on page 48).	No	
8 (COMPLETE_IDENT)	Motor identification (see Section "Identification of synchronous motor data" on page 49 or Section "Identification of asynchronous motor data" on page 55).	Yes	No
9 (CALC_CONTROL_STD)	Configuration of motor controller as performed at the end of motor identification. The rating plate and electrical parameters of the motor must be known. Controller configuration does not depend on other parameters.	No	
10 (JSum)	Automatic inertia detection (see Section "Basic setting" on page 121).	Yes	Yes
11 (CALC_CCON)	Configure current control based on design parameters.	No	
12 (CALC_SCON)	Configure speed control based on design parameters (see Section "Basic setting" on page 121).	No	

Value	Function	Activates the power stage	Motor movement required
13 (ENC_OFFSET)	Identification of encoder offset (see Section "Encoder offset" on page 80).	Yes	Yes
15 (PARA_ASM)	Calculate asynchronous motor parameters from rated data (see Section "Asynchronous motor" on page 55).	No	
16 (MOTPHASE)	Check motor and encoder wiring, for synchronous motors only (see Section "Identification of synchronous motor data" on page 49).	Yes	Yes

### 8.9.2.1 Configure current control (CALC\_CCON)

The rating plate parameters and electrical parameters of the motor must be set. Then you can choose one of three methods using **P 3058[0] - Mode** that each calculate the current control parameters differently:

Method	Function
STD	<ul style="list-style-type: none"> <li>Gain is set to 60 degrees phase reserve.</li> <li>Integration time is set to compensation of stator time constants, i.e. <math>T_n = L_{sig} / R_{stat}</math>.</li> </ul>
BW	<ul style="list-style-type: none"> <li>Gain is set to the bandwidth set in <b>P 3058[1] - Bandwidth</b>.</li> <li>Integration time is set to compensation of stator time constants.</li> </ul>
DEADBEAT	<ul style="list-style-type: none"> <li>The current observer is activated.</li> <li>Gain is configured so that a pending control error is compensated in 62.5 <math>\mu s</math>.</li> <li>Integration time is set to compensation of stator time constants.</li> </ul>

### 8.9.2.2 Configuration of speed and position control (CALC\_SCON)

The rating plate parameters and electrical parameters of the motor must be set. The you can select a method in **P 3059[0] - Mode** that calculates speed and position control and the feed forward control parameters. **P 3059[1] - Stiffness** can be adjusted for this purpose.

Method	Function
STIFFNESS	Definition according to the enhanced symmetrical optimum: $\alpha = 1,0$ @ stiffness = 200 % $\alpha = 6,0$ @ stiffness = 0 % $T_{sum} = (\text{sum of the underlying time constants})$ $T_n = \alpha^2 * T_{sum}$ $K_p = 2 * J / (\alpha * T_{sum});$

## 8.10 V/Hz control (VFC)

In VFC mode (Voltage Frequency Control), the motor is controlled without measuring the actual speed. The speed target value results in a frequency output.

The easiest way to configure a voltage/frequency characteristic curve is by means of rated frequency, nominal voltage and boost voltage (voltage at 0 Hz). These three values are determined automatically during motor identification.

At the interpolation points, there is a defined voltage assigned to every frequency. The characteristic curve is linearly interpolated between the interpolation points. As of rated frequency, the voltage setpoint  $V_{Nom}$  is used.

P No.	Name / Settings	Function
P 2995	CON_VFC_Table	VFC characteristic curve
[0]	VBoost	Boost voltage: Voltage level difference at $f = 0$
[1]	FNom	Rated frequency
[2]	VNom	Nominal voltage
[3]	F0	Frequency for interpolation point 0
[4]	V0	Voltage for interpolation point 0
[5]	F1	Frequency for interpolation point 1
[6]	V1	Voltage for interpolation point 1
[7]	F2	Frequency for interpolation point 2
[8]	V2	Voltage for interpolation point 2
[9]	F3	Frequency for interpolation point 3
[10]	V3	Voltage for interpolation point 3
[11]	F4	Frequency for interpolation point 4
[12]	V4	Voltage for interpolation point 4
[13]	F5	Frequency for interpolation point 5
[14]	V5	Voltage for interpolation point 5
P 2996	CON_VFC_Settings	V/Hz settings
[0]	URefTf	The filter time [ms] enables a smooth transition between the interpolation points when transitioning from open-loop to closed-loop control.

Table 8.26: Parameters for VFC mode

P No.	Name / Settings	Function
[1]	DisableTime	Delayed voltage shutoff [ms]. For "DisableTime" = 0, the boost voltage continues to be output after the motor comes to a standstill.
[2]	DemagTime	Demagnetisation time
[3]	LConSpeedThres	Load control: Activation of the speed threshold in [%] of the rated motor frequency
[4]	LConSpeedRange	Load control: Speed range for linear addition of the voltage characteristic curve that has been parametrized.
[5]	LConKpos	Load control: Gain factor for the voltage increase
[6]	LConKNeg	Load control: Gain factor for the voltage decrease
[7]	LConTf	Load control: Voltage filter for the avoidance of voltage jumps (smoothing of the additive voltage).
[8]	AntiOscSpeedThres	Oscillation damping (anti-oscillation): Speed threshold in % of the rated motor frequency
[9]	AntiOscSpeedRange	Oscillation damping (anti-oscillation): Speed range for linear addition. The speed damping ramps in as soon as the value set in <b>P 2996[0] - URefTf</b> is exceeded.
[10]	AntiOscKp	Oscillation damping (anti-oscillation): Gain factor for the frequency change. The tendency to oscillate is reduced as a factor of the active current. When the active current in the motor changes, a correction frequency is generated via the gain factor and the filter time. This is added in as an additional setpoint to prevent oscillation of the motor.
[11]	AntiOscTf	Oscillation damping (anti-oscillation): Filter for correction frequency
[12]	SyncCurrent	Motor synchronisation: Current amplitude of the search current
[13]	SyncFRamp	Motor synchronisation: Frequency ramp for the search
[14]	SyncTf	Motor synchronisation: Current filter for the synchronisation operation
[15]	CLimConCurrentThresh	Current limit value controller: Current threshold in % of rated current at which ramp is scaled to 0.
[16]	CLimConCurrentRange	Current limit value controller: Current range in % of rated motor current at which current limit value controller starts
[17]	CLimConSpeedStart	Current limit value controller: Speed at which the current limit value controller starts in % of rated motor frequency.
[18]	CLimConSpeedMin	Current limit value controller: Minimum speed value for speed reduction in % of rated motor frequency
[19]	CLimCurrTf	Current limit value controller: Current filter time for current limit value controller
P 2997	CON_VFC_DCCurrent	Direct current controller
[0]	DCStartCurrent	Current setpoint in % of rated motor current

P No.	Name / Settings	Function
[1]	DCStartTime	Duration of the current injection
[2]	DCBrakeCurrent	Current setpoint in % of rated motor current
[3]	DCBrakeTime	Duration of the current injection
[4]	DCBrakeSpeedThreshold	Speed threshold in % of the rated motor frequency Below the speed threshold, a stationary current space vector with an amplitude of <b>P 2997[2] Amplitude DCBrakeCurrent</b> is injected. The braking time must be set in <b>P 2998[2] DCBrake</b> in order to brake the machine. If the speed threshold is <b>P 299[4] = 0 Hz</b> , the current is injected directly during braking. After the configurable time <b>P 2998[2]</b> , the drive switches to the state "DCStop".
[5]	DCStopCurrent	Current setpoint in % of rated motor current
[6]	DCStopTime	Duration of the current injection
[7]	DCMoveCurrent	Current setpoint in [%] of the rated motor current During direct current starting and braking, a defined current <b>P 2997[7] DCMoveCurrent</b> is injected over a defined speed range <b>P 2997[8] DCMoveSpeedThreshold</b> . The filter time <b>P 2997[9] - DCMoveTf</b> is used to avoid voltage jumps in the transition zone from the direct-current regulated mode to the VFC characteristic curve mode.
[8]	DCMoveSpeedThreshold	Speed threshold in % of the rated motor frequency
[9]	DCMoveTf	Filter time
P 2998	CON_VFC_controlword	VFC control word: Current injection of a stationary current space vector.
bit0	Sync	Synchronization
bit1	DCStart	DCStart: Direct current controller active before start. The current is injected into the motor before the VFC characteristic curve is active or the controller is in the "ON" state. The objective is "motor holding in standstill" (magnetic biasing of the rotor, motor holding at f = 0 Hz).
bit2	DCBrake	DCBrake: Direct current controller active during braking. This function is employed for motors with a large moment of inertia so that the machine is not overloaded during braking.
bit3	DCStop	DCStop: Direct current controller active after standstill. This function causes the machine to be held at a standstill as soon as the setpoint speed = 0 Hz (direct current holding). A stationary current space vector with <b>P 2997[5] - DCStopCurrent</b> is injected for a time of <b>P 2997[6] - DCStopTime</b> .
bit4	DCMoveAcc	DCMove: Direct current controller active after acceleration.
bit5	DCMoveDec	DCMove: Direct current controller active during braking operation.
bit6	DCMoveOnce	DCMove: Direct current controller active one time only after the start.

Table 8.26: Parameters for VFC mode (continue)

P No.	Name / Settings	Function
bit7	LoadControl	Load control: Activate boost voltage
bit8	AntiOscillation	Activate oscillation damping
bit9	CLim ConAcc	Activate current limit value controller during acceleration
bit10	CLim ConDec	Activate current limit value controller during braking
bit11	CLim ConReduce	Activate speed reduction by current limit value controller
P 2999	CON_VFC_statusword	VFC status word
bit0	RefValZero	Speed setpoint value = 0
bit1	LockSpeed	Speed setpoint value is locked for VFC
bit2	LockPWM	PWM is not active
bit3	LoadControl	Load control active
bit4	AntiOscillation	Vibration damping active
bit5	SyncActive	Synchronisation active
bit6	CLimConActive	Current limitation controller active
bit7	DCInjectReady	Direct current injection not active
bit8	CCMoveActive	Constant current controller for run-up active
bit9	CCMoveOnceDone	Constant current controller was performed completely at least once
P 3025	CON_VFC_ActVal	Current state of VFC state machine bit0: Off bit1: On bit2: Sync bit3: DCStart bit4: DCBrake bit5: DCStop bit6: Demag

Table 8.26: Parameters for VFC mode (continue)

### 8.10.1 Voltage frequency characteristic curve for V/Hz mode with configurable interpolation points

Boost voltage	<ul style="list-style-type: none"> <li>Boost voltage (VBoost) at <math>f = 0</math>, this value is preset during motor identification</li> </ul>
Interpolation points	<ul style="list-style-type: none"> <li>6 interpolation points, (<math>V_0/F_0, V_1/F_1, \dots, V_5/F_5</math>)</li> </ul>
Motor nominal point	<ul style="list-style-type: none"> <li><math>V_{Nom}</math> and <math>F_{Nom}</math> The values are preset during the motor identification.</li> <li>After the nominal point has been reached, the voltage remains constant (as a result of the nominal voltage). If the frequency rises, the motor is operated with field weakening. Torque decreases at constant power.</li> </ul>
Interpolation point not enabled: $f = 0$ Characteristic curve not enabled: $f_{Nom} = 0$	

Table 8.27: Definition of the V/Hz characteristic curve

The voltages are given effectively linked. If a frequency value is zero, it is not active in the characteristic curve. If  $F_{Nom}$  is zero, the whole characteristic curve is not evaluated and not voltage is output.

The values input are sorted internally by ascending frequency, therefore the order of input is irrelevant. It is thus also possible to configure values greater than  $V_{Nom}$  and  $F_{Nom}$ .

Boost voltage always gives the voltage value at a frequency of zero and is thus the first value on the characteristic curve. The nominal point usually results from the motor data, from the values of rated frequency and nominal voltage of the motor. These two values are preset during motor identification, the six interpolation points in contrast are set to zero. The voltage from the characteristic curve is kept constant for higher frequencies as of the last interpolation point.

The voltage from the V/Hz characteristic curve to be output can be additionally filtered with a PT1 filter, if required, by means of **P 2996[0] - URefTf**. This slightly rounds the corners at the interpolation points and enables a more harmonious transition from open-loop to closed-loop control operation.

The adjustable time **P 2996[1] - DisableTime** allows the user to implement delayed voltage shutoff. This time defines how long the drive remains in the "ON" state of the VFC state machine after a motor standstill was detected (motor standstill flag and ramp setpoint at zero). If DisableTime is set to zero, the drive no longer enters "OFF" state and boost voltage is still output after motor standstill.

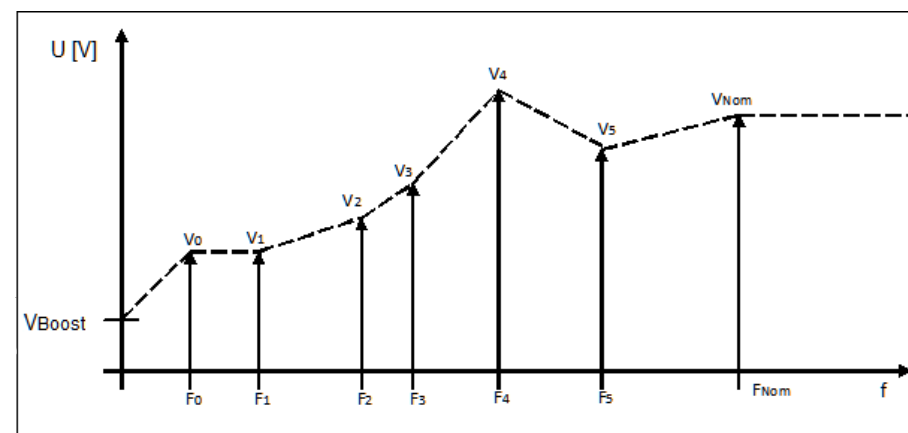


Fig. 8.35: VFC characteristic curve with 6 interpolation points

Because the current in the V/Hz mode is not controlled, the application is principally speaking more susceptible to excess current errors. For this reason, a general current limitation should be activated.

In parameter **P 3035[1] - Limit** set the permissible maximum current as a percentage of the maximum current of the power stage at the current switching frequency.

**P3035[0] Method = ZERO** has the effect that when the limit is exceeded, no voltage is any longer output. This prevents excess currents during acceleration operations, but not during overshooting or during braking.

**P3035[0] Method = FULL** causes output of an opposite voltage when there is an excess over the limit. This effectively prevents overcurrent shutdowns, however, it can lead to harmonic currents and noise in the case of limitation.

## 8.10.2 State machine V/Hz mode

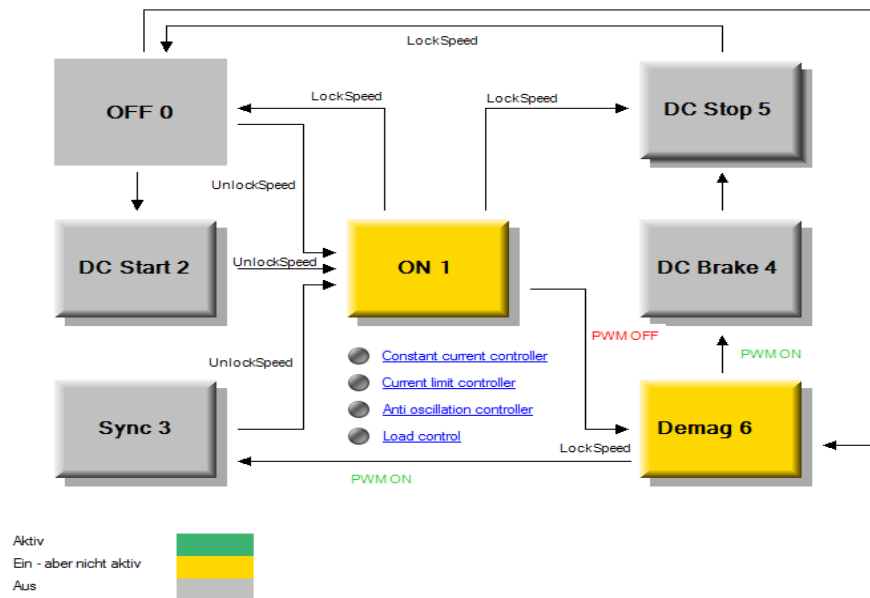


Fig. 8.36: State machine V/Hz mode

## LockSpeed

Speed lock = ON

Ramp generator = OFF

## UnlockSpeed:

Speed lock = OFF

Ramp generator = ON

## 8.10.3 Load control

Load control (**LCon**) can be used to increase or decrease the characteristic voltage curve. Additive voltage results from the difference in current and the gain factor. It is possible to configure two different gains for voltage increase (**P 2996[5] - LConKpPos**) and voltage decrease (**P 2996[6] - LConKpNeg**). The function is active if the speed setpoint is above a speed threshold (**P 2996[3] - LConSpeedThresh**) and is linearly activated over a range (**P 2996[4] - LConSpeedRange**). The additional voltage is smoothed with the aid of filter time (**P 2996[7] - LConTf**).

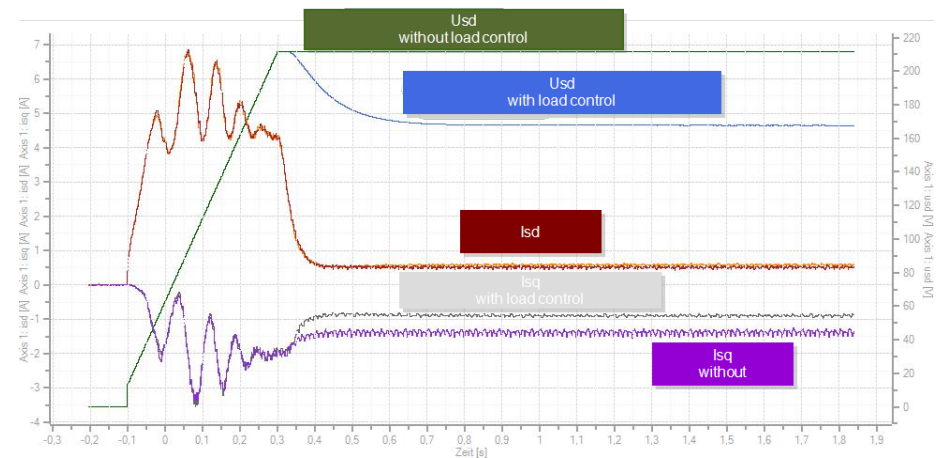


Fig. 8.37:  $i_{sd}$  and  $i_{sq}$  with and without load control (0 Hz to 40 Hz)



### 8.10.4 Current injection

VFC mode allows the user to inject a stationary current space vector into a connected machine. For this purpose, the direct current is injected using the PI current controller. The current controller control parameters can be configured as usual with the aid of motor identification.

The current can be activated and configured at different points of the VFC state machine. The options are available:

- Direct current controller before start (**DCStart**)
- Direct current controller for braking (**DCBrake**)
- Direct current controller after standstill (**DCStop**)
- Direct current controller for starting/stopping (**DCMove**)

At **DCStart**, **DCBrake** and **DCStop** all speed setpoints are switched off and a stationary current space vector is injected. In each case, current injection is performed in a special VFC state.

With **DCMove**, the speed profile is run as usual, albeit not with the voltage defined by the V/Hz characteristic curve. Here, the voltage setpoint results from current control and the configured amplitude of the current space vector.

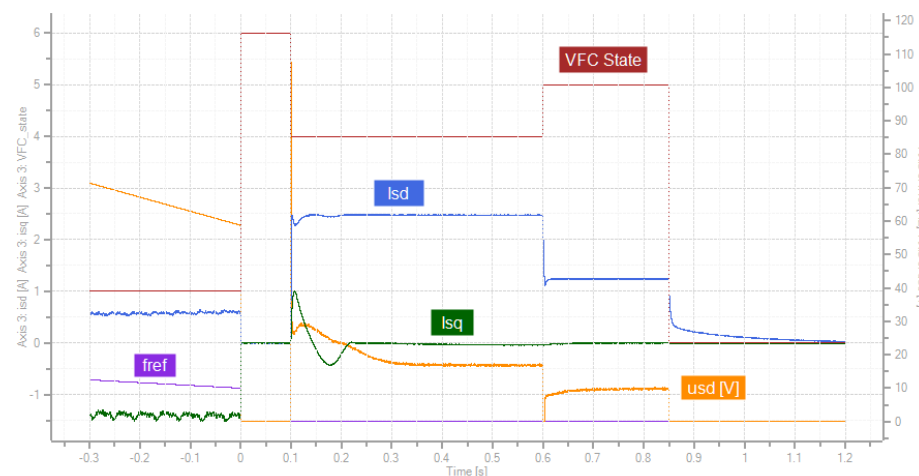


Fig. 8.38: Braking operation via DCBrake and DCStop (current injection)

#### 8.10.4.1 Direct current controller before start (DCStart)

The direct current controller before start is used to inject a current **P 2997[0] - DCStartCurrent** into the motor for the time **P 2997[1] - DCStartTime**, before the V/Hz characteristic curve becomes active and the controller enters the "ON" state of the VFC state machine. This enables pre-magnetisation of the rotor of an asynchronous motor, for example, or prevents a motor movement before start.

#### 8.10.4.2 Direct current controller for braking (DCBrake)

With direct current brakes, a stationary current space vector is injected below the configurable speed threshold **P 2997[4] - DCBrakeSpeedThreshold** in order to brake the connected machine. Amplitude is defined by **P 2997[2] - DCBrakeCurrent**, time by **P 2997[3] - DCBrakeTime**. For example, this function is employed for motors with a large moment of inertia so that the machine is not overloaded during braking.

If the speed threshold is parametrized to zero, the current is injected immediately upon deceleration. After the configurable time, the drive switches to the “DCStop” state.

#### 8.10.4.3 Direct current controller after standstill (DCStop)

The direct current controller after standstill (previously DC stopping) injects a stationary current space vector after reaching the setpoint speed of zero. Amplitude is defined by **P 2997[5] - DCStopCurrent**, time by **P 2997[6] - DCStopTime**. This function causes the machine to be held at standstill.

#### 8.10.4.4 Direct current controller for starting / stopping (DCMove)

With the aid of direct current starting it is possible to start a machine with the current **P 2997[7] - DCMoveCurrent** up to a speed of **P 2997[8] - DCMoveSpeedThreshold** and to brake down to zero from this speed. Filter time **P 2997[9] - DCMoveTf** filters the transition from DC current controlled mode to V/Hz characteristic curve mode, thus preventing voltage jumps.

### 8.10.5 Current limitation controller

The current limitation controller prevents a defined current limit value from being exceeded. The starting frequency can be stopped, reduced or increased to achieve this.

**P 2996[15] - CLimConCurrentThresh** specifies a current threshold and **P 2996[17] - CLimConSpeedStart** a speed limit as of which the current limitation controller is active.

**P 2996[16] - CLimConCurrentRange** defines a current range as of the current switch-on threshold. The speed ramp is reduced on a linear basis in this range.

If a speed reduction was also activated to control current limitation, **P 2996[18] - CLimConSpeedMin** can be used to specify a minimum speed for reduction. The current to be monitored is the apparent current filtered by current filter time **P 2996[19] - CLimCurrTf**.

### 8.10.6 Oscillation damping (anti-oscillation)

In oscillation damping, the change in active current is taken to form a correction frequency based on gain factor **P 2996[10] - AntiOscKp** and filter time **P 2996[11] - AntiOscTf**. This correction frequency is added in as an additional setpoint to counteract oscillation of the motor. This function is additionally activated by a parameterisable speed limit **P 2996[8] - AntiOscSpeedThres** and ramped up from there over the range **P 2996[9] - AntiOscSpeedRange**.

### 8.10.7 Asynchronous motor synchronisation (Sync)

The synchronisation prevents an overcurrent shutdown when a machine is switched on while it is in motion (e.g. a fan that is rotating due to the wind).

- **P 2997[12] - SyncCurrent**  
Inject search current with this amplitude into the motor.
- **P 2996[13] - SyncFRamp**  
Set the search ramp for the search frequency. The search frequency is 0 % to 125 % of the maximum speed. The sign of the setpoint value determines the starting direction in which the search must be conducted first. Ultimately, the search is conducted in both directions.
- **P 2996[14] - SyncTf**  
Current filter for id and iq.

If a speed is detected, the machine is remagnetized at this frequency for the duration of demagnetization time (voltage ramp in table value from voltage characteristic). Otherwise, VFC mode starts directly at a speed of zero.

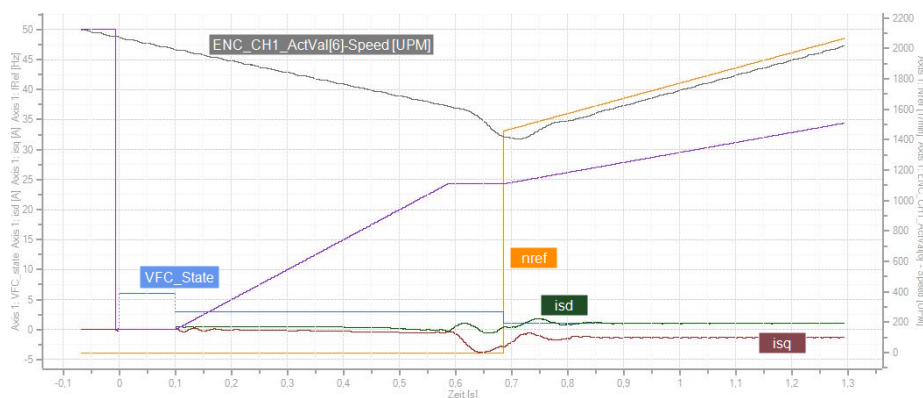


Fig. 8.39: Asynchronous motor synchronisation (status: 0, 6, 3, 1)

## 8.11 Compensation function

The compensation function consists of two identical, independent function blocks per axis. By selecting input and output variables it is possible to compensate various physical effects of the motor or application. The memory for the compensation tables is managed dynamically, with a total of 32768 values available per Axis Controller.

Compensation function 1 per axis is preset for detent torque compensation, compensation function 2 for axis error and spindle error compensation. A description of selected applications is given below.

### NOTE



- Persistent storage of correction tables is implemented in the form of files. They are saved using the “Save data set in device” function. Copying and restoring parameters, however, must be done via the project or device initial commissioning file in DriveManager 5 (see DriveManager 5 help). The data set function does not save the correction tables!

P No.	Index	Name	Unit	Description
3000 / 5048 / 7096		CON_COMP_1_Settings		Axis 1 / 2 / 3: Compensation function 1: Data set parameter
3000 / 5048 / 7096	0	Startup		Initialize table
3000 / 5048 / 7096	1	FileName		Name of saved file
3000 / 5048 / 7096	2	Input		Input table
3000 / 5048 / 7096	3	Output		Output value table
3001 / 5049 / 7097		CON_COMP_1_SizeSettings		Axis 1 / 2 / 3: Compensation function 1: Table size parameter (write access triggers INIT)
3001 / 5049 / 7097	0	Length		Table length
3001 / 5049 / 7097	1	Dual		Table double (pos. and neg.)
3002 / 5050 / 7098		CON_COMP_1_FileSettings		Axis 1 / 2 / 3: Compensation function 1: Setting saved in table file
3002 / 5050 / 7098	0	StartVal		Index start

Table 8.28: Parameter list – Control axis – Compensation functions

P No.	Index	Name	Unit	Description
3002 / 5050 / 7098	1	EndVal		Index end
3002 / 5050 / 7098	2	Modulo		Input periodical / modulo
3003 / 5051 / 7099	0	CON_COMP_1_Action		Axis 1 / 2 / 3: Compensation function 1: Table/file actions
3004 / 5052 / 7100		CON_COMP_1_Tune		Axis 1 / 2 / 3: Compensation function 1: Tuning parameter
3004 / 5052 / 7100	0	Operation		Compensation mode
3004 / 5052 / 7100	1	Delay	ms	Deceleration input
3004 / 5052 / 7100	2	Shift		Shift table
3004 / 5052 / 7100	3	Scale	%	Scale table
3004 / 5052 / 7100	4	TeachFactor		Teach factor (update table filtering)
3004 / 5052 / 7100	5	ErrorLimit		Tracking error threshold
3004 / 5052 / 7100	6	TeachMinSpeed	rpm	No learning below this speed
3004 / 5052 / 7100	7	FadeStartSpeed	rpm	Fade Hide
3004 / 5052 / 7100	8	FadeEndSpeed	rpm	End speed Hide
3004 / 5052 / 7100	9	SignThreshSpeed	rpm	Transition window for direction-dependent table
3005 / 5053 / 7101		CON_COMP_1_ActVal		Axis 1 / 2 / 3: Compensation function 2: Actual values
3005 / 5053 / 7101	0	ActVal		Actual table value (for current position)
3005 / 5053 / 7101	1	Error		Error update
3006 / 5054 / 7102		CON_COMP_2_Settings		Axis 1 / 2 / 3: Compensation function 2: Table size parameter (write access triggers INIT)
3006 / 5054 / 7102	0	Startup		Initialize table
3006 / 5054 / 7102	1	FileName		Name of saved file
3006 / 5054 / 7102	2	Input		Input table
3006 / 5054 / 7102	3	Output		Output value table
3007 / 5055 / 7103		CON_COMP_2_SizeSettings		Axis 1 / 2 / 3: Compensation function 2: Setting saved in table file
3007 / 5055 / 7103	0	Length		Table length
3007 / 5055 / 7103	1	Dual		Table double (pos. and neg.)
3008 / 5056 / 7104		CON_COMP_2_FileSettings		Axis 1 / 2 / 3: Compensation function 2: Table/file actions
3008 / 5056 / 7104	0	StartVal		Index start
3008 / 5056 / 7104	1	EndVal		Index end

Table 8.28: Parameter list – Control axis – Compensation functions (continue)

P No.	Index	Name	Unit	Description
3008 / 5056 / 7104	2	Modulo		Input periodical / modulo
3009 / 5057 / 7105	0	CON_COMP_2_Action		Axis 1 / 2 / 3: Compensation function 2: Table/file actions
3010 / 5058 / 7106		CON_COMP_2_Tune		Axis 1 / 2 / 3: Compensation function 2: Tuning parameter
3010 / 5058 / 7106	0	Operation		Compensation mode
3010 / 5058 / 7106	1	Delay	ms	Deceleration input
3010 / 5058 / 7106	2	Shift		Shift table
3010 / 5058 / 7106	3	Scale	%	Scale table
3010 / 5058 / 7106	4	TeachFactor		Teach factor (update table filtering)
3010 / 5058 / 7106	5	ErrorLimit		Tracking error threshold
3010 / 5058 / 7106	6	TeachMinSpeed	rpm	No learning below this speed
3010 / 5058 / 7106	7	FadeStartSpeed	rpm	Fade Hide
3010 / 5058 / 7106	8	FadeEndSpeed	rpm	End speed Hide
3010 / 5058 / 7106	9	SignThreshSpeed	rpm	Transition window for direction-dependent table
3011 / 5059 / 7107		CON_COMP_2_ActVal		Axis 1 / 2 / 3: Compensation function 2: Actual values
3011 / 5059 / 7107	0	ActVal		Actual table value (for current position)
3011 / 5059 / 7107	1	Error		Error update

Table 8.28: Parameter list – Control axis – Compensation functions (continue)



#### NOTE

- Changes in **P 3001 - CON\_COMP\_1\_SizeSettings** or **P 3002 - CON\_COMP\_1\_FileSettings** delete the current table and require restarting the controller. Changes in **P 3000 - CON\_COMP\_1\_Settings** also require restarting the controller.

## 8.11.1 Detent torque compensation (anti cogging)

In speed and position-controlled operation, the ripple of the torque or power causes a current ripple in the q-current. The compensation function allows compensation of detent torques and/or position errors. When detent torque compensation is used, the

compensation data are read from a table in the controller. When position error compensation is used, the compensation data must be determined externally and then be read into the controller.

The detent torque is an angle-dependent disturbance torque which occurs in synchronous machines under permanent excitation. The cause of detent torques is the magnetic attraction between the magnets in the rotor and the grooves in the stator. In the low speed range (when the frequency of the interference lies well below the band width of the speed control), these disturbance torques can be eliminated well by the control system. In the medium speed range, the disturbance torques can be reduced using table-based compensation. At high speed (when the frequency of the interference lies in the band width range of the current control), the compensation tends to be counter productive.

In the broader sense, detent torque compensation can always be used when an external disturbance torque occurs regularly as a function of position.

## 8.11.1.1 Compensating detent torque of servomotors

- Move the axis at a constant, low speed.
- If the positioning range is limited, move in reverse. In this case, use **P 3004[6] - TeachMinSpeed** to ensure that the range of insufficient speed is disregarded when reversing.
- Start the teaching process using **P 3004[0] Operation = TEACH0(1)**
- A teaching run should be performed at low rates of travel. The progress of the learning can be recorded together with the **q-axis actual current** using **P 3005[0] - ActVal**.
- Enable compensation using **P 3004[0] - Operation = COMP(3)**
- Remove the direct component with the corresponding button. This prevents the compensation from working against the integrator of the speed controller.
- Save the setting to the device.

The drive now moves with detent torque compensation. The improvement can be seen because actual speed and tracking error no longer display systematic ripple. If this is still the case, the following improvements are possible. The compensation data must be relearned in each case.

- Use a speed that is not too high (100–200 rpm) for verification. Otherwise, the current controller cannot represent the frequencies requested by detent torque compensation. At higher speeds it usually makes sense to fade detent torque compensation using the fade function (**P 3004[7] - FadeStartSpeed** and **P 3004[8] - FadeEndSpeed**).
- Change **P 3000[2] - Input** to **EPSST(2)**, the motor pole pairs may not be identical in structure. With EPSST(2), the compensation is recorded via one mechanical revolution of the motor.
- Enlarge the table (**P 3001[0] - Length**).
- Systematic errors of the encoder system may be to blame (see Section "GPOC (Gain Phase Offset Correction)" on page 117). Special care is required with single pole pair resolvers in the **EPSST(2)** setting or with resolvers with the same number of pole pairs as the motor. In this case, check encoder correction first.

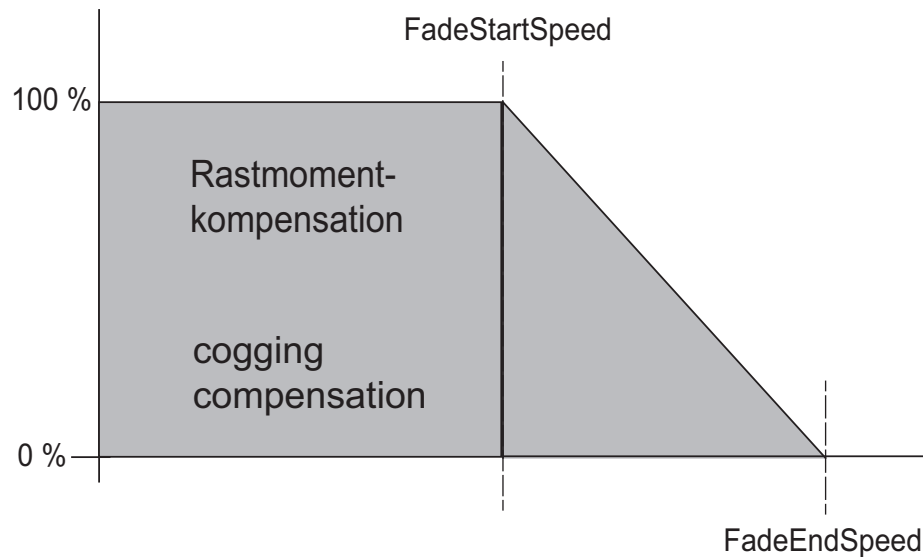


Fig. 8.40: FadeStartSpeed and FadeEndSpeed

### 8.11.1.2 Compensating detent force of linear motors

For linear motors, the same basic approach can be taken as with servomotors (Section "Compensating detent torque of servomotors" on page 169).

However, the EPSST(2) setting does not always lead to optimal results as the magnets of the pole pairs generally display deviations over the length of the motor. For this reason, **P 3000[2] - Input** should be tested with the POS(3) or ABSPOS(4) setting.

The input variable used by POS(3) is the referenced actual position in internal units, as displayed in **P 2955[0] - CON\_PCON\_ActPosition**. ABSPOS(4) uses the actual

position in user units. In both cases **P 3002[0] - StartVal** and **P 3002[1] - EndVal** must be used to define a range in which compensation is performed. The table scales to this range, increase table memory!

### 8.11.1.3 Compensating detent torques of rotation processes (e.g. round table)

Round tables are usually operated in modulo scaling (see Section "Scaling / Units" on page 197).

- Set **P 3000[2] - Input** to ABSPOS(4).
- Set **P 3002[0] - StartVal** and **P 3002[1] - EndVal** to the limits of the modulo range.
- Set **P 3002[2] - Modulo** to 1.
- Proceed as described above.

### 8.11.1.4 Remove mean value !!New chapter!!

## 8.11.2 Position error compensation

This function compensates errors between the encoder system of the drive and the real position. An example is spindle errors with ball screws when movement is implemented by the motor encoder. The compensation data can only be determined externally. The data must be converted to CSV format and sent to the Axis Controller by TFTP.

LENGTH;<length>	Table length
DUAL;1	Separate tables for positive and negative movement => 1, otherwise 0
STARTVAL;<val>	Starting and ending positions must be given in fieldbus units
ENDVAL;<val>	
TAB;<val>	Table values for positive movement
TAB;<val>	
TBRV;<val>	Table values for negative movement (only if DUAL = 1)
TBRV;<val>	
[...]	

Table 8.29: Syntax for CSV format

#### Activation of the function

- Save the CSV file. A dot (full stop) must be used as the decimal separator.
- Load the file to the axis module using TFTP via the “Compensation data” screen (see 8.11.4 Compensation data).
- Activate the file for compensation function 2 of the axis. This writes the file name to **P 3006[1] - FileName**
- **P 3006[0] - Startup** = SPEC (start-up with a specific file)
- **P3010[0]** Operation = COMP (compensation)
- Save the setting to the device.
- Start the axis

The axis now moves with corrected actual position values. The correction can be recorded in parameter **P3011.0 ActVal**. The improvement of positioning accuracy can only be verified with the external measuring system, however.

The transition between the table for positive movement and the table for negative movement is governed by the parameter **P 3010[9] SignThreshSpeed**: If the value of the current feed-forward controlled speed is greater than SignThreshSpeed, one of the two tables is put into play. The transition at lower speeds is realized using a combination of hysteresis and interpolation; at a standstill, the last compensation value is retained.

#### Example:

Create the following table, for example in Microsoft® Excel:

	A	B	C	D
1	// Position unit is um			
2	// Position correction from 0 to 20000 um			
3				
4	LENGTH	5		
5	DUAL	0		
6	STARTVAL	0		
7	ENDVAL	20000		
8	TAB	0		
9	TAB	20		
10	TAB	30		
11	TAB	20		
12	TAB	0		

Fig. 8.41: Example of a table:

- Export the table as example.csv.
- Change the decimal separator from a comma to a point using a text editor, if necessary.

- Load the file to the axis module via the “Compensation data” screen (see 8.11.4 Compensation data).
- Activate the function (see Activation of the function above) and set the drive in motion. The following figure shows the result:

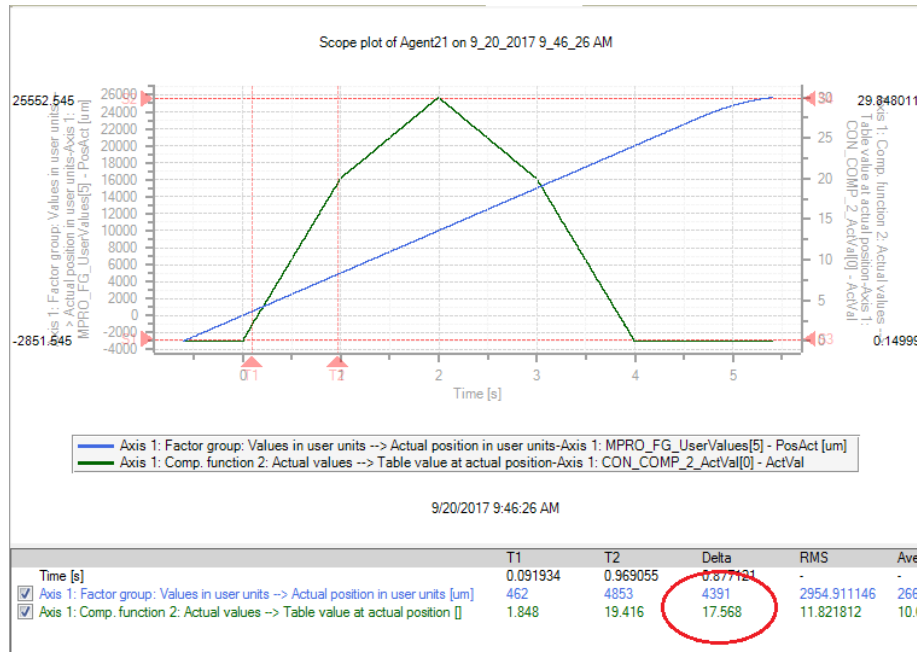


Fig. 8.42: Example scope view



#### NOTE

- The position error compensation is intended for correcting small errors. It is only taken into account in the position control, but not in the feed forward control or speed control. The change in the compensation value must be significantly smaller in every section than the position difference (see Fig. 8.42: Example scope view, slope  $\ll 1$ ), otherwise there will be a deviation of the position.

### 8.11.3 Error monitoring (tracking)

This function is suitable for monitoring regular movements for unexpected disturbances. A higher-level controller is usually required that switches the function on and off and regularly relearns the data. Observe the long-term behaviour of the system!

The output variable is not modified by the table but rather compared with the table value. The error is cumulated. If it exceeds a monitoring limit, the error message is output.

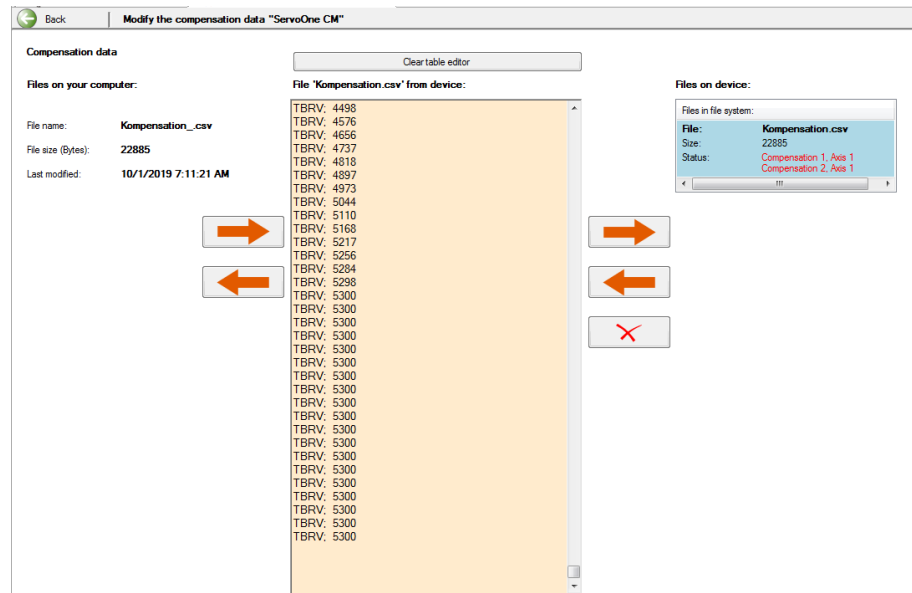
- Select **P 3006[2] - Input** = ABSPOS(4) and **P 3006[3] - Output** = ISQREF(4)
- Select table length **P 3007[0] - Length**, **P 3008[0] - StartVal** and **P 3008[1] - EndVal** and set **P 3007[1] - Dual** = True(1)
- Start the movement
- Set the monitoring limit **P 3004[5] - ErrorLimit** to a very high value (e.g. 10000)
- Learn the movement with **P 3010[0] - Operation** = TEACH1
- Display **P 3005[0] - ActVal**, **P 3005[1] - Error** and scope variable 1023 isqRefSum in DigitalScope.
- Check the range of **P 3005[1] - Error**. Set the monitoring limit accordingly.
- Simulate a disturbance and check the monitoring.

### 8.11.4 Compensation data

The “Compensation data” screen is for managing compensation tables in the file system of the axis module and on the PC. This is of special relevance for the position error compensation in which the data are always measured using external tools. The data determined in the device are also displayed and can be evaluated externally or overwritten with existing tables.





The table editor is used to view the files and make small changes.



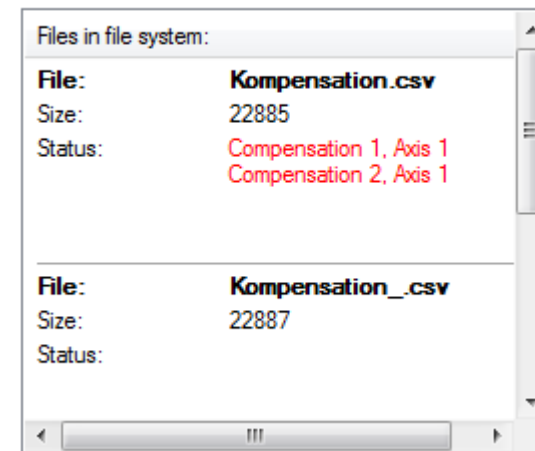
#### Data on your computer:

The file name, the file size and the last modification of the selected csv file are displayed.

	Loading a csv file from the hard disk of the computer to the table editor.
	Saving the data displayed in the table editor to a csv file on the hard disk.




#### Files on the device:

##### Files on device:



The csv files available in the file system of the device are displayed here.

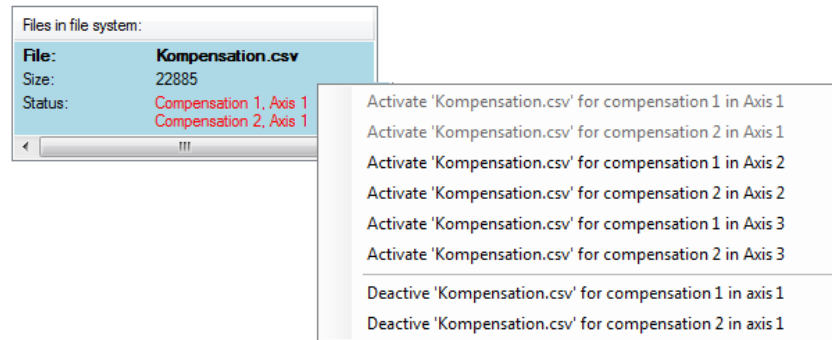
The name of the csv file, the file size and the status are displayed. The status indicates for which compensation (1 or 2) and axis (1, 2, 3) the csv file is activated.

	The csv file displayed in the table editor is stored in the file system of the device.
	The csv file selected in the "Files on the device" window is loaded into the table editor.
	This button deletes the selected csv file from the device.

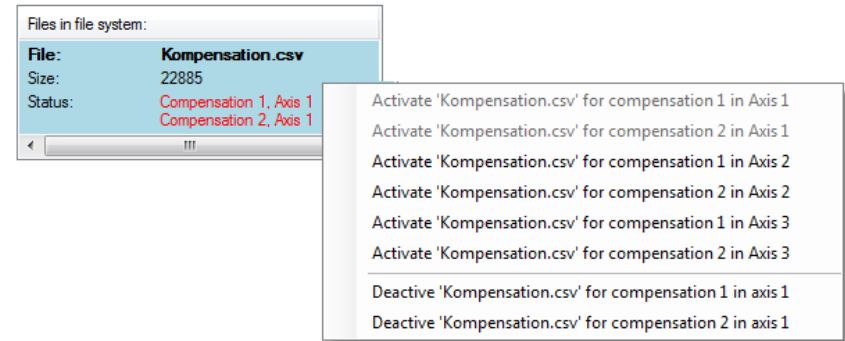
### Activating a csv file

1. In the "Files on the device:" window, select the csv file you want to activate.
2. Press the right mouse button. From the list, select the item for which the compensation is to be activated. Greyed out list items indicate that these have already been activated for a compensation x and axis-x. These are then listed under "Deactivate xxx.csv" for compensation x in axis x.

Files on device:



Files on device:



### Deactivating a csv file

1. In the "Files on the device:" window, select the csv file you want to deactivate.
2. Press the right mouse button. From the list, select the item for which the compensation is to be deactivated. Greyed out list items indicate that these have already been activated for a compensation x and axis-x. These are then listed under "Deactivate xxx.csv" for compensation x in axis x.

## 8.12 Power failure management



### NOTE

- Take note of the chapter 4.1.4 Undervoltage on the general behaviour of the axis group in the event of a power failure.

In the event of a failure of the voltage supply, the drives can be braked. The braking energy is used to supply the devices. When mains power is restored, the drives can return to controlled operation. If the drives have reached a speed of zero and the mains supply is still off, the power supply cannot be maintained and the devices are shut down.

Braking of drives can be performed individually or as speed-synchronized operation of all module drives.



### NOTE

- If this function is employed with a controller, care must be taken to ensure that in the event of a power failure, the controller behaves passively. This is necessary because the axis controller handles braking independently in the event of a power failure and therefore does not respond to anything specified by the controller.

<b>CAUTION!</b>	<b>Your system/motor may be damaged if put into operation in an uncontrolled or inappropriate manner.</b>
	<b>Improper conduct can cause damage to your system / machine.</b> <ul style="list-style-type: none"> <li>Do not use this function for drives with mechanically limited travel. Positioning monitoring is no longer performed, the system could be damaged in the event of a power failure.</li> </ul>

P No.	Index	Name	Unit	Description
3021 / 5069 / 7117		CON_POWF_Ctrl		Axis 1 / 2 / 3: VFC settings
3021 / 5069 / 7117	0	Kp	A/V	Gain
3021 / 5069 / 7117	1	Tn	ms	Voltage control: Time constant of I component
3021 / 5069 / 7117	2	SRatio		Speed ratio between axes
3021 / 5069 / 7117	3	SThres	%	Speed threshold at which voltage control is shut down
3021 / 5069 / 7117	4	Tf	ms	Filter time for current below Sthres

Table 8.30: Parameter list – Control axis – Power failure management

P No.	Index	Name	Unit	Description
904		CON_POWF_Settings		Power failure management settings
904	0	Vref	V	Setpoint voltage for voltage control
904	1	Vpowf	V	Threshold for power failure detection
905	0	CON_POWF_Controlword		Power failure management control word
906	0	CON_POWF_Statusword		Power failure management status word

Table 8.31: Parameter list – Device control – Power failure management settings

Use the parameter **Supply\_FastPara P 703[4]-astatS** (Status bits: mains voltage / DC-link / precharging / brake chopper) **7 – TRUE** = Error, the error Phase Failure will be displayed.

## 8.12.1 Control structure

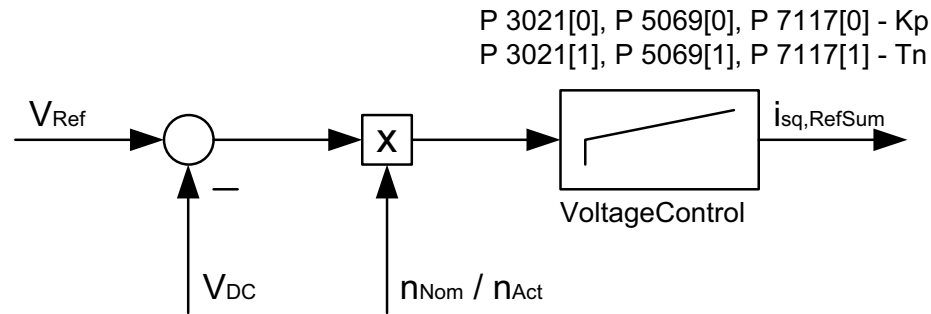


Fig. 8.43: Master axis structure

The master axis is controlled by a PI voltage controller. The parameters can be preset axis-specifically **P 3021 - CON\_POWF\_Ctrl**. The setpoint of DC link voltage is defined in **P 904[0] - Vref**. The same structure applies to all axes if individual power failure backup is active.

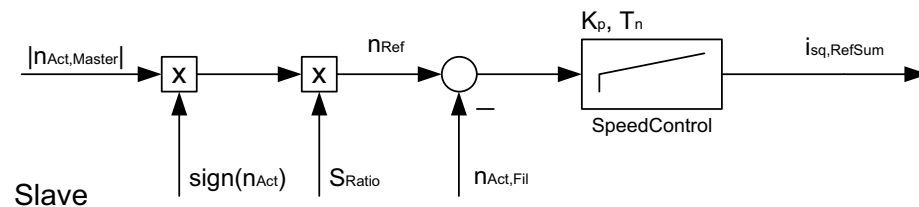


Fig. 8.44: Slave axis structure

The slave axes are run in speed control with a setpoint derived from the speed of the master. The speed ratio is preset axis-specifically in **P 3021[2] - SRatio**. The direction is automatically determined based on the state at power failure. The control bit **AutoSpeedSync** also automatically determines the speed ratio.



### NOTE

- Use the axis with the highest moment of inertia as master axis.
- For the slave axes, the voltage controller must be parametrized to zero.

## 8.12.2 Control of the functions

The functions for the entire Axis Controller are activated by the control word **P 905[0] - CON\_POWF\_Controlword**. The parameter is effective immediately. The meaning of the control bits is as follows:

Bit No.	Meaning	Explanation
0	ActivateAxis1	Activates power failure management for the axis. Axes for which power failure management is not activated continue to follow their setpoints and, if appropriate, also consume energy from the DC link.
1	ActivateAxis2	
2	ActivateAxis3	
3	SetMasterBit0	<b>Bit word</b> 00 : Each axis brakes individually. 01 : Axis 1 is master axis 10 : Axis 2 is master axis 11 : Axis 3 is master axis
4	SetMasterBit1	

Bit No.	Meaning	Explanation
5	PowerfailDetected	Can be used to activate the "Mains power supply failure" state from the controller. The bit is deleted as soon as the drives are in this state.
6	VoltageReturned	Can be used to activate the "Mains power restored" state from the controller. The bit is deleted as soon as the drives are in the original state again.
7	AutoSpeedSync	If this bit is set, the speed ratios are automatically scanned at the time of power failure. Then, the parameter SRatio (per axis) has no function.

Power failure is detected when the DC link voltage falls below the value of **P 904[1] - Vpowf**. A return of voltage is not detected.

If the speed of an axis falls below the value **P 3021[3] - SThres** (relative to rated speed), the power failure management is disabled. The axis runs down at residual speed.

The following table shows the meaning of the individual bits in the status word **P 906 [0] - CON\_POWF\_Statusword**:

Bit No.	Meaning	Explanation
0	MonitoringVoltageAxis1	DC-link voltage monitoring mode
1	MonitoringVoltageAxis2	
2	MonitoringVoltageAxis3	

Bit No.	Meaning	Explanation
3	ControlActiveAxis1	Power failure bridging active
4	ControlActiveAxis2	
5	ControlActiveAxis3	
6	MasterAxis1	Display of the active master axis
7	MasterAxis2	
8	MasterAxis3	

## 8.13 Test functions

### 8.13.1 Motor phase test

This function checks whether all motor phases are connected and conducting current when the controller is switched on.

The test is activated by **P 3027[0] - Mode**. A current is applied to the motor whose amplitude is set by **P 3027[1] - Current** (in percent of rated motor current) and whose maximum duration is set by **P 3027[2] - Time**. If a current is detected in all three motor phases, the motor phase test is aborted before **P 3027[2] - Time** has elapsed.

The motor phase test only runs when the controller is started for the first time, as it can be assumed that the wiring is not changed during operation. The motor phase check can be repeated by

- a change in **P 3027 - CON\_MPCHK**,
- an error in the motor phase check,
- a change in encoder parametrization

P No.	Index	Name	Unit	Description
3027 / 5075 / 7123		CON_MPCHK		Axis 1 / 2 / 3: Motor wire break detection
3027 / 5075 / 7123	0	Mode		Inverter wiring test ON/OFF
3027 / 5075 / 7123	1	Current	%	Measuring current in per cent of rated motor current
3027 / 5075 / 7123	2	Time	ms	Timeout to detect current before error state

Table 8.32: Parameter list – Control axis – Test functions

### 8.13.2 Wire test at start-up

A short-circuit in the motor wiring or in the motor (to a different phase or to earth) endangers the power stage. To rule this out, a defined voltage pulse is output before applying current to the motor and the level of current is tested. If there is a short-circuit, the power stage is switched off.



#### NOTE

- The wire test can lead to unintended shutdowns in motors with very low inductance or motors with a mains filter.

The wire test is active by default and can be disabled by setting **P 3026[0] - CON\_WireTest** = DISABLE.

The wire test only runs when the controller is started for the first time, as it can be assumed that the wiring is not changed while the device is switched on. An error in the wire test causes the wire test to be repeated.

P No.	Index	Name	Unit	Description
3026 / 5074 / 7122	0	CON_WireTest		Axis 1 / 2 / 3: Enable/disable inverter short-circuit wiring test. 0 (DISABLE) = Switch off wiring test of drive 1 (ENABLE) = Switch on wiring test of drive

Table 8.33: Parameter list – Control axis – Test functions

### 8.13.3 Motor brake check

**Brake test**

**Settings**

Rated torque of brake: 10 Nm

**Direction**

Left ☐ Right ☐

**Test Status**

Busy ☒ Pass ☐ Fail ☐

**Grinding in**

Grinding in distance: 360000 mdeg

Grinding in speed: 100 rev/min

Grinding in acceleration: 100 rev/min/s

Grinding in timeout: 3000 ms

Start Stop

**Hold torque measurement**

Required hold torque: 120 %

Required hold torque: 0 Nm

Torque ramp: 50 %/s

Hold time: 0 ms

Max. position difference: 10000 mdeg

Start Stop

Distance positive: 0 mdeg

Distance negative: 0 mdeg

**Slip & Stick torque measurement**

Maximum test torque: 150 %

Required hold torque: 0 Nm

Torque ramp: 50 %/s

Start Stop

Slip torque positive: 0 Nm

Slip torque negative: 0 Nm

Stick torque positive: 0 Nm

Stick torque negative: 0 Nm

**Safety brake test**

Required hold torque: 120 %

Required hold torque: 0 Nm

Torque ramp: 50 %/s

Hold time: 0 ms

Test of two brakes ☐

Start Stop

Distance positive: 0 mdeg

Distance negative: 0 mdeg

Warning brake test required ☒

**Brake monitoring**

☐ Enable test period for brake test

Test period: 0 h

Operation time: 0 h

Time to next brake test: 1 h

Warning brake test required ☒

☐ Enable emergency stop counter

Threshold: 0 rev/min

Allowed emergency stops: 0

Emergency stop count: 5

Warning allowed emergency stops exceeded ☒

Fig. 8.45: "Motor brake test" dialog box

The state of the motor brake can be checked with three functions. A fourth function can be used to improve the effectiveness of the brake. There are also two programmable monitoring functions.

#### Settings, direction

For all four test functions, the rated torque of the brake (**P 2314[0] - RatedTorque**) and the desired direction of movement must be selected (**P 2315[0]**, bit 4 (DIR1) for "Left"; (**P 2315[0]**, bit 3 (DIR0) for "Right").



#### NOTE

- Further details about the motor brake can be found in Section "Motor brake" on page 66.
- The functions are designed with a time resolution of 10 ms. The waiting times of the brake control are rounded accordingly.

### 8.13.3.1 Parameter

P No.	Index	Name	Unit	Description
2151 / 4199 / 6247	0	ERR_WRN_State		Axis 1 / 2 / 3: Warning state
2314 / 4362 / 6410		MPRO_BRK_CK_Settings		Axis 1 / 2 / 3: Settings for motor brake test
2314 / 4362 / 6410	0	RatedTorque	Nm	Rated torque of brake. Setpoint of VerTorque, MaesTorque and TorqueRamp
2314 / 4362 / 6410	1	VerifiedTorque	Nm	Brake torque was checked in production, no function
2314 / 4362 / 6410	2	HoldTorque	%	Verification test: Required stopping torque in % of rated torque
2314 / 4362 / 6410	3	HoldMaxDelta	PosUnit	Verification test: Maximum position difference during test
2314 / 4362 / 6410	4	MeasTorque	%	Stopping torque measurement: Maximum test torque in % of rated torque
2314 / 4362 / 6410	5	TorqueRamp	%/s	Torque ramp in % of rated torque /s
2314 / 4362 / 6410	6	GrindDist	PosUnit	Grinding: distance
2314 / 4362 / 6410	7	GrindSpeed	SpeedUnit	Grinding: Speed
2314 / 4362 / 6410	8	GrindAcc	AccUnit	Grinding: Acceleration
2314 / 4362 / 6410	9	GrindTO	ms	Grinding: Timeout
2314 / 4362 / 6410	10	TestPeriod	h	Cycle for brake test 0 = disabled
2314 / 4362 / 6410	11	EmcyStopThresh	SpeedUnit	Speed level above which a stop is an emergency stop.
2314 / 4362 / 6410	12	StickSpeed	u/min	Speed limit below which the brake holds
2314 / 4362 / 6410	13	AllwEmergcStp		Number of max. allowed emergency stops
2314 / 4362 / 6410	14	VerMaxTorqHoldTime	ms	Hold time of the test torque (only active for holding torque measurement) Specifies the dwell time in the maximum test torque in the verification test as well as in the positive and in the negative torque.
2314 / 4362 / 6410	15	AddBrkCloseTime	ms	Additional time for closing of the brake Specifies the additional brake close time, meaning this is added to the set brake close time ( <b>P 2308[0]</b> ). This takes effect in the verification and in the hold torque test.

Table 8.34: Parameter list – Motor axis – Motor brake test

P No.	Index	Name	Unit	Description
2314 / 4362 / 6410	17	HoldMaxDeltaMot	rounds	Verification test: Maximum position difference during test, in motor revolutions. If 0, <b>P 2314[3] HoldMaxDelta</b> is used.
2315 / 4363 / 6411	0	MPRO_BRK_CK_Control		Axis 1 / 2 / 3: Bit-coded control word for motor brake test
2316 / 4364 / 6412		MPRO_BRK_CK_Actual		Axis 1 / 2 / 3: Actual brake check values
2316 / 4364 / 6412	0	State		Current brake test status
2316 / 4364 / 6412	1	SlipTorqPos	Nm	Torque at which the slip takes effect with a positive torque
2316 / 4364 / 6412	2	SlipTorqNeg	Nm	Torque at which the slip takes effect with a negative torque
2316 / 4364 / 6412	3	StickTorqPos	Nm	Torque at which the brake holds once again with a positive torque
2316 / 4364 / 6412	4	StickTorqNeg	Nm	Torque when brake holds again with negative torque
2316 / 4364 / 6412	5	DistancePos	PosUnit	Distance travelled during measurement of the holding torque or of the slip and holding torque with a positive torque.
2316 / 4364 / 6412	6	DistanceNeg	PosUnit	Distance travelled during measurement of the holding torque or of the slip and holding torque with a negative torque.
2316 / 4364 / 6412	7	TorqueM0	Nm	Torque at start of test
2316 / 4364 / 6412	8	EmcySpeed	SpeedUnit	Speed while closing the brake due to an Emergency stop
2316 / 4364 / 6412	9	OperationTime	h	Time since the brake test was started
2316 / 4364 / 6412	10	Pireglimit	A	Effective current limitation in TCon
2316 / 4364 / 6412	11	ReqHoldTqVE	Nm	Required holding torque in verification test
2316 / 4364 / 6412	12	ReqHoldTqHT	Nm	Required holding torque during holding torque measurement
2317 / 4365 / 6413		MPRO_BRK_CK_Backup		Axis 1 / 2 / 3: Brake test backup values
2317 / 4365 / 6413	0	TestSchedule	h	Time until the next brake test
2317 / 4365 / 6413	1	EmcyStopCount		Emergency stop counter

Table 8.34: Parameter list – Motor axis – Motor brake test (continue)

The parameter **P 2314[15] - AddBrkCloseTime** defines an additional waiting time between the closing of the brake incl. torque reduction and the actual test. For example, it can be used if the system begins to vibrate during braking and this must be allowed to dissipate before the test.

### 8.13.3.2 Grinding

This test function is used to improve the effectiveness of the brake by means of grinding.

No.	Activity
1	Set values for ... <ul style="list-style-type: none"> <li>the desired distance (path of travel) for grinding (<b>P 2314[6] - GrindDist</b>),</li> <li>the desired speed (<b>P 2314[7] - GrindSpeed</b>),</li> <li>the desired acceleration (<b>P 2314[8] - GrindAcc</b>),</li> <li>maximum available time (<b>P 2314[9] - GrindTO</b>).</li> </ul>
2	Put Servo controller into the "Operation enabled" state (see Section "EtherCAT® state machine" on page 509), e.g. using the manual mode window (see Section "Manual mode window" on page 541).
3	Press "Start" to activate the test and confirm the safety prompt ( <b>P 2316[0]</b> , bit 2 and 15).
4	The distance covered is stored in <b>P 2316[5] - DistancePos</b> or <b>P 2316[6] - DistanceNeg</b> (depending on the direction of movement selected).
5	If the drive distance is covered successfully in the given time, this is displayed in "Status" as "Test completed successfully" ( <b>P 2316[0]</b> , bit 0 (PASS)).
6	If the drive distance was not covered successfully in the given time, the test is displayed in "Status" as "Test failed" ( <b>P 2316[0]</b> , bit 1 (FAIL)).



### 8.13.3.3 Stopping torque measurement

This test function checks whether the motor brake still holds at the configured torque.

No.	Activity
1	Set values for ... <ul style="list-style-type: none"> <li>• “Required holding torque” (<b>P 2314[2] - HoldTorque</b>)</li> <li>• “Hold time” (<b>P 2314[14] - VerMaxTorqHoldTime</b>)</li> <li>• “Torque ramp” (<b>P 2314[5] - TorqueRamp</b>) and</li> <li>• “Max. position difference” (<b>P 2314[3] - HoldMaxDelta</b>).</li> </ul>
2	Put Servo controller into the “Operation enabled” state (see Section “EtherCAT® state machine” on page 509), e.g. using the manual mode window (see Section “Manual mode window” on page 541).
3	Press “Start” to activate the test and confirm the safety prompt ( <b>P 2316[0]</b> , bit 0 and 15).
4	The torque is increased based on the configured ramp ( <b>P 2314[5] - TorqueRamp</b> ) up to the configured rated torque ( <b>P 2314[0 and 2]</b> ). Meanwhile, the position is monitored for exceeding the configured maximum position difference ( <b>P 2314[3] - VerMaxDelta</b> ).
5	If the maximum position difference is exceeded, the test is aborted and “Status” displays “Test failed” ( <b>P 2316[0]</b> , bit 1) and “Positive slip” ( <b>P 2316[0]</b> , bit 3) or “Negative slip” ( <b>P 2316[0]</b> , bit 4) (depending on the direction of movement selected).
6	If the test is successful, it is displayed in “Status” as “Test completed successfully” ( <b>P 2316[0]</b> , bit 0) and “Positive holding torque” ( <b>P 2316[0]</b> , bit 5) or “Negative holding torque” ( <b>P 2316[0]</b> , bit 6) (depending on the direction of movement selected).

### Display parameters

- “Torque at start of test” (**P 2316[7] - TorqueM0**) displays the holding torque measured at the start of the test in Nm.
- “Positive distance” (**P 2316[5] - DistancePos**) and “Negative distance” **P 2316[6] - DistanceNeg** display the drive distance covered during the test.

### 8.13.3.4 Slip & holding torque measurement

This test determines ...

- the torque at which the brake starts to slip and
- the torque at which the brake holds again.

No.	Activity
1	Set values for ... <ul style="list-style-type: none"> <li>• "Maximum test torque" (<b>P 2314[4] - MeasTorque</b>) and</li> <li>• "Torque ramp" (<b>P 2314[5] - TorqueRamp</b>).</li> </ul>
2	Put Servo controller into the "Operation enabled" state (see Section "EtherCAT® state machine" on page 509), e.g. using the manual mode window (see Section "Manual mode window" on page 541).
3	Press "Start" to activate the test and confirm the safety prompt ( <b>P 2316[0]</b> , bit 1 and 15).
4	The torque is increased based on the configured ramp ( <b>P 2314[5] - TorqueRamp</b> ) up to the configured torque ( <b>P 2314[0+4]</b> ). Meanwhile, the speed is monitored for exceeding the configured maximum speed ( <b>P 2314[12] - StickSpeed</b> ).
5	If maximum speed is exceeded, the current actual torque value in <b>P 2316[1] - SlipTorquePos</b> or <b>P 2316[2] - SlipTorqueNeg</b> (depending on the direction of movement selected) is recorded.
6	Then the torque ramp is inverted.
7	If speed drops below maximum speed again, the current actual torque value in <b>P 2316[3] - StickTorquePos</b> or <b>P 2316[4] - StickTorqueNeg</b> (depending on the direction of movement selected) is recorded.
8	If the test is successful, it is displayed in "Status" as "Test completed successfully" ( <b>P 2316[0]</b> , bit 0) and "Positive slip" ( <b>P 2316[0]</b> , bit 3) or "Negative slip" ( <b>P 2316[0]</b> , bit 4) and "Positive holding torque" ( <b>P 2316[0]</b> , bit 5) or "Negative holding torque" ( <b>P 2316[0]</b> , Bit 6) (depending on the direction of movement selected).
9	If the test could not be performed (e.g. because the necessary torque was not reached), the test is displayed in "Status" as "Test failed" ( <b>P 2316[0]</b> , bit 1).

### 8.13.3.5 Safe brake test measurement

This test function in the SCD device version can be used to initiate a safe brake test. This test works in a manner similar to the test "Holding torque measurement". In contrast to this, with the safe brake test the zero-speed monitoring, the evaluation of the applied torque and the time monitoring are carried out by the SBT safety function (for details on the SBT safety function, see SafetyManager Programming Manual SDC).

Like the other three brake test functions, the safe brake test must be parametrized and started via the functional part of the drive controller.

No.	Activity
1	Set values for ... <ul style="list-style-type: none"> <li>“Required holding torque” (<b>P 2314[2] - HoldTorque</b>)</li> <li>“Hold time” (<b>P 2314[14] - VerMaxTorqHoldTime</b>)</li> <li>“Torque ramp” (<b>P 2314[5] - TorqueRamp</b>).</li> <li>Activate/deactivate "Test of two brakes" (<b>P 2316[0] - Bit 12 SBT_2BRK_Test</b>)</li> </ul>
2	The SBT function block must be inserted, parametrized and activated in the safety program (see SafetyManager Programming Manual SDC).
3	Put Servo controller into the “Operation enabled” state (see Section "EtherCAT® state machine" on page 509), e.g. using the manual mode window (see Section "Manual mode window" on page 541).
4	Press the “Start” button to activate the test and confirm the safety prompt ( <b>P 2316[0]</b> , bit 5 and 15).
5	The torque is increased based on the configured ramp ( <b>P 2314[5] - TorqueRamp</b> ) up to the configured rated torque ( <b>P 2314[0 and 2]</b> ). Meanwhile, the position is monitored for exceeding the maximum position difference configured in the SBT function block.
6	If the maximum position difference is exceeded, the torque expected in the SBT function block is not achieved or the test time expected in the SBT function block is exceeded, the test is aborted and “Status” displays “Test failed” ( <b>P 2316[0]</b> , bit 1) and “Positive slip” ( <b>P 2316[0]</b> , bit 3) or “Negative slip” ( <b>P 2316[0]</b> , bit 4) (depending on the direction of movement selected) and/or the corresponding status bit of the SBT function “SBT slip” ( <b>P 2316[0]</b> , bit 7), “SBT Torque” ( <b>P 2316[0]</b> , bit 8) or “SBT Time” ( <b>P 2316[0]</b> , bit 9).
7	If the test is successful, it is displayed in “Status” as “Test completed successfully” ( <b>P 2316[0]</b> , bit 0) and “Positive holding torque” ( <b>P 2316[0]</b> , bit 5) or “Negative holding torque” ( <b>P 2316[0]</b> , bit 6) (depending on the direction of movement selected).

### Display parameters

- “Torque at start of test” (**P 2316[7] - TorqueM0**) displays the holding torque measured at the start of the test in Nm.
- “Positive distance” (**P 2316[5] - DistancePos**) and “Negative distance” **P 2316[6] - DistanceNeg** display the drive distance covered during the test.

### 8.13.3.6 Cyclical brake test

This monitoring function outputs a warning if no brake test was performed within a defined interval. After a successful “Holding torque” test or after setting **P 2315[0] - MPRO\_BRK\_CK\_Control**, bit 14 (RST\_BT\_W), the warning is reset.

No.	Activity
1	Set the desired interval with “Duration” ( <b>P 2314[10] - TestPeriod</b> ). Entering a value of 0 disables monitoring.
2	Activate function with “Activate duration for brake test” ( <b>P 2315[0]</b> , bit 14).
3	<b>P 2316[9] - OperationTime</b> displays the time that has elapsed since the last brake test.
4	<b>P 2317[0] - TestSchedule</b> stores the time in absolute operating hours (also refer to <b>P 3064[0] - MON_OperationEnTime</b> in Section "Setting for the switching frequency" on page 42) when the next brake test is due.
5	Any changes to <b>P 2314[10] - TestPeriod</b> initialize a new test phase.

### 8.13.3.7 Emergency stop counter

This monitoring function counts the emergency stops and outputs a warning if the counter exceeds a defined number.

No.	Activity
1	Use "Threshold" ( <b>P 2314[11] - EmcyStopThresh</b> ) to define the speed at which a braked stop counts as an emergency stop. Entering a value of 0 disables monitoring.
2	Enter the number of emergency stops allowed in "Allowed emergency stops" ( <b>P 2314[13] - AllwEmergcStp</b> ).
3	Activate function with "Activate emergency stop counter" ( <b>P 2315[0]</b> , bit 13).
4	If <b>P 2317[1] - EmcyStopCount</b> exceeds the value of <b>P 2314[13] - AllwEmergcStp</b> , bit 21 (EmergencyStop) is set in <b>P 2151[0] - ERR_WRN_State</b> (cf. Section "Warnings" on page 221).
5	The warning can be reset with <b>P 2315[0] - MPRO_BRK_CK_Control</b> , bit 13.

### 8.13.3.8 Control / status word

Bit	Function
0	Stopping torque measurement
1	Slip & holding torque measurement
2	Grinding
3	Right direction
4	Left direction
5	Safe brake test (SBT)
12	Safe brake test with 2-brake system

Table 8.35: Control word P 2315[0] / 4363[0] / 6411[0] - MPRO\_BRK\_CK\_Control

Bit	Function
13	Reset the emergency stop counter
14	Reset the timer for cyclical brake test
15	Test start / stop

Table 8.35: Control word P 2315[0] / 4363[0] / 6411[0] - MPRO\_BRK\_CK\_Control (continue)

Bit	Meaning
0	Test completed successfully
1	Test failed
2	Busy – test in progress
3	Positive slip
4	Negative slip
5	Positive holding torque
6	Negative holding torque
7	Slip during safe brake test
8	Missing torque during safe brake test
9	Timeout during safe brake test

Table 8.36: Status word P 2316[0] / 4364[0] / 6412[0] - MPRO\_BRK\_CK\_Actual - Status

## 8.14 Gantry operation (2 and 3-axis)

The term gantry refers to a portal or any other application in which two or three mechanically coupled axes move the same mechanism.

The gantry mode in the ServoOne CM offers the possibility of coupling axes 1 and 2 in a two-axis module and axes 1, 2 and 3 in a three-axis module directly at the axis module level and addressing them synchronously as axis 1. The setpoint values are processed simultaneously for both axes. Then a change in the control structure is possible.

The axes can execute auto commutation (*see also section "Synchronous motor autocommutation" on page 152*) and homing (*see also section "Homing" on page 202*) separately if each of the coupled axes is able to move the mechanism by itself. If the mechanism must not be moved by only one, then absolute encoders must be used.

The axes must be structured identically, meaning

- Rotary motors must use the same gear unit ratio (or no gear unit)
- Ball screws must have the same gear unit and the same spindle pitch
- Linear motors must have the same pole pitch

Select the same scaling for the axes that are to be coupled. If the direction of the axes must be defined to be different, invert the scaling of one of the two axes and set the **INV** bit in the **GANTRY\_CtrlWord** (see Section "Activation" on page 185).

The exact coupling in process must be implemented in the higher-level controller; the axis module offers interfaces for this purpose.

P No.	Index	Name	Unit	Description
907	0	GANTRY_CtrlWord		Gantry control word
909		GANTRY_YawCtrl		Settings for the displacement control
909	0	PconKp	1/min	Position control gain
909	1	SconKp	Nm/rpm	Yaw-speed controller gain
909	2	SconTn	ms	Yaw-speed controller integration time
909	3	UsrPosDiffMax	POS	Displacement control: Monitoring of the position difference
909	4	SpeedDiffMax	rpm	Displacement control: Monitoring of the speed difference
909	5	TMax	%	Torque limit (relative to axis 1 motor rated torque)
910		GANTRY_YawScale		On-line scaling parameters for displacement control
910	0	KpScaleScon	%	Scaling of speed control gain
910	1	SpeedLimit	rpm	Speed threshold for scaling
910	2	FilterZero	ms	Filter time for change from high to low speed
910	3	FilterHigh	ms	Filter time for change from low to high speed
910	4	KpScalePcon	%	Position controller gain scaling
910	5	KpScaleSconConst	%	Scale speed control mode permanently (e.g. adaptation to moment of inertia)
911		GANTRY_RefVal		Cyclical setpoint values for gantry mode
911	0	ScaleAxis1	%	Scale torque for axis 1
911	1	ScaleAxis2	%	Scale torque for axis 2

Table 8.37: Parameter Gantry

### 8.14.1 Activation

The gantry mode is controlled by the parameter **P 907 GANTRY\_CtrlWord**.

The individual axes of the axis module can be controlled separately or coupled. What is intended here is coupling of axis 2 or axes 2 and 3 with axis 1. The coupling can be absolute with reference to the position of axis 1 or relative to the current positions of the coupled axes.

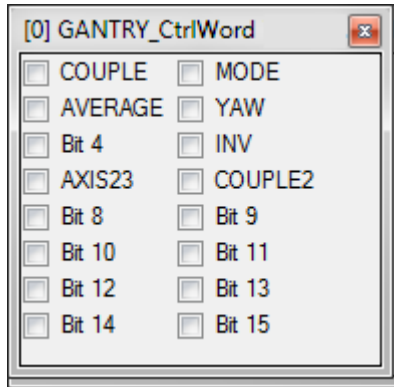


Fig. 8.46: GENTRY\_CtrlWord

The control word of gantry operation should be operated from a PLC program. Proceed as follows:

- Set **MODE**, **INV** and **AXIS23** according to the desired operation mode as soon as the PLC starts.
- Set **COUPLE** before or after switching on the control system (see 8.14.1.2 Gantry operation – coupling axes)
- Set **AVERAGE** and **YAW** as needed once the axes are switched on and coupled. (see 8.14.2 Control structure)

### 8.14.1.1 Meaning of the control bits

Bit[0] **COUPLE** in the gantry control word (**P 907[0]**) couples axis 2 and axis 1 with each other. To couple axis 3 as well, bit[6] **AXIS23** in the gantry control word (**P 907[0]**) must be set. Axis 1 can now be controlled as usual. In the coupled mode, the state and setpoints of axis 1 are adopted for the corresponding coupled axes. Accordingly, the control of the DriveCom state machines of the coupled axes have no effect; the coupled axes follow axis 1.

The DriveCom state machines of the coupled axes are no longer in operation; the status of the coupled axes is represented by the overall status of axis 1. In the same manner, all errors of the coupled axes are redirected to axis 1. In the expanded error window, "Slave axis error" can then be found under "Further information".



#### NOTE

Coupling and decoupling of the axes is possible:

- when all axes are switched off
- or when all axes are switched on and are at a standstill. For absolute coupling, the position must also match, otherwise there will be a tracking error.
- In the "mixed" state, a tracking error will probably be triggered because the transitions of the internal state machine cannot be executed correctly.

Before coupling, bit[1] (**MODE** = 0/1 relative/absolute) in the gantry control word (**P 907[0]**) must be defined and must no longer be changed in the coupled state or when the power stages are active because otherwise divergent setpoints would be applied to the coupled axes erratically, which would result in corresponding tracking error messages.

Absolute coupling (application of the absolute position to the coupled axes) can be selected with **MODE = 1**.

**MODE = 0** defines a coupling based on the current positions of the coupled axes (meaning the coupling is done relative to the current position).

**INV** specifies that the setpoint values of axis 1 are to be negated for axis 2 or axis 3. The axes can only be coupled meaningfully in position 0.

For **AVERAGE** and **YAW**, see 8.14.2 Control structure

**COUPLE2** causes axis 1 and axis 2 to be coupled relatively, whereby axis 2 functions as the master axis. This is only necessary when referencing axes with incremental encoders. Absolute coupling and **Average/ Yaw** control are not possible with **COUPLE2**.

### 8.14.1.2 Gantry operation – coupling axes

There are several options for coupling:

- Relative coupling
- Coupling after separate homing
- Coupling with compensating movement

#### Relative coupling

Relative coupling (**MODE = 0**) detects the position of both axes at the point in time at which **COUPLE = 1** is set. From this position onward, the coupled axes are moved at the same time relatively. The coupling state **COUPLE** can be changed at any time if both axes are switched off or both axes are switched on and at a standstill.

#### Absolute coupling: Coupling with compensating movement

Establish the absolute coupling in the switched off state (**COUPLE = 1** and **MODE = 1**).

Start axis 1. The coupled axes 2 and 3 then carry out a compensating movement to the position of axis 1.

- The precondition for the compensating movement is that the specifications of the direction in the scaling of axis 1 and the coupled axis/axes be consistent. If the directions are different, then the inversion bit (**INV**) must be set.
- The position difference between axis 1 and the coupled axis/axes must be less than **P 2262.2 EnOpDistance** (axis 1). For **P 2262.2 = 0**, no check takes place; for **P 2262.2 > 0** and a difference that is too large, an error is set.
- The speed of the synchronization movement is taken from **P 26777[0] – SpeedSwitch** of the respective coupled axis.

#### Absolute coupling: Coupling after separate homing

Absolute coupling can be switched on during operation of both axes. The position of both axes must be the same, otherwise a tracking error occurs immediately.

This requires several steps:

- Perform homing for both axes separately.
- Switch both axes on and move the axes to suitable positions (e.g. 0)
- While the axes are at a standstill, set the bits **COUPLE = 1** and **MODE = 1** as bit **COUPLE**

For a complete sequence for axes with incremental encoders, see Fig. 8.49: Standard control structure.

### 8.14.1.3 Monitoring

For a simple, absolute coupling (**MODE = 1** and without **YAW** and **AVERAGE**), the absolute target positions between axis 1 and the coupled axes can be monitored. The max. permissible deviation is defined using **P 909[3] UsrPosDiffMax**. If the value is equal to zero, no monitoring of the target position takes place. The deviation from the actual values is observed in the context of the local tracking error monitoring on each axis. This means that monitoring of target and actual values takes place with reference to axis 1 (main gantry axis) and the coupled axes. By default, the monitoring is disabled (**P 909[3] UsrPosDiffMax = 0**).

### 8.14.1.4 Auto commutation and homing

For gantry operation with absolute coupling, axes with absolute encoders should be used. This means that position information is available immediately at start-up. The axes can be switched on directly as gantry.

If the axes do not have absolute value encoders, each axis must perform auto commutation and homing before the gantry can be coupled. This, in turn, is possible with no problems if the mechanical system can and may be operated with a single axis.

If the mechanical system must only be moved coupled, the homing run must be carried out with relative coupling. Coupling during auto commutation is not possible; use the method with minimized movement (see also section "Commutation position by alignment with minimized movement (IECON)" on page 154).

In this case, use the following sequence:

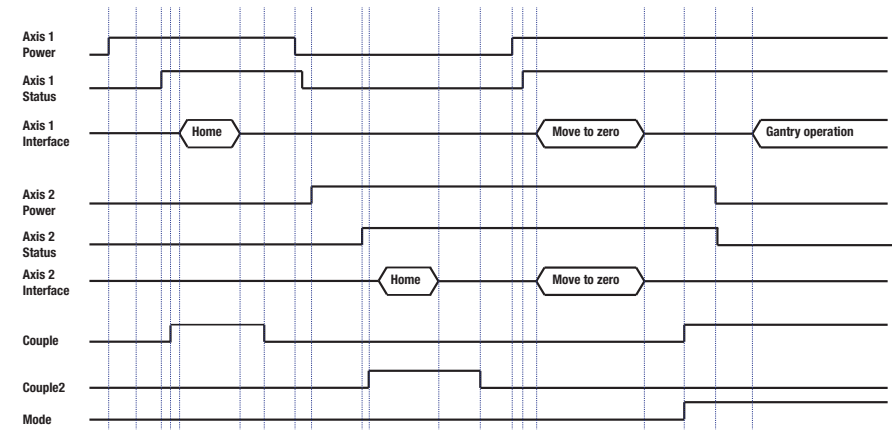


Fig. 8.47: Gantry for axes with incremental encoders

After the axis has been switched on, wait for the status "Operation enabled". Auto commutation is performed during this time. Switch off the respective slave axis in coupled operation. This ensures a smooth application of the position between the controller and the drive. The control is not switched off as this takes place.

### 8.14.1.5 Decoupling the gantry

The simplest is for the axes to be decoupled in the switched-off state. First switch off the control of axis 1.

In some applications, however, coupling and decoupling while the controller is switched on is also desirable.

To do so, use the following sequence:



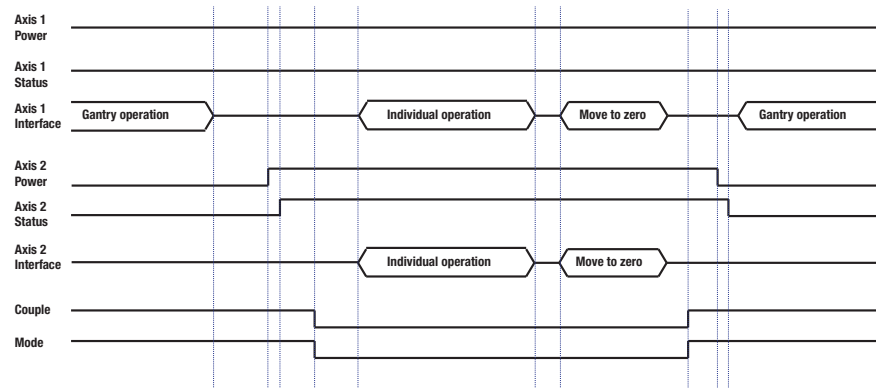


Fig. 8.48: Decoupling and coupling with control switched on

Switch off the respective slave axis in coupled operation. This ensures a smooth application of the position between the controller and the drive when the axis is switched on once again. The control is not switched off as this takes place.

## 8.14.2 Control structure

For the coupling of (only) axis 1 and axis 2, an extension of the control structure is possible, for example, to compensate for a strain of the mechanisms between the axes.

If **AVERAGE** = 1 is set, the control structure is changed. Only one control circuit is then active and this controls the average position of the two axes.

When **YAW** = 1 is set, an additional position control circuit is activated which controls the relative offset between axis 1 and axis 2.

### 8.14.2.1 Overview

Fig. 8.49: Standard control structure shows the standard control structure. The control circuits of axis 1, 2 and 3 operate independently of each other, each with their own setpoint value generation and state machine.

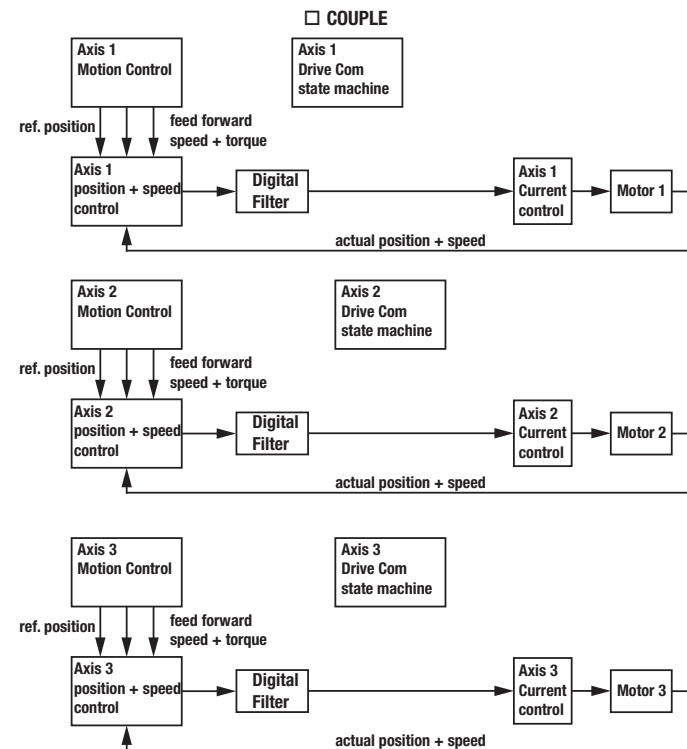


Fig. 8.49: Standard control structure

Figure 1.3 shows the control structure with axis coupling (**COUPLE**). The reference value generation and state machine of axis 1 are both active, but the control circuits still operate independently. It is recommended that the parameters for control of axes 1, 2 and 3 be configured the same.

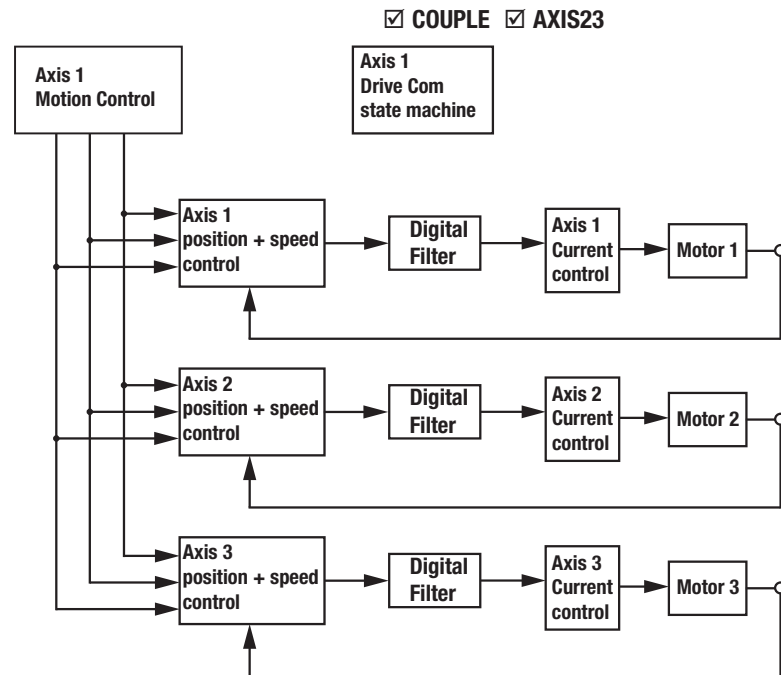


Fig. 8.50: Control structure with axis coupling (axes 1, 2 and 3)

The expanded gantry control structure is shown in the Fig. 8.51: Enhanced gantry control structure.

Changing the control structure by means of **YAW** and **AVERAGE** only affects the coupling of axis 1 with axis 2, and only when it is activated (**COUPLE = 1**). The precondition for this is that a plausible controller amplification of the YAW control

circuit (**P 909 > 0**) be entered and it be a 2-axis coupling (**AXIS23** in the gantry control word is not set). Otherwise the functions **YAW** and **AVERAGE** are inactive and the bits in the gantry control word have no function.

If **AVERAGE = 1** is set, the control structure is changed. Only one control circuit is then active and this controls the average position of the two axes.

In the same way, the monitoring changes; using **P 909[3] UsrPosDiffMax**, the corresponding difference between axis 1 and axis 2 is now monitored (see Fig. 8.51: Enhanced gantry control structure).

With **YAW = 1**, an additional position control circuit is activated which controls the relative offset between axis 1 and axis 2 (see Fig. 8.51: Enhanced gantry control structure).

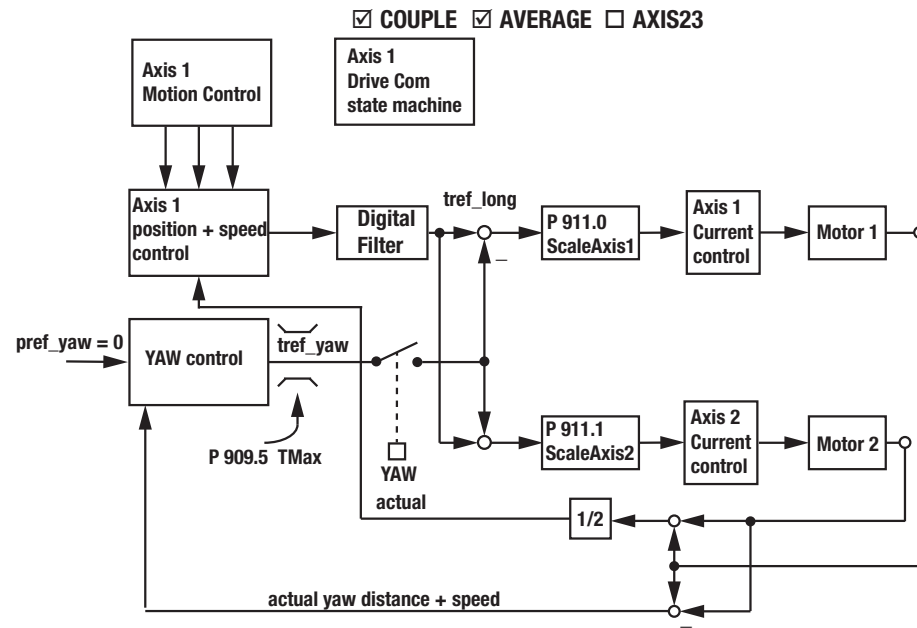


Fig. 8.51: Enhanced gantry control structure



## NOTE

- ScaleAxis1 and ScaleAxis2 affect the entire output signal of the control and thus also affect the limitation of the output signal. Any scaling also means a loss of peak torque.

## 8.14.2.2 Adaptation to the mass distribution using the example of a 2-axis gantry

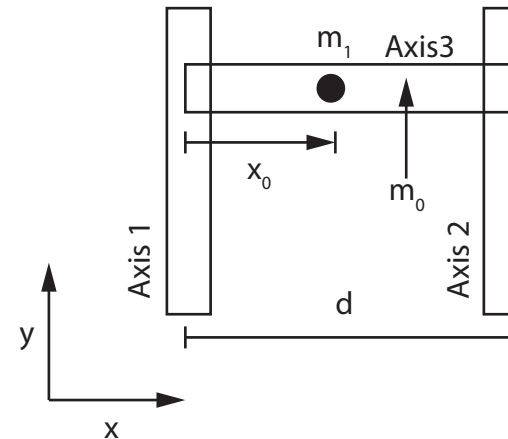


Fig. 8.52: Adaptation to the mass distribution

An example of the kinematics is shown in Fig. 8.52: Adaptation to the mass distribution. The y-axis is set up as a gantry while the x-axis is set up with a single drive. Use of the same motors is a prerequisite and it is permissible for the y-axis to be moved by one of the two motors. The mass  $m_1$  is moved by the x-axis; the mass of the mechanism moved in the y-direction is  $m_0$ .

If the mechanism is moved by axis 1 or 2 by itself, the individual drive “sees” the overall mass  $m$ . When the axes are moved while coupled, each control circuit “sees” only a portion of the mass  $m$ . If the x-axis is located at the centre, this is then 50% each; otherwise the following applies for the torque balance:

Virtual mass in the axis 1 control circuit:  $m_v1 = m_0/2 + m_1(d - x_0)/d$

Virtual mass in the axis 2 control circuit:  $m_v2 = m_0/2 + m_1x_0/d$

Proceed as follows to perform commissioning:

Step	Action
1.	Put the motor and encoder of axis 1 into operation. Load the motor data set.
2.	In the Control/Basic Settings dialog of axis 1: <ul style="list-style-type: none"> <li>Determine the inertia.</li> <li>Divide the inertia by two</li> <li>Set the control to 100% and move the y-axis via axis 1 for test purposes.</li> </ul>
3.	Copy the data set from axis 1 to axis 2. Adjust the direction if needed. Move the y-axis via axis 2 for test purposes.
4.	Both drives are now set up for joint movements of the gantry. Perform further optimisations for this operation case. When the gantry is moved by only one motor, the control is set up too softly, but this does not represent a problem.
5.	Generally, the relationship should be $m_0 \gg m_1$ , and the control is now set up properly for this. If this is not the case, map ScaleAxis1 and ScaleAxis2 from the control and scale the gain in accordance with the virtual mass – in dependence on the position of the x-axis – between about 100% and 70%.

### 8.14.3 Other functionalities in gantry mode

The functions of the axis controller are handled differently in the gantry mode. In part, the functionality of axis 1 is used – and thereby the parameters of axis 1 as well – and in part, the local parametrisation of the coupled axes remains in effect.

It is generally recommended that the parameters of axis 1 and the coupled axes be configured the same. Use the axis data sets function of DriveManager 5 to compare and apply the settings between the axis and the coupled axes as needed.

The following table provides an overview of the available settings:

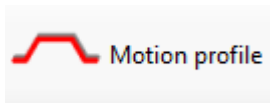
	Function of axis 1 active	Axes operate separately
DriveCom state machine and status LEDs	X	
EtherCAT control and status word, EtherCAT objects	X	
Encoder, multiturn simulation, homing, persistent homing		X
Motion profile, reference value generation	X	
scaling	X	
Position and speed control, feed forward control limitation of position, speed, torque and current	X	
Current control and motor control, motor data		X
Control thresholds. E.g. standstill or setpoint value reached	X	
Test signals, commissioning functions	X	
Error reaction settings	X	
Motor brake settings		X
Safety functions		X
Touchprobe function	X	
Motor and power stage protection, automatic switchover of the switching frequency		X

Table 8.38: Overview of the device functions

## 9 Motion profile

### Chapter overview

#### Pictogram



#### Navigation

► Project tree ► Axis adjustment ► X axis ► Motion profile

**Brief description** This chapter describes the available motion profiles, as well as their basic and special settings. The motion profile is always created per axis.

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## 9.1 Motion profile introduction

The basic motion profile must be configured. This includes all parameter settings regarding the reference source, scaling, stop ramps, error reactions, homing and state machine. Standard dialog boxes help the user configure the main parameters.

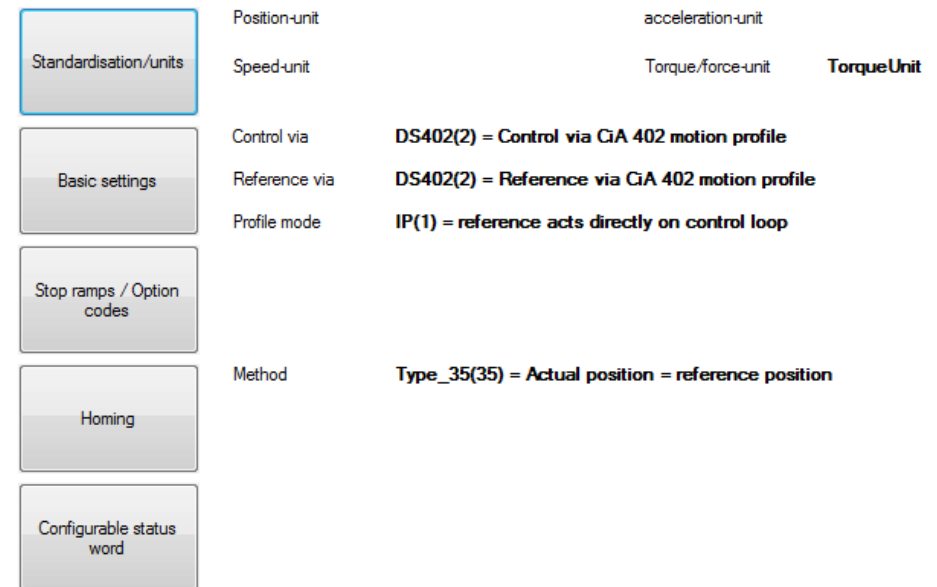


Fig. 9.1: Main Motion profile dialog box

Scaling must always be configured depending on the particular application. This may be custom scaling or scaling to DS402. Scaling to DS402 is recommended by default for initial commissioning. The “Scaling / units” dialog box provides assistance.



#### NOTE

- “DS402” means the “Draft Standard 402 - Part 2” of CAN in Automation (CiA). This specification has left draft status and is now valid, which is why it is officially known as “CiA 402. To maintain consistency with DriveManager 5 and the dialog boxes, the specification is still referred to as DS402 in this document.
- Refer to [www.can-cia.org](http://www.can-cia.org) for more information.

A basic distinction is still made whether the motion sequence (phys.: trajectory = path, space curve) is calculated in the device itself or sent to the drive controller by a higher-level controller via a fieldbus. The scaling configured in “Scaling / units” is incorporated.

Two operation modes are distinguished:

- **Profile generating (PG)**  
Internal calculation in the device by means of the integrated profile generator (specification of target value, acceleration, deceleration, smoothing), e.g. for simple point-to-point movements on single axes or manual mode using DriveManager 5.
- **Interpolating (IP)**  
Target values arriving cyclically are fine-interpolated based on the interpolation mode set (calculation of interpolated values between interpolation points), e.g. for synchronized movements of multiple axes in real time or coordinated movements of multiple axes.

Depending on the operation mode set, different parameters are effective. The settings also affect the operation mode of the EtherCAT® fieldbus system, that is defined by default as the reference source. If you are using the manual mode window in DriveManager 5, the reference source is switched to the internal profile generator (= parameter interface) for the duration of using the activated manual mode window.

DS402 defines different operation modes that cover operation using the internal profile generator or an interpolating mode of operation. It is thus possible to communicate with the internal profile generator via the fieldbus. In this case, only target and dynamic values are transmitted and the movement is initiated. With interpolating operation modes, the cycle time and interpolation time must also be taken into account. Then, target positions are cyclically specified and adopted by the controller at bus frequency.

In addition, the settings for stop ramps and homing are included in the motion profile. The ramp for deceleration is defined in the subject area “Stop ramps / Option codes”. It can be performed if an event arrives. Behaviour in response to various events is defined as option codes in accordance with DS402.

In subject area “Homing” it is possible to define a homing method with associated dynamic values for reference point finding. Homing is usually only required if there is no absolute value encoder system (excepting special cases).

## 9.2 Motion profile basic settings

**Set control and reference**

Control via  
DS402(2) = Control via CiA 402 motion profile

Reference via  
DS402(2) = Reference via CiA 402 motion profile

Motor control start condition  
Off(0) = Auto start off (edge detection on SwitchOn)

**Profile**

Profile mode  
IP(1) = reference acts directly on control loop

Jerk time  
0 ms

**Interpolation**

Interpolation type  
CUBIC(1) = Cubic spline interpolation

Cycle time  
1 ms

**Limit**

Speed override  
100 %

Rotation inhibit

Fig. 9.2: Subordinate dialog box Motion profile > basic settings

P No.	Index	Name	Unit	Description
2253 / 4301 / 6349	0	MPRO_DRVCOM_AutoStart		Axis 1 / 2 / 3: DriveCom system auto. start
2257 / 4305 / 6353	0	MPRO_DRVCOM_Init		Axis 1 / 2 / 3: Initialisation
2288 / 4336 / 6384	0	MPRO_CTRL_Sel		Axis 1 / 2 / 3: Control location selector
2289 / 4337 / 6385	0	MPRO_REF_Sel		Axis 1 / 2 / 3: Setpoint selector
2290 / 4338 / 6386	0	MPRO_REF_Override	%	Axis 1 / 2 / 3: Speed override
2291 / 4339 / 6387	0	MPRO_REF_JTime	ms	Axis 1 / 2 / 3: Smoothing time
2963 / 5011 / 7059	0	CON_REF_Mode		Axis 1 / 2 / 3: Profile mode
2969 / 5017 / 7065	0	CON_IP_Sel		Axis 1 / 2 / 3: Interpolation method

Table 9.1: Parameter list – Motion profile axis basic settings

### 9.2.1 Control and setpoint

The reference source and start condition are defined in “Control and setpoint”.

#### Control via

**P 2288[0] - MPRO\_CTRL\_SEL** defines which source to use for the control commands (e.g. activate control, apply setpoint, etc.).

- OFF(0) = No control location selector selected  
No external control possible.
- PARA(1) = Control via parameter interface  
Here, the internal control word is used that is also operated from the manual control window in DriveManager 5.
- DS402(2) = Control via CiA 402 EtherCAT®  
Control of the axis is defined by the DS402 device profile. Specifically, the control word (object 0x6040h) in the object directory has control over the axis. Depending on the EtherCAT® operation mode set (object 0x6060h) the control word / status word has a different meaning in each case. The status word then returns the state of the axis.

Value	Description
-128 ... -1	Manufacturer-specific operation modes
0	reserved
1	Profile Position Mode
2	Velocity Mode
3	Profile velocity mode
4	Torque profile mode
5	reserved
6	Homing mode
7	Interpolated Position Mode
8	Cyclic Synchronous Position Mode (CSP)
9	Cyclic Synchronous Velocity Mode (CSV)
10	Cyclic Synchronous Torque Mode (CST)
11 ... 127	reserved

Table 9.2: EtherCAT® operation modes for object 0x6060h “Modes of operation”

## Setpoint via

**P 2289[0] - MPRO\_REF\_SEL** defines from which source to apply the setpoints for control.

- OFF(0) = No setpoint selected  
No source defined.
- PARA(1) = Setpoint via parameter interface / manual mode  
The internal dynamic parameters are used. They are also operated and used by the manual control window of DriveManager 5.
- DS402(2) = Setpoint from CiA 402 EtherCAT®  
For control via EtherCAT® fieldbus, the objects defined in DS402 are used as setpoints, depending on the operation mode set in object 0x6060h (target speed, target position, target torque, etc.).
- HOMING(3) = Controller guided homing
- TAB(4) = Setpoint via table positioning

## Start condition of motor control

- Off(0) = Function not active
- On(1) = Autom. start (no edge evaluation)

## 9.2.2 Profile

### Profile mode

The profile mode in **P 2963[0] - CON\_REF\_MODE** defines whether to calculate the motion sequence (phys.: trajectory = path, space curve) in the device itself or to receive it from a higher-level controller. In this case, new target values for position, speed or torque are sent cyclically to the drive controller by a fieldbus system.

- PG(0) = Setpoint acts on profile generator  
Internal calculation in device by means of profile generator with 125  $\mu$ s = 8 kHz (specification of target value, acceleration, deceleration, smoothing),

e.g. for simple point-to-point movements on single axes or for manual mode via the DriveManager 5.

- IP(1) = Setpoint directly on control structure  
Target values arriving cyclically are fine-interpolated based on the interpolation mode set (calculation of interpolated values between interpolation points), e.g. for synchronized movements of multiple axes in real time or coordinated movements of multiple axes.

## Smoothing time

Ramp smoothing can be achieved with **P 2291[0] - MPRO\_REF\_JTIME** in milliseconds. Smoothing time is only effective if the internal profile generator is configured. The acceleration and braking phases are extended by one half of smoothing time. Smoothing time is used to achieve jerk limitation in sensitive mechanical constructions and thus, for example, to reduce mechanical stress and wear during start and deceleration phases.

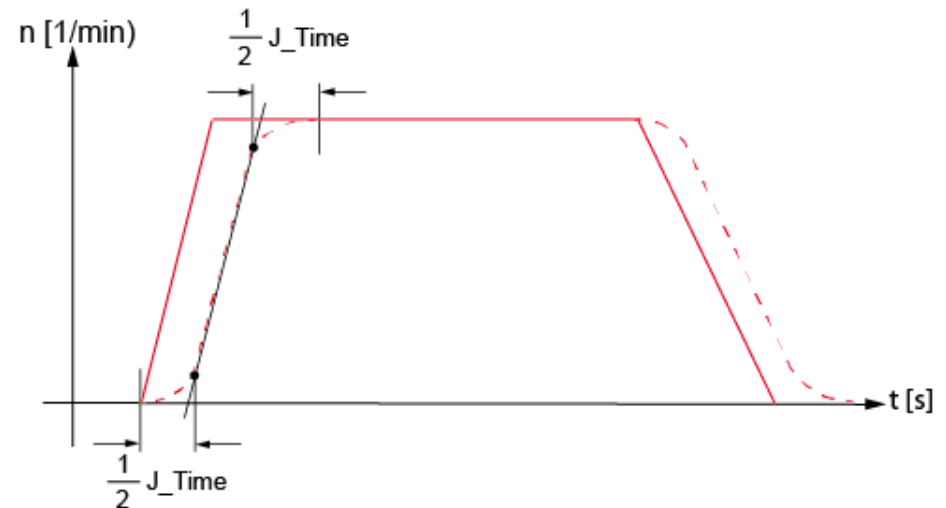


Fig. 9.3: Smoothing time in travel profile



## 9.2.3 Interpolation

### Interpolation type

The interpolation type in **P 2969[0] - CON\_IP\_Sel** defines with which mathematical method to calculate the interpolated points between two interpolation points. The interpolation type configured is only valid if an interpolating profile mode is set. The interpolation method is constantly applied to the cyclically arriving setpoint data. In addition to the basic mathematical functions, the degree of the polynomial is also distinguished.

- **LIN(0)** = Linear interpolation (no torque feed forward control)  
In this simple, but coarse method, two interpolation points are joined by a straight line.
- **CUBIC(1)** = Cubic spline interpolation  
This method works on a segment-by-segment basis using a cubic polynomial of the third degree between two interpolation points. This method returns more accurate results and is particularly suitable for dynamic movements.

### Cycle time

The cycle time is the interval at which a higher-level controller sends new data to the Axis Controller via the EtherCAT® fieldbus. In ServoOne CM this time cannot be edited manually. The EtherCAT® master automatically enters the cycle time in an object in the ServoOne CM object directory at start-up. The time entered by the master is displayed here.

## 9.2.4 Limitation

### Speed override

With the aid of **P 2290[0] - MPRO\_REF\_Override** it is possible to scale the current speed setpoint in percent online. This only applies to a profile-generating mode.

## 9.3 Scaling / Units

The subject area “Scaling / units” is called up via ►Project tree ►Axis adjustment ►X axis ►Motion profile ►Scaling / units. The physical data of the application is matched to the drive controller there. The scaling setting is necessary for every axis and always refers to the present application. Scaling is performed according to DS402 or user-specific scaling.

**Standardisation profile:** DS402(0) = Factor group defined by CiA 402

**Units:**

Position: PosUnit This unit will not be taken into account during the normalization process. It is only a string unit.

Speed: SpeedUnit

Acceleration: AccUnit

**Position:**

Feed constant: 360000 PosUnit

1 of driven shaft

Quick stop ramp: 60000000 AccUnit

**Velocity:**

Velocity constant: 1 PosUnit

1 s

Maximum deceleration time: 0.3 s

**Gear ratio (if available):**

Input revolutions (motor shaft): 1

Output revolutions (driving shaft): 1

**Position encoder resolution:**

1048576 = 2<sup>20</sup> (power of two)

1 (motor)

**Polarity of command values:**

Position control modes: ☒ clockwise ☐ anti-clockwise

Speed control modes: ☒ clockwise ☐ anti-clockwise

**Processing format:**

☒ absolute ☐ modulo (rotary table)

**Outcoming multibit resolution**

The actual setting of position controller resolution and position standardisation leads to a maximum range from:

2147483648 rev

-737280000 PosUnit

to:

2147487743 rev

737279999 PosUnit

☐ Expert Settings - Velocity

☐ Expert Settings - MT Base

Fig. 9.4: Scaling dialog box

This dialog box contains all of the main parameters for scaling to DS402. Objects (factor group) and conversion formulae are defined for units and factors. The conversion factors are automatically calculated based on the inputs (feed rate, gear ratio, etc.). User-specific scaling means that the conversion factors are calculated and input manually. All values and factors must then be input manually with the aid of lists based on **P 2299 - MPRO\_FG\_User**. The unit texts (e.g. **P 2301 - MPRO\_FG\_Units**) are still used. This leads to a non-standard scaling.

Index	Object	Name	Type	Attribute
608Fh	Array	position_encoder_resolution	Unsigned32	Read/Write
6090h	Array	velocity_encoder_resolution	Unsigned32	Read/Write
6091h	Array	gear_ratio	Unsigned32	Read/Write
6092h	Array	feed_constant	Unsigned32	Read/Write
6093h	Array	position_factor	Unsigned32	Read/Write
6094h	Array	velocity_encoder_factor	Unsigned32	Read/Write
608Eh	Var	polarity	Unsigned8	Read/Write

Table 9.3: Objects for scaling to DS402 supported by ServoOne CM

## 9.3.1 Setting options

### Scaling profile

The selection in **P 2298[0] - MPRO\_FG\_Type** defines the scaling type (0 = DS402 or 1 = user-specific). The user-specific scaling type is only intended for internal tests; do not use this in your application.

### Units

A higher-level controller can describe and overwrite the scaling objects. The units (**P 2301 - MPRO\_FG\_Units**) are merely text labels and can be input individually (free text). This text is then displayed as a unit for other parameters in DriveManager 5 that make reference to scaling (e.g. actual speed, actual position, target speed, target position, etc.).

### Position (object 6092h)

A higher-level controller can describe and overwrite the scaling objects. The feed constant must be specified for the position. It is the quotient of feed rate [in user unit] and the number of revolutions [rpm] on the drive shaft.

The position unit should have a higher resolution than that which the application itself requires. A high-resolution position unit increases the quality of the feed-forward control signals. However, it reduces the width of the multturn information and thereby the possible positioning range as well.

### Speed (MPRO\_402\_VelEncRes2)

A higher-level controller can describe and overwrite the scaling objects. If a higher-level controller is used as the setpoint source, the speed factor remains unchanged 1:1. Then, position and speed have the same basic unit (e.g. mdeg and mdeg/s). Speed scaling between drive and controller then match. Deviating from this, the speed factor can be modified or adjusted by activating “Advanced speed setting”. For this purpose, this factor must be taken into account in higher-level controllers. Thus, position and speed may have different units (e.g. mdeg and rpm).

### Examples of position and speed

Fig. 9.5: Example 1: Unit [mdeg] for position and unit [rpm] for speed

Fig. 9.6: Example 2: Unit [μm] for position and unit [μm/s] for speed

Position:

Feed constant:

200000 um

1 of driven shaft

Velocity:

1 um/s

1000 mm/s

☒ Expert Settings - Velocity

Fig. 9.7: Example 3: Unit [ $\mu\text{m}$ ] for position and unit [ $\text{mm/s}$ ] for speed

## Quick Stop Ramp

This is a deceleration ramp that is performed depending on the event that occurs. The quick stop ramp entered here [in user units] is the same as in the subject area "Stop ramps / option code". It is also contained in this dialog box to demonstrate that the ramp depends on the scaling (that may have been modified) and needs to be adjusted.

## Gear ratio (object 6091h)

A higher-level controller can describe and overwrite the scaling objects. If there is a gear unit in the application, the gear ratio (i) must be specified here. The ratio is the quotient of input revolution and output revolution. An  $i > 1$  corresponds to a gear reduction, an  $i < 1$  corresponds to a gear transmission.

## Internal singleturn resolution (object 608Fh)

This parameter defines how many increments represent one revolution in the device (= resolution). The value can be given as an absolute value or as an exponent of base 2.

A high internal signal resolution increases the quality of the feed-forward control signals. However, it reduces the width of the multiturn information and thereby the possible positioning range as well.

## Direction of rotation (object 607Eh)

The direction of rotation for positioning and speed control can be configured separately. By default, clockwise rotation is set for both.

## Process format

The process format defines the mode of positioning. If it is "absolute", the system moves absolutely to every target position set. If the "modulo" option (= division with remainder) is selected, the round table mode is used. Additional parameters are displayed in the dialog box for this purpose.

### Processing format:

☐ absolute ☒ modulo (rotary table)

upper position  um

lower position  um

### Position option:

☒ as linear

☐ left direction

☐ right direction

☐ shortest way

Fig. 9.8: Parameter for round table mode

In round table mode, the position is interpreted by default from  $0^\circ$  to  $360^\circ$  and from the defined upper to lower limit in user units. If the upper or lower positions are exceeded/not reached, the position is inverted. A multiple is also possible. The way in which the system travels to a target value in modulo mode can be defined using the process option. For example, the path-optimized method calculates and uses the shortest path from current position to target position.

## 9.3.2 Possible positioning range

Both the position unit and the internal singleturn resolution restrict the positioning range which can be displayed. The range which can be displayed must not be exceeded for absolute positioning commands in the profile mode (e.g. EtherCAT PP) and positioning in the interpolating mode (e.g. EtherCAT CSP). Otherwise, the target

position could be interpreted differently by the axis than the user expects. For relative or infinite positioning in the profile mode, the axis operates incrementally; exceeding the positioning range is permitted.



#### NOTE

- Take note of the information on this with respect to the overflow correction of the position in the Section "Overrun correction of the position" on page 116.

Use the modulo position correction for round tables and similar applications.

### Display of resulting multiturn resolution

This part of the dialog box displays the current maximum setpoint range which results from the setting of the position control resolution and the position scaling. Two messages indicate when setting ranges have been exceeded during the configuration.

The upper message indicates that the scaled multiturn range is greater than the range which can be covered by the encoder. There is no expedient use for the additional bits. Adapt the internal resolution to match the multiturn resolution of the encoder.

The lower message indicates that the selected position unit cannot display the multiturn resolution available internally. Select a position unit with a lower resolution if this is possible in combination with the controller.

### Outcoming multiturn resolution

The actual setting of position controller resolution and position standardisation leads to a maximum range from:

2147483648	rev
-75497472000	E-3 deg

to:

2151677951	rev
75497471999	E-3 deg

☐ Expert Settings - MT Base

The selected resolution is greater than the multiturn range of the position encoder.

Caution! Exceeded the maximum representable range of 2 to the power of 32 [E-3 deg].

Fig. 9.9: Display of resulting multiturn resolution

## 9.3.3 Parameters

P No.	Index	Name	Unit	Description
2301 / 4349 / 6397		MPRO_FG_Units		Axis 1 / 2 / 3: Factor Group units
2301 / 4349 / 6397	0	PosUnit		Units for position values
2301 / 4349 / 6397	1	SpeedUnit		Unit for speed values
2301 / 4349 / 6397	2	AccUnit		Acceleration unit
2301 / 4349 / 6397	3	TorqueUnit		Unit for torque values
2298 / 4346 / 6394	0	MPRO_FG_Type		Axis 1 / 2 / 3: Factor group scaling type
2299 / 4347 / 6395		MPRO_FG_User		Axis 1 / 2 / 3: Factor group - User-specific scaling
2299 / 4347 / 6395	0	Num		Numerator
2299 / 4347 / 6395	1	Den		Denominator

Table 9.4: Parameter list – Motion profile axis – Scaling / units

P No.	Index	Name	Unit	Description
2299 / 4347 / 6395	2	SpeedFac		Speed factor
2299 / 4347 / 6395	3	AccFac		Acceleration factor
2299 / 4347 / 6395	4	Reverse		Reversing (speed and position)
2300 / 4348 / 6396	0	MPRO_FG_PosNorm	incr/rev	Axis 1 / 2 / 3: Factor group – Internal position resolution
2303 / 4351 / 6399		MPRO_FG_UserValues		Axis 1 / 2 / 3: Factor group – Actual values (user units)
2303 / 4351 / 6399	0	SpeedAct	SpeedUnit	Actual speed value in user units
2303 / 4351 / 6399	1	SpeedRef	SpeedUnit	Setpoint speed in user units
2303 / 4351 / 6399	2	SpeedCmd	SpeedUnit	Speed command in user units
2303 / 4351 / 6399	3	SpeedDiff	SpeedUnit	Speed difference in user units
2303 / 4351 / 6399	4	PosDiff	PosUnit	Position tracking error in user units
2303 / 4351 / 6399	5	PosAct	PosUnit	Actual position value in user units
2303 / 4351 / 6399	6	PosRef	PosUnit	Setpoint position value in user units
24818 / 26866 / 28914	0	PositioningOC		Axis 1 / 2 / 3: Option code positioning
2304 / 4352 / 6400		MPRO_FG_BackupActPos		Backup values for multiturn overflow in modulo operation
2304 / 4352 / 6400	0	ActPosMT		Backup current multiturn position from position encoder
2304 / 4352 / 6400	1	OverflowCounter		Number of overflows
2305 / 4353 / 6401	0	MPRO_FG_ModuloComp		Axis 1 / 2 / 3: Modulo position correction
2306 / 4354 / 6402		MPRO_FG_Settings		Axis 1 / 2 / 3: Factor group settings
2306 / 4354 / 6402	0	ActPosDelayTime	ms	Actual position delay sent to master (125 us scanning time)
2306 / 4354 / 6402	1	reserved		

Table 9.4: Parameter list – Motion profile axis – Scaling / units (continue)

## 9.4 Stop ramps / option codes

See Section "Stop ramps" on page 502.

## 9.5 Homing

The dialog box for selecting and configuring homing is called up via ►Project tree ►Axis adjustment ►X axis ►Motion profile ►Homing.



### NOTE

- Further information about homing can be found in Section "Homing / homing mode" on page 470.

### 9.5.1 Settings

Homing is a function used to determine and define a reference point within a range of travel. The result is thus an absolute reference point. Homing is required for positioning if there is no absolute value encoder. There are different methods of finding a reference point. This may be a buffer limit stop, a reference mark or a zero pulse. The various methods (0 to 37) are described and standardised in DS402. There are also a number of manufacturer-specific methods (< 0). These are special methods, some of which may also be used with absolute value encoders.

Some homing methods may require dynamic parameters. These are mainly required for homing methods that perform a movement. All of the main parameters are defined in a dialog box in the subject area "Homing".

Fig. 9.10: Homing dialog box

### Speeds

Two speeds V1 and V2 can be specified. Depending on the homing method, they are used differently to find the reference point. Speeds should be chosen appropriately.

### Homing offset

If the home point has been reached, a home offset **P 24700[0] - HomeOffset** can also be taken into account by adding it to the actual homing position.

### Max. distance during homing

With the aid of the **P 2280[0] - MC\_HOMING\_MaxDistance** input it is possible to limit the path (distance). If no reference is found after travelling the path, the search is aborted.

## 9.5.2 Parameters

P No.	Index	Name	Unit	Description
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA 402 Reference point shift
24728 / 26776 / 28824	0	HomingMethod		Axis 1 / 2 / 3: CiA 402 Homing method
24729 / 26777 / 28825		HomingSpeeds		Axis 1 / 2 / 3: CiA 402 Homing speeds
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA 402 Homing acceleration
2279 / 4327 / 6375	0	MC_HOMING_TMaxScale	%	Axis 1 / 2 / 3: Torque scaling during homing
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
2281 / 4329 / 6377		MC_HOMING_Settings		Axis 1 / 2 / 3: "Homing" settings
2281 / 4329 / 6377	0	SimEnable		Homing simulation
2281 / 4329 / 6377	1	EncMode		Homing start
2281 / 4329 / 6377	2	IndexPulseOffset		Absolute movement after homing
2282 / 4330 / 6378		MC_HOMING_Backup		Axis 1 / 2 / 3: Position backup
2282 / 4330 / 6378	0	HomeDiffST		Singleturn position backup
2282 / 4330 / 6378	1	HomeDiffMT		Multiturn position backup
2282 / 4330 / 6378	2	Valid		Backup
2283 / 4331 / 6379	0	MC_HOMING_Backup_User	PosUnit	Axis 1 / 2 / 3: Position backup in user units
2284 / 4332 / 6380	0	MC_HOMING_SimState		Axis 1 / 2 / 3: Homing simulation state

Table 9.5: Parameter list – Motion profile axis homing

## 9.6 Touch probe

The Touch probe function is implemented in accordance with DS402 and described in the subject area "EtherCAT®" in Section "Touch probe" on page 523.

## 9.7 State machine

On the one hand, the purpose of a state machine is to divide functions and functionalities into separate states. On the other, it also enable defined transitions. A distinction is made between different state machines.

### 9.7.1 Drive controller state machine

This state machine is implemented in accordance with the definition of DRIVECOM User Group e.V., ([www.drivecom.org](http://www.drivecom.org)). It defines the basic states of the controller (e.g. ready for starting, switched on, quick stop, etc.). The state machine can be influenced by different sources (e.g. fieldbus, manual mode, terminal, etc.).

Some of the special features of the implemented state machine are described below:

the controller enters "Not ready for starting" state if

- no motor data set is loaded (**P 2964[0] - MOT\_Type = 0**)
- any axis encoder is not ready.

This gives a higher-level controller a reliable indication of whether position informations are valid or not. The controller can retrieve the information from the ControlReady and EncoderReady bits of the DriveCom control word (**P 2251[0] - MPRO\_DRVCOM\_Controlword**, for details see Section "Configurable control word and status word" on page 518).

If parameter settings were changed that require initialisation for activation, they are flagged internally. Initialisation is performed before the next state change of the state machine if the motor controller is still switched off.

**P 2257[0] - MPRO\_DRVCOM\_Init** can be used to start initialisation independently of a state change. This is helpful, for example, to retrieve current position values after any changes to the encoder setting or current temperature values after changing the motor temperature sensor.

The following values can be set manually in **P 2257[0] - MPRO\_DRVCOM\_Init**:

- **START(2)** – triggers an initialisation of the settings flagged for initialisation.
- **FORCE(4)** – triggers an initialisation of all settings.
- **ERRQUIT(5)** – resets an error if the state machine is in error state. Otherwise, it triggers an initialization of the settings flagged for initialization.

P No.	Index	Name	Unit	Description
2248 / 4296 / 6344	0	MPRO_DRVCOM_State		Axis 1 / 2 / 3: DriveCom state
2249 / 4297 / 6345	0	MPRO_DRVCOM_StateText		Axis 1 / 2 / 3: DriveCom state (text)
2250 / 4298 / 6346	0	MPRO_DRVCOM_Statusword		Axis 1 / 2 / 3: DriveCom status word
2251 / 4299 / 6347	0	MPRO_DRVCOM_Controlword		Axis 1 / 2 / 3: DriveCom control word
2252 / 4300 / 6348	0	MPRO_DRVCOM_FaultReset		Axis 1 / 2 / 3: DriveCom fault reset
2253 / 4301 / 6349	0	MPRO_DRVCOM_AutoStart		Axis 1 / 2 / 3: DriveCom system auto. start
2257 / 4305 / 6353	0	MPRO_DRVCOM_Init		Axis 1 / 2 / 3: Initialisation

Table 9.6: Parameter list – Motion profile axis – State machine

### 9.7.2 Fieldbus system state machine

Most fieldbus systems (e.g. CANopen, EtherCAT®, OPC-UA, etc.) include their own state machines. The state machine for the EtherCAT® fieldbus system is also included in ServoOne CM. This model also defines states in which various services are available for communication (e.g. OPERATIONAL (OP): PDO service active, SDO service active, etc.). The EtherCAT® state machine is operated by the NMT service (Network Management). The transitions are influenced by the control and status word and the mode of operation.



#### NOTE

- Details about the EtherCAT® state machine can be found in Section "EtherCAT® state machine" on page 509.



## 9.8 Status word

Status	Source parameter	Bit number
<input type="radio"/>	SYSIO(0) = System IO state (parameter MPRO_INPUT_SysState) ▼	0
<input type="radio"/>	SYSIO(0) = System IO state (parameter MPRO_INPUT_SysState) ▼	0
<input type="radio"/>	SYSIO(0) = System IO state (parameter MPRO_INPUT_SysState) ▼	0
<input type="radio"/>	SYSIO(0) = System IO state (parameter MPRO_INPUT_SysState) ▼	0

Configurable Statusword:

Fig. 9.11: Configurable status word dialog box

In many applications it is necessary to send status information from many different sources at set intervals to a controller for evaluation. The configurable status word allows you to collect status bits and thus to save transmission bandwidth.

In DriveManager 5 you can configure the status word in the dialog box in ►Project tree ►Axis adjustment ►X axis ►Motion profile ►Control and status bit.

The configurable status word is a **P 2332[0] - MPRO\_INPUT\_StatusWord**. Bits 0 to 3 can represent status bits from other status parameters. They are selected in

**P 2331 - MPRO\_INPUT\_StatusSel**. Bits 6 and 7 are hard-coded:

- Bit 6: PowerFail signal from the supply unit: The mains voltage is switched off (see Section "Supply unit" on page 36).
- Bit 7: Control bit for external motor brake: 1 => the external drive brake is to be opened (see Section "Motor brake" on page 66).

P No.	Index	Name	Unit	Description
2331 / 4379 / 6427		MPRO_INPUT_StatusSel		Axis 1 / 2 / 3: Configurable status word selector
2331 / 4379 / 6427	0	Source		Source selector
2331 / 4379 / 6427	1	BitNo		Bit number
2331 / 4379 / 6427	2	Source		Source selector
2331 / 4379 / 6427	3	BitNo		Bit number
2331 / 4379 / 6427	4	Source		Source selector
2331 / 4379 / 6427	5	BitNo		Bit number
2331 / 4379 / 6427	6	Source		Source selector
2331 / 4379 / 6427	7	BitNo		Bit number
2332 / 4380 / 6428	0	MPRO_INPUT_StatusWord		Axis 1 / 2 / 3: Configurable status word

Table 9.7: Parameter list – Motion profile axis, configurable status word

## 9.9 Control word

A general control word has been created in **P 2333[0] - MPRO\_INPUT\_ControlWord**. It cannot be configured for reasons of safety. Only bit 7 is currently used:

- Bit 7: Status bit of external motor brake: 1 => the external drive brake was opened.

P No.	Index	Name	Unit	Description
2333 / 4381 / 6429	0	MPRO_INPUT_ControlWord		Axis 1 / 2 / 3: Control word for special functions

Table 9.8: Parameter list – Motion profile axis, configurable status word

## 9.10 Advanced functions of motion profile

### 9.10.1 Retract movement

The retract movement is designed to move individual axes out of the danger zone in the event of a mains power failure to prevent collisions when shutting the system down. The function is only available if the drive is in position control. It can only be activated via an input (see Section "Digital inputs" on page 208).

In **P 2260 - MPRO\_DRVCOM\_RetractMove** an absolute or relative positioning command (with target position, speed, acceleration and deceleration) is configured. It is performed on request. As long as the retract movement is active, the DriveCom state machine is in "QuickStop" state. The request is represented in bit 23 of **P 2251 [0] - MPRO\_DRVCOM\_Controlword**, the state in bit 24 of the DriveCom status word **P 2250[0] - MPRO\_DRVCOM\_Statusword**.

P No.	Index	Name / Setting	Unit	Description
2260 / 4308 / 6356		MPRO_DRVCOM_RetractMove		Axis 1 / 2 / 3: Retract movement data
2260 / 4308 / 6356	0	Pos	PosUnit	Position
2260 / 4308 / 6356	1	Spd	SpeedUnit	Speed feed forward control
2260 / 4308 / 6356	2	Acc	AccUnit	Acceleration
2260 / 4308 / 6356	3	Dec	AccUnit	Deceleration
2260 / 4308 / 6356	4	Mode		Position mode

Table 9.9: Parameter list – Motion profile axis, advanced motion profile functions

### 9.10.2 Retract movement after auto commutation

Many controllers scan the current position of the drive when the controller starts up and use this as a start value for the position setpoint **P 24698[0] - TargetPosition**. This can cause problems if the drive moves during the start-up phase, e.g. as a result of auto commutation (see Section "Synchronous motor autocommutation" on page 152).

**P 2262[0] - EnOpOPC** remedies this situation. Set the parameter to MOVE(1) to move the drive to the setpoint position defined in **TargetPosition** before it reaches "OperationEnabled" state. This function uses the fast speed and the homing acceleration (see Section "Homing" on page 202). If the deviation of the current position of **TargetPosition** is greater than the limit **P2262[2] - EnOpDistance**, an error is output.

Set **EnOpOPC** = STD(0) for backwards-compatible behaviour without movement.

P No.	Index	Name / Setting	Unit	Description
2262 / 4310 / 6358	0	EnOpOPC		Enable operation option code
		STD(0)		No device-assisted positioning on transition to OperationEnabled
		MOVE(1)		Move to reference position on transition to OperationEnabled
	2	EnOpDistance	...	EnOpDistance

Table 9.10: Parameter list – Motion profile axis, advanced motion profile functions

## 9.11 Input shaping

ID	Index	Name	Unit	Description	Data type
2263		MPRO_402_Shaping		Axis 1: Input shaping in Profile position mode	
2263	0	Mode	-	Input shaping mode: <ul style="list-style-type: none"> <li>STD (0) = Standard mode</li> <li>SH1F (1) = Input shaping for one frequency without damping"</li> </ul>	uint8
2263	1	Frequency	Hz	First frequency to respect	float32

Table 9.11: Parameter - Input shaping

The term 'input shaping' refers to the execution of motion blocks in such a way that certain resonant frequencies are not excited.



### NOTE

- Input shaping is only possible in the Profile mode (Profile Position Mode) because in this case, the axis module controls the execution of the motion block.

When the default setting **P 2263[0] Mode = STD** is used, the fastest possible path is calculated using the maximum values for speed, acceleration and deceleration. This form of path generation is always active for halt and stop ramps.

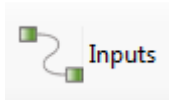
Set **P 2263[0] Mode = SH1F** for input shaping in dependence on a resonant frequency.

Set the frequency in **P 2263[1] - Frequency**. The path will be generated in such a way that this frequency will not be excited.

# 10 Digital inputs

## Chapter overview

### Pictogram



### Navigation

► Project tree ► Axis adjustment ► X axis ► Digital inputs

### Brief description

This chapter describes the configuration options for digital inputs.

### Contents

10.1 Digital inputs .....208

## 10.1 Digital inputs

**Digital standard inputs:**

		Low active	Digital Filter	
ISD00	None(0) = No function	<input type="checkbox"/>	0 ms	Options...
ISD01	None(0) = No function	<input type="checkbox"/>	0 ms	Options...
ISD02	None(0) = No function	<input type="checkbox"/>	0 ms	Options...

Status of digital inputs:

- ☒ ISD00
- ☐ ISD01
- ☐ ISD02

Fig. 10.1: Digital standard inputs dialog box, example Axis 1



### NOTE

- All input functions are now multi-input capable. If more than one input has the same function, then these inputs operate together with an OR link. The selected output function is active as long as at least one input is active.

P No.	Index	Name	Unit	Description
2329 / 4377 / 6425		MPRO_INPUT_Config		Axis 1 / 2 / 3: Dig. inputs settings
2329 / 4377 / 6425	0	Inverse		Inversion of inputs
2329 / 4377 / 6425	1	FilterTime_DI01	ms	Filter time DI01
2329 / 4377 / 6425	2	FilterTime_DI02	ms	Filter time DI02
2329 / 4377 / 6425	3	FilterTime_DI03	ms	Filter time DI03
2329 / 4377 / 6425	4	FuncSel_DI01		Function selector DI01
2329 / 4377 / 6425	5	FuncSel_DI02		Function selector DI02
2329 / 4377 / 6425	6	FuncSel_DI03		Function selector DI03

Table 10.1: Parameter list – Digital inputs axis

P No.	Index	Name	Unit	Description
2328 / 4376 / 6424		MPRO_INPUT_State		Axis 1 / 2 / 3: State of digital inputs Axis 1: Inputs DI00 -DI02 Axis 2: Inputs DI03-DI05 Axis 3: Inputs DI06-DI08 <i>see also section "Digital input parameters" on page 210 Table 10.2: Digital input parameters Table 10.2: Digital input parameters</i>
2328 / 4376 / 6424	0	State		Status of digital inputs
2328 / 4376 / 6424	1	StateFil		Status of digital inputs (filtered)

Table 10.1: Parameter list – Digital inputs axis (continue)

## 10.1.1 Status of the digital inputs

The status of the digital inputs **P 280[0] - MPRO\_INPUT\_SysState** is refreshed at an interval of 125 µs. Independent of the number of axes, all inputs are always evaluated here.

If an input is inverted in its function (**P 2329[0] - Inverse**), its status is also displayed inverted in the input map. The status of the ISDx inputs is always displayed inverted (1 = safety function requested).

The touchprobe function is implemented in accordance with ETG profile and uses inputs DI08, DI09, DI10 (Section "Touch probe" on page 523). Input allocations are fixed.

Id	Sub id	Name	Value	Unit	Introduction
2328		MPRO_INPUT_State			Axis 1: States of digital i
2328	0	State	0000000000000000...		States of digital inputs
2328	1	StateFil	0000000000000000...		States of filtered and inv
2329		MPRO_INPUT_Config			Axis 1: Configuration of
2329	0	Inverse	0000000000000000...		Input inversion
2329	1	FilterTime_DI01	0		Filter time for DI01
2329	2	FilterTime_DI02	0		Filter time for DI02
2329	3	FilterTime_DI03	0		Filter time for DI03
2329	4	FuncSel_DI01	None		Function of digital input I
2329	5	FuncSel_DI02	None		Function of digital input I
2329	6	FuncSel_DI03	None		Function of digital input I

Open the panel "Bits" with a double click on status word.

Bits of 2328[0]...

- ISD\_1
- ISD\_2
- ISD\_3
- Bit 3
- Bit 4
- Bit 5
- Bit 6
- Bit 7
- Bit 8
- Bit 9
- Bit 10
- Bit 11
- Bit 12
- Bit 13
- Bit 14
- Bit 15
- Bit 16
- Bit 17
- Bit 18
- Bit 19
- Bit 20
- Bit 21
- Bit 22
- Bit 23
- Bit 24
- Bit 25
- Bit 26
- Bit 27
- Bit 28
- Bit 29
- Bit 30
- Bit 31

Fig. 10.2: Status of the digital standard inputs

ID	Index	Name / Bit	Description	Axis assignment
280	0	MPRO_INPUT_SysState	State of digital inputs	
		(0)DI00	Digital input DI00	DI01 axis 1
		(1)DI01	Digital input DI01	DI02
		(2)DI02	Digital input DI02	DI03
		(3)DI03	Digital input DI03	DI01 axis 2
		(4)DI04	Digital input DI04	DI02
		(5)DI05	Digital input DI05	DI03
		(6)DI06	Digital input DI06	DI01 axis 3
		(7)DI07	Digital input DI07	DI02
		(8)DI08	Digital input DI08	DI03
		(9)DI09	Digital input DI09	Touch Probe
		(10)DI010	Digital input DI010	Touch Probe
		(11)ISD_ST01_IN1	Safety input SDI0	
		(12)ISD_ST01_IN2	Safety input SDI1	
		(13)ISD_ST02_IN1	Safety input SDI2	
		(14)ISD_ST02_IN2	Safety input SDI3	

Table 10.2: Digital input parameters

## 10.1.2 Input functions

The following functions can be allocated to the digital inputs:

Setting	Function
(0) None	no function
(1) LimP	Positive hardware limit switch
(2) LimN	Negative hardware limit switch
(3) HomeSw	Reference mark (see Section "Homing" on page 202)

Table 10.3: Configuration of the digital inputs

Setting	Function
(4) FieldbusJogN	No internal function but indicates that the input is read and evaluated by controller. Jog in negative direction
(5) TabEnable	Reserved
(6) RetrMove	Quick stop with retract movement (see Section "Advanced functions of motion profile" on page 206)
(7) Quickstop	Request quick stop (see DS402). The input must be set to Low in order to reach SwitchOn.
(8) Halt	Request halt (see DS402). The input must be set to Low in order to reach SwitchOn.
(9) BrakeCtrl	Input monitors motor brake but has lower priority than <b>MPRO_BRK_Lock</b> . If multiple inputs are configured to BrakeCtrl, the brake is vented if at least one input is active.

Table 10.3: Configuration of the digital inputs (continue)

The hardware limit switches are used for position limitation and can be used as a reference mark for homing operations (Section "Homing" on page 202).

If the drive travels up to or past a limit switch apart from homing operations, an E-27-2 or E-27-3 error is triggered. After resetting the error, the drive can only be moved in the direction back to the permissible positioning range. Once this range has been reached, both directions of movement are possible again.

A separate error message E-27-1 indicates that the limit switches were swapped (positive limit switch was crossed during negative movement or vice versa).

If the error reaction limit switch error (**P 2153[18] - HWLimitSwitch**), (see also chapter 12.2 Error reactions) is set to Ignore, the error messages will be suppressed and instead, a quick stop will be executed by the device. If you use this option

together with the QuickStop option code "...Remain in QuickStop" (see also chapter 13.15 Stop ramps), then the axis is available once again after the quick stop and can be moved in the direction that brings it back into the permitted positioning range.

## 10.1.3 Functional state of the digital inputs

The objects **0x60FD**, **0x68FD** and **0x70FD** indicate the axis-related functional state of the digital inputs.

Object	Index	Parameter	Name	Description	Type
0x60FD	0000	24829	DigitalInputs	Axis 1: CiA 402 digital inputs	uint32
0x68FD	0000	26877	DigitalInputs	Axis 2: CiA 402 digital inputs	uint32
0x70FD	0000	28925	DigitalInputs	Axis 3: CiA 402 digital inputs	uint32

To do so, the function selectors of the digital inputs (MPRO\_INPUT\_Config) must be set accordingly for the functions negative hardware limit switch, positive hardware limit switch or reference mark. The status of the STO is also indicated even without prior parametrisation.

### Example configuration / Setting of the function selectors in DriveManager 5:

**Digital standard inputs:**

		Low active	Digital Filter	
DI00	LimP(1) = Positive limit switch	<input type="checkbox"/>	0 ms	Options...
DI01	LimN(2) = Negative limit switch	<input type="checkbox"/>	0 ms	Options...
DI02	HomeSw(3) = Homing switch	<input type="checkbox"/>	0 ms	Options...

Status of digital inputs:

- ☒ DI00
- ☒ DI01
- ☒ DI02

### Meaning of the individual bits:

Object	Bit	Meaning
0x60FD 0x68FD 0x70FD	0	Status of negative hardware limit switch
	1	Status of positive hardware limit switch
	2	Status of reference mark
	3-17	Reserved
	18	Status of STO (low active)
	19-31	Reserved

### Meaning of the state of the bits:

Logical state	Meaning
0	Switched off / inactive
1	Switched on / active

## 10.1.4 STO function

STO is available via the inputs and the configuration of the DIL switches only in the SDO device version.

In the SDC device version, the DIL switches are for FSoE address configuration and the safe inputs can be used as desired in the safety program. The STO must be enabled/disabled from that location.



### NOTE

- Further information on the SDC device version can be found in ServoOne CM Specification SDC (ID No.:1400.206B.x).
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com) in the DOCU-PORTAL.

### 10.1.4.1 STO function selector switch



#### NOTE

- Only the two permissible switch settings are listed here in order to simplify commissioning.
- Please refer to ServoOne CM Specification SD0 (ID No.: 1400.402B.x) for a complete description of the STO function (description of function, connections, configuration, wiring and commissioning, validation).
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com) in the DOCU-PORTAL.

Because the ServoOne CM can take the form of a single-axis, double-axis or triple-axis controller, it has two digital inputs STO1/STO2 that can have two channels each. You can use the DIL switch bank S-ADR to select two different presets.

	Switch position DIL switches S-ADR	Function	affects
Joint switching of all axes		STO1	Axis 1 Axis 2* Axis 3*
		STO2	no function!
Separate switching of all axes		STO1	Axis 1
		STO2	Axis 2* Axis 3*
* if axis exists			

Table 10.4: Default STO1/STO2 Axis Controller

### 10.1.4.2 Test pulse monitoring selector switch



#### NOTE

- Only the two permissible switch settings are listed here in order to simplify commissioning.
- Please refer to ServoOne CM Specification SD0 (ID No.: 1400.402B.x) for a complete description of test pulse monitoring (description of function, connections, configuration, wiring and commissioning, validation).
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com) in the DOCU-PORTAL.



To identify short-circuits and cross-circuits in the wiring of inputs, it is additionally possible to modulate test pulses to the input signals. The test pulses can be monitored by Axis Controller.



## NOTE

- If the test impulse monitoring is switched on by means of DIP switch S-ADR [6,7], it is possible that the error message "35-8 STO\_TPX external test impulse error" may occur during a firmware update of the supply unit because the test impulses are switched off briefly during the update.


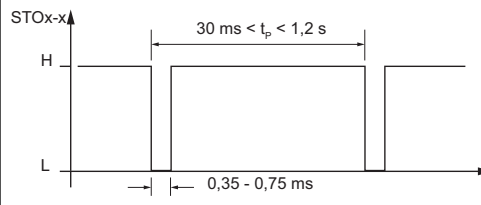

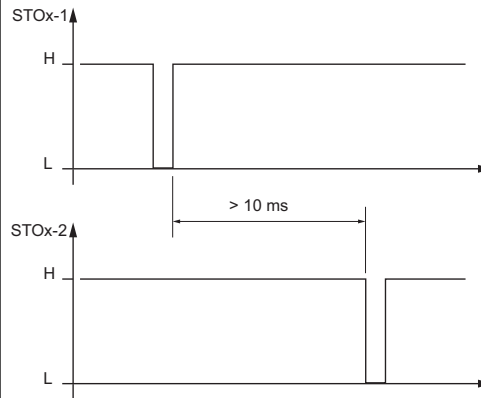
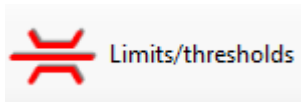
Switch position DIL switches S-ADR	Function	Test pulse format
	Test pulse monitoring is <b>enabled</b> on input	
	Test pulse monitoring is <b>disabled</b> on input	

Table 10.5: Test pulse monitoring switch position

# 11 Limitations and Thresholds

## Chapter overview

### Pictogram



### Navigation

► Project tree ► Axis adjustment ► X axis ► Limitations / thresholds

### Brief description

This chapter describes the possible limit values and thresholds.

### Contents

11.1 Limitations	214
11.2 Thresholds	217
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## 11.1 Limitations

The Supply unit ServoOne CM-P and the Axis Controller ServoOne CM are protected by various mechanisms against damage, e.g. caused by overcurrent or overtemperature. These mechanisms and their limit values cannot be changed.

Additional, narrower limits and thresholds can be defined to protect the connected motor and downline mechanical components. Position, speed, torque and current can be limited separately and independently. The limitations refer to the motor's rated data.

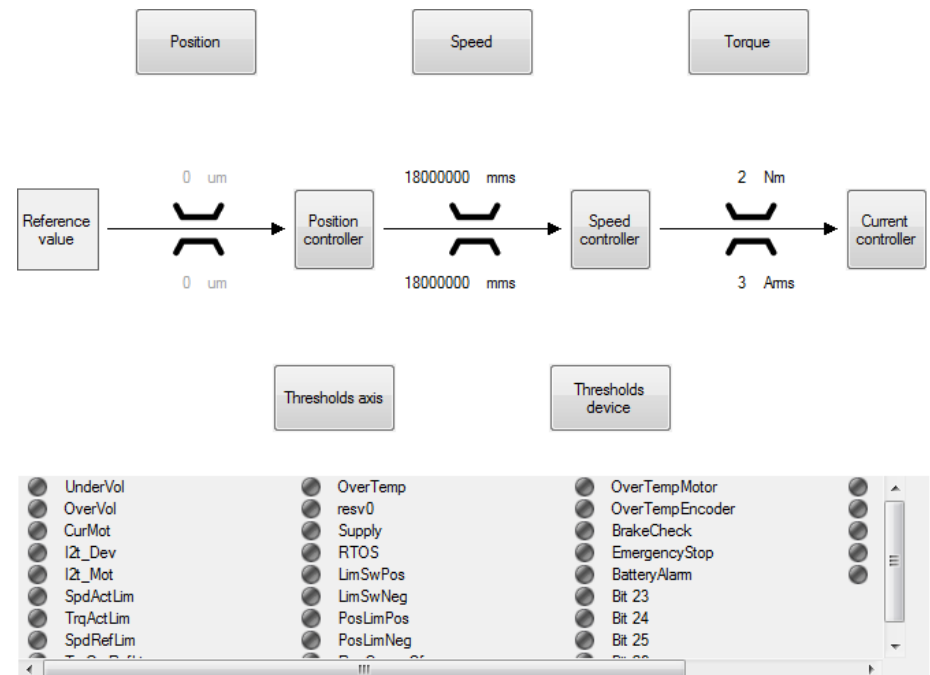


Fig. 11.1: "Limitations, thresholds settings" dialog box

Press the "Position", "Speed" and "Torque" buttons to define limits for the particular topic. The dialog boxes for these three topics include buttons that take you straight to the pertinent control settings.

The limits are shown in the middle of the "Limitations and thresholds" dialog box, with buttons to access the control settings.

**P 2151[0] - ERR\_WRN\_State** is displayed bit by bit at the bottom of the dialog box. This gives you a quick idea of whether the drive axis is at a limit.

## 11.1.1 Position limitation

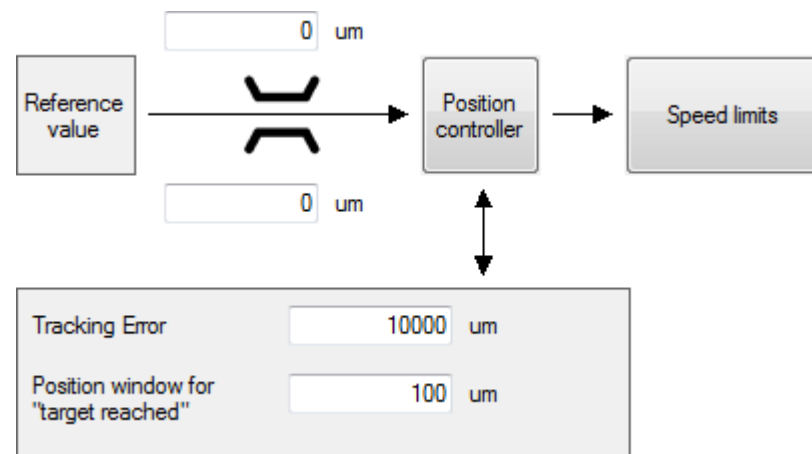


Fig. 11.2: Dialog box for "Position control limitations"

**P 24701[1] - PosLim\_Max** defines the upper, **P 24701[0] - PosLim\_Min** the lower position limit.

If a motion block is activated in the profile generating mode that would exceed the position limitation, then error 13-2 is issued and the motion block is not executed.

In the interpolating mode, exceeding the position limitation is possible. If the drive moves beyond a position limitation, then error 28-1 or error 28-2 is triggered. After resetting the error, the drive can only be moved in the direction that returns it to the permissible positioning range. Once this range has been reached, both directions of movement are possible again.

If the error reaction is set to limit switch error (**P 2153[19] - Ignore**, see also section "Error reactions" on page 225), the error messages will be suppressed and instead, a quick stop will be executed by the device. If you use this option together with the QuickStop option code "...Remain in QuickStop" (see also section "Stop ramps" on page 502), then the axis is available once again after the quick stop and can be moved in the direction that brings it back into the permitted positioning range.

The maximum tracking error can be defined using **P 3051[4] - UsrPosDiffMax** and the standstill window (position setpoint reached) using **P 3051[3] - UsrPosWindow**.



### NOTE

- The standstill window must be set to be sufficiently large so that the target position can be reached stably. Position noise resulting from the resolution of the encoder must also be taken into account.

The position limitation becomes active when the axis has been referenced. For referencing to hardware limit switches with position limitation, see chapter 13.13 Homing / homing mode.

## 11.1.2 Speed limitation

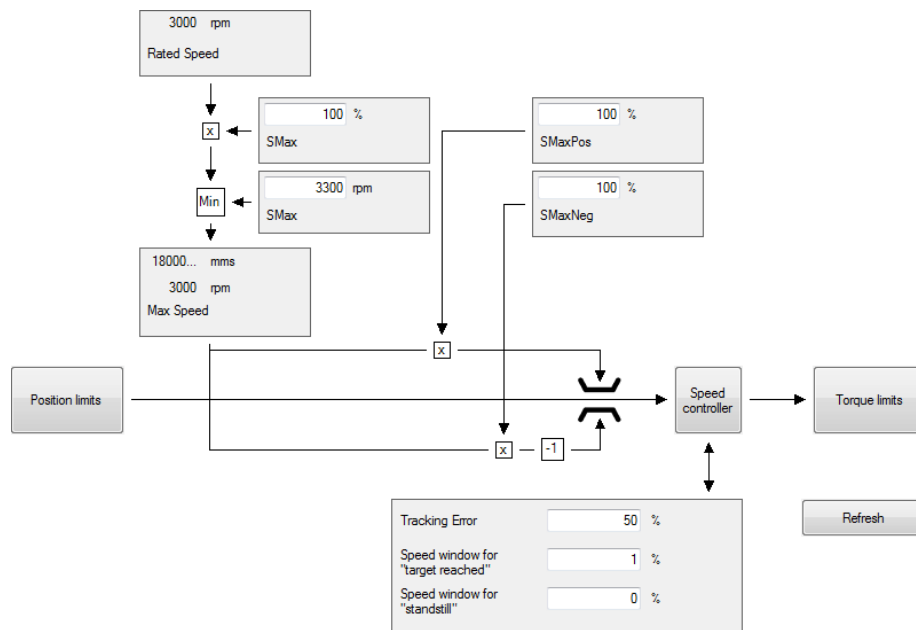


Fig. 11.3: Dialog box for "speed control limitations"

**P 2968[0] - LimFac\_Speed** sets the speed limit as a percentage of the motor's rated speed. The default setting is 100% and thus the motor's rated speed. The parameter cannot be changed during operation. A change is only effective after restarting the control. The resulting speed limit is displayed in **P 2958[0] - ActMax\_Speed**. To refresh the display after making any changes, press the "Refresh" button at the bottom right of the dialog box. **P 2976[2] - SMaxPos** and **P 2976[3] - SMaxNeg** can be used to further limit speed during operation (online) as dependent on the direction of movement.

Tracking error indicates the permissible difference between setpoint and actual speed as a percentage and refers to the motor's rated speed. It is activated if the difference exceeds the calculated threshold. **P 3051[2] - TargetReachedWindow** defines the setpoint-reached window and **P 3051[1] - StandstillWindow** defines the standstill window. These windows are displayed in the 6041h\_Statusword object. Bit 10 --> Target reached, Bit 14 --> Standstill

## 11.1.3 torque limitation scaling

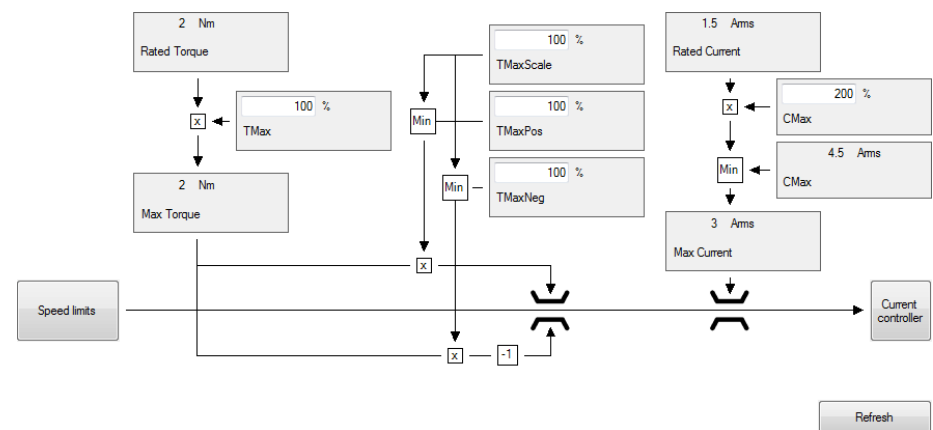


Fig. 11.4: "Torque / current control limitations" dialog box

**P 2968[2] - LimFac\_Torque** sets the torque limit as a percentage of rated torque. The default setting is 100% and thus the motor's rated torque. **P 2968[1] - LimFac\_Current** sets the current limit as a percentage of rated current. The lower value of the two parameters specifies the limitation which the controller uses. The ratio of current and torque is defined in the rated motor data and is displayed in **P 2964[13] - MOT\_Km**. Neither of these parameters can be changed during operation. A change is only effective after restarting the control. The resulting limits for current and torque are displayed in **P 2958[1] - ActMax\_Current** and **P 2958[2] - ActMax\_Torque**. To

refresh the values displayed after making any changes, press the "Refresh" button at the bottom right of the dialog box. With the aid of **P 2976[5] - TMaxScale** it is possible to further limit the set torque limit during operation (online). The torque limit for different directions of rotation can be limited differently during operation using **P 2976[0] - TMaxPos** and **P 2976[1] - TMaxNeg**.

**NOTE**

- Current and torque limitation is also influenced by the compensation of magnetic saturation (see Section "Magnetic saturation: Compensation" on page 50).

## 11.2 Thresholds

The settings for the warning thresholds are divided into "Axis thresholds" and "Device thresholds". The thresholds for each axis can be accessed from ►Project tree ►Axis adjustment ►X axis ►Limitations / thresholds ►Axis thresholds. The thresholds for the device can be accessed from ►Project tree ►Axis adjustment ►Device ►Alarms / Warnings ►Warning thresholds.

There are two values for each variable to be monitored. The value (on) indicates when the warning message is activated, the value (off) indicates when the warning message is disabled again. This allows you to implement a suitable hysteresis for the system.

### Axis thresholds

Motor current (on)	<input type="text" value="1000"/>	A
Motor current (off)	<input type="text" value="1000"/>	A
I <sup>2</sup> t device protection (on)	<input type="text" value="110"/>	%
I <sup>2</sup> t device protection (off)	<input type="text" value="110"/>	%
I <sup>2</sup> t motor protection (on)	<input type="text" value="110"/>	%
I <sup>2</sup> t motor protection (off)	<input type="text" value="110"/>	%
Motor torque (on)	<input type="text" value="1000"/>	Nm
Motor torque (off)	<input type="text" value="1000"/>	Nm
Motor actual speed (on)	<input type="text" value="10000"/>	rpm
Motor actual speed (off)	<input type="text" value="10000"/>	rpm
Cooler temperature (on)	<input type="text" value="200"/>	degC
Cooler temperature (off)	<input type="text" value="200"/>	degC
Motor temperature sensor (on)	<input type="text" value="200"/>	degC
Motor temperature sensor (off)	<input type="text" value="200"/>	degC

Fig. 11.5: "Axis warning thresholds" dialog box

### Device thresholds

DC link undervoltage (on)	<input type="text" value="0"/>	V
DC link undervoltage (off)	<input type="text" value="0"/>	V
DC link overvoltage (on)	<input type="text" value="1000"/>	V
DC link overvoltage (off)	<input type="text" value="1000"/>	V
Internal temperature (on)	<input type="text" value="200"/>	degC
Internal temperature (off)	<input type="text" value="200"/>	degC

Fig. 11.6: "Device warning thresholds" dialog box

## 11.3 Parameters

P No.	Index	Name	Unit	Description
2958 / 5006 / 7054		CON_SCON_ActMax		Axis 1 / 2 / 3: Limitation of the actual values
2958 / 5006 / 7054	0	ActMax_Speed	rpm	Maximum speed
2958 / 5006 / 7054	1	ActMax_Current	Arms	Maximum current
2958 / 5006 / 7054	2	ActMax_Torque	Nm	Max. torque
2958 / 5006 / 7054	3	ActMax_UsrSpeed	SpeedUnit	Max. speed in user units
2958 / 5006 / 7054	4	Reserved		Reserved
2958 / 5006 / 7054	5	Reserved		Reserved
2958 / 5006 / 7054	6	Reserved		Reserved
2968 / 5016 / 7064		CON_SCON_LimitFactors		Axis 1 / 2 / 3: Limitations (in % of rated motor data)
2968 / 5016 / 7064	0	LimFac_Speed	%	Speed limitation scaling factor
2968 / 5016 / 7064	1	LimFac_Current	%	Current limitation scaling factor
2968 / 5016 / 7064	2	LimFac_Torque	%	Torque unit scaling factor
2976 / 5024 / 7072		CON_SCON_ScaleLimits		Axis 1 / 2 / 3: Limitation scaling (in % of min. / max. values)
2976 / 5024 / 7072	0	TMaxPos	%	Pos. torque limitation scaling
2976 / 5024 / 7072	1	TMaxNeg	%	Neg. torque limitation scaling
2976 / 5024 / 7072	2	SMaxPos	%	Pos. speed limitation scaling
2976 / 5024 / 7072	3	SMaxNeg	%	Neg. Speed limitation
2976 / 5024 / 7072	4	ScaleTf	ms	Filter time scaling
2976 / 5024 / 7072	5	TMaxScale	%	Scale torque limitation symmetrically
2994 / 5042 / 7090		CON_SCON_Lin_ActMax		Axis 1 / 2 / 3: Limitation of the actual values
2994 / 5042 / 7090	0	ActMax_Lin_Speed	m/s	Maximum speed
2994 / 5042 / 7090	1	ActMax_Lin_Force	N	Maximum force
3048 / 5096 / 7144	0	MON_State		Axis 1 / 2 / 3: Status / device status word
3051 / 5099 / 7147		MON_MotorStatus		Axis 1 / 2 / 3: Motor status
3051 / 5099 / 7147	0	SDiffMax	%	Speed difference threshold (% of Snom)
3051 / 5099 / 7147	1	StandstillWindow	%	Standstill window (% of Snom)
3051 / 5099 / 7147	2	TargetReachedWindow	%	TargetReached window in speed control (% of Snom)

Table 11.1: Parameter list – Limitations / thresholds axis – General

P No.	Index	Name	Unit	Description
3051 / 5099 / 7147	3	UsrPosWindow	PosUnit	Pos. setpoint reached window
3051 / 5099 / 7147	4	UsrPosDiffMax	PosUnit	Position tracking error
24701 / 26749 / 28797		SoftwarePositionLimit		Axis 1 / 2 / 3: Software limit switch
24701 / 26749 / 28797	0	PosLim_Min	PosUnit	Software limit switch neg.
24701 / 26749 / 28797	1	PosLim_Max	PosUnit	Software limit switch pos.

Table 11.1: Parameter list – Limitations / thresholds axis – General (continue)

P No.	Index	Name	Unit	Description
3071 / 5119 / 7167		MON_WarningLevels		Axis 1 / 2 / 3: Warning thresholds
3071 / 5119 / 7167	0	I_ON	A	Threshold for Motor current "ON"
3071 / 5119 / 7167	1	I_OFF	A	Threshold for Motor current "OFF"
3071 / 5119 / 7167	2	DeviceI2t_ON	%	Threshold for I2t internal device protection "ON"
3071 / 5119 / 7167	3	DeviceI2t_OFF	%	Threshold for I2t internal device protection "OFF"
3071 / 5119 / 7167	4	MotorI2t_ON	%	Threshold for I2t Motor protection "ON"
3071 / 5119 / 7167	5	MotorI2t_OFF	%	Threshold for I2t Motor protection "OFF"
3071 / 5119 / 7167	6	Torque_ON	Nm	Threshold for Motor torque "ON"
3071 / 5119 / 7167	7	Torque_OFF	Nm	Threshold for Motor torque "OFF"
3071 / 5119 / 7167	8	Speed_ON	rpm	Threshold for Actual speed of the motor "ON"
3071 / 5119 / 7167	9	Speed_OFF	rpm	Threshold for Actual speed of the motor "OFF"
3071 / 5119 / 7167	10	TC_ON	degC	Threshold for Heat sink temperature "ON"
3071 / 5119 / 7167	11	TC_OFF	degC	Threshold for Heat sink temperature "OFF"
3071 / 5119 / 7167	12	MotorTemp_On	degC	Threshold for Internal motor sensor "ON"
3071 / 5119 / 7167	13	MotorTemp_Off	degC	Threshold for Internal motor sensor "OFF"

Table 11.2: Parameter list – Limitations / thresholds axis – Axis limitations

P No.	Index	Name	Unit	Description
1002		MON_ DeviceWarningLevels		Warning thresholds of the device
1002	0	Undervoltage_ON	V	DC-link undervoltage
1002	1	Undervoltage_OFF	V	DC-link undervoltage
1002	2	OverVoltage_ON	V	DC-link overvoltage
1002	3	OverVoltage_OFF	V	DC-link overvoltage
1002	4	Tint_ON	degC	Interior temperature
1002	5	Tint_OFF	degC	Interior temperature

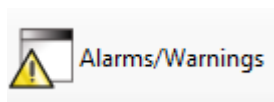
*Table 11.3: Parameter list – Device alarms / warnings – Warning threshold*



## 12 Alarms / Warnings

### Chapter overview

#### Pictogram



#### Navigation

► Project tree ► Axis adjustment ► X axis ► Alarms / Warnings  
or  
► Project tree ► Axis adjustment ► Device ► Alarms / Warnings

#### Brief description

This chapter describes the possible alarm and warning events, thresholds for triggering and resetting, and error reactions.

#### Contents

12.1 Warnings .....	221
12.2 Error reactions .....	225
12.3 Error history .....	229
12.4 Error simulation .....	230
12.5 Error list .....	231

## 12.1 Warnings

It is possible to parametrize warnings for some measured values. Parameterization is performed by means of a switch-on and a switch-off threshold in **P 3071 - MON\_WarningLevels** for each separate axis and **P 1002 - MON\_DeviceWarningLevels** for the complete device. A switch-on and a switch-off threshold must be parameterized, i.e. it is possible to configure a hysteresis.

The status of warnings for the axis is represented in **P 2151 - ERR\_WRN\_State**:

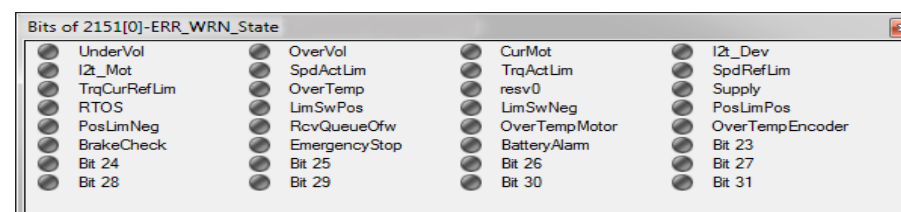


Fig. 12.1: *ERR\_WRN\_State status word*

Bit	Name	Function	Reference	Parameter for threshold(s)
0	UnderVol	Undervoltage detected	Device	<b>P 1002 0</b> Undervoltage_ON, <b>P 1002 1</b> Undervoltage_OFF
1	OverVol	Overvoltage detected	Device	<b>P 1002 2</b> OverVoltage_ON, <b>P 1002 3</b> OverVoltage_OFF
2	IMon	Motor current greater than threshold	Axis	<b>P 3071 0</b> I_ON, <b>P 3071 1</b> I_OFF
3	I2t_Dev	Overload Axis Controller detected	Axis	<b>P 3071 2</b> DeviceI2t_ON, <b>P 3071 3</b> DeviceI2t_OFF
4	I2t_Mot	Motor overload detected	Axis	<b>P 3071 4</b> MotorI2t_ON, <b>P 3071 5</b> MotorI2t_OFF
5	SpdActLim	Speed limitation active	Axis	<b>P 3071 8</b> Speed_ON, <b>P 3071 9</b> Speed_OFF

Table 12.1: *ERR\_WRN\_State status word*

Bit	Name	Function	Reference	Parameter for threshold(s)
6	TrqActLim	Torque limitation active	Axis	<b>P 3071 6</b> Torque_ON, <b>P 3071 7</b> Torque_OFF
7	SpdRefLim	Speed setpoint limitation active	Axis	--
8	CurRefLim	Current setpoint limitation active	Axis	--
9	OverTemp	Overtemperature detected	Device / axis	<b>P 1002 4</b> Tint_ON, <b>P 1002 5</b> Tint_OFF (Device temperature) <b>P 3071 10</b> TC_ON, <b>P 3071 11</b> TC_OFF (power stage module temperature)
10	PSTLoad	reserved		
11	Supply	reserved	Supply unit	Details of the cause of a warning are provided by the Supply unit status parameters. The following status bits can lead to a warning: <b>P 703[3]</b> bit 5 <b>P 703[4]</b> bit 0, 2, 3 <b>P 703[5]</b> bit 4 - 9, 12, 14 However, these bits only lead to a warning if they were activated for this purpose with mask parameters. <b>P 705[2]</b> as a mask for <b>P 703[3]</b> <b>P 705[5]</b> as a mask for <b>P 703[4]</b> <b>P 705[8]</b> as a mask for <b>P 703[5]</b>
12	RTOS	Warning: critical stack load	Device	--
13	LimSwPos	Positive hardware limit switch reached	Axis	--
14	LimSwNeg	Negative hardware limit switch reached	Axis	--
15	PosLimPos	Positive position limit reached	Axis	<b>P 24701 1</b> PosLim_Max
16	PosLimNeg	Negative position limit reached	Axis	<b>P 24701 0</b> PosLim_Min
17	RcvQueueOfw	Ethernet RX queue overflow	Device	--

Table 12.1: ERR\_WRN\_State status word (continue)

Bit	Name	Function	Reference	Parameter for threshold(s)
18	OverTempMotor	Motor overtemperature	Axis	<b>P 3071 12</b> MotorTemp_On, <b>P 3071 13</b> MotorTemp_Off
19	OverTempEncoder	Ovetemperature encoder (on this axis)	Axis	<b>P 2874 31</b> TemperatureWarning
20	BrakeCheck	A brake test is required.	Axis	see also section "Cyclical brake test" on page 183
21	EmergencyStop	Allowed emergency stops exceeded	Axis	see also section "Emergency stop counter" on page 183
22	BatteryAlarm	Encoder battery low	Axis	The voltage of the supply battery is low.
23	ZKSYM	Zk asymetrie in four capacity systems (BG3_4 ) detected	Axis	
24	SafeBrakeTest	Safe brake test is required		

Table 12.1: ERR\_WRN\_State status word (continue)

Warnings of the Supply unit can be called up using parameter **P 703- SUPPLY\_FastPara**. When doing so, it is important to differentiate between parameters **P703-3** (estatS), **P 703-4** (astatS) and **P 703-5** (tstatS). The following table indicates the warnings of the Supply unit . For some warnings, it is possible to configure thresholds.

Bit	Name	Function	Reference	Parameter for threshold(s)
SUPPLY_FastPara: Parameter <b>P 703-3 estatS</b>				
5	NO_SNT_START	No serial status info from the switch supply print has been received. If a switched-mode power supply has been detected, then serial status information is expected from it. This warning also occurs if the switched-mode power supply is not supplied with 1x380 V.	Supply unit	--

SUPPLY\_FastPara: Parameter **P 703-4 astatS**

Table 12.2: Supply unit warnings

Bit	Name	Function	Reference	Parameter for threshold(s)
0	UV_SNT_CR	Undervoltage in the DC link of the switched-mode power supply print detected, DC-link coupling with closed precharge relay.	Supply unit	<b>P 711-0 = 2:</b> Setting of the DC link; CPLCLSREL(2)=DC link coupling on snt undervoltage between main and snt supply with grid power connected.
2	UV_SNT	Undervoltage in the DC link of the switched-mode power supply print detected, DC-link coupling with open precharge relay.	Supply unit	--
3	LINE_OFF	Mains voltage interrupted for longer than one mains period with precharging closed.	Supply unit	--

#### Acknowledgement of the warning LINE\_OFF

Setting bit 2 SupLnOff in **P 271-MPRO\_OUTPUT\_CT** acknowledges the pending warning LINE\_OFF and renewed generation is suppressed. The value of bit 2 SupLnOff in **P 271-MPRO\_OUTPUT\_CT** is volatile and must be written once again after every power on. The function is only active if **P 270-OUTPUT\_X5 = CT271**.

#### SUPPLY\_FastPara: Parameter **P 703-5 tstatS**

4	T_VSE_W	If the interior temperature of PSU rises above the set warning threshold.	Supply unit	<b>P 705-11:</b> PSU interior temperature warning threshold.
5	T_KK_W	If the PSU heat sink temperature rises above the set warning threshold.	Supply unit	<b>P 705-13:</b> 24V supply HS temperature warning threshold.
6	T_SNT_W	If the PSU switched-mode power supply temperature rises above the set warning threshold.	Supply unit	<b>P 705-12:</b> 24V supply interior temperature warning threshold.
7	OL_SNT	If, via the serial communication, the switched-mode power supply indicates an overvoltage in its DC link.	Supply unit	--
8	U24HIGH	If the switched-mode power supply voltage exceeds the value in <b>P 651-5 tmx_u</b> .	Supply unit	<b>P 651-5 tmx_u:</b> Maximum 24V output voltage.

Table 12.2: Supply unit warnings (continue)

Bit	Name	Function	Reference	Parameter for threshold(s)
9	U24LOW	If the switched-mode power supply voltage falls below the value in <b>P 651-4 tmn_u</b> .	Supply unit	<b>P 651-4 tmn_u:</b> Minimum 24V output voltage.
12	T_BR_WRN	Overtemperature threshold, brake chopper, exceeded due to P*t monitoring. If the Pxt counter in <b>P 704-35 pxtbc</b> exceeds the value in <b>P 713-1 pxtlv</b> .	Supply unit	<b>P 704-35 pxtbc:</b> actual pxt level of brake chopper overload. [%] <b>P 713-1:</b> Brake chopper pxt: Warning threshold [%]
14	I2T_W	I2t overload warning threshold exceeded. If the maximum value of the PSU Ixt (scope variable 1934) exceeds 80.	Supply unit	-

Table 12.2: Supply unit warnings (continue)

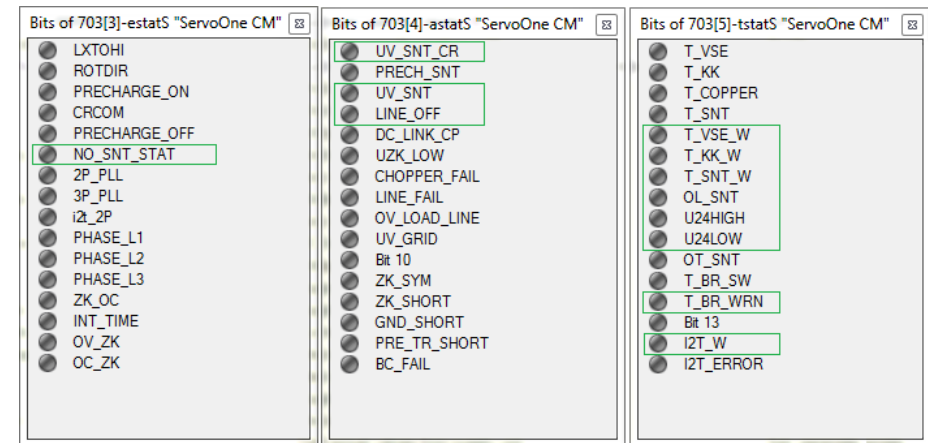


Fig. 12.2: Supply unit Warnings

## 12.1.1 Parameter warnings/errors

P No.	Index	Name	Unit	Description
<b>Status warnings</b>				
2151 / 4199 / 6247	0	ERR_WRN_State		Axis 1 / 2 / 3: Warning state
<b>Error status</b>				
2148 / 4196 / 6244		ERR_Actual		Axis 1 / 2 / 3: Error status
2148 / 4196 / 6244	0	Cause		Text
2148 / 4196 / 6244	1	Remedy		Remedy
2148 / 4196 / 6244	2	ID		ID
2148 / 4196 / 6244	3	Location		Location
2148 / 4196 / 6244	4	CommentID		Additional ID
2148 / 4196 / 6244	5	CommentText		Additional text
2148 / 4196 / 6244	6	SourceLine		Source line
2148 / 4196 / 6244	7	SourceFile		Name of source
2148 / 4196 / 6244	8	TimeString		Time stamp
2149 / 4197 / 6245		ERR_Actual_SysState		Axis 1 / 2 / 3: System status
2149 / 4197 / 6245	0	TempInt	°C	Interior temperature
2149 / 4197 / 6245	1	Voltage	V	DC link voltage
2149 / 4197 / 6245	2	OperationTime	s	Time
2149 / 4197 / 6245	3	TempInv1	°C	Temperature power stage 1
2149 / 4197 / 6245	4	TempInv2	°C	Temperature power stage 2
2149 / 4197 / 6245	5	TempInv3	°C	Temperature power stage 3
2149 / 4197 / 6245	6	ETCSysTimeHigh		EtherCAT system time high word
2149 / 4197 / 6245	7	ETCSysTimeLow		EtherCAT system time low word
2150 / 4198 / 6246		ERR_Actual_AxisState		Axis 1 / 2 / 3: Axis state
2150 / 4198 / 6246	0	Speed	SpeedUnit	Speed
2150 / 4198 / 6246	1	Current	A	Effective current
2150 / 4198 / 6246	2	TimePowerStage	s	Power stage active (hours)
2150 / 4198 / 6246	3	DriveCom		Device status
2151 / 4199 / 6247	0	ERR_WRN_State		Axis 1 / 2 / 3: Warning state

Table 12.3: Parameter list - Axis warnings/errors

P No.	Index	Name	Unit	Description
2152 / 4200 / 6248		ERR_AbsoluteCount		Axis 1 / 2 / 3: Error counter
2152 / 4200 / 6248	0	RunTime		Runtime
2152 / 4200 / 6248	1	ParaList		Parameter list
2152 / 4200 / 6248	2	ObjList		Object list
2152 / 4200 / 6248	3	EtherCAT		EtherCAT
2152 / 4200 / 6248	4	Ethernet		Ethernet
2152 / 4200 / 6248	5	Fatal		Fatal error
2152 / 4200 / 6248	6	Parameters		Parameters
2152 / 4200 / 6248	7	EncoderInit		Encoder initialisation
2152 / 4200 / 6248	8	Timing		Timing
2152 / 4200 / 6248	9	OverCurrent		Overcurrent
2152 / 4200 / 6248	10	I2tPowerAmplifier		I2T power stage
2152 / 4200 / 6248	11	I2tMotor		I2T motor
2152 / 4200 / 6248	12	MotionControl		Motion control
2152 / 4200 / 6248	13	OverVoltage		Overvoltage
2152 / 4200 / 6248	14	Off		Off (undervoltage)
2152 / 4200 / 6248	15	SpeedDiff		Speed difference
2152 / 4200 / 6248	16	PositionDiff		Position difference
2152 / 4200 / 6248	17	DeviceTemp		Device temperature
2152 / 4200 / 6248	18	CrossComm		Cross communication
2152 / 4200 / 6248	19	CommonSys		CommonSys
2152 / 4200 / 6248	20	MotorBrake		Motor brake
2152 / 4200 / 6248	21	EncoderCyclic		Encoder (cyclic)
2152 / 4200 / 6248	22	Homing		Homing
2152 / 4200 / 6248	23	Supply		Supply
2152 / 4200 / 6248	24	MotorTemp		Motor temperature
2152 / 4200 / 6248	25	Calib		Calibration
2152 / 4200 / 6248	26	HardLimitSwitch		Hardware limit switch
2152 / 4200 / 6248	27	PositionLimit		Software limit switch
2152 / 4200 / 6248	28	LockViolate		Setpoint exceeded
2154 / 4202 / 6250	0	ERR_ActCode		Axis 1 / 2 / 3: Code of the current error (8-bit ID, 8-bit location). Bit 0-7: Error ID, bit 8-15: Error location (process-data capable)

Table 12.3: Parameter list - Axis warnings/errors (continue)

P No.	Index	Name	Unit	Description
1002		MON_DeviceWarningLevels		Warning thresholds of the device
1002	0	Undervoltage_ON	V	DC link under voltage
1002	1	Undervoltage_OFF	V	DC link under voltage
1002	2	OverVoltage_ON	V	DC link over voltage
1002	3	OverVoltage_OFF	V	DC link over voltage
1002	4	Tint_ON	degC	Interior temperature
1002	5	Tint_OFF	degC	Interior temperature

**Table 12.4:** Parameter list – Device alarms / warnings warning thresholds

## 12.2 Error reactions

For each error type there is a parameter with which to identify the reaction. The error type is defined by the first number of the error (see Section "Error list" on page 231).

The error reaction is parametrized per axis and concerns the respective axis. All three axes react to system errors with the same reaction. Some error reactions have limited configuration options.

The drive can have the following reactions:

Setting	Function
Ignore (0)	Error is ignored
FaultReactionOptionCode (1)	Reaction as defined in FaultReactionOptionCode. FaultReactionOptionCode is an object defined by CiA 402 that defines a standard error reaction, usually a stop ramp. This setting is configured in the subject area "Stop ramps" (see Section "Stop ramps" on page 502).
ServoStop (2)	Perform quick stop, then shut down power stage.
GenericStop (3)	The motor is slowed down by a pulsed short circuit. No encoder information is required for this.
ServoHalt (4)	Shut down power stage, apply holding brake. If the drive does not have a holding brake, it runs down uncontrolled.
Reserved (5)	reserved, do not use.
WaitERSAndReset	Shut down power stage, apply holding brake. If the drive does not have a holding brake, it runs down uncontrolled. Can only be reset by a system reset.

**Table 12.5:** Error reaction setting values

#### Error reactions (axis):

Reaction on error 6 'Fatal error'	WaitERSAndReset(6) = Switch off power stage, needs system reset to quit
Reaction on error 7 'Parameter error'	ServoHalt(4) = Switch off power stage
Reaction on error 8 'Encoder error'	ServoHalt(4) = Switch off power stage
Reaction on error 9 'Timing error'	ServoHalt(4) = Switch off power stage
Reaction on error 10 'Overcurrent error'	ServoHalt(4) = Switch off power stage
Reaction on error 11 'I2tAmplifier error'	ServoHalt(4) = Switch off power stage
Reaction on error 12 'I2t Motor error'	ServoHalt(4) = Switch off power stage
Reaction on error 13 'Motion control error'	ServoHalt(4) = Switch off power stage
Reaction on error 15 'Undervoltage error'	ServoHalt(4) = Switch off power stage
Reaction on error 16 'Speed difference error'	ServoHalt(4) = Switch off power stage
Reaction on error 17 'Position difference error'	ServoHalt(4) = Switch off power stage
Reaction on error 18 'Power stage overtemperature'	ServoHalt(4) = Switch off power stage
Reaction on error 21 'Motor brake error'	ServoHalt(4) = Switch off power stage
Reaction on error 22 'Encoder cyclic error'	ServoHalt(4) = Switch off power stage
Reaction on error 23 'Homing error'	ServoHalt(4) = Switch off power stage
Reaction on error 25 'Motor temperature error'	ServoHalt(4) = Switch off power stage
Reaction on error 26 'Calibration error'	ServoHalt(4) = Switch off power stage
Reaction on error 27 'Hardware limit switch error'	ServoHalt(4) = Switch off power stage
Reaction on error 28 'Position limit error'	ServoHalt(4) = Switch off power stage
Reaction on error 29 'Lock violation error'	ServoHalt(4) = Switch off power stage
Reaction on error 30 'Encoder hardware error'	ServoHalt(4) = Switch off power stage
Reaction on error 31 'Compensation table tracking error'	ServoHalt(4) = Switch off power stage
Reaction on error 32 'Control initialization'	ServoHalt(4) = Switch off power stage
Reaction on error 36 'Encoder error in idle state'	ServoHalt(4) = Switch off power stage
Stop ramps / Option codes	

Fig. 12.3: Error reaction (axis)

P No.	Index	Name	Unit	Description
2153 / 4201 / 6249		ERR_Reaction_Axis		Custom programmable error reaction for all axis errors
2153 / 4201 / 6249	0	NoError		no error
2153 / 4201 / 6249	1	Fatal		Fatal error
2153 / 4201 / 6249	2	Parameters		Parameter error
2153 / 4201 / 6249	3	Encoder		Encoder
2153 / 4201 / 6249	4	Timing		Timing
2153 / 4201 / 6249	5	OverCurrent		Overcurrent
2153 / 4201 / 6249	6	I2tPowerAmplifier		I2T power stage
2153 / 4201 / 6249	7	I2tMotor		I2T motor
2153 / 4201 / 6249	8	MotionControl		Motion control
2153 / 4201 / 6249	9	UnderVoltage		Undervoltage
2153 / 4201 / 6249	10	SpeedDiff		Speed tracking error
2153 / 4201 / 6249	11	PositionDiff		Position tracking error
2153 / 4201 / 6249	12	DeviceTemp		Reaction to error 18 'Overtemperature of power stage'
2153 / 4201 / 6249	13	MotorBrake		Holding brake
2153 / 4201 / 6249	14	EncoderCyclic		Encoder cycle
2153 / 4201 / 6249	15	Homing		Homing
2153 / 4201 / 6249	16	MotorTemp		Motor temperature
2153 / 4201 / 6249	17	Calib		Calibration
2153 / 4201 / 6249	18	HWLimitSwitch		Hardware limit switch
2153 / 4201 / 6249	19	PositionLimit		Position limit
2153 / 4201 / 6249	20	LockViolate		Setpoint exceeded
2153 / 4201 / 6249	21	EncoderHW		Encoder hardware
2153 / 4201 / 6249	22	CompTracking		Reaction to error 31 'Compensation table tracking error'
2153 / 4201 / 6249	23	InitCon		Reaction to error 32 'Control initialisation'
2153 / 4201 / 6249	24	EncoderIdle		Reaction to error 36 'Encoder error while in idle state'
3071 / 5119 / 7167		MON_WarningLevels		Axis 1 / 2 / 3: Warning thresholds
3071 / 5119 / 7167	0	I_ON	A	Motor current
3071 / 5119 / 7167	1	I_OFF	A	Motor current

Table 12.6: Parameter list – Error reaction alarms / warnings axis

P No.	Index	Name	Unit	Description
3071 / 5119 / 7167	2	DeviceI2t_ON	%	I2t device protection
3071 / 5119 / 7167	3	DeviceI2t_OFF	%	I2t device protection
3071 / 5119 / 7167	4	MotorI2t_ON	%	I2t motor protection
3071 / 5119 / 7167	5	MotorI2t_OFF	%	I2t motor protection
3071 / 5119 / 7167	6	Torque_ON	Nm	Torque
3071 / 5119 / 7167	7	Torque_OFF	Nm	Torque
3071 / 5119 / 7167	8	Speed_ON	rpm	Speed
3071 / 5119 / 7167	9	Speed_OFF	rpm	Speed
3071 / 5119 / 7167	10	TC_ON	degC	Heat sink temperature (power electronics)
3071 / 5119 / 7167	11	TC_OFF	degC	Heat sink temperature (power electronics)
3071 / 5119 / 7167	12	MotorTemp_On	degC	Motor temperature sensor
3071 / 5119 / 7167	13	MotorTemp_Off	degC	Motor temperature sensor

Table 12.6: Parameter list – Error reaction alarms / warnings axis (continue)

## Error reactions (device):

Reaction on Error 1 'Runtime error'	FaultReactionOptionCode(1) = Reaction depends on fault reaction option code
Reaction on Error 2 'Parameter List error'	WaitERSAndReset(6) = Switch off power stage, needs system reset to quit
Reaction on Error 3 'Object List error'	ServoHalt(4) = Switch off power stage
Reaction on Error 4 'EtherCAT error'	FaultReactionOptionCode(1) = Reaction depends on fault reaction option code
Reaction on Error 5 'Ethernet error'	FaultReactionOptionCode(1) = Reaction depends on fault reaction option code
Reaction on Error 6 'Fatal error'	WaitERSAndReset(6) = Switch off power stage, needs system reset to quit
Reaction on Error 7 'Parameter error'	ServoHalt(4) = Switch off power stage
Reaction on Error 9 'Timing error'	ServoHalt(4) = Switch off power stage
Reaction on Error 14 'Overvoltage error'	ServoHalt(4) = Switch off power stage
Reaction on Error 18 'Device electronics overtemperature'	FaultReactionOptionCode(1) = Reaction depends on fault reaction option code
Reaction on Error 19 'Cross communication error'	FaultReactionOptionCode(1) = Reaction depends on fault reaction option code
Reaction on Error 20 'Common system error'	ServoHalt(4) = Switch off power stage
Reaction on Error 24 'Supply error 1'	ServoHalt(4) = Switch off power stage
Reaction on Error 34 'Non-fatal safety error'	ServoHalt(4) = Switch off power stage
Reaction on Error 35 'Fatal safety error'	WaitERSAndReset(6) = Switch off power stage, needs system reset to quit
Reaction on Error 37 'Safety SDC communication error'	ServoHalt(4) = Switch off power stage
Reaction on Error 38 'Safety IO-Expander error'	ServoHalt(4) = Switch off power stage
Reaction on Error 39 'Safety SDC error'	ServoHalt(4) = Switch off power stage
Reaction on Error 41 'Expansion-module error'	ServoHalt(4) = Switch off power stage
Reaction on Error 42 'Capacity-module error'	ServoHalt(4) = Switch off power stage

Stop ramps / Option codes

Fig. 12.4: Error reaction (device)

ID	Index	Name	Unit	Description
103		ERR_Reaction_System		Custom programmable error reaction for all system errors
103	0	NoError		No error
103	1	Runtime		Reaction to error 1 'Runtime error'
103	2	ParameterList		Reaction to error 2 'Error in parameter list'
103	3	ObjectList		Reaction to error 3 'Error in object list'
103	4	EtherCAT		Reaction to error 4 'EtherCAT error'

Table 12.7: Parameter list – Device error reactions

ID	Index	Name	Unit	Description
103	5	Ethernet		Reaction to error 5 'Ethernet error'
103	6	Fatal		Reaction to error 6 'Fatal error'
103	7	Parameter		Reaction to error 7 'Parameter error'
103	8	Timing		Reaction to error 9 'Timing error'
103	9	OverVoltage		Reaction to error 14 'Overcurrent error'
103	10	DeviceTemp		Reaction to error 18 'Overtemperature of device electronics'
103	11	CrossCom		Reaction to error 19 'Error in cross-communication'
103	12	CommonSys		Reaction to error 20 'Error in shared system'
103	13	Supply_1		Reaction to error 24 'Error in supply unit 1'
103	14	SafetyQuit		Reaction to error 34 'Non-fatal safety error'
103	15	SafetySysReset		Reaction to error 35 'Fatal safety error'
103	16	SPI_SDC		Reaction on error 37 'Safety SDC communication error'
103	17	IO-Expd		Reaction to error 38 'Error in the Safety I/O Expander'
103	18	SDC_Option		Reaction to error 39 'Error in the Safety SDC'
103	19	Sys_Reset		Reaction to error 40 'Error during system reset'
103	20	ExpansionModule		Reaction to error 41 'Error in the expansion module'
103	21	CapacityModule		Reaction to error 42 'Error in the capacity module'
103	22	IxT_Device		Reaction to error 43 'Devices IxT'

Table 12.7: Parameter list – Device error reactions (continue)

## 12.2.1 Parametrization of generic halt (GenericStop)

The generic halt uses no ramps and no encoder information.

The target current is calculated from the torque specified in **P 2267.0**. The machine current is controlled to this value. If the magnetic field of an asynchronous motor is discharged, the system switches over to DC brakes.

The brake is closed after expiration of the time **P 2267.1**. There is no evaluation of the standstill.



### NOTE

- Test the generic halt for your application from different starting speeds. You can use parameter **P 106** to deliberately generate errors. Record the total current and the speed.

The procedure for an asynchronous machine is shown by Fig. 12.5: Procedure for an asynchronous machine (example) (TorqueLimit  $\pm 6.2A$ , Timeout = 450 ms):

The error is triggered at time  $t = 0$ . As of  $t = 0.2$ , the switchover to DC brakes takes place. After the timeout has expired, the axis coasts down uncontrolled because this motor does not have a holding brake.

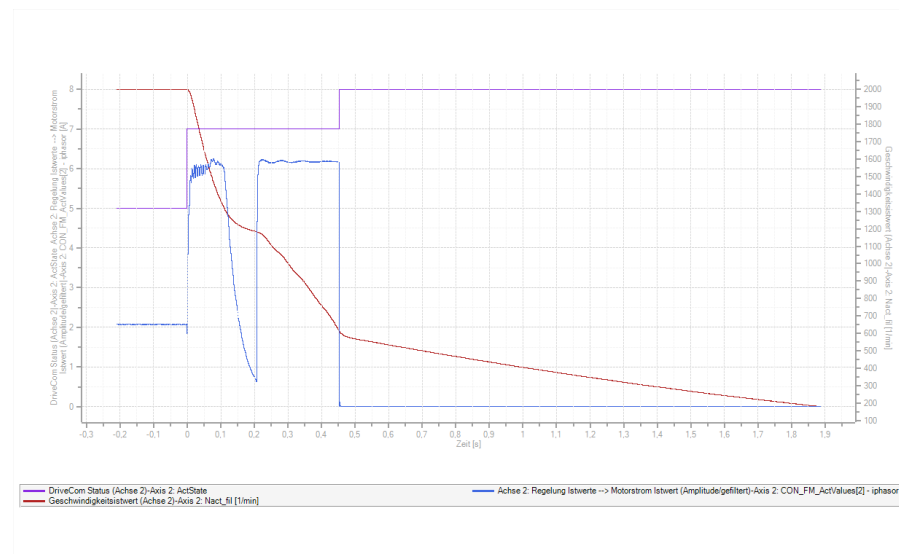


Fig. 12.5: Procedure for an asynchronous machine (example)



## 12.3 Error history

### 12.3.1 Error counter

How often a certain error type has occurred can be displayed using the array **P 2152 - ERR\_AbsoluteCount**, that can be retrieved from ►Project tree ►Axis adjustment ►X axis ►Alarms / Warnings.

### 12.3.2 Overview

A detailed history of the last 20 errors can be displayed from ►Project tree ►Axis adjustment ►Device ►Alarms / Warnings. This screen includes:

- Causes
- Troubleshooting tips
- Buttons for quick access to the defined error reactions and warning thresholds for device and axes
- Warning status display for every axis

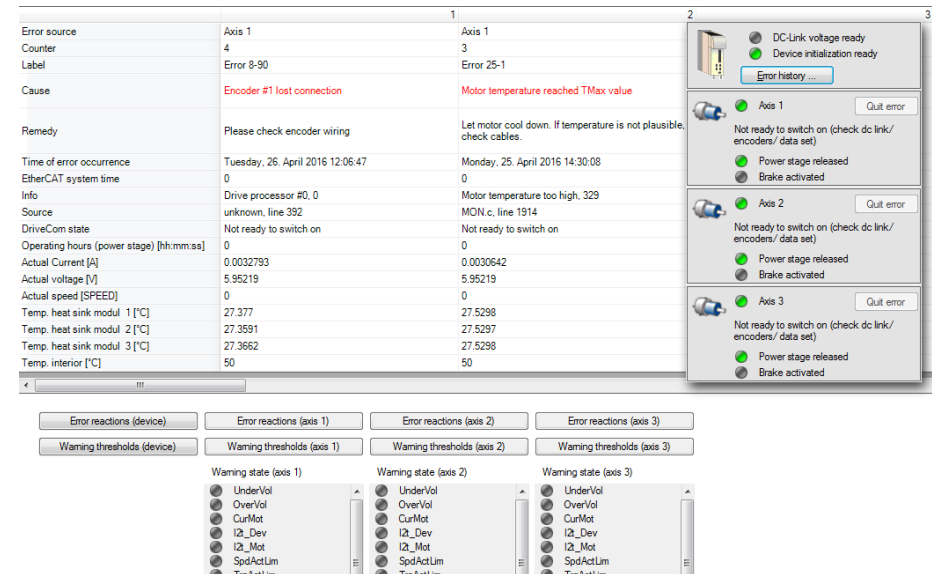


Fig. 12.6: Alarm / warning history dialog box

An overview of all errors can be found in Section "Error list" on page 231.

## 12.4 Error simulation

P No.	Index	Name	Unit	Description
106		ERR_SetError		Error simulation
106	0	Set_error		Activate error: <ul style="list-style-type: none"> <li>False(0)= False</li> <li>True(1)= True</li> </ul>
106	1	Error_Id		Error number: None(0)= None RunTime (1)= RunTime ParaList(2)= ParaList ObjList(3)= Obj ListEtherCAT(4)= EtherCAT Ethernet(5)= Ethernet Fatal (6)= Fatal Parameter(7)= Parameter EncoderInit(8)= EncoderInit Timing(9)= Timing OverCurrent(10)= OverCurrent I2tPowerAmplifier(11)= I2tPowerAmplifier I2tMotor(12)= I2tMotor MotionControl(13)= MotionControl OverVoltage(14)= OverVoltage Off(15)= Off SpeedDiff(16)= SpeedDiff PositionDiff(17)= PositionDiff DeviceTemp(18)= DeviceTemp CrossComm(19)= CrossComm CommonSys(20)= CommonSys MotorBrake(21)= MotorBrake EncoderCyclic(22)= EncoderCyclic Homing(23)= Homing Supply_1(24)= Supply 1 MotorTemp(25)= MotorTemp Calib(26)= Calib HardLimitSwitch(27)= HardLimitSwitch PositionLimit(28)= PositionLimit

Table 12.8: Parameter P 106

P No.	Index	Name	Unit	Description
106	1	Error_Id		Error number: LockViolate(29)= LockViolate EncoderHardware(30)= EncoderHardware Tracking(31)= Tracking InitCon(32)= InitCon reserved(33)= reserved SafetyQuit(34)= SafetyQuit SafetySysReset(35)= SafetySysReset
106	2	Error_Location		Error location
106	3	Error_Axis		Axis number (0 is a system error) All(0)= All axis Axis1(1)= Axis 1 Axis2(2)= Axis 2 Axis3(3)= Axis 3

Table 12.8: Parameter P 106 (continue)

Parameter **P 106** provides the option of triggering any errors desired. This is useful, for example, for testing the error reaction, the initialization behaviour or the higher-order controller. Enter the error number in **P 106.1** and the location in **P 106.2**.

**P 106.3** specifies on which axis the error is to occur; system errors should occur on all axes.



### NOTE

Some safety-critical errors have special reactions that cannot be parametrized:

- If there is an overcurrent or over- or undervoltage, the power stage is switched off as quickly as possible.
- If there is an encoder error, a transition to sensorless mode is made.

These reactions do not occur when the error is triggered by **P 106**.

A list of the system's error messages can be found in the Section "Error list" on page 231

## 12.5 Error list

### 12.5.1 Error 1-x Runtime error

#### 12.5.1.1 Error 1-0 (emergency code 100007h)

**Cause:** Unknown runtime error

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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### 12.5.2 Error 2-x Parameter List error

#### 12.5.2.1 Error 2-0 (emergency code 631007h)

**Cause:** Unknown parameter list error

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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### 12.5.2.2 Error 2-1 (emergency code 631007h)

**Cause:** Parameter initialization failed

**Suggested steps:**

Try to save parameter set in device, and restart.

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>

### 12.5.2.3 Error 2-2 (emergency code 631007h)

**Cause:** Parameter base initialization failed

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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### 12.5.2.4 Error 2-3 (emergency code 553007h)

**Cause:** Parameter OEM initialization failed

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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## 12.5.2.5 Error 2-4 (emergency code 553007h)

**Cause:** Backup of device setting failed

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"> <li>• Save your parameter set for a later restore.</li> <li>• See 'history of parameter changes' and undo the latest changes.</li> <li>• Please check your parameter set for implausible settings.</li> <li>• Please set device to factory setting, restart, and see if the error occurs again.</li> <li>• When reporting this error to your service partner, please include your device's parameter setting.</li> </ul>
The axis module's flash memory might be full.	If you have stored large user data of the device, please remove them
An unexpected error in the file system has occurred.	<ul style="list-style-type: none"> <li>• Please report this error to your service partner.</li> <li>• Please check with your service partner how to generate an image file of the drive.</li> <li>• Please provide the KeStudio DriveManager message log.</li> </ul>
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>

## 12.5.2.6 Error 2-5 (emergency code 631007h)

**Cause:** Registration of new parameter failed

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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## 12.5.2.7 Error 2-6 (emergency code 631007h)

**Cause:** Parameter check failed

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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### 12.5.2.8 Error 2-7 (emergency code 631007h)

**Cause:** Attempt to register multiple parameter with same ID

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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### 12.5.2.9 Error 2-8 (emergency code 553007h)

**Cause:** Initialization of power stage parameters failed

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>

### 12.5.2.10 Error 2-9 (emergency code 631007h)

**Cause:** Error during FLASH file access

**Suggested steps:**

An unexpected error in the file system has occurred.	<ul style="list-style-type: none"><li>• Please report this error to your service partner.</li><li>• Please check with your service partner how to generate an image file of the drive.</li><li>• Please provide the KeStudio DriveManager message log.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>

## 12.5.3 Error 3-x Object List error

### 12.5.3.1 Error 3-0 (emergency code 100007h)

**Cause:** General error generating object list

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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## 12.5.3.2 Error 3-1 (emergency code 100007h)

**Cause:** Error while generating object list

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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## 12.5.4 Error 4-x EtherCAT error

### 12.5.4.1 Error 4-0 (emergency code 810004h)

**Cause:** General EtherCAT error

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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### 12.5.4.2 Error 4-1 (emergency code 810004h)

**Cause:** Invalid configuration for syncmanager

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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### 12.5.4.3 Error 4-2 (emergency code 810004h)

**Cause:** Watchdog of syncmanager expired

**Suggested steps:**

The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

#### 12.5.4.4 Error 4-3 (emergency code 810004h)

**Cause:** Sync manager event missed

**Suggested steps:**

The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"><li>• Please check the EtherCAT connection. Try to replace the cables.</li><li>• Please try to reduce computational load on the master.</li><li>• Try to increase the master cycle time.</li></ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>

#### 12.5.4.5 Error 4-4 (emergency code 810004h)

**Cause:** Synchronization accuracy is outside the expected tolerance

**Suggested steps:**

The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"><li>• Please check the EtherCAT connection. Try to replace the cables.</li><li>• Please try to reduce computational load on the master.</li><li>• Try to increase the master cycle time.</li></ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>

#### 12.5.4.6 Error 4-5 (emergency code A00004h)

**Cause:** Transition from PreOperational to SafeOperational failed

**Suggested steps:**

The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"><li>• Please check the EtherCAT connection. Try to replace the cables.</li><li>• Please try to reduce computational load on the master.</li><li>• Try to increase the master cycle time.</li></ul>
---	--



## 12.5.4.7 Error 4-6 (emergency code A00104h)

**Cause:** Transition from SafeOperational to Operational failed

**Suggested steps:**

The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>
---	--

## 12.5.4.8 Error 4-7 (emergency code 810004h)

**Cause:** One of the transmit queues for mailbox TX transfer has overflowed

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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## 12.5.4.9 Error 4-8 (emergency code 810004h)

**Cause:** netx indicates a dpm hardware access failure

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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## 12.5.4.10 Error 4-9 (emergency code 810004h)

**Cause:** Value from RxPdo is out of range

**Suggested steps:**

PLC program	Please check PLC program vs. parameter list min/max values.
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## 12.5.5 Error 5-x Ethernet error

### 12.5.5.1 Error 5-0 (emergency code FF0007h)

**Cause:** General Ethernet error

**Suggested steps:**

An error occurred on the Ethernet/ EoE connection to the drive. The connection is probably no longer working.	<ul style="list-style-type: none"><li>• Please restart application (24V reset).</li><li>• If the error occurs again, switch device to service mode. Try to save a device commissioning file with your settings.</li><li>• Please re-view ethernet over EtherCAT (EoE) settings on the master.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.5.2 Error 5-1 (emergency code FF0007h)

**Cause:** Initialization of hardware failed

**Suggested steps:**

An error occurred on the Ethernet/ EoE connection to the drive. The connection is probably no longer working.	<ul style="list-style-type: none"><li>• Please restart application (24V reset).</li><li>• If the error occurs again, switch device to service mode. Try to save a device commissioning file with your settings.</li><li>• Please re-view ethernet over EtherCAT (EoE) settings on the master.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.5.3 Error 5-2 (emergency code FF0007h)

**Cause:** Receive queue overflow of ethernet controller

**Suggested steps:**

An error occurred on the Ethernet/ EoE connection to the drive. The connection is probably no longer working.	<ul style="list-style-type: none"><li>• Please restart application (24V reset).</li><li>• If the error occurs again, switch device to service mode. Try to save a device commissioning file with your settings.</li><li>• Please re-view ethernet over EtherCAT (EoE) settings on the master.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.5.4 Error 5-3 (emergency code FF0007h)

**Cause:** Transmit queue overflow of ethernet controller

**Suggested steps:**

An error occurred on the Ethernet/ EoE connection to the drive. The connection is probably no longer working.	<ul style="list-style-type: none"><li>• Please restart application (24V reset).</li><li>• If the error occurs again, switch device to service mode. Try to save a device commissioning file with your settings.</li><li>• Please re-view ethernet over EtherCAT (EoE) settings on the master.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.6 Error 6-x Fatal error

## 12.5.6.1 Error 6-0 (emergency code 500007h)

**Cause:** Unknown fatal error

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.6.2 Error 6-1 (emergency code 500007h)

**Cause:** Axis controller FW load failed

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.6.3 Error 6-2 (emergency code 500007h)

**Cause:** Axis controller not started

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

#### 12.5.6.4 Error 6-3 (emergency code 500007h)

**Cause:** Axis controller not responding

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

#### 12.5.6.5 Error 6-4 (emergency code 500007h)

**Cause:** Illegal computation in axis controller

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.6.6 Error 6-5 (emergency code 630F07h)

**Cause:** Production data access error

**Suggested steps:**

An unexpected error in the file system has occurred.	<ul style="list-style-type: none"> <li>• Please report this error to your service partner.</li> <li>• Please check with your service partner how to generate an image file of the drive.</li> <li>• Please provide the KeStudio DriveManager message log.</li> </ul>
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.6.7 Error 6-6 (emergency code FF0107h)

**Cause:** Hardware revision or variant not suitable

**Suggested steps:**

Please check the encoder cables. Pins 12 and 13 must not be connected to the Sense +/- signals

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.6.8 Error 6-7 (emergency code 630707h)

**Cause:** Supply unit fatal error

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.

### 12.5.6.9 Error 6-8 (emergency code 630F07h)

**Cause:** Production data access error (article number)

**Suggested steps:**

An unexpected error in the file system has occurred.	<ul style="list-style-type: none"><li>• Please report this error to your service partner.</li><li>• Please check with your service partner how to generate an image file of the drive.</li><li>• Please provide the KeStudio DriveManager message log.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.7 Error 7-x Parameter error

### 12.5.7.1 Error 7-0 (emergency code 632007h)

**Cause:** Unknown error during initialization

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>

## 12.5.7.2 Error 7-1 (emergency code 632007h)

**Cause:** Initialization of SYNC unit failed

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"> <li>• Save your parameter set for a later restore.</li> <li>• See 'history of parameter changes' and undo the latest changes.</li> <li>• Please check your parameter set for implausible settings.</li> <li>• Please set device to factory setting, restart, and see if the error occurs again.</li> <li>• When reporting this error to your service partner, please include your device's parameter setting.</li> </ul>
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>

## 12.5.7.3 Error 7-2 (emergency code 632007h)

**Cause:** Configuration of sigma/delta ADCs failed

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"> <li>• Save your parameter set for a later restore.</li> <li>• See 'history of parameter changes' and undo the latest changes.</li> <li>• Please check your parameter set for implausible settings.</li> <li>• Please set device to factory setting, restart, and see if the error occurs again.</li> <li>• When reporting this error to your service partner, please include your device's parameter setting.</li> </ul>
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>

#### 12.5.7.4 Error 7-3 (emergency code 632007h)

**Cause:** Error during control initialization

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>

#### 12.5.7.6 Error 7-5 (emergency code 632001h)

**Cause:** Error during init current monitoring

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
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#### 12.5.7.5 Error 7-4 (emergency code 632007h)

**Cause:** Selected switching frequency is not possible

**Suggested steps:**

Selected actual switching frequency is not allowed (see parameters CON\_SwitchFreq and CON\_SwitchFreqMask). Change setting.



## 12.5.7.7 Error 7-6 (emergency code 632001h)

**Cause:** Error during init I2t monitoring

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
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## 12.5.7.8 Error 7-7 (emergency code 632007h)

**Cause:** Timeout during parameter control mode

**Suggested steps:**

- This error may be caused by time-consuming operations in the PC software. Quit error and restart manual mode.
- Please check your Ethernet/ EoE connection to the device.

## 12.5.7.9 Error 7-8 (emergency code 632007h)

**Cause:** Error while initializing the standardization parameters

**Suggested steps:**

An internal calculation result exceeds 32 bit (4294967296). Please simplify the gear ratio and/or feed constant.

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
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#### 12.5.7.10 Error 7-9 (emergency code 632007h)

**Cause:** Error in Math library

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>

#### 12.5.7.11 Error 7-11 (emergency code 632007h)

**Cause:** Voltage levels too high

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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#### 12.5.7.12 Error 7-12 (emergency code 632007h)

**Cause:** Error in motor commutation

**Suggested steps:**

Auto commutation might not be working properly.	<ul style="list-style-type: none"><li>• Please check the encoder speed and direction, and motor pole pairs.</li><li>• Check auto commutation parameters.</li><li>• Make a scope record with scope values 24, 25, 21, 1009.</li></ul>
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#### 12.5.7.13 Error 7-13 (emergency code 632007h)

**Cause:** Error in observer method, inertia is zero

**Suggested steps:**

In Control/ Basic settings, run automatic detection of inertia

#### 12.5.7.14 Error 7-14 (emergency code 632007h)

**Cause:** Error in power stage data

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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## 12.5.7.15 Error 7-15 (emergency code 632007h)

**Cause:** Interpolation cycle time not allowed

**Suggested steps:**

Please check field bus master configuration

## 12.5.7.16 Error 7-16 (emergency code 632007h)

**Cause:** Autotuning/ identification error

**Suggested steps:**

- Please view details (>>) and message log.
- Please verify that the axis is ready to switch on before starting procedure.
- Please try to use a different procedure

## 12.5.7.17 Error 7-17 (emergency code 632007h)

**Cause:** Compensation table 1 failed to initialize

**Suggested steps:**

- Please check parameter data set for compensation table 1.
- Read online help.
- When copying the settings from one drive to another, if the table data should also be copied, use the 'commissioning file' tool

## 12.5.7.18 Error 7-18 (emergency code 632007h)

**Cause:** Compensation table 2 failed to initialize

**Suggested steps:**

- Please check parameter data set for compensation table 2.
- Read online help.
- When copying the settings from one drive to another, if the table data should also be copied, use the 'commissioning file' tool

## 12.5.7.19 Error 7-19 (emergency code 632007h)

**Cause:** Speed limit of 600Hz exceeded

**Suggested steps:**

- This device is limited to 600 Hz output frequency. Please reduce maximum speed.
- Please contact service for a higher frequency device.

### 12.5.7.20 Error 7-20 (emergency code 632007h)

**Cause:** The VSU hardware variant does not support some selected features

**Suggested steps:**

Please check parameter SUPPLY\_DcLinkCoupling. Please contact service for a different VSU device.

This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>

### 12.5.7.21 Error 7-21 (emergency code 632007h)

**Cause:** Error while initializing modulo position parameters

**Suggested steps:**

Check modulo position limits.

### 12.5.7.22 Error 7-22 (emergency code 730007h)

**Cause:** Position encoder must not use MTBase and overflow compensation together

**Suggested steps:**

Set ENC\_CHx\_Settings.MTBase back to default. Please read online help.

## 12.5.8 Error 8-x Encoder error

### 12.5.8.1 Error 8-0 (emergency code 730007h)

**Cause:** General encoder error

**Suggested steps:**

- Please check encoder settings and connected encoders of this axis.

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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### 12.5.8.2 Error 8-11 (emergency code 730007h)

**Cause:** Encoder offset detection failed

**Suggested steps:**

Auto commutation might not be working properly.	<ul style="list-style-type: none"><li>• Please check the encoder speed and direction, and motor pole pairs.</li><li>• Check auto commutation parameters.</li><li>• Make a scope record with scope values 24, 25, 21, 1009.</li></ul>
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## 12.5.8.3 Error 8-12 (emergency code 730007h)

**Cause:** Motor was replaced with different motor type

**Suggested steps:**

- Quit error, load new motor nameplate manually, and tune parameters for application
- If motor change guarding is not intended, please see "encoder special function"

## 12.5.8.4 Error 8-13 (emergency code 730007h)

**Cause:** Motor was replaced with unknown motor type

**Suggested steps:**

- Execute a factory reset, and load motor parameter set
- If motor change guarding is not intended, please see "encoder special function"

## 12.5.8.5 Error 8-14 (emergency code 730007h)

**Cause:** Encoder #1: Cannot acquire position because motor is moving

**Suggested steps:**

Stop motor mechanically and quit error

## 12.5.8.6 Error 8-15 (emergency code 730007h)

**Cause:** Position encoder has no distance-coded zero pulses, or wrong parameter setting

**Suggested steps:**

- Please check parameter setting of encoder. DistCodeA and DistCodeB must be set.
- Use a different homing method

### 12.5.8.7 Error 8-20 (emergency code 751007h)

**Cause:** Encoder: SSI error

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.8.8 Error 8-30 (emergency code 751007h)

**Cause:** Encoder: ENDAT protocol error

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.8.9 Error 8-42 (emergency code 751007h)

**Cause:** Encoder: Hiperface protocol error

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.8.10 Error 8-50 (emergency code 730007h)

**Cause:** Encoder #1: Internal communication error

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.8.11 Error 8-51 (emergency code 730007h)

**Cause:** Encoder #2: Internal communication error

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.8.12 Error 8-52 (emergency code 730007h)

**Cause:** Encoder #3: Internal communication error

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.



## 12.5.8.13 Error 8-53 (emergency code 730007h)

**Cause:** Encoder #4: Internal communication error

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.8.14 Error 8-60 (emergency code 230507h)

**Cause:** Encoder #1: A/B pattern error, probably EMC problem

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.8.15 Error 8-61 (emergency code 230607h)

**Cause:** Encoder #2: A/B pattern error, probably EMC problem

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"><li>• Check cabling. If available, please try another encoder and cable.</li><li>• See detailed error information (&gt;&gt;) for a more detailed description.</li><li>• The problem may be caused by mechanical shock</li><li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li></ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"><li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li><li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li><li>• See detailed error information (&gt;&gt;) for a more detailed description.</li></ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>

### 12.5.8.16 Error 8-70 (emergency code 730007h)

**Cause:** Encoder #1: Gearbox error

**Suggested steps:**

Please check this encoder's gear ratio settings.

### 12.5.8.17 Error 8-71 (emergency code 730007h)

**Cause:** Encoder #2: Gearbox error

**Suggested steps:**

Please check this encoder's gear ratio settings.

### 12.5.8.18 Error 8-72 (emergency code 730007h)

**Cause:** Encoder #3: Gearbox error

**Suggested steps:**

Please check this encoder's gear ratio settings.

### 12.5.8.19 Error 8-73 (emergency code 730007h)

**Cause:** Encoder #4: Gearbox error

**Suggested steps:**

Please check this encoder's gear ratio settings.

## 12.5.8.20 Error 8-74 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: Gearbox error

**Suggested steps:**

Please check this encoder's gear ratio settings.

## 12.5.8.21 Error 8-75 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: Gearbox error

**Suggested steps:**

Please check this encoder's gear ratio settings.

## 12.5.8.22 Error 8-76 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: Gearbox error

**Suggested steps:**

Please check this encoder's gear ratio settings.

## 12.5.8.23 Error 8-80 (emergency code 730007h)

**Cause:** Encoder #1: (Absolute) position calculation error

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.8.24 Error 8-81 (emergency code 730007h)

**Cause:** Encoder #2: (Absolute) position calculation error

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.8.25 Error 8-82 (emergency code 730007h)

**Cause:** Encoder #3: (Absolute) position calculation error

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.8.26 Error 8-83 (emergency code 730007h)

**Cause:** Encoder #4: (Absolute) position calculation error

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.8.27 Error 8-84 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: (Absolute) position calculation error

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.8.28 Error 8-85 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: (Absolute) position calculation error

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.8.29 Error 8-86 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: (Absolute) position calculation error

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.8.30 Error 8-90 (emergency code 230507h)

**Cause:** Encoder #1 lost connection

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.8.31 Error 8-91 (emergency code 230607h)

**Cause:** Encoder #2 lost connection

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.8.32 Error 8-92 (emergency code 730007h)

**Cause:** Encoder #3 lost connection

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.8.33 Error 8-94 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: status bit released

**Suggested steps:**

Please check encoder wiring, field bus system, and master settings

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>



## 12.5.8.34 Error 8-95 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: status bit released

### Suggested steps:

Please check encoder wiring, field bus system, and master settings

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>Check cabling. If available, please try another encoder and cable.</li> <li>See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>The problem may be caused by mechanical shock</li> <li>In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>Please check the device cabling for proper connection.</li> <li>Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>Check motor grounding and motor cable length.</li> </ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>Please check the EtherCAT connection. Try to replace the cables.</li> <li>Please try to reduce computational load on the master.</li> <li>Try to increase the master cycle time.</li> </ul>

## 12.5.8.35 Error 8-96 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: status bit released

### Suggested steps:

Please check encoder wiring, field bus system, and master settings

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>Check cabling. If available, please try another encoder and cable.</li> <li>See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>The problem may be caused by mechanical shock</li> <li>In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>Please check the device cabling for proper connection.</li> <li>Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>Check motor grounding and motor cable length.</li> </ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>Please check the EtherCAT connection. Try to replace the cables.</li> <li>Please try to reduce computational load on the master.</li> <li>Try to increase the master cycle time.</li> </ul>

### 12.5.8.36 Error 8-100 (emergency code 230507h)

**Cause:** Encoder #1 TTL error

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
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### 12.5.8.37 Error 8-101 (emergency code 230607h)

**Cause:** Encoder #2 TTL error

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
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### 12.5.8.38 Error 8-110 (emergency code 730007h)

**Cause:** Hardware does not support encoder #1

**Suggested steps:**

This axis module's hardware variant does not support the selected encoder channel/type. Use a different encoder or contact your service partner for a different hardware.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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## 12.5.8.39 Error 8-111 (emergency code 730007h)

**Cause:** Hardware does not support encoder #2

**Suggested steps:**

This axis module's hardware variant does not support the selected encoder channel/type. Use a different encoder or contact service for a different hardware.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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## 12.5.8.40 Error 8-112 (emergency code 730007h)

**Cause:** Hardware does not support encoder #3

**Suggested steps:**

This axis module's hardware variant does not support the selected encoder channel/type. Use a different encoder or contact service for a different hardware.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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## 12.5.8.41 Error 8-124 (emergency code 730007h)

**Cause:** EtherCAT enc. #1 is in use by another axis

**Suggested steps:**

This EtherCAT encoder channel was selected by two or three axes. Use a different channel for each axis.

## 12.5.8.42 Error 8-125 (emergency code 730007h)

**Cause:** EtherCAT enc. #2 is in use by another axis

**Suggested steps:**

This EtherCAT encoder channel was selected by two or three axes. Use a different channel for each axis.

## 12.5.8.43 Error 8-126 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 is in use by another axis

**Suggested steps:**

This EtherCAT encoder channel was selected by two or three axes. Use a different channel for each axis.

#### 12.5.8.44 Error 8-134 (emergency code 730007h)

**Cause:** EtherCAT enc. #1 error

**Suggested steps:**

The EtherCAT encoder bit number might be wrong.

The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"><li>• Please check the EtherCAT connection. Try to replace the cables.</li><li>• Please try to reduce computational load on the master.</li><li>• Try to increase the master cycle time.</li></ul>
This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>

#### 12.5.8.45 Error 8-135 (emergency code 730007h)

**Cause:** EtherCAT enc. #2 error

**Suggested steps:**

The EtherCAT encoder bit number might be wrong.

The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"><li>• Please check the EtherCAT connection. Try to replace the cables.</li><li>• Please try to reduce computational load on the master.</li><li>• Try to increase the master cycle time.</li></ul>
This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>

## 12.5.8.46 Error 8-136 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 error

### Suggested steps:

The EtherCAT encoder bit number might be wrong.

The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>
This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"> <li>• Save your parameter set for a later restore.</li> <li>• See 'history of parameter changes' and undo the latest changes.</li> <li>• Please check your parameter set for implausible settings.</li> <li>• Please set device to factory setting, restart, and see if the error occurs again.</li> <li>• When reporting this error to your service partner, please include your device's parameter setting.</li> </ul>

## 12.5.8.47 Error 8-140 (emergency code 730007h)

**Cause:** Encoder #1: Absolute encoder simulation: Initialisation error

### Suggested steps:

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.8.48 Error 8-141 (emergency code 730007h)

**Cause:** Encoder #2: Absolute encoder simulation: Initialisation error

### Suggested steps:

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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#### 12.5.8.49 Error 8-142 (emergency code 730007h)

**Cause:** Encoder #3: Absolute encoder simulation: Initialisation error

**Suggested steps:**

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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#### 12.5.8.50 Error 8-143 (emergency code 730007h)

**Cause:** Encoder #4: Absolute encoder simulation: Initialisation error

**Suggested steps:**

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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#### 12.5.8.51 Error 8-144 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: Absolute encoder simulation: Initialisation error

**Suggested steps:**

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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#### 12.5.8.52 Error 8-145 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: Absolute encoder simulation: Initialisation error

**Suggested steps:**

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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## 12.5.8.53 Error 8-146 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 Absolute encoder simulation: Initialisation error

### Suggested steps:

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.8.54 Error 8-150 (emergency code 730007h)

**Cause:** Encoder #1: Backup information not valid

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.8.55 Error 8-151 (emergency code 730007h)

**Cause:** Encoder #2: Backup information not valid

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.8.56 Error 8-152 (emergency code 730007h)

**Cause:** Encoder #3: Backup information not valid

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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#### 12.5.8.57 Error 8-153 (emergency code 730007h)

**Cause:** Encoder #4: Backup position not valid

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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#### 12.5.8.58 Error 8-154 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: Backup position not valid

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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#### 12.5.8.59 Error 8-155 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: Backup position not valid

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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#### 12.5.8.60 Error 8-156 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: Backup position not valid

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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## 12.5.8.61 Error 8-160 (emergency code 730007h)

**Cause:** Encoder #1 position out of range, motor was moved

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.8.62 Error 8-161 (emergency code 730007h)

**Cause:** Encoder #2 position out of range, motor was moved

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.8.63 Error 8-162 (emergency code 730007h)

**Cause:** Encoder #3 position out of range, motor was moved

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.8.64 Error 8-163 (emergency code 730007h)

**Cause:** Encoder #4 position out of range, motor was moved

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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#### 12.5.8.65 Error 8-164 (emergency code 730007h)

**Cause:** EtherCAT enc. #1 position out of range, motor was moved

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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#### 12.5.8.66 Error 8-165 (emergency code 730007h)

**Cause:** EtherCAT enc. #2 position out of range, motor was moved

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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#### 12.5.8.67 Error 8-166 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 position out of range, motor was moved

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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#### 12.5.8.68 Error 8-170 (emergency code 730007h)

**Cause:** Encoder #1 serial number changed, motor was replaced

**Suggested steps:**

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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## 12.5.8.69 Error 8-171 (emergency code 730007h)

**Cause:** Encoder #2 serial number changed, motor was replaced

### Suggested steps:

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.8.70 Error 8-172 (emergency code 730007h)

**Cause:** Encoder #3 serial number changed, motor was replaced

### Suggested steps:

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.8.71 Error 8-173 (emergency code 730007h)

**Cause:** Encoder #4 serial number changed, motor was replaced

### Suggested steps:

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.8.72 Error 8-174 (emergency code 730007h)

**Cause:** EtherCAT enc. #1 serial number changed, motor was replaced

### Suggested steps:

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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### 12.5.8.73 Error 8-175 (emergency code 730007h)

**Cause:** EtherCAT enc. #2 serial number changed, motor was replaced

**Suggested steps:**

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.8.74 Error 8-176 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 serial number changed, motor was replaced

**Suggested steps:**

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.8.75 Error 8-180 (emergency code 751007h)

**Cause:** Encoder #1 Hiperface DSL error

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"><li>• Check cabling. If available, please try another encoder and cable.</li><li>• See detailed error information (&gt;&gt;) for a more detailed description.</li><li>• The problem may be caused by mechanical shock</li><li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li></ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
Hiperface DSL encoder	Verify the AxialPosition (Rid D4) in the scope to ensure the encoder mounting quality.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>

## 12.5.8.76 Error 8-182 (emergency code FF0B07h)

**Cause:** Encoder #3 Hiperface DSL error

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
Hiperface DSL encoder	Verify the AxialPosition (Rid D4) in the scope to ensure the encoder mounting quality.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.8.77 Error 8-210 (emergency code 230507h)

**Cause:** Encoder: SD encoder error

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
Hiperface DSL encoder	Verify the AxialPosition (Rid D4) in the scope to ensure the encoder mounting quality.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.8.78 Error 8-220 (emergency code 730007h)

**Cause:** Encoder #1: Battery low, multiturn position is lost

**Suggested steps:**

Check voltage and cabling of encoder backup battery. Replace battery, quit error and repeat homing

The encoder is not connected or not working properly.	<ul style="list-style-type: none"><li>• Check cabling. If available, please try another encoder and cable.</li><li>• See detailed error information (&gt;&gt;) for a more detailed description.</li><li>• The problem may be caused by mechanical shock</li><li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li></ul>
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### 12.5.8.79 Error 8-221 (emergency code 730007h)

**Cause:** Encoder #2: Battery low, multiturn position is lost

**Suggested steps:**

Check voltage and cabling of encoder backup battery. Replace battery, quit error and repeat homing

The encoder is not connected or not working properly.	<ul style="list-style-type: none"><li>• Check cabling. If available, please try another encoder and cable.</li><li>• See detailed error information (&gt;&gt;) for a more detailed description.</li><li>• The problem may be caused by mechanical shock</li><li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li></ul>
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## 12.5.8.80 Error 8-222 (emergency code 730007h)

**Cause:** Encoder #3: Battery low, multiturn position is lost

### Suggested steps:

Check voltage and cabling of encoder backup battery. Replace battery, quit error and repeat homing

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
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## 12.5.8.81 Error 8-230 (emergency code 230507h)

**Cause:** Encoder #1: SmartAbs encoder error

### Suggested steps:

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

#### 12.5.8.82 Error 8-240 (emergency code 730007h)

**Cause:** Encoder #1 Parameter error

**Suggested steps:**

Please check parameter data set. Expand error window and see detailed information.

#### 12.5.8.83 Error 8-241 (emergency code 730007h)

**Cause:** Encoder #2 Parameter error

**Suggested steps:**

Please check parameter data set. Expand error window and see detailed information.

#### 12.5.8.84 Error 8-242 (emergency code 730007h)

**Cause:** Encoder #3 Parameter error

**Suggested steps:**

Please check parameter data set. Expand error window and see detailed information.

#### 12.5.8.85 Error 8-243 (emergency code 730007h)

**Cause:** Encoder #4 Parameter error

**Suggested steps:**

Please check parameter data set. Expand error window and see detailed information.

#### 12.5.8.86 Error 8-250 (emergency code 751007h)

**Cause:** Encoder #1: BISS protocol error

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"><li>• Check cabling. If available, please try another encoder and cable.</li><li>• See detailed error information (&gt;&gt;) for a more detailed description.</li><li>• The problem may be caused by mechanical shock</li><li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li></ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>



## 12.5.8.87 Error 8-260 (emergency code 730007h)

**Cause:** Encoder #1: Axis module was powered off in operation enabled state.  
Homing backup not available.

### Suggested steps:

Quit error, and repeat homing.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.8.88 Error 8-261 (emergency code 730007h)

**Cause:** Encoder #2: Axis module was powered off in operation enabled state.  
Homing backup not available.

### Suggested steps:

Quit error, and repeat homing.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.8.89 Error 8-262 (emergency code 730007h)

**Cause:** Encoder #3: Axis module was powered off in operation enabled state.  
Homing backup not available.

### Suggested steps:

Quit error, and repeat homing.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.8.90 Error 8-263 (emergency code 730007h)

**Cause:** Encoder #4: Axis module was powered off in operation enabled state.  
Homing backup not available.

### Suggested steps:

Quit error, and repeat homing.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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#### 12.5.8.91 Error 8-264 (emergency code 730007h)

**Cause:** EtherCAT enc.: #1 Axis module was powered off in operation enabled state.  
Homing backup not available.

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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#### 12.5.8.92 Error 8-265 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: Axis module was powered off in operation enabled state.  
Homing backup not available.

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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#### 12.5.8.93 Error 8-266 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: Axis module was powered off in operation enabled state.  
Homing backup not available.

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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#### 12.5.9 Error 9-x Timing error

## 12.5.9.1 Error 9-0 (emergency code 610007h)

**Cause:** Unknown Timing Error

**Suggested steps:**

Computational load in time-critical task of axis module is too high.	<ul style="list-style-type: none"> <li>• Please reduce computational load by removing parameters from mapping.</li> <li>• De-activate features of control system or motion control.</li> </ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>

## 12.5.9.2 Error 9-1 (emergency code 610007h)

**Cause:** DMA timing error

**Suggested steps:**

Computational load in time-critical task of axis module is too high.	<ul style="list-style-type: none"> <li>• Please reduce computational load by removing parameters from mapping.</li> <li>• De-activate features of control system or motion control.</li> </ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>

### 12.5.9.3 Error 9-2 (emergency code 610007h)

**Cause:** Task sequence timing error

**Suggested steps:**

Computational load in time-critical task of axis module is too high.	<ul style="list-style-type: none"><li>• Please reduce computational load by removing parameters from mapping.</li><li>• De-activate features of control system or motion control.</li></ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"><li>• Please check the EtherCAT connection. Try to replace the cables.</li><li>• Please try to reduce computational load on the master.</li><li>• Try to increase the master cycle time.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>

### 12.5.9.4 Error 9-3 (emergency code 610007h)

**Cause:** Internal state synchronisation error

**Suggested steps:**

Computational load in time-critical task of axis module is too high.	<ul style="list-style-type: none"><li>• Please reduce computational load by removing parameters from mapping.</li><li>• De-activate features of control system or motion control.</li></ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"><li>• Please check the EtherCAT connection. Try to replace the cables.</li><li>• Please try to reduce computational load on the master.</li><li>• Try to increase the master cycle time.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>

## 12.5.9.5 Error 9-4 (emergency code 610007h)

**Cause:** Internal register access error

**Suggested steps:**

Computational load in time-critical task of axis module is too high.	<ul style="list-style-type: none"> <li>• Please reduce computational load by removing parameters from mapping.</li> <li>• De-activate features of control system or motion control.</li> </ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>

## 12.5.9.6 Error 9-5 (emergency code 610007h)

**Cause:** Motion task timing error

**Suggested steps:**

Computational load in time-critical task of axis module is too high.	<ul style="list-style-type: none"> <li>• Please reduce computational load by removing parameters from mapping.</li> <li>• De-activate features of control system or motion control.</li> </ul>
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>

## 12.5.9.7 Error 9-6 (emergency code 610007h)

**Cause:** Slow task timing error

**Suggested steps:**

Computational load in time-critical task of axis module is too high.	<ul style="list-style-type: none"> <li>• Please reduce computational load by removing parameters from mapping.</li> <li>• De-activate features of control system or motion control.</li> </ul>
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>

## 12.5.10 Error 10-x Overcurrent error

### 12.5.10.1 Error 10-0 (emergency code 221101h)

**Cause:** General overcurrent

**Suggested steps:**

An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.10.2 Error 10-1 (emergency code 221101h)

**Cause:** Hardware overcurrent detected

**Suggested steps:**

An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.10.3 Error 10-2 (emergency code 221201h)

**Cause:** Software overcurrent detected

**Suggested steps:**

An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.10.4 Error 10-3 (emergency code 221101h)

**Cause:** Hardware overcurrent (alternate location)

**Suggested steps:**

- First, try the steps below to fix an overcurrent issue in the control system.
- Try to swap motor and power cable with another axis. If the error moves, consider replacing motor and cable.

An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.10.5 Error 10-4 (emergency code 221201h)

**Cause:** DC overcurrent detected

**Suggested steps:**

An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.10.6 Error 10-6 (emergency code 221201h)

**Cause:** Power stage high overload I2T limit exceeded

**Suggested steps:**

An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.



## 12.5.10.7 Error 10-7 (emergency code 221201h)

**Cause:** Actual current exceeds motor maximum current

**Suggested steps:**

An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.10.8 Error 10-8 (emergency code FF0D01h)

**Cause:** Motor wirebreak detected

**Suggested steps:**

- A motor wire-break was detected. Please check motor connection.
- Please check parameter CON\_MPCHK. Make a scope record with the motor's phase currents

## 12.5.10.9 Error 10-9 (emergency code 221201h)

**Cause:** Sum current u+v+w too high, possible short circuit to ground

**Suggested steps:**

An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.11 Error 11-x I2tAmplifier error

### 12.5.11.1 Error 11-0 (emergency code 222101h)

**Cause:** I2T limit exceeded (device protection)

**Suggested steps:**

The long-term r.m.s current is too high. Reduce load or consider using a larger device.

The long-term r.m.s current is too high for this axis module.	Reduce load or consider using a larger axis module.
An overcurrent was detected.	<ul style="list-style-type: none"><li>• Please check current control settings and step response.</li><li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li><li>• If possible, reduce the needed current, especially in low-frequency range.</li><li>• If possible, lower the switching frequency or enable automatic frequency selection.</li><li>• Check if the encoder offset is set properly.</li><li>• Consider using an axis module with higher current rating.</li></ul>

### 12.5.11.2 Error 11-1 (emergency code 222101h)

**Cause:** I2T limit exceeded (device protection)

**Suggested steps:**

The long-term r.m.s current is too high. Reduce load or consider using a larger device.

The long-term r.m.s current is too high for this axis module.	Reduce load or consider using a larger axis module.
An overcurrent was detected.	<ul style="list-style-type: none"><li>• Please check current control settings and step response.</li><li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li><li>• If possible, reduce the needed current, especially in low-frequency range.</li><li>• If possible, lower the switching frequency or enable automatic frequency selection.</li><li>• Check if the encoder offset is set properly.</li><li>• Consider using an axis module with higher current rating.</li></ul>

### 12.5.12 Error 12-x I2t Motor error

## 12.5.12.1 Error 12-0 (emergency code 222201h)

**Cause:** I2T limit exceeded (motor protection)

**Suggested steps:**

The long-term r.m.s current is too high for this motor.	<ul style="list-style-type: none"> <li>• Please let the motor cool down.</li> <li>• Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet.</li> </ul>
An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>

## 12.5.12.2 Error 12-1 (emergency code 222201h)

**Cause:** I2T limit exceeded (motor protection)

**Suggested steps:**

The long-term r.m.s current is too high for this motor.	<ul style="list-style-type: none"> <li>• Please let the motor cool down.</li> <li>• Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet.</li> </ul>
An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>

### 12.5.12.3 Error 12-2 (emergency code 222201h)

**Cause:** I2t monitoring: Need motor temperature source

**Suggested steps:**

The long-term r.m.s current is too high for this motor.	<ul style="list-style-type: none"><li>• Please let the motor cool down.</li><li>• Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet.</li></ul>
An overcurrent was detected.	<ul style="list-style-type: none"><li>• Please check current control settings and step response.</li><li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li><li>• If possible, reduce the needed current, especially in low-frequency range.</li><li>• If possible, lower the switching frequency or enable automatic frequency selection.</li><li>• Check if the encoder offset is set properly.</li><li>• Consider using an axis module with higher current rating.</li></ul>

### 12.5.12.4 Error 12-3 (emergency code 222201h)

**Cause:** Thermal model: Motor overload detected

**Suggested steps:**

The long-term r.m.s current is too high for this motor.	<ul style="list-style-type: none"><li>• Please let the motor cool down.</li><li>• Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet.</li></ul>
An overcurrent was detected.	<ul style="list-style-type: none"><li>• Please check current control settings and step response.</li><li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li><li>• If possible, reduce the needed current, especially in low-frequency range.</li><li>• If possible, lower the switching frequency or enable automatic frequency selection.</li><li>• Check if the encoder offset is set properly.</li><li>• Consider using an axis module with higher current rating.</li></ul>

### 12.5.13 Error 13-x Motion control error

## 12.5.13.1 Error 13-0 (emergency code FF0207h)

**Cause:** General Motion control error

### Suggested steps:

Quit error and start again

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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## 12.5.13.2 Error 13-1 (emergency code FF0207h)

**Cause:** Set of set points: Stack overflow, too many set points commanded

### Suggested steps:

Please re-view master PLC program

## 12.5.13.3 Error 13-2 (emergency code 861207h)

**Cause:** Software limit switch would be violated by new profile mode command. Command is discarded.

### Suggested steps:

Please check position limitation and reference value.

## 12.5.13.4 Error 13-3 (emergency code 861207h)

**Cause:** Failed to move axis to TargetPosition: distance too large

### Suggested steps:

- Please check auto-commutation settings. Consider using method with minimum movement.
- Consider raising the position tracking error threshold, or changing EnOpOPC to FORCE

## 12.5.13.5 Error 13-4 (emergency code 861207h)

**Cause:** Failed to move slave axis to TargetPosition: distance too large

### Suggested steps:

Check the setting of parameter 2262.2 EnOpDistance

Auto commutation might not be working properly.	<ul style="list-style-type: none"> <li>• Please check the encoder speed and direction, and motor pole pairs.</li> <li>• Check auto commutation parameters.</li> <li>• Make a scope record with scope values 24, 25, 21, 1009.</li> </ul>
The control system failed to track the reference value	<ul style="list-style-type: none"> <li>• Please check if the axis is blocked.</li> <li>• Try to reduce acceleration or deceleration.</li> <li>• If reference speed is higher than the motor rated speed, please check field weakening settings. In field-weakening range, the available torque per current is reduced.</li> </ul>

### 12.5.13.6 Error 13-5 (emergency code 861207h)

**Cause:** SSP sequence must not end 'change on setpoint'

**Suggested steps:**

Please check the master PLC program

## 12.5.14 Error 14-x Overvoltage error

### 12.5.14.1 Error 14-0 (emergency code 321002h)

**Cause:** Over voltage detected

**Suggested steps:**

An over-voltage occurred.	<ul style="list-style-type: none"><li>• Please check if the actual grid voltage matches the supply setting (parameter PST_VoltageSupply)</li><li>• Over-voltage may be caused by a decelerating axis, possibly with high inertia. Reduce deceleration ramp.</li><li>• Consider using a braking resistor with higher power. If the supply unit has an internal braking resistor, please contact your service partner.</li></ul>
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### 12.5.14.2 Error 14-1 (emergency code 321002h)

**Cause:** Device monitoring: Over voltage detected

**Suggested steps:**

An over-voltage occurred.	<ul style="list-style-type: none"><li>• Please check if the actual grid voltage matches the supply setting (parameter PST_VoltageSupply)</li><li>• Over-voltage may be caused by a decelerating axis, possibly with high inertia. Reduce deceleration ramp.</li><li>• Consider using a braking resistor with higher power. If the supply unit has an internal braking resistor, please contact your service partner.</li></ul>
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### 12.5.14.3 Error 14-2 (emergency code 225002h)

**Cause:** DC link center out of range

**Suggested steps:**

This axis module seems to be broken. Switch off power supply and replace it.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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## 12.5.15 Error 15-x Undervoltage error

## 12.5.15.1 Error 15-0 (emergency code 322002h)

**Cause:** Under voltage detected

**Suggested steps:**

An under-voltage occurred on the drive while this axis was switched on.	<ul style="list-style-type: none"> <li>• Power supply was possibly switched off.</li> <li>• Please check if the actual grid voltage matches the supply setting (parameter PST_VoltageSupply)</li> <li>• Verify that the grid is stable under load condition.</li> </ul>
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## 12.5.15.2 Error 15-1 (emergency code 322002h)

**Cause:** Device monitoring: Under voltage detected

**Suggested steps:**

An under-voltage occurred on the drive while this axis was switched on.	<ul style="list-style-type: none"> <li>• Power supply was possibly switched off.</li> <li>• Please check if the actual grid voltage matches the supply setting (parameter PST_VoltageSupply)</li> <li>• Verify that the grid is stable under load condition.</li> </ul>
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## 12.5.16 Error 16-x Speed difference error

## 12.5.16.1 Error 16-0 (emergency code 840007h)

**Cause:** Speed limit error

**Suggested steps:**

The control system failed to track the reference value	<ul style="list-style-type: none"> <li>• Please check if the axis is blocked.</li> <li>• Try to reduce acceleration or deceleration.</li> <li>• If reference speed is higher than the motor rated speed, please check field weakening settings. In field-weakening range, the available torque per current is reduced.</li> </ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"> <li>• Please check that the encoder offset is set properly.</li> <li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li> <li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.16.2 Error 16-1 (emergency code 840007h)

**Cause:** Max. speed difference detected

**Suggested steps:**

The control system failed to track the reference value	<ul style="list-style-type: none"> <li>• Please check if the axis is blocked.</li> <li>• Try to reduce acceleration or deceleration.</li> <li>• If reference speed is higher than the motor rated speed, please check field weakening settings. In field-weakening range, the available torque per current is reduced.</li> </ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"> <li>• Please check that the encoder offset is set properly.</li> <li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li> <li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.16.3 Error 16-2 (emergency code 840007h)

**Cause:** Max. speed detected

**Suggested steps:**

The control system failed to track the reference value	<ul style="list-style-type: none"> <li>• Please check if the axis is blocked.</li> <li>• Try to reduce acceleration or deceleration.</li> <li>• If reference speed is higher than the motor rated speed, please check field weakening settings. In field-weakening range, the available torque per current is reduced.</li> </ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"> <li>• Please check that the encoder offset is set properly.</li> <li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li> <li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>



## 12.5.16.4 Error 16-3 (emergency code 840007h)

**Cause:** Gantry mode: Speed difference between coupled axes is too high

**Suggested steps:**

- Please check the gantry mode yaw control parameters.
- Make sure there is no mechanical block in the gantry kinematics.

The control system failed to track the reference value	<ul style="list-style-type: none"> <li>• Please check if the axis is blocked.</li> <li>• Try to reduce acceleration or deceleration.</li> <li>• If reference speed is higher than the motor rated speed, please check field weakening settings. In field-weakening range, the available torque per current is reduced.</li> </ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"> <li>• Please check that the encoder offset is set properly.</li> <li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li> <li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.17.1 Error 17-0 (emergency code 861107h)

**Cause:** Max. position difference detected

**Suggested steps:**

The position tracking error is too high. This limit is usually defined according to process requirements.

The control system failed to track the reference value	<ul style="list-style-type: none"> <li>• Please check if the axis is blocked.</li> <li>• Try to reduce acceleration or deceleration.</li> <li>• If reference speed is higher than the motor rated speed, please check field weakening settings. In field-weakening range, the available torque per current is reduced.</li> </ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"> <li>• Please check that the encoder offset is set properly.</li> <li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li> <li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.17 Error 17-x Position difference error

### 12.5.17.2 Error 17-1 (emergency code 861107h)

**Cause:** Max. position difference detected

**Suggested steps:**

The position tracking error is too high. This limit is usually defined according to process requirements.

The control system failed to track the reference value	<ul style="list-style-type: none"> <li>• Please check if the axis is blocked.</li> <li>• Try to reduce acceleration or deceleration.</li> <li>• If reference speed is higher than the motor rated speed, please check field weakening settings. In field-weakening range, the available torque per current is reduced.</li> </ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"> <li>• Please check that the encoder offset is set properly.</li> <li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li> <li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.17.3 Error 17-2 (emergency code 861107h)

**Cause:** Gantry mode: Position difference between coupled axes is too high

**Suggested steps:**

- Please check the gantry mode yaw control parameters.
- Make sure there is no mechanical block in the gantry kinematics.

The control system failed to track the reference value	<ul style="list-style-type: none"> <li>• Please check if the axis is blocked.</li> <li>• Try to reduce acceleration or deceleration.</li> <li>• If reference speed is higher than the motor rated speed, please check field weakening settings. In field-weakening range, the available torque per current is reduced.</li> </ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"> <li>• Please check that the encoder offset is set properly.</li> <li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li> <li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.18 Error 18-x Power stage overtemperature

## 12.5.18.1 Error 18-0 (emergency code 421003h)

**Cause:** Overtemperature Detected

**Suggested steps:**

- Please check outside temperature and air flow.
- Reduce output power or switching frequency.
- This error may also be caused by other axes of this device.

An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.18.2 Error 18-1 (emergency code 421003h)

**Cause:** Interior temperature too high

**Suggested steps:**

- Please check outside temperature and air flow.
- Reduce output power or switching frequency.
- This error may also be caused by other axes of this device.

An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.18.3 Error 18-2 (emergency code 421003h)

**Cause:** Power stage temperature too high

**Suggested steps:**

- Please check outside temperature and air flow.
- Reduce output power or switching frequency.
- This error may also be caused by other axes of this device.

An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.19 Error 19-x Cross communication error

### 12.5.19.1 Error 19-0 (emergency code FF0307h)

**Cause:** Cross communication: Error

**Suggested steps:**

An error occurred on the cross-communication line.	<ul style="list-style-type: none"> <li>• Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies).</li> <li>• Cross communication must not be connected across different power supplies.</li> <li>• The last axis module's X4 or X40B connector (whichever applies) must remain open.</li> <li>• All axis modules on a cross communication should run the same firmware</li> <li>• Though this error is displayed by all axis modules, the cause is often a single device or cable. Try to locate the fault by excluding devices from cross-communication.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.19.2 Error 19-1 (emergency code FF0307h)

**Cause:** Cross communication: Enumeration error

**Suggested steps:**

An error occurred on the cross-communication line.	<ul style="list-style-type: none"> <li>• Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies).</li> <li>• Cross communication must not be connected across different power supplies.</li> <li>• The last axis module's X4 or X40B connector (whichever applies) must remain open.</li> <li>• All axis modules on a cross communication should run the same firmware</li> <li>• Though this error is displayed by all axis modules, the cause is often a single device or cable. Try to locate the fault by excluding devices from cross-communication.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.19.3 Error 19-2 (emergency code FF0307h)

**Cause:** Cross communication: Physical layer error

**Suggested steps:**

An error occurred on the cross-communication line.	<ul style="list-style-type: none"> <li>• Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies).</li> <li>• Cross communication must not be connected across different power supplies.</li> <li>• The last axis module's X4 or X40B connector (whichever applies) must remain open.</li> <li>• All axis modules on a cross communication should run the same firmware</li> <li>• Though this error is displayed by all axis modules, the cause is often a single device or cable. Try to locate the fault by excluding devices from cross-communication.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

#### 12.5.19.4 Error 19-3 (emergency code FF0307h)

**Cause:** Supply unit firmware loader error

**Suggested steps:**

An error occurred on the cross-communication line.	<ul style="list-style-type: none"> <li>• Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies).</li> <li>• Cross communication must not be connected across different power supplies.</li> <li>• The last axis module's X4 or X40B connector (whichever applies) must remain open.</li> <li>• All axis modules on a cross communication should run the same firmware</li> <li>• Though this error is displayed by all axis modules, the cause is often a single device or cable. Try to locate the fault by excluding devices from cross-communication.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

#### 12.5.20.1 Error 20-0 (emergency code FF0407h)

**Cause:** Unspecified I/O error occurred

**Suggested steps:**

This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

#### 12.5.20 Error 20-x Common system error

## 12.5.20.2 Error 20-1 (emergency code FF0407h)

**Cause:** Power stage controller framing error

**Suggested steps:**

Please check 24V supply for short-time power loss.

This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.20.3 Error 20-2 (emergency code FF0407h)

**Cause:** Power stage controller checksum error

**Suggested steps:**

Please check 24V supply for short-time power loss.

This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

#### 12.5.20.4 Error 20-3 (emergency code FF0407h)

**Cause:** Power stage controller I/O error

**Suggested steps:**

Please check 24V supply for short-time power loss.

This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

#### 12.5.20.5 Error 20-4 (emergency code 630C07h)

**Cause:** Initialization of power stage parameters failed

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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#### 12.5.20.6 Error 20-5 (emergency code 630D07h)

**Cause:** Initialization of supply parameters failed

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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#### 12.5.21 Error 21-x Motor brake error



## 12.5.21.1 Error 21-0 (emergency code FF0507h)

**Cause:** Unspecified motor brake error occurred

**Suggested steps:**

This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.21.2 Error 21-1 (emergency code FF0507h)

**Cause:** Motor brake wire break detected

**Suggested steps:**

Please check the wiring of the motor brake.

## 12.5.21.3 Error 21-2 (emergency code FF0507h)

**Cause:** Motor brake not released though release requested

**Suggested steps:**

Please increase the motor brake lift time.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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## 12.5.21.4 Error 21-3 (emergency code FF0507h)

**Cause:** Brake check: Current reached limit.

**Suggested steps:**

If possible, increase the current limit. Consider using lower switching frequency.

## 12.5.21.5 Error 21-4 (emergency code FF0507h)

**Cause:** Brake check: Reached torque limit

**Suggested steps:**

if possible, increase the torque limit.

## 12.5.21.6 Error 21-5 (emergency code FF0507h)

**Cause:** Brake check interrupted by user.

**Suggested steps:**

MPRO\_BRK\_CK\_Control bit 15 was reset

#### 12.5.21.7 Error 21-6 (emergency code FF0507h)

**Cause:** Brake Check: wrong mode

**Suggested steps:**

Exactly one bit in Parameter MPRO\_BRK\_CK\_Control/ MODE field can be set

#### 12.5.21.8 Error 21-7 (emergency code FF0507h)

**Cause:** Brake Check: no direction defined

**Suggested steps:**

Exactly one bit in Parameter MPRO\_BRK\_CK\_Control/ Dir field can be set

#### 12.5.21.9 Error 21-8 (emergency code FF0507h)

**Cause:** Brake Check: Grind in timeout

**Suggested steps:**

Increase timeout setting in Parameter GrindTO

#### 12.5.21.10 Error 21-9 (emergency code FF0507h)

**Cause:** Brake Check: power stage off

**Suggested steps:**

Enable control.

#### 12.5.21.11 Error 21-10 (emergency code FF0507h)

**Cause:** Brake Check: Safe brake test failed

**Suggested steps:**

Please check settings of the brake test, in both functional settings and SafePLC program

#### 12.5.21.12 Error 21-11 (emergency code FF0507h)

**Cause:** Brake Check: no rated torque defined

**Suggested steps:**

Please check settings of the brake test, in both functional settings and SafePLC program

### 12.5.22 Error 22-x Encoder cyclic error

#### 12.5.22.1 Error 22-0 (emergency code 730007h)

**Cause:** General encoder error (Encoder error during operation)

**Suggested steps:**

- Please check encoder settings and connected encoders of this axis.

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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## 12.5.22.2 Error 22-11 (emergency code 730007h)

**Cause:** Encoder offset detection failed (Encoder error during operation)

**Suggested steps:**

Auto commutation might not be working properly.	<ul style="list-style-type: none"><li>• Please check the encoder speed and direction, and motor pole pairs.</li><li>• Check auto commutation parameters.</li><li>• Make a scope record with scope values 24, 25, 21, 1009.</li></ul>
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## 12.5.22.3 Error 22-12 (emergency code 730007h)

**Cause:** Motor was replaced with different motor type (Encoder error during operation)

**Suggested steps:**

- Quit error, load new motor nameplate manually, and tune parameters for application
- If motor change guarding is not intended, please see "encoder special function"

## 12.5.22.4 Error 22-13 (emergency code 730007h)

**Cause:** Motor was replaced with unknown motor type (Encoder error during operation)

**Suggested steps:**

- Execute a factory reset, and load motor parameter set
- If motor change guarding is not intended, please see "encoder special function"

## 12.5.22.5 Error 22-14 (emergency code 730007h)

**Cause:** Encoder #1: Cannot acquire position because motor is moving (Encoder error during operation)

**Suggested steps:**

Stop motor mechanically and quit error

## 12.5.22.6 Error 22-15 (emergency code 730007h)

**Cause:** Position encoder has no distance-coded zero pulses, or wrong parameter setting (Encoder error during operation)

**Suggested steps:**

- Please check parameter setting of encoder. DistCodeA and DistCodeB must be set.
- Use a different homing method

### 12.5.22.7 Error 22-20 (emergency code 751007h)

**Cause:** Encoder: SSI error (Encoder error during operation)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.22.8 Error 22-30 (emergency code 751007h)

**Cause:** Encoder: ENDAT protocol error (Encoder error during operation)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.22.9 Error 22-42 (emergency code 751007h)

**Cause:** Encoder: Hiperface protocol error (Encoder error during operation)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.22.10 Error 22-50 (emergency code 730007h)

**Cause:** Encoder #1: Internal communication error (Encoder error during operation)

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.22.11 Error 22-51 (emergency code 730007h)

**Cause:** Encoder #2: Internal communication error (Encoder error during operation)

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.22.12 Error 22-52 (emergency code 730007h)

**Cause:** Encoder #3: Internal communication error (Encoder error during operation)

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.22.13 Error 22-53 (emergency code 730007h)

**Cause:** Encoder #4: Internal communication error (Encoder error during operation)

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.22.14 Error 22-60 (emergency code 230507h)

**Cause:** Encoder #1: A/B pattern error, probably EMC problem (Encoder error during operation)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.22.15 Error 22-61 (emergency code 230607h)

**Cause:** Encoder #2: A/B pattern error, probably EMC problem (Encoder error during operation)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"><li>• Check cabling. If available, please try another encoder and cable.</li><li>• See detailed error information (&gt;&gt;) for a more detailed description.</li><li>• The problem may be caused by mechanical shock</li><li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li></ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"><li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li><li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li><li>• See detailed error information (&gt;&gt;) for a more detailed description.</li></ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>

### 12.5.22.16 Error 22-70 (emergency code 730007h)

**Cause:** Encoder #1: Gearbox error (Encoder error during operation)

**Suggested steps:**

Please check this encoder's gear ratio settings.

### 12.5.22.17 Error 22-71 (emergency code 730007h)

**Cause:** Encoder #2: Gearbox error (Encoder error during operation)

**Suggested steps:**

Please check this encoder's gear ratio settings.

### 12.5.22.18 Error 22-72 (emergency code 730007h)

**Cause:** Encoder #3: Gearbox error (Encoder error during operation)

**Suggested steps:**

Please check this encoder's gear ratio settings.

### 12.5.22.19 Error 22-73 (emergency code 730007h)

**Cause:** Encoder #4: Gearbox error (Encoder error during operation)

**Suggested steps:**

Please check this encoder's gear ratio settings.



## 12.5.22.20 Error 22-74 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: Gearbox error (Encoder error during operation)

**Suggested steps:**

Please check this encoder's gear ratio settings.

## 12.5.22.21 Error 22-75 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: Gearbox error (Encoder error during operation)

**Suggested steps:**

Please check this encoder's gear ratio settings.

## 12.5.22.22 Error 22-76 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: Gearbox error (Encoder error during operation)

**Suggested steps:**

Please check this encoder's gear ratio settings.

## 12.5.22.23 Error 22-80 (emergency code 730007h)

**Cause:** Encoder #1: (Absolute) position calculation error (Encoder error during operation)

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>• Check motor grounding and motor cable length.</li> </ul>
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#### 12.5.22.24 Error 22-81 (emergency code 730007h)

**Cause:** Encoder #2: (Absolute) position calculation error (Encoder error during operation)

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>Check motor grounding and motor cable length.</li> </ul>
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## 12.5.22.25 Error 22-82 (emergency code 730007h)

**Cause:** Encoder #3: (Absolute) position calculation error (Encoder error during operation)

### Suggested steps:

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>Check cabling. If available, please try another encoder and cable.</li> <li>See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>The problem may be caused by mechanical shock</li> <li>In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>Please check the device cabling for proper connection.</li> <li>Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>• Check motor grounding and motor cable length.</li> </ul>
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## 12.5.22.26 Error 22-83 (emergency code 730007h)

**Cause:** Encoder #4: (Absolute) position calculation error (Encoder error during operation)

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>Check motor grounding and motor cable length.</li> </ul>
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## 12.5.22.27 Error 22-84 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: (Absolute) position calculation error (Encoder error during operation)

### Suggested steps:

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>Check cabling. If available, please try another encoder and cable.</li> <li>See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>The problem may be caused by mechanical shock</li> <li>In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>Please check the device cabling for proper connection.</li> <li>Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>• Check motor grounding and motor cable length.</li> </ul>
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## 12.5.22.28 Error 22-85 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: (Absolute) position calculation error (Encoder error during operation)

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>Check motor grounding and motor cable length.</li> </ul>
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## 12.5.22.29 Error 22-86 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: (Absolute) position calculation error (Encoder error during operation)

### Suggested steps:

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>Check cabling. If available, please try another encoder and cable.</li> <li>See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>The problem may be caused by mechanical shock</li> <li>In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>Please check the device cabling for proper connection.</li> <li>Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>• Check motor grounding and motor cable length.</li> </ul>
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### 12.5.22.30 Error 22-90 (emergency code 230507h)

**Cause:** Encoder #1 lost connection (Encoder error during operation)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>



## 12.5.22.31 Error 22-91 (emergency code 230607h)

**Cause:** Encoder #2 lost connection (Encoder error during operation)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.22.32 Error 22-92 (emergency code 730007h)

**Cause:** Encoder #3 lost connection (Encoder error during operation)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.22.33 Error 22-94 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: status bit released (Encoder error during operation)

**Suggested steps:**

Please check encoder wiring, field bus system, and master settings

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>

### 12.5.22.34 Error 22-95 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: status bit released (Encoder error during operation)

**Suggested steps:**

Please check encoder wiring, field bus system, and master settings

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>

## 12.5.22.35 Error 22-96 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: status bit released (Encoder error during operation)

### Suggested steps:

Please check encoder wiring, field bus system, and master settings

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>

## 12.5.22.36 Error 22-100 (emergency code 230507h)

**Cause:** Encoder #1 TTL error (Encoder error during operation)

### Suggested steps:

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"> <li>• Save your parameter set for a later restore.</li> <li>• See 'history of parameter changes' and undo the latest changes.</li> <li>• Please check your parameter set for implausible settings.</li> <li>• Please set device to factory setting, restart, and see if the error occurs again.</li> <li>• When reporting this error to your service partner, please include your device's parameter setting.</li> </ul>
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### 12.5.22.37 Error 22-101 (emergency code 230607h)

**Cause:** Encoder #2 TTL error (Encoder error during operation)

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
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### 12.5.22.38 Error 22-110 (emergency code 730007h)

**Cause:** Hardware does not support encoder #1 (Encoder error during operation)

**Suggested steps:**

This axis module's hardware variant does not support the selected encoder channel/type. Use a different encoder or contact your service partner for a different hardware.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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### 12.5.22.39 Error 22-111 (emergency code 730007h)

**Cause:** Hardware does not support encoder #2 (Encoder error during operation)

**Suggested steps:**

This axis module's hardware variant does not support the selected encoder channel/type. Use a different encoder or contact service for a different hardware.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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### 12.5.22.40 Error 22-112 (emergency code 730007h)

**Cause:** Hardware does not support encoder #3 (Encoder error during operation)

**Suggested steps:**

This axis module's hardware variant does not support the selected encoder channel/type. Use a different encoder or contact service for a different hardware.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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### 12.5.22.41 Error 22-124 (emergency code 730007h)

**Cause:** EtherCAT enc. #1 is in use by another axis (Encoder error during operation)

**Suggested steps:**

This EtherCAT encoder channel was selected by two or three axes. Use a different channel for each axis.

## 12.5.22.42 Error 22-125 (emergency code 730007h)

**Cause:** EtherCAT enc. #2 is in use by another axis (Encoder error during operation)

### Suggested steps:

This EtherCAT encoder channel was selected by two or three axes. Use a different channel for each axis.

## 12.5.22.43 Error 22-126 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 is in use by another axis (Encoder error during operation)

### Suggested steps:

This EtherCAT encoder channel was selected by two or three axes. Use a different channel for each axis.

## 12.5.22.44 Error 22-134 (emergency code 730007h)

**Cause:** EtherCAT enc. #1 error (Encoder error during operation)

### Suggested steps:

The EtherCAT encoder bit number might be wrong.

<p>The device was probably disconnected from the master controller, or the master is overloaded.</p>	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>
<p>This issue is probably caused by an unsuitable parameter setting.</p>	<ul style="list-style-type: none"> <li>• Save your parameter set for a later restore.</li> <li>• See 'history of parameter changes' and undo the latest changes.</li> <li>• Please check your parameter set for implausible settings.</li> <li>• Please set device to factory setting, restart, and see if the error occurs again.</li> <li>• When reporting this error to your service partner, please include your device's parameter setting.</li> </ul>

### 12.5.22.45 Error 22-135 (emergency code 730007h)

**Cause:** EtherCAT enc. #2 error (Encoder error during operation)

**Suggested steps:**

The EtherCAT encoder bit number might be wrong.

The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"><li>• Please check the EtherCAT connection. Try to replace the cables.</li><li>• Please try to reduce computational load on the master.</li><li>• Try to increase the master cycle time.</li></ul>
This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>

### 12.5.22.46 Error 22-136 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 error (Encoder error during operation)

**Suggested steps:**

The EtherCAT encoder bit number might be wrong.

The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"><li>• Please check the EtherCAT connection. Try to replace the cables.</li><li>• Please try to reduce computational load on the master.</li><li>• Try to increase the master cycle time.</li></ul>
This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>

## 12.5.22.47 Error 22-140 (emergency code 730007h)

**Cause:** Encoder #1: Absolute encoder simulation: Initialisation error (Encoder error during operation)

### Suggested steps:

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.22.48 Error 22-141 (emergency code 730007h)

**Cause:** Encoder #2: Absolute encoder simulation: Initialisation error (Encoder error during operation)

### Suggested steps:

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.22.49 Error 22-142 (emergency code 730007h)

**Cause:** Encoder #3: Absolute encoder simulation: Initialisation error (Encoder error during operation)

### Suggested steps:

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.22.50 Error 22-143 (emergency code 730007h)

**Cause:** Encoder #4: Absolute encoder simulation: Initialisation error (Encoder error during operation)

### Suggested steps:

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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### 12.5.22.51 Error 22-144 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: Absolute encoder simulation: Initialisation error (Encoder error during operation)

**Suggested steps:**

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.22.52 Error 22-145 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: Absolute encoder simulation: Initialisation error (Encoder error during operation)

**Suggested steps:**

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.22.53 Error 22-146 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 Absolute encoder simulation: Initialisation error (Encoder error during operation)

**Suggested steps:**

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.22.54 Error 22-150 (emergency code 730007h)

**Cause:** Encoder #1: Backup information not valid (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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## 12.5.22.55 Error 22-151 (emergency code 730007h)

**Cause:** Encoder #2: Backup information not valid (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.22.56 Error 22-152 (emergency code 730007h)

**Cause:** Encoder #3: Backup information not valid (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.22.57 Error 22-153 (emergency code 730007h)

**Cause:** Encoder #4: Backup position not valid (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.22.58 Error 22-154 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: Backup position not valid (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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### 12.5.22.59 Error 22-155 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: Backup position not valid (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.22.60 Error 22-156 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: Backup position not valid (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.22.61 Error 22-160 (emergency code 730007h)

**Cause:** Encoder #1 position out of range, motor was moved (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.22.62 Error 22-161 (emergency code 730007h)

**Cause:** Encoder #2 position out of range, motor was moved (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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## 12.5.22.63 Error 22-162 (emergency code 730007h)

**Cause:** Encoder #3 position out of range, motor was moved (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.22.64 Error 22-163 (emergency code 730007h)

**Cause:** Encoder #4 position out of range, motor was moved (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.22.65 Error 22-164 (emergency code 730007h)

**Cause:** EtherCAT enc. #1 position out of range, motor was moved (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.22.66 Error 22-165 (emergency code 730007h)

**Cause:** EtherCAT enc. #2 position out of range, motor was moved (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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### 12.5.22.67 Error 22-166 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 position out of range, motor was moved (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.22.68 Error 22-170 (emergency code 730007h)

**Cause:** Encoder #1 serial number changed, motor was replaced (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.22.69 Error 22-171 (emergency code 730007h)

**Cause:** Encoder #2 serial number changed, motor was replaced (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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## 12.5.22.70 Error 22-172 (emergency code 730007h)

**Cause:** Encoder #3 serial number changed, motor was replaced (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.22.71 Error 22-173 (emergency code 730007h)

**Cause:** Encoder #4 serial number changed, motor was replaced (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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### 12.5.22.72 Error 22-174 (emergency code 730007h)

**Cause:** EtherCAT enc. #1 serial number changed, motor was replaced (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.22.73 Error 22-175 (emergency code 730007h)

**Cause:** EtherCAT enc. #2 serial number changed, motor was replaced (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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## 12.5.22.74 Error 22-176 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 serial number changed, motor was replaced (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.22.75 Error 22-180 (emergency code 751007h)

**Cause:** Encoder #1 Hiperface DSL error (Encoder error during operation)

### Suggested steps:

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
Hiperface DSL encoder	Verify the AxialPosition (Rid D4) in the scope to ensure the encoder mounting quality.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.22.76 Error 22-182 (emergency code FF0B07h)

**Cause:** Encoder #3 Hiperface DSL error (Encoder error during operation)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
Hiperface DSL encoder	Verify the AxialPosition (Rid D4) in the scope to ensure the encoder mounting quality.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.22.77 Error 22-210 (emergency code 230507h)

**Cause:** Encoder: SD encoder error (Encoder error during operation)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
Hiperface DSL encoder	Verify the AxialPosition (Rid D4) in the scope to ensure the encoder mounting quality.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>



## 12.5.22.78 Error 22-220 (emergency code 730007h)

**Cause:** Encoder #1: Battery low, multiturn position is lost (Encoder error during operation)

### Suggested steps:

Check voltage and cabling of encoder backup battery. Replace battery, quit error and repeat homing

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
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## 12.5.22.79 Error 22-221 (emergency code 730007h)

**Cause:** Encoder #2: Battery low, multiturn position is lost (Encoder error during operation)

### Suggested steps:

Check voltage and cabling of encoder backup battery. Replace battery, quit error and repeat homing

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
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## 12.5.22.80 Error 22-222 (emergency code 730007h)

**Cause:** Encoder #3: Battery low, multiturn position is lost (Encoder error during operation)

### Suggested steps:

Check voltage and cabling of encoder backup battery. Replace battery, quit error and repeat homing

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
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## 12.5.22.81 Error 22-230 (emergency code 230507h)

**Cause:** Encoder #1: SmartAbs encoder error (Encoder error during operation)

### Suggested steps:

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.22.82 Error 22-240 (emergency code 730007h)

**Cause:** Encoder #1 Parameter error (Encoder error during operation)

### Suggested steps:

Please check parameter data set. Expand error window and see detailed information.

## 12.5.22.83 Error 22-241 (emergency code 730007h)

**Cause:** Encoder #2 Parameter error (Encoder error during operation)

### Suggested steps:

Please check parameter data set. Expand error window and see detailed information.

## 12.5.22.84 Error 22-242 (emergency code 730007h)

**Cause:** Encoder #3 Parameter error (Encoder error during operation)

### Suggested steps:

Please check parameter data set. Expand error window and see detailed information.

## 12.5.22.85 Error 22-243 (emergency code 730007h)

**Cause:** Encoder #4 Parameter error (Encoder error during operation)

### Suggested steps:

Please check parameter data set. Expand error window and see detailed information.

## 12.5.22.86 Error 22-250 (emergency code 751007h)

**Cause:** Encoder #1: BISS protocol error (Encoder error during operation)

### Suggested steps:

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.22.87 Error 22-260 (emergency code 730007h)

**Cause:** Encoder #1: Axis module was powered off in operation enabled state.  
Homing backup not available. (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.22.88 Error 22-261 (emergency code 730007h)

**Cause:** Encoder #2: Axis module was powered off in operation enabled state.  
Homing backup not available. (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.22.89 Error 22-262 (emergency code 730007h)

**Cause:** Encoder #3: Axis module was powered off in operation enabled state.  
Homing backup not available. (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.22.90 Error 22-263 (emergency code 730007h)

**Cause:** Encoder #4: Axis module was powered off in operation enabled state.  
Homing backup not available. (Encoder error during operation)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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## 12.5.22.91 Error 22-264 (emergency code 730007h)

**Cause:** EtherCAT enc.: #1 Axis module was powered off in operation enabled state.  
Homing backup not available. (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.22.92 Error 22-265 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: Axis module was powered off in operation enabled state.  
Homing backup not available. (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.22.93 Error 22-266 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: Axis module was powered off in operation enabled state.  
Homing backup not available. (Encoder error during operation)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.23 Error 23-x Homing error

### 12.5.23.1 Error 23-0 (emergency code FF0607h)

**Cause:** Unspecified homing error occurred

**Suggested steps:**

There is a problem with the digital inputs	<ul style="list-style-type: none"><li>• Please check the 24V I/O wiring, function assignment and inversion parameters.</li><li>• Please check connected switches for chattering. Consider using the input filter.</li></ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>

### 12.5.23.2 Error 23-1 (emergency code FF0707h)

**Cause:** Homing error: Limit switches interchanged

**Suggested steps:**

Please check limit switches.

There is a problem with the digital inputs	<ul style="list-style-type: none"><li>• Please check the 24V I/O wiring, function assignment and inversion parameters.</li><li>• Please check connected switches for chattering. Consider using the input filter.</li></ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>

## 12.5.23.3 Error 23-2 (emergency code FF0607h)

**Cause:** Homing error: Unexpected home switch event

**Suggested steps:**

Please check home switch.

There is a problem with the digital inputs	<ul style="list-style-type: none"> <li>• Please check the 24V I/O wiring, function assignment and inversion parameters.</li> <li>• Please check connected switches for chattering. Consider using the input filter.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.23.4 Error 23-3 (emergency code FF0700h)

**Cause:** Homing error: Error limit switch event

**Suggested steps:**

Please check limit switches.

There is a problem with the digital inputs	<ul style="list-style-type: none"> <li>• Please check the 24V I/O wiring, function assignment and inversion parameters.</li> <li>• Please check connected switches for chattering. Consider using the input filter.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.23.5 Error 23-4 (emergency code FF0607h)

**Cause:** Homing error: Unknown homing method

**Suggested steps:**

Please use a different homing method.

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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### 12.5.23.6 Error 23-5 (emergency code FF0607h)

**Cause:** Homing error: Method is not defined in motionprofile

**Suggested steps:**

Please use a different homing method.

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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### 12.5.23.7 Error 23-6 (emergency code FF0607h)

**Cause:** Homing error: Drive not ready, missing motor standstill

**Suggested steps:**

Please set motor to standstill. Please check standstill window (position limitation topic).

### 12.5.23.8 Error 23-7 (emergency code FF0607h)

**Cause:** Homing error: Drive not ready, missing operational or motor standstill

**Suggested steps:**

Please set motor to standstill and operational. Please check standstill window (position limitation topic).

### 12.5.23.9 Error 23-8 (emergency code FF0607h)

**Cause:** Homing error: Drive not ready, wrong control mode

**Suggested steps:**

Homing is only supported in position control mode.

### 12.5.23.10 Error 23-9 (emergency code FF0607h)

**Cause:** Homing error: Encoder initialisation failed

**Suggested steps:**

The homing function during start-up failed due to an internal error.

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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### 12.5.23.11 Error 23-10 (emergency code FF0607h)

**Cause:** Homing error: Homing distance control, maximum distance overrun

**Suggested steps:**

- The index pulse was not reached within the given distance. Please check the encoder's index pulse configuration and max. distance parameter.
- Please check if the encoder is working correctly.



## 12.5.23.12 Error 23-11 (emergency code FF0607h)

**Cause:** Homing error: Restore position with backup position failed

### Suggested steps:

Reset error, save setting, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.23.13 Error 23-12 (emergency code FF0607h)

**Cause:** Homing error: Backup position not valid

### Suggested steps:

Reset error, save setting, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.23.14 Error 23-13 (emergency code FF0607h)

**Cause:** Homing error: Encoder not initialised with changed data set

### Suggested steps:

Initialise encoder first.

## 12.5.24 Error 24-x Supply error 1

### 12.5.24.1 Error 24-0 (emergency code FF0807h)

**Cause:** Supply unit: Unspecified error

### Suggested steps:

An error occurred on the cross-communication line.	<ul style="list-style-type: none"> <li>• Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies).</li> <li>• Cross communication must not be connected across different power supplies.</li> <li>• The last axis module's X4 or X40B connector (whichever applies) must remain open.</li> <li>• All axis modules on a cross communication should run the same firmware</li> <li>• Though this error is displayed by all axis modules, the cause is often a single device or cable. Try to locate the fault by excluding devices from cross-communication.</li> </ul>
This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.

### 12.5.24.2 Error 24-1 (emergency code FF0807h)

**Cause:** Supply error, from fast error signal

**Suggested steps:**

An error occurred on the cross-communication line.	<ul style="list-style-type: none"><li>• Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies).</li><li>• Cross communication must not be connected across different power supplies.</li><li>• The last axis module's X4 or X40B connector (whichever applies) must remain open.</li><li>• All axis modules on a cross communication should run the same firmware</li><li>• Though this error is displayed by all axis modules, the cause is often a single device or cable. Try to locate the fault by excluding devices from cross-communication.</li></ul>
This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.

### 12.5.24.3 Error 24-2 (emergency code FF0807h)

**Cause:** Supply unit: Line voltage above chopper limit

**Suggested steps:**

Nominal voltage in para 602.0 is lower than detected grid voltage. Check nominal voltage and grid connection.

### 12.5.24.4 Error 24-5 (emergency code FF0807h)

**Cause:** Supply unit: Cross communication failed

**Suggested steps:**

An error occurred on the cross-communication line.	<ul style="list-style-type: none"><li>• Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies).</li><li>• Cross communication must not be connected across different power supplies.</li><li>• The last axis module's X4 or X40B connector (whichever applies) must remain open.</li><li>• All axis modules on a cross communication should run the same firmware</li><li>• Though this error is displayed by all axis modules, the cause is often a single device or cable. Try to locate the fault by excluding devices from cross-communication.</li></ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>
This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.

## 12.5.24.5 Error 24-7 (emergency code FF0807h)

**Cause:** Supply unit: Error in 24V power supply unit

### Suggested steps:

- Communication to the 24V supply print is missing. Check if the supply unit features a 24V supply.
- Check parameter 702-5.

An error concerning 24V supply was reported	<ul style="list-style-type: none"> <li>• Check the source of the 24V supply.</li> <li>• Measure the exact voltage, and check limits in the instruction manual.</li> <li>• Check the supply voltage when switching on the system.</li> <li>• Check the supply voltage in special situations, esp. when the motor brakes are opening</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.

## 12.5.24.6 Error 24-14 (emergency code FF0807h)

**Cause:** Supply unit: DC link symmetry error from an inverter module

### Suggested steps:

Please check the axis modules for errors.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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## 12.5.24.7 Error 24-15 (emergency code FF0807h)

**Cause:** Supply unit: Internal error

### Suggested steps:

Please contact your service partner and report the values of parameter 704.1, 28, 29

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.

#### 12.5.24.8 Error 24-16 (emergency code FF0807h)

**Cause:** Supply unit: DC link overvoltage

**Suggested steps:**

DC link voltage higher than defined in parameter 613.2. Check nominal voltage in para 602.0. Check brake resistor.

An over-voltage occurred.	<ul style="list-style-type: none"><li>• Please check if the actual grid voltage matches the supply setting (parameter PST_VoltageSupply)</li><li>• Over-voltage may be caused by a decelerating axis, possibly with high inertia. Reduce deceleration ramp.</li><li>• Consider using a braking resistor with higher power. If the supply unit has an internal braking resistor, please contact your service partner.</li></ul>
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#### 12.5.24.9 Error 24-24 (emergency code FF0807h)

**Cause:** Supply unit: Brake resistor overcurrent

**Suggested steps:**

Please check brake resistor. Use chopper with higher resistance.

#### 12.5.24.10 Error 24-25 (emergency code FF0807h)

**Cause:** Supply unit: Grid phase L1 or L3 lost longer than 20ms during startup

**Suggested steps:**

Check power switch. All 3 phases must be connected during preload.

#### 12.5.24.11 Error 24-27 (emergency code FF0807h)

**Cause:** Supply unit: Undervoltage grid

**Suggested steps:**

Grid voltage too low. Check grid connection and nominal voltage in para 602.0. This check is only performed once at the end of the preload phase.

#### 12.5.24.12 Error 24-28 (emergency code FF0807h)

**Cause:** Supply unit: Rectifier Overload

**Suggested steps:**

The calculated rectifier temperature exceeds the limit. Reduce peak current.

#### 12.5.24.13 Error 24-29 (emergency code FF0807h)

**Cause:** Supply unit: DC link voltage balance out of range

**Suggested steps:**

The supply unit seems to be broken. Switch off power supply and replace it.

This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.
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## 12.5.24.14 Error 24-30 (emergency code FF0807h)

**Cause:** Supply unit: Brake transistor or DC link short circuit detected

**Suggested steps:**

- Check DC link load.
- Check DC link connection for short circuit.

## 12.5.24.15 Error 24-31 (emergency code FF0807h)

**Cause:** Supply unit: Short circuit to ground detected

**Suggested steps:**

- Check DC link connection.
- Check motor connection of all axes.

## 12.5.24.16 Error 24-32 (emergency code FF0807h)

**Cause:** Supply unit: Load IGBT short circuit detected

**Suggested steps:**

Please check brake resistor. Use lower resistance.

This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.
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## 12.5.24.17 Error 24-33 (emergency code FF0807h)

**Cause:** Supply unit: Brake resistor not connected

**Suggested steps:**

Please check brake resistor. Use lower resistance.

## 12.5.24.18 Error 24-34 (emergency code FF0807h)

**Cause:** Supply unit: Interior temperature too high

**Suggested steps:**

- Please check outside temperature and air flow.
- Reduce output power of whole assemblage.

This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.
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## 12.5.24.19 Error 24-35 (emergency code FF0807h)

**Cause:** Supply unit: Cooler temperature too high

**Suggested steps:**

- Please check outside temperature and air flow.
- Reduce output power of whole assemblage.

This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.
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#### 12.5.24.20 Error 24-36 (emergency code FF0807h)

**Cause:** Supply unit: Brake resistor P\*t protection triggered

**Suggested steps:**

- Reduce deceleration in whole assemblage, esp. Axes with large mass.
- Please check brake resistor protection settings.

#### 12.5.24.21 Error 24-37 (emergency code FF0807h)

**Cause:** Supply unit: 24V supply: interior temperature too high

**Suggested steps:**

- Please check outside temperature and air flow.
- Reduce 24V power consumption.
- Reduce output power of whole assemblage.

#### 12.5.24.22 Error 24-41 (emergency code FF0807h)

**Cause:** Supply unit: 24V supply: overload

**Suggested steps:**

Check 24V power consumption for peaks.

#### 12.5.24.23 Error 24-44 (emergency code FF0807h)

**Cause:** Supply unit: 24V supply: cooler temperature too high

**Suggested steps:**

- Please check outside temperature and air flow.
- Reduce 24V power consumption.
- Reduce output power of whole assemblage.

#### 12.5.24.24 Error 24-45 (emergency code FF0807h)

**Cause:** Supply unit: Brake resistor temperature switch triggered

**Suggested steps:**

- Reduce deceleration in whole assemblage, esp. Axes with large mass.
- Please check brake resistor protection settings.

#### 12.5.24.25 Error 24-49 (emergency code FF0807h)

**Cause:** Supply unit: DC link supply overload

**Suggested steps:**

The DC line current on whole system was too high.	<ul style="list-style-type: none"><li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li><li>• Try to use sequential movement of the relevant axes.</li></ul>
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## 12.5.24.26 Error 24-52 (emergency code FF0807h)

**Cause:** Supply unit: Emergency shutdown detected

### Suggested steps:

An error is reported on the quick shutdown line.	<ul style="list-style-type: none"> <li>• Please check the emergency line requirements in the instruction manual</li> <li>• Check errors on other modules connected to the emergency line</li> <li>• Check if any axis module in the system reports a critical error</li> </ul>
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## 12.5.24.27 Error 24-53 (emergency code FF0807h)

**Cause:** Supply unit: Chopper current too low

### Suggested steps:

- The system needs a chopper resistor connected to the supply unit. Please check manual for allowable resistance range.
- Check cabling of chopper resistor

## 12.5.24.28 Error 24-54 (emergency code FF0807h)

**Cause:** Supply unit: Chopper resistance out of range

### Suggested steps:

- The system needs a chopper resistor connected to the supply unit. Please check manual for allowable resistance range.
- Check cabling of chopper resistor

## 12.5.24.29 Error 24-55 (emergency code FF0807h)

**Cause:** Supply unit: grid choke temperature to high

### Suggested steps:

- Temperature protection switch for grid choke has triggered.
- If protection switch is not needed, please check parameter P717.0

The DC line current on whole system was too high.	<ul style="list-style-type: none"> <li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li> <li>• Try to use sequential movement of the relevant axes.</li> </ul>
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## 12.5.25 Error 25-x Motor temperature error

### 12.5.25.1 Error 25-0 (emergency code FF0903h)

**Cause:** Motor temperature too high

**Suggested steps:**

The long-term r.m.s current is too high for this motor.	<ul style="list-style-type: none"> <li>• Please let the motor cool down.</li> <li>• Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet.</li> </ul>
The motor temperature is too high.	<ul style="list-style-type: none"> <li>• Please check motor temperature and motor temperature resistance (PTC sensors do not report the motor temperature). If the values are not plausible, check cables and sensor type.</li> <li>• If you are not using a system motor, please check with the motor manufacturer if the motor can stand a higher temperature</li> </ul>
An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly an EMC	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper</li> </ul>

issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.

connection.

- Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.
- Check motor grounding and motor cable length.



## 12.5.25.2 Error 25-1 (emergency code FF0903h)

**Cause:** Motor temperature reached TMax value

**Suggested steps:**

The long-term r.m.s current is too high for this motor.	<ul style="list-style-type: none"> <li>• Please let the motor cool down.</li> <li>• Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet.</li> </ul>
The motor temperature is too high.	<ul style="list-style-type: none"> <li>• Please check motor temperature and motor temperature resistance (PTC sensors do not report the motor temperature). If the values are not plausible, check cables and sensor type.</li> <li>• If you are not using a system motor, please check with the motor manufacturer if the motor can stand a higher temperature</li> </ul>
An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly an EMC	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper</li> </ul>

issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.

connection.

- Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.
- Check motor grounding and motor cable length.

### 12.5.25.3 Error 25-2 (emergency code FF0903h)

**Cause:** Motor temperature too high (PTC/ TSS)

**Suggested steps:**

The long-term r.m.s current is too high for this motor.	<ul style="list-style-type: none"> <li>• Please let the motor cool down.</li> <li>• Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet.</li> </ul>
The motor temperature is too high.	<ul style="list-style-type: none"> <li>• Please check motor temperature and motor temperature resistance (PTC sensors do not report the motor temperature). If the values are not plausible, check cables and sensor type.</li> <li>• If you are not using a system motor, please check with the motor manufacturer if the motor can stand a higher temperature</li> </ul>
An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly an EMC	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper</li> </ul>

issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.

connection.

- Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.
- Check motor grounding and motor cable length.

## 12.5.25.4 Error 25-3 (emergency code FF0903h)

**Cause:** PTC/TSS short circuit detected

**Suggested steps:**

- Please check cabling.
- Consider using 'PTC without short circuit detection'

The long-term r.m.s current is too high for this motor.	<ul style="list-style-type: none"> <li>• Please let the motor cool down.</li> <li>• Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet.</li> </ul>
The motor temperature is too high.	<ul style="list-style-type: none"> <li>• Please check motor temperature and motor temperature resistance (PTC sensors do not report the motor temperature). If the values are not plausible, check cables and sensor type.</li> <li>• If you are not using a system motor, please check with the motor manufacturer if the motor can stand a higher temperature</li> </ul>
An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> </ul>

	<ul style="list-style-type: none"> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.25.5 Error 25-4 (emergency code FF0903h)

**Cause:** Encoder temperature too high

**Suggested steps:**

The long-term r.m.s current is too high for this motor.	<ul style="list-style-type: none"> <li>• Please let the motor cool down.</li> <li>• Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet.</li> </ul>
The motor temperature is too high.	<ul style="list-style-type: none"> <li>• Please check motor temperature and motor temperature resistance (PTC sensors do not report the motor temperature). If the values are not plausible, check cables and sensor type.</li> <li>• If you are not using a system motor, please check with the motor manufacturer if the motor can stand a higher temperature</li> </ul>
An overcurrent was detected.	<ul style="list-style-type: none"> <li>• Please check current control settings and step response.</li> <li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li> <li>• If possible, reduce the needed current, especially in low-frequency range.</li> <li>• If possible, lower the switching frequency or enable automatic frequency selection.</li> <li>• Check if the encoder offset is set properly.</li> <li>• Consider using an axis module with higher current rating.</li> </ul>
This is possibly an EMC	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper</li> </ul>

issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<p>connection.</p> <ul style="list-style-type: none"> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
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### 12.5.25.6 Error 25-5 (emergency code FF0903h)

**Cause:** Motor temperature source is not available or inactive

**Suggested steps:**

Please check parameter setting of motor protection.

### 12.5.26 Error 26-x Calibration error

#### 12.5.26.1 Error 26-0 (emergency code 100007h)

**Cause:** Error during calibration. This error should not appear during normal operation.

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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## 12.5.26.2 Error 26-1 (emergency code 100007h)

**Cause:** Error during AFE calibration. This error should not appear during normal operation.

### Suggested steps:

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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## 12.5.27 Error 27-x Hardware limit switch error

### 12.5.27.1 Error 27-0 (emergency code FF0707h)

**Cause:** Unspecified hardware limit switch error occurred

### Suggested steps:

Position was limited internally.	<ul style="list-style-type: none"> <li>• Please check factor group setting and position command</li> <li>• Take a scope record to determine if the position control overshoots.</li> </ul>
There is a problem with the digital inputs	<ul style="list-style-type: none"> <li>• Please check the 24V I/O wiring, function assignment and inversion parameters.</li> <li>• Please check connected switches for chattering. Consider using the input filter.</li> </ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"> <li>• Please check that the encoder offset is set properly.</li> <li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li> <li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li> </ul>

### 12.5.27.2 Error 27-1 (emergency code FF0707h)

**Cause:** Hardware limit switches interchanged

**Suggested steps:**

Please check direction of movement and limit switch assignment.

Position was limited internally.	<ul style="list-style-type: none"><li>• Please check factor group setting and position command</li><li>• Take a scope record to determine if the position control overshoots.</li></ul>
There is a problem with the digital inputs	<ul style="list-style-type: none"><li>• Please check the 24V I/O wiring, function assignment and inversion parameters.</li><li>• Please check connected switches for chattering. Consider using the input filter.</li></ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"><li>• Please check that the encoder offset is set properly.</li><li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li><li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li></ul>

### 12.5.27.3 Error 27-2 (emergency code FF0707h)

**Cause:** Positive hardware limit switch (LSW\_P) detected

**Suggested steps:**

Position was limited internally.	<ul style="list-style-type: none"><li>• Please check factor group setting and position command</li><li>• Take a scope record to determine if the position control overshoots.</li></ul>
There is a problem with the digital inputs	<ul style="list-style-type: none"><li>• Please check the 24V I/O wiring, function assignment and inversion parameters.</li><li>• Please check connected switches for chattering. Consider using the input filter.</li></ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"><li>• Please check that the encoder offset is set properly.</li><li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li><li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li></ul>

## 12.5.27.4 Error 27-3 (emergency code FF0707h)

**Cause:** Negative hardware limit switch (LSW\_N) detected

**Suggested steps:**

Position was limited internally.	<ul style="list-style-type: none"> <li>• Please check factor group setting and position command</li> <li>• Take a scope record to determine if the position control overshoots.</li> </ul>
There is a problem with the digital inputs	<ul style="list-style-type: none"> <li>• Please check the 24V I/O wiring, function assignment and inversion parameters.</li> <li>• Please check connected switches for chattering. Consider using the input filter.</li> </ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"> <li>• Please check that the encoder offset is set properly.</li> <li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li> <li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li> </ul>

## 12.5.28.1 Error 28-0 (emergency code 861207h)

**Cause:** Unknown position limit error

**Suggested steps:**

Position was limited internally.	<ul style="list-style-type: none"> <li>• Please check factor group setting and position command</li> <li>• Take a scope record to determine if the position control overshoots.</li> </ul>
There is a problem with the digital inputs	<ul style="list-style-type: none"> <li>• Please check the 24V I/O wiring, function assignment and inversion parameters.</li> <li>• Please check connected switches for chattering. Consider using the input filter.</li> </ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"> <li>• Please check that the encoder offset is set properly.</li> <li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li> <li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li> </ul>

## 12.5.28 Error 28-x Position limit error

### 12.5.28.2 Error 28-1 (emergency code 861207h)

**Cause:** Negative software limit switch is exceeded (negative position limit)

**Suggested steps:**

Position was limited internally.	<ul style="list-style-type: none"><li>• Please check factor group setting and position command</li><li>• Take a scope record to determine if the position control overshoots.</li></ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"><li>• Please check that the encoder offset is set properly.</li><li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li><li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li></ul>

### 12.5.28.3 Error 28-2 (emergency code 861207h)

**Cause:** Positive software limit switch is exceeded (positive position limit)

**Suggested steps:**

Position was limited internally.	<ul style="list-style-type: none"><li>• Please check factor group setting and position command</li><li>• Take a scope record to determine if the position control overshoots.</li></ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"><li>• Please check that the encoder offset is set properly.</li><li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li><li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li></ul>



## 12.5.28.4 Error 28-3 (emergency code 861207h)

**Cause:** Software limit switch overtravel detected

**Suggested steps:**

Position was limited internally.	<ul style="list-style-type: none"> <li>• Please check factor group setting and position command</li> <li>• Take a scope record to determine if the position control overshoots.</li> </ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"> <li>• Please check that the encoder offset is set properly.</li> <li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li> <li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li> </ul>

## 12.5.28.5 Error 28-4 (emergency code 861207h)

**Cause:** Position reference value out of range

**Suggested steps:**

Position was limited internally.	<ul style="list-style-type: none"> <li>• Please check factor group setting and position command</li> <li>• Take a scope record to determine if the position control overshoots.</li> </ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"> <li>• Please check that the encoder offset is set properly.</li> <li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li> <li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li> </ul>

## 12.5.29 Error 29-x Lock violation error

### 12.5.29.1 Error 29-0 (emergency code 861207h)

**Cause:** Unknown lock violate error

**Suggested steps:**

The reference value violates a lock or limit switch.	<ul style="list-style-type: none"> <li>• Please check reference values. If this axis is working in cyclic synchronous mode, make a scope record.</li> <li>• Check factor group settings.</li> <li>• Check mode of operation.</li> </ul>
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### 12.5.29.2 Error 29-1 (emergency code 861207h)

**Cause:** New reference value violates lock or limit switch

**Suggested steps:**

The reference value violates a lock or limit switch.	<ul style="list-style-type: none"><li>• Please check reference values. If this axis is working in cyclic synchronous mode, make a scope record.</li><li>• Check factor group settings.</li><li>• Check mode of operation.</li></ul>
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### 12.5.29.3 Error 29-2 (emergency code 861207h)

**Cause:** Lock in positive and(!) negative direction active

**Suggested steps:**

Check plausibility of limit switches and/or software limits

The reference value violates a lock or limit switch.	<ul style="list-style-type: none"><li>• Please check reference values. If this axis is working in cyclic synchronous mode, make a scope record.</li><li>• Check factor group settings.</li><li>• Check mode of operation.</li></ul>
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### 12.5.29.4 Error 29-3 (emergency code 861207h)

**Cause:** New reference value violates torque limit

**Suggested steps:**

The reference value violates a lock or limit switch.	<ul style="list-style-type: none"><li>• Please check reference values. If this axis is working in cyclic synchronous mode, make a scope record.</li><li>• Check factor group settings.</li><li>• Check mode of operation.</li></ul>
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### 12.5.29.5 Error 29-4 (emergency code 861207h)

**Cause:** New reference value violates position limits

**Suggested steps:**

The reference value violates a lock or limit switch.	<ul style="list-style-type: none"><li>• Please check reference values. If this axis is working in cyclic synchronous mode, make a scope record.</li><li>• Check factor group settings.</li><li>• Check mode of operation.</li></ul>
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## 12.5.29.6 Error 29-5 (emergency code 861207h)

**Cause:** New reference value violates speed limit or direction lock

**Suggested steps:**

The reference value violates a lock or limit switch.	<ul style="list-style-type: none"> <li>• Please check reference values. If this axis is working in cyclic synchronous mode, make a scope record.</li> <li>• Check factor group settings.</li> <li>• Check mode of operation.</li> </ul>
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## 12.5.30 Error 30-x Encoder hardware error

### 12.5.30.1 Error 30-0 (emergency code 730007h)

**Cause:** Unknown error reported by encoder

**Suggested steps:**

An error or warning was reported by the digital protocol encoder.	<ul style="list-style-type: none"> <li>• Please check message log for further information.</li> <li>• Restart application (24V reset) and see if the error occurs again.</li> <li>• Please view encoder documentation or contact motor manufacturer</li> <li>• If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore'</li> </ul>
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### 12.5.30.2 Error 30-10 (emergency code 730007h)

**Cause:** Unknown error reported by ENDAT encoder

**Suggested steps:**

An error or warning was reported by the digital protocol encoder.	<ul style="list-style-type: none"> <li>• Please check message log for further information.</li> <li>• Restart application (24V reset) and see if the error occurs again.</li> <li>• Please view encoder documentation or contact motor manufacturer</li> <li>• If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore'</li> </ul>
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### 12.5.30.3 Error 30-15 (emergency code 730007h)

**Cause:** Unknown error reported by SD encoder

**Suggested steps:**

An error or warning was reported by the digital protocol encoder.	<ul style="list-style-type: none"> <li>• Please check message log for further information.</li> <li>• Restart application (24V reset) and see if the error occurs again.</li> <li>• Please view encoder documentation or contact motor manufacturer</li> <li>• If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore'</li> </ul>
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#### 12.5.30.4 Error 30-20 (emergency code 730007h)

**Cause:** Overspeed reported by SD encoder

**Suggested steps:**

An error or warning was reported by the digital protocol encoder.	<ul style="list-style-type: none"><li>• Please check message log for further information.</li><li>• Restart application (24V reset) and see if the error occurs again.</li><li>• Please view encoder documentation or contact motor manufacturer</li><li>• If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore'</li></ul>
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#### 12.5.30.5 Error 30-25 (emergency code 730007h)

**Cause:** Singleturn position error (STERR) reported by SD encoder

**Suggested steps:**

An error or warning was reported by the digital protocol encoder.	<ul style="list-style-type: none"><li>• Please check message log for further information.</li><li>• Restart application (24V reset) and see if the error occurs again.</li><li>• Please view encoder documentation or contact motor manufacturer</li><li>• If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore'</li></ul>
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#### 12.5.30.6 Error 30-30 (emergency code 730007h)

**Cause:** Multiturn position error (PSERR) reported by SD encoder

**Suggested steps:**

An error or warning was reported by the digital protocol encoder.	<ul style="list-style-type: none"><li>• Please check message log for further information.</li><li>• Restart application (24V reset) and see if the error occurs again.</li><li>• Please view encoder documentation or contact motor manufacturer</li><li>• If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore'</li></ul>
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#### 12.5.30.7 Error 30-35 (emergency code 730007h)

**Cause:** Overtemperature reported by SD encoder

**Suggested steps:**

An error or warning was reported by the digital protocol encoder.	<ul style="list-style-type: none"><li>• Please check message log for further information.</li><li>• Restart application (24V reset) and see if the error occurs again.</li><li>• Please view encoder documentation or contact motor manufacturer</li><li>• If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore'</li></ul>
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## 12.5.30.8 Error 30-40 (emergency code 730007h)

**Cause:** Hardware error reported by BISS encoder

**Suggested steps:**

An error or warning was reported by the digital protocol encoder.	<ul style="list-style-type: none"> <li>• Please check message log for further information.</li> <li>• Restart application (24V reset) and see if the error occurs again.</li> <li>• Please view encoder documentation or contact motor manufacturer</li> <li>• If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore'</li> </ul>
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## 12.5.31 Error 31-x Compensation table tracking error

### 12.5.31.1 Error 31-0 (emergency code FF0A07h)

**Cause:** Unknown tracking error

**Suggested steps:**

The tracking function of the compensation table has triggered. This function is used to guard process-specific requirements.	<ul style="list-style-type: none"> <li>• Please check axis for mechanical problems</li> <li>• Please check setting of the tracking function.</li> </ul>
--	---

### 12.5.31.2 Error 31-1 (emergency code FF0A07h)

**Cause:** Table #0 tracking error too large

**Suggested steps:**

The tracking function of the compensation table has triggered. This function is used to guard process-specific requirements.	<ul style="list-style-type: none"> <li>• Please check axis for mechanical problems</li> <li>• Please check setting of the tracking function.</li> </ul>
--	---

### 12.5.31.3 Error 31-2 (emergency code FF0A07h)

**Cause:** Table #1 tracking error too large

**Suggested steps:**

The tracking function of the compensation table has triggered. This function is used to guard process-specific requirements.	<ul style="list-style-type: none"> <li>• Please check axis for mechanical problems</li> <li>• Please check setting of the tracking function.</li> </ul>
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## 12.5.32 Error 32-x Control initialization

### 12.5.32.1 Error 32-0 (emergency code 632007h)

**Cause:** Unknown control initialization error

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>

### 12.5.32.2 Error 32-1 (emergency code 632007h)

**Cause:** Error of field weakening initialization

**Suggested steps:**

Check field weakening parameters

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
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## 12.5.32.3 Error 32-2 (emergency code 632007h)

**Cause:** Error in motor parameters/ asynchronous motor

**Suggested steps:**

Check motor electrical parameters

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
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## 12.5.32.4 Error 32-3 (emergency code 632007h)

**Cause:** Error in motor parameters

**Suggested steps:**

Check motor electrical parameters

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
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### 12.5.32.5 Error 32-4 (emergency code 632007h)

**Cause:** No motor type was specified

**Suggested steps:**

Check motor parameters

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
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### 12.5.32.6 Error 32-5 (emergency code 632007h)

**Cause:** Error initializing motor simulation

**Suggested steps:**

Check motor parameters

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
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## 12.5.32.7 Error 32-7 (emergency code 632007h)

**Cause:** Error in motor parameters/ synchronous motor

### Suggested steps:

Check motor electrical parameters

<p>This issue is probably caused by an unsuitable parameter setting.</p>	<ul style="list-style-type: none"> <li>• Save your parameter set for a later restore.</li> <li>• See 'history of parameter changes' and undo the latest changes.</li> <li>• Please check your parameter set for implausible settings.</li> <li>• Please set device to factory setting, restart, and see if the error occurs again.</li> <li>• When reporting this error to your service partner, please include your device's parameter setting.</li> </ul>
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## 12.5.32.8 Error 32-8 (emergency code 632007h)

**Cause:** Error in motor parameters/ asynchronous motor

### Suggested steps:

Parameter IMag has to be set for asynchronous motor

<p>This issue is probably caused by an unsuitable parameter setting.</p>	<ul style="list-style-type: none"> <li>• Save your parameter set for a later restore.</li> <li>• See 'history of parameter changes' and undo the latest changes.</li> <li>• Please check your parameter set for implausible settings.</li> <li>• Please set device to factory setting, restart, and see if the error occurs again.</li> <li>• When reporting this error to your service partner, please include your device's parameter setting.</li> </ul>
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## 12.5.33 Error 33-x Device Communication error

### 12.5.33.1 Error 33-0 (emergency code FF0807h)

**Cause:** Unspecified I/O error occurred

### Suggested steps:

### 12.5.33.2 Error 33-1 (emergency code FF0807h)

**Cause:** Internal error in module handling/ module firmware update

**Suggested steps:**

This error may occur if parameters are written too fast which affect the supply, capacitor, or expansion module. Insert wait cycles in the PLC program.

An error occurred on the cross-communication line.	<ul style="list-style-type: none"><li>• Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies).</li><li>• Cross communication must not be connected across different power supplies.</li><li>• The last axis module's X4 or X40B connector (whichever applies) must remain open.</li><li>• All axis modules on a cross communication should run the same firmware</li><li>• Though this error is displayed by all axis modules, the cause is often a single device or cable. Try to locate the fault by excluding devices from cross-communication.</li></ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>
This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>

### 12.5.33.3 Error 33-2 (emergency code FF0807h)

**Cause:** More than 4 capacity modules detected on cross-communication line

**Suggested steps:**

Es sind nur 4 Kapazitätsmodule im Verbund erlaubt.

### 12.5.33.4 Error 33-3 (emergency code FF0807h)

**Cause:** Detected axis modules with different firmware on the cross-communication line.

**Suggested steps:**

Verwenden Sie die gleiche Firmware auf allen Achsmodulen

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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## 12.5.33.5 Error 33-4 (emergency code FF0807h)

**Cause:** Timeout reading firmware from internal file system.

### Suggested steps:

Bitte laden Sie die Firmware erneut ins Gerät

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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## 12.5.34 Error 34-x Non-fatal safety error

### 12.5.34.1 Error 34-0 (emergency code FF0C07h)

**Cause:** STO: Unspecified error occurred

### Suggested steps:

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.34.2 Error 34-1 (emergency code FF0C07h)

**Cause:** STO input sequence, turn off both inputs

**Suggested steps:**

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• Please check the DIP switch setting.</li><li>• Check the external STO cabling and safety master configuration.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.35.1 Error 35-0 (emergency code FF0C07h)

**Cause:** SD0 Safety unknown failure

**Suggested steps:**

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• Please check the DIP switch setting.</li><li>• Check the external STO cabling and safety master configuration.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.35 Error 35-x Fatal safety error

## 12.5.35.2 Error 35-1 (emergency code FF0C07h)

**Cause:** SD0 Safety unknown failure

**Suggested steps:**

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.35.3 Error 35-2 (emergency code FF0C07h)

**Cause:** SD0 Status data timeout

**Suggested steps:**

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

#### 12.5.35.4 Error 35-3 (emergency code FF0C07h)

**Cause:** STO SF diagnostic error

**Suggested steps:**

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• Please check the DIP switch setting.</li><li>• Check the external STO cabling and safety master configuration.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

#### 12.5.35.5 Error 35-4 (emergency code FF0C07h)

**Cause:** STO EF0 diagnostic error

**Suggested steps:**

The switch-on time of the external test pulses may be too short.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• Please check the DIP switch setting.</li><li>• Check the external STO cabling and safety master configuration.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.35.6 Error 35-5 (emergency code FF0C07h)

**Cause:** STO EF1 diagnostic error

### Suggested steps:

Check safety master switch for chattering.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>To quit this error, it is necessary to restart the application (24V reset).</li> <li>Please check the DIP switch setting.</li> <li>Check the external STO cabling and safety master configuration.</li> <li>Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.35.7 Error 35-6 (emergency code FF0C07h)

**Cause:** STO diagnostic error

### Suggested steps:

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>To quit this error, it is necessary to restart the application (24V reset).</li> <li>Please check the DIP switch setting.</li> <li>Check the external STO cabling and safety master configuration.</li> <li>Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.35.8 Error 35-7 (emergency code FF0C07h)

**Cause:** STO\_TPI internal test pulse failure

**Suggested steps:**

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• Please check the DIP switch setting.</li><li>• Check the external STO cabling and safety master configuration.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.35.9 Error 35-8 (emergency code FF0C07h)

**Cause:** STO\_TPX external test pulse failure

**Suggested steps:**

This error is known to occur during a firmware update of the supply unit, if the supply unit test pulse outputs are used. Restart the system.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• Please check the DIP switch setting.</li><li>• Check the external STO cabling and safety master configuration.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.



## 12.5.35.10 Error 35-9 (emergency code FF0C07h)

**Cause:** STO\_TIME internal failure

**Suggested steps:**

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.35.11 Error 35-10 (emergency code FF0C07h)

**Cause:** STO SF OV: internal supply out of range

**Suggested steps:**

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.35.12 Error 35-11 (emergency code FF0C07h)

**Cause:** STO\_TPF external signature frequency too high

**Suggested steps:**

Please check external test pulse frequency.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• Please check the DIP switch setting.</li><li>• Check the external STO cabling and safety master configuration.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.35.13 Error 35-12 (emergency code FF0C07h)

**Cause:** STO input sequence wrong

**Suggested steps:**

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• Please check the DIP switch setting.</li><li>• Check the external STO cabling and safety master configuration.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.35.14 Error 35-13 (emergency code FF0C07h)

**Cause:** STO EF OV failure

**Suggested steps:**

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.35.15 Error 35-14 (emergency code FF0C07h)

**Cause:** SBC Master switch failure

**Suggested steps:**

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.35.16 Error 35-15 (emergency code FF0C07h)

**Cause:** SBC Master switch off

**Suggested steps:**

The 24V supply voltage is probably out of allowed range.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
An error concerning 24V supply was reported	<ul style="list-style-type: none"> <li>• Check the source of the 24V supply.</li> <li>• Measure the exact voltage, and check limits in the instruction manual.</li> <li>• Check the supply voltage when switching on the system.</li> <li>• Check the supply voltage in special situations, esp. when the motor brakes are opening</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable</li> </ul>

	length.
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.35.17 Error 35-16 (emergency code FF0C07h)

**Cause:** SBC Brake 1 failure

**Suggested steps:**

- Please check motor brake cabling for short circuit
- The brake supply voltage might be too low.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
An error concerning 24V supply was reported	<ul style="list-style-type: none"> <li>• Check the source of the 24V supply.</li> <li>• Measure the exact voltage, and check limits in the instruction manual.</li> <li>• Check the supply voltage when switching on the system.</li> <li>• Check the supply voltage in special situations, esp. when the motor brakes are opening</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

	<ul style="list-style-type: none"> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.35.18 Error 35-17 (emergency code FF0C07h)

**Cause:** SBC Brake 2 failure

**Suggested steps:**

- Please check motor brake cabling for short circuit
- The brake supply voltage might be too low.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.35.19 Error 35-18 (emergency code FF0C07h)

**Cause:** SBC Brake 3 failure

**Suggested steps:**

- Please check motor brake cabling for short circuit
- The brake supply voltage might be too low.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• Please check the DIP switch setting.</li><li>• Check the external STO cabling and safety master configuration.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.35.20 Error 35-19 (emergency code FF0C07h)

**Cause:** SBC Brake 1 off

**Suggested steps:**

- Please check motor brake cabling for short circuit
- The brake supply voltage might be too low.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• Please check the DIP switch setting.</li><li>• Check the external STO cabling and safety master configuration.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.35.21 Error 35-20 (emergency code FF0C07h)

**Cause:** SBC Brake 2 off

**Suggested steps:**

- Please check motor brake cabling for short circuit
- The brake supply voltage might be too low.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.35.22 Error 35-21 (emergency code FF0C07h)

**Cause:** SBC Brake 3 off

**Suggested steps:**

- Please check motor brake cabling for short circuit
- The brake supply voltage might be too low.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.35.23 Error 35-22 (emergency code FF0C07h)

**Cause:** SBC internal pulse 1 failure

**Suggested steps:**

- Please check the motor brake and cabling.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• Please check the DIP switch setting.</li><li>• Check the external STO cabling and safety master configuration.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.35.24 Error 35-23 (emergency code FF0C07h)

**Cause:** SBC internal pulse 2 failure

**Suggested steps:**

- Please check the motor brake and cabling.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• Please check the DIP switch setting.</li><li>• Check the external STO cabling and safety master configuration.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.



## 12.5.35.25 Error 35-24 (emergency code FF0C07h)

**Cause:** SBC internal pulse 3 failure

**Suggested steps:**

- Please check the motor brake and cabling.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.35.26 Error 35-25 (emergency code FF0C07h)

**Cause:** SBC input sequence 1 failure

**Suggested steps:**

- Please check the motor brake and cabling.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"> <li>• To quit this error, it is necessary to restart the application (24V reset).</li> <li>• Please check the DIP switch setting.</li> <li>• Check the external STO cabling and safety master configuration.</li> <li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li> <li>• An external relay in the safety circuit might chatter.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.35.27 Error 35-26 (emergency code FF0C07h)

**Cause:** SBC input sequence 2 failure

**Suggested steps:**

- Please check the motor brake and cabling.

A diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• Please check the DIP switch setting.</li><li>• Check the external STO cabling and safety master configuration.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li></ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.36 Error 36-x Encoder error in idle state

#### 12.5.36.1 Error 36-0 (emergency code 730007h)

**Cause:** General encoder error (Encoder error while switched off)

**Suggested steps:**

- Please check encoder settings and connected encoders of this axis.

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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#### 12.5.36.2 Error 36-11 (emergency code 730007h)

**Cause:** Encoder offset detection failed (Encoder error while switched off)

**Suggested steps:**

Auto commutation might not be working properly.	<ul style="list-style-type: none"><li>• Please check the encoder speed and direction, and motor pole pairs.</li><li>• Check auto commutation parameters.</li><li>• Make a scope record with scope values 24, 25, 21, 1009.</li></ul>
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## 12.5.36.3 Error 36-12 (emergency code 730007h)

**Cause:** Motor was replaced with different motor type (Encoder error while switched off)

**Suggested steps:**

- Quit error, load new motor nameplate manually, and tune parameters for application
- If motor change guarding is not intended, please see "encoder special function"

## 12.5.36.4 Error 36-13 (emergency code 730007h)

**Cause:** Motor was replaced with unknown motor type (Encoder error while switched off)

**Suggested steps:**

- Execute a factory reset, and load motor parameter set
- If motor change guarding is not intended, please see "encoder special function"

## 12.5.36.5 Error 36-14 (emergency code 730007h)

**Cause:** Encoder #1: Cannot acquire position because motor is moving (Encoder error while switched off)

**Suggested steps:**

Stop motor mechanically and quit error

## 12.5.36.6 Error 36-15 (emergency code 730007h)

**Cause:** Position encoder has no distance-coded zero pulses, or wrong parameter setting (Encoder error while switched off)

**Suggested steps:**

- Please check parameter setting of encoder. DistCodeA and DistCodeB must be set.
- Use a different homing method

### 12.5.36.7 Error 36-20 (emergency code 751007h)

**Cause:** Encoder: SSI error (Encoder error while switched off)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.36.8 Error 36-30 (emergency code 751007h)

**Cause:** Encoder: ENDAT protocol error (Encoder error while switched off)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.36.9 Error 36-42 (emergency code 751007h)

**Cause:** Encoder: Hiperface protocol error (Encoder error while switched off)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.36.10 Error 36-50 (emergency code 730007h)

**Cause:** Encoder #1: Internal communication error (Encoder error while switched off)

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.36.11 Error 36-51 (emergency code 730007h)

**Cause:** Encoder #2: Internal communication error (Encoder error while switched off)

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.36.12 Error 36-52 (emergency code 730007h)

**Cause:** Encoder #3: Internal communication error (Encoder error while switched off)

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.36.13 Error 36-53 (emergency code 730007h)

**Cause:** Encoder #4: Internal communication error (Encoder error while switched off)

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

## 12.5.36.14 Error 36-60 (emergency code 230507h)

**Cause:** Encoder #1: A/B pattern error, probably EMC problem (Encoder error while switched off)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.36.15 Error 36-61 (emergency code 230607h)

**Cause:** Encoder #2: A/B pattern error, probably EMC problem (Encoder error while switched off)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.36.16 Error 36-70 (emergency code 730007h)

**Cause:** Encoder #1: Gearbox error (Encoder error while switched off)

**Suggested steps:**

Please check this encoder's gear ratio settings.

### 12.5.36.17 Error 36-71 (emergency code 730007h)

**Cause:** Encoder #2: Gearbox error (Encoder error while switched off)

**Suggested steps:**

Please check this encoder's gear ratio settings.

### 12.5.36.18 Error 36-72 (emergency code 730007h)

**Cause:** Encoder #3: Gearbox error (Encoder error while switched off)

**Suggested steps:**

Please check this encoder's gear ratio settings.

### 12.5.36.19 Error 36-73 (emergency code 730007h)

**Cause:** Encoder #4: Gearbox error (Encoder error while switched off)

**Suggested steps:**

Please check this encoder's gear ratio settings.



## 12.5.36.20 Error 36-74 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: Gearbox error (Encoder error while switched off)

**Suggested steps:**

Please check this encoder's gear ratio settings.

## 12.5.36.21 Error 36-75 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: Gearbox error (Encoder error while switched off)

**Suggested steps:**

Please check this encoder's gear ratio settings.

## 12.5.36.22 Error 36-76 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: Gearbox error (Encoder error while switched off)

**Suggested steps:**

Please check this encoder's gear ratio settings.

## 12.5.36.23 Error 36-80 (emergency code 730007h)

**Cause:** Encoder #1: (Absolute) position calculation error (Encoder error while switched off)

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>• Check motor grounding and motor cable length.</li> </ul>
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## 12.5.36.24 Error 36-81 (emergency code 730007h)

**Cause:** Encoder #2: (Absolute) position calculation error (Encoder error while switched off)

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>• Check motor grounding and motor cable length.</li> </ul>
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## 12.5.36.25 Error 36-82 (emergency code 730007h)

**Cause:** Encoder #3: (Absolute) position calculation error (Encoder error while switched off)

### Suggested steps:

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>• Check motor grounding and motor cable length.</li> </ul>
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## 12.5.36.26 Error 36-83 (emergency code 730007h)

**Cause:** Encoder #4: (Absolute) position calculation error (Encoder error while switched off)

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>Check motor grounding and motor cable length.</li> </ul>
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## 12.5.36.27 Error 36-84 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: (Absolute) position calculation error (Encoder error while switched off)

### Suggested steps:

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>Check cabling. If available, please try another encoder and cable.</li> <li>See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>The problem may be caused by mechanical shock</li> <li>In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>Please check the device cabling for proper connection.</li> <li>Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>• Check motor grounding and motor cable length.</li> </ul>
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## 12.5.36.28 Error 36-85 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: (Absolute) position calculation error (Encoder error while switched off)

**Suggested steps:**

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>Check motor grounding and motor cable length.</li> </ul>
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## 12.5.36.29 Error 36-86 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: (Absolute) position calculation error (Encoder error while switched off)

### Suggested steps:

- Check line count and encoder gear ratio settings.
- Try switching AbsInitMode to 1.

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>Check cabling. If available, please try another encoder and cable.</li> <li>See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>The problem may be caused by mechanical shock</li> <li>In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC	<ul style="list-style-type: none"> <li>Please check the device cabling for proper connection.</li> <li>Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> </ul>

link power supply.	<ul style="list-style-type: none"> <li>• Check motor grounding and motor cable length.</li> </ul>
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### 12.5.36.30 Error 36-90 (emergency code 230507h)

**Cause:** Encoder #1 lost connection (Encoder error while switched off)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>



## 12.5.36.31 Error 36-91 (emergency code 230607h)

**Cause:** Encoder #2 lost connection (Encoder error while switched off)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.36.32 Error 36-92 (emergency code 730007h)

**Cause:** Encoder #3 lost connection (Encoder error while switched off)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Analog encoder: Amplitude check failed	<ul style="list-style-type: none"> <li>• Please scope the signal amplitude, and compare to parameter EncObsMin</li> <li>• If short-time failures are tolerable, use parameter EncObsTf to filter the amplitude check. This does not affect the encoder performance. However, encoder signal quality during failures is most likely poor.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.36.33 Error 36-94 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: status bit released (Encoder error while switched off)

**Suggested steps:**

Please check encoder wiring, field bus system, and master settings

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>

### 12.5.36.34 Error 36-95 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: status bit released (Encoder error while switched off)

**Suggested steps:**

Please check encoder wiring, field bus system, and master settings

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>

## 12.5.36.35 Error 36-96 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: status bit released (Encoder error while switched off)

### Suggested steps:

Please check encoder wiring, field bus system, and master settings

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>

## 12.5.36.36 Error 36-100 (emergency code 230507h)

**Cause:** Encoder #1 TTL error (Encoder error while switched off)

### Suggested steps:

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"> <li>• Save your parameter set for a later restore.</li> <li>• See 'history of parameter changes' and undo the latest changes.</li> <li>• Please check your parameter set for implausible settings.</li> <li>• Please set device to factory setting, restart, and see if the error occurs again.</li> <li>• When reporting this error to your service partner, please include your device's parameter setting.</li> </ul>
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### 12.5.36.37 Error 36-101 (emergency code 230607h)

**Cause:** Encoder #2 TTL error (Encoder error while switched off)

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
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### 12.5.36.38 Error 36-110 (emergency code 730007h)

**Cause:** Hardware does not support encoder #1 (Encoder error while switched off)

**Suggested steps:**

This axis module's hardware variant does not support the selected encoder channel/type. Use a different encoder or contact your service partner for a different hardware.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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### 12.5.36.39 Error 36-111 (emergency code 730007h)

**Cause:** Hardware does not support encoder #2 (Encoder error while switched off)

**Suggested steps:**

This axis module's hardware variant does not support the selected encoder channel/type. Use a different encoder or contact service for a different hardware.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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### 12.5.36.40 Error 36-112 (emergency code 730007h)

**Cause:** Hardware does not support encoder #3 (Encoder error while switched off)

**Suggested steps:**

This axis module's hardware variant does not support the selected encoder channel/type. Use a different encoder or contact service for a different hardware.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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### 12.5.36.41 Error 36-124 (emergency code 730007h)

**Cause:** EtherCAT enc. #1 is in use by another axis (Encoder error while switched off)

**Suggested steps:**

This EtherCAT encoder channel was selected by two or three axes. Use a different channel for each axis.

## 12.5.36.42 Error 36-125 (emergency code 730007h)

**Cause:** EtherCAT enc. #2 is in use by another axis (Encoder error while switched off)

### **Suggested steps:**

This EtherCAT encoder channel was selected by two or three axes. Use a different channel for each axis.

## 12.5.36.43 Error 36-126 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 is in use by another axis (Encoder error while switched off)

### **Suggested steps:**

This EtherCAT encoder channel was selected by two or three axes. Use a different channel for each axis.

## 12.5.36.44 Error 36-134 (emergency code 730007h)

**Cause:** EtherCAT enc. #1 error (Encoder error while switched off)

### **Suggested steps:**

The EtherCAT encoder bit number might be wrong.

<p>The device was probably disconnected from the master controller, or the master is overloaded.</p>	<ul style="list-style-type: none"> <li>• Please check the EtherCAT connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>
<p>This issue is probably caused by an unsuitable parameter setting.</p>	<ul style="list-style-type: none"> <li>• Save your parameter set for a later restore.</li> <li>• See 'history of parameter changes' and undo the latest changes.</li> <li>• Please check your parameter set for implausible settings.</li> <li>• Please set device to factory setting, restart, and see if the error occurs again.</li> <li>• When reporting this error to your service partner, please include your device's parameter setting.</li> </ul>

### 12.5.36.45 Error 36-135 (emergency code 730007h)

**Cause:** EtherCAT enc. #2 error (Encoder error while switched off)

**Suggested steps:**

The EtherCAT encoder bit number might be wrong.

The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"><li>• Please check the EtherCAT connection. Try to replace the cables.</li><li>• Please try to reduce computational load on the master.</li><li>• Try to increase the master cycle time.</li></ul>
This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>

### 12.5.36.46 Error 36-136 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 error (Encoder error while switched off)

**Suggested steps:**

The EtherCAT encoder bit number might be wrong.

The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"><li>• Please check the EtherCAT connection. Try to replace the cables.</li><li>• Please try to reduce computational load on the master.</li><li>• Try to increase the master cycle time.</li></ul>
This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>

## 12.5.36.47 Error 36-140 (emergency code 730007h)

**Cause:** Encoder #1: Absolute encoder simulation: Initialisation error (Encoder error while switched off)

### Suggested steps:

Absolute encoder simulation is not usable for this encoder.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.36.48 Error 36-141 (emergency code 730007h)

**Cause:** Encoder #2: Absolute encoder simulation: Initialisation error (Encoder error while switched off)

### Suggested steps:

Absolute encoder simulation is not usable for this encoder.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.36.49 Error 36-142 (emergency code 730007h)

**Cause:** Encoder #3: Absolute encoder simulation: Initialisation error (Encoder error while switched off)

### Suggested steps:

Absolute encoder simulation is not usable for this encoder.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.36.50 Error 36-143 (emergency code 730007h)

**Cause:** Encoder #4: Absolute encoder simulation: Initialisation error (Encoder error while switched off)

### Suggested steps:

Absolute encoder simulation is not usable for this encoder.

<p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p>	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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### 12.5.36.51 Error 36-144 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: Absolute encoder simulation: Initialisation error (Encoder error while switched off)

**Suggested steps:**

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.36.52 Error 36-145 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: Absolute encoder simulation: Initialisation error (Encoder error while switched off)

**Suggested steps:**

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.36.53 Error 36-146 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 Absolute encoder simulation: Initialisation error (Encoder error while switched off)

**Suggested steps:**

Absolute encoder simulation is not usable for this encoder.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.36.54 Error 36-150 (emergency code 730007h)

**Cause:** Encoder #1: Backup information not valid (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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## 12.5.36.55 Error 36-151 (emergency code 730007h)

**Cause:** Encoder #2: Backup information not valid (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.36.56 Error 36-152 (emergency code 730007h)

**Cause:** Encoder #3: Backup information not valid (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.36.57 Error 36-153 (emergency code 730007h)

**Cause:** Encoder #4: Backup position not valid (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.36.58 Error 36-154 (emergency code 730007h)

**Cause:** EtherCAT enc. #1: Backup position not valid (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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### 12.5.36.59 Error 36-155 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: Backup position not valid (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.36.60 Error 36-156 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: Backup position not valid (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.36.61 Error 36-160 (emergency code 730007h)

**Cause:** Encoder #1 position out of range, motor was moved (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.36.62 Error 36-161 (emergency code 730007h)

**Cause:** Encoder #2 position out of range, motor was moved (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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## 12.5.36.63 Error 36-162 (emergency code 730007h)

**Cause:** Encoder #3 position out of range, motor was moved (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.36.64 Error 36-163 (emergency code 730007h)

**Cause:** Encoder #4 position out of range, motor was moved (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.36.65 Error 36-164 (emergency code 730007h)

**Cause:** EtherCAT enc. #1 position out of range, motor was moved (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.36.66 Error 36-165 (emergency code 730007h)

**Cause:** EtherCAT enc. #2 position out of range, motor was moved (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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### 12.5.36.67 Error 36-166 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 position out of range, motor was moved (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.36.68 Error 36-170 (emergency code 730007h)

**Cause:** Encoder #1 serial number changed, motor was replaced (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.36.69 Error 36-171 (emergency code 730007h)

**Cause:** Encoder #2 serial number changed, motor was replaced (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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## 12.5.36.70 Error 36-172 (emergency code 730007h)

**Cause:** Encoder #3 serial number changed, motor was replaced (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.36.71 Error 36-173 (emergency code 730007h)

**Cause:** Encoder #4 serial number changed, motor was replaced (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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### 12.5.36.72 Error 36-174 (emergency code 730007h)

**Cause:** EtherCAT enc. #1 serial number changed, motor was replaced (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.36.73 Error 36-175 (emergency code 730007h)

**Cause:** EtherCAT enc. #2 serial number changed, motor was replaced (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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## 12.5.36.74 Error 36-176 (emergency code 730007h)

**Cause:** EtherCAT enc. #3 serial number changed, motor was replaced (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing. Piece-specific parts of motor nameplate will be loaded automatically, if available.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.36.75 Error 36-180 (emergency code 751007h)

**Cause:** Encoder #1 Hiperface DSL error (Encoder error while switched off)

### Suggested steps:

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
Hiperface DSL encoder	Verify the AxialPosition (Rid D4) in the scope to ensure the encoder mounting quality.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.36.76 Error 36-182 (emergency code FF0B07h)

**Cause:** Encoder #3 Hiperface DSL error (Encoder error while switched off)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
Hiperface DSL encoder	Verify the AxialPosition (Rid D4) in the scope to ensure the encoder mounting quality.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.36.77 Error 36-210 (emergency code 230507h)

**Cause:** Encoder: SD encoder error (Encoder error while switched off)

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
Hiperface DSL encoder	Verify the AxialPosition (Rid D4) in the scope to ensure the encoder mounting quality.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>



## 12.5.36.78 Error 36-220 (emergency code 730007h)

**Cause:** Encoder #1: Battery low, multiturn position is lost (Encoder error while switched off)

### Suggested steps:

Check voltage and cabling of encoder backup battery. Replace battery, quit error and repeat homing

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
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## 12.5.36.79 Error 36-221 (emergency code 730007h)

**Cause:** Encoder #2: Battery low, multiturn position is lost (Encoder error while switched off)

### Suggested steps:

Check voltage and cabling of encoder backup battery. Replace battery, quit error and repeat homing

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
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## 12.5.36.80 Error 36-222 (emergency code 730007h)

**Cause:** Encoder #3: Battery low, multiturn position is lost (Encoder error while switched off)

### Suggested steps:

Check voltage and cabling of encoder backup battery. Replace battery, quit error and repeat homing

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
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## 12.5.36.81 Error 36-230 (emergency code 230507h)

**Cause:** Encoder #1: SmartAbs encoder error (Encoder error while switched off)

### Suggested steps:

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.36.82 Error 36-240 (emergency code 730007h)

**Cause:** Encoder #1 Parameter error (Encoder error while switched off)

### Suggested steps:

Please check parameter data set. Expand error window and see detailed information.

## 12.5.36.83 Error 36-241 (emergency code 730007h)

**Cause:** Encoder #2 Parameter error (Encoder error while switched off)

### Suggested steps:

Please check parameter data set. Expand error window and see detailed information.

## 12.5.36.84 Error 36-242 (emergency code 730007h)

**Cause:** Encoder #3 Parameter error (Encoder error while switched off)

### Suggested steps:

Please check parameter data set. Expand error window and see detailed information.

## 12.5.36.85 Error 36-243 (emergency code 730007h)

**Cause:** Encoder #4 Parameter error (Encoder error while switched off)

### Suggested steps:

Please check parameter data set. Expand error window and see detailed information.

## 12.5.36.86 Error 36-250 (emergency code 751007h)

**Cause:** Encoder #1: BISS protocol error (Encoder error while switched off)

### Suggested steps:

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.36.87 Error 36-260 (emergency code 730007h)

**Cause:** Encoder #1: Axis module was powered off in operation enabled state.  
Homing backup not available. (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.36.88 Error 36-261 (emergency code 730007h)

**Cause:** Encoder #2: Axis module was powered off in operation enabled state.  
Homing backup not available. (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.36.89 Error 36-262 (emergency code 730007h)

**Cause:** Encoder #3: Axis module was powered off in operation enabled state.  
Homing backup not available. (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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### 12.5.36.90 Error 36-263 (emergency code 730007h)

**Cause:** Encoder #4: Axis module was powered off in operation enabled state.  
Homing backup not available. (Encoder error while switched off)

**Suggested steps:**

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"><li>• Please check the 'encoder special function' dialog and the message log for current state.</li><li>• Please read documentation of 'encoder special function'</li><li>• When reporting this error to your service partner, please attach the current project file and message log.</li></ul>
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## 12.5.36.91 Error 36-264 (emergency code 730007h)

**Cause:** EtherCAT enc.: #1 Axis module was powered off in operation enabled state. Homing backup not available. (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.36.92 Error 36-265 (emergency code 730007h)

**Cause:** EtherCAT enc. #2: Axis module was powered off in operation enabled state. Homing backup not available. (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.36.93 Error 36-266 (emergency code 730007h)

**Cause:** EtherCAT enc. #3: Axis module was powered off in operation enabled state. Homing backup not available. (Encoder error while switched off)

### Suggested steps:

Quit error, and repeat homing.

The encoder special function (persistent homing and multiturn simulation) has reported an error	<ul style="list-style-type: none"> <li>• Please check the 'encoder special function' dialog and the message log for current state.</li> <li>• Please read documentation of 'encoder special function'</li> <li>• When reporting this error to your service partner, please attach the current project file and message log.</li> </ul>
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## 12.5.37 Error 38-x Safety IO-Expander error

### 12.5.37.1 Error 38-0 (emergency code FF0C07h)

**Cause:** Fatal error on Safety IO expander SR1 detected

**Suggested steps:**

An internal diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• Please check the wiring of the device</li><li>• If this error occurs in a SDC application, check for errors on SDC system and try to solve this errors first.</li><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• If error still applies after restart, it's probably an hardware issue. Please replace the axis module and contact your service partner</li></ul>
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### 12.5.37.2 Error 38-1 (emergency code FF0C07h)

**Cause:** Fatal error on Safety IO expander SR2 detected

**Suggested steps:**

An internal diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• Please check the wiring of the device</li><li>• If this error occurs in a SDC application, check for errors on SDC system and try to solve this errors first.</li><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• If error still applies after restart, it's probably an hardware issue. Please replace the axis module and contact your service partner</li></ul>
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### 12.5.37.3 Error 38-2 (emergency code FF0C07h)

**Cause:** Error in communication to Safety IO expander

**Suggested steps:**

Please check that the version of functional firmware is compatible with the version of safety firmware

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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### 12.5.37.4 Error 38-3 (emergency code FF0C07h)

**Cause:** No valid firmware found on Safety IO expander

**Suggested steps:**

If error applies after firmware update, please retry the update process.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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## 12.5.37.5 Error 38-4 (emergency code FF0C07h)

**Cause:** Alarm on Safety IO expander SR1

**Suggested steps:**

An external diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• Please check the wiring the safe inputs.</li><li>• Please check the DIP switch setting.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li><li>• Please check the wiring of the motor brake</li><li>• If this error occurs in a SDC application, check for errors on SDC system and try to solve these errors first.</li></ul>
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## 12.5.37.6 Error 38-5 (emergency code FF0C07h)

**Cause:** Alarm on Safety IO expander SR2

**Suggested steps:**

An external diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• Please check the wiring the safe inputs.</li><li>• Please check the DIP switch setting.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li><li>• Please check the wiring of the motor brake</li><li>• If this error occurs in a SDC application, check for errors on SDC system and try to solve these errors first.</li></ul>
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### 12.5.37.7 Error 38-6 (emergency code FF0C07h)

**Cause:** Fatal error in BIOS on Safety IO expander SR1

**Suggested steps:**

An internal diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• Please check the wiring of the device</li><li>• If this error occurs in a SDC application, check for errors on SDC system and try to solve this errors first.</li><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• If error still applies after restart, it's probably an hardware issue. Please replace the axis module and contact your service partner</li></ul>
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### 12.5.37.8 Error 38-7 (emergency code FF0C07h)

**Cause:** Fatal error in BIOS on Safety IO expander SR2

**Suggested steps:**

An internal diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• Please check the wiring of the device</li><li>• If this error occurs in a SDC application, check for errors on SDC system and try to solve this errors first.</li><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• If error still applies after restart, it's probably an hardware issue. Please replace the axis module and contact your service partner</li></ul>
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### 12.5.37.9 Error 38-8 (emergency code FF0C07h)

**Cause:** No valid production data found on Safety IO expander

**Suggested steps:**

- Please restart the device (24V reset)
- If error still applies after restart, please contact your service partner

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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### 12.5.37.10 Error 38-9 (emergency code FF0C07h)

**Cause:** Fatal error SBC on Safety IO expander detected

**Suggested steps:**

An internal diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• Please check the wiring of the device</li><li>• If this error occurs in a SDC application, check for errors on SDC system and try to solve this errors first.</li><li>• To quit this error, it is necessary to restart the application (24V reset).</li><li>• If error still applies after restart, it's probably an hardware issue. Please replace the axis module and contact your service partner</li></ul>
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## 12.5.37.11 Error 38-10 (emergency code FF0C07h)

**Cause:** Alarm SBC on Safety IO expander detected

**Suggested steps:**

An external diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• Please check the wiring the safe inputs.</li><li>• Please check the DIP switch setting.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li><li>• Please check the wiring of the motor brake</li><li>• If this error occurs in a SDC application, check for errors on SDC system and try to solve these errors first.</li></ul>
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## 12.5.37.12 Error 38-11 (emergency code FF0C07h)

**Cause:** Alarm - External testpulse on Safety IO expander detected

**Suggested steps:**

An external diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• Please check the wiring the safe inputs.</li><li>• Please check the DIP switch setting.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li><li>• Please check the wiring of the motor brake</li><li>• If this error occurs in a SDC application, check for errors on SDC system and try to solve these errors first.</li></ul>
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### 12.5.37.13 Error 38-12 (emergency code FF0C07h)

**Cause:** Alarm - Invalid DipSwitch settings on Safety IO expander detected

**Suggested steps:**

An external diagnostic error occurred in the safety module.	<ul style="list-style-type: none"><li>• Please check the wiring the safe inputs.</li><li>• Please check the DIP switch setting.</li><li>• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.</li><li>• An external relay in the safety circuit might chatter.</li><li>• Please check the wiring of the motor brake</li><li>• If this error occurs in a SDC application, check for errors on SDC system and try to solve these errors first.</li></ul>
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## 12.5.38 Error 39-x Safety SDC error

### 12.5.38.1 Error 39-0 (emergency code FF0C07h)

**Cause:** Error on SDC-option detected

**Suggested steps:**

An fatal error occured in the safety module SDC.	<ul style="list-style-type: none"><li>• Please check the extended error code in the message window</li><li>• For more detailed error information please refer to document "ServoOne CM ErrorList SDC Option"</li><li>• To quit this error please STOP/START the safePLC or restart the complete device</li></ul>
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### 12.5.38.2 Error 39-1 (emergency code FF0C07h)

**Cause:** Common Alarm on SDC-option detected

**Suggested steps:**

An alarm occured in the safety module SDC	<ul style="list-style-type: none"><li>• Please check the extended error code in the message window</li><li>• For more detailed error information please refer to the SDC programming manual</li></ul>
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## 12.5.38.3 Error 39-2 (emergency code FF0C07h)

**Cause:** Common encoder alarm on SDC-option detected

**Suggested steps:**

An alarm occurred in the safe encoder system SDC.	<ul style="list-style-type: none"> <li>• Please check the encoder hardware and the wiring.</li> <li>• Please check the encoder settings in SafetyManager and KeStudio DriveManager. Encoder must be configured correctly in both the functional and safety part</li> </ul>
An alarm occurred in the safety module SDC	<ul style="list-style-type: none"> <li>• Please check the extended error code in the message window</li> <li>• For more detailed error information please refer to the SDC programming manual</li> </ul>

## 12.5.38.4 Error 39-3 (emergency code FF0C07h)

**Cause:** Diagnose alarm SinCos encoder on SDC-option detected

**Suggested steps:**

An alarm occurred in the safe encoder system SDC.	<ul style="list-style-type: none"> <li>• Please check the encoder hardware and the wiring.</li> <li>• Please check the encoder settings in SafetyManager and KeStudio DriveManager. Encoder must be configured correctly in both the functional and safety part</li> </ul>
An alarm occurred in the safety module SDC	<ul style="list-style-type: none"> <li>• Please check the extended error code in the message window</li> <li>• For more detailed error information please refer to the SDC programming manual</li> </ul>

## 12.5.38.5 Error 39-4 (emergency code FF0C07h)

**Cause:** Diagnose alarm HDSL encoder on SDC-option detected

**Suggested steps:**

An alarm occurred in the safe encoder system SDC.	<ul style="list-style-type: none"> <li>• Please check the encoder hardware and the wiring.</li> <li>• Please check the encoder settings in SafetyManager and KeStudio DriveManager. Encoder must be configured correctly in both the functional and safety part</li> </ul>
An alarm occurred in the safety module SDC	<ul style="list-style-type: none"> <li>• Please check the extended error code in the message window</li> <li>• For more detailed error information please refer to the SDC programming manual</li> </ul>

## 12.5.38.6 Error 39-5 (emergency code FF0C07h)

**Cause:** Diagnose alarm HTL encoder on SDC-option detected

**Suggested steps:**

An alarm occurred in the safe encoder system SDC.	<ul style="list-style-type: none"> <li>• Please check the encoder hardware and the wiring.</li> <li>• Please check the encoder settings in SafetyManager and KeStudio DriveManager. Encoder must be configured correctly in both the functional and safety part</li> </ul>
An alarm occurred in the safety module SDC	<ul style="list-style-type: none"> <li>• Please check the extended error code in the message window</li> <li>• For more detailed error information please refer to the SDC programming manual</li> </ul>

### 12.5.38.7 Error 39-6 (emergency code FF0C07h)

**Cause:** Diagnose alarm SSI encode on SDC-option detected

**Suggested steps:**

An alarm occurred in the safe encoder system SDC.	<ul style="list-style-type: none"><li>• Please check the encoder hardware and the wiring.</li><li>• Please check the encoder settings in SafetyManager and KeStudio DriveManager. Encoder must be configured correctly in both the functional and safety part</li></ul>
An alarm occurred in the safety module SDC	<ul style="list-style-type: none"><li>• Please check the extended error code in the message window</li><li>• For more detailed error information please refer to the SDC programming manual</li></ul>

### 12.5.38.8 Error 39-7 (emergency code FF0C07h)

**Cause:** Invalid SRA checksum detected

**Suggested steps:**

- Please check the settings of the FSoE Master

An alarm occurred in the safety module SDC	<ul style="list-style-type: none"><li>• Please check the extended error code in the message window</li><li>• For more detailed error information please refer to the SDC programming manual</li></ul>
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### 12.5.38.9 Error 39-8 (emergency code FF0C07h)

**Cause:** Alarm on SDC-option SafetyFunction detected

**Suggested steps:**

- Please check the settings of the used safety functions in Safety Manager.
- Please check that the version of the Safety Manager is compatible with the version of SDC firmware.

An alarm occurred in the safety module SDC	<ul style="list-style-type: none"><li>• Please check the extended error code in the message window</li><li>• For more detailed error information please refer to the SDC programming manual</li></ul>
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### 12.5.38.10 Error 39-9 (emergency code FF0C07h)

**Cause:** Alarm on Safe Input detected

**Suggested steps:**

- Please check the settings of the used safe inputs in Safety Manager.
- Please check the correct wiring of the safe inputs.
- Unused inputs should not be wired anyway.

An alarm occurred in the safety module SDC	<ul style="list-style-type: none"><li>• Please check the extended error code in the message window</li><li>• For more detailed error information please refer to the SDC programming manual</li></ul>
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## 12.5.38.11 Error 39-10 (emergency code FF0C07h)

**Cause:** Common Fatal error on SDC-option detected

**Suggested steps:**

An fatal error occurred in the safety module SDC.	<ul style="list-style-type: none"> <li>• Please check the extended error code in the message window</li> <li>• For more detailed error information please refer to document "ServoOne CM ErrorList SDC Option"</li> <li>• To quit this error please STOP/START the safePLC or restart the complete device</li> </ul>
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## 12.5.38.12 Error 39-11 (emergency code FF0C07h)

**Cause:** Fatal error on SDC configuration data detected

**Suggested steps:**

- Please check the settings of the used safety functions in Safety Manager.
- Please check that the version of the Safety Manager is compatible with the version of SDC firmware.

An fatal error occurred in the safety module SDC.	<ul style="list-style-type: none"> <li>• Please check the extended error code in the message window</li> <li>• For more detailed error information please refer to document "ServoOne CM ErrorList SDC Option"</li> <li>• To quit this error please STOP/START the safePLC or restart the complete device</li> </ul>
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## 12.5.38.13 Error 39-12 (emergency code FF0C07h)

**Cause:** Fatal error on SDC-option detected - invalid DeviceID

**Suggested steps:**

- The device selection of the Safety Manager program, doesn't match the used hardware configuration.
- Load a valid Safety Manager program to the device

An fatal error occurred in the safety module SDC.	<ul style="list-style-type: none"> <li>• Please check the extended error code in the message window</li> <li>• For more detailed error information please refer to document "ServoOne CM ErrorList SDC Option"</li> <li>• To quit this error please STOP/START the safePLC or restart the complete device</li> </ul>
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## 12.5.38.14 Error 39-13 (emergency code FF0C07h)

**Cause:** Fatal error on SDC-option detected - internal diagnose error

**Suggested steps:**

An fatal error occurred in the safety module SDC.	<ul style="list-style-type: none"> <li>• Please check the extended error code in the message window</li> <li>• For more detailed error information please refer to document "ServoOne CM ErrorList SDC Option"</li> <li>• To quit this error please STOP/START the safePLC or restart the complete device</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.38.15 Error 39-14 (emergency code FF0C07h)

**Cause:** Fatal error on SDC-option detected - internal Timing error

**Suggested steps:**

- Please check the compilation statistics for the safety program in Safety Manager
- Reduce the size and complexity of the Safety Manager Program

An fatal error occurred in the safety module SDC.	<ul style="list-style-type: none"> <li>• Please check the extended error code in the message window</li> <li>• For more detailed error information please refer to document "ServoOne CM ErrorList SDC Option"</li> <li>• To quit this error please STOP/START the safePLC or restart the complete device</li> </ul>
This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.

### 12.5.38.16 Error 39-15 (emergency code FF0C07h)

**Cause:** Fatal error on SDC-option detected - Range check error

**Suggested steps:**

Please check the SafePLC parameter setting

### 12.5.38.17 Error 39-16 (emergency code FF0C07h)

**Cause:** Diagnose alarm Resolver on SDC-option detected

**Suggested steps:**

The encoder is not connected or not working properly.	<ul style="list-style-type: none"> <li>• Check cabling. If available, please try another encoder and cable.</li> <li>• See detailed error information (&gt;&gt;) for a more detailed description.</li> <li>• The problem may be caused by mechanical shock</li> <li>• In case of a linear encoder, the problem may be caused by imprecise encoder mounting.</li> </ul>
Digital encoder: protocol error or problem reported by encoder	If short-time failures are tolerable, use parameter ErrorTol to tolerate a given number of failures (in 125 us Task). Scope the error counter CHx_ErrorCount to monitor the behaviour. In case of an error, position is estimated from previous data.
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.39 Error 41-x Expansion module error

## 12.5.39.1 Error 41-0 (emergency code FF0807h)

**Cause:** ExpansionModule: Unspecified error

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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## 12.5.39.2 Error 41-3 (emergency code FF0C07h)

**Cause:** Emergency line is disconnected or short circuit

**Suggested steps:**

- Check errors on other modules connected to the emergency line
- Check if any axis module reports a critical error

An error is reported on the quick shutdown line.	<ul style="list-style-type: none"> <li>• Please check the emergency line requirements in the instruction manual</li> <li>• Check errors on other modules connected to the emergency line</li> <li>• Check if any axis module in the system reports a critical error</li> </ul>
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## 12.5.39.3 Error 41-4 (emergency code FF0C07h)

**Cause:** ExpansionModule: Emergency shutdown circuit not connected to supply unit.

**Suggested steps:**

- The emergency line is not connected to the supply unit. Please check circuit
- If emergency line is not needed, please check parameter P732.6 EmcyLine

An error is reported on the quick shutdown line.	<ul style="list-style-type: none"> <li>• Please check the emergency line requirements in the instruction manual</li> <li>• Check errors on other modules connected to the emergency line</li> <li>• Check if any axis module in the system reports a critical error</li> </ul>
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#### 12.5.39.4 Error 41-5 (emergency code FF0C07h)

**Cause:** ExpansionModule: Cross communication

**Suggested steps:**

An error occurred on the cross-communication line.	<ul style="list-style-type: none"><li>• Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies).</li><li>• Cross communication must not be connected across different power supplies.</li><li>• The last axis module's X4 or X40B connector (whichever applies) must remain open.</li><li>• All axis modules on a cross communication should run the same firmware</li><li>• Though this error is displayed by all axis modules, the cause is often a single device or cable. Try to locate the fault by excluding devices from cross-communication.</li></ul>
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#### 12.5.39.5 Error 41-11 (emergency code FF0C07h)

**Cause:** ExpansionModule: Fuse 401 has triggered

**Suggested steps:**

This is possibly an expansion module hardware issue	If other measures fail, please try to replace the expansion module hardware.
The DC line current on the expansion module was too high.	<ul style="list-style-type: none"><li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li><li>• Try to use sequential movement of the relevant axes.</li></ul>

#### 12.5.39.6 Error 41-12 (emergency code FF0C07h)

**Cause:** ExpansionModule: Fuse 400 has triggered

**Suggested steps:**

This is possibly an expansion module hardware issue	If other measures fail, please try to replace the expansion module hardware.
The DC line current on the expansion module was too high.	<ul style="list-style-type: none"><li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li><li>• Try to use sequential movement of the relevant axes.</li></ul>

#### 12.5.39.7 Error 41-14 (emergency code FF0C07h)

**Cause:** ExpansionModule: Axis module symmetry

**Suggested steps:**

Please check the axis modules for errors.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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## 12.5.39.8 Error 41-15 (emergency code FF0C07h)

**Cause:** ExpansionModule: Internal error

### Suggested steps:

Please contact your service partner and report the values of parameter 731.16,17

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly an expansion module hardware issue	If other measures fail, please try to replace the expansion module hardware.

## 12.5.39.9 Error 41-17 (emergency code FF0C07h)

**Cause:** ExpansionModule: DC link overcurrent detected

### Suggested steps:

The DC line current on the expansion module was too high.	<ul style="list-style-type: none"> <li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li> <li>• Try to use sequential movement of the relevant axes.</li> </ul>
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## 12.5.39.10 Error 41-35 (emergency code FF0C07h)

**Cause:** ExpansionModule: Internal temperature too high

### Suggested steps:

Please let expansion module cool down

The DC line current on the expansion module was too high.	<ul style="list-style-type: none"> <li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li> <li>• Try to use sequential movement of the relevant axes.</li> </ul>
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## 12.5.39.11 Error 41-36 (emergency code FF0C07h)

**Cause:** ExpansionModule: Heatsink temperature too high

### Suggested steps:

Please let expansion module cool down

The DC line current on the expansion module was too high.	<ul style="list-style-type: none"> <li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li> <li>• Try to use sequential movement of the relevant axes.</li> </ul>
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### 12.5.39.12 Error 41-43 (emergency code FF0C07h)

**Cause:** ExpansionModule: 24V overvoltage

**Suggested steps:**

The 24V supply voltage is probably out of allowed range. Please check the external 24V supply.

An error concerning 24V supply was reported	<ul style="list-style-type: none"><li>• Check the source of the 24V supply.</li><li>• Measure the exact voltage, and check limits in the instruction manual.</li><li>• Check the supply voltage when switching on the system.</li><li>• Check the supply voltage in special situations, esp. when the motor brakes are opening</li></ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>

### 12.5.39.13 Error 41-44 (emergency code FF0C07h)

**Cause:** ExpansionModule: 24V undervoltage

**Suggested steps:**

The 24V supply voltage is probably out of allowed range. Please check the external 24V supply.

An error concerning 24V supply was reported	<ul style="list-style-type: none"><li>• Check the source of the 24V supply.</li><li>• Measure the exact voltage, and check limits in the instruction manual.</li><li>• Check the supply voltage when switching on the system.</li><li>• Check the supply voltage in special situations, esp. when the motor brakes are opening</li></ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>

## 12.5.39.14 Error 41-45 (emergency code FF0C07h)

**Cause:** ExpansionModule 24V undervoltage

### Suggested steps:

The 24V supply voltage is probably out of allowed range. Please check the external 24V supply.

An error concerning 24V supply was reported	<ul style="list-style-type: none"> <li>• Check the source of the 24V supply.</li> <li>• Measure the exact voltage, and check limits in the instruction manual.</li> <li>• Check the supply voltage when switching on the system.</li> <li>• Check the supply voltage in special situations, esp. when the motor brakes are opening</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

## 12.5.39.15 Error 41-49 (emergency code FF0C07h)

**Cause:** ExpansionModule: I2t monitoring of DC link current detected overload

### Suggested steps:

The DC line current on the expansion module was too high.	<ul style="list-style-type: none"> <li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li> <li>• Try to use sequential movement of the relevant axes.</li> </ul>
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## 12.5.40 Error 42-x Error in Capacitor Module #1

### 12.5.40.1 Error 42-0 (emergency code FF0807h)

**Cause:** CapacityModule: Unspecified error

### Suggested steps:

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
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#### 12.5.40.2 Error 42-3 (emergency code FF0C07h)

**Cause:** Emergency line is disconnected or short

**Suggested steps:**

- Check errors on other modules connected to the emergency line
- Check if any axis module reports a critical error

An error is reported on the quick shutdown line.	<ul style="list-style-type: none"><li>• Please check the emergency line requirements in the instruction manual</li><li>• Check errors on other modules connected to the emergency line</li><li>• Check if any axis module in the system reports a critical error</li></ul>
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#### 12.5.40.3 Error 42-5 (emergency code FF0C07h)

**Cause:** CapacityModule: Cross communication

**Suggested steps:**

- The emergency line is not connected to the supply unit. Please check circuit
- If emergency line is not needed, please check parameter P732.6 EmcyLine

An error is reported on the quick shutdown line.	<ul style="list-style-type: none"><li>• Please check the emergency line requirements in the instruction manual</li><li>• Check errors on other modules connected to the emergency line</li><li>• Check if any axis module in the system reports a critical error</li></ul>
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#### 12.5.40.4 Error 42-14 (emergency code FF0C07h)

**Cause:** CapacityModule: Axis module symmetry

**Suggested steps:**

Please check the axis modules for errors.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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#### 12.5.40.5 Error 42-15 (emergency code FF0C07h)

**Cause:** CapacityModule: Internal error

**Suggested steps:**

Please contact your service partner and report the values of parameter 731.16,17

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
This is possibly a capacitor module hardware issue	If other measures fail, please try to replace the capacitor module hardware.

## 12.5.40.6 Error 42-29 (emergency code FF0807h)

**Cause:** CapacityModule unit: unbalanced DC-link

### Suggested steps:

The capacity module seems to be broken. Switch off power supply and replace it.

This is possibly a capacitor module hardware issue	If other measures fail, please try to replace the capacitor module hardware.
--	--

## 12.5.40.7 Error 42-35 (emergency code FF0C07h)

**Cause:** CapacityModule: Print temperature limit exceeded

### Suggested steps:

Please let capacitor module cool down

The DC line current on the capacitor module was too high.	<ul style="list-style-type: none"> <li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li> <li>• Try to use sequential movement of the relevant axes.</li> </ul>
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## 12.5.40.8 Error 42-36 (emergency code FF0C07h)

**Cause:** CapacityModule: Heatsink temperature limit exceeded

### Suggested steps:

Please let capacitor module cool down

The DC line current on the capacitor module was too high.	<ul style="list-style-type: none"> <li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li> <li>• Try to use sequential movement of the relevant axes.</li> </ul>
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## 12.5.40.9 Error 42-49 (emergency code FF0C07h)

**Cause:** CapacityModule: I2t watch detected current overload

### Suggested steps:

The DC line current on the expansion module was too high.	<ul style="list-style-type: none"> <li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li> <li>• Try to use sequential movement of the relevant axes.</li> </ul>
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## 12.5.41 Error 43-x Device I\*t error

### 12.5.41.1 Error 43-0 (emergency code 220007h)

**Cause:** Device IxT: Overall Motor current too high

**Suggested steps:**

- If possible, reduce the needed current on the relevant axes, especially those with high power rating.
- Try to use sequential movement of the relevant axes.

## 12.5.42 Error 44-x Error in Slave supply unit

### 12.5.42.1 Error 44-0 (emergency code FF0807h)

**Cause:** Supply unit: Unspecified error (Error in Slave supply unit)

**Suggested steps:**

An error occurred on the cross-communication line.	<ul style="list-style-type: none"><li>• Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies).</li><li>• Cross communication must not be connected across different power supplies.</li><li>• The last axis module's X4 or X40B connector (whichever applies) must remain open.</li><li>• All axis modules on a cross communication should run the same firmware</li><li>• Though this error is displayed by all axis modules, the cause is often a single device or cable. Try to locate the fault by excluding devices from cross-communication.</li></ul>
This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.

### 12.5.42.2 Error 44-1 (emergency code FF0807h)

**Cause:** Supply error, from fast error signal (Error in Slave supply unit)

**Suggested steps:**

An error occurred on the cross-communication line.	<ul style="list-style-type: none"><li>• Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies).</li><li>• Cross communication must not be connected across different power supplies.</li><li>• The last axis module's X4 or X40B connector (whichever applies) must remain open.</li><li>• All axis modules on a cross communication should run the same firmware</li><li>• Though this error is displayed by all axis modules, the cause is often a single device or cable. Try to locate the fault by excluding devices from cross-communication.</li></ul>
This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.

### 12.5.42.3 Error 44-2 (emergency code FF0807h)

**Cause:** Supply unit: Line voltage above chopper limit (Error in Slave supply unit)

**Suggested steps:**

Nominal voltage in para 602.0 is lower than detected grid voltage. Check nominal voltage and grid connection.

## 12.5.42.4 Error 44-5 (emergency code FF0807h)

**Cause:** Supply unit: Cross communication failed (Error in Slave supply unit)

**Suggested steps:**

An error occurred on the cross-communication line.	<ul style="list-style-type: none"> <li>• Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies).</li> <li>• Cross communication must not be connected across different power supplies.</li> <li>• The last axis module's X4 or X40B connector (whichever applies) must remain open.</li> <li>• All axis modules on a cross communication should run the same firmware</li> <li>• Though this error is displayed by all axis modules, the cause is often a single device or cable. Try to locate the fault by excluding devices from cross-communication.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.

## 12.5.42.5 Error 44-7 (emergency code FF0807h)

**Cause:** Supply unit: Error in 24V power supply unit (Error in Slave supply unit)

**Suggested steps:**

- Communication to the 24V supply print is missing. Check if the supply unit features a 24V supply.
- Check parameter 702-5.

An error concerning 24V supply was reported	<ul style="list-style-type: none"> <li>• Check the source of the 24V supply.</li> <li>• Measure the exact voltage, and check limits in the instruction manual.</li> <li>• Check the supply voltage when switching on the system.</li> <li>• Check the supply voltage in special situations, esp. when the motor brakes are opening</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>
This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.

#### 12.5.42.6 Error 44-14 (emergency code FF0807h)

**Cause:** Supply unit: DC link symmetry error from an inverter module (Error in Slave supply unit)

**Suggested steps:**

Please check the axis modules for errors.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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#### 12.5.42.7 Error 44-15 (emergency code FF0807h)

**Cause:** Supply unit: Internal error (Error in Slave supply unit)

**Suggested steps:**

Please contact your service partner and report the values of parameter 704.1, 28, 29

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.

#### 12.5.42.8 Error 44-16 (emergency code FF0807h)

**Cause:** Supply unit: DC link overvoltage (Error in Slave supply unit)

**Suggested steps:**

DC link voltage higher than defined in parameter 613.2. Check nominal voltage in para 602.0. Check brake resistor.

An over-voltage occurred.	<ul style="list-style-type: none"><li>• Please check if the actual grid voltage matches the supply setting (parameter PST_VoltageSupply)</li><li>• Over-voltage may be caused by a decelerating axis, possibly with high inertia. Reduce deceleration ramp.</li><li>• Consider using a braking resistor with higher power. If the supply unit has an internal braking resistor, please contact your service partner.</li></ul>
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#### 12.5.42.9 Error 44-24 (emergency code FF0807h)

**Cause:** Supply unit: Brake resistor overcurrent (Error in Slave supply unit)

**Suggested steps:**

Please check brake resistor. Use chopper with higher resistance.



## 12.5.42.10 Error 44-25 (emergency code FF0807h)

**Cause:** Supply unit: Grid phase L1 or L3 lost longer than 20ms during startup (Error in Slave supply unit)

**Suggested steps:**

Check power switch. All 3 phases must be connected during preload.

## 12.5.42.11 Error 44-27 (emergency code FF0807h)

**Cause:** Supply unit: Undervoltage grid (Error in Slave supply unit)

**Suggested steps:**

Grid voltage too low. Check grid connection and nominal voltage in para 602.0. This check is only performed once at the end of the preload phase.

## 12.5.42.12 Error 44-28 (emergency code FF0807h)

**Cause:** Supply unit: Rectifier Overload (Error in Slave supply unit)

**Suggested steps:**

The calculated rectifier temperature exceeds the limit. Reduce peak current.

## 12.5.42.13 Error 44-29 (emergency code FF0807h)

**Cause:** Supply unit: DC link voltage balance out of range (Error in Slave supply unit)

**Suggested steps:**

The supply unit seems to be broken. Switch off power supply and replace it.

This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.
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## 12.5.42.14 Error 44-30 (emergency code FF0807h)

**Cause:** Supply unit: Brake transistor or DC link short circuit detected (Error in Slave supply unit)

**Suggested steps:**

- Check DC link load.
- Check DC link connection for short circuit.

## 12.5.42.15 Error 44-31 (emergency code FF0807h)

**Cause:** Supply unit: Short circuit to ground detected (Error in Slave supply unit)

**Suggested steps:**

- Check DC link connection.
- Check motor connection of all axes.

## 12.5.42.16 Error 44-32 (emergency code FF0807h)

**Cause:** Supply unit: Load IGBT short circuit detected (Error in Slave supply unit)

**Suggested steps:**

Please check brake resistor. Use lower resistance.

This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.
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#### 12.5.42.17 Error 44-33 (emergency code FF0807h)

**Cause:** Supply unit: Brake resistor not connected (Error in Slave supply unit)

**Suggested steps:**

Please check brake resistor. Use lower resistance.

#### 12.5.42.18 Error 44-34 (emergency code FF0807h)

**Cause:** Supply unit: Interior temperature too high (Error in Slave supply unit)

**Suggested steps:**

- Please check outside temperature and air flow.
- Reduce output power of whole assemblage.

This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.
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#### 12.5.42.19 Error 44-35 (emergency code FF0807h)

**Cause:** Supply unit: Cooler temperature too high (Error in Slave supply unit)

**Suggested steps:**

- Please check outside temperature and air flow.
- Reduce output power of whole assemblage.

This is possibly a supply unit hardware issue	If other measures fail, please try to replace the supply unit hardware.
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#### 12.5.42.20 Error 44-36 (emergency code FF0807h)

**Cause:** Supply unit: Brake resistor P\*t protection triggered (Error in Slave supply unit)

**Suggested steps:**

- Reduce deceleration in whole assemblage, esp. Axes with large mass.
- Please check brake resistor protection settings.

#### 12.5.42.21 Error 44-37 (emergency code FF0807h)

**Cause:** Supply unit: 24V supply: interior temperature too high (Error in Slave supply unit)

**Suggested steps:**

- Please check outside temperature and air flow.
- Reduce 24V power consumption.
- Reduce output power of whole assemblage.

#### 12.5.42.22 Error 44-41 (emergency code FF0807h)

**Cause:** Supply unit: 24V supply: overload (Error in Slave supply unit)

**Suggested steps:**

Check 24V power consumption for peaks.

## 12.5.42.23 Error 44-44 (emergency code FF0807h)

**Cause:** Supply unit: 24V supply: cooler temperature too high (Error in Slave supply unit)

**Suggested steps:**

- Please check outside temperature and air flow.
- Reduce 24V power consumption.
- Reduce output power of whole assemblage.

## 12.5.42.24 Error 44-45 (emergency code FF0807h)

**Cause:** Supply unit: Brake resistor temperature switch triggered (Error in Slave supply unit)

**Suggested steps:**

- Reduce deceleration in whole assemblage, esp. Axes with large mass.
- Please check brake resistor protection settings.

## 12.5.42.25 Error 44-49 (emergency code FF0807h)

**Cause:** Supply unit: DC link supply overload (Error in Slave supply unit)

**Suggested steps:**

The DC line current on whole system was too high.	<ul style="list-style-type: none"> <li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li> <li>• Try to use sequential movement of the relevant axes.</li> </ul>
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## 12.5.42.26 Error 44-52 (emergency code FF0807h)

**Cause:** Supply unit: Emergency shutdown detected (Error in Slave supply unit)

**Suggested steps:**

An error is reported on the quick shutdown line.	<ul style="list-style-type: none"> <li>• Please check the emergency line requirements in the instruction manual</li> <li>• Check errors on other modules connected to the emergency line</li> <li>• Check if any axis module in the system reports a critical error</li> </ul>
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## 12.5.42.27 Error 44-53 (emergency code FF0807h)

**Cause:** Supply unit: Chopper current too low (Error in Slave supply unit)

**Suggested steps:**

- The system needs a chopper resistor connected to the supply unit. Please check manual for allowable resistance range.
- Check cabling of chopper resistor

## 12.5.42.28 Error 44-54 (emergency code FF0807h)

**Cause:** Supply unit: Chopper resistance out of range (Error in Slave supply unit)

**Suggested steps:**

- The system needs a chopper resistor connected to the supply unit. Please check manual for allowable resistance range.
- Check cabling of chopper resistor

### 12.5.42.29 Error 44-55 (emergency code FF0807h)

**Cause:** Supply unit: grid choke temperature too high (Error in Slave supply unit)

**Suggested steps:**

- Temperature protection switch for grid choke has triggered.
- If protection switch is not needed, please check parameter P717.0

The DC line current on whole system was too high.	<ul style="list-style-type: none"><li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li><li>• Try to use sequential movement of the relevant axes.</li></ul>
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## 12.5.43 Error 45-x Error in Capacitor Module #2

### 12.5.43.1 Error 45-0 (emergency code FF0807h)

**Cause:** CapacityModule: Unspecified error (Error in Capacitor Module #2)

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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### 12.5.43.2 Error 45-3 (emergency code FF0C07h)

**Cause:** Emergency line is disconnected or short (Error in Capacitor Module #2)

**Suggested steps:**

- Check errors on other modules connected to the emergency line
- Check if any axis module reports a critical error

An error is reported on the quick shutdown line.	<ul style="list-style-type: none"><li>• Please check the emergency line requirements in the instruction manual</li><li>• Check errors on other modules connected to the emergency line</li><li>• Check if any axis module in the system reports a critical error</li></ul>
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### 12.5.43.3 Error 45-5 (emergency code FF0C07h)

**Cause:** CapacityModule: Cross communication (Error in Capacitor Module #2)

**Suggested steps:**

- The emergency line is not connected to the supply unit. Please check circuit
- If emergency line is not needed, please check parameter P732.6 EmcyLine

An error is reported on the quick shutdown line.	<ul style="list-style-type: none"><li>• Please check the emergency line requirements in the instruction manual</li><li>• Check errors on other modules connected to the emergency line</li><li>• Check if any axis module in the system reports a critical error</li></ul>
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## 12.5.43.4 Error 45-14 (emergency code FF0C07h)

**Cause:** CapacityModule: Axis module symmetry (Error in Capacitor Module #2)

### Suggested steps:

Please check the axis modules for errors.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
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## 12.5.43.5 Error 45-15 (emergency code FF0C07h)

**Cause:** CapacityModule: Internal error (Error in Capacitor Module #2)

### Suggested steps:

Please contact your service partner and report the values of parameter 731.16,17

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly a capacitor module hardware issue	If other measures fail, please try to replace the capacitor module hardware.

## 12.5.43.6 Error 45-29 (emergency code FF0807h)

**Cause:** CapacityModule unit: unbalanced DC-link (Error in Capacitor Module #2)

### Suggested steps:

The capacity module seems to be broken. Switch off power supply and replace it.

This is possibly a capacitor module hardware issue	If other measures fail, please try to replace the capacitor module hardware.
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## 12.5.43.7 Error 45-35 (emergency code FF0C07h)

**Cause:** CapacityModule: Print temperature limit exceeded (Error in Capacitor Module #2)

### Suggested steps:

Please let capacitor module cool down

The DC line current on the capacitor module was too high.	<ul style="list-style-type: none"> <li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li> <li>• Try to use sequential movement of the relevant axes.</li> </ul>
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### 12.5.43.8 Error 45-36 (emergency code FF0C07h)

**Cause:** CapacityModule: Heatsink temperature limit exceeded (Error in Capacitor Module #2)

**Suggested steps:**

Please let capacitor module cool down

The DC line current on the capacitor module was too high.	<ul style="list-style-type: none"><li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li><li>• Try to use sequential movement of the relevant axes.</li></ul>
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### 12.5.43.9 Error 45-49 (emergency code FF0C07h)

**Cause:** CapacityModule: I2t watch detected current overload (Error in Capacitor Module #2)

**Suggested steps:**

The DC line current on the expansion module was too high.	<ul style="list-style-type: none"><li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li><li>• Try to use sequential movement of the relevant axes.</li></ul>
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## 12.5.44 Error 46-x Error in Capacitor Module #3

### 12.5.44.1 Error 46-0 (emergency code FF0807h)

**Cause:** CapacityModule: Unspecified error (Error in Capacitor Module #3)

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
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### 12.5.44.2 Error 46-3 (emergency code FF0C07h)

**Cause:** Emergency line is disconnected or short (Error in Capacitor Module #3)

**Suggested steps:**

- Check errors on other modules connected to the emergency line
- Check if any axis module reports a critical error

An error is reported on the quick shutdown line.	<ul style="list-style-type: none"><li>• Please check the emergency line requirements in the instruction manual</li><li>• Check errors on other modules connected to the emergency line</li><li>• Check if any axis module in the system reports a critical error</li></ul>
--	--

## 12.5.44.3 Error 46-5 (emergency code FF0C07h)

**Cause:** CapacityModule: Cross communication (Error in Capacitor Module #3)

**Suggested steps:**

- The emergency line is not connected to the supply unit. Please check circuit
- If emergency line is not needed, please check parameter P732.6 EmcyLine

An error is reported on the quick shutdown line.	<ul style="list-style-type: none"> <li>• Please check the emergency line requirements in the instruction manual</li> <li>• Check errors on other modules connected to the emergency line</li> <li>• Check if any axis module in the system reports a critical error</li> </ul>
--	--

## 12.5.44.4 Error 46-14 (emergency code FF0C07h)

**Cause:** CapacityModule: Axis module symmetry (Error in Capacitor Module #3)

**Suggested steps:**

Please check the axis modules for errors.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
-----------------------------------	--

## 12.5.44.5 Error 46-15 (emergency code FF0C07h)

**Cause:** CapacityModule: Internal error (Error in Capacitor Module #3)

**Suggested steps:**

Please contact your service partner and report the values of parameter 731.16,17

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly a capacitor module hardware issue	If other measures fail, please try to replace the capacitor module hardware.

## 12.5.44.6 Error 46-29 (emergency code FF0807h)

**Cause:** CapacityModule unit: unbalanced DC-link (Error in Capacitor Module #3)

**Suggested steps:**

The capacity module seems to be broken. Switch off power supply and replace it.

This is possibly a capacitor module hardware issue	If other measures fail, please try to replace the capacitor module hardware.
--	--

#### 12.5.44.7 Error 46-35 (emergency code FF0C07h)

**Cause:** CapacityModule: Print temperature limit exceeded (Error in Capacitor Module #3)

**Suggested steps:**

Please let capacitor module cool down

The DC line current on the capacitor module was too high.	<ul style="list-style-type: none"><li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li><li>• Try to use sequential movement of the relevant axes.</li></ul>
---	--

#### 12.5.44.8 Error 46-36 (emergency code FF0C07h)

**Cause:** CapacityModule: Heatsink temperature limit exceeded (Error in Capacitor Module #3)

**Suggested steps:**

Please let capacitor module cool down

The DC line current on the capacitor module was too high.	<ul style="list-style-type: none"><li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li><li>• Try to use sequential movement of the relevant axes.</li></ul>
---	--

#### 12.5.44.9 Error 46-49 (emergency code FF0C07h)

**Cause:** CapacityModule: I2t watch detected current overload (Error in Capacitor Module #3)

**Suggested steps:**

The DC line current on the expansion module was too high.	<ul style="list-style-type: none"><li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li><li>• Try to use sequential movement of the relevant axes.</li></ul>
---	--

#### 12.5.45 Error 47-x Error in Capacitor Module #4

##### 12.5.45.1 Error 47-0 (emergency code FF0807h)

**Cause:** CapacityModule: Unspecified error (Error in Capacitor Module #4)

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
------------------------------------	--



## 12.5.45.2 Error 47-3 (emergency code FF0C07h)

**Cause:** Emergency line is disconnected or short (Error in Capacitor Module #4)

**Suggested steps:**

- Check errors on other modules connected to the emergency line
- Check if any axis module reports a critical error

An error is reported on the quick shutdown line.	<ul style="list-style-type: none"> <li>• Please check the emergency line requirements in the instruction manual</li> <li>• Check errors on other modules connected to the emergency line</li> <li>• Check if any axis module in the system reports a critical error</li> </ul>
--	--

## 12.5.45.3 Error 47-5 (emergency code FF0C07h)

**Cause:** CapacityModule: Cross communication (Error in Capacitor Module #4)

**Suggested steps:**

- The emergency line is not connected to the supply unit. Please check circuit
- If emergency line is not needed, please check parameter P732.6 EmcyLine

An error is reported on the quick shutdown line.	<ul style="list-style-type: none"> <li>• Please check the emergency line requirements in the instruction manual</li> <li>• Check errors on other modules connected to the emergency line</li> <li>• Check if any axis module in the system reports a critical error</li> </ul>
--	--

## 12.5.45.4 Error 47-14 (emergency code FF0C07h)

**Cause:** CapacityModule: Axis module symmetry (Error in Capacitor Module #4)

**Suggested steps:**

Please check the axis modules for errors.

This is possibly a hardware issue	If other measures fail to solve the problem, please replace the axis module.
-----------------------------------	--

## 12.5.45.5 Error 47-15 (emergency code FF0C07h)

**Cause:** CapacityModule: Internal error (Error in Capacitor Module #4)

**Suggested steps:**

Please contact your service partner and report the values of parameter 731.16,17

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
This is possibly a capacitor module hardware issue	If other measures fail, please try to replace the capacitor module hardware.

#### 12.5.45.6 Error 47-29 (emergency code FF0807h)

**Cause:** CapacityModule unit: unbalanced DC-link (Error in Capacitor Module #4)

**Suggested steps:**

The capacity module seems to be broken. Switch off power supply and replace it.

This is possibly a capacitor module hardware issue	If other measures fail, please try to replace the capacitor module hardware.
--	--

#### 12.5.45.7 Error 47-35 (emergency code FF0C07h)

**Cause:** CapacityModule: Print temperature limit exceeded (Error in Capacitor Module #4)

**Suggested steps:**

Please let capacitor module cool down

The DC line current on the capacitor module was too high.	<ul style="list-style-type: none"><li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li><li>• Try to use sequential movement of the relevant axes.</li></ul>
---	--

#### 12.5.45.8 Error 47-36 (emergency code FF0C07h)

**Cause:** CapacityModule: Heatsink temperature limit exceeded (Error in Capacitor Module #4)

**Suggested steps:**

Please let capacitor module cool down

The DC line current on the capacitor module was too high.	<ul style="list-style-type: none"><li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li><li>• Try to use sequential movement of the relevant axes.</li></ul>
---	--

#### 12.5.45.9 Error 47-49 (emergency code FF0C07h)

**Cause:** CapacityModule: I2t watch detected current overload (Error in Capacitor Module #4)

**Suggested steps:**

The DC line current on the expansion module was too high.	<ul style="list-style-type: none"><li>• If possible, reduce the needed current on the relevant axes, especially those with high power rating.</li><li>• Try to use sequential movement of the relevant axes.</li></ul>
---	--

#### 12.5.46 Error 49-x POWERLINK error

## 12.5.46.1 Error 49-0 (emergency code 1810004h)

**Cause:** General POWERLINK error

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>
------------------------------------	---

## 12.5.46.2 Error 49-1 (emergency code 1810004h)

**Cause:** POWERLINK initialization error

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"> <li>• Save your parameter set for a later restore.</li> <li>• See 'history of parameter changes' and undo the latest changes.</li> <li>• Please check your parameter set for implausible settings.</li> <li>• Please set device to factory setting, restart, and see if the error occurs again.</li> <li>• When reporting this error to your service partner, please include your device's parameter setting.</li> </ul>
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>

## 12.5.46.3 Error 49-2 (emergency code 1810004h)

**Cause:** Invalid configuration for process data

**Suggested steps:**

PLC configuration	Please check the PLC configuration regarding the process data mapping (number of objects / PDO length).
This is probably a software issue.	<ul style="list-style-type: none"> <li>• Please try to switch to a different version of device firmware.</li> <li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li> </ul>

## 12.5.46.4 Error 49-3 (emergency code 1810004h)

**Cause:** Watchdog expired

**Suggested steps:**

The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"> <li>• Please check the POWERLINK connection. Try to replace the cables.</li> <li>• Please try to reduce computational load on the master.</li> <li>• Try to increase the master cycle time.</li> </ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"> <li>• Please check the device cabling for proper connection.</li> <li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li> <li>• Check motor grounding and motor cable length.</li> </ul>

### 12.5.46.5 Error 49-5 (emergency code 1810004h)

**Cause:** Synchronization initialization or deinitialization failed

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
------------------------------------	--

### 12.5.46.6 Error 49-6 (emergency code 1810004h)

**Cause:** Synchronization accuracy is outside the expected tolerance

**Suggested steps:**

This issue is probably caused by an unsuitable parameter setting.	<ul style="list-style-type: none"><li>• Save your parameter set for a later restore.</li><li>• See 'history of parameter changes' and undo the latest changes.</li><li>• Please check your parameter set for implausible settings.</li><li>• Please set device to factory setting, restart, and see if the error occurs again.</li><li>• When reporting this error to your service partner, please include your device's parameter setting.</li></ul>
The device was probably disconnected from the master controller, or the master is overloaded.	<ul style="list-style-type: none"><li>• Please check the POWERLINK connection. Try to replace the cables.</li><li>• Please try to reduce computational load on the master.</li><li>• Try to increase the master cycle time.</li></ul>
This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC link power supply.	<ul style="list-style-type: none"><li>• Please check the device cabling for proper connection.</li><li>• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth.</li><li>• Check motor grounding and motor cable length.</li></ul>

## 12.5.46.7 Error 49-7 (emergency code 1810004h)

**Cause:** netx indicates a dpm hardware access failure

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
------------------------------------	--

## 12.5.46.8 Error 49-8 (emergency code 1810004h)

**Cause:** Value from RxPdo is out of range

**Suggested steps:**

PLC program	Please check PLC program vs. parameter list min/max values.
-------------	---

## 12.5.46.9 Error 49-9 (emergency code 1810004h)

**Cause:** FatalError

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
------------------------------------	--

## 12.5.47 Error 50-x Error in hydraulic systems module

## 12.5.47.1 Error 50-0 (emergency code 100007h)

**Cause:** General Error in hydraulic systems module

**Suggested steps:**

This is probably a software issue.	<ul style="list-style-type: none"><li>• Please try to switch to a different version of device firmware.</li><li>• Save your dataset and reset the axis module to factory setting. See if the error persists, or if it comes with activating a certain feature.</li></ul>
------------------------------------	--

### 12.5.47.2 Error 50-1 (emergency code 100007h)

**Cause:** Error or Overload of Hydraulic Pump

**Suggested steps:**

An overcurrent was detected.	<ul style="list-style-type: none"><li>• Please check current control settings and step response.</li><li>• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.</li><li>• If possible, reduce the needed current, especially in low-frequency range.</li><li>• If possible, lower the switching frequency or enable automatic frequency selection.</li><li>• Check if the encoder offset is set properly.</li><li>• Consider using an axis module with higher current rating.</li></ul>
The control system failed to track the reference value	<ul style="list-style-type: none"><li>• Please check if the axis is blocked.</li><li>• Try to reduce acceleration or deceleration.</li><li>• If reference speed is higher than the motor rated speed, please check field weakening settings. In field-weakening range, the available torque per current is reduced.</li></ul>

### 12.5.47.3 Error 50-2 (emergency code 100007h)

**Cause:** Position difference maximum value exceeded

**Suggested steps:**

The control system failed to track the reference value	<ul style="list-style-type: none"><li>• Please check if the axis is blocked.</li><li>• Try to reduce acceleration or deceleration.</li><li>• If reference speed is higher than the motor rated speed, please check field weakening settings. In field-weakening range, the available torque per current is reduced.</li></ul>
The speed control might run away, most likely due to a wrong encoder offset.	<ul style="list-style-type: none"><li>• Please check that the encoder offset is set properly.</li><li>• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.</li><li>• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation.</li></ul>

### 12.5.47.4 Error 50-3 (emergency code 100007h)

**Cause:** Hydraulic system: defective pressure sensor detected

**Suggested steps:**

- Please check the wiring of the pressure sensor
- Please check the hydraulic system

# 13 EtherCAT®



## NOTE

- EtherCAT® is defined in IEC 61158 and IEC 61784.
- For general information on EtherCAT®, please visit [www.ethercat.org](http://www.ethercat.org)
- EtherCAT® is a registered trademark and patented technology licensed by Beckhoff Automation GmbH, Germany.



## Chapter overview

### Pictogram



**Navigation** ► Project tree ► Axis adjustment ► X axis ► EtherCAT

**Brief description** This chapter describes the various operation modes, homing modes, objects, control and status words, and all other relevant settings.

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## 13.1 EtherCAT® abbreviations

Abbreviation	Meaning
M	Mandatory
C	Conditional
R	Recommended
O	Optional
CSP	Cyclic synchronous position mode
CSV	Cyclic synchronous velocity mode
CST	Cyclic synchronous torque mode
PP	Profile position mode
PV	Profile velocity mode
PT	Profile torque Mode
VM	Velocity mode
Setpoint	Setpoint

Table 13.1: EtherCAT® abbreviations



## 13.2 Parameters

Object No.	Index	Name / Setting	Unit	Description	Data type
0x6040	0000	Control word		Axis 1: CiA402 control word	uint16
0x6041	0000	Status word		Axis 1: CiA402 status word	uint16
0x6060	0000	Modes of operation		Axis 1: CiA402 Modes of operation selector	int8
		(0)None		No function	
		(1)ProfilePosition		Profile Position Mode	
		(2)VelocityMode		Velocity Mode	
		(3)ProfileVelocity		Profile velocity mode	
		(4)TorqueProfile		Profile Torque Mode	
		(5)Reserved		Reserved	
		(6)Homing		Homing mode	
		(7)IP_Position		Interpolated Position Mode	
		(8)CycSync_PM		Position control operation mode: Travel profile generation via control system	
		(9)CycSync_VM		Speed control operation mode: travel profile generation via control system	
		(10)CycSync_TM		Torque control operation mode: Travel profile generation via control system	
0x6061	0000	ModesOfOperationDisplay		Axis 1: CiA402 Modes of operation display	int8
0x6502	0000	SupDriveModes		Axis 1: Operation modes supported by CiA402	uint32

Table 13.2: Parameter list – EtherCAT® axis – Basic settings

## 13.3 Modes of Operation EtherCAT®

- **CycSync position mode**  
(see Section "Cyclic synchronous position mode (CSP)" on page 455)
- **CycSync velocity mode**  
(see Section "Cyclic synchronous velocity mode (CSV)" on page 456)
- **CycSync torque mode**  
(see Section "Cyclic synchronous torque mode (CST)" on page 457)
- **Profile position mode**  
(see Section "Profile position mode" on page 459)
- **Velocity mode (V/Hz mode)**  
(see Section "Velocity mode (V/Hz mode)" on page 462)
- **Profile velocity mode**  
(see Section "Profile velocity mode" on page 463)
- **Homing mode**  
(see Section "Homing mode" on page 464)
- )

Object No.	Index	Name / Setting	Unit	Description	Data type
0x6060	0000	Modes of operation		Axis 1: CiA402 Modes of operation selector	int8
		(8)CycSync_PM		Position control operation mode: Travel profile generation via control system	
		(9)CycSync_VM		Speed control operation mode: travel profile generation via control system	
		(10)CycSync_TM		Torque control operation mode: Travel profile generation via control system	

Table 13.3: Parameter list – EtherCAT® - Modes of operation EtherCAT® axis

Object No.	Index	Name / Setting	Unit	Description	Data type
0x6061	0000	ModesOfOperationDisplay		Axis 1: CiA402 Modes of operation display	int8
0x6502	0000	SupDriveModes		Axis 1: Operation modes supported by CiA402	uint32
1) Value definition on the object 0x6502 SubDriveModes					
<div> <div>3115109876543210</div> <div> <div>Manufacturer-specific</div> <div>r(eserved)</div> <div>cst</div> <div>csv</div> <div>csp</div> <div>ip</div> <div>hm</div> <div>r</div> <div>tq</div> <div>p<sub>v</sub></div> <div>v<sub>l</sub></div> <div>pp</div> </div> </div> <div>MSBLSB</div>					

Table 13.3: Parameter list – EtherCAT® - Modes of operation EtherCAT® axis (continue)

Bit	Name	Function is supported
Manufacturer specific	-	-
r(eserved)	-	-
cst	CycSync_TM	Yes
csv	CycSync_VM	Yes
csp	CycSync_PM	Yes
ip	Interpolated position mode (IP)	No
hm	Homing Mode (HM)	Yes
r	-	reserved
tq	Profile torque mode (PT)	No
p <sub>v</sub>	Profile velocity mode (PV)	Yes
v <sub>l</sub>	Velocity mode (VM)	Yes
pp	Profile position mode (PP)	Yes

Table 13.4: Functions supported

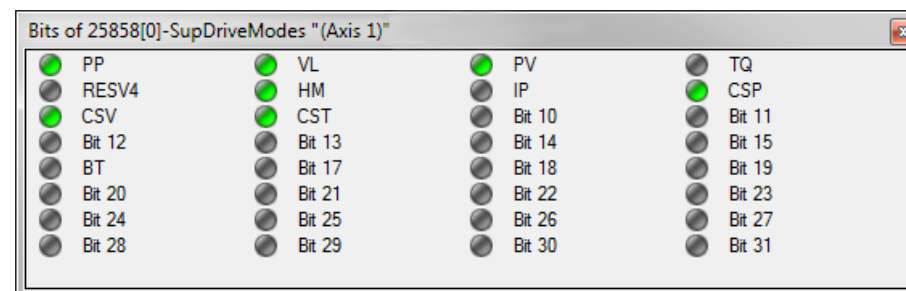


Fig. 13.1: Functions supported

The timing for all modes of operation is shown in Fig. 13.2: Modes of operation - Timing. It is assumed here that the PLC is working with a 1 ms cycle; the fieldbus cycle (time difference between two DC0 pulses) is also 1 ms. The control ("control task") operates with a 125 µs cycle. All data concerning switching the axis on/off, Halt, QuickStop and Profile Mode are processed in the "motion planning task", which always operates at 1 ms.

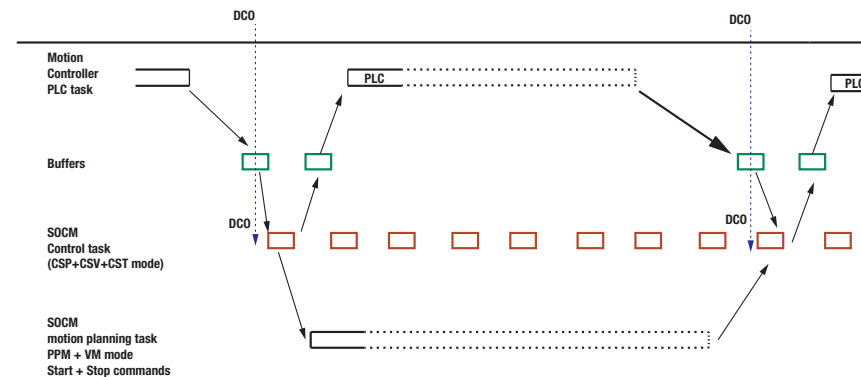


Fig. 13.2: Modes of operation - Timing

The cyclical communication is synchronized via the distributed clocks.

The communication operates via an intermediate buffer. To optimize the timing, the output transfers of the control should have arrived in the intermediate buffer before they are read by the firmware; the reverse applies accordingly for the input transfers.

The output transfers are read by the firmware directly after the DC0 point in time. The input data are available in the intermediate buffer 125 µs after the DC0 point in time.

In the "motion planning task", the processing time is increased by one bus cycle, but at least by 1 ms.

### 13.3.1 Cyclic synchronous position mode (CSP)

- Controller cyclically sends position setpoints to the drives
- Position, speed and current control are undertaken in the drive
- Optional transfer of cumulative speed and torque setpoint for the position feed forward control.
- Synchronisation using the "Distributed clocks" function
- The stop bit (bit 8) of the control word is ignored

Object No.	Index	Name	Unit	Description	Category	Data type
0x607A	0000	TargetPosition	PosUnit	Axis 1: CiA402 target position	M	int32
0x6064	0000	PositionActualValue	PosUnit	Axis 1: CiA402 actual position value	M	int32
0x606C	0000	VelocityActualValue	SpeedUnit	Axis 1: CiA402 actual speed value	M	int32
0x6077	0000	TorqueActualValue		Axis 1: CiA402 actual torque value	R	int16
0x60B1	0000	VelocityOffset	SpeedUnit	Axis 1: CiA402 Speed feed forward control setpoint	R	int32
0x60B2	0000	TorqueOffset		Axis 1: CiA402 Torque feed forward control setpoint	R	int16

Table 13.5: Parameterliste – EtherCAT® axis – Operation mode-specific objects in CSP

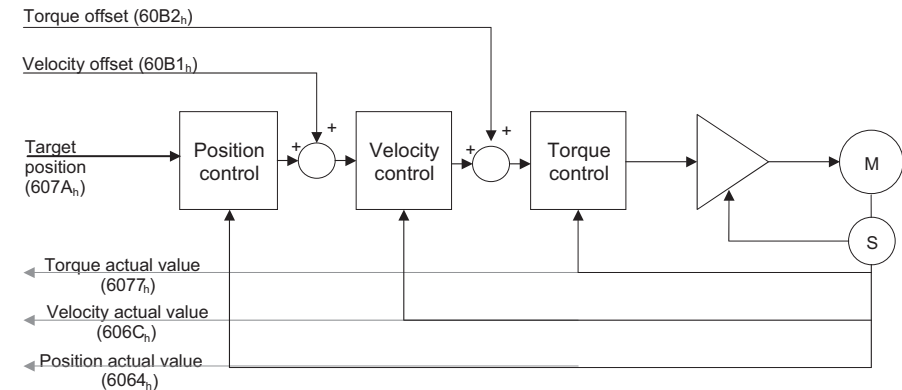


Fig. 13.3: Structure model CSP

Bit	Name	Value	Function
12	Target position	0	Target position ignored
		1	Target position is to be used as input for the position control loop.
13	Following Error	0	No tracking error
		1	Tracking error

Table 13.6: Bits in the status word that are specific to the operation mode

The setpoints are interpolated at the controller cycle speed.

When the timing is optimal (see Fig. 13.2: Modes of operation - Timing) the TargetPosition is passed to the controller at the next DC0 point in time. The interpolated target position reaches a DC0 time later than the TargetPosition; spline interpolation (P 2969.0 CON\_IP\_Sel = CUBIC) causes a delay of two fieldbus cycles.

To optimize the feed forward control, it can be helpful to delay the position setpoint internally by a few controller cycles (see also section "Feed forward control of speed and acceleration" on page 140, **Parameter P 2959 - CON\_IP\_EpsDly**). This can generally not be compensated on the part of the controller. In this case, parameter **P 2306.0 - ActPosDelayTime** must be set in such a way that **CON\_IP\_EpsDly + ActPosDelayTime** = 1 PLC cycle. The dead time is then greater by one additional PLC cycle, but can then once again be compensated in the controller itself.

### 13.3.2 Cyclic synchronous velocity mode (CSV)

- Controller cyclically sends speed setpoints to the drives
- Speed and current control are undertaken in the drive
- Optional transfer of cumulative speed, torque setpoint for the torque feed forward control.
- Synchronisation using the "Distributed clocks" function
- The stop bit (bit 8) of the control word is ignored

Object No.	Index	Name	Unit	Description	Category	Data type
0x60FF	0000	Target Velocity	SpeedUnit	Axis 1: CiA402 target speed	M	int32
0x6064	0000	Position actual value	PosUnit	Axis 1: CiA402 actual position value	M	int32
0x606C	0000	Velocity actual value	SpeedUnit	Axis 1: CiA402 actual speed value	R	int32
0x6077	0000	Torque actual value		Axis 1: CiA402 actual torque value	R	int16
0x60B1	0000	Velocity offset	SpeedUnit	Axis 1: CiA402 Speed feed forward control setpoint	R	int32
0x60B2	0000	Torque offset		Axis 1: CiA402 Torque feed forward control setpoint	R	int16

Table 13.7: Parameterliste – EtherCAT® axis – Operation mode-specific objects in CSV

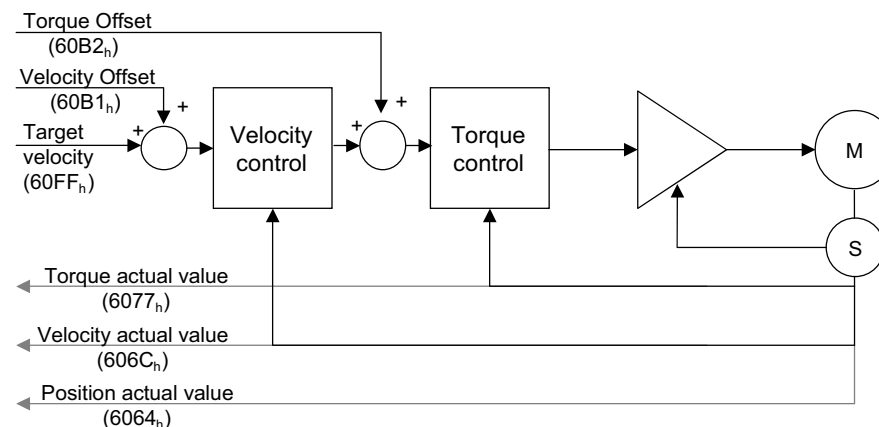


Fig. 13.4: Structure model CSV

Bit	Name	Value	Function
12	Target velocity	0	Set speed ignored
		1	Set speed is to be used as input for the speed control loop

Table 13.8: Bits in the status word that are specific to the operation mode

When the timing is optimal (see Fig. 13.2: Modes of operation - Timing) the TargetVelocity is passed to the controller at the next DC0 point in time. The interpolated target velocity reaches a DC0 time later than the TargetVelocity. It can be delayed additionally using **P 2959.0 RefTf**.

VelocityActualValue is determined at the DC0 times and is passed to the controller directly.

### 13.3.3 Cyclic synchronous torque mode (CST)

- Controller cyclically sends torque setpoints to the drives
- Current control is undertaken in the drive
- Synchronisation using the “Distributed clocks” function
- The stop bit (bit 8) of the control word is ignored

Object No.	Index	Name	Unit	Description	Category	Data type
0x6064	0000	Position actual value	PosUnit	Axis 1: CiA402 actual position value	R	int32
0x606C	0000	Velocity actual value	SpeedUnit	Axis 1: CiA402 actual speed value	M	int32
0x6071	0000	TargetTorque	0/00	The value for the set torque is given in 1/1000 of the motor's rated torque ( <b>0x6076</b> ) - <b>motor rated torque</b> .	M	int16
0x6076	0000	MotorRatedTorque	mNm	Axis 1: CiA402 motor rated torque	0	uint32
0x6077	0000	TorqueActualValue		Axis 1: CiA402 actual torque value	M	int16

Table 13.9: Parameterliste – EtherCAT® axis – Operation mode-specific objects in CST

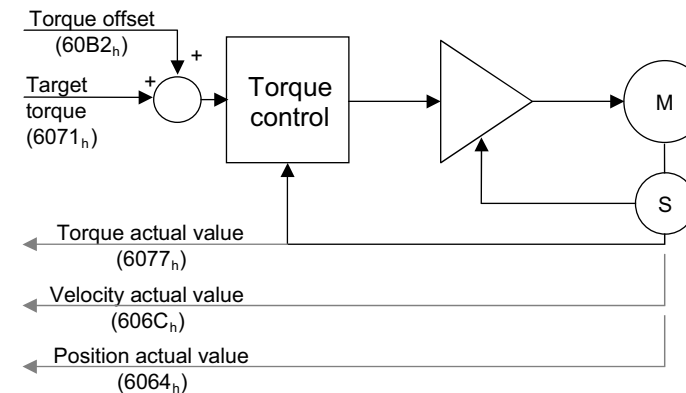


Fig. 13.5: Structure CST

Bit	Name	Value	Function
12	Target torque	0	Set torque ignored
		1	Set torque is to be used as input

Table 13.10: Bits in the status word that are specific to the operation mode

When the timing is optimal (see Fig. 13.2: Modes of operation - Timing) the TargetTorque is passed to the controller at the next DC0 point in time. The interpolated target torque reaches a DC0 time later than TargetTorque. It can be delayed additionally using **P 2959.0 RefTf**.

VelocityActualValue is determined at the DC0 times and is passed to the controller directly.

## 13.4 External feed forward control

In the "Cyclic synchronous position" or "Cyclic synchronous velocity" operation modes, a controller provides external feed forward control values for speed and torque. The internal feed forward control of the drive must be deactivated.

Object No.	Index	Name	Unit	Description	Data type
0x60B1	0000	VelocityOffset	SpeedUnit	Axis 1: CiA402 Speed feed forward control setpoint	int32
0x60B2	0000	TorqueOffset	0/00	Axis 1: CiA402 Torque feed forward control setpoint	int16
0x6076	0000	MotorRatedTorque	mNm	Axis 1: CiA402 motor rated torque	uint32

**Table 13.11: Parameter list – EtherCAT® axis – External feed forward control objects**

Object No.	Index	Name	Unit	Description	Data type
0x2B8F		CON_IP_RefFil		Axis 1: Filter time constants feed forward control (prediction)	float32
0x2B8F	0001	CON_IP_RefTf	ms	Speed setpoint filter	float32
0x2B8F	0002	CON_IP_EpsDly	ms	Position controller deceleration time (n x 0.125 ms)	float32
0x2B8F	0003	CON_IP_SFFTf	ms	Filter time speed feed forward control	float32
0x2B8F	0004	CON_IP_AccFFTf	ms	Filter time acceleration feed forward control	float32
0x2B9A		CON_IP_FFMode		Axis 1: Feed forward control mode	uint16
0x2B9A	0001	Speed		Speed feed forward control mode	uint16
0x2B9A	0002	Torque		Torque feed forward control mode	uint16
0x2B9B		CON_IP_FFScale		Axis 1: Scaling of the feed forward control	float32
0x2B9B	0001	Speed	%	Speed feed forward control scaling	float32
0x2B9B	0002	Torque	%	Torque feed forward control scaling	float32
0x2B9B	0003	ExtSpeed	%	Additional scaling of external speed feed forward control	float32
0x2B9B	0004	ExtTorque	%	Additional scaling of external torque/power feed forward control	float32

**Table 13.12: Parameter list – Control axis – Feed forward control**

## 13.5 Modes of Operation CiA402

- Profile position mode
- Velocity mode (V/Hz mode)
- Profile velocity mode
- Torque profile mode
- Homing mode
- Interpolated position mode

Object No.	Index	Name / Setting	Unit	Description	Data type
0x6060	0000	Modes of operation		Axis 1: CiA402 Modes of operation selector	int8
		(0)None		No operation mode selected	
		(1)ProfilePosition mode		Position control with drive-side profile generation	
		(2)Velocity mode		Frequency-controlled operation mode VCF mode.	
		(3)Profile velocity mode		Speed control operation mode according to the DS402 device profile.	
		(4)Torque profile mode		Torque-controlled operation mode	
		(5)Reserved			
		(6)Homing mode		References a position-controlled axis. Homing method (object 0x6098)	
		(7)Interpolated position mode		Travel profile without the use of the profile generator. Travel profile generation via control system	
0x6061	0000	ModesOfOperationDisplay		Axis 1: CiA402 Modes of operation display	int8
0x6502	0000	SupDriveModes		Axis 1: Operation modes supported by CiA402	uint32

**Table 13.13: Parameter list – EtherCAT® - Modes of operation EtherCAT® axis**

## 13.6 Profile position mode

In the profile position mode, the controller transfers the target position, speed, acceleration and deceleration to the axis. The corresponding movement is then executed under the control of a few bits in the DS402 control and status word. Path generation takes place in the axis.

The operation mode is implemented according to CiA 402 or DIN EN 61800-7-201.

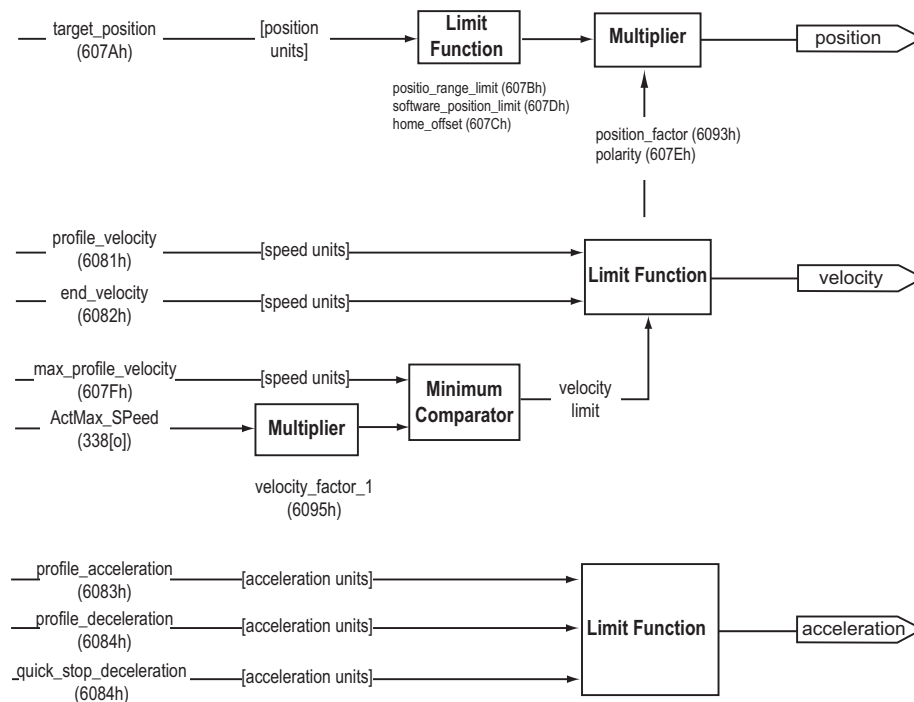


Fig. 13.6: Structure model of the Profile position mode

With optimal timing (see Fig. 13.2: Modes of operation - Timing), the status bits have a dead time of two PLC cycles relative to the control bits.

The path generation of the target position starts 1 ms after `SetpointAcknowledge` is set. The interpolated target position is delayed again by 1 ms plus the smoothing time **P 2291.0 MPRO\_REF\_JTime**; Spline interpolation (**P 2969.0 CON\_IP\_Sel = CUBIC**) an additional 1 ms delay.

To optimize the feed forward control, it can be helpful to delay the position setpoint internally by a few controller cycles (see also section "Feed forward control of speed and acceleration" on page 140, **Parameter P 2959 - CON\_IP\_EpsDly**). Parameter **P 2306.0 - ActPosDelayTime** delays the actual position, but is not helpful in the PPM module.

The following table provides an overview of the relevant objects:

Object No.	Index	Name	Unit	Description	Data type
0x607A	0000	Target position	PosUnit	Axis 1: CiA 402 Target position	int32
0x607D		Software position limit		Axis 1: Software limit switch	int32
0x607D	0001	PosLim_Min	PosUnit	Software limit switch neg.	int32
0x607D	0002	PosLim_Max	PosUnit	Software limit switch pos.	int32
0x6081	0000	ProfileVelocity	SpeedUnit	Axis 1: Profile speed	uint32
0x6083	0000	ProfileAcceleration	AccUnit	Axis 1: Profile acceleration	uint32
0x6084	0000	ProfileDeceleration	AccUnit	Axis 1: Deceleration profile	uint32
0x6085	0000	QuickStopDec	AccUnit	Axis 1: CiA 402 Quick stop deceleration ramp	uint32
0x6064	0000	Position actual value	PosUnit	Axis 1: CiA 402 Position actual value	
0x607E	0000	Polarity		Axis 1: CiA 402 Polarity	

Table 13.14: Objects in the "Profile position mode"

Bit	Name	Value	Description
4	New setpoint	0	Target position not accepted
		1	Target position accepted
5	Change set immediately	0	End current positioning and start next positioning
		1	Interrupt current positioning and start next positioning
6	absolute / relative	0	Target position is an absolute value
		1	Target position is a relative value
8	Stop	0	Perform positioning
		1	Stop the axis with the profile deceleration (if profile acceleration is not active)
9	Change on setpoint	0	Motion blocks are processed one after the other; the drive stops at each target position
		1	Motion blocks transition seamlessly with no halt between them

Table 13.15: Bits in the control word that are specific to the operation mode

Bit	Name	Value	Description
10	Target reached	0	Stop = 0: Target position not reached Stop = 1: Axis brakes
		1	Stop = 0: Target position reached Stop = 1: Velocity of the axis is 0
12	Setpoint acknowledge	0	The trajectory generation has not accepted the position values
		1	The trajectory generation has accepted the position values
13	Tracking error	0	No tracking error
		1	Tracking error
14	ROT_0	1	Axis at a standstill, speed is less than P 3051[1] – standstill window.

Table 13.16: Bits in the status word that are specific to the operation mode

### 13.6.1 Single setpoint

In this mode, the parameters of a single motion task are configured and it is transmitted by setting **bit 4 - New setpoint**. After this, the controller waits until the axis has reached this target. The axis signals this by means of **bit 10 - Target Reached** =

1. After this, the next motion block is transmitted.

A motion block can be interrupted by transmitting a new motion block with **bit 5 - ChangeSetImmediately** set. The axis immediately switches to the new speed in the direction of the new target position.

Example:

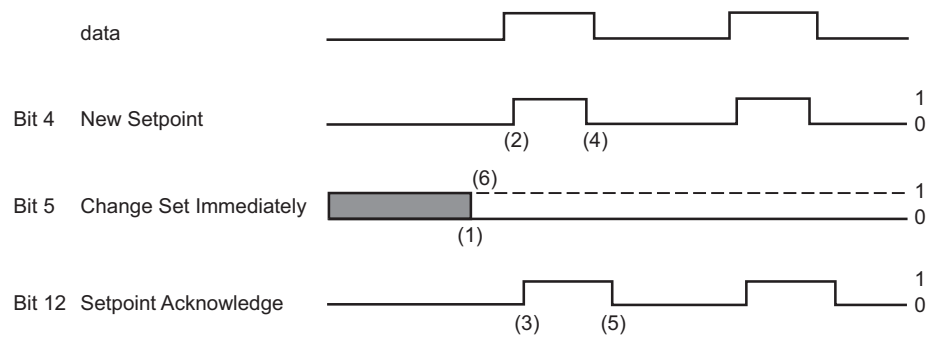
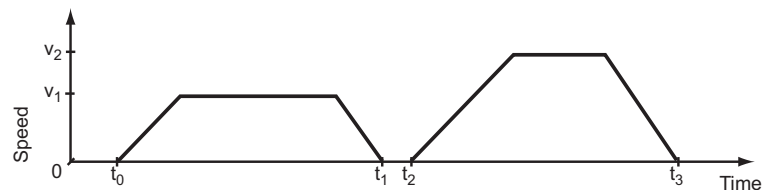


Fig. 13.7: Setpoint transmission from a master



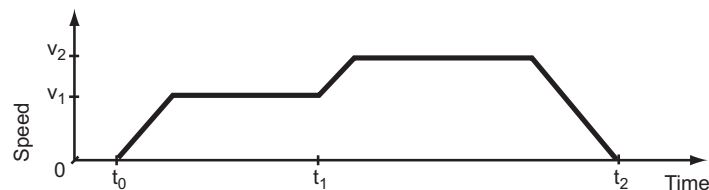
- (1) If bit 5, "Change Set Immediately" equals "0" (solid line in the figure above), the drive expects a "Single setpoint".
- (2) When the setpoint has been transmitted to the drive, the master activates the positioning by setting bit 4 "New Setpoint" in the control word.
- (3) When the new data has been recognized and saved, the drive sets bit 12 "Setpoint Acknowledge" in the status word.
- (4) The master deletes bit 4, "New Setpoint".
- (5) The drive transmits a new setpoint by deleting bit 12, "Setpoint Acknowledge".



When the target position has been reached at time  $t_1$ :

- the velocity is at 0.
- the next target position is triggered at time  $t_2$ .

- (6) If bit 5, "Change Set Immediately" equals "1" (dashed line in the figure), the new target position is accepted.



The drive is given:

- the 1st target position at time  $t_0$ ,
  - the 2nd target position at time  $t_1$
- and it implements the motions immediately.

## 13.6.2 Set of setpoints

In the mode "Set of Setpoints", several motion blocks are written to the drive. **Bit 12 - Setpoint acknowledge** follows **bit 4 - New setpoint** with a delay. Once **bit 12 - Setpoint acknowledge = 0**, additional motion blocks can then be written. Once the intermediate buffer of 4 motion blocks is full, **bit 12 - Setpoint acknowledge = 1** remains unchanged. If an additional job is sent to the drive in spite of a full buffer (FIFO), it will report an error 13-1 "SSP (set of setpoints) stack overflow".

**Bit 9 - Change on setpoint** can be used to cause the drive to not stop at a target position, but instead to transition directly to the new speed to the target of the next motion block. This feature must not be used for the last motion block in a chain because the drive will then stop with Error 13-5.

If a motion task is interrupted using the Halt bit, the drive brakes to a standstill. However, the tasks are then still in the memory. They are resumed when the Halt bit is zero again.

If a motion block is written with "**bit 5 - Change set immediately**", the drive will delete the entire contents of the intermediate buffer and activate the new motion block immediately as of the current position. If it defines a relative movement, the current position is taken as the basis.

The buffer is also emptied when the state of the DriveCom state machine changes.

## 13.7 Velocity mode (V/Hz mode)

The Velocity Mode operation mode (Modes of operation = 2) controls the drive in the frequency-controlled mode (V/Hz mode).

The units, the setpoint and the ramp values result from the settings in the factor group (see Section "Scaling / units (Factor Group)" on page 466).

The device supports the following objects in the "Velocity Mode" operation mode:

Object No.	Index	Name	Unit	Description	Data type
0x6042	0000	viTarget Velocity		Axis 1: Target speed	int16
0x6046		viVelocityMinMaxAmount		Axis 1: Velocity min and max amount	uint32
0x6046	0001	VelMinAmount	SpeedUnit	velocity mode, velocity min amount (min. velocity in user unit)	uint32
0x6046	0002	VelMaxAmount	SpeedUnit	velocity mode, velocity max amount (max. velocity in user unit)	uint32
0x6048		viVelocityAcceleration		Axis 1: Velocity mode acceleration	
0x6048	0001	DeltaSpeed	SpeedUnit	Delta speed for acceleration slope (velocity change in user unit)	uint32
0x6048	0002	DeltaTime	s	Velocity mode delta time for acceleration slope (per time unit)	uint16
0x6049		viVelocityDeceleration		Axis 1: Velocity mode deceleration	
0x6049	0001	DeltaSpeed	SpeedUnit	Delta speed for deceleration slope (velocity change in user unit)	uint32
0x6049	0002	DeltaTime	s	Velocity mode delta time for deceleration slope (per time unit)	uint16

Table 13.17: Objects and limitations in velocity mode (V/Hz mode)

Control word bits in the velocity mode

Bit	Name	Value	Description
4	Enable ramp	0	Reference speed is generated in a different manner (manufacturer-specific), e.g. through a test function generator or a manufacturer-specific holding function
		1	Reference speed corresponds to the ramp function generator output value
5	Unlock ramp	0	Lock ramp function generator output value at current value
		1	Ramp function generator output value follows the ramp function generator input value
6	Reference ramp	0	Set ramp function generator input value to NULL
		1	Ramp function generator input value corresponds to the setpoint
8	Stop	0	No command
		1	Stop axis

Table 13.18: Control word bits in the velocity mode

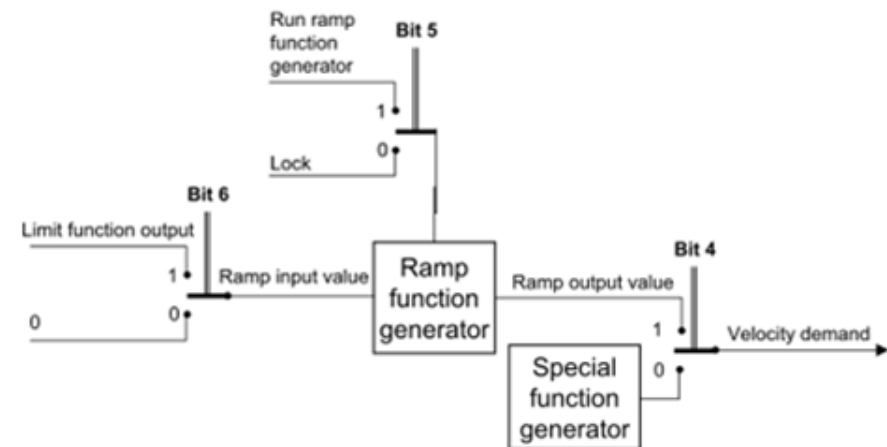


Fig. 13.8: Structure model of control word bits for profile velocity mode

## 13.8 Profile velocity mode

In the "Profile velocity mode" operation mode (Modes of operation = 3)

- The device is activated with a velocity setpoint according to a CiA 402 device profile.
- The drive is subject to velocity control.

The units, the setpoint and the ramp values result from the settings in the factor group (see Section "Scaling / units (Factor Group)" on page 466).

Object No.	Index	Name	Unit	Description	Data type
0x606C	0000	VelocityActualValue	SpeedUnit	Axis 1: CiA402 actual velocity value	int32
0x60FF	0000	TargetVelocity	SpeedUnit	Axis 1: CiA402 target speed	int32
0x6094		VelFactor		Axis 1: CiA402 factor velocity	
0x6094	0001	VelFactorNumerator		Resulting numerator	uint32
0x6094	0002	VelFactorDenominator		Resulting denominator	uint32
0x6083	0000	ProfileAcceleration	AccUnit	Axis 1: Profile acceleration	uint32
0x6084	0000	ProfileDeceleration	AccUnit	Axis 1: Deceleration profile	uint32
0x6085	0000	QuickStopDec	AccUnit	Axis 1: CiA402 quick-stop deceleration ramp	uint32
0x607E	0000	Polarity	Polarity	Axis 1: CiA402 Polarity	uint8

Table 13.19: Objects in Profile velocity mode

### NOTE



- The "Profile velocity mode" updates the following cyclically:  
The objects listed in the table.  
- Object 0x6064 "Position actual value".

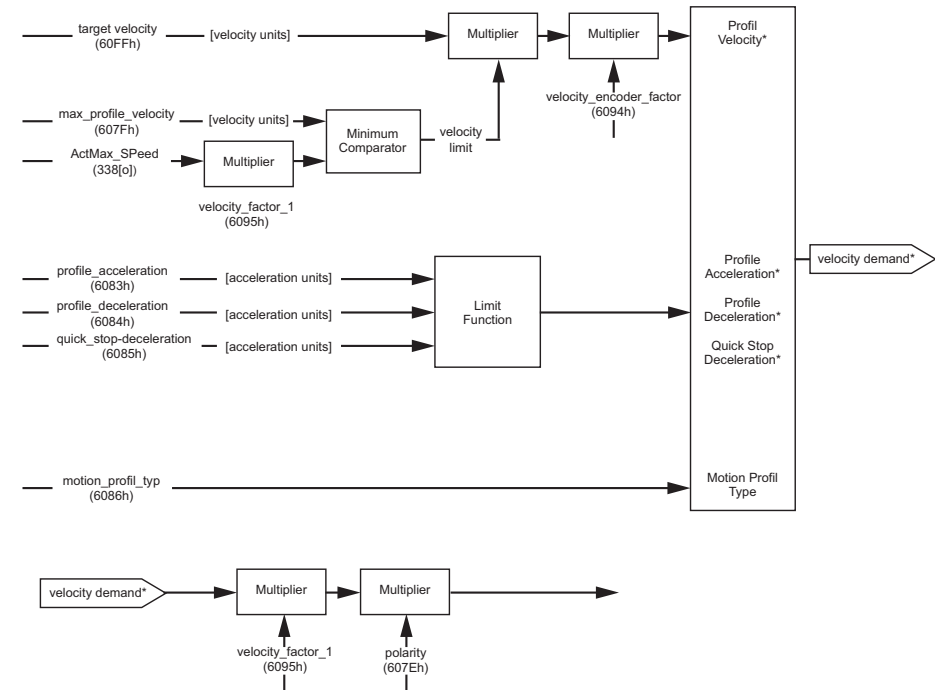


Fig. 13.9: Structure model of the Profile velocity mode

The Profile Velocity Mode is controlled by the bits in the control and status word.

### Profile velocity mode: Bits in the control word

Bit	Name	Value	Description
8	Stop	0	Execute the motion (Execute the motion)
		1	Stop axle (Stop Axis)

Table 13.20: Profile velocity mode: Bits in the control word

**Profile velocity mode: Bits in the status word**

Bit	Name	Value	Meaning
10	Target reached	0	Stop = 0: Target velocity not (yet) reached (Target speed (not yet) reached) Stop = 1: Axis decelerates (Axis is decelerating)
		1	Stop = 0: Target velocity reached (Target speed reached) Stop = 1: Axis has velocity 0 (Axis has velocity 0)
12	Speed	0	Speed is not equal 0 (Speed is not equal 0)
		1	Speed is equal 0 (Speed is 0)
13	Maximum slippage error	0	Maximum slippage not reached (Maximum slippage not reached)
		1	Maximum slippage reached (Maximum slippage reached)

*Table 13.21: Profile velocity mode: Bits in the status word*

With optimal timing (see Fig. 13.2: Modes of operation - Timing), the status bits have a dead time of two PLC cycles relative to the control bits.

The path generation of the target speed starts 1 ms after SetpointAcknowledge is set. The interpolated target speed is once again delayed by 1 ms plus the smoothing time **P 2291.0 MPRO\_REF\_JTime**. It can be delayed additionally using **P 2959.0 RefTf**.

## 13.9 Homing mode

The “homing mode” operation mode (Modes of operation = 6) references a position-controlled axis. The programmed homing method (homing method object 0x6098) determines the movement of the drive.



### NOTE

- Controller guided referencing of the drive by means of the Touch Probe function. See chapter Section "Touch probe" on page 523.

The homing methods differ from one another in terms of the inclusion of hardware limit switches reference marks and zero pulse of the encoder system.

Parametrize the corresponding digital inputs for the following limit-switch and reference-mark functionalities:

- Limit switch function
- LCW - right HW limit switch
- LCCW - left HW limit switch
- HOMSW - reference mark

Object No.	Index	Name	Unit	Description	Data type
0x607C	0000	HomeOffset	PosUnit	Axis 1: CiA402 Reference point shift	int32
0x6098	0000	HomingMethod		Axis 1: CiA402 Homing method	int8
0x6099		HomingSpeeds*		Axis 1: CiA402 Homing speed	
	0001	SpeedSwitch	SpeedUnit	Cam search speed	uint32
	0002	SpeedZero	SpeedUnit	Zero pulse search speed	uint32
0x609A	0000	HomingAcc	AccUnit	Axis 1: CiA402 Homing acceleration	uint32

\* 0x6099.01 - Rapid traverse speed  
0x6099.02 - Creep speed velocity

*Table 13.22: Objects in homing mode*

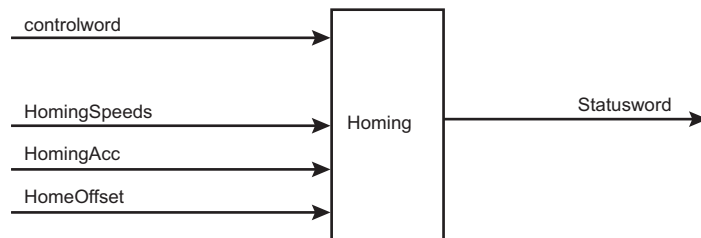


Fig. 13.10: Homing mode structure model

The drive supports all 35 of the homing methods (HOMING METHODS) defined in the CiA402.

The functions and motion sequences of the homing methods can be found in the Section "Homing / homing mode" on page 470.

### 13.9.1 Home offset

The "Home offset" object is the difference between position 0 of the application and the "Home position" found during referencing. The difference is displayed in positioning units. After referencing, the new zero position results from the sum of "Home offset" and "Home position". All of the following absolute positionings reference this new zero position.

The homing method and its properties can be changed in two ways:

1. Via the DriveManager 5
2. Via CANopen fieldbus system

Parameterization via CANopen controls the objects of the "Homing mode". Example: Changes to object 0x6098 change the homing method.

Bit	Name	Value	Description
4	Homing operation start	0	Homing inactive
		0 => 1	Start homing
		1 => 0	Interrupt homing
8	Stop	0	Execute instruction of bit 4
		1	Stops axis with deceleration

Table 13.23: HOMING MODE bits in the control word

Bit	Name	Value	Description
10	Target reached	0	Stop = 0: Home position not reached Stop = 1: Axis brakes
		1	Stop = 0: Home position reached Stop = 1: Axis in velocity 0
12	Homing attained	0	Homing not performed, axis not homed
		1	Homing performed successfully, axis homed
13	Homing error	0	No homing error
		1	Homing error. Homing failed. Error code shows the cause of the error (see Section "Error list" on page 231).
14	ROT_0	1	Axis at a standstill. Speed much less than <b>P 3051 [1] - StandstillWindow</b>

Table 13.24: HOMING MODE bits in the status word

## 13.10 Scaling / units (Factor Group)

An assistant implements the application variables in the display of the parameters from the "DS402-Factor Group". The objects saved in the formulas (e.g. feed constant, gear ratio etc.) serve as the basis for the calculation. The objects of the Factor Group can be calculated and directly set independently of the DriveManager 5 scaling assistant.

Object / Index	Name	Function	Data type
0x28FA	MPRO_FG_Type	Setting, user defined or standard CiA402	uint16
[0x000]	(0)DS402	CiA402 Factor Group	
	(1)USER	Factor Group user specific	
0x28FC	MPRO_FG_PosNorm	Internal position resolution [incr/rev)	uint32
0x28FD	MPRO_FG_Units	Axis 1: Factor Group units	string
[0001]	PosUnit	Units for position values	
[0002]	SpeedUnit	Unit for speed values	
[0003]	AccUnit	Unit for acceleration values	
[0004]	TorqueUnit	Unit for torque values	
0x607B	Position RangeLimit	Axis 1: Modulo limitation of use	int32
[0001]	Position RangeLimit_Min	Negative range position limit	
[0002]	Position RangeLimit_Max	Positive range position limit	

Table 13.25: Factor Group

Object / Index	Name	Function	Data type
0x607E	Polarity	CiA402 polarity Value 0 = Multiply setpoint by 1, Value 1 = Multiply setpoint by -1, Bits 0 to 5 = reserved Bit 6 = Velocity Polarity Bit 7 = Position Polarity	uint8
0x608F	PosEncRes	Axis 1: CiA402 Position encoder resolution $\text{PositionEncoderResolution} = \frac{\text{Encoder increments}}{\text{Motor revolutions}}$	uint32
[0001]	PosEncRes	Encoder increments singleturn	
[0002]	PosEncRes	Multiturn motor revolutions	
0x6090	VelEncRes	CiA402 Velocity encoder resolution $\text{VelocityEncoderResolution} = \frac{\text{Encoder} \frac{\text{Increments}}{\text{Second}}}{\text{Motor} \frac{\text{Revolutions}}{\text{Second}}}$	uint32
[0001]		Encoder increments per second	
[0002]		Motor revolutions per second	
0x6091	GearRatio	CiA402 gear ratio $\text{GearRatio} = \frac{\text{Revolutions of motor shaft}}{\text{Revolutions of drive shaft}}$	uint32
[0001]	GearRatio	Multiturn motor revolutions	
[0002]	GearRatio	Shaft revolutions	
0x6092	FeedConst	CiA402 Feed constant $\text{feedconstant} = \frac{\text{Feed}}{\text{Revolutions of drive shaft}}$	uint32
[0001]	Feed	Feed	

Table 13.25: Factor Group (continue)

Object / Index	Name	Function	Data type
[0002]	Shaft Rev	Shaft revolutions	
0x6093	PosFactor	CiA402 Position factor $\textbf{PositionFactor} = \frac{\text{PositionEncoderResolution} \cdot \text{Gear ratio}}{\text{Feed constant}}$	uint32
[0001]	PosFactor	Resulting numerator	
[0002]	PosFactor	Resulting denominator	
0x6094	VelFactor	CiA402 Velocity encoder factor $\textbf{VelocityEncoderFactor} = \frac{\text{VelocityEncoderResolution} \cdot \text{Gear ratio} \cdot \text{Position unit} \cdot F_{\text{Speed (notation index)}}}{\text{Feed constant} \cdot \text{Speed unit} \cdot \text{Second} \cdot F_{\text{Position (notation index)}}}$ Example of $F_{\text{velocity (notation index)}} = 10^2$ $F_{\text{Position (notation index)}} = 10^{-6}$	uint32
[0001]	VelFactor Numerator	Resulting numerator	
[0002]	VelFactor Denominator	Resulting denominator	
0x60F2	PositioningOC	OptionCode positioning status	uint16

Table 13.25: Factor Group (continue)



**NOTE**

- Changed objects are applied upon re-initialisation (e.g. by controller enable).



## 13.11 Setpoint / actual values

Object	Index	Name	Unit	Function	Data type
0x6064	0000	PositionActualValue	PosUnit	Axis 1: CiA 402 Position actual value	int32
0x606C	0000	VelocityActualValue	SpeedUnit	Axis 1: CiA 402 Velocity actual value	int32
0x6071	0000	TargetTorque	mNm	Axis 1: CiA 402 Target torque	int16
0x6076	0000	MotorRatedTorque	mNm	Axis 1: CiA 402 Motor rated torque	uint32
0x6077	0000	TorqueActualValue	mNm	Axis 1: CiA 402 Torque actual value	int16
0x607A	0000	Target position	PosUnit	Axis 1: CiA 402 Target position	int32
0x60B1	0000	VelocityOffset	SpeedUnit	Axis 1: CiA 402 Speed feed forward control setpoint	int32
0x60B2	0000	TorqueOffset	mNm	Axis 1: CiA 402 Torque feed forward control setpoint	int16
0x60FF	0000	Target Velocity	SpeedUnit	Axis 1: CiA 402 Target velocity	int32
0x60F4	0000	PositionFollowingError	PosUnit	Axis 1: CiA 402 Position tracking error	int32

Table 13.26: Objects for querying the target/actual values

## 13.12 Profile settings

The settings configure ramp steepness and maximum velocity used to calculate the travel profile.

Object	Index	Name	Unit	Description	Data type
0x6081	0000	ProfileVelocity	SpeedUnit	Axis 1: Profile speed	uint32
0x6083	0000	ProfileAcceleration	AccUnit	Axis 1: Profile acceleration	uint32
0x6084	0000	ProfileDeceleration	AccUnit	Axis 1: Deceleration profiles	uint32

Table 13.27: Objects for profile settings

## 13.13 Homing / homing mode

The homing operation establishes the absolute position reference for the entire axis. In the "Homing mode", the drive undertakes a homing operation in accordance with the homing method set (**0x6098 HomingMethod**). On reaching the reference mark ("current position" = 0), the "home offset" is set as the actual position. During homing for absolute value encoders, the "home offset" is added to the raw encoder position ("current position" = x).

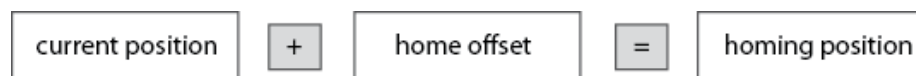


Fig. 13.11: Definition "homing position"

The different homing methods differ in terms of how they use hardware limit switches, reference mark and zero pulse of the encoder system for singleturn encoders and how they calculate the home position for absolute value encoders. During this process, bear in mind that with limit switch and reference mark functionality, the parameters must be set for the corresponding digital inputs (Section "Digital inputs" on page 208).

### NOTE



- The homing methods (-1) to (-11) are manufacturer-specific. The homing methods (0) to (37) are CANopen402 compliant.
- Further information about homing can be found in Section "Homing" on page 202.
- Further information about encoder configuration can be found in Section "TTL encoder" on page 83 and in Section "SinCos encoder" on page 84.

Object	Index	Name	Unit	Description
0x607C	0000	HomeOffset		Axis 1: CiA 402 Homing point shift
0x6098	0000	HomingMethod		Axis 1: CiA 402 Homing method
0x6099		HomingSpeeds		Axis 1: CiA 402 Homing speeds
0x6099	0001	SpeedSwitch		Cam search speed
0x6099	0002	SpeedZero		Zero pulse search speed
0x609A	0000	HomingAcc		Axis 1: CiA 402 Homing acceleration
0x28E7	0000	MC_HOMING_TMaxScale	%	Axis 1: Torque scaling during homing
0x28E8	0000	MC_HOMING_MaxDistance		Axis 1: Max. path during homing
0x28E9		MC_HOMING_Settings		Axis 1: Homing settings
28E9	0001	SimEnable		Homing simulation
28E9	0002	EncMode		Homing start
28E9	0003	IndexPulseOffset		Absolute movement after homing
28E9	0004	IndexPulseMode		Optional advanced modi for index pulse search
28E9	0005	IndexPulseSpeedScale	%	Speed scale for advanced index pulse search in % of V2
28E9	0006	IndexPulseSearchDist		Distance in user units for repeated index pulse search
28EA		MC_HOMING_Backup		Axis 1: Position backup
28EA	0001	HomeDiffST		Singleturn position backup
28EA	0002	HomeDiffMT		Multiturn position backup
28EA	0003	Valid		Backup
28EB	0000	MC_HOMING_Backup_User		Axis 1: Position backup in user units
28EC	0000	MC_HOMING_SimState		Axis 1: Homing simulation state

Table 13.28: Homing parameter settings

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#### Control word 0x6040

Bit	Name	Value	Function
4	homing operation start	0	Homing not active
		1	Homing active
8	Stop	0	Execute instruction of bit 4
		1	Stop axis as per " <b>halt option code</b> " <b>0x605D</b>

Table 13.29: Operation mode-specific control bits in the homing mode

#### Status word 0x6041

Bit	Name	Value	Function
10	Target reached	0	Stop = 0: Target position not reached Stop = 1: Axis brakes
		1	Stop = 0: Target position reached Stop = 1: Axis stationary
12	Homing attained	0	Homing point not yet defined
		1	Homing run successful or homing point defined
13	Homing error	0	No homing error
		1	Homing error occurred. Homing not carried out successfully. The cause of the error can be determined by the error code
14	ROT_0	1	Axis at a standstill, speed is less than the standstill window ( <b>P 3051[1] – standstill window</b> ).
15	Axis synchronized	0	Axis not synchronized
		1	Axis synchronized

Table 13.30: Operation mode-specific status bits in the homing mode

### 13.13.1 Evaluation of the zero pulse

The homing methods -11, -10, -7, -6 and 1-14 additionally evaluate the zero pulse of the encoder. As a rule, this substantially improves the repeatability of the position. A true zero-pulse signal is usually present in incremental encoders. For absolute value encoders, the zero pulse is the zero point of the singleturn position. With linear absolute encoders, referencing with a zero pulse cannot be applied meaningfully.

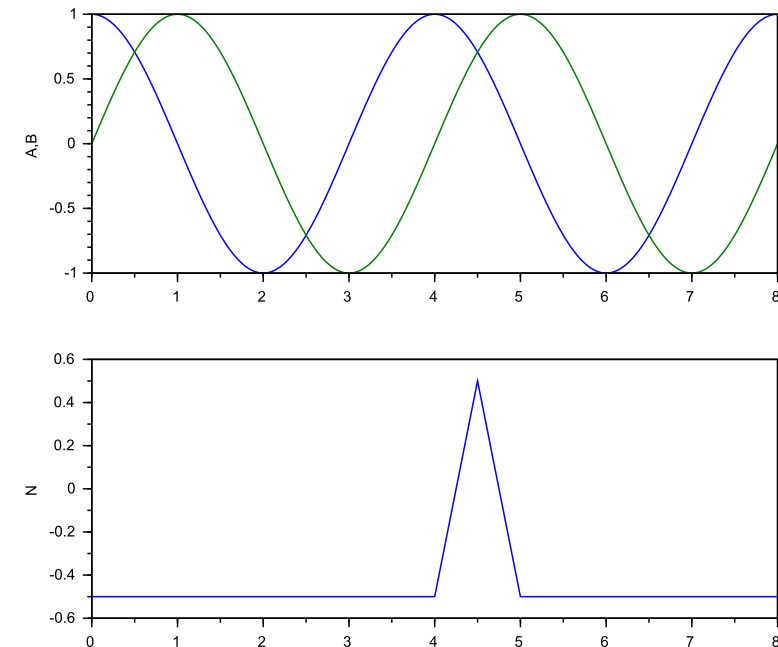
Zero pulses are in principle susceptible to interference. If necessary, connect an oscilloscope via an adapter plug and check the analogue signals. The threshold for detecting a zero pulse is 0 V differentially. Also take note of the information on signal adaptation (common mode) in (see 7.5.1 TTL encoder and 7.5.2 SinCos encoder).

The reduced speed 0x6099:0001 SpeedSwitch is already provided in the EtherCAT profile for moving to the zero pulse. The lower the value selected for this, the higher the accuracy - however the homing also takes correspondingly longer.

Several methods are implemented to increase the accuracy when evaluating a zero pulse:

#### 13.13.1.1 Defining quadrants

First, for encoders where the zero pulse is clearly assigned to a quadrant of the sine-cosine information, the zero position can be rounded to a quadrant boundary. To do so, set parameter **P 2848.45 ENC\_CH1\_Settings.EncZMmode** (or the equivalent) to **ADVANCED**. This eliminates the jitter caused by interference resulting from the analogue signal. However, the encoder must be set up in such a way that the evaluation result can be allocated to a quadrant exactly, otherwise a false position of an entire encoder period could be measured.



### 13.13 Homing / homing mode

#### 13.13.1.2 Multiple movements to the zero pulse

The zero pulse can be approached twice. To do so, set parameter **P 2281.3 IndexPulseMode = DOUBLE\_SEARCH**. The axis then travels to the zero pulse as defined in homing, then back by **P 2281.5 IndexPulseSearchDist** and finally back to the zero pulse once again. For the second approach, the speed is once again scaled with the factor **P 2281.4 IndexPulseSpeedScale**, typically reduced. This second position value is used.

This increases the accuracy because the zero pulse can be approached even more slowly without unnecessarily increasing the duration of homing.

With some homing methods, the zero pulse can be approached from different sides, depending on the procedure. This results in an inaccuracy equal to the width of the zero pulse. Use the setting **P 2281.3 IndexPulseMode= RIGHT** to always approach the right edge (with a negative speed). Use **P 2281.3 IndexPulseMode= LEFT** to always approach the left edge (with a positive speed). With this application, bear in mind that **P 2281.5 IndexPulseSearchDist** must be greater than the width of the zero pulse.

With parameter **P 2281.6 IndexPulseRepeat** the zero pulse search can also be carried out multiple times. When doing so, the axis always travels back by the value of **P 2281.5 IndexPulseSearchDist** and then forwards again to the zero pulse. Ultimately, the zero pulse that was furthest away is used. This is based on the assumption that sometimes a zero pulse signal which is not actually present is detected due to interference, but because the real zero pulse signal is the only one that always occurs, it should ultimately be found.

The positions found are recorded in parameter **P 2285 MC\_HOMING\_NpVal**.

### 13.13.2 Movement after homing

The parameter **P 2281.2 IndexPulseOffset** defines a distance which the axis travels after finding the cam and before searching for the zero pulse. This also indirectly changes the zero position.

A typical use case is the following:

- A linear axis is equipped with hardware limit switches. These mark the absolute mechanical limit of the travel path.

- The axis is to be referenced to one of the limit switches.
- Within the range, a position limitation ("software limit switch") is defined.

The position limitation becomes active directly after the referencing, but at this point in time, the axis is located outside of the position limitation. Consequently, an error is triggered immediately after homing.

For this use case, parametrize an additional movement after the homing. Set the parameter **P 2281.2 IndexPulseOffset** to a distance that causes the axis to come to a stop at a point clearly within the position limitation. Subtract this value from the HomingOffset **P 24700** so that the absolute position remains the same.

### 13.13.3 Method (-12) homing mode: Homing to raw data

The homing mode -12 is suitable for finished machines in which the zero positions are specified by the suppliers in the form of encoder raw values.

The specified zero position must be entered in parameters **P 2281.7 RawMT** and **P 2281.8 RawST**. Both values are right justified without the addition of a sign. When performing homing - without movement - or when starting the device, the zero position is determined accordingly.

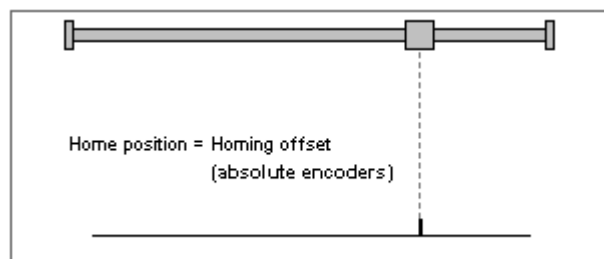


Fig. 13.12: Method (-12) Homing to raw data

### 13.13.4 Method (-10) and Method (-11): Move to block in negative / positive direction of movement with zero pulse

- Tracking error monitoring is switched off during the homing procedure.
- The maximum permissible torque can be reduced during the homing operation. Set **P 2279[0] - MC\_HOMING\_TMaxScale** in the range of 0–100 % for this purpose.
- A block is detected for a tracking error value of  $> 0.5 \times \text{P 2280[0]} - \text{MC\_HOMING\_MaxDistance}$ .
- The drive moves back from the target position by the value of **MC\_HOMING\_MaxDistance** or from the actual value by half of **MC\_HOMING\_MaxDistance**.

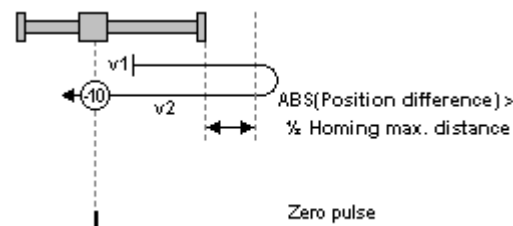


Fig. 13.13: Method (-10): Move to block in negative direction of movement with zero pulse

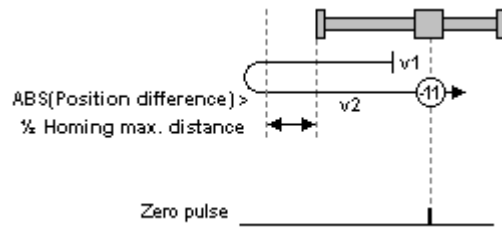


Fig. 13.14: Method (-11): Move to block in positive direction of movement with zero pulse

P No.	Index	Name	Unit	Description
2279 / 4327 / 6375	0	MC_HOMING_TMaxScale	%	Axis 1 / 2 / 3: Torque scaling during homing
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: DS402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.31: Parameters for homing method (-10) and (-11)

### 13.13.5 Method (-8) and Method (-9): Move to block in negative / positive direction of movement

- Tracking error monitoring is switched off during the homing procedure.
- The maximum permissible torque can be reduced during the homing operation. Set **P 2279[0] - MC\_HOMING\_TMaxScale** in the range of 0–100 % for this purpose. This parameter replaces **P 2968[2] - LimFac\_Torque** during homing.
- P 2280[0] - MC\_HOMING\_MaxDistance** is used to define the tracking error in the positioning range in which the block is detected.
- After the block has been detected, the axis is moved back by one half of the value of **MC\_HOMING\_MaxDistance** and the zero point is defined.

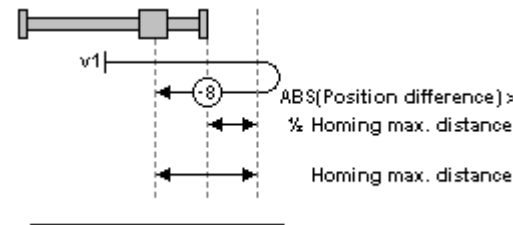


Fig. 13.15: Method (-8): Move to block in negative direction of movement

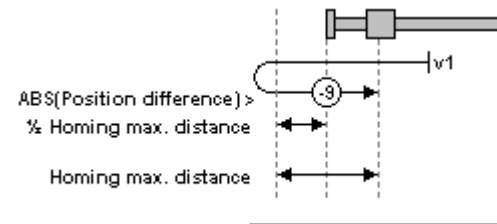


Fig. 13.16: Method (-9): Move to block in positive direction of movement

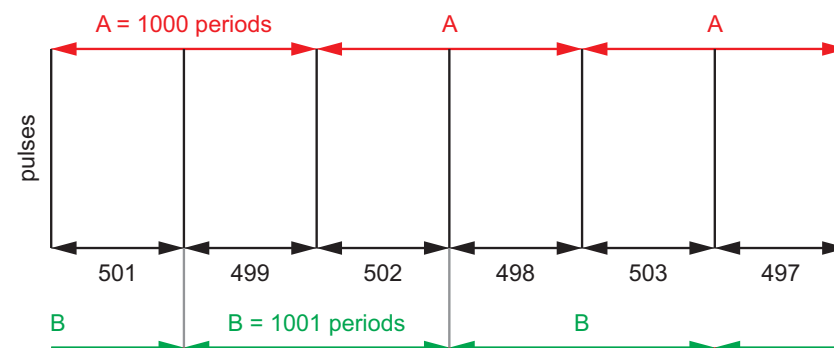


P No.	Index	Name	Unit	Description
2279 / 4327 / 6375	0	MC_HOMING_TMaxScale	%	Axis 1 / 2 / 3: Torque scaling during homing
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.32: Parameters for homing method (-8) and (-9)

### 13.13.6 Method (-6) and Method (-7): Homing to encoders with distance-coded zero pulses in the negative direction

- Homing methods -6 and -7 are supported for special encoders equipped with multiple zero pulses with varying distance. The two homing methods differ only in the direction of movement.
- The expected pattern is as follows:



- Parameter A and B of the pattern are measured in encoder periods and are shown in the encoder data sheet. Enter these values in parameters **DistCodeA** and **DistCodeB**.
- If there is no distance coding, **DistCodeA** must be set to zero.
- The singleturn absolute position is determined by traversing two zero pulses at low speed. Up to two repetitions are performed automatically if the distance was not determined with sufficient accuracy. The drive stops at the second zero pulse, not necessarily at zero position.

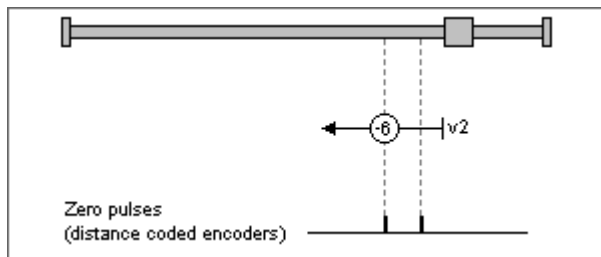


Fig. 13.17: Method (-6): Homing to encoders with distance-coded zero pulses in the negative direction

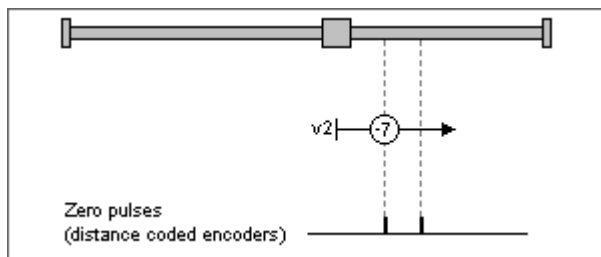


Fig. 13.18: Method (-7): Homing to encoders with distance-coded zero pulses in the positive direction

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
2848 / 4896 / 6944	6	Lines		Pulses per revolution / number of pole pairs
2848 / 4896 / 6944	39	DistCodeA		Distance-coded zero pulses: Fundamental period. Zero if no distance coding
2848 / 4896 / 6944	40	DistCodeB		Distance-coded zero pulses: Changed periods (B > A)

Table 13.33: Parameters for homing method (-6) and (-7)

P No.	Index	Name	Unit	Description
2868 / 4916 / 6964	6	Lines		Pulses per revolution / number of pole pairs
2868 / 4916 / 6964	37	DistCodeA		Distance-coded zero pulses: Fundamental period. Zero if no distance coding
2868 / 4916 / 6964	38	DistCodeB		Distance-coded zero pulses: Changed periods (B > A)
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.33: Parameters for homing method (-6) and (-7) (continue)

### 13.13.7 Method (-5): Current position + zero point offset

- This homing method is suitable for absolute value encoders (e.g. SSI multiturn encoders). Referencing is performed immediately after a mains power up. The homing position is calculated from the encoder absolute position plus the zero point offset (homing offset). No drive movement is performed. For an SSI multiturn encoder, referencing with a zero point offset = 0 results in the absolute position of the SSI encoder. Referencing again without changing the setting for the zero point offset does not cause a change of the position.

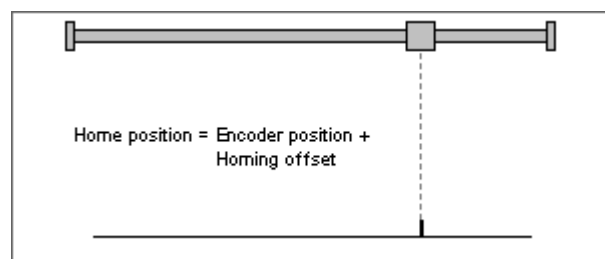


Fig. 13.19: Method (-5): Current position + zero point offset



#### NOTE

- Only use this homing method in combination with a multiturn encoder, but not with a multiturn encoder simulation (see 7.11.3 Multiturn encoder simulation). Otherwise, if the backup information is lost, the axis could start up with HomingAttained and an incorrect position.

### 13.13.8 Method (-3) and method (-4): Not implemented

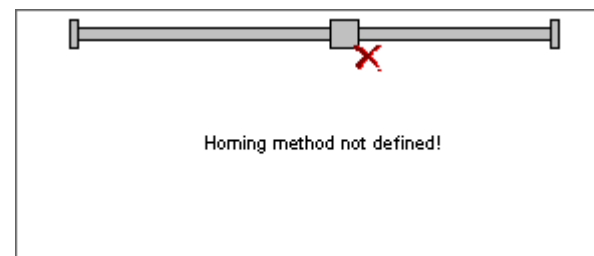


Fig. 13.20: Method (-3) and (-4): Not implemented

### 13.13.9 Method (-2): no homing

- No homing will be performed. The zero point offset is added to the current position. When the power stage is first switched on, "Homing completed" is set as the status. This method is suitable for absolute value encoders, provided that no offset compensation is required. For an offset compensation, please select method (-5).

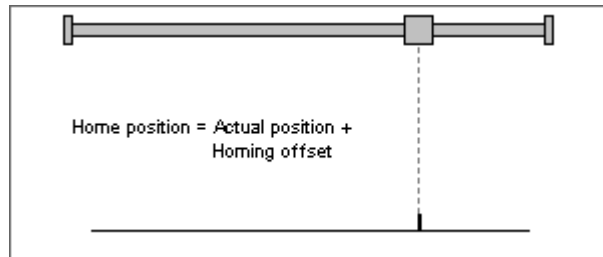


Fig. 13.21: Method (-2): No homing

### 13.13.10 Method (-1): Homing position = offset

- The actual position and the homing position are reset. Homing position = actual position = zero point offset. Homing again overwrites the last valid homing position.

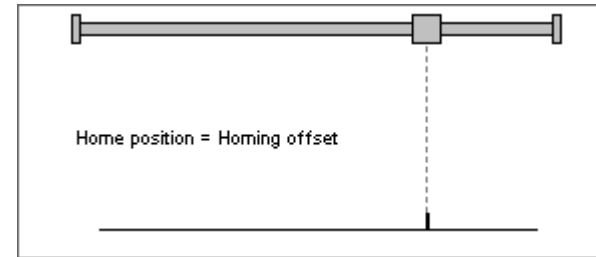


Fig. 13.22: Method (-1): Homing position = zero point offset

### 13.13.11 Method (0): Homing point reached

- The current actual position value of the position encoder is used as home position.

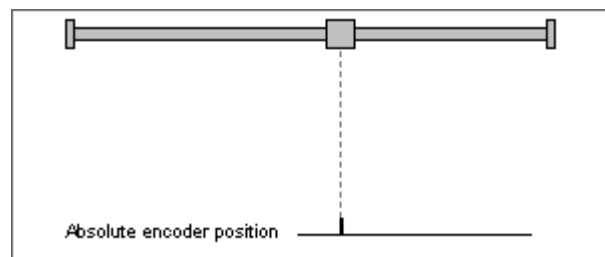


Fig. 13.23: Method (0): Homing position reached

### 13.13.12 Method (1) and Method (2): limit switch and zero pulse

- The initial movement is performed in the negative direction (method 1) or in the positive direction (method 2).
- The direction of movement is inverted when the limit switch has a rising edge.
- The zero point / homing point is set at the first zero pulse after the inversion of direction.

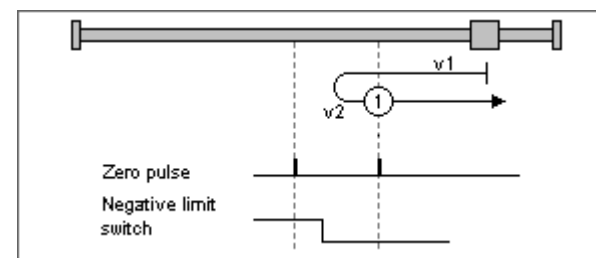


Fig. 13.24: Negative limit switch and zero pulse

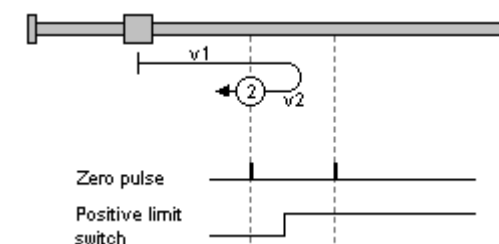


Fig. 13.25: Positive limit switch and zero pulse

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.34: Parameters for homing method (1) and (2)

### 13.13.13 Method (3): Positive reference cam and zero pulse

- The initial movement is in the positive direction if the homing cam is inactive, otherwise in the negative direction.
- The direction of movement is inverted when the homing cam has a rising edge.
- The zero point / homing point is set at the first zero pulse after the falling edge of the homing cam.

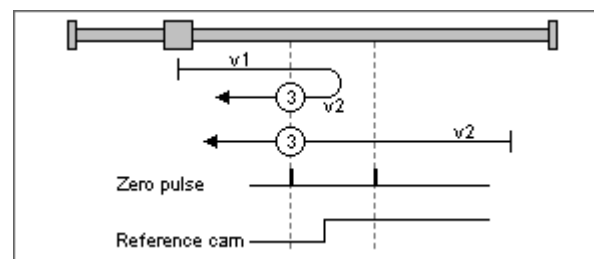


Fig. 13.26: Method (3): Positive homing cam and negative zero pulse

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.35: Parameters for homing method (3)

### 13.13.14 Method (4): Positive reference cam and zero pulse

- The initial movement is in the positive direction if the homing cam is inactive, otherwise in the negative direction.
- The direction of movement is inverted when the homing cam has a falling edge.
- The zero point / homing point is set at the first zero pulse after the rising edge of the homing cam.

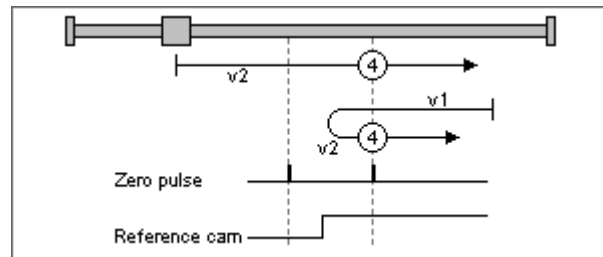


Fig. 13.27: Method (4): Positive homing cam and positive zero pulse

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: DS402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: DS402 Homing acceleration

Table 13.36: Parameters for homing method (4)

### 13.13.15 Method (5): Negative reference cam and zero pulse

- The initial movement is in the positive direction if the homing cam is active, otherwise in the negative direction.
- The direction of movement is inverted when the homing cam has a rising edge.
- The zero point / homing point is set at the first zero pulse after the falling edge of the homing cam.

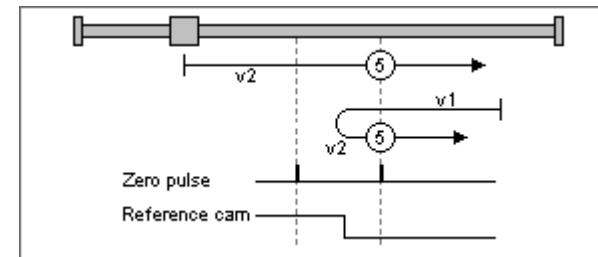


Fig. 13.28: Method (5): Negative reference mark and zero pulse

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.37: Parameters for homing method (5)

### 13.13.16 Method (6): Negative reference cam and zero pulse

- The initial movement is in the positive direction if the homing cam is active, otherwise in the negative direction.
- The direction of movement is inverted when the homing cam has a falling edge.
- The zero point / homing point is set at the first zero pulse after the rising edge of the homing cam.

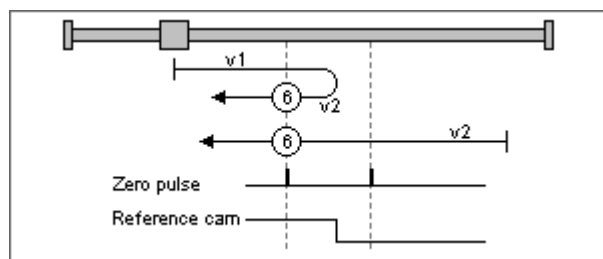


Fig. 13.29: Method (6): Negative reference cam and zero pulse

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.38: Parameters for homing method (6)

### 13.13.17 Method (7): Positive limit switch, left homing edge, zero pulse while homing cam is active

- The initial movement is in the positive direction if the homing cam is inactive, otherwise in the negative direction.
- The direction of movement is inverted after the rising edge of the homing cam has a falling edge or the positive limit switch has a rising edge.
- The zero point / homing point is set at the first zero pulse after the falling edge of the homing cam.

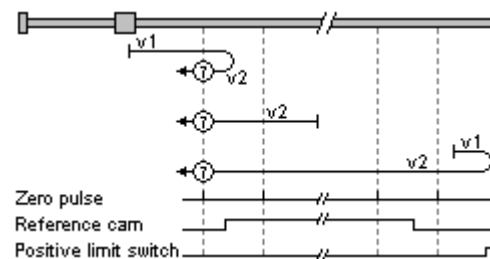


Fig. 13.30: Method (7): Positive limit switch, left homing edge, zero pulse while homing cam is active

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.39: Parameters for homing method (7)



### 13.13.18 Method (8): Positive limit switch, left homing edge, zero pulse while homing cam is active

- The initial movement is in the positive direction if the homing cam is inactive, otherwise in the negative direction.
- The direction of movement is inverted after the falling edge of the homing cam has a falling edge or the positive limit switch has a rising edge.
- The zero point / homing point is set at the first zero pulse after the rising edge of the homing cam.

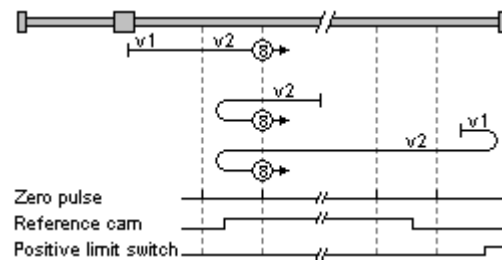


Fig. 13.31: Method (8): Positive limit switch, left homing edge, zero pulse while homing cam is active

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.40: Parameters for homing method (8)

### 13.13.19 Method (9): Positive limit switch, right homing edge, zero pulse while homing cam is active

- The initial movement is performed in the positive direction.
- The direction of movement is inverted after the falling edge of the homing cam has a falling edge or the positive limit switch has a rising edge.
- The zero point / homing point is set at the first zero pulse after the rising edge of the homing cam.

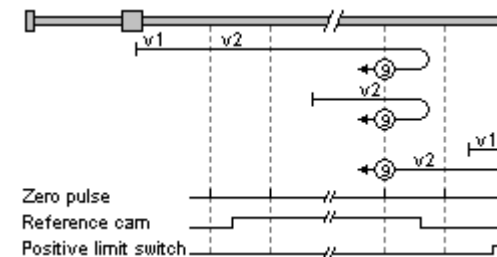


Fig. 13.32: Method (9): Positive limit switch, right homing edge, zero pulse while homing cam is active

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.41: Parameters for homing method (9)

### 13.13.20 Method (10): Positive limit switch, right homing edge, zero pulse while homing cam is inactive

- The initial movement is performed in the positive direction.
- The direction of movement is inverted after the rising edge of the positive limit switch and then again after the rising edge of the homing cam.
- The zero point / homing point is set at the first zero pulse after the falling edge of the homing cam.

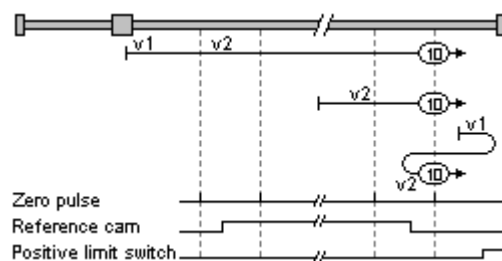


Fig. 13.33: Method (10): Positive limit switch, right homing edge, zero pulse while homing cam is inactive

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.42: Parameters for homing method (10)

### 13.13.21 Method (11): Negative limit switch, right homing edge, zero pulse while homing cam is active

- The initial movement is in the negative direction if the homing cam is inactive, otherwise in the positive direction.
- The direction of movement is inverted after the rising edge of the reference mark or if the negative limit switch is active.
- The zero point / homing point is set at the first zero pulse after the falling edge of the homing cam.

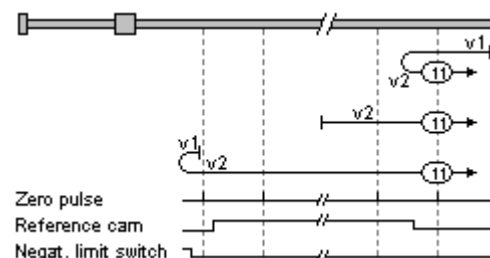


Fig. 13.34: Method (11): Negative limit switch, right homing edge, zero pulse while homing cam is active

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.43: Parameters for homing method (11)

### 13.13.22 Method (12): Negative limit switch, right homing edge, zero pulse while homing cam is active

- The initial movement is in the negative direction if the homing cam is inactive, otherwise in the positive direction.
- The direction of movement is inverted after the falling edge of the homing cam or if the negative limit switch is active.
- The zero point / homing point is set at the first zero pulse after a rising edge of the reference mark.

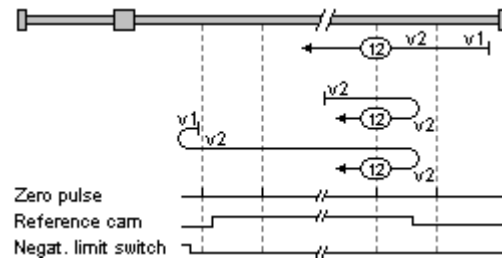


Fig. 13.35: Method (12): Negative limit switch, right homing edge, zero pulse while homing cam is active

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.44: Parameters for homing method (12)

### 13.13.23 Method (13): Negative limit switch, left homing edge, zero pulse while homing cam is inactive

- The initial movement is performed in the negative direction.
- The direction of movement is inverted after the falling edge of the homing cam or if the negative limit switch is active.
- The zero point / homing point is set at the first zero pulse after the rising edge of the homing cam.

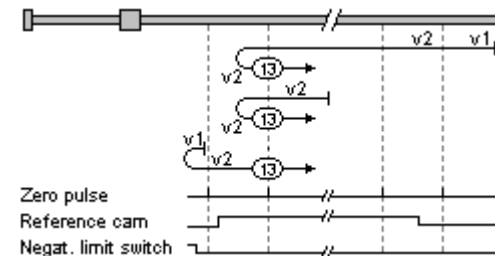


Fig. 13.36: Method (13): Negative limit switch, left homing edge, zero pulse while homing cam is inactive

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.45: Parameters for homing method (13)

### 13.13.24 Method (14): Negative limit switch, left homing edge, zero pulse while homing cam is inactive

- The initial movement is performed in the negative direction.
- The direction of movement is inverted if the negative limit switch is active and then again after the rising edge of the homing cam.
- The zero point / homing point is set at the first zero pulse after the falling edge of the homing cam.

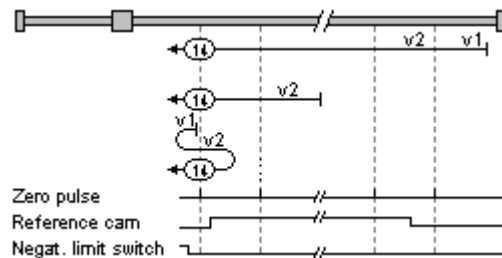


Fig. 13.37: Method (14): Negative limit switch, left homing edge, zero pulse while homing cam is inactive

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.46: Parameters for homing method (14)

### 13.13.25 Method (15) and method (16): Not implemented

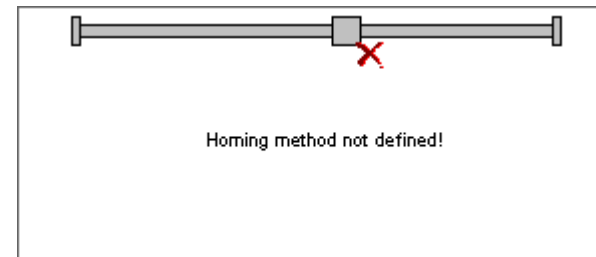


Fig. 13.38: Method (15) and (16): Not implemented

### 13.13.26 Method (17): Negative limit switch

- The initial movement is performed in the negative direction.
- The direction of movement is inverted if the negative limit switch is active.
- The zero point / homing point is set immediately after the inversion of direction.

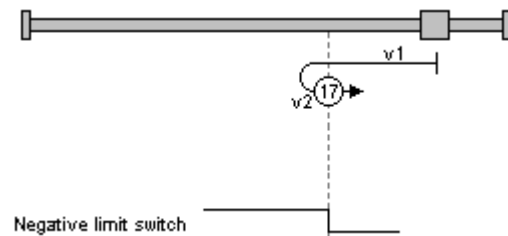


Fig. 13.39: Negative limit switch

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.47: Parameters for homing method (17)

### 13.13.27 Method (18): Positive limit switch

- The initial movement is performed in the positive direction.
- The direction of movement is inverted if the positive limit switch is active.
- The zero point / homing point is set immediately after the inversion of direction.

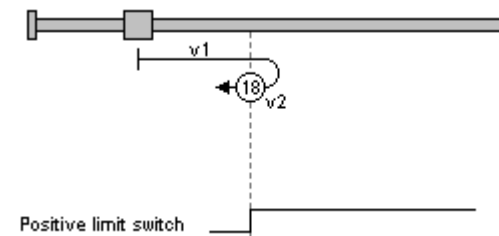


Fig. 13.40: Positive limit switch

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.48: Parameters for homing method (18)

### 13.13.28 Method (19): Positive homing cam, falling edge

- The initial movement is in the positive direction if the homing cam is inactive. In this case, the direction of movement is inverted when the homing cam has a rising edge.
- The initial movement is in the negative direction if the homing cam is active.
- The zero point / homing point is set if the homing cam has a falling edge.

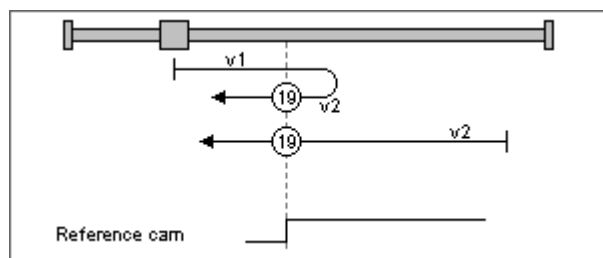


Fig. 13.41: Method (19): Positive homing cam, falling edge

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.49: Parameters for homing method (19)

### 13.13.29 Method (20): Positive homing cam, rising edge

- The initial movement is in the positive direction if the homing cam is inactive. The initial movement is in the negative direction if the homing cam is active. In this case, the direction of movement is inverted when the homing cam has a falling edge.
- The zero point / homing point is set if the homing cam has a rising edge.

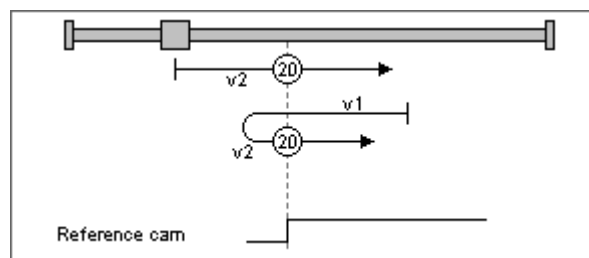


Fig. 13.42: Method (20): Positive homing cam, rising edge

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.50: Parameters for homing method (20)

### 13.13.30 Method (21): Negative homing cam, falling edge

- The initial movement is in the positive direction if the homing cam is active.
- The initial movement is in the negative direction if the homing cam is inactive. In this case, the direction of movement is inverted when the homing cam has a rising edge.
- The zero point / homing point is set if the homing cam has a falling edge.

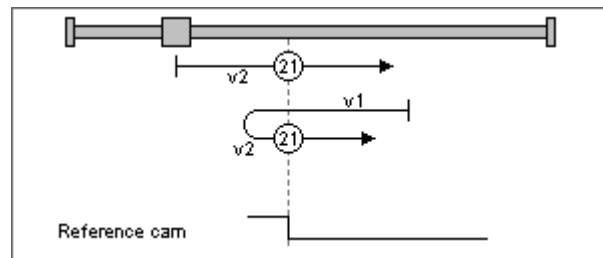


Fig. 13.43: Method (21): Negative homing cam, falling edge

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.51: Parameters for homing method (21)

### 13.13.31 Method (22): Negative homing cam, rising edge

- The initial movement is in the positive direction if the homing cam is active. In this case, the direction of movement is inverted when the homing cam has a falling edge.
- The initial movement is in the negative direction if the homing cam is inactive.
- The zero point / homing point is set if the homing cam has a rising edge.

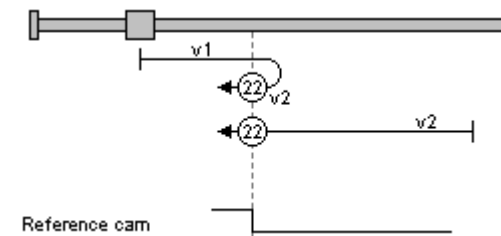


Fig. 13.44: Method (22): Negative homing cam, rising edge

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.52: Parameters for homing method (22)

### 13.13.32 Method (23): Positive limit switch, left homing edge, falling edge

- The initial movement is in the positive direction if the homing cam is inactive, otherwise in the negative direction.
- The direction of movement is inverted when the homing cam or positive limit switch has a rising edge.
- The zero point / homing point is set if the homing cam has a falling edge.

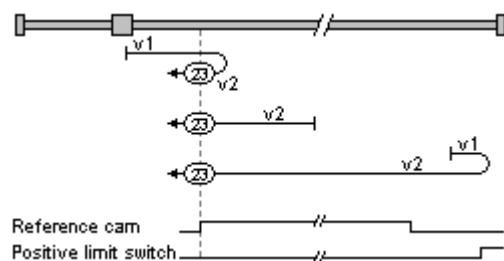


Fig. 13.45: Method (23): Positive limit switch, left homing edge, falling edge

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.53: Parameters for homing method (23)

### 13.13.33 Method (24): Positive limit switch, left homing edge, rising edge

- The initial movement is in the positive direction if the homing cam is inactive, otherwise in the negative direction.
- The direction of movement is inverted when the homing cam has a falling edge or the positive limit switch has a rising edge.
- The zero point / homing point is set if the homing cam has a rising edge.

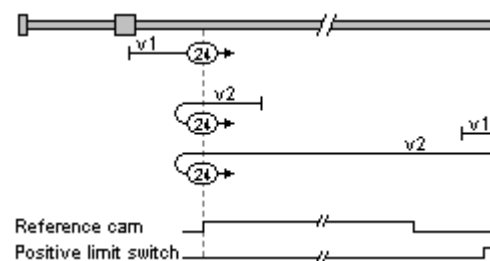


Fig. 13.46: Method (24): Positive limit switch, left homing edge, rising edge

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.54: Parameters for homing method (24)



### 13.13.34 Method (25): Positive limit switch, right homing edge, rising edge

- The initial movement is performed in the positive direction.
- The direction of movement is inverted when the homing cam has a falling edge or the positive limit switch has a rising edge.
- The zero point / homing point is set if the homing cam has a rising edge.

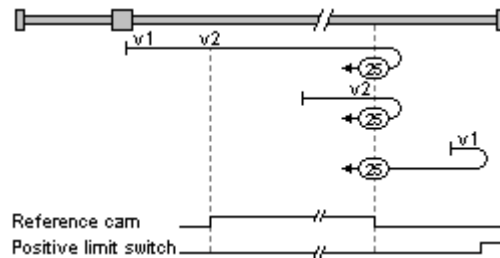


Fig. 13.47: Method (25): Positive limit switch, right homing edge, rising edge

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.55: Parameters for homing method (25)

### 13.13.35 Method (26): Positive limit switch, right homing edge, falling edge

- The initial movement is performed in the positive direction.
- The direction of movement is inverted if the positive limit switch is active and then again after the rising edge of the homing cam.
- The zero point / homing point is set if the homing cam has a falling edge.

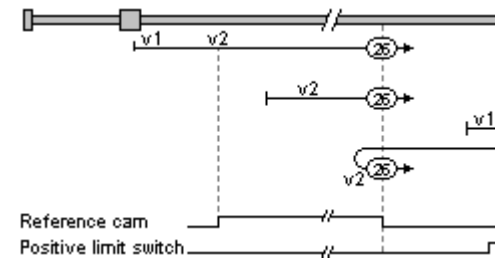


Fig. 13.48: Method (26): Positive limit switch, right homing edge, falling edge

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.56: Parameters for homing method (26)

### 13.13.36 Method (27): Negative limit switch, right homing edge, falling edge

- The initial movement is in the negative direction if the homing cam is inactive, otherwise in the positive direction.
- The direction of movement is inverted after the rising edge of the homing cam or if the negative limit switch is active.
- The zero point / homing point is set if the homing cam has a falling edge.

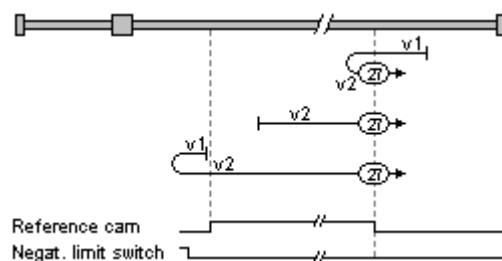


Fig. 13.49: Method (27): Negative limit switch, right homing edge, falling edge

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.57: Parameters for homing method (27)

### 13.13.37 Method (28): Negative limit switch, right homing edge, rising edge

- The initial movement is in the negative direction if the homing cam is inactive, otherwise in the positive direction.
- The direction of movement is inverted after the falling edge of the homing cam or if the negative limit switch is active.
- The zero point / homing point is set if the homing cam has a rising edge.

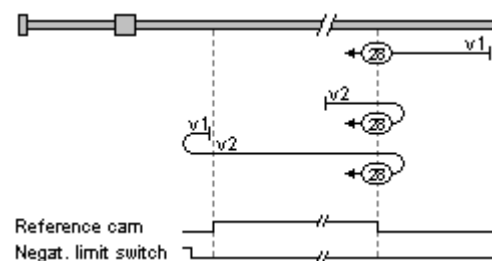


Fig. 13.50: Method (28): Negative limit switch, right homing edge, rising edge

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.58: Parameters for homing method (28)

### 13.13.38 Method (29): Negative limit switch, left homing edge, rising edge

- The initial movement is performed in the negative direction.
- The direction of movement is inverted if the homing cam has a falling edge or if the negative limit switch is active.
- The zero point / homing point is set if the homing cam has a rising edge.

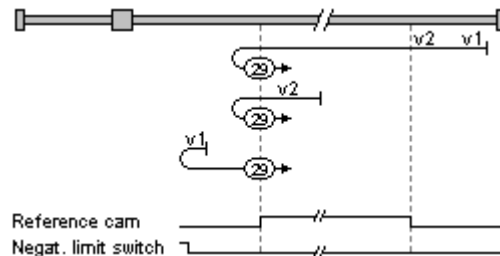


Fig. 13.51: Method (29): Negative limit switch, left homing edge, rising edge

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.59: Parameters for homing method (29)

### 13.13.39 Method (30): Negative limit switch, left homing edge, falling edge

- The initial movement is performed in the negative direction.
- The direction of movement is inverted if the negative limit switch is active and then again after the rising edge of the homing cam.
- The zero point / homing point is set if the homing cam has a falling edge.

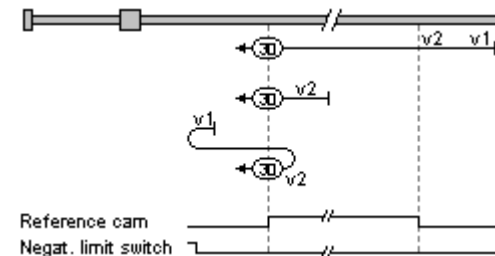


Fig. 13.52: Method (30): Negative limit switch, left homing edge, falling edge

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	Cam search speed
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.60: Parameter homing method (30)

### 13.13.40 Method (31) and method (32): Not implemented

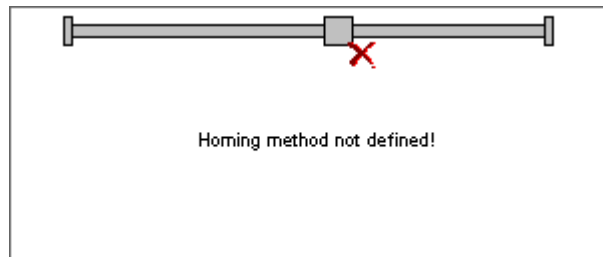


Fig. 13.53: Method (31) and (32): Not implemented

### 13.13.41 Method (33): Next left zero pulse

- The initial movement is performed in the negative direction.
- The zero point / homing point is set at the next zero pulse.

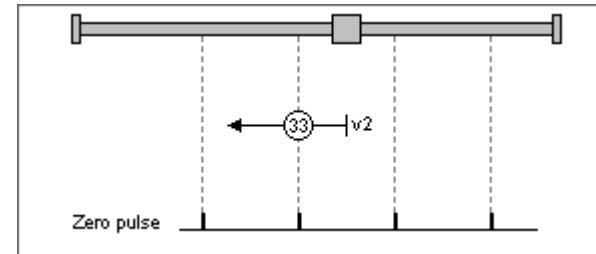


Fig. 13.54: Method (33): Next left zero pulse

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_ MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.61: Parameters for homing method (33)

### 13.13.42 Method (34): Next right zero pulse

- The initial movement is performed in the positive direction.
- The zero point / homing point is set at the next zero pulse.

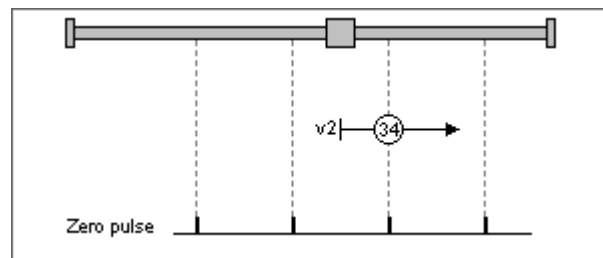


Fig. 13.55: Method (34): Next right zero pulse

P No.	Index	Name	Unit	Description
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	Axis 1 / 2 / 3: Max. distance during homing
24700 / 26748 / 28796	0	HomeOffset	PosUnit	Axis 1 / 2 / 3: CiA402 Reference point shift
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	Zero pulse search speed
24730 / 26778 / 28826	0	HomingAcc	AccUnit	Axis 1 / 2 / 3: CiA402 Homing acceleration

Table 13.62: Parameters for homing method (34)

### 13.13.43 Method (35): Current position

- The zero point / homing point is set to the current position.

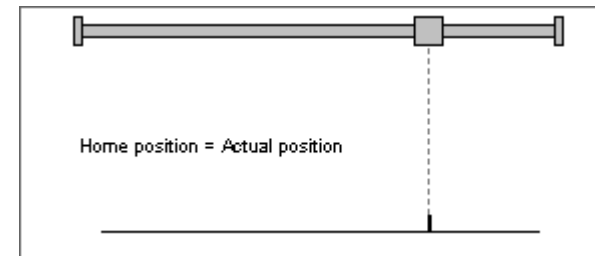


Fig. 13.56: Method (35): Zero point / homing point = current position

### 13.13.44 Method (36): Not implemented

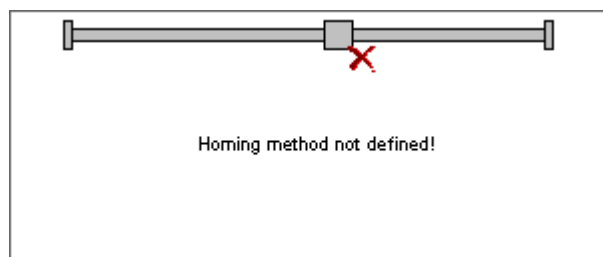


Fig. 13.57: Method (36): Not implemented

### 13.13.45 Method (37): Set the homing point for absolute value encoder

- Set a machine homing point for an absolute value encoder or for the absolute value encoder simulation.
- One-time definition of the machine homing point. Sets the current position **0x6064 PositionActualValue** to be equal to **0x607C HomingOffset**. The offset to the absolute position of the encoder is saved internally.
- The offset determined is calculated automatically using the absolute position of the encoder after a reboot of the device.
- It is possible to conduct a homing operation when the control is switched off, which triggers an automatic save operation of the offset in the background.
- When settings are made for scaling and for the encoder, The "Homing attained" bit is reset.

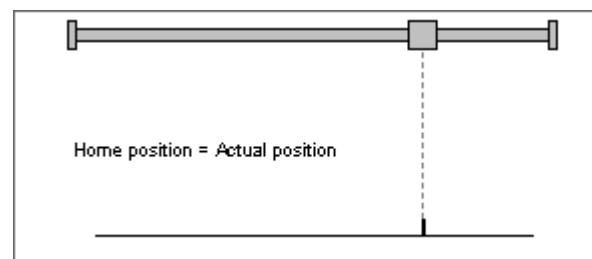


Fig. 13.58: Method (37): Zero point / homing point = offset



#### NOTE

- Only use this homing method in combination with a multiturn encoder, but not with a multiturn encoder simulation (see 7.11.3 Multiturn encoder simulation). Otherwise, if the backup information is lost, the axis could start up with HomingAttained and an incorrect position.

## 13.14 Backup of absolute position and homing status

In the dialog box ►Project tree ►Axis adjustment ►X axis ►Motion profile ►Homing, the “Special homing function” button gives access to various special functions pertaining to encoders and homing.

See also Section "Advanced encoder function" on page 108.

### Encoder special function for position encoder (CH3)

#### Multiturn simulation of singleturn encoder

(Saving the absolute position and encoder data at switching off)

OFF(0) = Encoder simulation inactive Activate absolute-encoder simulation

-683915712 Saved encoder position in user-units

Motor brake

Q5201200P Saved encoder serialnumber

Encoder position and serialnumber saved and valid

#### Encoder validation

(Plausibility check of actual position to saved position and detection of encoder changing at restart)

Force Auto

- ☐ ☒ Enable position singleturn validation (Single turn validation is enabled with Encoder special function.)
- ☐ Enable position multiturn validation
- ☐ ☒ Enable encoder serial number validation (Serial number validation is automatically enabled if any special function is used.)
- ☐ Enable validation encoder error (Checking the encoder initialization will be activated when a special function was selected)
- ☐ ☐ Enable validation power off (Checking the device state at Power Off will be activated when a special function was selected)

100 mdeg Hysteresis singleturn position (User unit)  
0.1 deg Hysteresis singleturn position (Motor shaft)  
0 mdeg Actual single position difference

#### Homing special function

(Restore the last absolute position and homing attained message at switch on)

OFF(0) = Homing simulation inactive Activate persistent homing

OFF Status Homing-Simulation

#### Encoder overrun compensation

(The overrun compensation displaces the actual position to compensate overrun effects of the encoder.)

OFF(0) = No compensation Activate overrun compensation

0 Number of overrun since last homing

Start encoder initialization

Save device settings

Fig. 13.59: Special homing function dialog box

## 13.14.1 Functions

- Simulation of a multiturn absolute encoder when using a singleturn encoder
- Restoration of the last absolute position before mains off (different encoder types)
- Overflow compensation
- Restoration of the homing status after power-on
- Plausibility check (serial number) of encoder (e.g. motor replacement in case of service)

## 13.14.2 Storable backup data

- **0x2B3C - ENC\_CH1\_Backup**
- **0x2B3C[0000] - PosST**: Current singleturn encoder position
- **0x2B3C[0001] - PosMT**: Current multiturn encoder position
- **0x2B3C[0002] - Valid**: Flag for the validity of the backup position (Position Valid Flag PVF)
- **0x2B3C[0003] - EncSerialNum**: Encoder serial number

## 13.14.3 Events triggering automatic backup

- Undervoltage detected  
DC-link voltage has fallen below the undervoltage threshold. The Position Valid Flag is set for the axes which have closed brakes at the moment of shutdown (standstill).
- Encoder simulation active
- Plausibility check active
- Associated initialisation method active  
Select method:  
Manual selection: **0x2B42 ENC\_BackupLatch**  
Automatic selection: **0x2B20[1D] - AbsSim\_Enable**

### Save manually

- Command using parameter (e.g. via controller) ENC\_BackupLatch.

### Initialisation

- **0x2B20[1D] - AbsSimEnable** Initialisation via a selected initialisation method.

Object	Designation	Function
0x2B20	ENC_CH1_Settings	Multi_Encoder interface settings
[001D]	AbsSim_Enable	Initialisation method: During the active initialisation method, no position validation check is made and no check of the validity of the backup data is made.
	(0) OFF	Simulation inactive
	(1) SIM_ENC	Simulation of the absolute encoder value: Encoder absolute value simulation including homing simulation active
	(2) SIM_ENC_Init	Automatic simulation of the MT encoder simulation and plausibility check
[001E]	ENC_Val_Enable	Activate plausibility check
[001F]	ENC_Val_PosDiffLim	Check of the maximum position difference: Setting for the limit range over which the actual singleturn position information at "PowerOn" is allowed to deviate from the stored singleturn position information (value as amount in user units).
0x2B23	ENC_CH1_ActVal	Encoder CH1 actual values
[0001]	ActPosST	Current singleturn encoder position
[0002]	ActPosMT	Current multiturn encoder position
0x2B3C	ENC_CH1_Backup	Backup position CH1
[0001]	PosST	Backup position Singleturn
[0002]	PosMT	Backup position Multiturn
[0003]	Valid	Position Valid Flag backup
[0004]	EncSerialNum	Encoder serial number
(4)	HomeOffsetST	Internal homing offset / Singleturn homing difference
(5)	HomeOffsetMT	Internal homing offset / Multiturn homing difference

Table 13.63: Axis 1 backup data parameters



Object	Designation	Function
0x2B42	ENC_BackupLatch	Manual initialisation (saving) of the backup data
[0000]	(0)Off	inactive
	(1)LATCH_CH1	Latching of the CH1 position value
	(2)LATCH_CH2	Latching of the CH2 position value
	(3)LATCH_CH3	Latching of the CH3 position value
	(4)LATCH_CH4	Latching of the CH4 position value
	(5)RESET_CH1	Reset of the CH1 backup data
	(6)RESET_CH2	Reset of the CH2 backup data
	(7)RESET_CH3	Reset of the CH3 backup data
	(8)RESET_CH4	Reset of the CH4 backup data
0x2B48	ENC_CH1_Backup_User	Axis 1: CH1 position backup in user units
[0001]	Pos	Backup singleturn encoder position in user units
[0002]	HEncVal_PosDiff	Internal homing offset / Singleturn homing difference in user units

Table 13.63: Axis 1 backup data parameters (continue)

### 13.14.4 Simulation of a multiturn absolute encoder

See Section "Multiturn encoder simulation" on page 115.

### 13.14.5 Restore absolute position (multiturn encoder)

#### Compensation of the overflow for an absolute encoder.

After "PowerOn", the absolute position is restored using the encoder position and the machine offset or homing offset (the Homing Attained bit is set).

#### Parameter setting:

##### 0x2B20

SIM\_HOME(2)

SIM\_Home\_INIT(5)

#### Functional sequence:

The encoder backup data are saved after "PowerOff".

On "PowerOn"

Variant 1:

Restoration of the backup data.

Check of the encoder (ST, MT information), only when enabled using

**0x2B20[1E] - EncVal\_Enable**, bit 0-2 (the Homing Attained bit is set if there is no error).

Variant 2:

The axis reports in with the restored absolute position. The overriding controller must complete the homing operation using homing method 37 (the Homing Attained bit is set)

### 13.14.6 Initial commissioning of the encoder

#### Description:

This setting is used for the initial setup of the encoder being used, or after a negative check of the encoder or a negative check of the backup data. Afterwards, the drive is referenced to the machine's home position.

#### Parameter setting:

##### 0x2B20

SIM\_ENC\_INIT(4)

SIM\_HOME\_INIT(5)

SIM\_ENCHOME\_INIT(6)

### Functional sequence:

The setting is made by the controller or DriveManager 5 before a homing operation is performed. After successful homing, the drive automatically resets the configuration value to the corresponding **SIM method** and saves the respective backup data.



#### NOTE

- The validity check of the encoder and backup data is suppressed during homing.

## 13.14.7 Configuration of the plausibility

### Description:

This setting specifies which encoder information should be used for the validity check of the encoder and backup data (singleturn or multiturn information or possibly the serial number of the encoder). The encoder must support the “electronic rating plate” function.

### Parameterization:

#### P 0x2B20(1D):

Bit0 - ST information

Bit1 - MT information

Bit2 - encoder serial number

### Functional sequence:

The possible validity checks for the setting versions SIM\_HOME and SIM\_ENCHOME must be selected. If the encoder being used does not provide the desired information, this check step is omitted.

## 13.15 Stop ramps



#### NOTE

- The axis-specific and device-specific settings of the error reactions can be configured via ► *Project tree* ► *Axis adjustment* ► *X axis* ► *Alarms / Warnings* ► *Error reactions* and ► *Project tree* ► *Axis adjustment* ► *Device* ► *Alarms / Warnings* ► *Error reactions* (see also section “Error reactions” on page 225).
- The dialog box for configuring stop ramp parameters can be accessed by pressing the “Stop ramps / Option codes” button at the bottom of the above dialogs.
- The stop ramp parameters are only available as a list view via ► *Project tree* ► *Axis adjustment* ► *X axis* ► *EtherCAT®* ► *Stop ramps / Option codes*.

#### Stop ramps

Reaction at control off (shutdown)	EqualQuickStopOC(-1) = Same as Quick Stop Option Code
Reaction at disable reference (disable)	DisableDrive(0) = Disable drive function (switch-off the drive power stage)
Reaction at halt command (halt)	DisableDrive(0) = Reserved - do not use
Reaction at quick stop command (quickstop)	DisableDrive(0) = Disable drive function
Quick stop ramp	30000000 Maximum deceleration time: 0.3 s
Quick stop time out	100 ms
Reaction at fault (fault reaction)	DisableDrive(0) = Disable drive function, motor is free to rotate
<button>Error reactions (axis)</button> <button>Error reactions (device)</button>	

#### Start-up

Move axis to target position before operation enabled	STD(0) = No drive based positioning when going operation enabled
---	--

Fig. 13.60: Dialog box for the stop ramps and option codes

In various different situations, the axis needs to be stopped in a drive-controlled manner. The exact behaviour is defined by the respective option code. The braking is typically to be carried out according to a defined ramp. As an alternative, "Brake at the current limit" can be selected so that the drive is braked with the maximum torque that is available. The speed setpoint is then abruptly set to zero and the axis brakes as fast as possible.

Ramps are generally carried out with smoothing. This makes the transition soft, but the smoothing time is also lost.

In the event that the controller cannot follow the configured stop ramp or if the drive cannot be controlled any more due to an error, quick-stop and error stop ramps are monitored by a timeout. If the (setpoint) stop ramp does not reach standstill plus the time in **P 2255[0] - MPRO\_DRVCOM\_ROT0\_Time**, the current speed value of the axis must also be in the standstill window. Otherwise, the power stage is shut down and the brake (if there is one) is applied.

The transition to a stop, quick stop or error stop ramp is performed so that the current position and speed of the axis is scanned and a quick stop is performed from there. This is particularly useful if the drive was unable to follow the setpoints before the error and has built up tracking errors. However, this can lead to positional inaccuracies if drive-controlled relative movements are interrupted by a stop. In this case, set **P 4310[1] - SyncHalt = False(0)** to perform a stop ramp based on setpoints alone.

The maximum deceleration time indicates the time which is required to go from the maximum axis speed to a standstill. It can be used as an aid in setting the quick-stop ramp **P 24709(0) - QuickStopDec**.

### 13.15.1 Shutdown, Halt, DisableOperation

"Shutdown" defines the behaviour when the control is switched off. "Halt" becomes active when the Halt bit is set via the controller or a digital input. The "DisableOperation" transition is only relevant in special cases.

Object	Name / Setting	Function	Data type
<b>0x28CF</b>	MPRO_DRVCOM_ROT0_Time	Timeout until motor standstill	uint32
<b>0x6085</b>	QuickStopDec	Setting for the quick-stop ramp	uint32
<b>0x605B</b>	ShutdownOC	Implement the selected action on the transition from the "Operation Enable state" to "Ready to switch on" state.	int16
[000-1]	EqualQuickStopOC	Same function as for Quick Stop OC (s. below).	
[0000]	Disable drive function	Shut down power stage	
[0001]	SlowDownRamp	Brake with the braking ramp set and inhibit power stage.	
<b>0x605C</b>	DisableOperationOC	Implement the selected action on the transition from the "Operation Enable state" to "Switched on State"	int16
[0000]	DisableDrive	Shut down power stage	
[0001]	SlowDownRamp	Brake with the braking ramp set and inhibit power stage.	
<b>0x605D</b>	StopOC	Stop	int16
[0000]	DisableDrive	Drive function switched off	
[0001]	SlowdownRamp	Brake with the braking ramp set and remain in the "Operation Enable state".	
[0002]	Quick Stop Ramp	Brake with the quick-stop ramp set and remain in the "Enabled" state.	
[0003]	CurrentLimit	Brake at the current limit and remain in the "Operation Enable state". This function is not recommended because it leaves position control.	

Table 13.64: Option codes for stopping a drive

### 13.15.2 Fault reaction option code

Object	Name / Setting	Function	Data type
<b>0x605E</b>	FaultReactionOC	Error reaction	int16
[0000]	DisableDrive	Drive function switched off	
[0001]	SlowdownRamp	Brake with the braking ramp set	
[0002]	QuickStopRamp	Brake with the quick-stop ramp set	
[0003]	CurrentLimit	Brake at the current limit	
0x6085	QuickStopDec	Setting for the quick-stop ramp	uint32

Table 13.65: Fault reaction option codes for stopping a drive

The error reaction is set per error code; for more on this, see chapter 12.2 Error reactions. If "FaultReactionOptionCode" is set there, then the option code set here becomes relevant.

It is typically used in order to set a suitable stop ramp.

### 13.15.3 Quick-stop

The quick-stop becomes active when the quick-stop bit is set via the controller or a digital input.

Object	Name / Setting	Function	Data type
<b>0x605A</b>	QuickStopOC	Drive behaviour in event of quick stop	int16
-4	SharpRampAndCurrentLimit	Braking with the quick-stop ramp and current limit, no smoothing, change to the "Switch On Disabled" state. <sup>1)</sup>	
-3	RampAndCurrentLimit	Braking with the quick-stop ramp and current limit, with smoothing, change to the "Switch On Disabled" state. <sup>1)</sup>	
-2	SharpRampQSA	Braking with the quick-stop ramp, no smoothing, change to the "Switch On Disabled" state.	
-1	SharpRampSOD	Braking with the quick-stop ramp, no smoothing, remain in the "Quick Stop Active" state.	
[0000]	DisableDrive	Shut down power stage	
[0001]	SlowDown RampSOD	Braking with the braking ramp, change to the "Switch On Disabled" state.	
[0002]	QuickStop RampSOD	Braking with the quick-stop ramp, change to the "Switch On Disabled" state.	

Table 13.66: Option codes for stopping a drive

Object	Name / Setting	Function	Data type
[0003]	CurrentLimitSOD	Brake at the current limit, change to the "Switch On Disabled" state.	
[0004]	Not Implemented	Does not exist.	
[0005]	SlowDownRampQSA	Braking with the braking ramp, remain in the "Quick Stop Active" state.	
[0006]	QuickStop RampQSA	Braking with the quick-stop ramp, remain in the "Quick Stop Active" state.	
[0007]	CurrentLimitQSA	Brake at the current limit ramp, remain in the "Quick Stop Active" state.	
<sup>1)</sup> With "Braking with the quick-stop ramp and current limit", the set quick stop ramp is specified as the setpoint and the axis follows as quickly as possible. Tracking errors are suppressed. Set a very fast ramp for this option code that the drive will possibly not be able to follow. This makes the ramp uniform for different loads. In addition, the transition is softer than braking at the current limit.			

Table 13.66: Option codes for stopping a drive (continue)

### 13.15.4 Secondary quick-stop

P No.	Index	Name	Unit	Description
2264/4312/6360		MPRO_402_QS2		Axis 1/2/3: Secondary quick stop parameters
	0	QuickStopOC2		Secondary quick stop parameters
	1	QuickStopRamp2		Secondary quick stop ramp
	2	TorqueLimit		Torque limit during secondary quick stop
2265/4313/6361	0	MPRO_402_QS2_Count		Axis 1/2/3: secondary quick stop counter

Table 13.67: Secondary quick-stop parameters

The secondary quick-stop is only triggered via the corresponding function of a digital input. It serves as an emergency stop in exceptional cases.

Parameter **P 2264** is used to define a separate OptionCode **P 2264[0]**

**QuickStopOC2** with the same settings as in Table 13.64: Option codes for stopping a drive. In addition, **P 2264[1] QuickStopRamp2** provides a separate stop ramp and **P 2264[2] TorqueLimit** provides a torque limit. This torque limit is valid during the stop and cancels the torque limit of the axis, but not its current limit (for more on this, see chapter 11.1.3 torque limitation scaling).

Because events of this nature can possibly shorten the service life of the components, the stops triggered are counted in parameter **P 2265**. The counter is saved persistently and cannot be reset.

### 13.15.5 Disable Operation option code

The DisableOperation option code (Object 0x605C), which can be generated by some controllers, becomes active with the transition "Disable Operation".

Object	Name / Setting	Function	Data type
<b>0x605C</b>	DisableOperationOC	Drive behaviour with "Disable Operation"	int16
-1	DisableWithBrake	Braking with the quick-stop ramp. However, the drive immediately applies the holding brake. After expiration of the close time ( <b>P 2308.0 CloseTime + P 2308.2 FadeTime</b> ) the control is switched off.	
0	DisableDrive	Drive function switched off	
1	SlowDownRamp	Brake with the braking ramp set	

Table 13.68: Option codes for "Disable Operation"

## 13.16 Limitations and Thresholds

No.	Name	Function	Data type
0x607B	Position RangeLimit	Axis 1: Modulo limitation of use	int32
0001	Position RangeLimit_Min	Negative range position limit	
0002	Position RangeLimit_Max	Positive range position limit	
0x607D	SoftwarePositionLimit	Axis 1: Software limit switch	int32
0001	PosLim_Min	Software limit switch, negative direction of movement	
0002	PosLim_Max	Software limit switch, positive direction of movement	
0x607F	MaxProfileVelocity	Axis 1: Maximum speed (positive and negative direction of movement)	

Table 13.69: Settings for limitations and thresholds

## 13.17 Modulo positioning OC (round table)

The rotation length for a modulo application is defined by the upper and lower position limit. For this purpose the limits must be entered in the object **0x607B - PositionRangeLimit**. After reaching the upper position limit, the actual position is set to the lower position limit.

Object / Axis 1	Option code / Setting	Function	Data type
0x607B	PositionRangeLimit	Positioning range	int32
(0)	PositionRangeLimit_Min	lower position limit	
(1)	PositionRangeLimit_Max	upper position limit	
0x60F2	PositioningOC	PositioningOC describes the behaviour of the drive during position control in the "Profile Position Mode" and "Interpolated Position Mode" operation modes.	uint16

Table 13.70: Objects for modulo applications

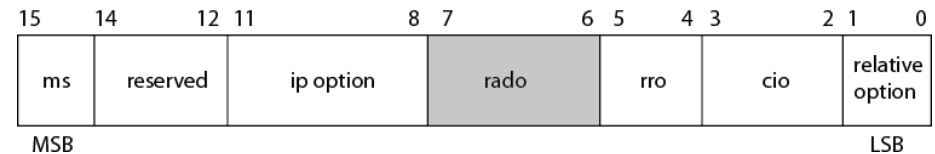


Fig. 13.61: Object structure 0x60F2 Positioning option code

- ms: Manufacturer-specific
- rado = "rotary axis direction option":  
Bits 6 and 7 describe the behaviour of the drive in modulo operation.

- rro = "request response option"
- cio = "change immediately option"

Bit 7	Bit 6	Function	
0	0	Normal positioning	After reaching or passing the position limit ( <b>0x607B</b> ) the entry jumps to the other end of the positioning range
0	1	Negative movement	If the target position is larger than the actual position, the axis must move past the zero position to reach the target position.
1	0	Positive movement	If the target position is smaller than the actual position, the axis must move past the 360° position to reach the target position.
1	1	Path-optimized positioning	The axis always moves to the target position via the shortest path. If the target position in a 360° system exceeds >180°, the axis always moves in the positive direction of movement.

Table 13.71: Definition for bits 6 and 7

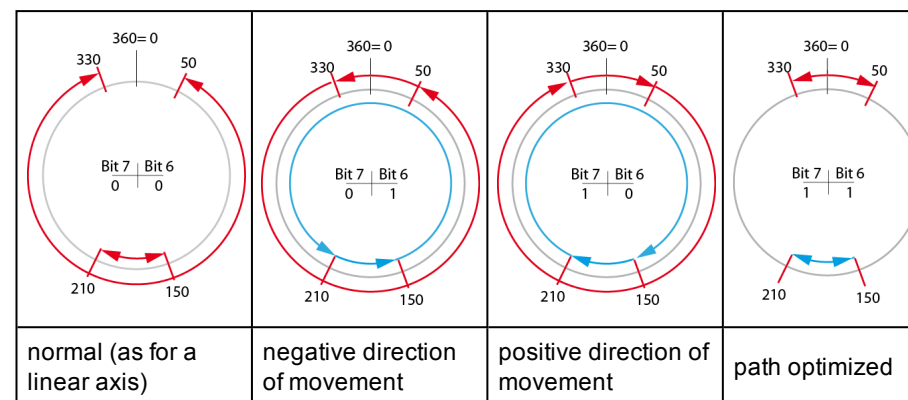


Table 13.72: Movement options for bits 6 and 7

## 13.18 NMT Network Management

The EtherCAT® network management (NMT) is orientated in keeping with NMT from CANopen. In EtherCAT®, the CANopen NMT state "Stopped" is replaced by the NMT state "Safe Operational" and is expanded to include the bootstrap state. The EtherCAT® network master checks the communication state of the other network nodes by sending NMT commands. The NMT state of all nodes or of an individual node can be changed using an NMT command.

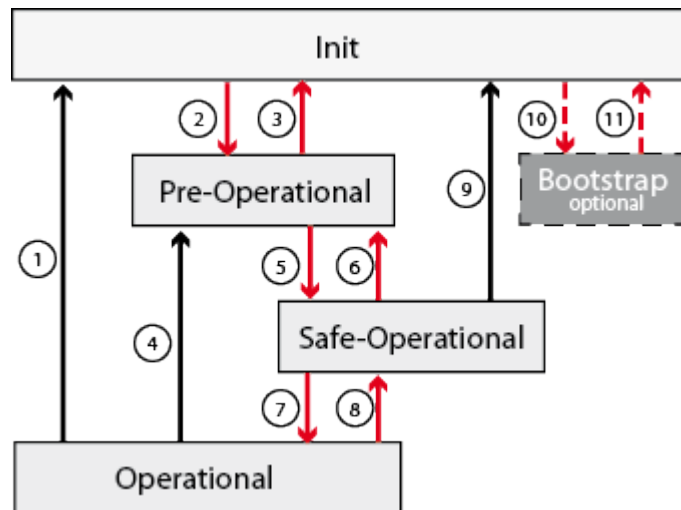


Fig. 13.62: Overview of NMT status

### 13.18.1 States

State	Description
Init	Initialisation, the device starts
Pre-Operational	The device is ready for parametrization. Mailbox communication is possible.
Safe-Operational	PDO input data (TxPDO device) can be read. PDO output data (RxPDO device) are ignored.
Operational	Cyclic I/O communication. PDO output data (RxPDO device) are processed
Bootstrap	<ul style="list-style-type: none"> <li>The slave firmware can be updated in the bootstrap state.</li> <li>The bootstrap state can only be accessed via the init state.</li> <li>In the bootstrap state, mailbox communication is possible via the File Access over EtherCAT® (FoE) protocol, however no other mailbox communication and no process data communication is possible.</li> </ul>

Table 13.73: Description of state for NMT status overview



## 13.18.2 Transitions

No.	Transitions	Action
①	(OI)	STOP "Output Update" STOP "Input Update" STOP "Mailbox Communication"
②	(IP)	START "Mailbox Communication"
③	(PI)	STOP "Mailbox Communication"
④	(OP)	STOP "Output Update" STOP "Input Update"
⑤	(PS)	START "Input Update"
⑥	(SP)	STOP "Input Update"
⑦	(SO)	START "Output Update"
⑧	(OS)	STOP "Output Update"
⑨	(SI)	STOP "Input Update" STOP "Mailbox Communication"
⑩	(IB)	START "Boot"
⑪	(BI)	STOP "Boot"

Table 13.74: EtherCAT® state machine transitions

## 13.19 EtherCAT® state machine

### 13.19.1 Device states and transitions

The state machine describes the drive status and the possible drive control sequences. These are dependent on the respective state of the drive.

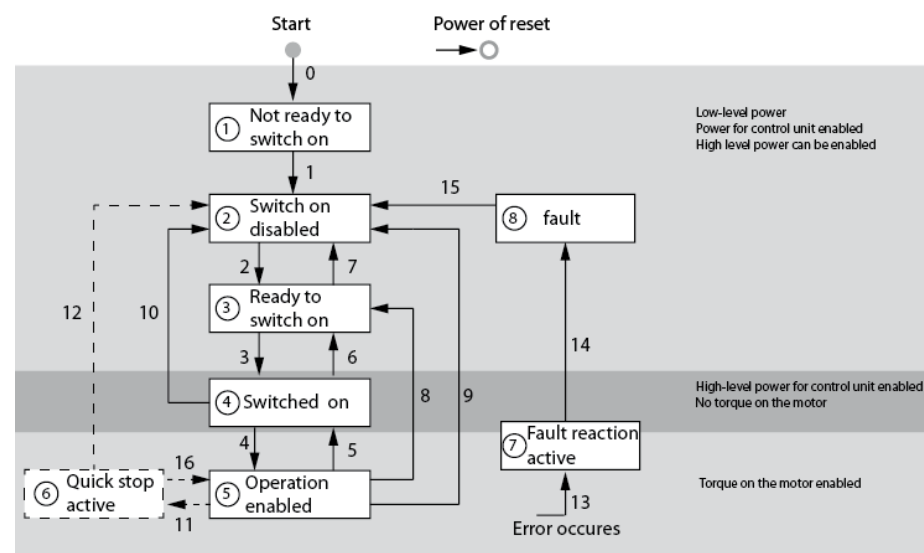


Fig. 13.63: EtherCAT® state machine

State	Description
①	<b>Not ready to switch on</b> <ul style="list-style-type: none"> <li>• Boot process active, Initialisation, Self test</li> <li>• Drive function is switched off</li> <li>• Power section is inhibited</li> <li>• Control voltage available</li> <li>• No error</li> </ul>
②	<b>Switch on disabled</b> <ul style="list-style-type: none"> <li>• Initialisation completed</li> <li>• Parametrization completed</li> <li>• Power section is switched off (for safety reasons)</li> <li>• Drive function is switched off "STO (Safe Torque Off)" stop and/or ENPO not active</li> <li>• No error</li> </ul>
③	<b>Ready to switch on</b> <ul style="list-style-type: none"> <li>• Power supply available</li> <li>• Drive function switched off</li> <li>• Drive parameters have been changed</li> <li>• No error</li> </ul>

Table 13.75: Device states

State	Description
④	<b>Switched on</b> <ul style="list-style-type: none"> <li>• Power supply available</li> <li>• Power stage is ready</li> <li>• Drive parameters have been changed</li> <li>• The drive function is switched off</li> <li>• No error</li> <li>• Brake applied</li> </ul>
⑤	<b>Operation enable (drive is energized and ready for setpoint to be specified)</b> <ul style="list-style-type: none"> <li>• Power supply available</li> <li>• Power section is switched on</li> <li>• Operation is enabled, processing setpoints</li> <li>• No error</li> <li>• Brake vented</li> </ul>

State	Description
⑥	<b>Quick stop active</b> <ul style="list-style-type: none"> <li>Power supply available</li> <li>Drive function is enabled</li> <li>Quick-stop reaction is implemented as per quick stop option code</li> <li>No error</li> <li>Brake vented</li> <li>If the "Quick Stop Option Code" is set to 5 (remain in the "Quick Stop Active" state), you cannot leave the "Quick Stop Active" state. However, you can change to the "Operation Enable" state using the "Enable Operation" command.</li> </ul>
⑦	<b>Fault reaction active</b> <ul style="list-style-type: none"> <li>An error has occurred</li> <li>Power supply available</li> <li>The drive function is enabled</li> <li>Error reaction is implemented as per "Fault Reaction", then change to "Fault" state.</li> </ul>
⑧	<b>Fault</b> <ul style="list-style-type: none"> <li>An error has occurred, the error reaction has been implemented. The shutdown and application of power depend on the application.</li> <li>The drive function is switched off.</li> </ul>

Table 13.75: Device states (continue)

## 13.19.2 State-specific bits in the control word


Command	7	3	2	1	0	Transitions
Stop	0	X	1	1	0	2, 6, 8
Switch on	0	X	1	1	1	3
Inhibit power	0	X	X	0	1	7, 9, 10, 12
Quick Stop	0	X	0	1	X	11
Inhibit operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4
Reset malfunction		X	X	X	x	15

Table 13.76: Control word bits 0, 1, 2, 3, 7

## 13.19.3 State-specific bits in the status word

State	6	5	3	2	1	0
Not ready to start	0	X	0	0	0	0
Start inhibit	1	X	0	0	0	0
Ready for start	0	1	0	0	0	1
Switched on	0	1	0	0	1	1
Operation enabled	0	1	0	1	1	1

Table 13.77: Status word bits 0, 1, 2, 3, 5, 6

State	6	5	3	2	1	0
Malfunction	0	X	1	0	0	0
Malfunction reaction active	0	X	1	1	1	1
Quick stop active	0	0	0	1	1	1

Table 13.77: Status word bits 0, 1, 2, 3, 5, 6 (continue)

## 13.20 Set parameters via CiA301, CiA402

### 13.20.1 Objects of the communication profile (CiA301)

The objects in the communication profile undertake the tasks of data and parameter exchange with other network nodes in the device. They initialize, control and monitor the device in the network.

### 13.20.2 PDO: Process data objects

#### Real-time transmission of process data

A PDO telegram is used to transmit data that is used for controlling and monitoring the process which is running and for which a short transmission time is required. No objects are addressed in the telegram, but instead, the contents of previously selected parameters are sent directly.

### 13.20.3 SDO: Service data objects

#### Read and write access to the object dictionary

All drive parameters can be read and written in the parameter channel by the SDO service (SDO = Service Data Object). Within an SDO telegram, a parameter (communication object) is addressed using an index and subindex. If the object ID in DriveManager 5 is displayed as "Standard", an offset of 0x2000 must be added to the hexadecimal parameter number for addressing manufacturer-specific objects. For a subindex, an offset of 1 must be added to the subindex displayed. If the indication of the object ID in the DriveManager 5 is set to EtherCAT®, the object ID and subindex can be applied directly from the DriveManager 5.

#### EMCY: Emergency-Object

- Error display for a device or its peripheral

#### NMT: Network management

- Initialisation and monitoring of the network
- Error handling in the network
- Monitoring the individual network nodes

### 13.20.4 Communication objects

#### SDO protocols

Protocols are processed acyclically; typical processing times are between 1 and 5 ms.

#### Server SDO

Pay attention to the definition of the timing conditions in the device; typical processing (time approx. 5 ms, depending on load).

#### Emergency object

Error code acc. to CiA402; manufacturer-specific error location and error number  
Operating hours of the device

#### Operating cycle

PDO protocols can be processed in a minimum cycle time of 125 µs. of 125 µs. If protocols arrive more quickly, previous protocols are overwritten.

Access to device parameters 2000h - 5FFFh (expedited/non-expedited)

### 13.20.5 Object dictionary for the CiA301

The object dictionary is a list of variables and parameters. Each entry is addressed by means of a separate index and, where applicable, a subindex. The entire index

space is divided into different ranges. A detailed overview of CAN objects supported (CiA301, CiA402, including subindexes) can be found in the object description (ObjDesc.pdf).

### 13.20.6 Supported data types

Data type	Value range	Function
USIGN8	0...255	Unsigned
USIGN16	0...65535	
USIGN32	0...4294967295	
INT8	-128...127	Integer, signed
INT16	-32768...32767	
INT32	-2147483648...2147483647	
FLOAT32	see IEEE	32 bit floating point in IEEE format
STRING		ASCII characters, max. 100 byte on bus operation incl. zero terminator

Table 13.78: Supported data types

### 13.20.7 Parameterization via CiA402

The control and setpoint sources are defined here. If (2)DS402 is selected, control is via fieldbus. If (1)PARA is selected, control is via parameter interface (e.g. the manual mode window, see Section "Manual mode window" on page 541).

No.	Object name	Setting	Function	Data type
0x28F0	MPRO_CTRL_SEL		Control location	uint16
[0000]	(0) Off	No Selector defined		
	(1) PARA	Control via Parameterinterface		
	(2) DS402	Control via CiA402		
0x28F1	PRO_REF_SEL		Setpoint source	uint16
[0000]	(0) Off			
	(1) PARA	Reference via Parameterinterface		
	(2) DS402	Reference via CiA402		
	(3) HOMING	Reference via motion control homing		

Table 13.79: Parametrization via CiA402 (drive to be configured for CoE as per CiA402)

## 13.21 Communication layers

### 13.21.1 Securing the data communication

- Physical layer
- Data link layer
- Application layer



#### NOTE

- EtherCAT® utilizes CAN bus technology for data communication and uses the seven-layer OSI model (basic network services for data communication).

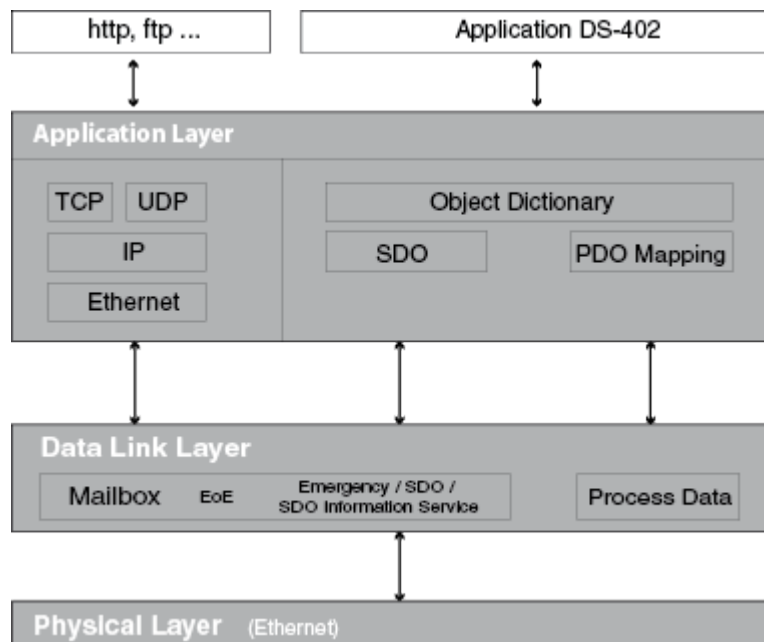


Fig. 13.64: OSI layer model

## 13.21.2 Physical Layer

The physical layer defines the electrical characteristics of the EtherCAT® bus, such as connectors, cable length and characteristics, as well as bit coding and bit timing. It corresponds to IEEE 802.3 100BASE-Tx Ethernet physics.

## 13.21.3 Data Link Layer

Divided into mailbox and process data. The data link layer provides the connection between the network nodes. It assigns priorities to data packets and undertakes error monitoring and error correction.

### 13.21.3.1 Mailbox

This contains services whose execution and contents intervene in the process data with non-critical timing. As a service channel, it allows access to the drive parameters via SDO (Service Data Objects). It is the basis for the EoE (Ethernet over EtherCAT®) services as well as for error handling (emergency telegrams).

#### SDO Information Service

- Access by the master to the object dictionary
- Alternative to integration of the EDS file

#### CAN over EtherCAT® (CoE)

- SDO Abort
- Initiate SDO Download
- Download SDO Segment
- Initiate SDO Upload
- Upload SDO Segment
- Abort SDO Transfer

#### Ethernet over EtherCAT® (EoE) = transmission of TC/IP protocols via EtherCAT

- Initiate EoE request
- Initiate EoE response
- EoE fragment request
- EoE fragment response

#### Emergency

- Error messages are retrieved by the master (see "Emergency Objects")

## Distributed Clocks

A synchronization pulse harmonizes the distributed clocks in the slaves (each slave has a dedicated clock). The reference clock is contained in one slave. The "distributed clocks" are configured via the controller. The cycle times are a multiple of the controller's timebase (125 µs).

## ESI file (EtherCAT® slave information)

- Interfacing the slave to the master
- The configuration (mapping, etc.) is contained in the ESI file It is provided with the firmware.

## NMT (Network Management)

- Initialisation, error monitoring, status monitoring of the network; monitoring of individual network nodes
- The "Stopped" state is replaced with the "Safe Operational" state when EtherCAT® is used, thus ensuring conformity with CANopen.
- Depending on the functionality of the controller software, individual state transitions can be undertaken automatically or via the PLC.

### 13.21.3.2 Process Data (DS301)

Cyclic transmission of position, speed, torque setpoints and actual values as PDOs (Process Data Objects).

## Process data profile (DS402)

- 3 RxPDOs
- 3 TxPDOs
- Transmission length:  
RxPDO = 40 Byte  
TxPDO = 50 Byte
- Variable mapping to DS301 (cf. CANopen)
- Cycle times:  
Transmission of cyclic position setpoints at max. 8 kHz (125 µs)  
Transmission of cyclic speed setpoints at max. 8 kHz (125 µs)  
Transmission of cyclic torque setpoints at max. 8 kHz (125 µs)

### 13.21.4 Application layer

Includes the services CoE (CAN over EtherCAT®) and EoE (Ethernet over EtherCAT®). The application layer uses Communication Objects (COB) to exchange data between the individual network nodes. Communication objects are elementary components for creating a CANopen application.

Parameter type	Range	Location
Profile parameter DS 301	0x1000 - 0x1FFF	
Profile parameter DS 402	0x6000 - 0x6FFF	Axis 1
"	0x6800 - 0x6FFF	Axis 2
"	0x7000 - 0x7FFF	Axis 3
Manufacturer-specific parameter	0x2000 - 0x27FF	Device parameter

Table 13.80: Addressing ranges



Parameter type	Range	Location
"	0x2800 - 0x2FFF	Axis 1
"	0x3000 - 0x37FF	Axis 2
"	0x3800 - 0x3FFF	Axis 3

Table 13.80: Addressing ranges (continue)

**NOTE**

- Display of the "Object ID" = "Standard": The EtherCAT® address results from the sum of the ID address + 0x2000.
- Display of the "Object ID" = "EtherCAT®": The object ID is used directly.

## 13.22 PDO Mapping

### 13.22.1 Mapping, general

The variable mapping is undertaken as per the definitions for the CANopen communication profile DS301 and applies to all 3 RxPDO and 3 TxPDO.

- RxPDO up to 40 bytes
- TxPDO up to 50 bytes

The controller transmits the mapping to the drive controller. With the factory setting, the PDOs do not contain any mapping.

### 13.22.2 Mapping objects

RxPDOs	TxPDOs
0x1600 RxPDO1_Axis 1	0x1A00 TxPDO1_Axis 1
0x1610 RxPDO1_Axis 2	0x1A10 TxPDO1_Axis 2
0x1620 RxPDO1_Axis 3	0x1A20 TxPDO1_Axis 3

Table 13.81: Mapping objects

## 13.23 Configurable control word and status word

The configurable **status word** allows you to collect bit information from several parameters. The controller can then read out the configurable status word cyclically instead of gathering the information from various locations.

The configurable **control word** serves the same purpose for the opposite data direction.

### 13.23.1 Configurable status word

Object No.	Index	Name / Setting	Unit	Description	Data type
0x291B / 0x311B / 0x391B		MPRO_INPUT_StatusSel		Axis 1 / 2 / 3: Configurable status word selector	uint8
	0001 / 0003 / 0005 / 0007	Source		Source selector	
		SYSIO(0)		State of system IOs (parameter MPRO_INPUT_SysState)	
		SYSSTAT(1)		System status bits (parameter MPRO_INPUT_SysAllStatus)	
		DCSTAT(2)		DriveCom status word	
		DCCTRL(3)		DriveCom control word	
		WRN(4)		Warning word	
		PWRFAIL(5)		Internal PowerFail function (parameter CON_POWF_Statusword)	
	0002 / 0004 / 0006 / 0008	BitNo		Bit number	

Table 13.82: Parameter list

Bits 0..3 of the status word are programmable; the setting can be made in object 0x291B.

Bit 7 is permanently assigned to the "External motor brake" function; see Motor/ Brake.

### 13.23.2 Configurable control word

Currently, only bit 7 is used in the configurable control word. It is for the "External motor brake" function; see Motor/ Brake.

### 13.23.3 Example for opening a bit window

A double-click on the status word opens the bit window.

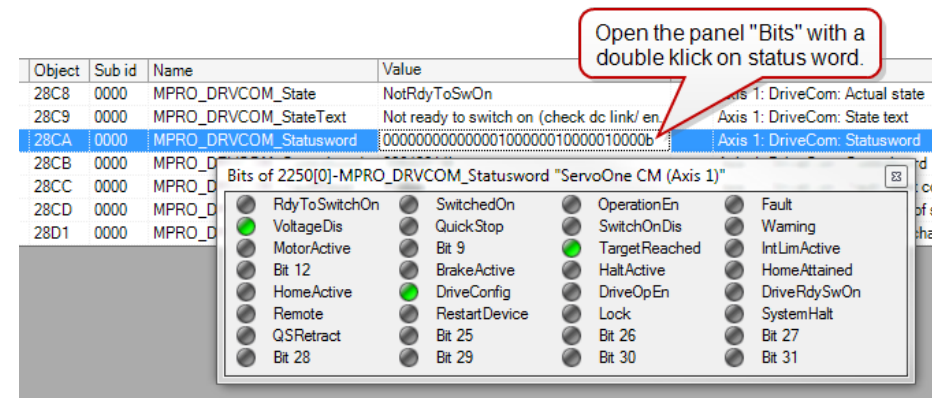


Fig. 13.65: Example for opening a bit window (2250)

## 13.24 Control and status Word

### 13.24.1 Control word object (0x6040)

The control word contains bits for:

- Device state control
- Controlling the operation modes
- Controlling the manufacturer-specific options

Functions that are not used by the drive are to be considered reserved and are always set to logical 0.

MSB			LSB					
15-11	10-9	8	7	6-4	3	2	1	0
manufac. specific	Reserved	Stop	Fault Reset	operation mode specific	Enable Operation	Quick Stop	Enable Voltage	Switch on

Table 13.83: Control word in accordance with DS402

Command	7	3	2	1	0	Transitions
Stop	0	X	1	1	0	2, 6, 8
Switch on	0	X	1	1	1	3
Inhibit power	0	X	X	0	1	7, 9, 10, 12
Quick stop	0	X	0	1	X	11

Table 13.84: Device state-specific bits in the control word


Command	7	3	2	1	0	Transitions
Inhibit operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4
Reset malfunction		X	X	X	x	15

Table 13.84: Device state-specific bits in the control word (continue)



#### NOTE

- Please do not use operation mode-specific bits in the operation modes CSP, CSV, and CST.

### 13.24.2 Status word 0x6041

State of the drive

- Device state
- States in the operation modes
- States of manufacturer-specific options

State	6	5	3	2	1	0
Not ready to start	0	X	0	0	0	0
Start inhibit	1	X	0	0	0	0
Ready for start	0	1	0	0	0	1
Switched on	0	1	0	0	1	1

Table 13.85: Bits in the status word that are specific to the operation mode

State	6	5	3	2	1	0
Operation enabled	0	1	0	1	1	1
Malfunction	0	X	1	0	0	0
Malfunction reaction active	0	X	1	1	1	1
Quick stop active	0	0	0	1	1	1

Table 13.85: Bits in the status word that are specific to the operation mode (continue)

Bit	State	Function
0	Ready to switch on	Device state-specific bits (see also section "Bits in the status word that are specific to the operation mode" on page 519).
1	Switched on	
2	Operation enabled	
3	Fault	
4	Voltage enabled	Power supply is present
5	Quick stop	Device state-specific bits (see also section "Bits in the status word that are specific to the operation mode" on page 519).
6	Switch on disabled	
7	Warning	The device state does not change if there are warnings. Information on a pending warning can be found in the error code.
8	Manufacturer specific	Not used

Table 13.86: Significance of the bits in the status word

Bit	State	Function
9	Remote	Control location selector is set to CiA402. Control is undertaken via the CiA402 control word.
10	Target reached	The bit is set in the: <ul style="list-style-type: none"> <li>"Quick stop" state after conclusion of the "Quick stop"</li> <li>"Stop" state if the drive is at a standstill</li> <li>Homing mode (see also section "Homing / homing mode" on page 470)</li> </ul>
11	Internal limit active	Bit active on reaching internal limitations
12	Operation mode specific	Operation mode-specific bits (see "Operation modes").
13	Operation mode specific	
14	Manufacturer specific	RED_0:Bit active at speed 0
15	Manufacturer specific	Axis synchronized

Table 13.86: Significance of the bits in the status word (continue)

## 13.25 Emergency object

"Emergency Objects" have high priority and provide information on the state of the users and the network. When an error occurs, the controller reacts according to the error reaction set in the parameters. They can be adjusted individually for specific errors in the drive (►Project tree ►Axis adjustment ►X axis ►Alarms / Warnings). There is a list of the error messages and error counters in ►Project tree ►Axis adjustment ►Device ►Alarms / Warnings. If the cause of the fault has not been rectified, the drive remains in the error state after sending a further "emergency message".

When the drive is connected to a controller, "Emergency objects" are also sent if there are any pending errors that occurred during initialization, for example.

### 13.25.1 Bit assignment "Emergency object"

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0-7	8-15	16-23	24-39		44-47		48-63
DS301			Drive				
Emergency Error Code	Error Register (0x1001)	Error number	Error location	Bit 4	5	6	7
				1: System error 0: Axis error	Axis number 0-7		Operating time counter (in complete hours)

Table 13.87: Emergency Telegram

### 13.25.2 Emergency error codes

Error code	Description	Function
0x0000	Error reset or no error	Error reset / no error
0x1000	Generic Error	Error
0x2000	Current – generic error	Actual error
0x2100	Current, CANopen device input side – generic	Current node error on the input side
0x2200	Current inside the CANopen device – generic	Error in the CANopen node
0x2300	Current, CANopen device output side – generic	Current node error on the output side
0x3000	Voltage – generic error	Control voltage error
0x3100	Mains voltage – generic	Supply voltage error
0x3200	Voltage inside the CANopen device – generic	Voltage error in the device
0x3300	Output voltage – generic	Output voltage error
0x4000	Temperature – generic error	Temperature
0x4100	Ambient temperature – generic	Ambient temperature
0x4200	Device temperature – generic	Internal device temperature
0x5000	CANopen device hardware – generic error	Hardware

Table 13.88: Error messages

Error code	Description	Function
0x6000	CANopen device software – generic error	Software
0x6100	Internal software – generic	Internal software error
0x6200	User software – generic	User software error
0x6300	Data set – generic	Setting error
0x7000	Additional modules – generic error	
0x8000	Monitoring – generic error	
0x8100	Communication – generic	Communication error
0x8110	CAN overrun (objects lost)	CAN overflow
0x8120	CAN in error passive mode	
0x8130	Life guard error or heartbeat error	
0x8140	recovered from bus off	
0x8150	CAN-ID collision	Addressing error
0x8200	Protocol error - generic	Protocol error
0x8210	PDO not processed due to length error	
0x8220	PDO length exceeded	
0x8230	DAM MPDO not processed, destination object not available	
0x8240	Unexpected SYNC data length	
0x8250	RPDO timeout	RPDO timeout

Table 13.88: Error messages (continue)

Error code	Description	Function
0x9000	External error – generic error	External error
0xF000	Additional functions – generic error	Error due to additional functions
0xFF00	Device specific – generic error	Device-specific error

Table 13.88: Error messages (continue)

### 13.25.3 Error Register (0x1001)

Bit	Meaning	Meaning
0	Generic error	Error
1	Current	Current
2	Voltage	Voltage
3	Temperature	Temperature
4	Communication error (overrun, error state)	Communication error
5	Device profile specific	Device-dependent
6	reserved (always 0b)	Reserved
7	manufacturer-specific	manufacturer-specific

Table 13.89: Structure of the error register

### 13.25.4 Acknowledge error

- Reset the error message in the control word (0x6040) with a rising edge on bit 7.
- “Acknowledge error” button in the device status window for the DriveManager 5
- **Object 0x28CC MPRO\_DRVCOM\_Faultreset = 1**



#### NOTE

- The reset of an existing error will be acknowledged with an "emergency message" with the content "0".

### 13.26 Touch probe

P No.	Index	Name	Unit	Description
290		Touchprobe filtering		Suppression of jitter at the input
2338 / 4386 / 6434		TouchprobeSettings		Axis 1 / 2 / 3: Settings for all touchprobe channels
2338 / 4386 / 6434	0	SelPosition		Position value selection
2338 / 4386 / 6434	1	reserved		reserved for future use
24760 / 26808 / 28856	0	TouchProbeFunction		Axis 1 / 2 / 3: CiA402 Touch probe control bits
24761 / 26809 / 28857	0	TouchprobeStatus		Axis 1 / 2 / 3: CiA402 Touchprobe status bits
24762 / 26810 / 28858	0	Touchprobe1PosEdge		Axis 1 / 2 / 3: CiA402 Touchprobe 1: Position on rising edge
24763 / 26811 / 28859	0	Touchprobe1NegEdge		Axis 1 / 2 / 3: CiA402 Touchprobe 1: Position on falling edge
24764 / 26812 / 28860	0	Touchprobe2PosEdge		Axis 1 / 2 / 3: CiA402 Touchprobe 2: Position on rising edge
24765 / 26813 / 28861	0	Touchprobe2NegEdge		Axis 1 / 2 / 3: CiA402 Touchprobe 2: Position on falling edge

Table 13.90: Parameter list – Touchprobe motion profile axis

The touchprobe function allows the position of the axis to be saved at edges of external inputs and then later read by the controller. The actual operation of the touchprobe function is implemented to CiA402 and is described in the following section.

There are two touchprobe channels per axis that can be set to fixed inputs or to the zero pulse of the position encoder of this axis. The inputs with fixed allocation are indicated in the following table, “Allocation of inputs.” Inputs DI09, DI10 and the zero pulse are recorded with an accuracy of less than 1 µs. The accuracy of input DI08 is better than 10 µs.

	TP1	TP2
Axis 1	DI09	DI10
Axis 2	DI10	DI08
Axis 3	DI08	DI09

Table 13.91: Allocation of inputs



#### NOTE

- The electrical connection is routed via plug-in connector X6/DI. For a complete description of the control connections of the Axis Controller (designation, position, pin assignment, function) for correct installation of devices, please refer to the Operation Manual ServoOne CMAxis Controller chapter "Overview of connections" and "Control connections".
- For the latest versions of the documents, please visit our website at [www.keba.com](http://www.keba.com) in the DOCU-PORTAL.

The touch probe inputs have a filter so that possible bouncing (jitter) on the input can be suppressed. The filtering can be configured in parameter **P 0290.0** as a multiple of 62.5 µs. The filtering leads to a delay of the detection by the configured time, however not to a falsification of the position value at the speed. Moreover, the filtering also leads to a suppression of impulses which are shorter than the configured time. **P 0290.0 = 0** means "no filtering". When used, be sure no jitter occurs on the input.



#### NOTE

- For measurements with very high accuracy at high speed please note the delay of the external pulse encoder and encoder system. The latter is displayed in **P 2879 / 4927 / 6975[4] - ENC\_CHx\_ Info.Delay**.

Further information Section "Digital inputs" on page 208

### 13.26.1 Configuration of the touchprobe function

Bit	Value	Function	Function
0	0	Switch off Touchprobe 1	Deactivate TP1
	1	Enable Touchprobe 1	Activate TP1
1	0	Trigger first event	Trigger on first event
	1	continuous	Continuous trigger
2	0	Trigger with Touchprobe 1 input	Trigger on digital input
	1	Trigger with zero impulse signal or position encoder	Trigger on zero pulse
3	0	reserved	reserved
4	0	Switch of sampling at positive edge of Touchprobe 1	Deactivate scanning for positive edge
	1	Enable sampling at positive edge of Touchprobe 1	Activate scanning for positive edge
5	0	Switch of sampling at negative edge of Touchprobe 1	Deactivate scanning for falling edge
	1	Enable sampling at negative edge of Touchprobe 1	Activate scanning for falling edge
6, 7	-	User defined (e.g. for testing)	user defined

Table 13.92: Touchprobe control word assignment in accordance with CiA402 (0x60B8)



Bit	Value	Function	Function
8	0	Switch of Touchprobe 2	Deactivate TP2
	1	Enable Touchprobe 2	Activate TP2
9	0	Trigger first event	Trigger on first event
	1	continuous	Continuous trigger
10	0	Trigger with Touchprobe 2 input	Trigger on digital input
	1	Trigger with zero impulse signal or position encoder	Trigger on zero pulse
11	0	reserved	
12	0	Switch of sampling at positive edge of Touchprobe 2	Deactivate scanning for positive edge
	1	Enable sampling at positive edge of Touchprobe 2	Activate scanning for positive edge
13	0	Switch of sampling at negative edge of Touchprobe 2	Deactivate scanning for falling edge
	1	Enable sampling at negative edge of Touchprobe 2	Activate scanning for falling edge
14, 15	-	User defined	User defined

Table 13.92: Touchprobe control word assignment in accordance with CiA402 (0x60B8) (continue)

Bit	Value	Function	Function
0	0	Touchprobe 1 is switched off	TP1 deactivated
	1	Touchprobe 1 is enabled	TP1 activated
1	0	Touchprobe 1 no positive edge value stored	TP1: No value saved for positive edge.
	1	Touchprobe 1 positive edge position stored	TP1: Value for positive edge saved.
2	0	Touchprobe 1 no negative edge value stored	TP1: No value saved for falling edge.
	1	Touchprobe 1 negative edge position stored	TP1: Value saved for falling edge.
3-5	0	Reserved	Reserved
6, 7	-	User defined	User defined
8	0	Touchprobe 2 is switched off	TP2 deactivated
	1	Touchprobe 2 is enabled	TP2 activated
9	0	Touchprobe 2 no positive edge value stored	TP2: No value saved for positive edge.
	1	Touchprobe 2 positive edge position stored	TP2: Value for positive edge saved.
10	0	Touchprobe 2 no negative edge value stored	TP2: No value saved for falling edge.
	1	Touchprobe 2 negative edge position stored	TP2: Value saved for falling edge.
11-13	0	Reserved	Reserved
14,15	-	User defined	User defined

Table 13.93: Touchprobe status word in accordance with CiA402 (0x60B9)

## Touchprobe configuration and signals over time

Continuous Trigger Mode (60B8h, Bit 1 = 1 or Bit 9 = 1)

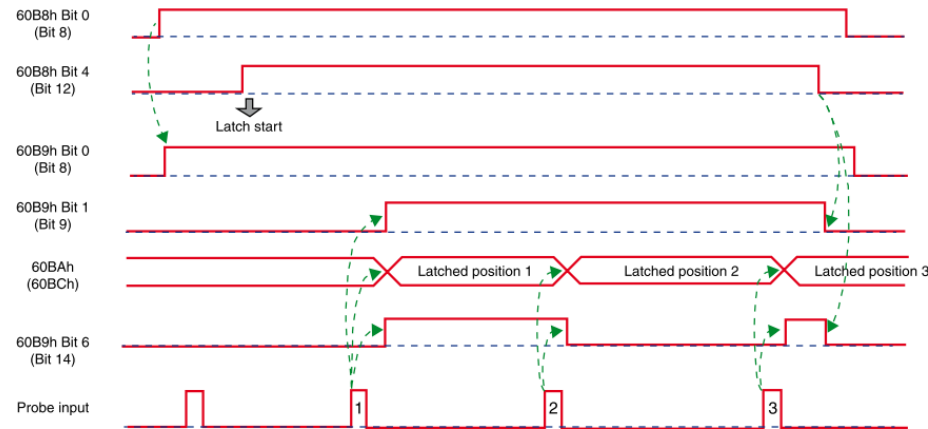


Fig. 13.66: Timing sequence of a measurement in Single Trigger Mode and in Continuous Trigger Mode.

## 13.27 Diagnostics and LED code

### 13.27.1 Status LEDs Axis Controller

There are two LEDs each on the RJ45 ports for the EtherCAT® interface. The meaning of the blink codes is explained below.



#### NOTE

- For information regarding position, labelling, colour and meaning of the LEDs on the **EtherCAT® interfaces** please refer to the ServoOne CM Operation Manual Axis Controller (ID No.: 1400.200B.x), chapter “EtherCAT interface specifications” on page 46.
- For information regarding position, labelling, colour and meaning of the LEDs concerning the **status of the Axis Controller** please refer to the Operation Manual mentioned above, chapter “LED axis status” on page 53.



All of the further applicable documents for this device can be found on our website:

[www.keba.com](http://www.keba.com) in the DOCU-PORTAL.

Interface	Labelling Colour Specification	Flashing code
ECAT IN X5.1	L/A green Port0 Link / Activity	<ul style="list-style-type: none"> <li>• OFF = no link</li> <li>• ON = Link Link stable, no data exchange</li> <li>• Blinking: Data exchange active</li> </ul>
	RUN green Device / EtherCAT RUN	<ul style="list-style-type: none"> <li>• OFF = Initialisation</li> <li>• Flashing = Pre-Operational</li> <li>• Blinks once = Safe-Operational</li> <li>• ON = Operational Device ready for operation</li> </ul>
ECAT OUT X5.2	L/A green Port1 Link / Activity	<ul style="list-style-type: none"> <li>• OFF = no link</li> <li>• ON = Link Link stable, no data exchange</li> <li>• Blinking: Data exchange active</li> </ul>
	ERR red Device / EtherCAT ERROR	<ul style="list-style-type: none"> <li>• ON = Error</li> </ul>

Table 13.94: ECAT IN / ECAT OUT

Category	Flashing code	Meaning
Start-up error	Flashing for one second	The number of flashes indicates the error ID.
BIOS mode	LEDs flash 300 ms	Firmware not saved
	Yellow and green LEDs blink alternately with the red LED	BIOS not in operation
	LEDs blink one after the other	BIOS is saving data to the flash memory
	All LEDs blink	Blinking several times interrupted by a 1-second pause indicates the error ID.

Table 13.95: Blink codes for startup and BIOS mode

### 13.27.2 Supply unit status LEDs ServoOne CM-P



#### NOTE

- For information regarding the position, labelling and colour of the LEDs concerning the **status of the Supply unit** please refer to the ServoOne CM-P Operation Manual Supply unit (ID No.: 1400.201B.x), chapter "LED status display" on page 38.



All of the further applicable documents for this device can be found on our website:

[www.keba.com](http://www.keba.com) in the DOCU-PORTAL.

Red	green	State	Meaning
X	Flashes slowly	no power supply	Relay for the voltage supply has not energized (no)
X	X	Ready	Relay for the voltage supply has energized (nc)
X	Flashes quickly	charge	Charge in progress
X	Flashes slowly	Error is active	Waiting for reset
-	X	OK	Normal operation
Flash	X	Warning is active	Warning triggered by the "estat", "astat" or "tstat" condition.
X	X	Error is active	Malfunction triggered by the "estat", "astat" or "tstat" condition.
<ul style="list-style-type: none"> <li>• - = off</li> <li>• X on</li> <li>• Yx number of pulses</li> </ul>			

Table 13.96: Error codes Supply unit

### 13.27.3 Other error codes

Green + Red (simultaneous)	State	Function
1x	Software is being loaded	On the completion of the software loading process, the red LED illuminates for 1 s (update Bios flash)
2x	Boot switch is activated with supply voltage switched on	Only Bios active
3x	Calculated Bios CRC does not match actual Bios CRC	Only Bios active
4x	Calculated program CRC does not match actual program CRC	Only Bios active
5x	Software reset after watchdog event	Only Bios active
6x	Memory underrun	Only Bios active
7x	Memory overflow	Only Bios active
8x	Undefined option code	Only Bios active
9x	Error during memory access	Only Bios active
10x	Protected instruction violation	Only Bios active

Table 13.97: Other error codes

Green + Red (simultaneous)	State	Function
11x	Illegal word access	Only Bios active
12x	Another class B trap	Only Bios active
13x	Floating point error	Only Bios active

Table 13.97: Other error codes (continue)

**NOTE**

## 13.28 Connection of controller to EtherCAT® master, TwinCAT example

### 13.28.1 Installation of the EtherCAT® slave information (ESI)

Install the LTI\_SO\_Drives.xml ESI file (C:\TwinCat3.1\Config\Io\Ethercat). This makes it possible for the slave to be identified by the controller.

**NOTE**

- The ESI file must be imported once at the beginning of start-up or after a firmware update.

### 13.28.2 Creating a TwinCAT 3 XAE project

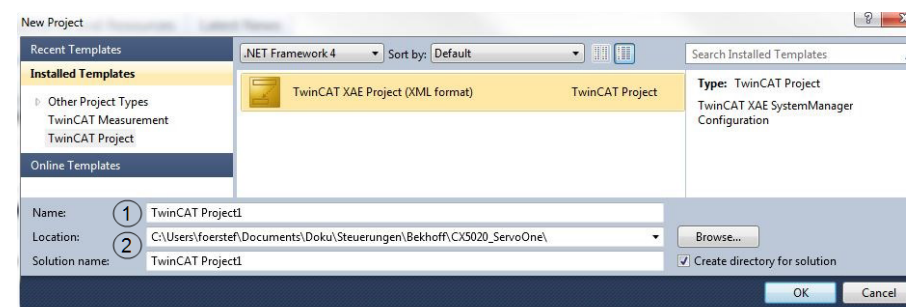


Fig. 13.67: Screenshot "New Project"

- ① Enter the name of the project
- ② Enter the location (path)

Legend for Screenshot "New Project"

### 13.28.3 Select target system

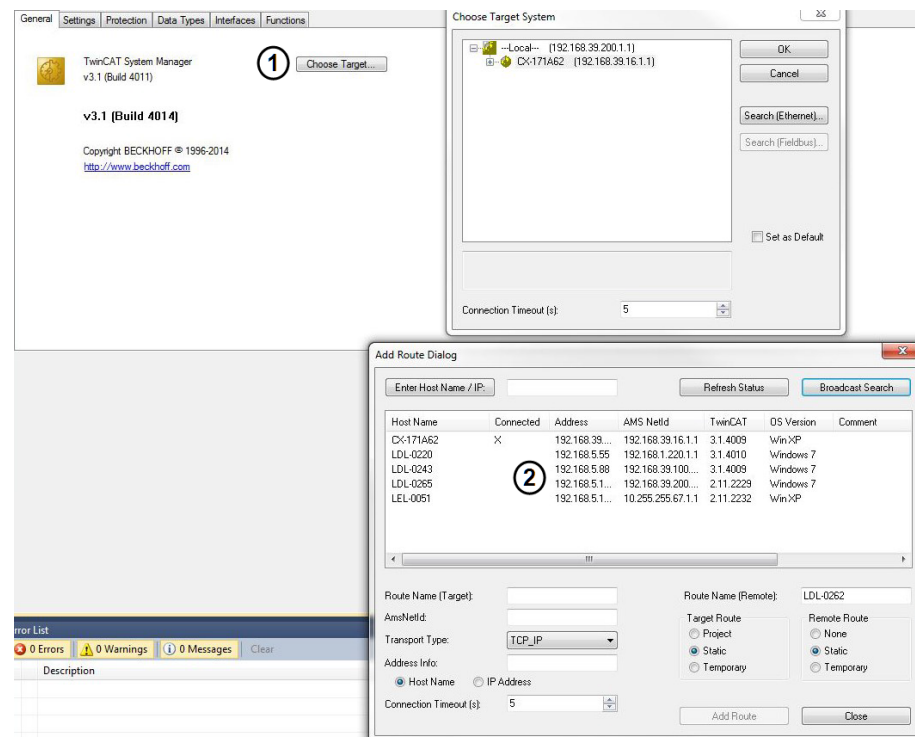


Fig. 13.68: Select target system

- ① Select target system
- ② External PLC target system (CX 5020)

Legend for "Select target system" image

If the correct PLC type does not appear in the list, please click the "Config Mode" button (on the taskbar or in the menu).

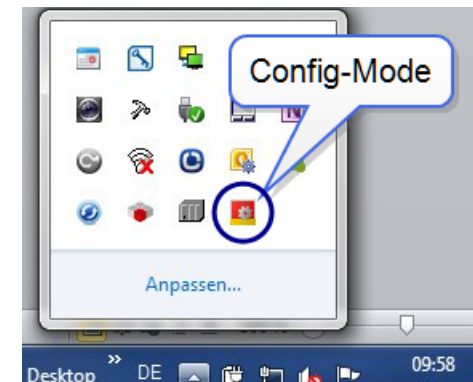


Fig. 13.69: "Config Mode" button on the taskbar

►Menu ►TwinCAT ►Restart TwinCAT (Config-mode)

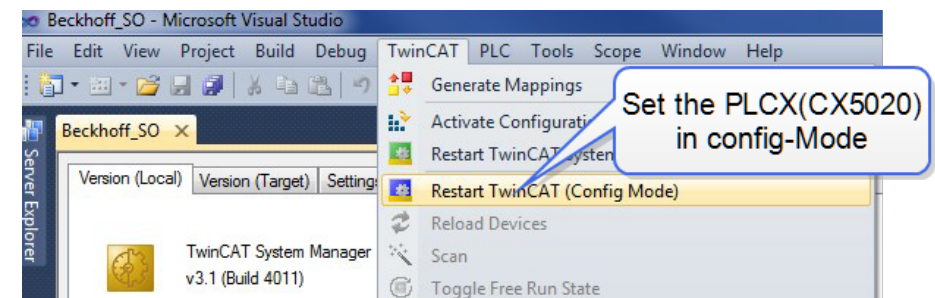
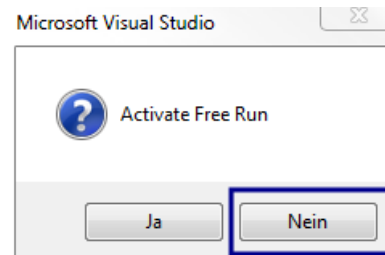
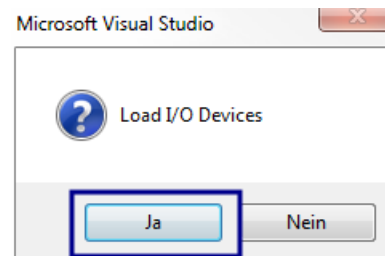
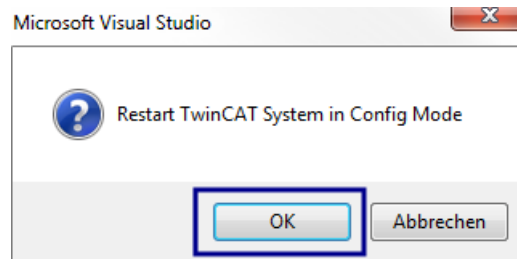


Fig. 13.70: Menu item "Restart TwinCAT (Config-Mode)"

Confirm the next three dialogs as shown below.



### 13.28.4 Setting the system time "Base Time" CX5020

The definition of the system time "Base Time" (clock for the controller) can be specified in the Real Time project tree (example, Base Time = 125 µs).

Solution 'Beckhoff\_SO' (1 project)

- Beckhoff\_SO
  - SYSTEM
    - License
      - Real-Time**
        - Tasks
          - PlcTask

Beckhoff\_SO x

Settings | Online | Priorities | C++ Debugger

Router Memory (MByte): 2

Available CPUs (Windows/Other): 1 0

Read from Target Set on target

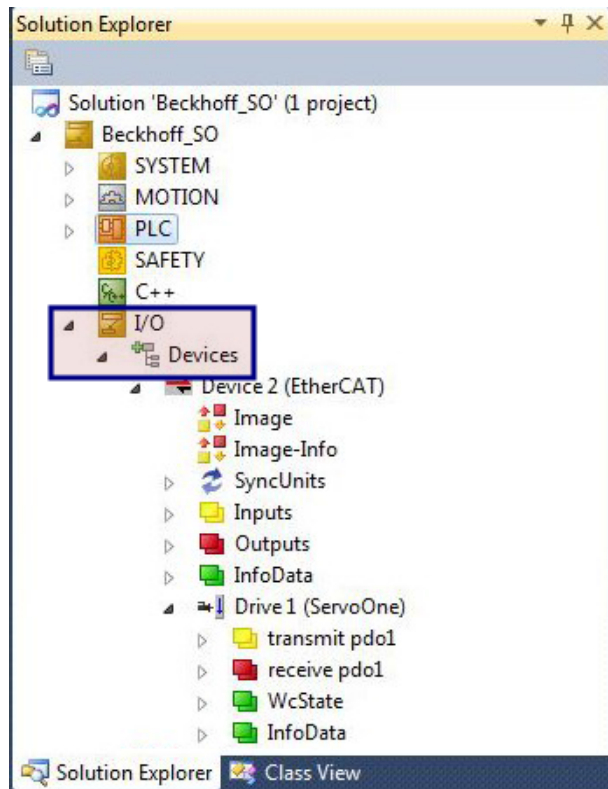
CPU	RT-CPU	Base Time	CPU Limit	Latency Warning
0	✓ Default	125 µs	80 %	(none)

Type	Object	RT-CPU	Base Time	Cycle Time	Cycle Ticks	Priority
TASK	PlcAuxTask	Default (0)	125 µs	(none)	0	50
TASK	PlcTask	Default (0)	125 µs	10 ms	80	20
TASK	NC-Task 1 SAF	Default (0)	125 µs	0.500 ms	4	4
TASK	I/O Idle Task	Default (0)	125 µs	1 ms	8	11

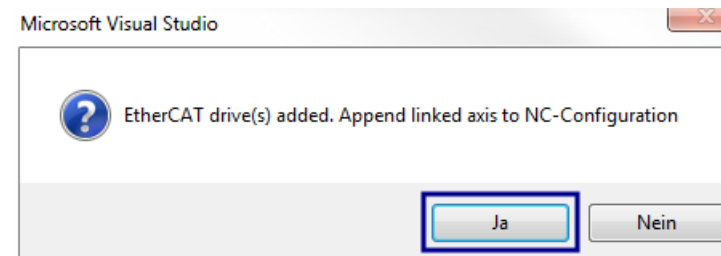
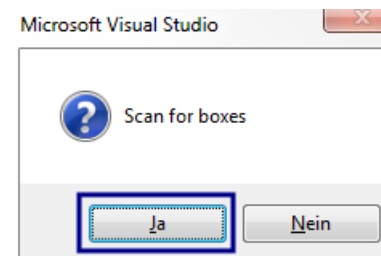
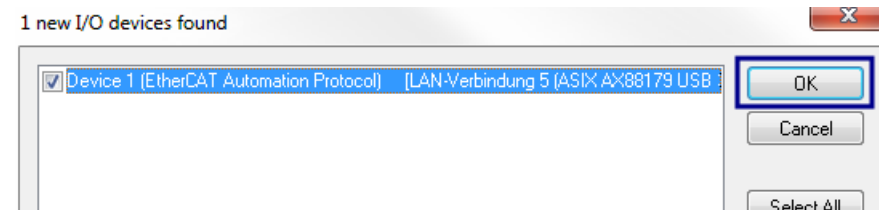
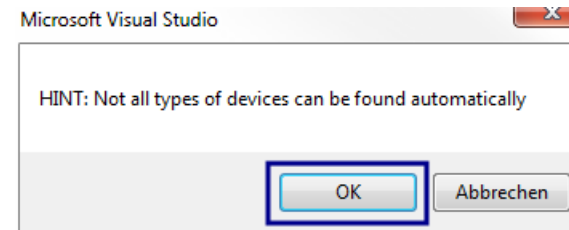
Fig. 13.71: Setting the system time

### 13.28.5 Detecting the nodes (EtherCAT® slaves) via the scan function:

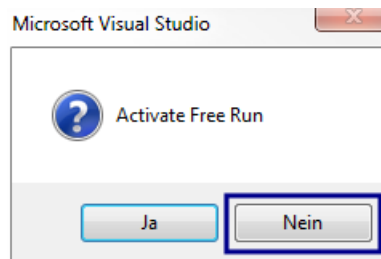
- open path ► I/O ► Devices
- right-click
- The scan starts



Confirm the next five dialogs as shown below.







After successful completion of the scan the project tree displays ...

- ① two devices in "I/O" and
- ② five axes in the "Motion" path.

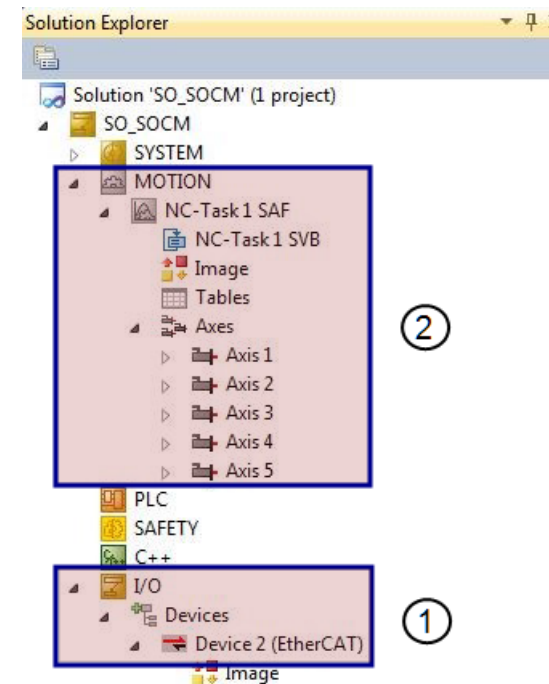


Fig. 13.72: Project tree after a successful scan

### 13.28.6 Setting the cycle time CX5020

The cycle time describes the scan rate for the data transmission.

- Open path ► Motion ► NC-Task1 SAF

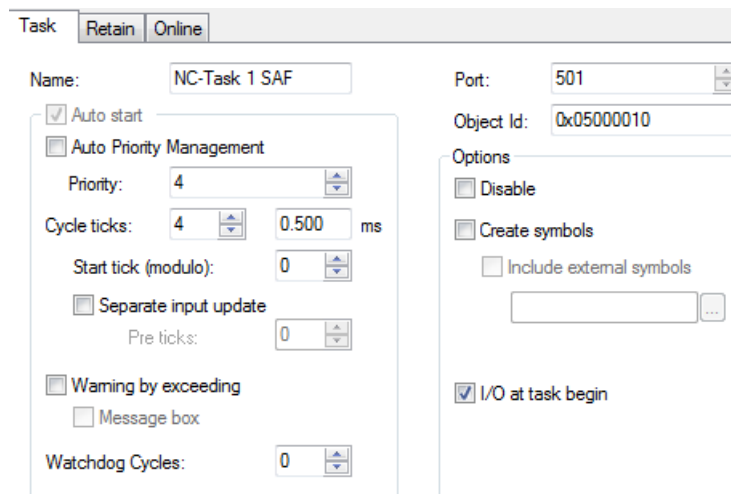
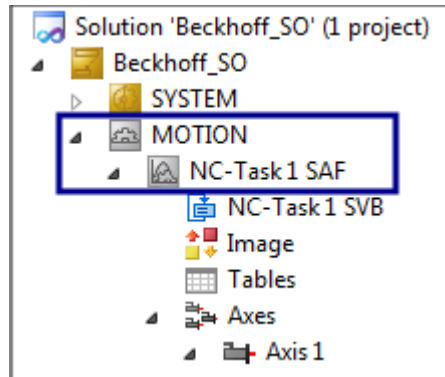
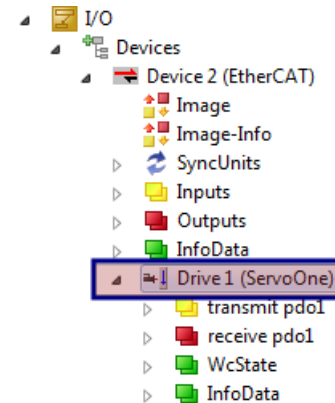


Fig. 13.73: Setting the cycle time

### 13.28.7 Setting and handling the EtherCAT® slave process data



**General** | **EtherCAT** | **DC** | **Process Data** | **Startup** | **CoE - Online** | **Online** | **NC: Online** | **NC: Functions**

**Sync Manager:**

SM	Size	Type	Flags
0	512	MbxOut	
1	512	MbxIn	
2	6	Outputs	
3	6	Inputs	

**PDO List:** (1)

Index	Size	Name	Flags	SM	SU
0x1A00	6.0	transmit pdo1		3	0
0x1600	6.0	receive pdo1		2	0

**PDO Content (0x1A00):** (2)

Index	Size	Offs	Name	Type	Default (hex)
0x6041:00	2.0	0.0	statusword	UINT	
0x6064:00	4.0	2.0	position actual value	DINT	
		6.0			

**PDO Assignment (0x1C12):**

☒ 0x1600

**Download**

☒ PDO Assignment

☒ PDO Configuration

Predefined PDO Assignment: (none)

Load PDO info from device

Custom PDO Assignment

Name	Online	Type	Size	>Addr...	In/Out	User ID	Linked to
statusword	X	UINT	2.0	0x4631 (17969)	Input	0	nState1, nState2
position actual v...	X	DINT	4.0	0x0006814B (426315)	Input	0	nDataIn1 . In . Inputs . E...
WcState	X	BIT	0.1	0	Input	0	nState4, nState4
InputToggle	X	BIT	0.1	0	Input	0	nState4, nState4
State	X	UINT	2.0	0x0008 (8)	Input	0	
AdsAddr	X	AMSADDR	8.0	192.168.39.16.3.1:1...	Input	0	
Chn0	X	USINT	1.0	0x00 (0)	Input	0	
DcOutputShift	X	DINT	4.0	0x000960C8 (614600)	Input	0	nDcOutputTime . In . In...
DcInputShift	X	DINT	4.0	0x0033A838 (33854...)	Input	0	nDcInputTime . In . Inpu...
controlword	X	UINT	2.0	0x0006 (6)	Output	0	nCtrl2, nCtrl1
target position	X	DINT	4.0	0x0006814A (426314)	Output	0	nDataOut1 . Out . Outpu...

Fig. 13.74: Setting and handling of the process data

**Edit Pdo Entry** (4)

Name: ModesOfOperation

Index (hex): 6060 24672

Sub Index: 0

Data Type: SINT

Bit Length: 8

From Dictionary:

**Attach Variable ModesOfOperation (Output)**

MOTION

NC-Task 1 SAF

Axis 1

Axis 2

Axis 3

Axis 4

Axis 5

PLC

Unbenannt1

Unbenannt1 Instance

MAIN.ModesOfOperation\_SO > QB 512516.0, SINT [1.0]

MAIN.ModesOfOperation\_SOCM\_Achse\_1 > QB 512517.0, SINT [1.0]

MAIN.ModesOfOperation\_SOCM\_Achse\_2 > QB 512518.0, SINT [1.0]

MAIN.ModesOfOperation\_SOCM\_Achse\_3 > QB 512519.0, SINT [1.0]

Show Variables

☒ Used and unused

☐ Exclude disabled

☒ Exclude other Devices

☒ Exclude same Image

☒ Show Tooltips

☐ Sort by Address

Show Variable Types

☐ Matching Type

☒ Matching Size

☒ All Types

☐ Array Mode

Offsets

☐ Continuous

☐ Show Dialog

Variable Name

☐ Hand over

☐ Take over

**Input**

- Name
- Index
- Sub Index
- Data Type

The transmission of the process data using PLC variables is carried out when a corresponding PLC program is selected.

**Prerequisite:** A PLC program must be present (see Section "Creating a PLC program" on page 537).

Table 13.98: Example, "Mode of operation"

①	transmit/receive PDO; select the first receive PDO
②	Content of the selected PDO; right click
③	Mapped process data
④	Open the dialog box "Edit PDO Entry"

### 13.28.8 Start-up parameters of the EtherCAT® slave

- Path ► I/O ► Devices ► Device2 ► Drive1 ► Startup
- Right-click on Startup
- Click on "Insert" in the popup window.

When the controller is booted, the device parameters are transferred to the drive one time.

The screenshot shows the TwinCAT Project1 interface with the 'Startup' tab selected. The top table lists PDO entries for various transitions and protocols. The bottom table lists device parameters for the slave.

Transition	Protocol	Index	Data	Comment
<PS>	CoE	0x1C12:00	0x00 (0)	clear sm pdos (0x1C12)
<PS>	CoE	0x1C13:00	0x00 (0)	clear sm pdos (0x1C13)
<PS>	CoE	0x1C14:00	0x00 (0)	clear sm pdos (0x1C14)
<PS>	CoE	0x1A00:00	0x00 (0)	clear pdo 0x1A00 entries
<PS>	CoE	0x1A00:01	0x60610008 (1616969736)	download pdo 0x1A00 entry
<PS>	CoE	0x1A00:02	0x60410010 (1614872592)	download pdo 0x1A00 entry
<PS>	CoE	0x1A00:03	0x60640020 (1617166368)	download pdo 0x1A00 entry
<PS>	CoE	0x1A00:00	0x03 (3)	download pdo 0x1A00 entr...
<PS>	CoE	0x1600:00	0x00 (0)	clear pdo 0x1600 entries
<PS>	CoE	0x1600:01	0x60600008 (1616904200)	download pdo 0x1600 entry
<PS>	CoE	0x1600:02	0x60400010 (1614807056)	download pdo 0x1600 entry
<PS>	CoE	0x1600:03	0x607A0020 (1618608160)	download pdo 0x1600 entry
<PS>	CoE	0x1600:00	0x03 (3)	download pdo 0x1600 entr...
<PS>	CoE	0x1A10:00	0x00 (0)	clear pdo 0x1A10 entries
<PS>	CoE	0x1A10:01	0x68610008 (1751187464)	download pdo 0x1A10 entry
<PS>	CoE	0x1A10:02	0x68410010 (1749090320)	download pdo 0x1A10 entry
<PS>	CoE	0x1A10:03	0x68640020 (1751384096)	download pdo 0x1A10 entry

Name	Online	Type	Size	>Addr...	In/Out	User ID	Linked to
Modes of Opera...	0x00 (0)	SINT	1.0	71.0	Input	0	
StatusWord	X 0x0000 (0)	UINT	2.0	72.0	Input	0	nState1, nState2
ActualPosition	X 0x00000000 (0)	DINT	4.0	74.0	Input	0	nDataIn1 . In . Inputs . E...
Modes of Opera...	0x00 (0)	SINT	1.0	78.0	Input	0	
StatusWord	X 0x0000 (0)	UINT	2.0	79.0	Input	0	nState1, nState2
ActualPosition	X 0x00000000 (0)	DINT	4.0	81.0	Input	0	nDataIn1 . In . Inputs . E...
Modes of Opera...	0x00 (0)	SINT	1.0	85.0	Input	0	
StatusWord	X 0x0000 (0)	UINT	2.0	86.0	Input	0	nState1, nState2
ActualPosition	X 0x00000000 (0)	DINT	4.0	88.0	Input	0	nDataIn1 . In . Inputs . E...
WcState0	1	BIT	0.1	1522.3	Input	0	
WcState1	1	BIT	0.1	1522.4	Input	0	
InputToggle0	0	BIT	0.1	1524.3	Input	0	
State	0x0002 (2)	UINT	2.0	1548.0	Input	0	
AdsAddr	5.23.29.60.3.1:1001	AMSADDR	8.0	1550.0	Input	0	
Chn0	0x00 (0)	USINT	1.0	1558.0	Input	0	
DcOutputShift	X 0x00027DE4 (163300)	DINT	4.0	1559.0	Input	0	nDcOutputTime . In . In...
DcInputShift	X 0x000CC45C (8367...	DINT	4.0	1563.0	Input	0	nDcInputTime, nDcInpu...
Modes of Opera...	0x00 (0)	SINT	1.0	71.0	Output	0	
ControlWord	X 0x0000 (0)	UINT	2.0	72.0	Output	0	nCtrl1, nCtrl2
TargetPosition	X 0x00000000 (0)	DINT	4.0	74.0	Output	0	nDataOut1 . Out . Outpu...

Fig. 13.75: Startup for the import of the device parameters

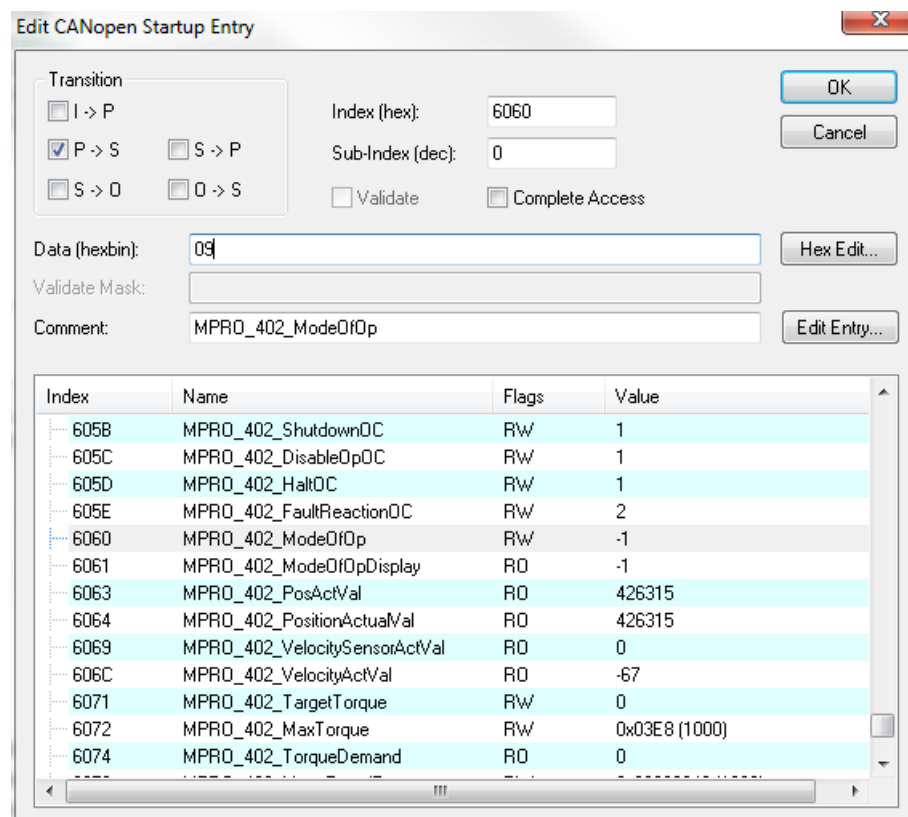
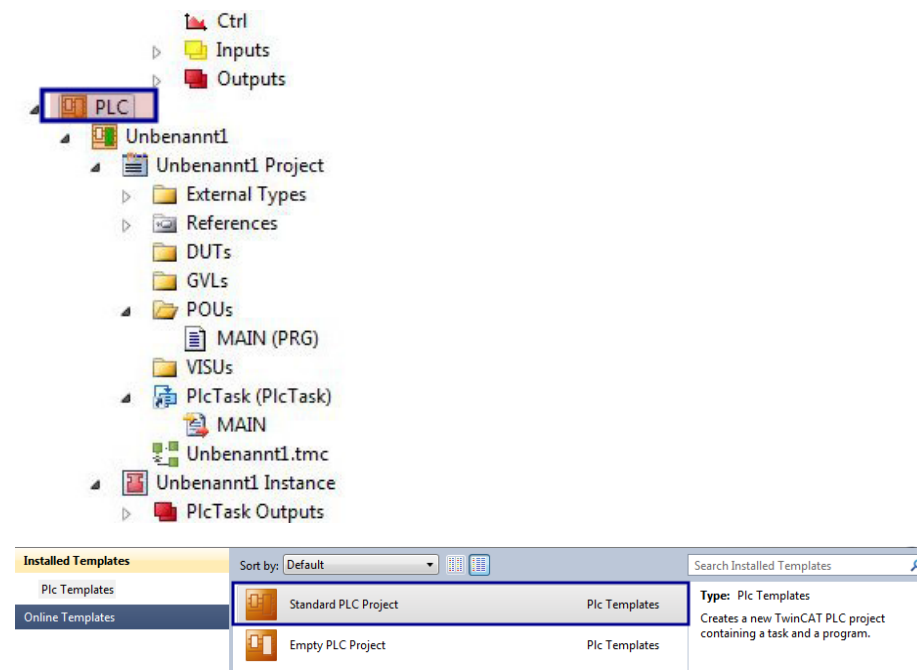


Fig. 13.76: Startup entries

### 13.28.9 Creating a PLC program

- Path ► PLC ► right-click ► Open dialog “Add New Item”



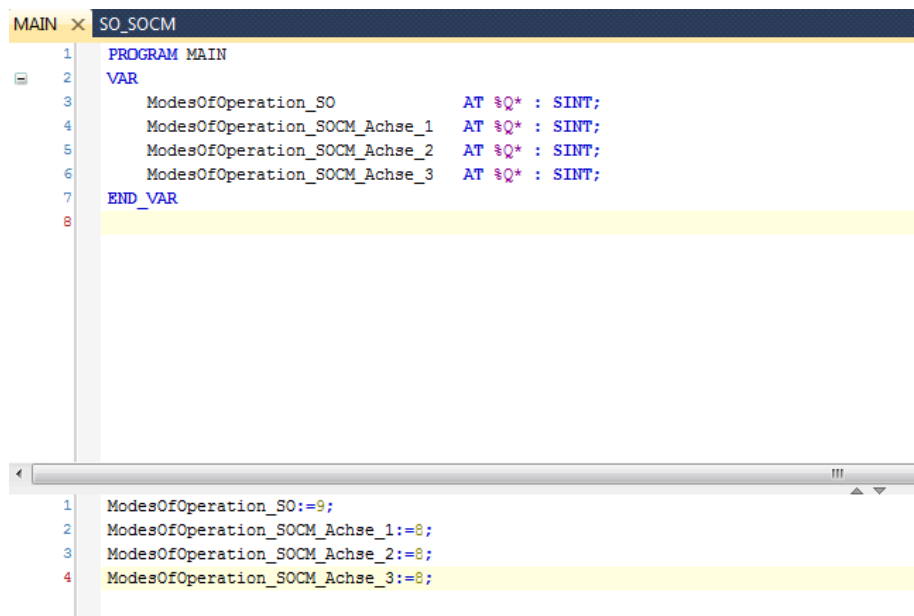


Fig. 13.77: Variables from the main program

### Requirements to be able to activate the PLC

- Restart the TwinCAT system in Run Mode; click "OK"
- Dialog box (old configuration will be overwritten), click "OK"
- Path ► PLC ► Login ► Start

PLC variables can also be linked to EtherCAT® drive variables as an option.

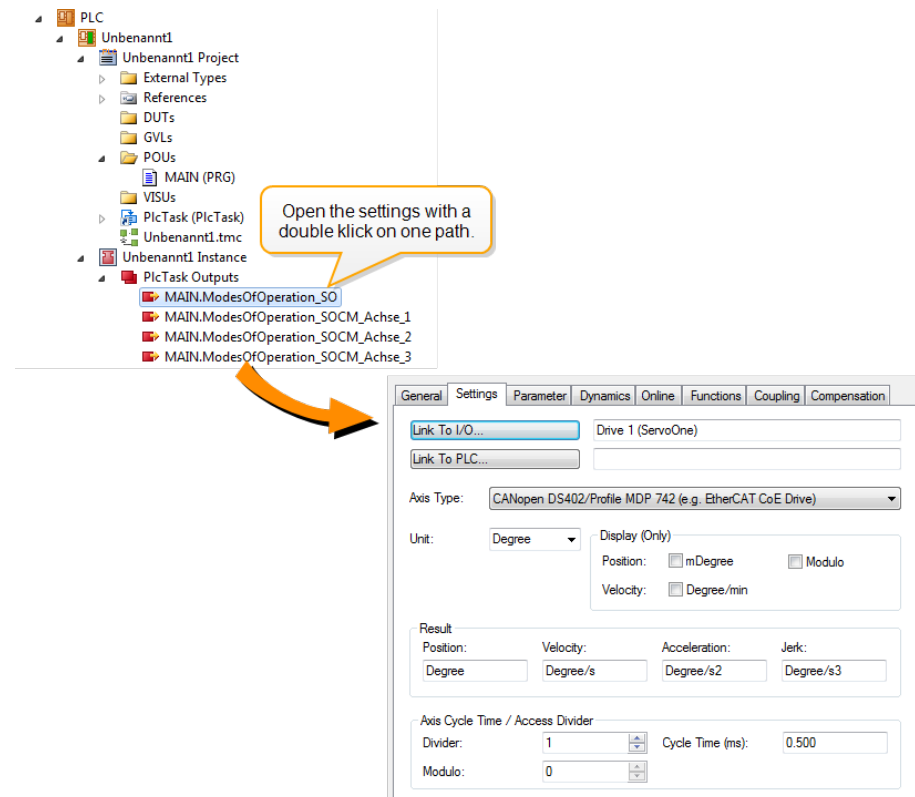


Fig. 13.78: Selection of the PLC variables

- Path ► Motion ► NC-Task1 SAF ► Axis ► Axis1

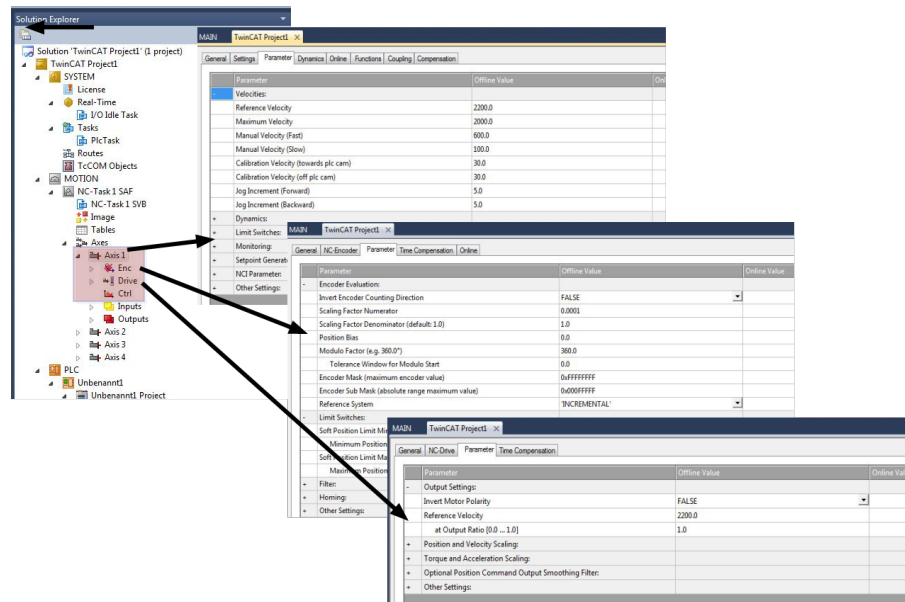


Fig. 13.79: Parameter editor for Axis1 (encoder, drive)

Parameter	Offline Value	Online Value
Encoder Evaluation:		
Invert Encoder Counting Direction	FALSE	FALSE
Scaling Factor Numerator	0.000343322	0.000343322
Scaling Factor Denominator (default: 1.0)	1.0	1.0
Position Bias	0.0	0.0
Modulo Factor (e.g. 360.0°)	360.0	360.0
Tolerance Window for Modulo Start	0.0	0.0
Encoder Mask (maximum encoder value)	0xFFFFFFFF	0xFFFFFFFF
Encoder Sub Mask (absolute range maximum value)	0x000FFFFF	0x000FFFFF

Fig. 13.80: Scaling Factor:

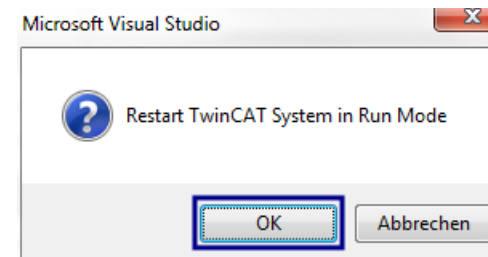
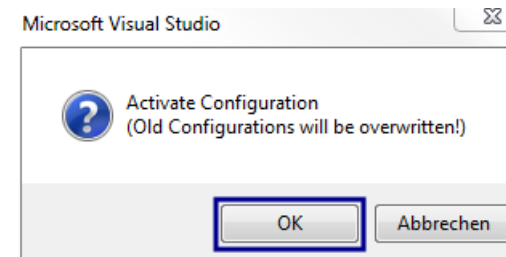
**NOTE**

- The Scaling Factor is used to adapt the scaling between the controller and the servo axis.  
**Example:** PLC (CX5020) [degrees/rev] and servo axis inc/rev:  
modulo factor: 360 degrees / 1048576 Inc = 0.00034322 degrees / Inc.

## 13.28.10 Activating the configuration

- Path ► Menu ► TwinCAT ► Activate Configuration

This sends the current parameter settings to the PLC (CX5020). Please press “OK” to confirm both dialogs.



### 13.28.11 Online dialog (e.g. for manual movement)

- Path ► I/O ► Device2 ► Drive1
- Register ► NC: Online

- ① F1-F4: Inching mode
- ② F5: Movement to the target position at the target velocity
- ③ F6: Stop movement
- ④ F7: Drive Reset
- ⑤ F8: Start Homing
- ⑥ Tab "NC: Function": Infinite positioning, reversal, etc.

Table 13.99: Beckhoff online dialog box

### 13.29 Checksum for data set

The "Checksum for data set" function supports backup of the data set on the controller. The checksum is determined using the parameters that can be stored in the permanent memory of the device with no calibration data or personalization. The checksum is recalculated when the device is started.

ID	Index	Name	Value	Description	Type
69872		BackupParameterCrc		Backup parameter checksum	List of subparameters
69872	0	Checksum	EF0BDB03h	Backup parameter checksum	uint32
69872	1	Changed	True	Backup parameter changed	bool32

Table 13.100: Backup parameter CRC

Parameter **P 69872.0 Checksum** describes the data set saved in the non-volatile memory of the device, linked with the firmware version. If one of the components has changed, then the checksum changes as well. The checksum is recalculated when the device is started as well as when the "Save in the device" function is enabled.

Parameter **P 69872.1 Changed** provides information as to whether the setting was changed intentionally. It is set to **true** when the function "Save in the device" is activated.

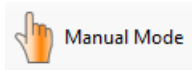
Use the checksum for the data set in conjunction with Backup/Restore concepts; for more on this, see 3.9 File system. The controller should check the checksum for a change. If a change is found and the data were changed intentionally (Changed = true), then the controller can apply the new settings. If a change is found and the data were not changed intentionally, then there is an error or the device has been replaced. The controller should then write the valid setting once again. After the comparison, the controller should set the parameter **P 69872.1 Changed** to **false** once again.



# 14 Manual mode

## Chapter overview

### Pictogram



### Navigation

► Project tree ► Axis adjustment ► X axis ► Manual mode

### Brief description

This chapter describes the configuration and control options for the "Manual mode" window.

### Contents

14.1 Manual mode window .....541

## 14.1 Manual mode window



### NOTE

- Read, observe and confirm the safety information!
- As soon as the "Manual mode" window opens, all unrelated device settings will be disabled. These device settings will be re-enabled after the "Manual mode" window is closed.

The manual mode window will appear, but be disabled at first. Once you click on the "Activate manual mode" button, a safety prompt that needs to be confirmed will appear.

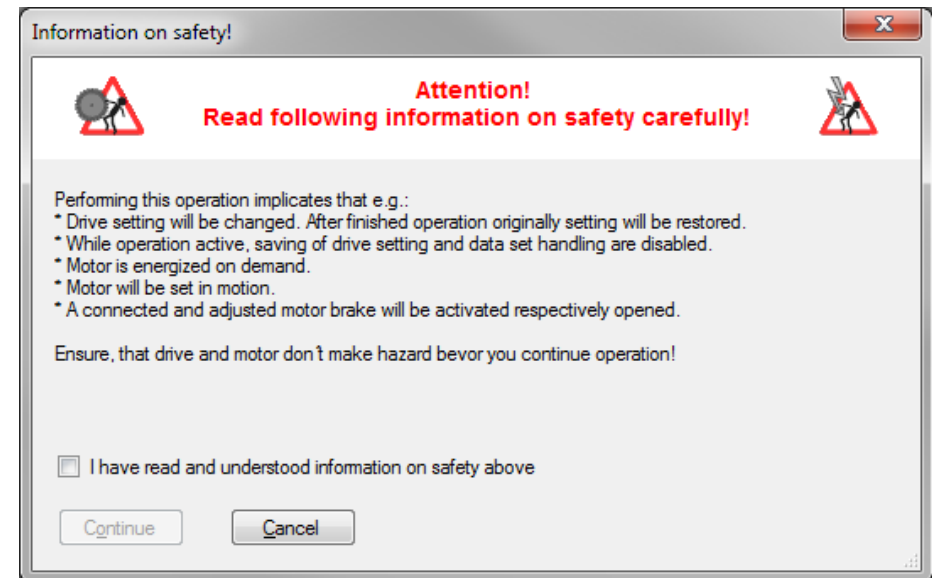


Fig. 14.1: Safety information

Once the safety prompt is confirmed, the "Manual mode" window will be enabled, after which you can select a control mode and configure it for manual operation. Depending on the control mode you selected, one to four configuration tabs will appear:

- A table with the parameters that are specific to the relevant control mode but that will only apply when using manual mode (e.g. acceleration, deceleration, setpoint, speed, etc.)
- Homing (see Section "Homing / homing mode" on page 470)
- Jog mode, which can be used to move the motor step-by-step in a positive or negative direction with two different speeds.
- Reversing operation, in which the motor can be moved back and forth with adjustable accelerations and speeds.

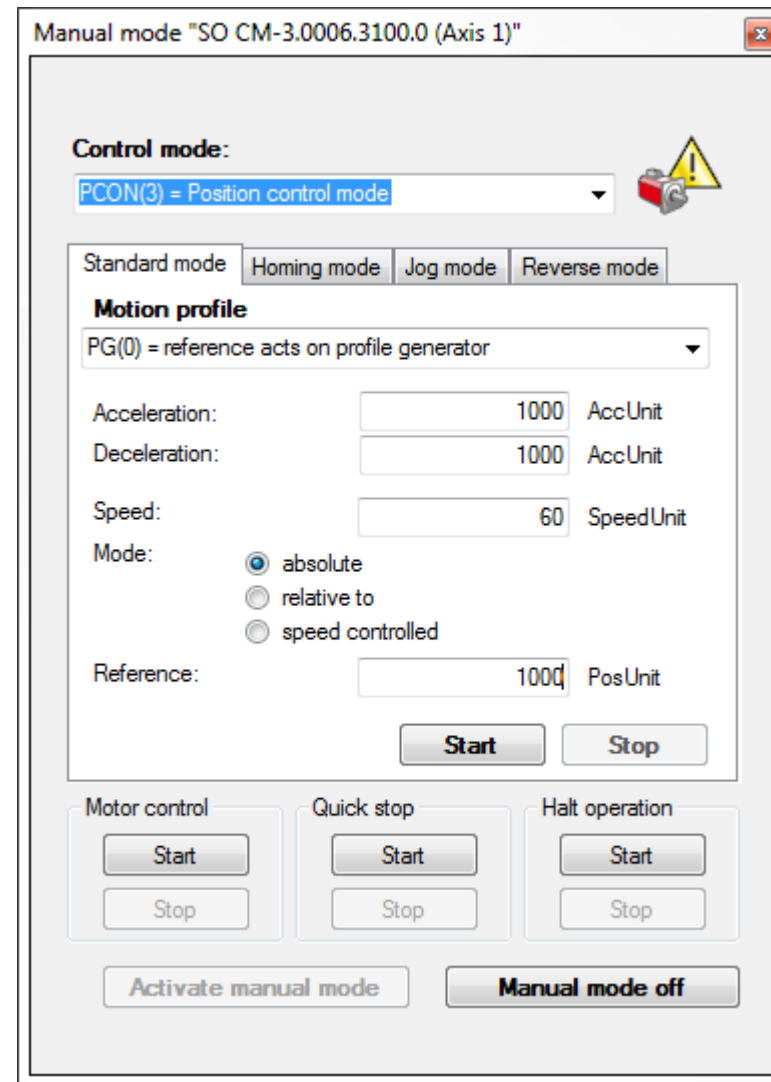


Fig. 14.2: Manual mode window (active) – Control mode tab

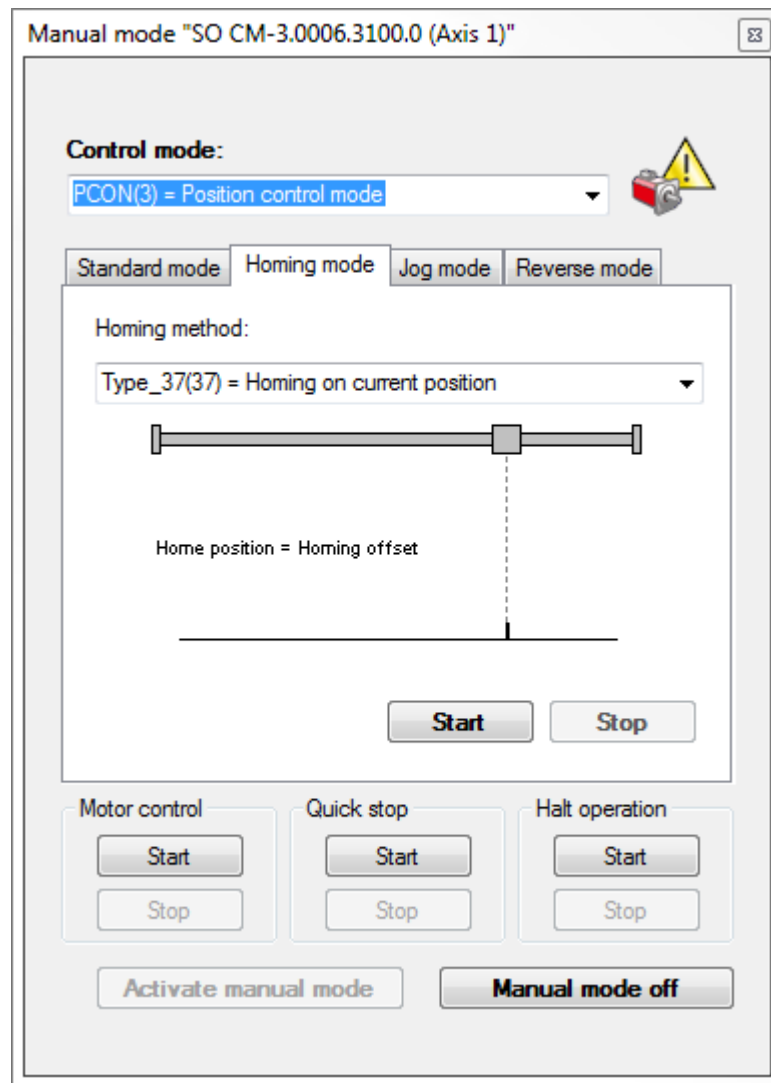


Fig. 14.3: Manual mode window (active) – Homing tab

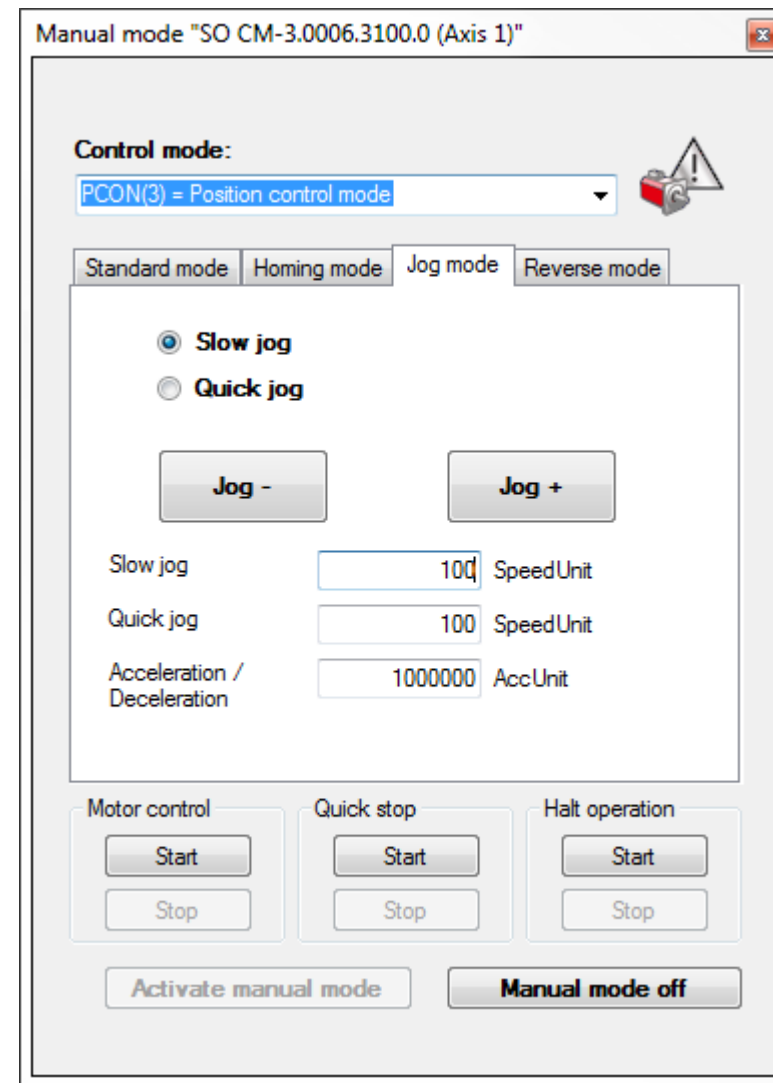


Fig. 14.4: Manual mode window (active) – Jog mode tab

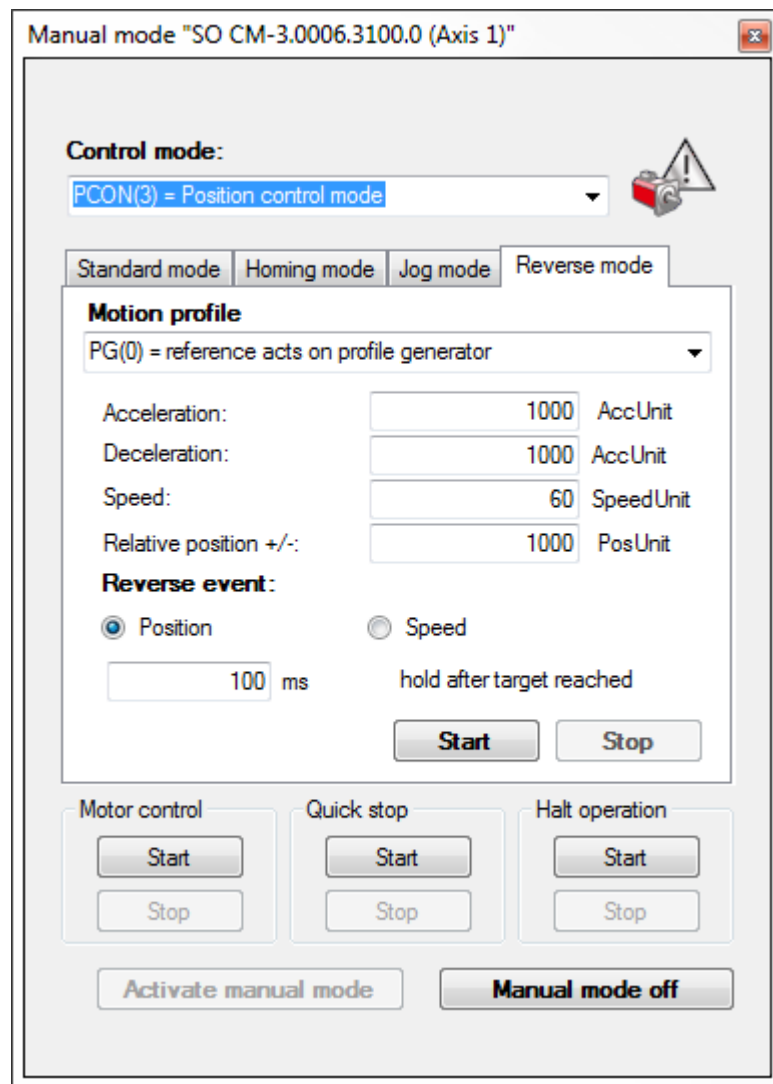


Fig. 14.5: Manual mode window (active) – Reversing PG(0) tab

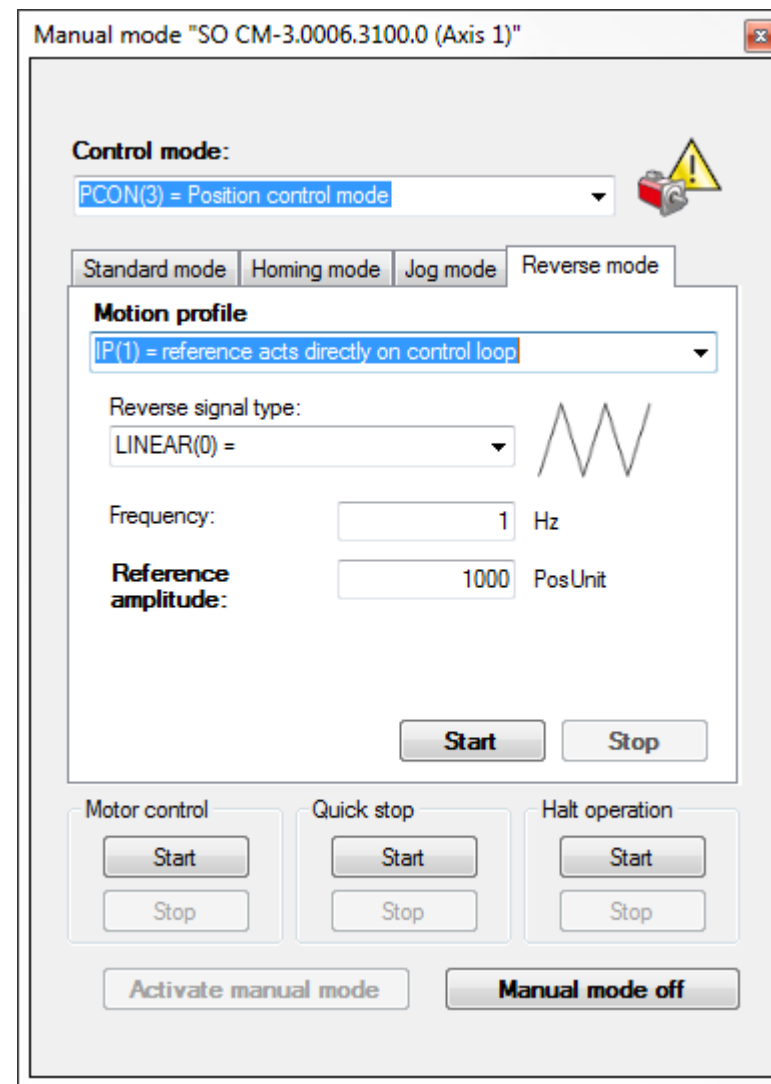
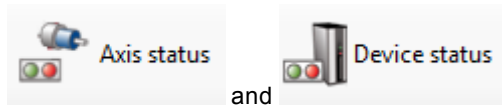


Fig. 14.6: Manual mode window (active) – Reversing IP(1) tab

# 15 State

## Chapter overview

### Pictogram



### Navigation

- Project tree ► Axis adjustment ► X axis ► Status  
or
- Project tree ► Axis adjustment ► Device ► Device status

### Brief description

This chapter describes the options for displaying axis and device status.

### Contents

15.1 Status messages .....	545
----------------------------	-----

## 15.1 Status messages

Status messages are divided into axis status messages and device status messages and can be opened by pressing the appropriate buttons on the quick start bar.

### 15.1.1 Axis status



Fig. 15.1: "Axis status" button

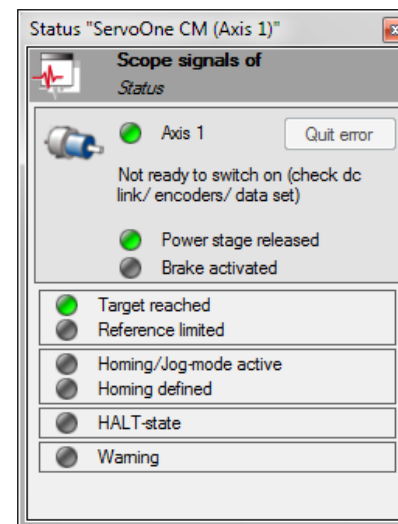


Fig. 15.2: "Axis status" window

An active warning is shown in **P 2151[0] ERR\_WRN\_State**. If the parameter does not equal 0, bit 7 is set in the DriveCom status word **P 2250 - DrivCom**. There is no reaction in the axis for a warning.

Errors can be reset by pressing the “Reset error” button.

P No.	Index	Name	Unit	Description
2248 / 4296 / 6344	0	MPRO_DRVCOM_State		Axis 1 / 2 / 3: DriveCom state
2249 / 4297 / 6345	0	MPRO_DRVCOM_StateText		Axis 1 / 2 / 3: DriveCom state (text)
2250 / 4298 / 6346	0	MPRO_DRVCOM_Statusword		Axis 1 / 2 / 3: DriveCom status word
2251 / 4299 / 6347	0	MPRO_DRVCOM_Controlword		Axis 1 / 2 / 3: DriveCom control word
2252 / 4300 / 6348	0	MPRO_DRVCOM_FaultReset		Axis 1 / 2 / 3: DriveCom fault reset

Table 15.1: Parameter list – Status axis

## 15.1.2 Device status



Fig. 15.3: “Device status” button

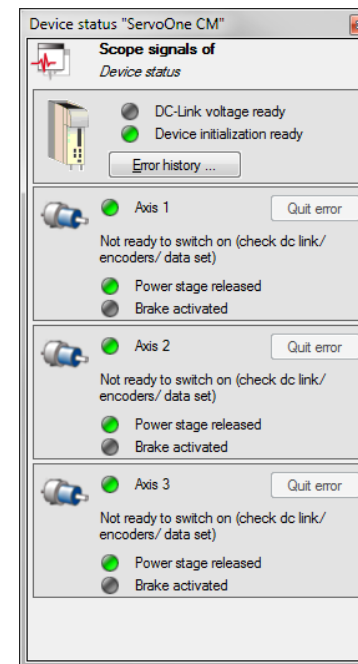


Fig. 15.4: “Device status” window for a three-axis controller

Comprehensive error information can be accessed using the “Error History” button (Section “Error history” on page 229).


Errors can be reset by pressing the “Reset error” button.

P No.	Index	Name	Unit	Description
280	0	MPRO_INPUT_SysState		Status of digital inputs
200	0	MPRO_DRVCOM_SystemState		DriveCom: System state
281	0	MPRO_INPUT_SysAllStatus		DriveCom system status

Table 15.2: Parameter list – Device status



# 16 Actual values

Chapter overview	
<b>Pictogram</b>	
<b>Navigation</b>	<ul style="list-style-type: none"> <li>► Project tree ► Axis adjustment ► X axis ► Actual values</li> <li>► Project tree ► Axis adjustment ► Device ► Actual values</li> </ul>
<b>Brief description</b>	The following chapter describes options for displaying various actual values and states of each individual axis and of the device.
<b>Contents</b>	<ul style="list-style-type: none"> <li>16.1 Overview .....548</li> <li>16.2 Cockpit .....550</li> <li>16.3 Digital inputs .....552</li> </ul>

## 16.1 Overview

ID	Index	Name	Unit	Description
2259 / 4307 / 6355		MPRO_402_RampTime		Axis 1 / 2 / 3: Times for configured ramps
2259 / 4307 / 6355	0	MPRO_402_RampTime	s	Time for profile acceleration
2259 / 4307 / 6355	1	MPRO_402_RampTime	s	Time for profile deceleration
2259 / 4307 / 6355	2	MPRO_402_RampTime	s	Quick stop time
2303 / 4351 / 6399		MPRO_FG_UserValues		Axis 1 / 2 / 3: Factor group – Actual values (user units)
2303 / 4351 / 6399	0	SpeedAct	SpeedUnit	Actual speed value in user units
2303 / 4351 / 6399	1	SpeedRef	SpeedUnit	Setpoint speed in user units
2303 / 4351 / 6399	2	SpeedCmd	SpeedUnit	Speed command in user units
2303 / 4351 / 6399	3	SpeedDiff	SpeedUnit	Speed difference in user units
2303 / 4351 / 6399	4	PosDiff	PosUnit	Position tracking error in user units
2303 / 4351 / 6399	5	PosAct	PosUnit	Actual position value in user units
2303 / 4351 / 6399	6	PosRef	PosUnit	Setpoint position value in user units
2955 / 5003 / 7051	0	CON_PCON_ActPosition	incr	Axis 1 / 2 / 3: Actual position
2967 / 5015 / 7063		CON_FM_ActValues		Axis 1 / 2 / 3: Control of actual values
2967 / 5015 / 7063	0	isq	A	Actual q-current value
2967 / 5015 / 7063	1	isd	A	Actual d-current value
2967 / 5015 / 7063	2	iphasor	A	Actual motor current value (amplitude/filtered)
2967 / 5015 / 7063	3	usq	V	Actual q-voltage value
2967 / 5015 / 7063	4	usd	V	Actual d-voltage value
2967 / 5015 / 7063	5	vmot	V	Motor voltage
2967 / 5015 / 7063	6	pmot	kW	Effective power
2967 / 5015 / 7063	7	smot	kVA	Apparent power
3016 / 5064 / 7112		CON_SCON_ActValues		Axis 1 / 2 / 3: Actual values (in system units)
3016 / 5064 / 7112	0	RefSpeed	rpm	Rated speed
3016 / 5064 / 7112	1	ActSpeed	rpm	Actual speed
3016 / 5064 / 7112	2	RefTorque	Nm	
3016 / 5064 / 7112	3	ActTorque	Nm	Actual torque
3016 / 5064 / 7112	4	ActTorqueNorm	Nm	Current torque (with sign for scaling)

Table 16.1: “Actual values – Axis” parameters



ID	Index	Name	Unit	Description
3017 / 5065 / 7113		CON_SystemPara		Axis 1 / 2 / 3: Actual control values
3017 / 5065 / 7113	0	JSUM	kgm2	System moment of inertia
3017 / 5065 / 7113	1	TE_I	ms	Current controller replacement time constant
3017 / 5065 / 7113	2	T_Filter	ms	Speed filter / observer replacement time constant
3017 / 5065 / 7113	3	TE_S	ms	Speed control replacement time constant
3017 / 5065 / 7113	4	Tdelay_S	ms	Internal delay of speed encoder
3017 / 5065 / 7113	5	Tdelay_P	ms	Internal delay of position encoder
3019 / 5067 / 7115	0	MOT_Km_adapt	Nm/A	Axis 1 / 2 / 3: Actual motor constant value (peak)
3033/5081/7129	0	CON_PCON_UsrPosDiff		Axis 1 / 2 / 3: Position difference between position encoder and speed encoder
3049 / 5097 / 7145		MON_ActValues		Axis 1 / 2 / 3: Actual values
3049 / 5097 / 7145	0	I2t_Motor	%	I2T integrator for motor
3049 / 5097 / 7145	1	I2t_Inverter	%	I2T integrator for device
3049 / 5097 / 7145	2	I2t_Fast	%	I2T integrator high overload
3049 / 5097 / 7145	3	I2tMax	A2s	Max. I2T integral
3049 / 5097 / 7145	4	IMaxDC	A	Max. DC current
3049 / 5097 / 7145	5	IMaxDC_sum	%	Integral DC protection
3049 / 5097 / 7145	6	InRot	A	Rated current at current switching frequency / voltage
3049 / 5097 / 7145	7	iphasor	A	Actual motor current value (amplitude, filtered)
3049 / 5097 / 7145	8	UsrPosDiffHistory	PosUnit	Position tracking error monitoring
3049 / 5097 / 7145	9	Temp_Motor	degC	Motor temperature
3049 / 5097 / 7145	10	Temp_Motor_R	Ohm	Temperature sensor resistance (power stage)
3049 / 5097 / 7145	11	SwitchFreqSelState		Switching frequency switchover state
		NONE (0)		Current switching frequency not changed
		MANUAL (1)		Current switching frequency changed manually
		I2T (2)		Current switching frequency changed by I2t
		FASTI2T (3)		Current switching frequency changed by fast IxT

Table 16.1: "Actual values – Axis" parameters (continue)

ID	Index	Name	Unit	Description
		OCSW (4)		Current switching frequency changed by software overcurrent
		OCDC (5)		Current switching frequency changed by DC overcurrent
3049 / 5097 / 7145	12	SwitchFreqSelAct		Switching frequency switchover: Actual switching frequency value
		2kHz (0)		
		4kHz (1)		
		8kHz (2)		
		12kHz (3)		
		16kHz (4)		
3049 / 5097 / 7145	13	Irms	A	Effective motor current value
3049 / 5097 / 7145	14	Tth_Motor	%	Actual motor protection value with thermal model
3049 / 5097 / 7145	15	PosDiffPconScon		Current position difference between PCon and SCon encoder: see parameter CON_PCON_Ctrl
24676 / 26724 / 28772	0	PositionActualValue	PosUnit	Axis 1 / 2 / 3: CiA402 actual position value
24684 / 26732 / 28780	0	VelocityActualValue	SpeedUnit	Axis 1 / 2 / 3: CiA402 actual speed value

Table 16.1: "Actual values – Axis" parameters (continue)

ID	Index	Name	Unit	Description
46	0	MON_OperationTime	s	Time
47		MON_HostTime		Localized system time. Must be set by host after every device restart
47	0	CUT_Seconds		Writeable localized time which represents the number of seconds elapsed since 00:00:00 on January 1, 1900
47	1	LongDateTimeString		Print out of date and time in the standard format
47	2	CUT_ActSeconds		Actual localized time which represents the number of seconds elapsed since 00:00:00 on January 1, 1900
280	0	MPRO_INPUT_SysState		State of the digital inputs

Table 16.2: "Actual values – Device" parameters

ID	Index	Name	Unit	Description
900		CON_TS		Control of cycle times
900	0	CCON_TS	ms	Current control scanning time
900	1	SCON_TS	ms	Speed control scanning time
900	2	PCON_TS	ms	Position control scanning time
900	3	IP_REF_TS	ms	NC cycle time (setpoint)
900	4	RAMP_REF_TS	ms	Scanning time in ramp mode
1000		MON_ActSystemValues		Monitoring: Actual values
1000	0	InteriorTemp	degC	Device interior temperature
1000	1	VDC	V	DC link voltage
1000	2	VDC_SYMM		DC link symmetry value (0.5 = ideal)
1000	3	InverterTemp1	degC	Temperature power stage 1
1000	4	InverterTemp2	degC	Temperature power stage 2
1000	5	InverterTemp3	degC	Temperature power stage 3

Table 16.2: "Actual values – Device" parameters (continue)

## 16.2 Cockpit

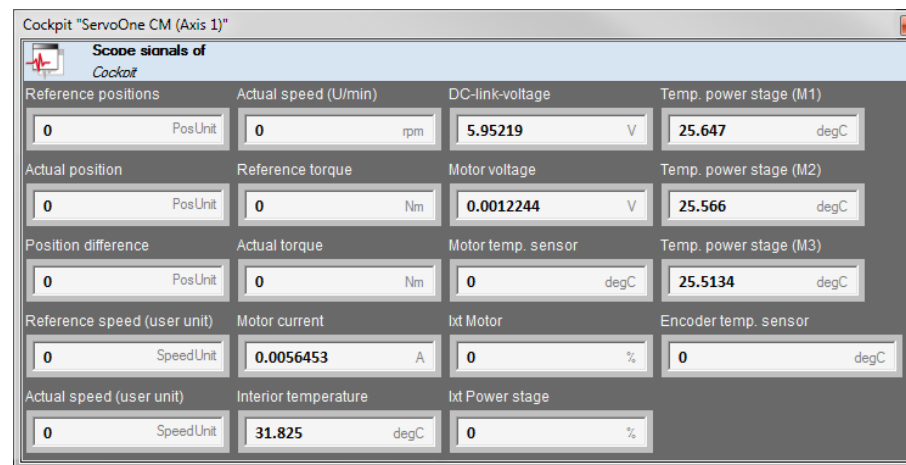


Fig. 16.1: "Cockpit" window

Cockpit displays the most important actual values of reach axis. These and other variables are actual value parameters that can be displayed in the scope and imported by the higher-level controller.

Click on the "Oscilloscope signals from Cockpit" box to import individual values into the scope. Right-click on the Cockpit box and then on "Display as parameter list" to view the parameters.

ID	Index	Name / Setting	Unit	Description
1000		MON_ActSystemValues		Monitoring: Actual values
1000	0	InteriorTemp	degC	Device interior temperature
1000	1	VDC	V	DC link voltage

Table 16.3: "Actual values – Cockpit axis" parameters

ID	Index	Name / Setting	Unit	Description
1000	2	VDC_SYMM		DC link symmetry value (0.5 = ideal)
1000	3	InverterTemp1	degC	Temperature power stage 1
1000	4	InverterTemp2	degC	Temperature power stage 2
1000	5	InverterTemp3	degC	Temperature power stage 3
2303 / 4351 / 6399		MPRO_FG_UserValues		Axis 1 / 2 / 3: Factor group – Actual values (user units)
2303 / 4351 / 6399	0	SpeedAct	SpeedUnit	Actual speed value in user units
2303 / 4351 / 6399	1	SpeedRef	SpeedUnit	Setpoint speed in user units
2303 / 4351 / 6399	2	SpeedCmd	SpeedUnit	Speed command in user units
2303 / 4351 / 6399	3	SpeedDiff	SpeedUnit	Speed difference in user units
2303 / 4351 / 6399	4	PosDiff	PosUnit	Position tracking error in user units
2303 / 4351 / 6399	5	PosAct	PosUnit	Actual position value in user units
2303 / 4351 / 6399	6	PosRef	PosUnit	Setpoint position value in user units
2948 / 4996 / 7044	0	ActSpeed	1/min	Axis 1 / 2 / 3: Actual speed value
2967 / 5015 / 7063		CON_FM_ActValues		Axis 1 / 2 / 3: Control of actual values
2967 / 5015 / 7063	0	isq	A	Actual q-current value
2967 / 5015 / 7063	1	isd	A	Actual d-current value
2967 / 5015 / 7063	2	iphasor	A	Actual motor current value (amplitude/filtered)
2967 / 5015 / 7063	3	usq	V	Actual q-voltage value
2967 / 5015 / 7063	4	usd	V	Actual d-voltage value
2967 / 5015 / 7063	5	vmot	V	Motor voltage
2967 / 5015 / 7063	6	pmot	kW	Effective power
2967 / 5015 / 7063	7	smot	kVA	Apparent power
3016 / 5064 / 7112		CON_SCON_ActValues		Axis 1 / 2 / 3: Actual values (in system units)
3016 / 5064 / 7112	0	RefSpeed	rpm	Rated speed
3016 / 5064 / 7112	1	ActSpeed	rpm	Actual speed
3016 / 5064 / 7112	2	RefTorque	Nm	
3016 / 5064 / 7112	3	ActTorque	Nm	Actual torque
3049 / 5097 / 7145		MON_ActValues		Axis 1 / 2 / 3: Actual values
3049 / 5097 / 7145	0	I2t_Motor	%	I2T integrator for motor
3049 / 5097 / 7145	1	I2t_Inverter	%	I2T integrator for device
3049 / 5097 / 7145	2	I2t_Fast	%	I2T integrator high overload
3049 / 5097 / 7145	3	I2tMax	A2s	Max. I2T integral

Table 16.3: “Actual values – Cockpit axis” parameters (continue)

ID	Index	Name / Setting	Unit	Description
3049 / 5097 / 7145	4	IMaxDC	A	Max. DC current
3049 / 5097 / 7145	5	IMaxDC_sum	%	Integral DC protection
3049 / 5097 / 7145	6	InRot	A	Rated current at current switching frequency / voltage
3049 / 5097 / 7145	7	iphasor	A	Actual motor current value (amplitude, filtered)
3049 / 5097 / 7145	8	UsrPosDiffHistory	PosUnit	Position tracking error monitoring
3049 / 5097 / 7145	9	Temp_Motor	degC	Motor temperature
3049 / 5097 / 7145	10	Temp_Motor_R	Ohm	Temperature sensor resistance (power stage)
3049 / 5097 / 7145	11	SwitchFreqSelState		Switching frequency switchover state
		NONE (0)		Current switching frequency not changed
		MANUAL (1)		Current switching frequency changed manually
		I2T (2)		Current switching frequency changed by I2t
		FASTI2T (3)		Current switching frequency changed by fast IxT
		OCSW (4)		Current switching frequency changed by software overcurrent
		OCDL (5)		Current switching frequency changed by DC overcurrent
3049 / 5097 / 7145	12	SwitchFreqSelAct		Switching frequency switchover: Actual switching frequency value
		2kHz (0)		
		4kHz (1)		
		8kHz (2)		
		12kHz (3)		
		16kHz (4)		
3049 / 5097 / 7145	13	Irms	A	Effective motor current value
3049 / 5097 / 7145	14	Tth_Motor	%	Actual motor protection value with thermal model

Table 16.3: “Actual values – Cockpit axis” parameters (continue)

## 16.3 Digital inputs

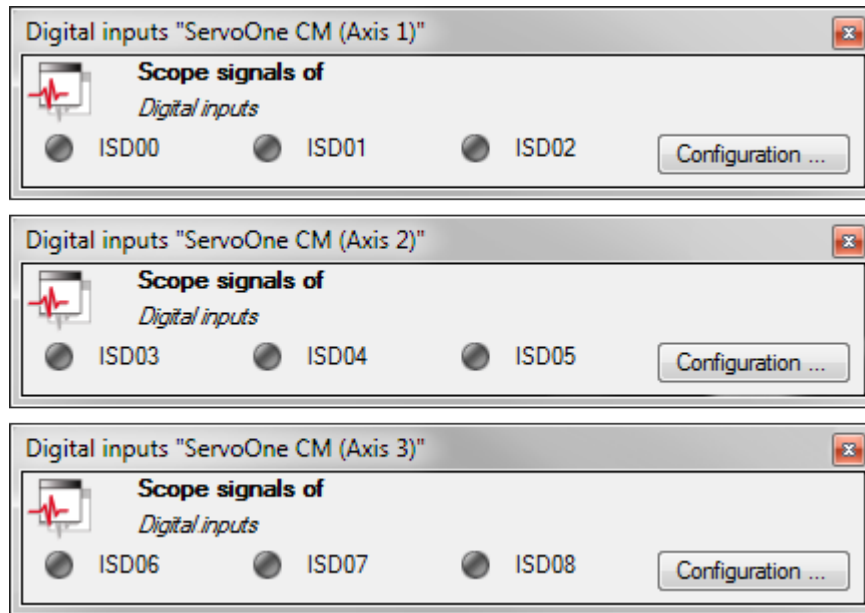


Fig. 16.2: “Digital inputs (axes 1–3)” window

The “Digital inputs” window displays the current status of the digital inputs for each axis.

ID	Index	Name	Unit	Description
2328 / 4376 / 6424		MPRO_INPUT_State		Axis 1 / 2 / 3: State of digital inputs
2328 / 4376 / 6424	0	State		States of the digital inputs
2328 / 4376 / 6424	1	StateFil		Status of digital inputs (filtered)

Table 16.4: “Actual values – Digital inputs” parameters

# 17 Safety

## Chapter overview

### Pictogram



### Navigation

► Project tree ► Axis adjustment ► Device ► Safety

### Brief description

The following chapter describes options for configuring and displaying the safety functions SD0 and SDC of the Axis Controller.

### Contents

17.1 SD0 Safety functionality .....	553
17.2 SDC Safety functionality .....	561

## 17.1 SD0 Safety functionality

Malfunctions of the drive controller must be detected through higher-level monitoring of the movement or through other measures in the application. The detection and the reaction to this are the responsibility of the user. The safety system provides the safety functions STO and SBC which can be used by the user as a reaction to malfunctions of the drive controller in the application.

## 17.1.1 Status and diagnostics SD0

### Status and diagnosis SD0

Status STO 1: ☒ channel 1  Message STO 1:

☒ channel 2

---

Status STO 2: ☒ channel 1  Message STO 2:

☒ channel 2

---

State SBC:  Message SBC:

---

**Functional brake control**

Functional brake control axis 1:	NONE	Control signal axis 1:	Off	Brake output	<input checked="" type="radio"/>
Functional brake control axis 2:	NONE	Control signal axis 2:	Off	Brake output	<input checked="" type="radio"/>
Functional brake control axis 3:	NONE	Control signal axis 3:	Off	Brake output	<input checked="" type="radio"/>

Fig. 17.1: "Status and diagnostics SD0" dialog box

The "Status and diagnostics SD0" dialog box provides status information and diagnostics tools for SD0 (STO + SBC) inputs and outputs.



### NOTE

- The STO and SBC functions, the digital inputs on X11 and the DIL switch block S-ADR of the ServoOne CM Axis Controller are described in the Specification SD0 (1400.402B.x) and Specification SDC (1400.206B.x).



All of the further applicable documents for this device can be found on our website:

[www.keba.com](http://www.keba.com) in the DOCU-PORTAL.



### NOTE

- This dialog box is only valid for Axis Controller with safety functionality SD0 (STO + SBC), SO CM-x.xxxx.x1xx.0.
- It is *not* valid for Axis Controller with safety functionality SDC, SO CM-x.xxxx.x2xx.x, SO CM-x.xxxx.x3xx.x, SO CM-x.xxxx.x4xx.x or SO CM-x.xxxx.x5xx.x.

ID	Index	Name / Setting	Unit	Description
150		DV_SAFETY_Channel1		Values of safety controller D8027
150	0	CH1_STO1_state		STO1 Status info
		RESET (0)		-
		PWONT (1)		-
		WAIT (2)		Power stage locked (STO). Waiting for both inputs "on".
		TSTAC (3)		-
		ON (4)		Power stage free
		OFF (5)		-
		OFWAIA (6)		Power stage locked (STO). Waiting for both inputs "off".
		INVALID (7)		-

Table 17.1: "Status and diagnostics SD0" parameters

ID	Index	Name / Setting	Unit	Description
		ERSTAT8 (8)		Error state
		ERSTAT9 (9)		Error state
		ERSTAT10 (10)		Error state
		ERSTAT11 (11)		Error state
		ERSTAT12 (12)		Error state
		ERSTAT13 (13)		-
		ERSTAT14 (14)		Error state
		ERSTAT15 (15)		-
150	1	CH1_STO2_state		STO2 Status info
		RESET (0)		-
		PWONT (1)		-
		WAIT (2)		Power stage locked (STO). Waiting for both inputs "on".
		TSTAC (3)		-
		ON (4)		Power stage free
		OFF (5)		-
		OFWAIA (6)		Power stage locked (STO). Waiting for both inputs "off".
		INVALID (7)		-
		ERSTAT8 (8)		Error state
		ERSTAT9 (9)		Error state
		ERSTAT10 (10)		Error state
		ERSTAT11 (11)		Error state
		ERSTAT12 (12)		Error state
		ERSTAT13 (13)		-
		ERSTAT14 (14)		Error state
		ERSTAT15 (15)		-
150	2	CH1_SBC_state		Brake status
		RESET (0)		-
		PWONT (1)		-
		WAIT (2)		Brake locked. Wait for STO1 inputs "on" and/or release of brake(s) by drive controller.
		TSTOV (3)		-

Table 17.1: "Status and diagnostics SD0" parameters (continue)

ID	Index	Name / Setting	Unit	Description
		WAITMS (4)		-
		ON (5)		Brake actuation enabled by drive controller.
		OFWAIA2 (6)		Brake locked (SBC). Waiting for STO1 CH2 "off".
		OFWAIA1 (7)		Brake locked (SBC). Waiting for STO1 CH1 "off".
		ERSTAT8 (8)		Error state
		ERSTAT9 (9)		Error state
		ERSTAT10 (10)		Error state
		ERSTAT11 (11)		Error state
		ERSTAT12 (12)		Error state
		ERSTAT13 (13)		Error state
		ERSTAT14 (14)		Error state
		ERSTAT15 (15)		Error state
150	3	CH1_STO1_fail		Error status STO1
		NOERR (0)		no error
		OVVF (1)		Internal error in range from input to source follower. Switch device off/on. Please contact your service partner if this error occurs again.
		INPON (2)		DIP switch set incorrectly. Input pulse (on time) too short or internal error in range from input to source follower. Check DIP switch setting.
		TIFBDEF (3)		Internal error in voltage controller and emitter follower range. Switch device off/on. Please contact your service partner if this error occurs again.
		INDPEF (4)		Internal error in range from input to diagnostics. Switch device off/on. Please contact your service partner if this error occurs again.

ID	Index	Name / Setting	Unit	Description
		INTFAIL (5)		DIP switch set incorrectly or internal error in range from input to source follower. Check DIP switch setting. Switch device off/on. Please contact your service partner if this error occurs again.
		EXTEPULSE (6)		Short-circuit or cross-circuit in external wiring. Check external wiring of STO inputs. Switch device off/on. Please contact your service partner if this error occurs again.
		NOBACKMSG (7)		Internal error in voltage controller and emitter follower range. Switch device off/on. Please contact your service partner if this error occurs again.
		INTBACKMSG (8)	-	
		UNEXPOFF (9)	-	
		INTPULSESP (10)	-	
		OVV11 (11)		Internal error in range from input to source follower. Switch device off/on. Please contact your service partner if this error occurs again.
		FRQTOHIGH (12)		External test pulse (signature) repeat rate too high. Check external test pulses. Switch device off/on. Please contact your service partner if this error occurs again.
		INPNOOFF (13)		Input not switching off. Probably short-circuit or cross-circuit in external wiring or defect in external safety controller. Check wiring and safety controller.
		UNUSED14 (14)		Internal error in voltage controller and emitter follower range. Switch device off/on. Please contact your service partner if this error occurs again.
		UNUSED15 (15)	-	
150	4	CH1_STO2_fail		Error status STO2
		NOERR (0)		no error
		OVVF (1)		Internal error in range from input to source follower. Switch device off/on. Please contact your service partner if this error occurs again.

Table 17.1: "Status and diagnostics SD0" parameters (continue)

ID	Index	Name / Setting	Unit	Description
				occurs again.
		INPON (2)		DIP switch set incorrectly. Input pulse (on time) too short or internal error in range from input to source follower. Check DIP switch setting.
		TIFBDEF (3)		Internal error in voltage controller and emitter follower range. Switch device off/on. Please contact your service partner if this error occurs again.
		INDPEF (4)		Internal error in range from input to diagnostics. Switch device off/on. Please contact your service partner if this error occurs again.
		INTFAIL (5)		DIP switch set incorrectly or internal error in range from input to source follower. Check DIP switch setting. Switch device off/on. Please contact your service partner if this error occurs again.
		EXTEPULSE (6)		Short-circuit or cross-circuit in external wiring. Check external wiring of STO inputs. Switch device off/on. Please contact your service partner if this error occurs again.
		NOBACKMSG (7)		Internal error in voltage controller and emitter follower range. Switch device off/on. Please contact your service partner if this error occurs again.
		INTBACKMSG (8)	-	
		UNEXPOFF (9)	-	
		INTPULSESP (10)	-	
		OVV11 (11)		Internal error in range from input to source follower. Switch device off/on. Please contact your service partner if this error occurs again.
		FRQTOHIGH (12)		External test pulse (signature) repeat rate too high. Check external test pulses. Switch device off/on. Please contact your service partner if this error occurs again.
		INPNOOFF (13)		Input not switching off. Probably short-



ID	Index	Name / Setting	Unit	Description
				circuit or cross-circuit in external wiring or defect in external safety controller. Check wiring and safety controller.
		UNUSED14 (14)		Internal error in voltage controller and emitter follower range. Switch device off/on. Please contact your service partner if this error occurs again.
		UNUSED15 (15)		-
150	5	CH1_SBC_fail		Brake error status
		NOERR (0)		no error
		MASWOFF (1)		Internal error in master switch. Switch device off/on. Please contact your service partner if this error occurs again.
		MASWON (2)		24V supply outside permissible range or internal error in master switch. Check 24V supply.
		BRKDRV1OFF (3)		Short-circuit in brake 1 supply line or internal error in brake driver range. Check wiring to brake 1. Switch device off/on. Please contact your service partner if this error occurs again.
		BRKDRV2OFF (4)		Short-circuit in brake 2 supply line or internal error in brake driver range. Check wiring to brake 2. Switch device off/on. Please contact your service partner if this error occurs again.
		BRKDRV3OFF (5)		Short-circuit in brake 3 supply line or internal error in brake driver range. Check wiring to brake 3. Switch device off/on. Please contact your service partner if this error occurs again.
		BRKDRV1ON (6)		Short-circuit in brake 1 supply line or internal error in brake driver range. Check supply line to brake 1.
		BRKDRV2ON (7)		Short-circuit in brake 2 supply line or internal error in brake driver range. Check supply line to brake 2.
		BRKDRV3ON (8)		Short-circuit in brake 3 supply line or internal error in brake driver range. Check

Table 17.1: "Status and diagnostics SD0" parameters (continue)

ID	Index	Name / Setting	Unit	Description
				supply line to brake 3.
		SWOFFCHK1FAIL (9)		SIP switch set incorrectly, no brake 1 connected, brake 1 supply line interrupted or internal error in brake driver range. Check DIP switch, brake and supply line. Switch device off/on. Please contact your service partner if this error occurs again.
		SWOFFCHK2FAIL (10)		SIP switch set incorrectly, no brake 2 connected, brake 2 supply line interrupted or internal error in brake driver range. Check DIP switch, brake and supply line. Switch device off/on. Please contact your service partner if this error occurs again.
		SWOFFCHK3FAIL (11)		SIP switch set incorrectly, no brake 3 connected, brake 3 supply line interrupted or internal error in brake driver range. Switch device off/on. Please contact your service partner if this error occurs again.
		INP1NOSW (12)		DIP switch set incorrectly, short-circuit or cross-circuit in external wiring, error in safety controller or internal error in SBC control logic. Switch device off/on. Please contact your service partner if this error occurs again.
		INP2NOSW (13)		DIP switch set incorrectly, short-circuit or cross-circuit in external wiring, error in safety controller or internal error in SBC control logic. Switch device off/on. Please contact your service partner if this error occurs again.
		INTESTDLY (14)		Info: Next start-up delayed by internal test.
		WTG (15)		-
150	6	CH1_global_fail		Gen. error register
150	7	CH1_hw_chan		Channel number
150	8	CH1_rst_reg		Reset register
150	9	CH1_mode		Mode
150	10	CH1_chks1		Controller 1 checksum

ID	Index	Name / Setting	Unit	Description
150	11	CH1_chks2		Controller 2 checksum
150	12	CH1_cdate		Compilation date
150	13	CH1_hdate		Hex file date
150	14	CH1_version		FW version
150	15	CH1_feature		FW status
151		DV_SAFETY_Channel2		Values of safety controller D8026
151	0	CH2_STO1_state		STO1 Status info
		RESET (0)		-
		PWONT (1)		-
		WAIT (2)		Power stage locked (STO). Waiting for both inputs "on".
		TSTAC (3)		-
		ON (4)		Power stage free
		OFF (5)		-
		OFWAIA (6)		Power stage locked (STO). Waiting for both inputs "off".
		INVALID (7)		-
		ERSTAT8 (8)		Error state
		ERSTAT9 (9)		Error state
		ERSTAT10 (10)		Error state
		ERSTAT11 (11)		Error state
		ERSTAT12 (12)		Error state
		ERSTAT13 (13)		-
		ERSTAT14 (14)		Error state
		ERSTAT15 (15)		-
151	1	CH2_STO2_state		STO2 Status info
		RESET (0)		-
		PWONT (1)		-
		WAIT (2)		Power stage locked (STO). Waiting for both inputs "on".
		TSTAC (3)		-
		ON (4)		Power stage free
		OFF (5)		-

Table 17.1: "Status and diagnostics SDO" parameters (continue)

ID	Index	Name / Setting	Unit	Description
		OFWAIA (6)		Power stage locked (STO). Waiting for both inputs "off".
		INVALID (7)		-
		ERSTAT8 (8)		Error state
		ERSTAT9 (9)		Error state
		ERSTAT10 (10)		Error state
		ERSTAT11 (11)		Error state
		ERSTAT12 (12)		Error state
		ERSTAT13 (13)		-
		ERSTAT14 (14)		Error state
		ERSTAT15 (15)		-
151	2	CH2_SBC_state		Brake status
		RESET (0)		-
		PWONT (1)		-
		WAIT (2)		Brake locked. Wait for STO1 inputs "on" and/or release of brake(s) by drive controller.
		TSTOV (3)		-
		WAITMS (4)		-
		ON (5)		Brake actuation enabled by drive controller.
		OFWAIA2 (6)		Brake locked (SBC). Waiting for STO1 CH2 "off".
		OFWAIA1 (7)		Brake locked (SBC). Waiting for STO1 CH1 "off".
		ERSTAT8 (8)		Error state
		ERSTAT9 (9)		Error state
		ERSTAT10 (10)		Error state
		ERSTAT11 (11)		Error state
		ERSTAT12 (12)		Error state
		ERSTAT13 (13)		Error state
		ERSTAT14 (14)		Error state
		ERSTAT15 (15)		Error state
151	3	CH2_STO1_fail		Error status STO1

ID	Index	Name / Setting	Unit	Description
		NOERR (0)		no error
		OVVF (1)		Internal error in range from input to source follower. Switch device off/on. Please contact your service partner if this error occurs again.
		INPON (2)		DIP switch set incorrectly. Input pulse (on time) too short or internal error in range from input to source follower. Check DIP switch setting.
		TIFBDEF (3)		Internal error in voltage controller and emitter follower range. Switch device off/on. Please contact your service partner if this error occurs again.
		INDPEF (4)		Internal error in range from input to diagnostics. Switch device off/on. Please contact your service partner if this error occurs again.
		INTFAIL (5)		DIP switch set incorrectly or internal error in range from input to source follower. Check DIP switch setting. Switch device off/on. Please contact your service partner if this error occurs again.
		EXTEPULSE (6)		Short-circuit or cross-circuit in external wiring. Check external wiring of STO inputs. Switch device off/on. Please contact your service partner if this error occurs again.
		NOBACKMSG (7)		Internal error in voltage controller and emitter follower range. Switch device off/on. Please contact your service partner if this error occurs again.
		INTBACKMSG (8)		-
		UNEXPOFF (9)		-
		INTPULSESP (10)		-
		OVV11 (11)		Internal error in range from input to source follower. Switch device off/on. Please contact your service partner if this error occurs again.

Table 17.1: "Status and diagnostics SD0" parameters (continue)

ID	Index	Name / Setting	Unit	Description
		FRQTOHIGH (12)		External test pulse repeat rate (signature) too high. Check external test pulses. Switch device off/on. Please contact your service partner if this error occurs again.
		INPNOOFF (13)		Input not switching off. Probably short-circuit or cross-circuit in external wiring or defect in external safety controller. Check wiring and safety controller.
		UNUSED14 (14)		Internal error in voltage controller and emitter follower range. Switch device off/on. Please contact your service partner if this error occurs again.
		UNUSED15 (15)		-
151	4	CH2_STO2_fail		Error status STO2
		NOERR (0)		no error
		OVVF (1)		Internal error in range from input to source follower. Switch device off/on. Please contact your service partner if this error occurs again.
		INPON (2)		DIP switch set incorrectly. Input pulse (on time) too short or internal error in range from input to source follower. Check DIP switch setting.
		TIFBDEF (3)		Internal error in voltage controller and emitter follower range. Switch device off/on. Please contact your service partner if this error occurs again.
		INDPEF (4)		Internal error in range from input to diagnostics. Switch device off/on. Please contact your service partner if this error occurs again.
		INTFAIL (5)		DIP switch set incorrectly or internal error in range from input to source follower. Check DIP switch setting. Switch device off/on. Please contact your service partner if this error occurs again.
		EXTEPULSE (6)		Short-circuit or cross-circuit in external wiring. Check external wiring of STO inputs. Switch device off/on. Please

ID	Index	Name / Setting	Unit	Description
				contact your service partner if this error occurs again.
		NOBACKMSG (7)		Internal error in voltage controller and emitter follower range. Switch device off/on. Please contact your service partner if this error occurs again.
		INTBACKMSG (8)	-	
		UNEXPOFF (9)	-	
		INTPULSEP (10)	-	
		OVV11 (11)		Internal error in range from input to source follower. Switch device off/on. Please contact your service partner if this error occurs again.
		FRQTOHIGH (12)		External test pulse (signature) repeat rate too high. Check external test pulses. Switch device off/on. Please contact your service partner if this error occurs again.
		INPNOOFF (13)		Input not switching off. Probably short-circuit or cross-circuit in external wiring or defect in external safety controller. Check wiring and safety controller.
		UNUSED14 (14)		Internal error in voltage controller and emitter follower range. Switch device off/on. Please contact your service partner if this error occurs again.
		UNUSED15 (15)	-	
151	5	CH2_SBC_fail		Brake error status
		NOERR (0)		no error
		MASWOFF (1)		Internal error in master switch. Switch device off/on. Please contact your service partner if this error occurs again.
		MASWON (2)		24V supply outside permissible range or internal error in master switch. Check 24V supply.
		BRKDRV1OFF (3)		Short-circuit in brake 1 supply line or internal error in brake driver range. Check wiring to brake 1. Switch device off/on. Please contact your service partner if this error occurs again.

Table 17.1: "Status and diagnostics SDO" parameters (continue)

ID	Index	Name / Setting	Unit	Description
		BRKDRV2OFF (4)		Short-circuit in brake 2 supply line or internal error in brake driver range. Check wiring to brake 2. Switch device off/on. Please contact your service partner if this error occurs again.
		BRKDRV3OFF (5)		Short-circuit in brake 3 supply line or internal error in brake driver range. Check wiring to brake 3. Switch device off/on. Please contact your service partner if this error occurs again.
		BRKDRV1ON (6)		Short-circuit in brake 1 supply line or internal error in brake driver range. Check supply line to brake 1.
		BRKDRV2ON (7)		Short-circuit in brake 2 supply line or internal error in brake driver range. Check supply line to brake 2.
		BRKDRV3ON (8)		Short-circuit in brake 3 supply line or internal error in brake driver range. Check supply line to brake 3.
		SWOCHK1FAIL (9)		SIP switch set incorrectly, no brake 1 connected, brake 1 supply line interrupted or internal error in brake driver range. Check DIP switch, brake and supply line. Switch device off/on. Please contact your service partner if this error occurs again.
		SWOCHK2FAIL (10)		SIP switch set incorrectly, no brake 2 connected, brake 2 supply line interrupted or internal error in brake driver range. Check DIP switch, brake and supply line. Switch device off/on. Please contact your service partner if this error occurs again.
		SWOCHK3FAIL (11)		SIP switch set incorrectly, no brake 3 connected, brake 3 supply line interrupted or internal error in brake driver range. Switch device off/on. Please contact your service partner if this error occurs again.

ID	Index	Name / Setting	Unit	Description
		INP1NOSW (12)		DIP switch set incorrectly, short-circuit or cross-circuit in external wiring, error in safety controller or internal error in SBC control logic. Switch device off/on. Please contact your service partner if this error occurs again.
		INP2NOSW (13)		DIP switch set incorrectly, short-circuit or cross-circuit in external wiring, error in safety controller or internal error in SBC control logic. Switch device off/on. Please contact your service partner if this error occurs again.
		INTESTDLY (14)		Info: Next start-up delayed by internal test.
		WTG (15)		-
151	6	CH2_global_fail		Gen. error register
151	7	CH2_hw_chan		Channel number
151	8	CH2_rst_reg		Reset register
151	9	CH2_mode		Mode
151	10	CH2_chks1		Controller 1 checksum
151	11	CH2_chks2		Controller 2 checksum
151	12	CH2_cdate		Compilation date
151	13	CH2_hdate		Hex file date
151	14	CH2_version		Firmware version, bit 8..15-> patchlevel, bit 16..23-> minor version, bit 24..31 major version number
151	15	CH2_feature		FW status
152		DV_SAFETY_Status		Contains status information about STO and SBC
152	0	StateSTO		Safety torque off state of 3 axis
152	1	StateBrakeAllAxis		Brake status of all axes in one byte
152	2	StateDiag		failure state

Table 17.1: "Status and diagnostics SD0" parameters (continue)

## 17.2 SDC Safety functionality

Malfunctions of the drive controller must be detected through higher-level monitoring of the movement or through other measures in the application. The detection and the reaction to this are the responsibility of the user. The safety system provides the safety functions STO and SBC which can be used by the user as a reaction to malfunctions of the drive controller in the application.

The safety control of the SDC device version of the ServoOne CM axis controller is certified according to the requirements of EN ISO 13849-1 "PL e / Cat. 4" and EN 61508 / EN 62061 "SIL CL 3".

For more information refer to ServoOne CM Specification SDC, ID No.:1400.206B.x.



All of the further applicable documents for this device can be found on our website:

[www.keba.com](http://www.keba.com) in the DOCU-PORTAL.

## 17.2.1 Status and diagnostics SDC

### Status and diagnosis

Operational mode SDC **RUN**

Status of safe digital inputs

- ☒ SDI00
- ☒ SDI01
- ☒ SDI02
- ☒ SDI03

SafePLC-Program

CRC: 423DFF5Bh  
1111359323

Status validation: unlocked

Configuration FSoE

FSoE Address - Connection 1	5
FSoE Address - Connection 2	6
FSoE Address - Connection 3	7

SRA CRC: 00000000h

LDV CRC: 00000000h

PDV CRC: 00000000h

PEV CRC: 00000000h

Fig. 17.2: "Status and diagnostics (SDC)" dialog box



#### NOTE

- This dialog box is only valid for Axis Controller with safety functionality SDC, SO CM-x.xxxx.x2xx.x, SO CM-x.xxxx.x3xx.x, SO CM-x.xxxx.x4xx.x or SO CM-x.xxxx.x5xx.x.
- It is *not* valid for Axis Controller with safety functionality SD0 (STO + SBC), SO CM-x.xxxx.x1xx.0.

ID	Index	Name / Setting	Unit	Description
154		DV_SAFETY_SR_Status		Status of the safety controller
154	0	Status_SR1		Status of SR1
154	1	Status_SR2		Status of SR2
155		DV_SAFETY_Error_Info_SR1		Error information from the SR1 safety controller
155	0	DV_SAFETY_Error_Info_SR1		Error code
155	1	DV_SAFETY_Error_Info_SR1		Row
155	2	DV_SAFETY_Error_Info_SR1		File ID
155	3	DV_SAFETY_Error_Info_SR1		Additional information
156		DV_SAFETY_Error_Info_SR2		Error information from the SR2 safety controller
156	0	DV_SAFETY_Error_Info_SR2		Error code
156	1	DV_SAFETY_Error_Info_SR2		Row
156	2	DV_SAFETY_Error_Info_SR2		File ID
156	3	DV_SAFETY_Error_Info_SR2		Additional information
157		DV_SAFETY_FW_Version_SR1		Information about FW and HW version of the SR1.
157	0	DV_SAFETY_Fw		FW version SR1.  Note: The Values of P157 and P158 must be identical.
157	1	DV_SAFETY_HwConfig_SR1		HW configuration SR1. IO-Expander function for SDC
157	2	DV_SAFETY_SerialNumber_SR1		Serial number in SR1 production data
158		DV_SAFETY_FW_Version_SR2		Information about FW and HW version of the SR2.
158	0	DV_SAFETY_Fw		FW version of SR2.  Note: The Values of P157 and P158 must be identical.
158	1	DV_SAFETY_HwConfig_SR2		HW configuration SR2. IO-Expander function for SDC
158	2	DV_SAFETY_SerialNumber_SR2		Serial number in SR2 production data
159		DV_SAFETY_CRC_Info		CRC of safety firmware and production data

Table 17.2: "Status and diagnostics (SDC)" parameters

ID	Index	Name / Setting	Unit	Description
159	0	DV_SAFETY_CRC_Info		CRC32 of the SR1 safety firmware
159	1	DV_SAFETY_CRC_Info		CRC32 of the SR2 safety firmware
159	2	DV_SAFETY_CRC_Info		CRC16 of the SR1 BIOS firmware
159	3	DV_SAFETY_CRC_Info		CRC16 of the SR2 BIOS firmware
159	4	DV_SAFETY_CRC_Info		CRC16 of SR1 production data
159	5	DV_SAFETY_CRC_Info		CRC16 of SR2 production data
161		DV_SAFETY_DiagDataSR1		SR1 diagnostics data
161	0	DV_SAFETY_DiagDataSR1		Configuration data of SDC
161	1	DV_SAFETY_DiagDataSR1		Process data of SDC
161	2	DV_SAFETY_DiagDataSR1		DIP switch setting
161	3	DV_SAFETY_DiagDataSR1		Status of inputs and external test pulses
		Bit 0: Status ISSD0		
		Bit 1: Diagnosis ext. test pulse valid ISSD0		
		Bit 2: reserved		
		Bit 3: Status ISSD 1		
		Bit 4: Diagnosis ext. test pulse valid ISSD1		
		Bit 5: reserved		
		Bit 6: Status ISSD2		
		Bit 7: Diagnosis ext. test pulse valid ISSD2		
		Bit 8: reserved		
		Bit 9: Status ISSD3		
		Bit 10: Diagnosis ext. test pulse valid ISSD3		
		Bit 11: reserved		
161	4	DV_SAFETY_DiagDataSR1		State of safe outputs
161	5	DV_SAFETY_DiagDataSR2		State of SDC
162		DV_SAFETY_DiagDataSR2		SR2 diagnostics data
162	0	DV_SAFETY_DiagDataSR2		Configuration data of SDC
162	1	DV_SAFETY_DiagDataSR2		Process data of SDC
162	2	DV_SAFETY_DiagDataSR2		DIP switch setting
162	3	DV_SAFETY_DiagDataSR2		Status of inputs and external test pulses

Table 17.2: "Status and diagnostics (SDC)" parameters (continue)

ID	Index	Name / Setting	Unit	Description
		Bit 0: Status ISSD0		
		Bit 1: Diagnosis ext. test pulse valid ISSD0		
		Bit 2: reserved		
		Bit 3: Status ISSD 1		
		Bit 4: Diagnosis ext. test pulse valid ISSD1		
		Bit 5: reserved		
		Bit 6: Status ISSD2		
		Bit 7: Diagnosis ext. test pulse valid ISSD2		
		Bit 8: reserved		
		Bit 9: Status ISSD3		
		Bit 10: Diagnosis ext. test pulse valid ISSD3		
		Bit 11: reserved		
162	4	DV_SAFETY_DiagDataSR2		State of safe outputs
162	5	DV_SAFETY_DiagDataSR2		State of SDC
183		SDC_DiagData		SDC option diagnostics data
183	0	SDC_State		Actual state of SDC option
		Undefined (0)		
		Sync A-B (1)		Init-State
		Check Config (2)		Init-State
		Startup (3)		Init-State
		Run (4)		Normal PLC operation
		Stop (5)		PLC stopped
		Fatal Error (6)		Fatal error state
		Alarm (7)		Alarm state
		Wait Bus Config (8)		PreRun state – wait for FSoE
		EtherCAT Init (9)		Init-State
		Check Config 2 (10)		Init-State
		EtherCAT Init 2 (11)		Init-State
		Undefined1 (12)		Init-State

ID	Index	Name / Setting	Unit	Description
		Undefined2 (13)		Init-State
		Undefined3 (14)		Init-State
		Undefined4 (15)		Init-State
183	1	SDC_AliveCnt		Alive counter of SDC option
280	0	MPRO_INPUT_SysState		Status of digital inputs
2310	0	MPRO_BRK_Lock_AX1		Axis 1: Brake man. Vent
		Off (0)		Function not active
		Lock (1)		Motor brake locked
		Open (2)		Motor brake vented
2313	0	MPRO_BRK_Status_AX1		Axis 1: Motor brake status
2318	0	MPRO_OUTPUT_FS_MOTBRK_AX1		Axis 1: Motor brake selector
		NONE (0)		No function
		INT (1)		Motor brake connected to drive
		EXT (2)		External motor brake without feedback
		FEEDB (3)		External motor brake with feedback
		INT_FEEDB (4)		Internal motor brake and external brake with feedback
		SDC (5)		Internal motor brake is controlled by SDC option
<b>ENC_CH3_Settings</b>				
2874		ENC_CH3_Settings		Axis 1/2/3: Channel 3 Hiperface DSL settings
2874	0	Select		Channel 3 encoder selection
		None (0)		No encoder selected.
		HDSL (6)		Hiperface DSL (2-wire interface)
		HDSL_SDC (11)		Hiperface DSL 2-wire interface (via SDC option)
4358	0	MPRO_BRK_Lock_AX2		Axis 2: Bleed brake man. Vent
		Off (0)		Function not active
		Lock (1)		Motor brake locked
		Open (2)		Motor brake vented
4361	0	MPRO_BRK_Status_AX2		Axis 2: Motor brake status
4366	0	MPRO_OUTPUT_FS_MOTBRK_AX2		Axis 2: Motor brake selector
		NONE (0)		No function
		INT (1)		Motor brake connected to drive

Table 17.2: "Status and diagnostics (SDC)" parameters (continue)

ID	Index	Name / Setting	Unit	Description
		EXT (2)		External motor brake without feedback
		FEEDB (3)		External motor brake with feedback
		INT_FEEDB (4)		Internal motor brake and external brake with feedback
		SDC (5)		Internal Motor brake controlled only by functional safety
6406	0	MPRO_BRK_Lock_AX3		Axis 3: Bleed brake man. Vent
		Off (0)		Function not active
		Lock (1)		Motor brake locked
		Open (2)		Motor brake vented
6409	0	MPRO_BRK_Status_AX3		Axis 3: Motor brake status
6414	0	MPRO_OUTPUT_FS_MOTBRK_AX3		Axis 3: Motor brake selector
		NONE (0)		No function
		INT (1)		Motor brake connected to drive
		EXT (2)		External motor brake without feedback
		FEEDB (3)		External motor brake with feedback
		INT_FEEDB (4)		Internal motor brake and external brake with feedback
		SDC (5)		Internal motor brake is controlled by SDC option.
129408		DeviceSafetyAddress		Safe device addresses
129408	0	NumberOfEntries		Number of subindices
129408	1	FSoE_AddressAxis1		FSoE address Instance 1
129408	2	FSoE_AddressAxis2		FSoE address Instance 2
129408	3	FSoE_AddressAxis3		FSoE address Instance 3
129408	4	FSoE_AddressAxis4		FSoE address Instance 4
132609	0	ErrorCodeSDC		SDC option error code
132612		SRA_CRC <sup>1)</sup>		SRA-CRC as transmitted from SafetyMaster. (Only if SRA-Parameter method is used)
132613		LDV_CRC <sup>1)</sup>		LDV CRC (PLC Program Data) (Only with FSoE)
132614		PDV_CRC <sup>1)</sup>		PDV CRC (Configuration Parameter Data) (Only with FSoE)
132615		PEV_CRC <sup>1)</sup>		PEV CRC (Parameter List) (Only with FSoE)



ID	Index	Name / Setting	Unit	Description
132616		ValidationLock		Lock configuration. This Parameter indicates (if read) if the current configuration is locked (see validation process). Writing another value than zero to this parameter via CoE start trying to lock the configuration. (Value stays 1 if successful)
132624		QuitAlarm		Alarm acknowledgement SDC option. Writing a 0-1-0 sequence within 3s to this parameter via CoE will force an alarm reset on the SDC System.
132640		TypeLabelDevice		Type Label Device
132640	0	Device Name		Device name of SDC option
132640	1	Software Version		Software version of the SDC option
132640	2	Hardware Version		Hardware version of the SDC option
132640	3	DeviceID		Device ID (configuration variant) of the SDC option
132640	4	FPGA_version		FPGA version of the SDC option
132640	5	SerialNumber		Serial number of the SDC option
132640	6	CRC_ConfigData		CRC for configuration data
132640	7	CRC_PLC_data		CRC for PLC data
132640	8	CRC_SRA		CRC for SRA data
132640	9	CRC_FirmwareCPU_A		CRC for firmware of the CPU A of the SDC option
132640	10	CRC_FirmwareCPU_B		CRC for firmware of the CPU B of the SDC option

<sup>1)</sup> These CRCs must have either a 0 or a value that is valid for the current configuration written to them by the FSoE master. The validation process can only be completed when valid values are present.

Table 17.2: "Status and diagnostics (SDC)" parameters (continue)

### SDC support for safe HDSL encoder

In order to use the HDSL encoder with safety, the encoder must be correctly configured in the safety manager program and ENC\_CH3\_settings **P 2874[0] - Select** must be set to "HDSL\_SDC(11)= Hiperface DSL 2 Wire Interface (via Functional Safety)".

If HDSL is used without safety, then the encoder must not be configured in the safety manager program, and ENC\_CH3\_settings **P 2874[0] - Select** must be set to "HDSL (6)= Hiperface-DSL (2-Draht-Interface)".

### SDC support: EtherCat/FSoE

Use the DIL switch to configure bit 11 .. 2 of the FSoE address. Bit 1 .. 0 of the FSoE address is allocated by the SDC system automatically.

If FSoE is used, then the first FSoE connection must always be active. The other connections can be used optionally.

## 17.2.2 Device encoder

### Source configuration of the device encoder

Axis 1

Axis 2

Axis 3

Fig. 17.3: "Device encoder (SDC)" dialog box



#### NOTE

- This dialog box is only valid for Axis Controller with safety functionality SDC, SO CM-x.xxxx.x2xx.x, SO CM-x.xxxx.x3xx.x, SO CM-x.xxxx.x4xx.x or SO CM-x.xxxx.x5xx.x.
- It is *not* valid for Axis Controller with safety functionality SD0 (STO + SBC), SO CM-x.xxxx.x1xx.x.

ID	Index	Name / Setting	Unit	Description
3073	0	ENC_CH_SDCSel		Axis 1: Encoder channel selection for safe SDC position
		CH1 (0) Multi Encoder Interface		Send nonsafe Position from Encoder Ch1 to SDC
		CH2 (1) Single Encoder Interface		Send nonsafe Position from Encoder Ch2 to SDC
		CH3 (2) encoder via motor cable		Send nonsafe Position from Encoder Ch3 to SDCSDC
5121	0	ENC_CH_SDCSel		Axis 2: Encoder channel selection for safe SDC position
		CH1 (0)		Multi-Encoder Interface
		CH2 (1)		Single Encoder Interface
		CH3 (2)		Encoder via motor cable
7169	0	ENC_CH_SDCSel		Axis 3: Encoder channel selection for safe SDC position
		CH1 (0)		Multi-Encoder Interface
		CH2 (1)		Single Encoder Interface
		CH3 (2)		Encoder via motor cable

Table 17.3: "Device encoder (SDC)" parameters

The parameter ENC\_CH\_SDCSel **P 3073[0]** is used to set the channel for the use of an encoder combination for SDC Safety with a "Drive Encoder" or "SSI Absolute Encoder".

For more information on possible encoder combinations, refer to ServoOne CM Specification SDC, ID No.:1400.206B.x.

## 17.2.3 Functional inputs

### Functional inputs

**Functional selection for functional inputs (Byte 0)**

Status FE1 to FE8

**(Byte 2)**

FE1 OFF(0) = no special function selected
 FE2 OFF(0) = no special function selected
 FE3 OFF(0) = no special function selected
 FE4 OFF(0) = no special function selected
 FE5 OFF(0) = no special function selected
 FE6 OFF(0) = no special function selected
 FE7 OFF(0) = no special function selected
 FE8 OFF(0) = no special function selected

Status of byte 2

**Functional selection for functional inputs (Byte 1)**

Status FE9 to FE16

**(Byte 3)**

FE9 OFF(0) = no special function selected
 FE10 OFF(0) = no special function selected
 FE11 OFF(0) = no special function selected
 FE12 OFF(0) = no special function selected
 FE13 OFF(0) = no special function selected
 FE14 OFF(0) = no special function selected
 FE15 OFF(0) = no special function selected
 FE16 OFF(0) = no special function selected

Status of byte 3

Fig. 17.4: "Functional inputs (SDC)" dialog box



### NOTE

- This dialog box is only valid for Axis Controller with safety functionality SDC, SO CM-x.xxxx.x2xx.x, SO CM-x.xxxx.x3xx.x, SO CM-x.xxxx.x4xx.x or SO CM-x.xxxx.x5xx.x.
- It is *not* valid for Axis Controller with safety functionality SD0 (STO + SBC), SO CM-x.xxxx.x1xx.x.

P No.	Index	Name / Setting	Unit	Description
180		FunctionalInputs		Functional inputs on the SafePLC
180	0	FunctionalInputs0		Functional inputs (bits: 1...8) of SafePLC
180	1	FunctionalInputs1		Functional inputs (bits: 9...16) of SafePLC
180	2	FunctionalInputs2		Functional inputs (bits: 17...24) of SafePLC
180	3	FunctionalInputs3		Functional inputs (bits: 25...32) of SafePLC
193		FunctionalInputSelect		Special function for SDC bit Functional Input
193	0	FunctionalInputSelect_1		Special function for SDC bit Functional Input 1
193	1	FunctionalInputSelect_2		Special function for SDC bit Functional Input 2
193	2	FunctionalInputSelect_3		Special function for SDC bit Functional Input 3
193	3	FunctionalInputSelect_4		Special function for SDC bit Functional Input 4
193	4	FunctionalInputSelect_5		Special function for SDC bit Functional Input 5
193	5	FunctionalInputSelect_6		Special function for SDC bit Functional Input 6
193	6	FunctionalInputSelect_7		Special function for SDC bit Functional Input 7
193	7	FunctionalInputSelect_8		Special function for SDC bit Functional Input 8
193	8	FunctionalInputSelect_9		Special function for SDC bit Functional Input 9
193	9	FunctionalInputSelect_10		Special function for SDC bit Functional Input 10
193	10	FunctionalInputSelect_11		Special function for SDC bit Functional Input 11
193	11	FunctionalInputSelect_12		Special function for SDC bit Functional Input 12
193	12	FunctionalInputSelect_13		Special function for SDC bit Functional Input 13

Table 17.4: "Safety - Functional inputs (SDC)" parameters

P No.	Index	Name / Setting	Unit	Description
193	13	FunctionalInputSelect_14		Special function for SDC bit Functional Input 14
193	14	FunctionalInputSelect_15		Special function for SDC bit Functional Input 15
193	15	FunctionalInputSelect_16		Special function for SDC bit Functional Input 16
For P 193 Index 0-15 the following settings are possible:		Off (0)		no special function selected
		STA_ISD00 (1)		State of input ISD00
		STA_ISD01 (2)		State of input ISD01
		STA_ISD02 (3)		State of input ISD02
		STA_ISD03 (4)		State of input ISD03
		STA_ISD04 (5)		State of input ISD04
		STA_ISD05 (6)		State of input ISD05
		STA_ISD06 (7)		State of input ISD06
		STA_ISD07 (8)		State of input ISD07
		STA_ISD08 (9)		State of input ISD08
		STA_ISD09 (10)		State of input ISD09
		STA_ISD10 (11)		State of input ISD10
		AXIS1_RDY (12)		Axis 1 ready for start
		AXIS2_RDY (13)		Axis 2 ready for start
		AXIS3_RDY (14)		Axis 3 ready for start
		AXIS1_ACTIV (15)		Power stage axis 1 active
		AXIS2_ACTIV (16)		Power stage axis 2 active
		AXIS3_ACTIV (17)		Power stage axis 3 active
		AXIS1_FAULT (18)		Fault on axis 1
		AXIS2_FAULT (19)		Fault on axis 2
		AXIS3_FAULT (20)		Fault on axis 3
		AXIS1_WARN (21)		Warning on axis 1
		AXIS2_WARN (22)		Warning on axis 2
		AXIS3_WARN (23)		Warning on axis 3
195		FunctionalInputsAct		Functional inputs and SafePLC after

P No.	Index	Name / Setting	Unit	Description
				selection
195	0	FunctionalInputsAct0		Functional inputs (bits: 1...8)
195	1	FunctionalInputsAct1		Functional inputs (bits: 9...16)
195	2	FunctionalInputsAct2		Functional inputs (bits: 17...24)
195	3	FunctionalInputsAct3		Functional inputs (bits: 25...32)

Table 17.4: "Safety - Functional inputs (SDC)" parameters (continue)

### Functional inputs SDC

There is 32-bit (4 byte) non-secure input data of the functional firmware which can be used by the SafePLC program.

Use **P 180 - Functional Inputs** to set setpoint values.

With **P 193 - FunctionalInputSelect**, alternative functions can be selected for the first 16 bits (1...23).

Use **P 195 - FunctionalInputsAct** to display the current input value of the SafePLC program.

## 17.2.4 Functional outputs

### Functional outputs

**Functional selection for functional outputs (Byte 0)**

Status FA1 to FA8

FA1	OFF(0) = no special function triggered	●	(Byte 1)	Status of byte 1	(Byte 4)	Status of byte 4
FA2	OFF(0) = no special function triggered	●	(Byte 2)	Status of byte 2	(Byte 5)	Status of byte 5
FA3	OFF(0) = no special function triggered	●	(Byte 3)	Status of byte 3	(Byte 6)	Status of byte 6
FA4	OFF(0) = no special function triggered	●				
FA5	OFF(0) = no special function triggered	●				
FA6	OFF(0) = no special function triggered	●				
FA7	OFF(0) = no special function triggered	●				
FA8	OFF(0) = no special function triggered	●				

Fig. 17.5: "Functional outputs (SDC)" dialog box



### NOTE

- This dialog box is only valid for Axis Controller with safety functionality SDC, SO CM-x.xxxx.x2xx.x, SO CM-x.xxxx.x3xx.x, SO CM-x.xxxx.x4xx.x or SO CM-x.xxxx.x5xx.x.
- It is *not* valid for Axis Controller with safety functionality SD0 (STO + SBC), SO CM-x.xxxx.x1xx.x.

P No.	Index	Name / Setting	Unit	Description
181		FunctionalOutputs		Functional outputs of the SafePLC
181	0	FunctionalOutput0		Functional outputs (bits: 1...8)
181	1	FunctionalOutput1		Functional outputs (bits: 9...16)
181	2	FunctionalOutput2		Functional outputs (bits: 17...24)
181	3	FunctionalOutput3		Functional outputs (bits: 25...32)
181	4	FunctionalOutput4		Functional outputs (bits: 33...40)
181	5	FunctionalOutput5		Functional outputs (bits: 41...48)
181	6	FunctionalOutput6		Functional outputs (bits: 49...56)
194		FunctionalOutputSelect		Special function for SDC bit Functional Output
194	0	FunctionalOutputSelect_1		Special function for SDC bit Functional Output 1
194	1	FunctionalOutputSelect_2		Special function for SDC bit Functional Output 2
194	2	FunctionalOutputSelect_3		Special function for SDC bit Functional Output 3
194	3	FunctionalOutputSelect_4		Special function for SDC bit Functional Output 4
194	4	FunctionalOutputSelect_5		Special function for SDC bit Functional Output 5
194	5	FunctionalOutputSelect_6		Special function for SDC bit Functional Output 6
194	6	FunctionalOutputSelect_7		Special function for SDC bit Functional Output 7
194	7	FunctionalOutputSelect_8		Special function for SDC bit Functional Output 8
For P 194 Index 0-7 the following settings are		Off (0)		no special function triggered

Table 17.5: "Functional outputs (SDC)" parameters

P No.	Index	Name / Setting	Unit	Description
possible:				
		AXIS1_QuickStop (1)		Quick stop command for axis 1 (low active)
		AXIS2_QuickStop (2)		Quick stop command for axis 2 (low active)
		AXIS3_QuickStop (3)		Quick stop command for axis 3 (low active)
		AXIS1_Halt (4)		Stop command for axis 1 (low active)
		AXIS2_Halt (5)		Stop command for axis 2 (low active)
		AXIS3_Halt (6)		Stop command for axis 3 (low active)

Table 17.5: "Functional outputs (SDC)" parameters (continue)

## 17.2.5 Safe encoder (actual values)

The parameters **P 189** and **P 190** are used to display the values for position and speed from the Safety SDC System using a refresh rate of 4 ms.

**P 189** shows the values of safety channel A and **P 190** shows the values of safety channel B. These values can be displayed with the scope function for commissioning and debugging.

### Safe encoder actual values

	System A	System B
<b>Axis 1:</b>		
Safe position	249998	249998
Safe speed	0	0
<b>Axis 2:</b>		
Safe position	250	248
Safe speed	0	0
<b>Axis 3:</b>		
Safe position	249998	249998
Safe speed	0	0

Fig. 17.6: Safe encoder actual values

P No.	Index	Name / Setting	Unit	Description
189		SDC_SafeActualValues_A		Encoder data from SafePLC System A
189	0	SafePositionAxis1_A		Safe position of axis 1 - System A (pass 1)
189	1	SafePositionAxis2_A		Safe position of axis 2 - System A (pass 1)
189	2	SafePositionAxis3_A		Safe position of axis 3 - System A (pass 1)
189	3	SafeSpeedAxis1_A		Safe speed of axis 1 - System A (pass 1)
189	4	SafeSpeedAxis2_A		Safe speed of axis 2 - System A (pass 1)

Table 17.6: Parameter "Safety - Safe encoder actual values (SDC)"

P No.	Index	Name / Setting	Unit	Description
189	5	SafeSpeedAxis3_A		Safe speed of axis 3 - System A (pass 1)
190		SDC_SafeActualValues_B		Encoder data from SafePLC System B
190	0	SafePositionAxis1_B		Safe position of axis 1 - System B (pass 1)
190	1	SafePositionAxis2_B		Safe position of axis 2 - System B (pass 1)
190	2	SafePositionAxis3_B		Safe position of axis 3 - System B (pass 1)
190	3	SafeSpeedAxis1_B		Safe speed of axis 1 - System B (pass 1)
190	4	SafeSpeedAxis2_B		Safe speed of axis 2 - System B (pass 1)
190	5	SafeSpeedAxis3_B		Safe speed of axis 3 - System B (pass 1)

Table 17.6: Parameter "Safety - Safe encoder actual values (SDC)" (continue)




#### NOTE

- The resolution and display of these values depends on the settings of the encoder in the safety manager program. A factor for the speed and position can be found there which must be taken into account for the displayed values.

#### Example:

Position factor 1000; position in **P 189.0**: 249998 ----> real position: 249.998.

# 18 Utilization monitor

Chapter overview	
Pictogram	
Navigation	<ul style="list-style-type: none"> <li>► Project tree ► Device ► Utilization monitor</li> <li>► Project tree ► Axis adjustment ► X axis ► Utilization monitor</li> </ul>
Brief description	The following chapter describes the option for displaying the degree of utilization of the supply unit, brake chopper and DC link capacity (device and supply unit) on the system level as well as the power stage and motor on the axis level (axis).
Contents	<ul style="list-style-type: none"> <li>18.1 System utilization monitor ..... 571</li> <li>18.2 Axis ..... 574</li> </ul>

## 18.1 System utilization monitor

**System utilization monitor**

Cycle time of working cycle  s

Actual cycle time 0 s

---

**Power supply unit (PSU), brake chopper and system utilization**

PSU nominal load	0	%
PSU short time overload (I <sub>2t</sub> )	0	%
PSU peak load	0	%
Brake chopper nominal load	0	%
Brake chopper peak load	0	%
DC-Link capacity load	0	%

Fig. 18.1: "Device monitoring" dialog box

A utilization monitor is available for analysing the utilization of the axis group (Supply unit and ServoOne CM). It is activated by setting the process cycle time in the box **“Cycle time of a work cycle”** (P 1004[0] - MON\_Load\_Device\_CycleTime) on the 1st drive after the Supply unit for all components on the DC link. As a result, the utilization parameters are determined that provide an overview for the dimensioning of the components installed.

The time until the end of the current work cycle is shown in the **“Current cycle time”** field. After “Stop”, the calculation in the current cycle is cancelled; the data from the last complete cycle remain stored.

**“Data export”** can be used to export all utilization parameters of a ServoOne CM or of a partial system of a ServoOne CM-P to an .xls spreadsheet.

The following utilization parameters are determined:

Characteristic parameter	Determination	Interpretation
PSU nominal load	The maximum values of the three currents (Scope index 1921, 22 and 23) in the three mains phases are recorded for one full mains period respectively. This maximum value is in Scope index 1937. This value (1937) is squared every 20 ms and the result is added up over the entire measurement cycle. At the end of the measurement cycle, the sum is divided by the number of sums (20 ms ticks). Then the square root of this value is taken. The result is then set in proportion to the current value of the I2t inception threshold (P 652-1) and is transferred to P 1005-0 as a percentage.	Mean current of the supply unit in proportion to the rated current in %. If the value is too large, a larger supply unit is required.
PSU short-time overload (I2t)	Maximum value of the I2t counter.	Maximum value of the I2t counter.
PSU peak load	Maximum effective value during a measuring period in proportion to the i2ts value (P 652-1).	Peak current of the supply unit in proportion to the i2ts current limit in %. If the value is too large, a larger supply unit is required.

Table 18.1: Utilization parameters

Characteristic parameter	Determination	Interpretation
Brake chopper nominal load	Starting with the braking power (Scope Id 1935), the power is added up every 20 ms throughout the measurement cycle and the mean value is determined at the end of the cycle. This mean braking power is set in proportion to the setting for the inception threshold of the PxT monitoring (P 713-0, P 712-1 or P 653-1) and shown as a percentage in P 1005-3.	Utilisation of the brake chopper relative to the set PxT continuous power. If the value is too high, a brake chopper with a higher continuous power rating must be used.
Brake chopper peak load	Maximum braking power in a measuring cycle in proportion to the setting for the maximum threshold of the PxT monitoring (P 713-0, P 712-2 or P 653-2).	Greatest dissipated power relative to the maximum power. Utilization of the brake chopper relative to the set PxT peak power. If the value is too high, a brake chopper with a higher momentary power rating must be used. Check the minimum permissible resistance in the Operation Manual!
DC link capacity load	Measured DC link capacity in relation to the mean DC link power in % of the required DC link capacity per kW.	As the load goes up, faster ageing of the DC link capacity must be expected. The required DC link capacity per kW depends on the supply voltage and can be seen in the Operation Manual.

Table 18.1: Utilization parameters (continue)



P No.	Index	Name / Setting	Unit	Description	EtherCAT object ID	Index
1004	0	MON_Load_Device_CycleTime	s	Cycle time for work load analysis, 0 = not active.	23EC	
1005		MON_Load_Device_Values		Actual device values of load monitoring.	23ED	
1005	0	ThermalLoadVsu <sup>1)</sup>	%	Supply unit thermal load, vsu rms grid max current (scope id 1937) over one period to vsu i2t current (see <b>P 652-1</b> ) ratio.	23ED	0001
1005	1	I2tUsageVsu <sup>1)</sup>	%	Maximum I2t usage of supply unit, maximum value of i2t counter (scope id 1934).	23ED	0002
1005	2	PeakLoadVsu <sup>1)</sup>	%	Maximum overload of supply unit, maximum vsu rms grid current (scope id 1937) over one period to vsu i2ts current (see <b>P 652-2</b> ) ratio.	23ED	0003
1005	3	VsuChopperLoadRatio <sup>1)</sup>	%	Average chopper power, vsu avg chopper power (scope id 1935 or <b>P 704-23</b> ) over one period to chopper pxt power (see <b>P 712-1</b> or <b>P 653-1</b> ) ratio.	23ED	0004
1005	4	VsuMaxChopperLoadRatio <sup>1)</sup>	%	Max. chopper power, vsu maximum chopper power (scope id 1935 or <b>P 704-23</b> ) in one period to chopper pxt power (see <b>P 712-2</b> or <b>P 653-2</b> ) ratio.	23ED	0005
1005	5	PowToCap	%	Capacity load, vsu rms load Current (scope id	23ED	0006

Table 18.2: "Monitoring control and Supply unit"parameter

P No.	Index	Name / Setting	Unit	Description	EtherCAT object ID	Index
				1911 or <b>P 704-21</b> ) at 560 V to capacity (see <b>P 704-34</b> ) ratio, 1kW / 100uF is 100%.		
1005	6	ActualCycleTime	s	Actual measuring cycle time.	23ED	0007
1006	0	MON_Load_Device_Control 0 (OFF) = Utilization monitor on Work load calculation off 1 (ON) = Utilization monitor off Work load calculation on		Start work load cycle.	23EE	0000

1) The query is made via the first axis controller of the axis group.

Table 18.2: "Monitoring control and Supply unit"parameter (continue)

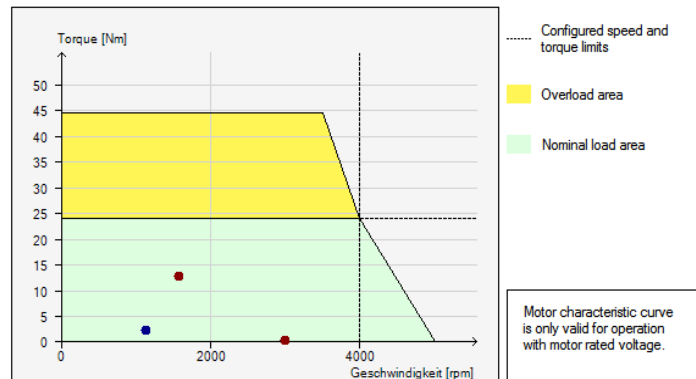
## 18.2 Axis

### Axis utilization

	Power stage			Motor			
Nominal load	0 %			0 %			
Short time overload (I <sub>2t</sub> )	0 %			0 %			
Peak load	0 %			0 %			
Maximum temperature	0 degC	of	100 degC	0 degC	of	100 degC	
Encoder maximum temperature				0 degC	of	0 degC	
Inertia ratio				0	:	1	

Export Data

### Motor utilization and motor characteristic curve



#### Mean values

Torque: 0 Nm  
Speed: 0 rpm

#### Maximum values

Torque: 0 Nm at 0 rpm  
Speed: 0 rpm at 0 Nm

The axis level displays the utilization parameters for the power stage, motor and encoder. A comparison with the motor characteristic is also possible. Operation is carried out via the “System utilization monitor” on the 1st device after the supply unit.

“Data export” can be used to export all utilization parameters of a ServoOne CM or of a partial system of a ServoOne CM-P to an .xls spreadsheet.

Characteristic parameter	Determination	Interpretation
Rated load (thermal utilization)	Average load of the axis in % of the rated current	
Short-term overload (I <sub>2t</sub> )	Maximum value of the I <sub>2t</sub> counter	The value rises the longer and the higher the device is operated in the overload range.
Peak load	Maximum load of a device in % of the maximum current	
Maximum temperature (power stage, motor)	Maximum value of the measured temperature	The maximum measured temperature should not be too close to the temperature limit of the component. Include reserves in the planning if operation is to take place at locations with a high ambient temperature!
Encoder maximum temperature	Maximum value of the measured temperature	The maximum measured temperature should not be too close to the temperature limit of the component. Include reserves in the planning if operation is to take place at locations with a high ambient temperature!
Inertia ratio	Load mass inertia to motor mass inertia	If the ratio become to great, the performance of the position control may be reduced. <b>Rectification:</b> Use a gear unit with a higher gear reduction. The load inertia moment is determined after “Automatic mass inertia definition” is executed (see also section “Automatic mass inertia definition” on page 121).

Table 18.3: Utilization parameters

### Motor utilization and motor characteristic curve:

Fig. 18.2: “Monitoring – Axis” dialog box

The following graphic shows an example based on a synchronous motor characteristic curve at the nominal voltage. The constant load range (green area) is defined by the points stall torque **P 3074[12] - StandStillTorque**, nominal point **P 2964[4] - MOT\_TNom** (torque) and **P 2964[2] - MOT\_SNom** (speed) and no-load speed **P 3074[11] - NoLoadSpeed**. If the maximum speed is parametrized at the maximum torque (**P 3075[1] - SMax\_at\_TMax**), the overload range (yellow area) of the motor is also displayed. In addition, the parametrized speed limitation and torque limitation are also plotted. The parameters are a part of the motor data set.

In this graphic, a point with an average speed and torque is plotted (**P 3074[6] - Effective Torque** (torque) and **P 3074[7] - AverageSpeed** (speed)). It must be located within the constant load range (blue point). In addition, the operating points with the maximum torque and maximum speed derived from the torque/speed history are plotted (**P 3074[9] - MaxMotorTorque** (torque) and **P 3074[10] - MaxMotorSpeed** (speed)). These must be within the limits for the overload range and within the speed/torque limits.

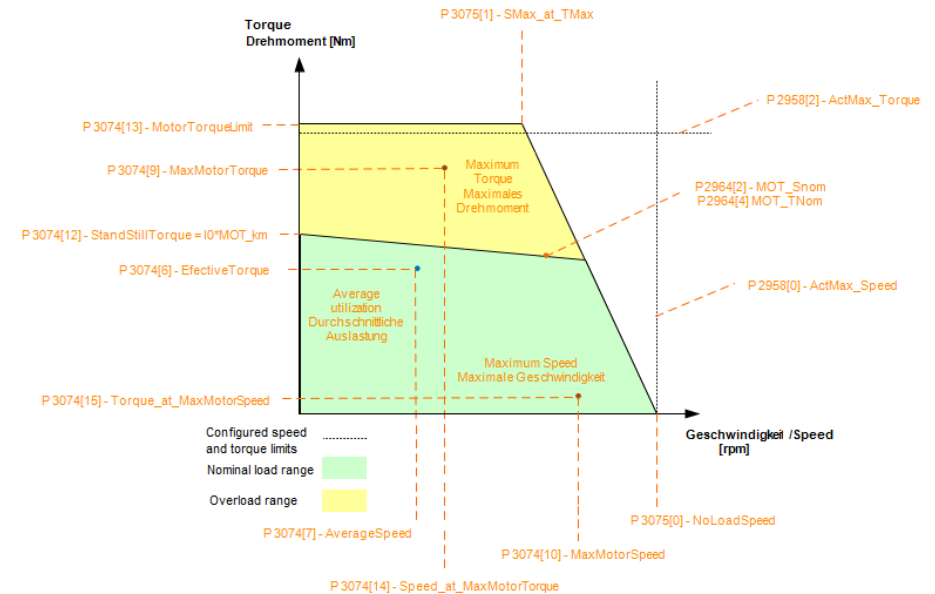


Fig. 18.3: Example of a motor characteristic curve



#### NOTE

- The motor characteristic curve shown only presents an approximation of the real characteristic curve and is only valid for operation at the nominal motor voltage.

P No.	Index	Name / Setting	Unit	Description	EtherCAT object ID	Index
3049 / 5097 / 7145		MON_ActValues		Axis 1: Actual values	2BE9	
3049 / 5097 / 7145	0	I2t_Motor	%	I2T integrator for motor	2BE9	0001
3049 / 5097 / 7145	1	I2t_Inverter	%	I2T integrator for device	2BE9	0002
3049 / 5097 / 7145	2	I2t_Fast	%	I2T integrator high overload	2BE9	0003
3049 / 5097 / 7145	3	I2tMax	A2s	Max. I2T integral	2BE9	0004
3049 / 5097 / 7145	4	IMaxDC	A	Max. DC current	2BE9	0005
3049 / 5097 / 7145	5	IMaxDC_sum	%	Integral DC protection	2BE9	0006
3049 / 5097 / 7145	6	InRot	A	Rated current at current switching frequency / voltage	2BE9	0007
3049 / 5097 / 7145	7	iphasor	A	Actual motor current value (amplitude, filtered)	2BE9	0008
3049 / 5097 / 7145	8	UsrPosDiffHistory	PosUnit	Position tracking error monitoring	2BE9	0009
3049 / 5097 / 7145	9	Temp_Motor	degC	Motor temperature	2BE9	000A
3049 / 5097 / 7145	10	Temp_Motor_R	Ohm	Temperature sensor resistance (power stage)	2BE9	000B
3049 / 5097 / 7145	11	SwitchFreqSelState		Switching frequency switchover state	2BE9	000C
		NONE (0)		Current switching frequency not changed		
		MANUAL (1)		Current switching frequency changed manually		
		I2T (2)		Current switching frequency changed by I2t		
		FASTI2T (3)		Current switching frequency changed by fast IxT		
		OCSW (4)		Current switching frequency changed by software overcurrent		

Table 18.4: Parameter "Monitoring axis"

P No.	Index	Name / Setting	Unit	Description	EtherCAT object ID	Index
		OCDL (5)		Current switching frequency changed by DC overcurrent		
3049 / 5097 / 7145	12	SwitchFreqSelAct		Switching frequency switchover: Actual switching frequency value	2BE9	000D
		2kHz (0)				
		4kHz (1)				
		8kHz (2)				
		12kHz (3)				
		16kHz (4)				
3049 / 5097 / 7145	13	Irms	A	Effective motor current value	2BE9	000E
3049 / 5097 / 7145	14	Tth_Motor	%	Actual motor protection value with thermal model	2BE9	000F
3049 / 5097 / 7145	15	PosDiffPconScon		Current position difference between PCon and SCon encoder: see parameter CON_PCON_Ctrl	2BE9	0010
3074 / 5122 / 7170		MON_Load_Axis_Values		Axis 1: Motor protection settings Axis 1: Motor temperature protection settings	2C02	
3074 / 5122 / 7170	0	ThermalLoadMotor	%	Thermal load of the motor Motor thermal load	2C02	0001
3074 / 5122 / 7170	1	ThermalLoadDevice	%	Thermal load of the power stage Device thermal load	2C02	0002
3074 / 5122 / 7170	2	I2tUsageMotor	%	Maximum I2t of the motor Maximum motor i2t value over on workload cycle	2C02	0003
3074 / 5122 / 7170	3	I2tUsageDevice	%	Maximum I2t of the power stage Maximum I2t usage of device	2C02	0004
3074 / 5122 / 7170	4	PeakLoadMotor	%	Maximum motor current in relation to MOT_Cmax. Maximum motor regarding MOT_CMax	2C02	0005

P No.	Index	Name / Setting	Unit	Description	EtherCAT object ID	Index
3074 / 5122 / 7170	5	PeakLoadDevice	%	Thermal load of the power stage Device thermal load	2C02	0006
3074 / 5122 / 7170	6	EfectiveTorque	Nm	Effective torque r.m.s torque	2C02	0007
3074 / 5122 / 7170	7	AverageSpeed	rpm	Average speed Average speed	2C02	0008
3074 / 5122 / 7170	8	MaxMotorCurrent	A	Max. motor current Maximum motor current	2C02	0009
3074 / 5122 / 7170	9	MaxMotorTorque	Nm	Max. motor torque Maximum motor torque	2C02	000A
3074 / 5122 / 7170	10	MaxMotorSpeed	rpm	Max. speed Maximum motor speed	2C02	000B
3074 / 5122 / 7170	11	NoLoadSpeed	rpm	Idle speed (from rating plate) No load speed (from nameplate)	2C02	000C
3074 / 5122 / 7170	12	StandStillTorque	Nm	Maximum stall torque (from rating plate) Maximum standstill torque (from nameplate)	2C02	000D
3074 / 5122 / 7170	13	MotorTorqueLimit	Nm	Motor maximum torque Motor maximum torque	2C02	000E
3074 / 5122 / 7170	14	Speed_at_ MaxMotorTorque	rpm	Speed at measuring point MaxMotorTorque	2C02	000F
3074 / 5122 / 7170	15	Torque_at_ MaxMotorSpeed	Nm	Torque at measuring point MaxMotorSpeed	2C02	0010
3074 / 5122 / 7170	16	LoadRatio		Lastmasse / Motormasse Load mass / motor mass	2C02	0011
3074 / 5122 / 7170	17	Tmax_Motor	degC	Maximum motor temperature in cycle Maximum motor temperature in cycle	2C02	0012

Table 18.4: Parameter "Monitoring axis" (continue)

P No.	Index	Name / Setting	Unit	Description	EtherCAT object ID	Index
3074 / 5122 / 7170	18	Tmax_PowerStage	degC	Maximale Endstufentemperatur im Zyklus Maximum power stage temperature in cycle	2C02	0013
3074 / 5122 / 7170	19	Tmax_Encoder	degC	Maximale Temperatur des Motorgebers im Zyklus Maximum motor encoder temperature in cycle	2C02	0014
3074 / 5122 / 7170	20	Tlim_Encoder	degC	Geber-Temperaturlimit Encoder temperature limit	2C02	0015

Table 18.4: Parameter "Monitoring axis" (continue)

## 19 Condition monitoring

P No.	Index	Name	Unit	Description
3039 / 5087 / 7135	0	SCD_COND_Control		Axis 1/2/3: control word
3040 / 5088 / 7136	0	SCD_COND_Status		Axis 1/2/3: status word
3041 / 5089 / 7137		SCD_COND_Features		Axis 1/2/3: Features for condition monitoring
3041 / 5089 / 7137	0	FreqData		2000 - 4000 Hz
3041 / 5089 / 7137	1	FreqData		1000 - 2000 Hz
3041 / 5089 / 7137	2	FreqData		500 - 1000 Hz
3041 / 5089 / 7137	3	FreqData		250 - 500 Hz
3041 / 5089 / 7137	4	FreqData		125 - 250 Hz
3041 / 5089 / 7137	5	FreqData		0 - 125 Hz
3041 / 5089 / 7137	6	J	kgm2	Estimated inertia
3041 / 5089 / 7137	7	TConst	Nm	constant torque (weight)
3041 / 5089 / 7137	8	Tfric	Nm	static friction
3041 / 5089 / 7137	9	Tvisc	Nm/(1000 rpm)	Viscous friction
3042 / 5090 / 7138		SCD_COND_Settings		Axis 1/2/3: Settings for condition monitoring
3042 / 5090 / 7138	0	MechFilterFreq	Hz	Cut-off frequency for mechanical identification

Table 18.5: Parameter - Condition Monitoring

### 19.1 Monitoring in the frequency range

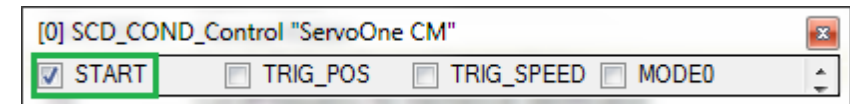
Many errors affecting bearings or gearing cause vibrations at certain frequencies. Even without knowing all possible error modes in advance, it makes sense to monitor the drive behaviour in the frequency range. The monitoring function in ServoOne CM groups the frequency range into 6 feature values.



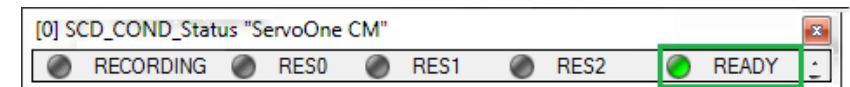
#### NOTE

- In order to obtain measurements that are useful for comparison purposes, the measurement should be made at a constant, defined speed.

1. Once the axis has reached a constant speed, set **bit 0** of **P 3039 - SCD\_COND\_Control** to start the measurement.



2. Wait until **bit 4** of **P 3040 - SCD\_COND\_Status** indicates that the measurement is ready.



3. Read the characteristics in the frequency range from **P 3041 - SCD\_COND\_Features [0...5]** and save them in a local database or in a cloud.

The measurements at the start-up of operation should be saved as a reference.

Consider the use of a (moving) average value over several measurements. A significant increase in the characteristics indicates a problem. It is likely that an error will cause an increase in the characteristics in the high-frequency range.

Classification algorithms should be used so that a distinction can be made between different types of errors.

## 19.2 Monitoring the mechanical properties

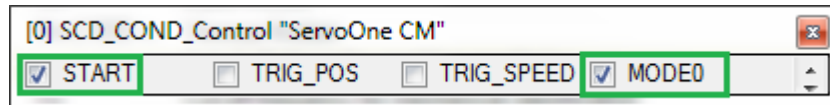
This function is for trying to identify mechanical parameters of the system. In doing so, inertia and constant torque as well as static and viscous friction are taken into account. Many long-term errors, for example, cause increased friction.



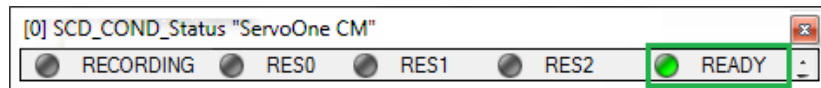
### NOTE

- The measurement should be made when the axis is accelerated and braked and is therefore passing through a significant part of its speed range.

1. Set bit 0 and bit 3 of **P 3039 - SCD\_COND\_Control** to start the measurement.



2. Wait until bit 4 of **P 3040 - SCD\_COND\_Status** indicates that the measurement is finished.



3. Read the characteristics from **P 3041 - SCD\_COND\_Features [6 ... 9]** and save them in a local database or in a cloud.
4. Parameter **P 3042 - SCD\_COND\_Settings [0]** defines the cut-off frequency of the identification algorithm. This should be faster than the acceleration and deceleration of the axis, but lower than the lowest mechanical resonance. The default setting is a good choice.

The measurements at the start-up of operation should be saved as a reference. Consider the use of a (moving) average value over several measurements. Deviations from the reference measurement indicate a change in the process. It is likely that mechanical problems will result in increased friction.

## 19.3 Monitoring of a repetitive motion

Many machines perform the same motion repeatedly. Normally, this should always require the same current curve. Deviations in the current curve can be a very quick and significant indication of a blocking of the axis.

Use the tracking function of the compensation function (*see also section "Error monitoring (tracking)" on page 172*) to determine the current curve in the axis module to then be able to monitor for deviations.

## 20 Parameter lists

The following lists contain all device parameters for Axis Controller ServoOne CM and Supply unit ServoOne CM-P , sorted by subject area. They include information about of the main properties of the parameters.

You can display more details on a particular parameter by highlighting the parameter and pressing “F2” in DriveManager 5. The windows this calls up includes the following additional information:

- EtherCAT® object ID
- List and description of all configuration options
- Attributes
  - NoDeviceReset = Parameter is not changed by “Reset to Factory Settings” procedure.
  - FireReadEvent = The device’s internal signal processor is informed immediately before performing read access to the parameter.
  - FireWriteEvent = The device’s internal signal processor is informed before performing write access to the parameter.
  - HasBackupMemory = The parameter value is stored in non-volatile memory.
  - DataSetMember = The parameter belongs to the portable device setting.
  - MultiAxisPara = The parameter exists multiple times, for each axis separately.
  - FirstAxisPara = The parameter belongs to the first axis of the device.
  - PDO\_Readable = Fast PDO read access is allowed. The parameter can be recorded with the internal digital oscilloscope.
  - PDO\_Writeable = Fast PDO write access is allowed.
  - ComplexArray = The indices of this array parameter differ with regard to data type or data description.
  - ProfileConform = The parameter is defined in a field bus profile.
  - RealTimeEffective = Parameter value changes are effective in real time.
  - AsapEffective = Parameter value changes are effective as soon as possible (usually < 50 ms).
  - Interactive = The parameter is interactive and therefore unsuitable for working offline.



**NOTE**

- Because parameters can be allocated to more than one subject area, some parameters are included in several of the following lists.
-

## 20.1 Power stage axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Power Stage					Power stage settings		0	0
2652 / 4700 / 6748		PST_AM_CurrentValues					Axis 1 / 2 / 3: Current values at @2, 4, 8, 12, 16, kHz		0	4
2652 / 4700 / 6748	0	INom	A	0	0	1000	Rated current	float32		
2652 / 4700 / 6748	1	IMaxDC	A	0	0	1000	Max DC current [A peak]	float32		
2652 / 4700 / 6748	2	IMax	A	0	0	3.4E+38	Max. current	float32		
2652 / 4700 / 6748	3	ITValDC	A	0	0	3.4E+38	I*T-protection DC	float32		
2652 / 4700 / 6748	4	I2T_Current	A	0	0	3.4E+38	I2T-protection: Current	float32		
2652 / 4700 / 6748	5	I2T_Time	s	0.1	0.1	3.4E+38	I2T-protection: Time	float32		
2652 / 4700 / 6748	6	I2TS_Current	A	0	0	3.4E+38	I2T-protection fast: Current	float32		
2652 / 4700 / 6748	7	I2TS_Level	A	0	0	3.4E+38	I2T-protection fast: Level	float32		
2652 / 4700 / 6748	8	I2TS_Time	s	0.1	0.1	3.4E+38	I2T-protection fast: Time	float32		
2652 / 4700 / 6748	9	INom	A	0	0	1000	Rated current	float32		
2652 / 4700 / 6748	10	IMaxDC	A	0	0	1000	Max DC current [A peak]	float32		
2652 / 4700 / 6748	11	IMax	A	0	0	3.4E+38	Max. current	float32		
2652 / 4700 / 6748	12	ITValDC	A	0	0	3.4E+38	I*T-protection DC	float32		
2652 / 4700 / 6748	13	I2T_Current	A	0	0	3.4E+38	I2T-protection: Current	float32		
2652 / 4700 / 6748	14	I2T_Time	s	0.1	0.1	3.4E+38	I2T-protection: Time	float32		
2652 / 4700 / 6748	15	I2TS_Current	A	0	0	3.4E+38	I2T-protection fast: Current	float32		
2652 / 4700 / 6748	16	I2TS_Level	A	0	0	3.4E+38	I2T-protection fast: Level	float32		
2652 / 4700 / 6748	17	I2TS_Time	s	0.1	0.1	3.4E+38	I2T-protection fast: Time	float32		
2652 / 4700 / 6748	18	INom	A	0	0	1000	Rated current	float32		
2652 / 4700 / 6748	19	IMaxDC	A	0	0	1000	Max DC current [A peak]	float32		
2652 / 4700 / 6748	20	IMax	A	0	0	3.4E+38	Max. current	float32		
2652 / 4700 / 6748	21	ITValDC	A	0	0	3.4E+38	I*T-protection DC	float32		
2652 / 4700 / 6748	22	I2T_Current	A	0	0	3.4E+38	I2T-protection: Current	float32		
2652 / 4700 / 6748	23	I2T_Time	s	0.1	0.1	3.4E+38	I2T-protection: Time	float32		
2652 / 4700 / 6748	24	I2TS_Current	A	0	0	3.4E+38	I2T-protection fast: Current	float32		
2652 / 4700 / 6748	25	I2TS_Level	A	0	0	3.4E+38	I2T-protection fast: Level	float32		
2652 / 4700 / 6748	26	I2TS_Time	s	0.1	0.1	3.4E+38	I2T-protection fast: Time	float32		

Table 18.6: Parameter list – Power stage axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2652 / 4700 / 6748	27	INom	A	0	0	1000	Rated current	float32		
2652 / 4700 / 6748	28	IMaxDC	A	0	0	1000	Max DC current [A peak]	float32		
2652 / 4700 / 6748	29	IMax	A	0	0	3.4E+38	Max. current	float32		
2652 / 4700 / 6748	30	ITValDC	A	0	0	3.4E+38	I*T-protection DC	float32		
2652 / 4700 / 6748	31	I2T_Current	A	0	0	3.4E+38	I2T-protection: Current	float32		
2652 / 4700 / 6748	32	I2T_Time	s	0.1	0.1	3.4E+38	I2T-protection: Time	float32		
2652 / 4700 / 6748	33	I2TS_Current	A	0	0	3.4E+38	I2T-protection fast: Current	float32		
2652 / 4700 / 6748	34	I2TS_Level	A	0	0	3.4E+38	I2T-protection fast: Level	float32		
2652 / 4700 / 6748	35	I2TS_Time	s	0.1	0.1	3.4E+38	I2T-protection fast: Time	float32		
2652 / 4700 / 6748	36	INom	A	0	0	1000	Rated current	float32		
2652 / 4700 / 6748	37	IMaxDC	A	0	0	1000	Max DC current [A peak]	float32		
2652 / 4700 / 6748	38	IMax	A	0	0	3.4E+38	Max. current	float32		
2652 / 4700 / 6748	39	ITValDC	A	0	0	3.4E+38	I*T-protection DC	float32		
2652 / 4700 / 6748	40	I2T_Current	A	0	0	3.4E+38	I2T-protection: Current	float32		
2652 / 4700 / 6748	41	I2T_Time	s	0.1	0.1	3.4E+38	I2T-protection: Time	float32		
2652 / 4700 / 6748	42	I2TS_Current	A	0	0	3.4E+38	I2T-protection fast: Current	float32		
2652 / 4700 / 6748	43	I2TS_Level	A	0	0	3.4E+38	I2T-protection fast: Level	float32		
2652 / 4700 / 6748	44	I2TS_Time	s	0.1	0.1	3.4E+38	I2T-protection fast: Time	float32		
3060 / 5108 / 7156		CON_SwitchFreq					Axis 1 / 2 / 3: Switching frequency settings		0	2
3060 / 5108 / 7156	0	Mode		ON (1)	OFF (0)	ON (1)	Auto switching frequency switchover	uint16		
3060 / 5108 / 7156	1	Frequency		8kHz (1)	2kHz (0)	16kHz (4)	Switching frequency	uint16		
3061 / 5109 / 7157	0	CON_SwitchFreqMask		31	1	65535	Axis 1 / 2 / 3: Permissible switching frequencies	uint16	0	5
3062 / 5110 / 7158	0	CON_SwitchFreqMask_Sel		30	1	31	Axis 1 / 2 / 3: Permissible switching frequencies (auto switchover)	uint16	0	2
3064 / 5112 / 7160	0	MON_OperationEnTime	s	0	0	4294967295	Axis 1 / 2 / 3: Time in "power stage active" state	uint32	0	4

Table 18.6: Parameter list – Power stage axis (continue)

## 20.2 Motor axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
SUBJECT AREA		Motor					Motor configuration data		0	0		
2990 / 5038 / 7086	0	MOT_isLinear		False (0)	False (0)	True (1)	Axis 1 / 2 / 3: Linear motor yes / no	bool32	0	2		
SUBJECT AREA		Synchronous motor					Synchronous motor settings		0	0		
SUBJECT AREA		Elec. data synchronous motor					Elec. data synchronous motor		0	0		
2980 / 5028 / 7076		MOT_LsigDiff					Axis 1 / 2 / 3: Stator inductance saturation		0	2		
2980 / 5028 / 7076	0	Lsig_q_I0	%	100	0	1000	Inductance @ current 0	float32				
2980 / 5028 / 7076	1	Lsig_q_I1	%	100	0	1000	Inductance @ current 1	float32				
2980 / 5028 / 7076	2	Lsig_q_I2	%	100	0	1000	Inductance @ current 2	float32				
2980 / 5028 / 7076	3	Lsig_q_I3	%	100	0	1000	Inductance @ current 3	float32				
2980 / 5028 / 7076	4	CurrentI0	%	0	0	1000	Current 0 (in % rated motor current)	float32				
2980 / 5028 / 7076	5	CurrentI1	%	100	0	1000	Current 1 (in % rated motor current)	float32				
2980 / 5028 / 7076	6	CurrentI2	%	200	0	1000	Current 2 (in % rated motor current)	float32				
2980 / 5028 / 7076	7	CurrentI3	%	300	0	1000	Current 3 (in % rated motor current)	float32				
3018 / 5066 / 7114		MOT_TorqueSat					Axis 1 / 2 / 3: KT characteristic curve		0	2		
3018 / 5066 / 7114	0	Torque_at_I0	Nm	0	0	10000	Torque at current I0	float32				
3018 / 5066 / 7114	1	Torque_at_I1	Nm	0	0	10000	Torque at current I1	float32				
3018 / 5066 / 7114	2	Torque_at_I2	Nm	0	0	10000	Torque at current I2	float32				
3018 / 5066 / 7114	3	Torque_at_I3	Nm	0	0	10000	Torque at current I3	float32				
3018 / 5066 / 7114	4	Torque_at_IMax	Nm	0	0	10000	Torque at current IMax	float32				
3018 / 5066 / 7114	5	CurrentI0	Arms	0	0	1000	Current I0	float32				
3018 / 5066 / 7114	6	CurrentI1	Arms	0	0	1000	Current I1	float32				
3018 / 5066 / 7114	7	CurrentI2	Arms	0	0	1000	Current I2	float32				
3018 / 5066 / 7114	8	CurrentI3	Arms	0	0	1000	Current I3	float32				
3018 / 5066 / 7114	9	CurrentIMax	Arms	0	0	1000	Current IMax	float32				
2964 / 5012 / 7060		MOT_Para					Axis 1 / 2 / 3: Motor settings		0	2		
2964 / 5012 / 7060	0	MOT_Type		OFF (0)	OFF (0)	GSM (3)	Motor type	uint16				
2964 / 5012 / 7060	1	MOT_PolePairs		1	1	4096	Number of pole pairs	uint16				
2964 / 5012 / 7060	2	MOT_SNom	rpm	0.01	0.01	2000000	Rated motor speed	float32				
2964 / 5012 / 7060	3	MOT_FNom	Hz	0	0	100000	Rated motor frequency	float32				
2964 / 5012 / 7060	4	MOT_Tnom	Nm	0.001	0.001	10000	Rated torque	float32				

Table 18.7: Parameter list – Motor axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
2964 / 5012 / 7060	5	MOT_CNom	Arms	0.1	0.1	1000	Rated motor current	float32				
2964 / 5012 / 7060	6	MOT_CMax	Arms	0.1	0.1	1000	Maximum current	float32				
2964 / 5012 / 7060	7	MOT_Rs	Ohm	0.000001	0.000001	100	Stator resistance	float32				
2964 / 5012 / 7060	8	MOT_Rr	Ohm	0.000001	0.000001	100	Rotor resistance (only for ASM)	float32				
2964 / 5012 / 7060	9	MOT_Lsd	mH	0.000001	0.000001	1000	D axis stator inductance (PSM) or leakage inductance (ASM)	float32				
2964 / 5012 / 7060	10	MOT_Lsq	mH	0.000001	0.000001	1000	Stator inductance Q axis	float32				
2964 / 5012 / 7060	11	MOT_J	kg m*m	0.00000001	0.00000001	1000	Mass inertia	float32				
2964 / 5012 / 7060	12	MOT_Ke	Vrms/ (1000 rpm)	0	0	10000	Motor EMF	float32				
2964 / 5012 / 7060	13	MOT_Km	Nm/Arms	0.001	0.001	1000	Force constant	float32				
2964 / 5012 / 7060	14	MOT_Name					Motor name	string				
2964 / 5012 / 7060	15	MOT_CosPhi		0.01	0.01	0.99	Power factor	float32				
2964 / 5012 / 7060	16	MOT_VNom	Vrms	0	0	1000	Nominal motor voltage	float32				
2964 / 5012 / 7060	17	MOT_PNom	kW	0	0	10000	Rated motor power	float32				
2964 / 5012 / 7060	18	MOT_SMax	rpm	0	0	2000000	Maximum motor speed	float32				
SUBJECT AREA		Linear motor					Synchronous linear motor settings		0	0		
2980 / 5028 / 7076		MOT_LsigDiff					Axis 1 / 2 / 3: Stator inductance saturation		0	2		
2980 / 5028 / 7076	0	Lsig_q_I0	%	100	0	1000	Inductance @ current 0	float32				
2980 / 5028 / 7076	1	Lsig_q_I1	%	100	0	1000	Inductance @ current 1	float32				
2980 / 5028 / 7076	2	Lsig_q_I2	%	100	0	1000	Inductance @ current 2	float32				
2980 / 5028 / 7076	3	Lsig_q_I3	%	100	0	1000	Inductance @ current 3	float32				
2980 / 5028 / 7076	4	CurrentI0	%	0	0	1000	Current 0 (in % rated motor current)	float32				
2980 / 5028 / 7076	5	CurrentI1	%	100	0	1000	Current 1 (in % rated motor current)	float32				
2980 / 5028 / 7076	6	CurrentI2	%	200	0	1000	Current 2 (in % rated motor current)	float32				
2980 / 5028 / 7076	7	CurrentI3	%	300	0	1000	Current 3 (in % rated motor current)	float32				
2991 / 5039 / 7087		MOT_Lin_Para					Axis 1 / 2 / 3: Linear motor parameters		0	2		
2991 / 5039 / 7087	0	MOT_Lin_MagnetPitch	um	20000	1	2000000	Magnet pitch	uint32				
2991 / 5039 / 7087	1	MOT_Lin_SNom	m/s	0.01	0.01	200000	Linear motor rated speed	float32				
2991 / 5039 / 7087	2	MOT_Lin_ForceNom	N	0.001	0.001	10000	Rated force	float32				
2991 / 5039 / 7087	3	MOT_Lin_M	kg	0.000001	0.000001	1000	Motor mass / weight	float32				
2991 / 5039 / 7087	4	MOT_Lin_Ke	Vrms/ (m/s)	0	0	10000	Motor EMF	float32				

Table 18.7: Parameter list – Motor axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
2991 / 5039 / 7087	5	MOT_Lin_Km	N/Arms	0.01	0.01	1000	Force constant	float32				
2991 / 5039 / 7087	6	MOT_Lin_SMax	m/s	0	0	200000	Maximum speed of linear motor	float32				
3018 / 5066 / 7114		MOT_TorqueSat					Axis 1 / 2 / 3: KT characteristic curve		0	2		
3018 / 5066 / 7114	0	Torque_at_I0	Nm	0	0	10000	Torque at current I0	float32				
3018 / 5066 / 7114	1	Torque_at_I1	Nm	0	0	10000	Torque at current I1	float32				
3018 / 5066 / 7114	2	Torque_at_I2	Nm	0	0	10000	Torque at current I2	float32				
3018 / 5066 / 7114	3	Torque_at_I3	Nm	0	0	10000	Torque at current I3	float32				
3018 / 5066 / 7114	4	Torque_at_IMax	Nm	0	0	10000	Torque at current IMax	float32				
3018 / 5066 / 7114	5	CurrentI0	Arms	0	0	1000	Current I0	float32				
3018 / 5066 / 7114	6	CurrentI1	Arms	0	0	1000	Current I1	float32				
3018 / 5066 / 7114	7	CurrentI2	Arms	0	0	1000	Current I2	float32				
3018 / 5066 / 7114	8	CurrentI3	Arms	0	0	1000	Current I3	float32				
3018 / 5066 / 7114	9	CurrentIMax	Arms	0	0	1000	Current IMax	float32				
SUBJECT AREA		Electrical data of linear synchronous motors					Electrical data of linear synchronous motors		0	0		
2964 / 5012 / 7060		MOT_Para					Axis 1 / 2 / 3: Motor settings		0	2		
2964 / 5012 / 7060	0	MOT_Type		OFF (0)	OFF (0)	GSM (3)	Motor type	uint16				
2964 / 5012 / 7060	1	MOT_PolePairs		1	1	4096	Number of pole pairs	uint16				
2964 / 5012 / 7060	2	MOT_SNom	rpm	0.01	0.01	2000000	Rated motor speed	float32				
2964 / 5012 / 7060	3	MOT_FNom	Hz	0	0	100000	Rated motor frequency	float32				
2964 / 5012 / 7060	4	MOT_Tnom	Nm	0.001	0.001	10000	Rated torque	float32				
2964 / 5012 / 7060	5	MOT_CNom	Arms	0.1	0.1	1000	Rated motor current	float32				
2964 / 5012 / 7060	6	MOT_CMax	Arms	0.1	0.1	1000	Maximum current	float32				
2964 / 5012 / 7060	7	MOT_Rs	Ohm	0.000001	0.000001	100	Stator resistance	float32				
2964 / 5012 / 7060	8	MOT_Rr	Ohm	0.000001	0.000001	100	Rotor resistance (only for ASM)	float32				
2964 / 5012 / 7060	9	MOT_Lsd	mH	0.000001	0.000001	1000	D axis stator inductance (PSM) or leakage inductance (ASM)	float32				
2964 / 5012 / 7060	10	MOT_Lsq	mH	0.000001	0.000001	1000	Stator inductance Q axis	float32				
2964 / 5012 / 7060	11	MOT_J	kg m*m	0.00000001	0.00000001	1000	Mass inertia	float32				
2964 / 5012 / 7060	12	MOT_Ke	Vrms/ (1000 rpm)	0	0	10000	Motor EMF	float32				
2964 / 5012 / 7060	13	MOT_Km	Nm/Arms	0.001	0.001	1000	Force constant	float32				
2964 / 5012 / 7060	14	MOT_Name					Motor name	string				

Table 18.7: Parameter list – Motor axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
2964 / 5012 / 7060	15	MOT_CosPhi		0.01	0.01	0.99	Power factor	float32				
2964 / 5012 / 7060	16	MOT_VNom	Vrms	0	0	1000	Nominal motor voltage	float32				
2964 / 5012 / 7060	17	MOT_PNom	kW	0	0	10000	Rated motor power	float32				
2964 / 5012 / 7060	18	MOT_SMax	rpm	0	0	2000000	Maximum motor speed	float32				
2964 / 5012 / 7060		MOT_Para					Axis 1 / 2 / 3: Motor settings		0	2		
2964 / 5012 / 7060	0	MOT_Type		OFF (0)	OFF (0)	GSM (3)	Motor type	uint16				
2964 / 5012 / 7060	1	MOT_PolePairs		1	1	4096	Number of pole pairs	uint16				
2964 / 5012 / 7060	2	MOT_SNom	rpm	0.01	0.01	2000000	Rated motor speed	float32				
2964 / 5012 / 7060	3	MOT_FNom	Hz	0	0	100000	Rated motor frequency	float32				
2964 / 5012 / 7060	4	MOT_Tnom	Nm	0.001	0.001	10000	Rated torque	float32				
2964 / 5012 / 7060	5	MOT_CNom	Arms	0.1	0.1	1000	Rated motor current	float32				
2964 / 5012 / 7060	6	MOT_CMax	Arms	0.1	0.1	1000	Maximum current	float32				
2964 / 5012 / 7060	7	MOT_Rs	Ohm	0.000001	0.000001	100	Stator resistance	float32				
2964 / 5012 / 7060	8	MOT_Rr	Ohm	0.000001	0.000001	100	Rotor resistance (only for ASM)	float32				
2964 / 5012 / 7060	9	MOT_Lsd	mH	0.000001	0.000001	1000	D axis stator inductance (PSM) or leakage inductance (ASM)	float32				
2964 / 5012 / 7060	10	MOT_Lsq	mH	0.000001	0.000001	1000	Stator inductance Q axis	float32				
2964 / 5012 / 7060	11	MOT_J	kg m*m	0.00000001	0.00000001	1000	Mass inertia	float32				
2964 / 5012 / 7060	12	MOT_Ke	Vrms/ (1000 rpm)	0	0	10000	Motor EMF	float32				
2964 / 5012 / 7060	13	MOT_Km	Nm/Arms	0.001	0.001	1000	Force constant	float32				
2964 / 5012 / 7060	14	MOT_Name					Motor name	string				
2964 / 5012 / 7060	15	MOT_CosPhi		0.01	0.01	0.99	Power factor	float32				
2964 / 5012 / 7060	16	MOT_VNom	Vrms	0	0	1000	Nominal motor voltage	float32				
2964 / 5012 / 7060	17	MOT_PNom	kW	0	0	10000	Rated motor power	float32				
2964 / 5012 / 7060	18	MOT_SMax	rpm	0	0	2000000	Maximum motor speed	float32				
SUBJECT AREA		Asynchronous motor					Asynchronous motor settings		0	0		
2964 / 5012 / 7060		MOT_Para					Axis 1 / 2 / 3: Motor settings		0	2		
2964 / 5012 / 7060	0	MOT_Type		OFF (0)	OFF (0)	GSM (3)	Motor type	uint16				
2964 / 5012 / 7060	1	MOT_PolePairs		1	1	4096	Number of pole pairs	uint16				
2964 / 5012 / 7060	2	MOT_SNom	rpm	0.01	0.01	2000000	Rated motor speed	float32				
2964 / 5012 / 7060	3	MOT_FNom	Hz	0	0	100000	Rated motor frequency	float32				
2964 / 5012 / 7060	4	MOT_Tnom	Nm	0.001	0.001	10000	Rated torque	float32				

Table 18.7: Parameter list – Motor axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
2964 / 5012 / 7060	5	MOT_CNom	Arms	0.1	0.1	1000	Rated motor current	float32				
2964 / 5012 / 7060	6	MOT_CMax	Arms	0.1	0.1	1000	Maximum current	float32				
2964 / 5012 / 7060	7	MOT_Rs	Ohm	0.000001	0.000001	100	Stator resistance	float32				
2964 / 5012 / 7060	8	MOT_Rr	Ohm	0.000001	0.000001	100	Rotor resistance (only for ASM)	float32				
2964 / 5012 / 7060	9	MOT_Lsd	mH	0.000001	0.000001	1000	D axis stator inductance (PSM) or leakage inductance (ASM)	float32				
2964 / 5012 / 7060	10	MOT_Lsq	mH	0.000001	0.000001	1000	Stator inductance Q axis	float32				
2964 / 5012 / 7060	11	MOT_J	kg m²	0.00000001	0.00000001	1000	Mass inertia	float32				
2964 / 5012 / 7060	12	MOT_Ke	Vrms/ (1000 rpm)	0	0	10000	Motor EMF	float32				
2964 / 5012 / 7060	13	MOT_Km	Nm/Arms	0.001	0.001	1000	Force constant	float32				
2964 / 5012 / 7060	14	MOT_Name					Motor name	string				
2964 / 5012 / 7060	15	MOT_CosPhi		0.01	0.01	0.99	Power factor	float32				
2964 / 5012 / 7060	16	MOT_VNom	Vrms	0	0	1000	Nominal motor voltage	float32				
2964 / 5012 / 7060	17	MOT_PNom	kW	0	0	10000	Rated motor power	float32				
2964 / 5012 / 7060	18	MOT_SMax	rpm	0	0	2000000	Maximum motor speed	float32				
2980 / 5028 / 7076		MOT_LsigDiff					Axis 1 / 2 / 3: Stator inductance saturation		0	2		
2980 / 5028 / 7076	0	Lsig_q_I0	%	100	0	1000	Inductance @ current 0	float32				
2980 / 5028 / 7076	1	Lsig_q_I1	%	100	0	1000	Inductance @ current 1	float32				
2980 / 5028 / 7076	2	Lsig_q_I2	%	100	0	1000	Inductance @ current 2	float32				
2980 / 5028 / 7076	3	Lsig_q_I3	%	100	0	1000	Inductance @ current 3	float32				
2980 / 5028 / 7076	4	CurrentI0	%	0	0	1000	Current 0 (in % rated motor current)	float32				
2980 / 5028 / 7076	5	CurrentI1	%	100	0	1000	Current 1 (in % rated motor current)	float32				
2980 / 5028 / 7076	6	CurrentI2	%	200	0	1000	Current 2 (in % rated motor current)	float32				
2980 / 5028 / 7076	7	CurrentI3	%	300	0	1000	Current 3 (in % rated motor current)	float32				
2988 / 5036 / 7084		MOT_ActVal					Axis 1 / 2 / 3: Actual motor values		0	5		
2988 / 5036 / 7084	0	Lsh	H	100	0	3.4E+38	Main inductance (with magnet current / ASM only)	float32				
2988 / 5036 / 7084	1	FluxNom	Vs	0	-3.4E+38	3.4E+38	Motor flux linkage	float32				
2989 / 5037 / 7085		MOT_LshTab					Axis 1 / 2 / 3: Main inductance (ASM only)		0	2		
2989 / 5037 / 7085	0	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	1	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	2	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	3	MOT_LshTab	mH	1	0	3.4E+38		float32				

Table 18.7: Parameter list – Motor axis (continue)



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
2989 / 5037 / 7085	4	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	5	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	6	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	7	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	8	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	9	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	10	MOT_LshTab	mH	1	0	3.4E+38		float32				
2992 / 5040 / 7088	0	SCD_JSum	kg m*m	0	0	3.4E+38	Axis 1 / 2 / 3: Total mass inertia	float32	0	2		
SUBJECT AREA		Electrical data of asynchronous motors						Electrical data of the asynchronous motor				
2964 / 5012 / 7060		MOT_Para					Axis 1 / 2 / 3: Motor settings		0	0		
2964 / 5012 / 7060	0	MOT_Type		OFF (0)	OFF (0)	GSM (3)	Motor type	uint16				
2964 / 5012 / 7060	1	MOT_PolePairs		1	1	4096	Number of pole pairs	uint16				
2964 / 5012 / 7060	2	MOT_SNom	rpm	0.01	0.01	2000000	Rated motor speed	float32				
2964 / 5012 / 7060	3	MOT_FNom	Hz	0	0	100000	Rated motor frequency	float32				
2964 / 5012 / 7060	4	MOT_Tnom	Nm	0.001	0.001	10000	Rated torque	float32				
2964 / 5012 / 7060	5	MOT_CNom	Arms	0.1	0.1	1000	Rated motor current	float32				
2964 / 5012 / 7060	6	MOT_CMax	Arms	0.1	0.1	1000	Maximum current	float32				
2964 / 5012 / 7060	7	MOT_Rs	Ohm	0.000001	0.000001	100	Stator resistance	float32				
2964 / 5012 / 7060	8	MOT_Rr	Ohm	0.000001	0.000001	100	Rotor resistance (only for ASM)	float32				
2964 / 5012 / 7060	9	MOT_Lsd	mH	0.000001	0.000001	1000	D axis stator inductance (PSM) or leakage inductance (ASM)	float32				
2964 / 5012 / 7060	10	MOT_Lsq	mH	0.000001	0.000001	1000	Stator inductance Q axis	float32				
2964 / 5012 / 7060	11	MOT_J	kg m*m	0.00000001	0.00000001	1000	Mass inertia	float32				
2964 / 5012 / 7060	12	MOT_Ke	Vrms/ (1000 rpm)	0	0	10000	Motor EMF	float32				
2964 / 5012 / 7060	13	MOT_Km	Nm/Arms	0.001	0.001	1000	Force constant	float32				
2964 / 5012 / 7060	14	MOT_Name					Motor name	string				
2964 / 5012 / 7060	15	MOT_CosPhi		0.01	0.01	0.99	Power factor	float32				
2964 / 5012 / 7060	16	MOT_VNom	Vrms	0	0	1000	Nominal motor voltage	float32				
2964 / 5012 / 7060	17	MOT_PNom	kW	0	0	10000	Rated motor power	float32				
2964 / 5012 / 7060	18	MOT_SMax	rpm	0	0	2000000	Maximum motor speed	float32				
2988 / 5036 / 7084		MOT_ActVal					Axis 1 / 2 / 3: Actual motor values		0	5		
2988 / 5036 / 7084	0	Lsh	H	100	0	3.4E+38	Main inductance (with magnet current / ASM only)	float32				

Table 18.7: Parameter list – Motor axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
2988 / 5036 / 7084	1	FluxNom	Vs	0	-3.4E+38	3.4E+38	Motor flux linkage	float32				
3013 / 5061 / 7109		CON_FM_IMag					Axis 1 / 2 / 3: Magnetising current		0	2		
3013 / 5061 / 7109	0	IMag		0.001	0.001	1000	Magnetising current	float32				
3013 / 5061 / 7109	1	IMagMax		0	0	1000	Max. magnetizing current (LshTab)	float32				
3013 / 5061 / 7109	2	ImagSLim	%	100	0	10000	Field weakening start speed	float32				
2989 / 5037 / 7085		MOT_LshTab					Axis 1 / 2 / 3: Main inductance (ASM only)		0	2		
2989 / 5037 / 7085	0	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	1	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	2	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	3	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	4	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	5	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	6	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	7	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	8	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	9	MOT_LshTab	mH	1	0	3.4E+38		float32				
2989 / 5037 / 7085	10	MOT_LshTab	mH	1	0	3.4E+38		float32				
SUBJECT AREA		Motor simulation							0	0		
2965 / 5013 / 7061	0	MOT_Sim		0	0	1	Axis 1 / 2 / 3: Motor simulation settings	uint8	0	2		
2987 / 5035 / 7083		MOT_SIM_Tune					Axis 1 / 2 / 3: Motor simulation parameters		2	2		
2987 / 5035 / 7083	0	Damping	mNm/rpm	0	0	3.4E+38		float32				
2987 / 5035 / 7083	1	EncoderOffset	DEG	0	0	360	Encoder offset (simulated)	float32				
2987 / 5035 / 7083	2	VDC		565	10	3.4E+38	DC-link simulated	float32				
2987 / 5035 / 7083	3	LoadTorque	Nm	0	-3.4E+38	3.4E+38	Load torque simulated	float32				
2987 / 5035 / 7083	4	Jsum	kgm2	0	-3.4E+38	3.4E+38	Inertia simulated	float32				
2987 / 5035 / 7083	5	Cogging_Torque	Nm	0	-3.4E+38	3.4E+38	Actual cogging torque	float32				
2987 / 5035 / 7083	6	Cogging_Freq		1	1	255	Cogging torque frequency	uint8				
SUBJECT AREA		Protection							0	0		
3050 / 5098 / 7146		MON_MotorI2t					Axis 1 / 2 / 3: Motor I2T protection		0	2		
3050 / 5098 / 7146	0	Type		FREQ (0)	OFF (-1)	FREQ_TEMP (3)	Selection of I2T monitoring method	int16				
3050 / 5098 / 7146	1	INom	%	100	0	1000	Rated current @ FNom	float32				
3050 / 5098 / 7146	2	I0	%	100	0	1000	Rated current @ 0Hz	float32				
3050 / 5098 / 7146	3	I1	%	100	0	1000	Current @ F1 (% of INom)	float32				

Table 18.7: Parameter list – Motor axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
3050 / 5098 / 7146	4	F1	Hz	25	0.001	2000	Interpolation point	float32				
3050 / 5098 / 7146	5	FNom	Hz	50	0.001	2000	Rated frequency	float32				
3050 / 5098 / 7146	6	IMax	%	200	0.001	1000	Maximum current	float32				
3050 / 5098 / 7146	7	Time	s	2	0.001	6000	Max. overload duration	float32				
3050 / 5098 / 7146	8	TTTherm	s	10	0.01	60000	Thermal time constant	float32				
3050 / 5098 / 7146	9	IMax2	%	200	0.001	1000	Motor maximum current @T2	float32				
3050 / 5098 / 7146	10	Time2	s	2	0.001	6000	Max. time for max. current @ T2	float32				
3050 / 5098 / 7146	11	D1	degC	50	0	300	Temperature for operating point #1 (IMax, Time)	float32				
3050 / 5098 / 7146	12	T2	degC	150	0	300	Temperature for operating point #2 (IMax2, Time2)	float32				
3063 / 5111 / 7159		MON_MotorTemp					Axis 1 / 2 / 3: Motor protection settings		0	2		
3063 / 5111 / 7159	0	Select		NONE (0)	NONE (0)	KTY83_110 (6)	Motor temperature sensor type	uint16				
3063 / 5111 / 7159	1	Tmax	degC	100	0	500	Max. permissible motor temperature	float32				
3063 / 5111 / 7159	2	TVal1	°C	0	-3.4E+38	3.4E+38	Interpolation point 1	float32				
3063 / 5111 / 7159	3	TVal2	°C	0	-3.4E+38	3.4E+38	Interpolation point 2	float32				
3063 / 5111 / 7159	4	TVal3	°C	0	-3.4E+38	3.4E+38	Interpolation point 3	float32				
3063 / 5111 / 7159	5	TVal4	°C	0	-3.4E+38	3.4E+38	Interpolation point 4	float32				
3063 / 5111 / 7159	6	RVal1	Ohm	0	-3.4E+38	3.4E+38	Resistance @ interpolation point 1	float32				
3063 / 5111 / 7159	7	RVal2	Ohm	0	-3.4E+38	3.4E+38	Resistance @ interpolation point 2	float32				
3063 / 5111 / 7159	8	RVal3	Ohm	0	-3.4E+38	3.4E+38	Resistance @ interpolation point 3	float32				
3063 / 5111 / 7159	9	RVal4	Ohm	0	-3.4E+38	3.4E+38	Resistance @ interpolation point 4	float32				
3063 / 5111 / 7159	10	Source		MOTCON (0)	MOTCON (0)	ENC_MCON (2)	Select motor temperature source.	uint8				
SUBJECT AREA		Motor identification					Motor identification		0	0		
3065 / 5113 / 7161		SCD_CorrelatorControl					Axis 1 / 2 / 3: Correlator control		0	2		
3065 / 5113 / 7161	0	CorrelatorControl		IDLE (0)	IDLE (0)	CONTINUOUS (3)	Correlator selector	uint16				
3065 / 5113 / 7161	1	SettleZCCount		10	0	10000		uint16				
3065 / 5113 / 7161	2	RunningZCCount		100	1	10000		uint16				
3065 / 5113 / 7161	3	fexec		0	0	3.4E+38	Excitation frequency	float32				
3066 / 5114 / 7162		SCD_CorrelatorPair0					Axis 1 / 2 / 3: Correlator pair 0		0	2		
3066 / 5114 / 7162	0	active		False (0)	False (0)	True (1)		bool32				
3066 / 5114 / 7162	1	inputSelect		NONE (0)	NONE (0)	USQREF (9)		uint16				
3066 / 5114 / 7162	2	outputSelect		NONE (0)	NONE (0)	USQREF (9)		uint16				

Table 18.7: Parameter list – Motor axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
3066 / 5114 / 7162	3	inputDelay	ms	0	-3.4E+38	3.4E+38		float32				
3066 / 5114 / 7162	4	outputDelay	ms	0	-3.4E+38	3.4E+38		float32				
3067 / 5115 / 7163		SCD_CorrelatorPair0_Out					Axis 1 / 2 / 3: Correlator pair outputs		0	5		
3067 / 5115 / 7163	0	State		IDLE (0)	IDLE (0)	FINISHED (6)	Correlator status	int32				
3067 / 5115 / 7163	1	corr_input_cos		0	-3.4E+38	3.4E+38		float32				
3067 / 5115 / 7163	2	corr_input_sin		0	-3.4E+38	3.4E+38		float32				
3067 / 5115 / 7163	3	corr_output_cos		0	-3.4E+38	3.4E+38		float32				
3067 / 5115 / 7163	4	corr_output_sin		0	-3.4E+38	3.4E+38		float32				
3067 / 5115 / 7163	5	gain		0	-3.4E+38	3.4E+38	Gain (input to output)	float32				
3067 / 5115 / 7163	6	phase	deg	0	-3.4E+38	3.4E+38	Phase (input to output)	float32				
3067 / 5115 / 7163	7	real		0	-3.4E+38	3.4E+38		float32				
3067 / 5115 / 7163	8	imag		0	-3.4E+38	3.4E+38		float32				
3068 / 5116 / 7164		SCD_MotorIdent					Axis 1 / 2 / 3: Motor identification		0	2		
3068 / 5116 / 7164	0	command		IDLE (0)	STOP (-1)	MOTPHASE (16)	Motor identification	int32				
3068 / 5116 / 7164	1	settings		0	0	65535	Identification settings	uint16				
2964 / 5012 / 7060		MOT_Para					Axis 1 / 2 / 3: Motor settings		0	2		
2964 / 5012 / 7060	0	MOT_Type		OFF (0)	OFF (0)	GSM (3)	Motor type	uint16				
2964 / 5012 / 7060	1	MOT_PolePairs		1	1	4096	Number of pole pairs	uint16				
2964 / 5012 / 7060	2	MOT_SNom	rpm	0.01	0.01	2000000	Rated motor speed	float32				
2964 / 5012 / 7060	3	MOT_FNom	Hz	0	0	100000	Rated motor frequency	float32				
2964 / 5012 / 7060	4	MOT_Tnom	Nm	0.001	0.001	10000	Rated torque	float32				
2964 / 5012 / 7060	5	MOT_CNom	Arms	0.1	0.1	1000	Rated motor current	float32				
2964 / 5012 / 7060	6	MOT_CMax	Arms	0.1	0.1	1000	Maximum current	float32				
2964 / 5012 / 7060	7	MOT_Rs	Ohm	0.000001	0.000001	100	Stator resistance	float32				
2964 / 5012 / 7060	8	MOT_Rr	Ohm	0.000001	0.000001	100	Rotor resistance (only for ASM)	float32				
2964 / 5012 / 7060	9	MOT_Lsd	mH	0.000001	0.000001	1000	D axis stator inductance (PSM) or leakage inductance (ASM)	float32				
2964 / 5012 / 7060	10	MOT_Lsq	mH	0.000001	0.000001	1000	Stator inductance Q axis	float32				
2964 / 5012 / 7060	11	MOT_J	kg m*m	0.00000001	0.00000001	1000	Mass inertia	float32				
2964 / 5012 / 7060	12	MOT_Ke	Vrms/ (1000 rpm)	0	0	10000	Motor EMF	float32				
2964 / 5012 / 7060	13	MOT_Km	Nm/Arms	0.001	0.001	1000	Force constant	float32				

Table 18.7: Parameter list – Motor axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
2964 / 5012 / 7060	14	MOT_Name					Motor name	string				
2964 / 5012 / 7060	15	MOT_CosPhi		0.01	0.01	0.99	Power factor	float32				
2964 / 5012 / 7060	16	MOT_VNom	Vrms	0	0	1000	Nominal motor voltage	float32				
2964 / 5012 / 7060	17	MOT_PNom	kW	0	0	10000	Rated motor power	float32				
2964 / 5012 / 7060	18	MOT_SMax	rpm	0	0	2000000	Maximum motor speed	float32				
SUBJECT AREA		Motor brake					Motor brake		0	0		
2310 / 4358 / 6406	0	MPRO_BRK_Lock		Off (0)	Off (0)	Open (2)	Axis 1 / 2 / 3: Vent brake man.	uint16	0	2		
2311 / 4359 / 6407	0	MPRO_BRK_WireBreak		False (0)	False (0)	True (1)	Axis 1 / 2 / 3: Motor brake wire break monitoring	bool32	0	2		
2318 / 4366 / 6414	0	MPRO_OUTPUT_FS_MOTBRK		NONE (0)	NONE (0)	INT_FEEDB (4)	Axis 1 / 2 / 3: Motor brake selector	uint16	0	2		
SUBJECT AREA		Motor brake details							0	0		
2308 / 4356 / 6404		MPRO_BRK_Times					Axis 1 / 2 / 3: Motor brake times setting		0	2		
2308 / 4356 / 6404	0	CloseTime	ms	100	0	10000	Motor brake close time	uint16				
2308 / 4356 / 6404	1	LiftTime	ms	100	0	10000	Motor brake lift time	uint16				
2308 / 4356 / 6404	2	FadeTime	ms	0	0	10000	Torque fade time	uint16				
2308 / 4356 / 6404	3	RiseTime	ms	0	0	10000	Torque rise time	uint16				
2309 / 4357 / 6405		MPRO_BRK_Torque					Axis 1 / 2 / 3: Motor brake torque setting (-pre-load)		0	2		
2309 / 4357 / 6405	0	StartTorque	Nm	0	-10000	10000	Initialisation torque	float32				
2309 / 4357 / 6405	1	LastTorqueFac	%	0	0	100	Last torque scaling factor saved	float32				
2310 / 4358 / 6406	0	MPRO_BRK_Lock		Off (0)	Off (0)	Open (2)	Axis 1 / 2 / 3: Vent brake man.	uint16	0	2		
2311 / 4359 / 6407	0	MPRO_BRK_WireBreak		False (0)	False (0)	True (1)	Axis 1 / 2 / 3: Motor brake wire break monitoring	bool32	0	2		
2312 / 4360 / 6408	0	MPRO_BRK_LastTorque	Nm	0	-10000	10000	Axis 1 / 2 / 3: Motor brake last torque saved Torque (from last close)	float32	0	4		
2313 / 4361 / 6409	0	MPRO_BRK_Status		0	0	4294967295	Axis 1 / 2 / 3: Motor brake status	uint32	0	5		
2318 / 4366 / 6414	0	MPRO_OUTPUT_FS_MOTBRK		NONE (0)	NONE (0)	INT_FEEDB (4)	Axis 1 / 2 / 3: Motor brake selector	uint16	0	2		
SUBJECT AREA		Motor brake check										
2151 / 4199 / 6247	0	ERR_WRN_State		0	0	4294967295	Axis 1 / 2 / 3: Warning state	uint32	0	5	2867	0000
2314 / 4362 / 6410		MPRO_BRK_CK_Settings					Axis 1 / 2 / 3: Brake check settings		0	2	290A	
2314 / 4362 / 6410	0	RatedTorque	Nm	10	-3.4E+38	3.4E+38	Rated torque of brake. Setpoint of VerTorque, SlipTorque and TorqueRamp	float32			290A	0001
2314 / 4362 / 6410	1	VerifiedTorque	Nm	0	-3.4E+38	3.4E+38	Brake torque was checked in production, no function	float32			290A	0002
2314 / 4362 / 6410	2	VerTorque	%	120	-3.4E+38	3.4E+38	Verification test: Required stopping torque in % of rated torque	float32			290A	0003

Table 18.7: Parameter list – Motor axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
2314 / 4362 / 6410	3	VerMaxDelta	PosUnit	10000	0	4294967295	Verification test: Maximum position difference during test	uint32			290A	0004
2314 / 4362 / 6410	4	MeasTorque	%	150	-3.4E+38	3.4E+38	Stopping torque measurement: Maximum test torque in % of rated torque	float32			290A	0005
2314 / 4362 / 6410	5	TorqueRamp	%/s	50	-3.4E+38	3.4E+38	Torque ramp in % of rated torque /s	float32			290A	0006
2314 / 4362 / 6410	6	GrindDist	PosUnit	360000	-3.4E+38	3.4E+38	Grinding: distance	float32			290A	0007
2314 / 4362 / 6410	7	GrindSpeed	SpeedUnit	100	-3.4E+38	3.4E+38	Grinding: Speed	float32			290A	0008
2314 / 4362 / 6410	8	GrindAcc	AccUnit	100	-3.4E+38	3.4E+38	Grinding: Acceleration	float32			290A	0009
2314 / 4362 / 6410	9	GrindTO	ms	3000	0	4294967295	Grinding: Timeout	uint32			290A	000A
2314 / 4362 / 6410	10	TestPeriod	h	0	-3.4E+38	3.4E+38	Cycle for brake test 0 = disabled	float32			290A	000B
2314 / 4362 / 6410	11	EmcyStopThresh	SpeedUnit	200	-3.4E+38	3.4E+38	Speed level above which a stop is an emergency stop.	float32			290A	000C
2314 / 4362 / 6410	12	StickSpeed	u/min	3	-3.4E+38	3.4E+38	Speed threshold under which the brake is considered to be fixed.	float32			290A	000D
2315 / 4363 / 6411	0	MPRO_BRK_CK_Control		0	0	65535	Axis 1 / 2 / 3: Parameter control of the brake test	uint16	0	2	290B	0000
2316 / 4364 / 6412		MPRO_BRK_CK_Actual					Axis 1 / 2 / 3: Actual brake check values List of subparameters		0	5	290C	
2316 / 4364 / 6412	0	State		0	0	65535	Current brake test status	uint16			290C	0001
2316 / 4364 / 6412	1	SlipTorqPos	Nm	0	-3.4E+38	3.4E+38	Torque at which the slip takes effect with a positive torque	float32			290C	0002
2316 / 4364 / 6412	2	SlipTorqNeg	Nm	0	-3.4E+38	3.4E+38	Torque at which the slip takes effect with a negative torque	float32			290C	0003
2316 / 4364 / 6412	3	StickTorqPos	Nm	0	-3.4E+38	3.4E+38	Torque at which the brake holds once again with a positive torque	float32			290C	0004
2316 / 4364 / 6412	4	StickTorqNeg	Nm	0	-3.4E+38	3.4E+38	"Hold torque measurement: Torque at which the brake holds once again with a negative torque	float32			290C	0005
2316 / 4364 / 6412	5	DistancePos	PosUnit	0	-3.4E+38	3.4E+38	Distance during verification test or stopping torque measurement with positive torque	float32			290C	0006
2316 / 4364 / 6412	6	DistanceNeg	PosUnit	0	-3.4E+38	3.4E+38	Distance during verification test or stopping torque measurement with negative torque	float32			290C	0007
2316 / 4364 / 6412	7	TorqueM0	Nm	0	-3.4E+38	3.4E+38	Torque at start of test	float32			290C	0008
2316 / 4364 / 6412	8	EmcySpeed	SpeedUnit	0	-3.4E+38	3.4E+38	Speed at emergency braking	float32			290C	0009
2316 / 4364 / 6412	9	OperationTime	h	0	-3.4E+38	3.4E+38	Operation time	float32			290C	000A
2316 / 4364 / 6412	10	Pireglimit	A	0	-3.4E+38	3.4E+38	Effective current limitation in TCon	float32			290C	000B
2317 / 4365 / 6413		MPRO_BRK_CK_Backup					Axis 1 / 2 / 3: Brake test backup values		0	2	290D	
2317 / 4365 / 6413	0	TestSchedule	h	0	-3.4E+38	3.4E+38	Scheduled time of next test	float32			290D	0001
2317 / 4365 / 6413	1	EmcyStopCount		0	0	4294967295	Emergency stop counter	uint32			290D	0002

Table 18.7: Parameter list – Motor axis (continue)

## 20.3 Encoder axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Encoder					Encoder channel settings		0	0
SUBJECT AREA		Basic settings							0	0
2882 / 4930 / 6978		ENC_CH_Action					Axis 1 / 2 / 3: Actions for encoder system		0	2
2882 / 4930 / 6978	0	BackupLatch		OFF (0)	OFF (0)	RESET_POS (10)	Save encoder backup values	uint8		
2882 / 4930 / 6978	1	MtBase		OFF (0)	OFF (0)	ZERO_CH3 (9)	Set overflow point based on current position	uint8		
2966 / 5014 / 7062	0	CON_FM_EncOffset	deg	0	0	360	Axis 1 / 2 / 3: Encoder offset	float32	0	2
3057 / 5105 / 7153		ENC_CH_Sel					Axis 1 / 2 / 3: Encoder / control assignment		0	2
3057 / 5105 / 7153	0	SCon		CH1 (0)	CH1 (0)	CH4 (6)	Encoder speed control	uint16		
3057 / 5105 / 7153	1	PCon		CH1 (0)	CH1 (0)	CH4 (6)	Encoder position control	uint16		
3057 / 5105 / 7153	2	MCon		CH1 (0)	CH1 (0)	CH4 (6)	Encoder motor commutation	uint16		
SUBJECT AREA		Channel 1					Settings for encoder channel 1		0	0
2888 / 4936 / 6984		ENC_CH1_Backup_User					Axis 1 / 2 / 3: Channel 1 position backup in user units		0	5
2888 / 4936 / 6984	0	Pos	PosUnit	0	-2147483648	2147483647	Backup position in user units	int32		
2888 / 4936 / 6984	1	EncVal_PosDiff	PosUnit	0	-2147483648	2147483647	Validation of position difference	int32		
2892 / 4940 / 6988		ENC_CH1_Comp					Axis 1 / 2 / 3: Channel 1 encoder compensation		0	2
2892 / 4940 / 6988	0	GpocMode		OFF (0)	OFF (0)	RESET (3)	GPOC mode	uint32		
2892 / 4940 / 6988	1	Kr		0.15	0	100	GPOC controller: Gain / phase	float32		
2892 / 4940 / 6988	2	Kr_off		0.075	0	100	GPOC controller: Offset	float32		
2892 / 4940 / 6988	3	TrackA_offset		0	-3.4E+38	3.4E+38	Track A: Offset	float32		
2892 / 4940 / 6988	4	TrackB_offset		0	-3.4E+38	3.4E+38	Track B: Offset	float32		
2892 / 4940 / 6988	5	TrackA_gain		1	-3.4E+38	3.4E+38	Track A: Gain	float32		
2892 / 4940 / 6988	6	TrackB_gain		1	-3.4E+38	3.4E+38	Track B: Gain	float32		
2892 / 4940 / 6988	7	TrackAB_phase		0	-3.4E+38	3.4E+38	Track A/B: Phase	float32		
2848 / 4896 / 6944		ENC_CH1_Settings					Axis 1 / 2 / 3: Channel 1 multi-encoder interface settings		0	2
2848 / 4896 / 6944	0	Select		NONE (0)	NONE (0)	reserved9 (9)	Encoder selection channel 1	uint8		
2848 / 4896 / 6944	1	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		

Table 18.8: Parameter list – Encoder axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2848 / 4896 / 6944	2	AbsEncoder		NONE (0)	NONE (0)	HIPERFACE (3)	Absolute interface selector	uint16		
2848 / 4896 / 6944	3	AbsIntMode		DIG (1)	STD (0)	DIG (1)	Absolute value initialisation mode	uint16		
2848 / 4896 / 6944	4	Multiturn		0	0	32	Number of multiturn bits	uint16		
2848 / 4896 / 6944	5	Singleturn		0	0	32	Number of singleturn bits	uint16		
2848 / 4896 / 6944	6	Lines		1	1	65536	Pulses per revolution / number of pole pairs	uint32		
2848 / 4896 / 6944	7	LineDelay	us	0	-3.4E+38	3.4E+38	Phase shift compensation	float32		
2848 / 4896 / 6944	8	Amplitude	%	100	10	100	Amplitude of the resolver signal	float32		
2848 / 4896 / 6944	9	Corr		0	0	65535	Signal correction selector	uint16		
2848 / 4896 / 6944	10	Fc_override	kHz	0	0	1000	A/D converter cut-off frequency override	float32		
2848 / 4896 / 6944	11	Numerator		1	-2147483648	2147483647	Encoder gearing numerator	int32		
2848 / 4896 / 6944	12	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		
2848 / 4896 / 6944	13	EncObsMin	100%	0.2	0	3.4E+38	Encoder monitoring limit (root of a2+b2)	float32		
2848 / 4896 / 6944	14	PeriodLen	nm	0	0	4294967295	Analog signal period (linear encoder)	uint32		
2848 / 4896 / 6944	15	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
2848 / 4896 / 6944	16	TTL_SignalType		AB (0)	AB (0)	SinCos_AB (4)	TTL encoder signal type	uint16		
2848 / 4896 / 6944	17	CycleCountMax		1	1	75	Absolute interface sampling rate (n x 0.125ms)	uint8		
2848 / 4896 / 6944	18	Graycode		True (1)	False (0)	True (1)	Graycode / binary code	bool32		
2848 / 4896 / 6944	19	ParityOdd		False (0)	False (0)	True (1)	Parity odd/even	bool32		
2848 / 4896 / 6944	20	ParityEnable		False (0)	False (0)	True (1)	Evaluate parity bit	bool32		
2848 / 4896 / 6944	21	EncObsBitEnable		False (0)	False (0)	True (1)	Enable encoder monitoring bit	bool32		
2848 / 4896 / 6944	22	PreBits		0	0	32	Number of bits before position	uint16		
2848 / 4896 / 6944	23	PostBits		0	0	32	Number of bits after position	uint16		
2848 / 4896 / 6944	24	PostParityPosition		0	0	32	Position of parity bit (in postbits)	uint16		
2848 / 4896 / 6944	25	PostEncObsPosition		0	0	32	Position of encoder monitoring bit (in postbits)	uint16		
2848 / 4896 / 6944	26	OffsetST	incr	0	0	4294967295	Singleturn offset at original encoder position	uint32		
2848 / 4896 / 6944	27	OffsetMT	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
2848 / 4896 / 6944	28	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
2848 / 4896 / 6944	29	EncVal_Enable		224	0	65535	Encoder validation	uint16		
2848 / 4896 / 6944	30	EncVal_PosDiffLim	PosUnit	100	0	4294967295	Max. encoder validation position	uint32		
2848 / 4896 / 6944	31	MTBase		2147483648	0	4294967295	Multiturn zero point shift	uint32		

Table 18.8: Parameter list – Encoder axis (continue)



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2848 / 4896 / 6944	32	Mode		0	0	4294967295	Encoder mode	uint32		
2848 / 4896 / 6944	33	ResolverFexec		8kHz (0)	8kHz (0)	4kHz (1)	Resolver excitation frequency	uint32		
2848 / 4896 / 6944	34	EncObsTf	ms	0	0	1000	Filter time constant of signal $\sqrt{a^2+b^2}$ for wire break detection	float32		
2848 / 4896 / 6944	35	InitDelay	steps	4	0	100	Encoder initialisation delay	uint16		
2848 / 4896 / 6944	36	TemperatureLimit	degC	0	0	3.4E+38	Encoder temperature error threshold (0 = no function)	float32		
2848 / 4896 / 6944	37	TemperatureWarning	degC	0	0	3.4E+38	Encoder temperature warning threshold (0 = no function)	float32		
2848 / 4896 / 6944	38	ErrorTol		0	0	255	Tolerate small number of errors in digital protocol	uint8		
2851 / 4899 / 6947		ENC_CH1_ActVal					Axis 1 / 2 / 3: Actual encoder values channel 1		0	5
2851 / 4899 / 6947	0	ActPosST		0	0	4294967295	Current singleturn position	uint32		
2851 / 4899 / 6947	1	ActPosMT		0	0	4294967295	Current multiturn position	uint32		
2851 / 4899 / 6947	2	InitPosST		0	0	4294967295	Singleturn init position	uint32		
2851 / 4899 / 6947	3	InitPosMT		0	0	4294967295	Multiturn init position	uint32		
2851 / 4899 / 6947	4	RawDataLow		0	0	4294967295	Encoder raw data: Low-word	uint32		
2851 / 4899 / 6947	5	RawDataHigh		0	0	4294967295	Encoder raw data: High-word	uint32		
2851 / 4899 / 6947	6	Speed	RPM	0	-3.4E+38	3.4E+38	Speed from encoder module unfiltered	float32		
2851 / 4899 / 6947	7	ZmDetect		False (0)	False (0)	True (1)	Zero pulse	bool32		
2851 / 4899 / 6947	8	ZmPosST		0	0	4294967295	Singleturn position zero pulse	uint32		
2851 / 4899 / 6947	9	ZmPosMT		0	0	4294967295	Multiturn position zero pulse	uint32		
2851 / 4899 / 6947	10	MotorTempR	Ohm	0	-3.4E+38	3.4E+38	Resistance of motor temperature sensor read from digital protocol.	float32		
2851 / 4899 / 6947	11	EncoderTemp	degC	0	-3.4E+38	3.4E+38	Encoder temperature read from digital protocol	float32		
2851 / 4899 / 6947	12	ActPosInc	INCR	0	0	4294967295	Actual position in increments			
2852 / 4900 / 6948		ENC_CH1_AbsEncStatus		0	0		Axis 1 / 2 / 3: Digital encoder channel 1 error / status values		0	5
2852 / 4900 / 6948	0	ENC_CH1_AbsEncStatus		0	0	65535		uint16		
2852 / 4900 / 6948	1	ENC_CH1_AbsEncStatus		0	0	65535		uint16		
2852 / 4900 / 6948	2	ENC_CH1_AbsEncStatus		0	0	65535		uint16		
2852 / 4900 / 6948	3	ENC_CH1_AbsEncStatus		0	0	65535		uint16		
2852 / 4900 / 6948	4	ENC_CH1_AbsEncStatus		0	0	65535		uint16		
2876 / 4924 / 6972		ENC_CH1_Backup					Axis 1 / 2 / 3: Channel 1 position backup		0	4
2876 / 4924 / 6972	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
2876 / 4924 / 6972	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
2876 / 4924 / 6972	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2876 / 4924 / 6972	3	EncSerialNum					Encoder serial number	string		
2879 / 4927 / 6975		ENC_CH1_Info					Axis 1 / 2 / 3: Encoder information		0	5
2879 / 4927 / 6975	0	SerialNumber					Serial number	string		
2879 / 4927 / 6975	1	FirmwareVersion					Firmware version	string		
2879 / 4927 / 6975	2	EncoderType					Encoder type	string		
2879 / 4927 / 6975	3	Flags		0	0	4294967295	Encoder information	uint32		
SUBJECT AREA		Channel 2					Settings for encoder channel 2		0	0
2889 / 4937 / 6985		ENC_CH2_Backup_User					Axis 1 / 2 / 3: Channel 2 position backup in user units		0	5
2889 / 4937 / 6985	0	Pos	PosUnit	0	-2147483648	2147483647	Backup position in user units	int32		
2889 / 4937 / 6985	1	EncVal_PosDiff	PosUnit	0	-2147483648	2147483647	Validation of position difference	int32		
2893 / 4941 / 6989		ENC_CH2_Comp					Axis 1 / 2 / 3 Axis 1: Channel 2 encoder compensation		0	2
2893 / 4941 / 6989	0	GpocMode		OFF (0)	OFF (0)	RESET (3)	GPOC mode	uint32		
2893 / 4941 / 6989	1	Kr		0.15	0	100	GPOC controller: Gain / phase	float32		
2893 / 4941 / 6989	2	Kr_off		0.075	0	100	GPOC controller: Offset	float32		
2893 / 4941 / 6989	3	TrackA_offset		0	-3.4E+38	3.4E+38	Track A: Offset	float32		
2893 / 4941 / 6989	4	TrackB_offset		0	-3.4E+38	3.4E+38	Track B: Offset	float32		
2893 / 4941 / 6989	5	TrackA_gain		1	-3.4E+38	3.4E+38	Track A: Gain	float32		
2893 / 4941 / 6989	6	TrackB_gain		1	-3.4E+38	3.4E+38	Track B: Gain	float32		
2893 / 4941 / 6989	7	TrackAB_phase		0	-3.4E+38	3.4E+38	Track A/B: Phase	float32		
2868 / 4916 / 6964		ENC_CH2_Settings					Axis 1 / 2 / 3: Channel 2 incremental encoder interface settings		0	2
2868 / 4916 / 6964	0	Select		NONE (0)	NONE (0)	SINCOS (2)	Encoder selection channel 1	uint8		
2868 / 4916 / 6964	1	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		
2868 / 4916 / 6964	2	AbsEncoder		NONE (0)	NONE (0)	NONE (0)	Absolute interface selector	uint16		
2868 / 4916 / 6964	3	AbsIntMode		STD (0)	STD (0)	STD (0)	Absolute value initialisation mode	uint16		
2868 / 4916 / 6964	4	Multiturn		0	0	32	Number of multiturn bits	uint16		
2868 / 4916 / 6964	5	Singleturn		0	0	32	Number of singleturn bits	uint16		
2868 / 4916 / 6964	6	Lines		1	1	65536	Pulses per revolution / number of pole pairs	uint32		
2868 / 4916 / 6964	7	LineDelay	us	0	-3.4E+38	3.4E+38	Phase shift compensation	float32		
2868 / 4916 / 6964	8	Amplitude	%	100	10	100	Amplitude of the resolver signal	float32		
2868 / 4916 / 6964	9	Corr		0	0	65535	Signal correction selector	uint16		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2868 / 4916 / 6964	10	Fc_override	kHz	0	0	1000	A/D converter cut-off frequency override	float32		
2868 / 4916 / 6964	11	Numerator		1	- 2147483648	2147483647	Encoder gearing numerator	int32		
2868 / 4916 / 6964	12	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		
2868 / 4916 / 6964	13	EncObsMin	100%	0.2	0	3.4E+38	Encoder monitoring limit (root of a2+b2)	float32		
2868 / 4916 / 6964	14	PeriodLen	nm	0	0	4294967295	Analog signal period (linear encoder)	uint32		
2868 / 4916 / 6964	15	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
2868 / 4916 / 6964	16	TTL_SignalType		AB (0)	AB (0)	SinCos_AB (4)	TTL encoder signal type	uint16		
2868 / 4916 / 6964	17	CycleCountMax		1	1	75	Absolute interface sampling rate (n x 0.125ms)	uint8		
2868 / 4916 / 6964	18	Graycode		True (1)	False (0)	True (1)	Graycode / binary code	bool32		
2868 / 4916 / 6964	19	ParityOdd		False (0)	False (0)	True (1)	Parity odd/even	bool32		
2868 / 4916 / 6964	20	ParityEnable		False (0)	False (0)	True (1)	Evaluate parity bit	bool32		
2868 / 4916 / 6964	21	EncObsBitEnable		False (0)	False (0)	True (1)	Enable encoder monitoring bit	bool32		
2868 / 4916 / 6964	22	PreBits		0	0	32	Number of bits before position	uint16		
2868 / 4916 / 6964	23	PostBits		0	0	32	Number of bits after position	uint16		
2868 / 4916 / 6964	24	PostParityPosition		0	0	32	Position of parity bit (in postbits)	uint16		
2868 / 4916 / 6964	25	PostEncObsPosition		0	0	32	Position of encoder monitoring bit (in postbits)	uint16		
2868 / 4916 / 6964	26	OffsetST	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
2868 / 4916 / 6964	27	OffsetMT	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
2868 / 4916 / 6964	28	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
2868 / 4916 / 6964	29	EncVal_Enable		224	0	65535	Encoder validation	uint16		
2868 / 4916 / 6964	30	EncVal_PosDiffLim	PosUnit	100	0	4294967295	Max. encoder validation position	uint32		
2868 / 4916 / 6964	31	MTBase		2147483648	0	4294967295		uint32		
2868 / 4916 / 6964	32	unused1		0	0	4294967295	unused sub parameter	uint32		
2868 / 4916 / 6964	33	unused2		0	0	4294967295	unused sub parameter	uint32		
2868 / 4916 / 6964	34	EncObsTf	ms	0	0	1000	Filter time constant of signal $\sqrt{a^2+b^2}$ for wire break detection	float32		
2868 / 4916 / 6964	35	InitDelay	steps	4	0	100	Encoder initialisation delay	uint16		
2868 / 4916 / 6964	36	ErrorTol		0	0	255	Tolerate small number of errors in digital protocol	uint8		
2871 / 4919 / 6967		ENC_CH2_ActVal					Axis 1 / 2 / 3: Actual encoder values channel 2		0	5
2871 / 4919 / 6967	0	ActPosST		0	0	4294967295	Current singleturn position	uint32		
2871 / 4919 / 6967	1	ActPosMT		0	0	4294967295	Current multiturn position	uint32		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2871 / 4919 / 6967	2	InitPosST		0	0	4294967295	Singleturn init position	uint32		
2871 / 4919 / 6967	3	InitPosMT		0	0	4294967295	Multiturn init position	uint32		
2871 / 4919 / 6967	4	RawDataLow		0	0	4294967295	Encoder raw data: Low-word	uint32		
2871 / 4919 / 6967	5	RawDataHigh		0	0	4294967295	Encoder raw data: High-word	uint32		
2871 / 4919 / 6967	6	Speed	RPM	0	-3.4E+38	3.4E+38	Speed from encoder module unfiltered	float32		
2871 / 4919 / 6967	7	ZmDetect		False (0)	False (0)	True (1)	Zero pulse	bool32		
2871 / 4919 / 6967	8	ZmPosST		0	0	4294967295	Singleturn position zero pulse	uint32		
2871 / 4919 / 6967	9	ZmPosMT		0	0	4294967295	Multiturn position zero pulse	uint32		
2871 / 4919 / 6967	10	ActPosInc	INCR	0	0	4294967295	Actual position in increments			
2877 / 4925 / 6973		ENC_CH2_Backup					Axis 1 / 2 / 3: Channel 2 position backup		0	4
2877 / 4925 / 6973	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
2877 / 4925 / 6973	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
2877 / 4925 / 6973	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
2877 / 4925 / 6973	3	EncSerialNum					Encoder serial number	string		
2880 / 4928 / 6976		ENC_CH2_Info					Axis 1 / 2 / 3: Encoder information		0	5
2880 / 4928 / 6976	0	SerialNumber					Serial number	string		
2880 / 4928 / 6976	1	FirmwareVersion					Firmware version	string		
2880 / 4928 / 6976	2	EncoderType					Encoder type	string		
2880 / 4928 / 6976	3	Flags		0	0	4294967295	Encoder information	uint32		
2880 / 4928 / 6976	4	Delay		0	-3.4E+38	3.4E+38	Internal dead time of the position			
SUBJECT AREA		Channel 3					Settings for encoder 3 / Hiperface DSL on motor connector		0	0
2890 / 4938 / 6986		ENC_CH3_Backup_User					Axis 1 / 2 / 3: Channel 2 position backup in user units		0	5
2890 / 4938 / 6986	0	Pos	PosUnit	0	-2147483648	2147483647	Backup position in user units	int32		
2890 / 4938 / 6986	1	EncVal_PosDiff	PosUnit	0	-2147483648	2147483647	Validation of position difference	int32		
2874 / 4922 / 6970		ENC_CH3_Settings					Axis 1 / 2 / 3: Channel 3 Hiperface DSL settings		0	2
2874 / 4922 / 6970	0	Select		None (0)	None (0)	HDLSL (6)	Channel 3 encoder selection	uint8		
2874 / 4922 / 6970	1	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		
2874 / 4922 / 6970	2	AbsEncoder		None (0)	None (0)	None (0)	Absolute interface selector	uint16		
2874 / 4922 / 6970	3	AbsIntMode		None (0)	None (0)	None (0)	Absolute value initialisation mode	uint16		
2874 / 4922 / 6970	4	Multiturn		0	0	32	Number of multiturn bits	uint16		
2874 / 4922 / 6970	5	Singleturn		0	0	32	Number of singleturn bits	uint16		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2874 / 4922 / 6970	6	Lines		1	1	65536	Pulses per revolution / number of pole pairs	uint32		
2874 / 4922 / 6970	7	LineDelay	us	0	-3.4E+38	3.4E+38	Phase shift compensation	float32		
2874 / 4922 / 6970	8	Amplitude	+-%	0	-3.4E+38	3.4E+38	Amplitude of the resolver signal	float32		
2874 / 4922 / 6970	9	Corr		0	0	65535	Signal correction selector	uint16		
2874 / 4922 / 6970	10	reserved		0	- 2147483648	2147483647		int32		
2874 / 4922 / 6970	11	Numerator		1	- 2147483648	2147483647	Encoder gearing numerator	int32		
2874 / 4922 / 6970	12	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		
2874 / 4922 / 6970	13	EncObsMin	100%	0.2	0	3.4E+38	Encoder monitoring limit (root of a2+b2)	float32		
2874 / 4922 / 6970	14	PeriodLen	nm	0	0	4294967295	Analog signal period (linear encoder)	uint32		
2874 / 4922 / 6970	15	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
2874 / 4922 / 6970	16	TTL_SignalType		None (0)	None (0)	None (0)	TTL encoder signal type	uint16		
2874 / 4922 / 6970	17	CycleCountMax		1	1	75	Absolute interface sampling rate (n x 0.125ms)	uint8		
2874 / 4922 / 6970	18	Graycode		True (1)	False (0)	True (1)	Graycode / binary code	bool32		
2874 / 4922 / 6970	19	ParityOdd		False (0)	False (0)	True (1)	Parity odd/even	bool32		
2874 / 4922 / 6970	20	ParityEnable		False (0)	False (0)	True (1)	Evaluate parity bit	bool32		
2874 / 4922 / 6970	21	EncObsBitEnable		False (0)	False (0)	True (1)	Enable encoder monitoring bit	bool32		
2874 / 4922 / 6970	22	PreBits		0	0	32	Number of bits before position	uint16		
2874 / 4922 / 6970	23	PostBits		0	0	32	Number of bits after position	uint16		
2874 / 4922 / 6970	24	PostParityPosition		0	0	32	Position of parity bit (in postbits)	uint16		
2874 / 4922 / 6970	25	PostEncObsPosition		0	0	32	Position of encoder monitoring bit (in postbits)	uint16		
2874 / 4922 / 6970	26	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
2874 / 4922 / 6970	27	EncVal_Enable		224	0	65535	Encoder validation	uint16		
2874 / 4922 / 6970	28	EncVal_PosDiffLim	PosUnit	100	0	4294967295	Max. encoder validation position	uint32		
2874 / 4922 / 6970	29	MTBase		2147483648	0	4294967295	Multiturn zero point shift	uint32		
2874 / 4922 / 6970	30	TemperatureLimit	degC	0	0	3.4E+38	Encoder temperature error threshold (0 = no function)	float32		
2874 / 4922 / 6970	31	TemperatureWarning	degC	0	0	3.4E+38	Encoder temperature warning threshold (0 = no function)	float32		
2874 / 4922 / 6970	32	ErrorTol		0	0	255	Tolerate small number of errors in digital protocol	uint8		
2874 / 4922 / 6970	33	HdsIfFilter	rpm	0	0	37500	Cut-off frequency for deep pass filter (0 = no function)	uint32		
2875 / 4923 / 6971		ENC_CH3_ActVal					Axis 1 / 2 / 3: Channel 3 Hiperface DSL actual values		0	5
2875 / 4923 / 6971	0	ActPosST		0	0	4294967295	Current singleturn position	uint32		
2875 / 4923 / 6971	1	ActPosMT		0	0	4294967295	Current multiturn position	uint32		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2875 / 4923 / 6971	2	InitPosST		0	0	4294967295	Singleturn init position	uint32		
2875 / 4923 / 6971	3	InitPosMT		0	0	4294967295	Multiturn init position	uint32		
2875 / 4923 / 6971	4	RawDataLow		0	0	4294967295	Encoder raw data: Low-word	uint32		
2875 / 4923 / 6971	5	RawDataHigh		0	0	4294967295	Encoder raw data: High-word	uint32		
2875 / 4923 / 6971	6	Speed	RPM	0	-3.4E+38	3.4E+38	Speed from encoder module unfiltered	float32		
2875 / 4923 / 6971	7	ZmDetect		False (0)	False (0)	True (1)	Zero pulse	bool32		
2875 / 4923 / 6971	8	ZmPosST		0	0	4294967295	Singleturn position zero pulse	uint32		
2875 / 4923 / 6971	9	ZmPosMT		0	0	4294967295	Multiturn position zero pulse	uint32		
2875 / 4923 / 6971	10	MotorTempR	Ohm	0	-3.4E+38	3.4E+38	Resistance of motor temperature sensor read from digital protocol.	float32		
2875 / 4923 / 6971	11	EncoderTemp	degC	0	-3.4E+38	3.4E+38	Encoder temperature read from digital protocol	float32		
2875 / 4923 / 6971	12	DiagData		0	0	3.4E+38	Status of HDSL signal	uint32		
2875 / 4923 / 6971	13	HdslFilter	rpm	0	0	4294967295	HDSL position filter of encoder Rid 0x10A, 0 if it does not exist	uint32		
2875 / 4923 / 6971	14	ActPosInc	INCR	0	0	4294967295	Actual position in increments			
2878 / 4926 / 6974		ENC_CH3_Backup					Axis 1 / 2 / 3: Channel 3 position backup		0	4
2878 / 4926 / 6974	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
2878 / 4926 / 6974	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
2878 / 4926 / 6974	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
2878 / 4926 / 6974	3	EncSerialNum					Encoder serial number	string		
2881 / 4929 / 6977		ENC_CH3_Info					Axis 1 / 2 / 3: Encoder information		0	5
2881 / 4929 / 6977	0	SerialNumber					Serial number	string		
2881 / 4929 / 6977	1	FirmwareVersion					Firmware version	string		
2881 / 4929 / 6977	2	EncoderType					Encoder type	string		
2881 / 4929 / 6977	3	Flags		0	0	4294967295	Axis 1/2/3: Encoder information	uint32		
2881 / 4929 / 6977	4	Delay		0	-3.4E+38	3.4E+38	Internal dead time of the position			
SUBJECT AREA		Channel 4					Encoder channel 4 / sensorless control settings		0	0
2891 / 4939 / 6987		ENC_CH4_Backup_User					Axis 1 / 2 / 3: Channel 3 position backup in user units		0	5
2891 / 4939 / 6987	0	Pos	PosUnit	0	-2147483648	2147483647	Backup position in user units	int32		
2891 / 4939 / 6987	1	EncVal_PosDiff	PosUnit	0	-2147483648	2147483647	Validation of position difference	int32		
2884 / 4932 / 6980		ENC_CH4_Settings					Axis 1 / 2 / 3: Channel 4 virtual encoder interface settings		0	2
2884 / 4932 / 6980	0	Select		NONE (0)	NONE (0)	Kalman (10)	Encoder selection	uint8		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2884 / 4932 / 6980	1	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		
2884 / 4932 / 6980	2	AbsEncoder		NONE (0)	NONE (0)	NONE (0)	Absolute interface selector	uint16		
2884 / 4932 / 6980	3	AbsIntMode		STD (0)	STD (0)	DIG (1)	Absolute value initialisation mode	uint16		
2884 / 4932 / 6980	4	Multiturn		0	0	32	Number of multiturn bits	uint16		
2884 / 4932 / 6980	5	Singleturn		0	0	32	Number of singleturn bits	uint16		
2884 / 4932 / 6980	6	Lines		1	1	65536	Pulses per revolution / number of pole pairs	uint32		
2884 / 4932 / 6980	7	LineDelay	us	0	-3.4E+38	3.4E+38	Phase shift compensation	float32		
2884 / 4932 / 6980	8	Amplitude	+-%	0	-3.4E+38	3.4E+38	Amplitude of the resolver signal	float32		
2884 / 4932 / 6980	9	Corr		0	0	65535	Signal correction selector	uint16		
2884 / 4932 / 6980	10	reserved		0	-	2147483647		int32		
2884 / 4932 / 6980	11	Numerator		1	-	2147483648	Encoder gearing numerator	int32		
2884 / 4932 / 6980	12	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		
2884 / 4932 / 6980	13	EncObsMin	100%	0.2	0	3.4E+38	Encoder monitoring limit (root of a2+b2)	float32		
2884 / 4932 / 6980	14	PeriodLen	nm	0	0	4294967295	Analog signal period (linear encoder)	uint32		
2884 / 4932 / 6980	15	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
2884 / 4932 / 6980	16	TTL_SignalType		0	0	4	TTL encoder signal type	uint16		
2884 / 4932 / 6980	17	CycleCountMax		1	1	75	Absolute interface sampling rate (n x 0.125ms)	uint8		
2884 / 4932 / 6980	18	Graycode		True (1)	False (0)	True (1)	Graycode / binary code	bool32		
2884 / 4932 / 6980	19	ParityOdd		False (0)	False (0)	True (1)	Parity odd/even	bool32		
2884 / 4932 / 6980	20	ParityEnable		False (0)	False (0)	True (1)	Evaluate parity bit	bool32		
2884 / 4932 / 6980	21	EncObsBitEnable		False (0)	False (0)	True (1)	Enable encoder monitoring bit	bool32		
2884 / 4932 / 6980	22	PreBits		0	0	32	Number of bits before position	uint16		
2884 / 4932 / 6980	23	PostBits		0	0	32	Number of bits after position	uint16		
2884 / 4932 / 6980	24	PostParityPosition		0	0	32	Position of parity bit (in postbits)	uint16		
2884 / 4932 / 6980	25	PostEncObsPosition		0	0	32	Position of encoder monitoring bit (in postbits)	uint16		
2884 / 4932 / 6980	26	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
2884 / 4932 / 6980	27	EncVal_Enable		224	0	65535	Encoder validation	uint16		
2884 / 4932 / 6980	28	EncVal_PosDiffLim	PosUnit	100	0	4294967295	Max. encoder validation position	uint32		
2884 / 4932 / 6980	29	MTBase		2147483648	0	4294967295	Multiturn zero point shift	uint32		
2885 / 4933 / 6981		ENC_CH4_ActVal					Axis 1 / 2 / 3: Channel 4 actual encoder values		0	5
2885 / 4933 / 6981	0	ActPosST		0	0	4294967295	Current singleturn position	uint32		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2885 / 4933 / 6981	1	ActPosMT		0	0	4294967295	Current multiturn position	uint32		
2885 / 4933 / 6981	2	InitPosST		0	0	4294967295	Singleturn init position	uint32		
2885 / 4933 / 6981	3	InitPosMT		0	0	4294967295	Multiturn init position	uint32		
2885 / 4933 / 6981	4	RawDataLow		0	0	4294967295	Encoder raw data: Low-word	uint32		
2885 / 4933 / 6981	5	RawDataHigh		0	0	4294967295	Encoder raw data: High-word	uint32		
2885 / 4933 / 6981	6	Speed	RPM	0	-3.4E+38	3.4E+38	Speed from encoder module unfiltered	float32		
2885 / 4933 / 6981	7	ActPosInc	INCR	0	0	4294967295	Actual position in increments	bool32		
2886 / 4934 / 6982		ENC_CH4_SignalInjection					Axis 1 / 2 / 3: Channel 4 signal injection		0	2
2886 / 4934 / 6982	0	Switch		OFF (0)	OFF (0)	CTRL (2)	Current injection	uint16		
2886 / 4934 / 6982	1	FullSignalRange	rpm	100	0	3.4E+38	SC test signal: Full test signal amplitude range	float32		
2886 / 4934 / 6982	2	IncreasingSignalRange	rpm	100	1	3.4E+38	SC test signal: Linear transition range up until which the test signal is reduced to 0	float32		
2886 / 4934 / 6982	3	SinusFrequency	Hz	500	20	1000	SC test signal: Sinusoidal signal frequency	float32		
2886 / 4934 / 6982	4	SinusAmplitude	A	0	0	100	SC test signal: d-current amplitude of sine signal	float32		
2886 / 4934 / 6982	5	PRBSTime	ms	1	0	1000	SC test signal: PRBS signal time	float32		
2886 / 4934 / 6982	6	PRBSAmplitude	A	0	0	100	Amplitude of PBRs signal	float32		
2886 / 4934 / 6982	7	Offset	A	0	-100	100	Current injection: D-current offset	float32		
2887 / 4935 / 6983		ENC_CH4_Backup					Axis 1 / 2 / 3: Channel 4 position backup		0	4
2887 / 4935 / 6983	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
2887 / 4935 / 6983	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
2887 / 4935 / 6983	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
2900 / 4948 / 6996	0	ENC_CH4_Kalman_Ctrl		Ready (0)	Ready (0)	SetSigInjFF (4)	Axis 1 / 2 / 3: Control parameter for Kalman filter	int16	0	2
2901 / 4949 / 6997		ENC_CH4_Kalman					Axis 1 / 2 / 3: Kalman filter settings		0	2
2901 / 4949 / 6997	0	Q00		1	0	3.4E+38	Q-matrix: weighting factor fault voltage/inductance d-axis	float32		
2901 / 4949 / 6997	1	Q11		1	0	3.4E+38	Q-matrix: Weighting factor fault voltage/inductance q-axis	float32		
2901 / 4949 / 6997	2	Q22		1	0	3.4E+38	Q-matrix: Weighting factor torque/moment of inertia	float32		
2901 / 4949 / 6997	3	Q33		0	0	3.4E+38	Q-matrix: Weighting factor of model position error	float32		
2901 / 4949 / 6997	4	Q44		1	0	3.4E+38	Q-matrix: Weighting factor of Q11 and kmot	float32		
2901 / 4949 / 6997	5	R		0.0001	0	3.4E+38	R-matrix: Weighting factor of current measuring noise	float32		
SUBJECT AREA		Electronic rating plate							0	0
2896 / 4944 / 6992		ENC_ENP_Settings					Axis 1 / 2 / 3: ENP settings, electronic rating plate		0	2
2896 / 4944 / 6992	0	Select		AUTO (0)	AUTO (0)	EC3 (5)	Selection of encoder channel for ENP	uint8		

Table 18.8: Parameter list – Encoder axis (continue)



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2896 / 4944 / 6992	1	Mode		4	0	65535	ENP mode	uint16		
2896 / 4944 / 6992	2	Blocks		4	0	65535	ENP individual block selection	uint16		
2897 / 4945 / 6993		ENC_ENP_Action					Axis 1 / 2 / 3: ENP action parameters		0	2
2897 / 4945 / 6993	0	Load		OFF (0)	OFF (0)	ON (1)	Load motor rating plate now. Requires encoder initialisation.	uint8		
2897 / 4945 / 6993	1	Blocks		4294967295	0	4294967295	ENP individual block selection	uint32		
2897 / 4945 / 6993	2	Service					do not use	string		
2898 / 4946 / 6994		ENC_ENP_Info					Axis 1 / 2 / 3: ENP information		0	2
2898 / 4946 / 6994	0	DatasetRev		0	0	4294967295	Version of ENP data set (read by encoder)	uint32		
2898 / 4946 / 6994	1	FirmwareRev		11000	0	4294967295	Version of ENP firmware (stored in firmware)	uint32		
2898 / 4946 / 6994	2	DateOfMotorProduction		0	0	4294967295	Format yyyyymmdd. Read from motor rating plate	uint32		
2898 / 4946 / 6994	3	ManufacturingPlantID					Loaded from motor rating plate	string		
2899 / 4947 / 6995		ENC_ENP_Backup					Axis 1 / 2 / 3: ENP information		0	2
2899 / 4947 / 6995	0	MotorModelID					Loaded from motor rating plate	string		
2899 / 4947 / 6995	1	MotorSerialNumber					Loaded from motor rating plate	string		
2899 / 4947 / 6995	2	EncoderSerialNum					Manufacturer's serial number of encoder	string		
2257 / 4305 / 6353	0	MPRO_DRVCOM_Init		READY (0)	READY (0)	ERRQUIT (5)	Axis 1 / 2 / 3: Initialisation	uint8	0	2
SUBJECT AREA		Encoder homing backup					Backup for encoder and homing		0	0
2281 / 4329 / 6377		MC_HOMING_Settings					Axis 1 / 2 / 3: "Homing" settings		0	2
2281 / 4329 / 6377	0	SimEnable		OFF (0)	OFF (0)	SIM_AUTO (3)	Homing simulation	uint16		
2281 / 4329 / 6377	1	EncMode		STARTUP_MT (1)	STD (0)	STARTUP_MT (1)	Homing start	uint16		
2282 / 4330 / 6378		MC_HOMING_Backup					Axis 1 / 2 / 3: Position backup		0	4
2282 / 4330 / 6378	0	HomeDiffST		0	0	4294967295	Singleturn position backup	uint32		
2282 / 4330 / 6378	1	HomeDiffMT		0	0	4294967295	Multiturn position backup	uint32		
2282 / 4330 / 6378	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
2284 / 4332 / 6380	0	MC_HOMING_SimState		OFF (0)	OFF (0)	LOCK_MT (4)	Axis 1 / 2 / 3: Homing simulation state	uint16	0	5
2848 / 4896 / 6944		ENC_CH1_Settings					Axis 1 / 2 / 3: Channel 1 multi-encoder interface settings		0	2
2848 / 4896 / 6944	0	Select		NONE (0)	NONE (0)	reserved9 (9)	Encoder selection channel 1	uint8		
2848 / 4896 / 6944	1	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		
2848 / 4896 / 6944	2	AbsEncoder		NONE (0)	NONE (0)	HIPERFACE (3)	Absolute interface selector	uint16		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2848 / 4896 / 6944	3	AbsIntMode		DIG (1)	STD (0)	DIG (1)	Absolute value initialisation mode	uint16		
2848 / 4896 / 6944	4	Multiturn		0	0	32	Number of multiturn bits	uint16		
2848 / 4896 / 6944	5	Singleturn		0	0	32	Number of singleturn bits	uint16		
2848 / 4896 / 6944	6	Lines		1	1	65536	Pulses per revolution / number of pole pairs	uint32		
2848 / 4896 / 6944	7	LineDelay	us	0	-3.4E+38	3.4E+38	Phase shift compensation	float32		
2848 / 4896 / 6944	8	Amplitude	%	100	10	100	Amplitude of the resolver signal	float32		
2848 / 4896 / 6944	9	Corr		0	0	65535	Signal correction selector	uint16		
2848 / 4896 / 6944	10	Fc_override	kHz	0	0	1000	A/D converter cut-off frequency override	float32		
2848 / 4896 / 6944	11	Numerator		1	- 2147483648	2147483647	Encoder gearing numerator	int32		
2848 / 4896 / 6944	12	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		
2848 / 4896 / 6944	13	EncObsMin	100%	0.2	0	3.4E+38	Encoder monitoring limit (root of a <sup>2</sup> +b <sup>2</sup> )	float32		
2848 / 4896 / 6944	14	PeriodLen	nm	0	0	4294967295	Analog signal period (linear encoder)	uint32		
2848 / 4896 / 6944	15	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
2848 / 4896 / 6944	16	TTL_SignalType		AB (0)	AB (0)	SinCos_AB (4)	TTL encoder signal type	uint16		
2848 / 4896 / 6944	17	CycleCountMax		1	1	75	Absolute interface sampling rate (n x 0.125ms)	uint8		
2848 / 4896 / 6944	18	Graycode		True (1)	False (0)	True (1)	Graycode / binary code	bool32		
2848 / 4896 / 6944	19	ParityOdd		False (0)	False (0)	True (1)	Parity odd/even	bool32		
2848 / 4896 / 6944	20	ParityEnable		False (0)	False (0)	True (1)	Evaluate parity bit	bool32		
2848 / 4896 / 6944	21	EncObsBitEnable		False (0)	False (0)	True (1)	Enable encoder monitoring bit	bool32		
2848 / 4896 / 6944	22	PreBits		0	0	32	Number of bits before position	uint16		
2848 / 4896 / 6944	23	PostBits		0	0	32	Number of bits after position	uint16		
2848 / 4896 / 6944	24	PostParityPosition		0	0	32	Position of parity bit (in postbits)	uint16		
2848 / 4896 / 6944	25	PostEncObsPosition		0	0	32	Position of encoder monitoring bit (in postbits)	uint16		
2848 / 4896 / 6944	26	OffsetST	incr	0	0	4294967295	Singleturn offset at original encoder position	uint32		
2848 / 4896 / 6944	27	OffsetMT	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
2848 / 4896 / 6944	28	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
2848 / 4896 / 6944	29	EncVal_Enable		224	0	65535	Encoder validation	uint16		
2848 / 4896 / 6944	30	EncVal_PosDiffLim	PosUnit	100	0	4294967295	Max. encoder validation position	uint32		
2848 / 4896 / 6944	31	MTBase		2147483648	0	4294967295	Multiturn zero point shift	uint32		
2848 / 4896 / 6944	32	Mode		0	0	4294967295	Encoder mode	uint32		
2848 / 4896 / 6944	33	ResolverFexec		8kHz (0)	8kHz (0)	4kHz (1)	Resolver excitation frequency	uint32		
2848 / 4896 / 6944	34	EncObsTf	ms	0	0	1000	Filter time constant of signal sqrt(a <sup>2</sup> +b <sup>2</sup> ) for wire break	float32		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
							detection			
2848 / 4896 / 6944	35	InitDelay	steps	4	0	100	Encoder initialisation delay	uint16		
2848 / 4896 / 6944	36	TemperatureLimit	degC	0	0	3.4E+38	Encoder temperature error threshold (0 = no function)	float32		
2848 / 4896 / 6944	37	TemperatureWarning	degC	0	0	3.4E+38	Encoder temperature warning threshold (0 = no function)	float32		
2848 / 4896 / 6944	38	ErrorTol		0	0	255	Tolerate small number of errors in digital protocol	uint8		
2876 / 4924 / 6972		ENC_CH1_Backup					Axis 1 / 2 / 3: Channel 1 position backup		0	4
2876 / 4924 / 6972	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
2876 / 4924 / 6972	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
2876 / 4924 / 6972	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
2876 / 4924 / 6972	3	EncSerialNum					Encoder serial number	string		
2888 / 4936 / 6984		ENC_CH1_Backup_User					Axis 1 / 2 / 3: Channel 1 position backup in user units		0	5
2888 / 4936 / 6984	0	Pos	PosUnit	0	- 2147483648	2147483647	Backup position in user units	int32		
2888 / 4936 / 6984	1	EncVal_PosDiff	PosUnit	0	- 2147483648	2147483647	Validation of position difference	int32		
2868 / 4916 / 6964		ENC_CH2_Settings					Axis 1 / 2 / 3: Channel 3 incremental encoder interface settings		0	2
2868 / 4916 / 6964	0	Select		NONE (0)	NONE (0)	SINCOS (2)	Encoder selection channel 1	uint8		
2868 / 4916 / 6964	1	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		
2868 / 4916 / 6964	2	AbsEncoder		NONE (0)	NONE (0)	NONE (0)	Absolute interface selector	uint16		
2868 / 4916 / 6964	3	AbsIntMode		STD (0)	STD (0)	STD (0)	Absolute value initialisation mode	uint16		
2868 / 4916 / 6964	4	Multiturn		0	0	32	Number of multiturn bits	uint16		
2868 / 4916 / 6964	5	Singleturn		0	0	32	Number of singleturn bits	uint16		
2868 / 4916 / 6964	6	Lines		1	1	65536	Pulses per revolution / number of pole pairs	uint32		
2868 / 4916 / 6964	7	LineDelay	us	0	-3.4E+38	3.4E+38	Phase shift compensation	float32		
2868 / 4916 / 6964	8	Amplitude	%	100	10	100	Amplitude of the resolver signal	float32		
2868 / 4916 / 6964	9	Corr		0	0	65535	Signal correction selector	uint16		
2868 / 4916 / 6964	10	Fc_override	kHz	0	0	1000	A/D converter cut-off frequency override	float32		
2868 / 4916 / 6964	11	Numerator		1	- 2147483648	2147483647	Encoder gearing numerator	int32		
2868 / 4916 / 6964	12	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		
2868 / 4916 / 6964	13	EncObsMin	100%	0.2	0	3.4E+38	Encoder monitoring limit (root of a2+b2)	float32		
2868 / 4916 / 6964	14	PeriodLen	nm	0	0	4294967295	Analog signal period (linear encoder)	uint32		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2868 / 4916 / 6964	15	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
2868 / 4916 / 6964	16	TTL_SignalType		AB (0)	AB (0)	SinCos_AB (4)	TTL encoder signal type	uint16		
2868 / 4916 / 6964	17	CycleCountMax		1	1	75	Absolute interface sampling rate (n x 0.125ms)	uint8		
2868 / 4916 / 6964	18	Graycode		True (1)	False (0)	True (1)	Graycode / binary code	bool32		
2868 / 4916 / 6964	19	ParityOdd		False (0)	False (0)	True (1)	Parity odd/even	bool32		
2868 / 4916 / 6964	20	ParityEnable		False (0)	False (0)	True (1)	Evaluate parity bit	bool32		
2868 / 4916 / 6964	21	EncObsBitEnable		False (0)	False (0)	True (1)	Enable encoder monitoring bit	bool32		
2868 / 4916 / 6964	22	PreBits		0	0	32	Number of bits before position	uint16		
2868 / 4916 / 6964	23	PostBits		0	0	32	Number of bits after position	uint16		
2868 / 4916 / 6964	24	PostParityPosition		0	0	32	Position of parity bit (in postbits)	uint16		
2868 / 4916 / 6964	25	PostEncObsPosition		0	0	32	Position of encoder monitoring bit (in postbits)	uint16		
2868 / 4916 / 6964	26	OffsetST	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
2868 / 4916 / 6964	27	OffsetMT	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
2868 / 4916 / 6964	28	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
2868 / 4916 / 6964	29	EncVal_Enable		224	0	65535	Encoder validation	uint16		
2868 / 4916 / 6964	30	EncVal_PosDiffLim	PosUnit	100	0	4294967295	Max. encoder validation position	uint32		
2868 / 4916 / 6964	31	MTBase		2147483648	0	4294967295		uint32		
2868 / 4916 / 6964	32	unused1		0	0	4294967295	unused sub parameter	uint32		
2868 / 4916 / 6964	33	unused2		0	0	4294967295	unused sub parameter	uint32		
2868 / 4916 / 6964	34	EncObsTf	ms	0	0	1000	Filter time constant of signal $\sqrt{a^2+b^2}$ for wire break detection	float32		
2868 / 4916 / 6964	35	InitDelay	steps	4	0	100	Encoder initialisation delay	uint16		
2868 / 4916 / 6964	36	ErrorTol		0	0	255	Tolerate small number of errors in digital protocol	uint8		
2868 / 4916 / 6964	37	DistCodeA					Distance-coded zero pulses: Fundamental period. Zero if no distance coding	uint16		
2868 / 4916 / 6964	38	DistCodeB					Distance-coded zero pulses: Changed periods (B > A)	uint16		
2877 / 4925 / 6973		ENC_CH2_Backup					Axis 1 / 2 / 3: Channel 2 position backup		0	4
2877 / 4925 / 6973	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
2877 / 4925 / 6973	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
2877 / 4925 / 6973	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
2877 / 4925 / 6973	3	EncSerialNum					Encoder serial number	string		
2889 / 4937 / 6985		ENC_CH2_Backup_User					Axis 1 / 2 / 3: Channel 2 position backup in user units		0	5

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2889 / 4937 / 6985	0	Pos	PosUnit	0	-2147483648	2147483647	Backup position in user units	int32		
2889 / 4937 / 6985	1	EncVal_PosDiff	PosUnit	0	-2147483648	2147483647	Validation of position difference	int32		
2874 / 4922 / 6970		ENC_CH3_Settings					Axis 1 / 2 / 3: Channel 3 Hiperface DSL settings		0	2
2874 / 4922 / 6970	0	Select		None (0)	None (0)	HDSL (6)	Channel 3 encoder selection	uint8		
2874 / 4922 / 6970	1	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		
2874 / 4922 / 6970	2	AbsEncoder		None (0)	None (0)	None (0)	Absolute interface selector	uint16		
2874 / 4922 / 6970	3	AbsIntMode		None (0)	None (0)	None (0)	Absolute value initialisation mode	uint16		
2874 / 4922 / 6970	4	Multiturn		0	0	32	Number of multiturn bits	uint16		
2874 / 4922 / 6970	5	Singleturn		0	0	32	Number of singleturn bits	uint16		
2874 / 4922 / 6970	6	Lines		1	1	65536	Pulses per revolution / number of pole pairs	uint32		
2874 / 4922 / 6970	7	LineDelay	us	0	-3.4E+38	3.4E+38	Phase shift compensation	float32		
2874 / 4922 / 6970	8	Amplitude	+-%	0	-3.4E+38	3.4E+38	Amplitude of the resolver signal	float32		
2874 / 4922 / 6970	9	Corr		0	0	65535	Signal correction selector	uint16		
2874 / 4922 / 6970	10	reserved		0	-2147483648	2147483647		int32		
2874 / 4922 / 6970	11	Numerator		1	-2147483648	2147483647	Encoder gearing numerator	int32		
2874 / 4922 / 6970	12	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		
2874 / 4922 / 6970	13	EncObsMin	100%	0.2	0	3.4E+38	Encoder monitoring limit (root of a2+b2)	float32		
2874 / 4922 / 6970	14	PeriodLen	nm	0	0	4294967295	Analog signal period (linear encoder)	uint32		
2874 / 4922 / 6970	15	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
2874 / 4922 / 6970	16	TTL_SignalType		None (0)	None (0)	None (0)	TTL encoder signal type	uint16		
2874 / 4922 / 6970	17	CycleCountMax		1	1	75	Absolute interface sampling rate (n x 0.125ms)	uint8		
2874 / 4922 / 6970	18	Graycode		True (1)	False (0)	True (1)	Graycode / binary code	bool32		
2874 / 4922 / 6970	19	ParityOdd		False (0)	False (0)	True (1)	Parity odd/even	bool32		
2874 / 4922 / 6970	20	ParityEnable		False (0)	False (0)	True (1)	Evaluate parity bit	bool32		
2874 / 4922 / 6970	21	EncObsBitEnable		False (0)	False (0)	True (1)	Enable encoder monitoring bit	bool32		
2874 / 4922 / 6970	22	PreBits		0	0	32	Number of bits before position	uint16		
2874 / 4922 / 6970	23	PostBits		0	0	32	Number of bits after position	uint16		
2874 / 4922 / 6970	24	PostParityPosition		0	0	32	Position of parity bit (in postbits)	uint16		
2874 / 4922 / 6970	25	PostEncObsPosition		0	0	32	Position of encoder monitoring bit (in postbits)	uint16		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2874 / 4922 / 6970	26	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
2874 / 4922 / 6970	27	EncVal_Enable		224	0	65535	Encoder validation	uint16		
2874 / 4922 / 6970	28	EncVal_PosDiffLim	PosUnit	100	0	4294967295	Max. encoder validation position	uint32		
2874 / 4922 / 6970	29	MTBase		2147483648	0	4294967295	Multiturn zero point shift	uint32		
2874 / 4922 / 6970	30	TemperatureLimit	degC	0	0	3.4E+38	Encoder temperature error threshold (0 = no function)	float32		
2874 / 4922 / 6970	31	TemperatureWarning	degC	0	0	3.4E+38	Encoder temperature warning threshold (0 = no function)	float32		
2874 / 4922 / 6970	32	ErrorTol		0	0	255	Tolerate small number of errors in digital protocol	uint8		
2878 / 4926 / 6974		ENC_CH3_Backup					Axis 1 / 2 / 3: Channel 3 position backup		0	4
2878 / 4926 / 6974	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
2878 / 4926 / 6974	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
2878 / 4926 / 6974	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
2878 / 4926 / 6974	3	EncSerialNum					Encoder serial number	string		
2890 / 4938 / 6986		ENC_CH3_Backup_User					Axis 1 / 2 / 3: Channel 2 position backup in user units		0	5
2890 / 4938 / 6986	0	Pos	PosUnit	0	- 2147483648	2147483647	Backup position in user units	int32		
2890 / 4938 / 6986	1	EncVal_PosDiff	PosUnit	0	- 2147483648	2147483647	Validation of position difference	int32		
2882 / 4930 / 6978		ENC_CH_Action					Axis 1 / 2 / 3: Actions for encoder system		0	2
2882 / 4930 / 6978	0	BackupLatch		OFF (0)	OFF (0)	RESET_POS (10)	Save encoder backup values	uint8		
2882 / 4930 / 6978	1	MtBase		OFF (0)	OFF (0)	ZERO_CH3 (9)	Set overflow point based on current position	uint8		
800		ENC_EC1_Settings					EtherCAT encoder 1: Settings		0	2
800	0	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		
800	1	Multiturn		12	0	32	Number of multiturn bits	uint16		
800	2	Singleturn		16	0	32	Number of singleturn bits	uint16		
800	3	Delay	ms	0.125	-3.4E+38	3.4E+38	Compensation of the field bus delay	float32		
800	4	Numerator		1	- 2147483648	2147483647	Encoder gearing numerator	int32		
800	5	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		
800	6	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
800	7	OffsetST	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
800	8	OffsetMT	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
800	9	MTBase		2147483648	0	4294967295	Multiturn zero point shift	uint32		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
800	10	StatusCheck		ON (1)	OFF (0)	ON (1)	Status bit check on/off	uint8		
800	11	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
800	12	EncVal_Enable		224	0	65535	Encoder validation	uint16		
800	13	EncVal_PosDiffLim	PosUnit	100	0	4294967295	Max. encoder validation position	uint32		
800	14	EncoderType		NONE (0)	NONE (0)	ENDAT (2)	Type of remote encoder	uint8		
800	15	TemperatureLimit	degC	0	0	3.4E+38	Encoder temperature error threshold (0 = no function)	float32		
800	16	TemperatureWarning	degC	0	0	3.4E+38	Encoder temperature warning threshold (0 = no function)	float32		
800	17	ErrorTol		0	0	255	Tolerate small number of errors in digital protocol	uint8		
806		ENC_EC1_Backup					Field bus encoder #1 backup values		0	4
806	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
806	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
806	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
806	3	EncSerialNum					Encoder serial number	string		
809		ENC_EC1_Backup_User					Field bus encoder #1 backup values in user units		0	5
809	0	Pos	PosUnit	0	-2147483648	2147483647	Backup position in user units	int32		
809	1	EncVal_PosDiff	PosUnit	0	-2147483648	2147483647	Validation of position difference	int32		
812		ENC_EC1_Info					Encoder information of field bus encoder #1		0	2
812	0	SerialNumber					Serial number	string		
812	1	FirmwareVersion					Firmware version	string		
812	2	EncoderType					Encoder type	string		
812	3	Flags		0	0	4294967295	Encoder information	uint32		
802		ENC_EC2_Settings					EtherCAT encoder 2: Settings		0	2
802	0	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		
802	1	Multiturn		12	0	32	Number of multiturn bits	uint16		
802	2	Singleturn		16	0	32	Number of singleturn bits	uint16		
802	3	Delay	ms	0.125	-3.4E+38	3.4E+38	Compensation of the field bus delay	float32		
802	4	Numerator		1	-2147483648	2147483647	Encoder gearing numerator	int32		
802	5	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		
802	6	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
802	7	OffsetST	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
802	8	OffsetMT	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
802	9	MTBase		2147483648	0	4294967295	Multiturn zero point shift	uint32		
802	10	StatusCheck		ON (1)	OFF (0)	ON (1)	Status bit check	uint8		
802	11	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
802	12	EncVal_Enable		224	0	65535	Encoder validation	uint16		
802	13	EncVal_PosDiffLim	PosUnit	100	0	4294967295	Max. encoder validation position	uint32		
802	14	EncoderType		NONE (0)	NONE (0)	ENDAT (2)	Type of remote encoder	uint8		
802	15	TemperatureLimit	degC	0	0	3.4E+38	Encoder temperature error threshold (0 = no function)	float32		
802	16	TemperatureWarning	degC	0	0	3.4E+38	Encoder temperature warning threshold (0 = no function)	float32		
802	17	ErrorTol		0	0	255	Tolerate small number of errors in digital protocol	uint8		
807		ENC_EC2_Backup					Field bus encoder #2 backup values		0	4
807	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
807	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
807	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
807	3	EncSerialNum					Encoder serial number	string		
810		ENC_EC2_Backup_User					Field bus encoder #2 backup values in user units		0	5
810	0	Pos	PosUnit	0	- 2147483648	2147483647	Backup position in user units	int32		
810	1	EncVal_PosDiff	PosUnit	0	- 2147483648	2147483647	Validation of position difference	int32		
813		ENC_EC2_Info					Encoder information of field bus encoder #1		0	2
813	0	SerialNumber					Serial number	string		
813	1	FirmwareVersion					Firmware version	string		
813	2	EncoderType					Encoder type	string		
813	3	Flags		0	0	4294967295	Encoder information	uint32		
804		ENC_EC3_Settings					EtherCAT encoder 3: Settings		0	2
804	0	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		
804	1	Multiturn		12	0	32	Number of multiturn bits	uint16		
804	2	Singleturn		16	0	32	Number of singleturn bits	uint16		
804	3	Delay	ms	0.125	-3.4E+38	3.4E+38	Compensation of the field bus delay	float32		
804	4	Numerator		1	- 2147483648	2147483647	Encoder gearing numerator	int32		
804	5	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		

Table 18.8: Parameter list – Encoder axis (continue)



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
804	6	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
804	7	OffsetST	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
804	8	OffsetMT	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
804	9	MTBase		2147483648	0	4294967295	Multiturn zero point shift	uint32		
804	10	StatusCheck		ON (1)	OFF (0)	ON (1)	Activate status bit check	uint8		
804	11	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
804	12	EncVal_Enable		224	0	65535	Encoder validation	uint16		
804	13	EncVal_PosDiffLim	PosUnit	100	0	4294967295	Max. encoder validation position	uint32		
804	14	EncoderType		NONE (0)	NONE (0)	ENDAT (2)	Type of remote encoder	uint8		
804	15	TemperatureLimit	degC	0	0	3.4E+38	Encoder temperature error threshold (0 = no function)	float32		
804	16	TemperatureWarning	degC	0	0	3.4E+38	Encoder temperature warning threshold (0 = no function)	float32		
804	17	ErrorTol		0	0	255	Tolerate small number of errors in digital protocol	uint8		
808		ENC_EC3_Backup					Field bus encoder #3 backup values		0	4
808	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
808	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
808	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
808	3	EncSerialNum					Encoder serial number	string		
811		ENC_EC3_Backup_User					Field bus encoder #3 backup values in user units		0	5
811	0	Pos	PosUnit	0	- 2147483648	2147483647	Backup position in user units	int32		
811	1	EncVal_PosDiff	PosUnit	0	- 2147483648	2147483647	Validation of position difference	int32		
814		ENC_EC3_Info					Encoder information of field bus encoder #1		0	2
814	0	SerialNumber					Serial number	string		
814	1	FirmwareVersion					Firmware version	string		
814	2	EncoderType					Encoder type	string		
814	3	Flags		0	0	4294967295	Encoder information	uint32		
2884 / 4932 / 6980		ENC_CH4_Settings					Axis 1 / 2 / 3: Channel 4 virtual encoder interface settings		0	2
2884 / 4932 / 6980	0	Select		NONE (0)	NONE (0)	Kalman (10)	Encoder selection	uint8		
2884 / 4932 / 6980	1	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		
2884 / 4932 / 6980	2	AbsEncoder		NONE (0)	NONE (0)	NONE (0)	Absolute interface selector	uint16		
2884 / 4932 / 6980	3	AbsIntMode		STD (0)	STD (0)	DIG (1)	Absolute value initialisation mode	uint16		
2884 / 4932 / 6980	4	Multiturn		0	0	32	Number of multiturn bits	uint16		

Table 18.8: Parameter list – Encoder axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2884 / 4932 / 6980	5	Singleturn		0	0	32	Number of singleturn bits	uint16		
2884 / 4932 / 6980	6	Lines		1	1	65536	Pulses per revolution / number of pole pairs	uint32		
2884 / 4932 / 6980	7	LineDelay	us	0	-3.4E+38	3.4E+38	Phase shift compensation	float32		
2884 / 4932 / 6980	8	Amplitude	+-%	0	-3.4E+38	3.4E+38	Amplitude of the resolver signal	float32		
2884 / 4932 / 6980	9	Corrs		0	0	65535	Signal correction selector	uint16		
2884 / 4932 / 6980	10	reserved		0	- 2147483648	2147483647		int32		
2884 / 4932 / 6980	11	Numerator		1	- 2147483648	2147483647	Encoder gearing numerator	int32		
2884 / 4932 / 6980	12	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		
2884 / 4932 / 6980	13	EncObsMin	100%	0.2	0	3.4E+38	Encoder monitoring limit (root of a2+b2)	float32		
2884 / 4932 / 6980	14	PeriodLen	nm	0	0	4294967295	Analog signal period (linear encoder)	uint32		
2884 / 4932 / 6980	15	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
2884 / 4932 / 6980	16	TTL_SignalType		0	0	4	TTL encoder signal type	uint16		
2884 / 4932 / 6980	17	CycleCountMax		1	1	75	Absolute interface sampling rate (n x 0.125ms)	uint8		
2884 / 4932 / 6980	18	Graycode		True (1)	False (0)	True (1)	Graycode / binary code	bool32		
2884 / 4932 / 6980	19	ParityOdd		False (0)	False (0)	True (1)	Parity odd/even	bool32		
2884 / 4932 / 6980	20	ParityEnable		False (0)	False (0)	True (1)	Evaluate parity bit	bool32		
2884 / 4932 / 6980	21	EncObsBitEnable		False (0)	False (0)	True (1)	Enable encoder monitoring bit	bool32		
2884 / 4932 / 6980	22	PreBits		0	0	32	Number of bits before position	uint16		
2884 / 4932 / 6980	23	PostBits		0	0	32	Number of bits after position	uint16		
2884 / 4932 / 6980	24	PostParityPosition		0	0	32	Position of parity bit (in postbits)	uint16		
2884 / 4932 / 6980	25	PostEncObsPosition		0	0	32	Position of encoder monitoring bit (in postbits)	uint16		
2884 / 4932 / 6980	26	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
2884 / 4932 / 6980	27	EncVal_Enable		224	0	65535	Encoder validation	uint16		
2884 / 4932 / 6980	28	EncVal_PosDiffLim	PosUnit	100	0	4294967295	Max. encoder validation position	uint32		
2884 / 4932 / 6980	29	MTBase		2147483648	0	4294967295	Multiturn zero point shift	uint32		
2887 / 4935 / 6983		ENC_CH4_Backup					Axis 1 / 2 / 3: Channel 4 position backup		0	4
2887 / 4935 / 6983	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
2887 / 4935 / 6983	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
2887 / 4935 / 6983	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
2891 / 4939 / 6987		ENC_CH4_Backup_User					Axis 1 / 2 / 3: Channel 3 position backup in user units		0	5
2891 / 4939 / 6987	0	Pos	PosUnit	0	- 2147483648	2147483647	Backup position in user units	int32		
2891 / 4939 / 6987	1	EncVal_PosDiff	PosUnit	0	- 2147483648	2147483647	Validation of position difference	int32		

Table 18.8: Parameter list – Encoder axis (continue)

## 20.4 Control axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Control					Motor control settings		0	0
2962 / 5010 / 7058	0	CON_CfgCon		PCON (3)	VFCO (0)	ICON (4)	Axis 1 / 2 / 3: Control mode	uint16	0	1
SUBJECT AREA		Basic settings					Motor control basic setting		0	0
2949 / 4997 / 7045	0	CON_SCALC_Tf	ms	0.6	0	1000	Axis 1 / 2 / 3: Filter time constant actual speed value	float32	0	1
2951 / 4999 / 7047		CON_SCON_Ctrl					Axis 1 / 2 / 3: Controller settings speed control		0	2
2951 / 4999 / 7047	0	Kp	Nm/rpm	0	0	100000	Speed controller gain	float32		
2951 / 4999 / 7047	1	Tn	ms	10	0.01	10000	Speed controller integral-action time	float32		
2951 / 4999 / 7047	2	Scale	%	100	0	100000	Scale speed controller gain	float32		
2957 / 5005 / 7053	0	CON_PCON_Kp	1/min	0	0	200000	Axis 1 / 2 / 3: Position controller gain	float32	0	1
2992 / 5040 / 7088	0	SCD_JSum	kg m*m	0	0	3.4E+38	Axis 1 / 2 / 3: Total mass inertia	float32	0	2
2993 / 5041 / 7089	0	SCD_MSum	kg	0	0	3.4E+38	Axis 1 / 2 / 3: Total weight / mass	float32	0	2
SUBJECT AREA		Current Controller							0	0
2952 / 5000 / 7048		CON_CCON_Ctrl					Axis 1 / 2 / 3: Controller settings current control		0	2
2952 / 5000 / 7048	0	CON_CCON_Kp	V/A	0	0	10000	Current controller gain	float32		
2952 / 5000 / 7048	1	CON_CCON_Tn	ms	4	0.01	1000	Current controller integral-action time	float32		
2953 / 5001 / 7049		CON_CCON_Fact					Axis 1 / 2 / 3: Current control scaling factor		0	2
2953 / 5001 / 7049	0	Kscale_2	%	25	0	1000	Scaling factor @ 2 KHz	float32		
2953 / 5001 / 7049	1	Kscale_4	%	50	0	1000	Scaling factor @ 4 KHz	float32		
2953 / 5001 / 7049	2	Kscale_8	%	100	0	1000	Scaling factor @ 8 KHz	float32		
2953 / 5001 / 7049	3	Kscale_12	%	64.287	0	1000	Scaling factor @ 12 KHz	float32		
2953 / 5001 / 7049	4	Kscale_16	%	100	0	1000	Scaling factor @ 16 KHz	float32		
SUBJECT AREA		Advanced current control							0	0
2973 / 5021 / 7069		CON_CCON_Tune					Axis 1 / 2 / 3: Controller settings current control		0	2
2973 / 5021 / 7069	0	VDC_TF	ms	0.5	0	10	DC link voltage measurement: Filter time constant	float32		
2973 / 5021 / 7069	1	VDC_Weight	%	100	0	100	DC link voltage measurement: Weighting	float32		
2973 / 5021 / 7069	2	Mode		PRI (0)	PRI (0)	RESV2 (7)	Limitation mode	uint8		
2973 / 5021 / 7069	3	V_resv	%	10	0	40	Current control voltage reserve	float32		
2973 / 5021 / 7069	4	ObsMode		OFF (0)	OFF (0)	ON (1)	Current observer selection	uint32		
2973 / 5021 / 7069	5	ObsTf	ms	0.25	0.000001	1	Current observer time constant	float32		
2973 / 5021 / 7069	6	sat_mode		ISQ (0)	ISQ (0)	ISDQ (1)	Select saturation system	uint8		

Table 18.9: Parameter list – Control axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2984 / 5032 / 7080		CON_CCON_Settings					Axis 1 / 2 / 3: Controller settings current control		0	2
2984 / 5032 / 7080	0	I_TF	us	10	1	250	Current filter time	float32		
2984 / 5032 / 7080	1	Reserved		0	-3.4E+38	3.4E+38		float32		
SUBJECT AREA		Advanced scope signals					Advanced scope signals		2	2
SUBJECT AREA		Speed control							0	0
2949 / 4997 / 7045	0	CON_SCALC_Tf	ms	0.6	0	1000	Axis 1 / 2 / 3: Filter time constant actual speed value	float32	0	1
2951 / 4999 / 7047		CON_SCON_Ctrl					Axis 1 / 2 / 3: Controller settings speed control		0	2
2951 / 4999 / 7047	0	Kp	Nm/rpm	0	0	100000	Speed controller gain	float32		
2951 / 4999 / 7047	1	Tn	ms	10	0.01	10000	Speed controller integral-action time	float32		
2951 / 4999 / 7047	2	Scale	%	100	0	100000	Scale speed controller gain	float32		
2959 / 5007 / 7055		CON_IP_Reffil					Axis 1 / 2 / 3: Filter time constants feed forward control (prediction)		0	2
2959 / 5007 / 7055	0	CON_IP_RefTf	ms	0	0	1000	Speed setpoint filter	float32		
2959 / 5007 / 7055	1	CON_IP_EpsDly	ms	0.25	0	16	Position controller deceleration time (n x 0.125 ms)	float32		
2959 / 5007 / 7055	2	CON_IP_SFFTf	ms	0.875	0	1000	Filter time speed feed forward control	float32		
2959 / 5007 / 7055	3	CON_IP_AccFFTf	ms	0	0	10	Filter time acceleration feed forward control	float32		
SUBJECT AREA		Digital filter							0	0
2981 / 5029 / 7077		CON_SCON_DigFilSettings					Axis 1 / 2 / 3: Digital filter settings		0	2
2981 / 5029 / 7077	0	Type		OFF (0)	OFF (0)	BIQUAD (10)	Filter type selection	int32		
2981 / 5029 / 7077	1	fc_1	Hz	100	1	8000	1st filter: Centre frequency / cut-off frequency	float32		
2981 / 5029 / 7077	2	val_f1		1	0.0001	1000	1st filter: Bandwidth / damping	float32		
2981 / 5029 / 7077	3	fc_2	Hz	100	1	8000	2nd filter: Centre frequency / cut-off frequency	float32		
2981 / 5029 / 7077	4	val_f2	Hz	1	0.0001	1000	Value for 2nd frequency: bandwidth [Hz] or attenuation [1]	float32		
2982 / 5030 / 7078		CON_SCON_DigFilPara					Axis 1 / 2 / 3: Digital filter parameters		0	2
2982 / 5030 / 7078	0	b0		1	-3.4E+38	3.4E+38	$b_0 * x(k)$	float32		
2982 / 5030 / 7078	1	b1		0	-3.4E+38	3.4E+38	$b_1 * x(k-1)$	float32		
2982 / 5030 / 7078	2	b2		0	-3.4E+38	3.4E+38	$b_2 * x(k-2)$	float32		
2982 / 5030 / 7078	3	b3		0	-3.4E+38	3.4E+38	$b_3 * x(k-3)$	float32		
2982 / 5030 / 7078	4	b4		0	-3.4E+38	3.4E+38	$b_4 * x(k-4)$	float32		
2982 / 5030 / 7078	5	a1		0	-3.4E+38	3.4E+38	$a_1 * y(k-1)$	float32		
2982 / 5030 / 7078	6	a2		0	-3.4E+38	3.4E+38	$a_2 * y(k-2)$	float32		
2982 / 5030 / 7078	7	a3		0	-3.4E+38	3.4E+38	$a_3 * y(k-3)$	float32		
2982 / 5030 / 7078	8	a4		0	-3.4E+38	3.4E+38	$a_4 * y(k-4)$	float32		
SUBJECT AREA		Advanced speed control							0	0

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2974 / 5022 / 7070		CON_SCALC_SLStop					Axis 1 / 2 / 3: Quick stop without sensor settings		0	2
2974 / 5022 / 7070	0	LowSpeedLimit	%	10	0	100	Speed limit for I/F control (in % of Snom)	float32		
2974 / 5022 / 7070	1	LowSpeedCurrent	%	50	0	200	D-current for IF control (in % of INom)	float32		
2974 / 5022 / 7070	2	KpScale	%	25	10	100	Scaling of speed control gain	float32		
2974 / 5022 / 7070	3	KppScale	%	0	0	100	Position control gain scaling	float32		
2977 / 5025 / 7073		CON_SCALC_ObsSel					Axis 1 / 2 / 3: Observer / feedback method selection		0	2
2977 / 5025 / 7073	0	MethodSel		FILTER (0)	FILTER (0)	OBS1 (1)	Selection of the observer method	uint8		
2977 / 5025 / 7073	1	OnlineSel		OBSERVER (1)	FILTER (0)	OBSERVER (1)		uint8		
2978 / 5026 / 7074		CON_SCALC_ObsDesign					Axis 1 / 2 / 3: Observer design parameter		0	2
2978 / 5026 / 7074	0	DesignAssist		DEFAULT (0)	DEFAULT (0)	TIMES (2)	Observer configuration wizard	uint16		
2978 / 5026 / 7074	1	Tf	ms	1	0.05	1000	Observer time constant	float32		
2978 / 5026 / 7074	2	Alpha		2	0.25	10	Damping coefficient	float32		
2978 / 5026 / 7074	3	Tf1	ms	1	0.05	1000	Speed filter time constant	float32		
2978 / 5026 / 7074	4	Tf2	ms	0	-3.4E+38	3.4E+38	Acceleration time constant	float32		
2978 / 5026 / 7074	5	J	kgm2	0	-3.4E+38	3.4E+38	Moment of inertia of observed mass (0 = same as total moment of inertia of axis)	float32		
2983 / 5031 / 7079		CON_SCON_KpScale					Axis 1 / 2 / 3: Speed / position controller gain scaling		0	2
2983 / 5031 / 7079	0	KpScaleScon	%	100	0	1000	Scaling of speed control gain	float32		
2983 / 5031 / 7079	1	SpeedLimit	rpm	1	0	10000	Speed threshold for scaling	float32		
2983 / 5031 / 7079	2	FilterZero	ms	10	0	100	Filter time for change from high to low speed	float32		
2983 / 5031 / 7079	3	FilterHigh	ms	0	0	100	Filter time for change from low to high speed	float32		
2983 / 5031 / 7079	4	KpScalePcon	%	100	0	1000	Position controller gain scaling	float32		
2983 / 5031 / 7079	5	KpScaleSconConst	%	100	0	100000	Scaling of general speed control gain (adjustment to J)	float32		
SUBJECT AREA		Analysis of speed control					Advanced analysis of speed controller		0	0
2950 / 4998 / 7046	0	AddSRef	1/min	0	-3.4E+38	3.4E+38	Axis 1 / 2 / 3: Additive speed setpoint (without ramp)	float32	0	1
3052 / 5100 / 7148	0	AddTRef	Nm	0	-3.4E+38	3.4E+38	Axis 1 / 2 / 3: Additive torque setpoint (without ramp)	float32	0	1
SUBJECT AREA		Position control							0	0
2957 / 5005 / 7053	0	CON_PCON_Kp	1/min	0	0	200000	Axis 1 / 2 / 3: Position controller gain	float32	0	1
3031 / 5079 / 7127		CON_PCON_Tune					Axis 1 / 2 / 3: Advanced position control functions			
3031 / 5079 / 7127	0	Tf_EncOvr					Filter change-over frequency of position overlay (0 = function off)			

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
3031 / 5079 / 7127	1	Reserved								
3032 / 5081 / 7129	0	CON_PCON_Ctrl					Axis 1 / 2 / 3: Control word for position control			
SUBJECT AREA		Pre-control							0	0
2959 / 5007 / 7055		CON_IP_RefFil					Axis 1 / 2 / 3: Filter time constants feed forward control (prediction)		0	2
2959 / 5007 / 7055	0	CON_IP_RefTf	ms	0	0	1000	Speed setpoint filter	float32		
2959 / 5007 / 7055	1	CON_IP_EpsDly	ms	0.25	0	16	Position controller deceleration time (n x 0.125 ms)	float32		
2959 / 5007 / 7055	2	CON_IP_SFFTf	ms	0.875	0	1000	Filter time speed feed forward control	float32		
2959 / 5007 / 7055	3	CON_IP_AccFFTf	ms	0	0	10	Filter time acceleration feed forward control	float32		
2969 / 5017 / 7065	0	CON_IP_Sel		CUBIC (1)	LIN (0)	CUBIC (1)	Axis 1 / 2 / 3: Interpolation method	uint16	0	2
2970 / 5018 / 7066		CON_IP_FFMode					Axis 1 / 2 / 3: Feed forward control mode		0	2
2970 / 5018 / 7066	0	Speed		INTERN (0)	INTERN (0)	EXTERN (1)	Speed feed forward control mode	uint16		
2970 / 5018 / 7066	1	Torque		INTERN (0)	INTERN (0)	EXT2 (2)	Torque feed forward control mode	uint16		
2971 / 5019 / 7067		CON_IP_FFScale					Axis 1 / 2 / 3: Scaling of the feed forward control		0	2
2971 / 5019 / 7067	0	Speed	%	100	-3.4E+38	3.4E+38	Speed feed forward control scaling	float32		
2971 / 5019 / 7067	1	Torque	%	100	-3.4E+38	3.4E+38	Torque feed forward control scaling	float32		
2971 / 5019 / 7067	2	ExtSpeed	%	100	-3.4E+38	3.4E+38	Additional scaling of external speed feed forward control	float32		
2971 / 5019 / 7067	3	ExtTorque	%	100	-3.4E+38	3.4E+38	Additional scaling of external torque/power feed forward control	float32		
SUBJECT AREA		Friction compensation							0	0
2985 / 5033 / 7081		CON_SCON_TFric					Axis 1 / 2 / 3: Friction torque compensation settings		0	2
2985 / 5033 / 7081	0	Torque	%	0	-1000	1000	Friction compensation torque in % of rated motor torque	float32		
2985 / 5033 / 7081	1	Speed	rpm	5	0	100000	Limit speed at which the set torque is reached	float32		
2985 / 5033 / 7081	2	Torque	%	0	-1000	1000	Friction compensation torque in % of rated motor torque	float32		
2985 / 5033 / 7081	3	Speed	rpm	5	0	100000	Limit speed at which the set torque is reached	float32		
2985 / 5033 / 7081	4	Torque	%	0	-1000	1000	Friction compensation torque in % of rated motor torque	float32		
2985 / 5033 / 7081	5	Speed	rpm	5	0	100000	Limit speed at which the set torque is reached	float32		
2985 / 5033 / 7081	6	Torque	%	0	-1000	1000	Friction compensation torque in % of rated motor torque	float32		
2985 / 5033 / 7081	7	Speed	rpm	5	0	100000	Limit speed at which the set torque is reached	float32		
2985 / 5033 / 7081	8	Torque	%	0	-1000	1000	Friction compensation torque in % of rated motor torque	float32		
2985 / 5033 / 7081	9	Speed	rpm	5	0	100000	Limit speed at which the set torque is reached	float32		
2986 / 5034 / 7082		CON_SCON_TConst					Axis 1 / 2 / 3: Compensation for gravity		0	2
2986 / 5034 / 7082	0	Const	%	0	-100	100	Friction torque compensation: Constant (independent of direction)	float32		

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2986 / 5034 / 7082	1	reserved		0	-3.4E+38	3.4E+38	reserved	float32		
SUBJECT AREA		Field weakening							0	0
3012 / 5060 / 7108		CON_FM_VCon					Axis 1 / 2 / 3: Voltage controller (ASM / field weakening PSM)		0	2
3012 / 5060 / 7108	0	Kp	A/V	0	0	1000	Gain	float32		
3012 / 5060 / 7108	1	Tn	ms	10	0.01	10000	Integral-action time	float32		
3012 / 5060 / 7108	2	Tf	ms	10	0.01	10000	Filter time	float32		
3012 / 5060 / 7108	3	Vref	%	90	10	110	Setpoint (max.)	float32		
3013 / 5061 / 7109		CON_FM_IMag					Axis 1 / 2 / 3: Magnetising current		0	2
3013 / 5061 / 7109	0	IMag		0.001	0.001	1000	Magnetising current	float32		
3013 / 5061 / 7109	1	IMagMax		0	0	1000	Max. magnetizing current (LshTab)	float32		
3013 / 5061 / 7109	2	ImagSLim	%	100	0	10000	Field weakening start speed	float32		
3013 / 5061 / 7109	3	IMag0					individual magnetizing current	float32		
3014 / 5062 / 7110		CON_FM_FW					Axis 1 / 2 / 3: Field weakening settings		0	2
3014 / 5062 / 7110	0	SelMode		OFF (0)	OFF (0)	PARA (2)	Field weakening method	int32		
3014 / 5062 / 7110	1	SpeedScale	%	100	1	1000	Speed scaling (PARA mode)	float32		
3014 / 5062 / 7110	2	CurrentScale	%	100	1	1000	Current scaling (PARA mode)	float32		
3015 / 5063 / 7111		CON_FM_FW_Tab					Axis 1 / 2 / 3: Field weakening table		0	2
3015 / 5063 / 7111	0	ITab	%	0	0	200	Current (in % of IMag)	float32		
3015 / 5063 / 7111	1	STab	%	100	10	1000	Speed (in % of nom. speed)	float32		
3015 / 5063 / 7111	2	ITab	%	0	0	200	Current (in % of IMag)	float32		
3015 / 5063 / 7111	3	STab	%	100	10	1000	Speed (in % of nom. speed)	float32		
3015 / 5063 / 7111	4	ITab	%	0	0	200	Current (in % of IMag)	float32		
3015 / 5063 / 7111	5	STab	%	100	10	1000	Speed (in % of nom. speed)	float32		
3015 / 5063 / 7111	6	ITab	%	0	0	200	Current (in % of IMag)	float32		
3015 / 5063 / 7111	7	STab	%	100	10	1000	Speed (in % of nom. speed)	float32		
3015 / 5063 / 7111	8	ITab	%	0	0	200	Current (in % of IMag)	float32		
3015 / 5063 / 7111	9	STab	%	100	10	1000	Speed (in % of nom. speed)	float32		
3015 / 5063 / 7111	10	ITab	%	0	0	200	Current (in % of IMag)	float32		
3015 / 5063 / 7111	11	STab	%	100	10	1000	Speed (in % of nom. speed)	float32		
3015 / 5063 / 7111	12	ITab	%	0	0	200	Current (in % of IMag)	float32		
3015 / 5063 / 7111	13	STab	%	100	10	1000	Speed (in % of nom. speed)	float32		
3015 / 5063 / 7111	14	ITab	%	0	0	200	Current (in % of IMag)	float32		
3015 / 5063 / 7111	15	STab	%	100	10	1000	Speed (in % of nom. speed)	float32		

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Auto commutation							0	0
2972 / 5020 / 7068		CON_COM					Axis 1 / 2 / 3: Autocommutation settings		0	2
2972 / 5020 / 7068	0	AutoOn		SDIFF (1)	OFF (0)	SDIFF (1)	Automatic autocommutation after event	uint16		
2972 / 5020 / 7068	1	Mode		OFF (0)	OFF (0)	LHMEAS (3)	Method	uint16		
2972 / 5020 / 7068	2	KpScale	%	20	0	1000	Angle encoder gain scaling factor	float32		
2972 / 5020 / 7068	3	Time0	ms	1000	0	30000	Time	float32		
2972 / 5020 / 7068	4	Time1	ms	1000	0	30000	Time	float32		
2972 / 5020 / 7068	5	Time2	ms	1000	0	30000	Time	float32		
2972 / 5020 / 7068	6	Time3	ms	1000	0	30000	Time	float32		
2972 / 5020 / 7068	7	Current0	A	0	0	1000	Current	float32		
2972 / 5020 / 7068	8	Current1	A	0	0	30000	Current	float32		
2972 / 5020 / 7068	9	Nref	rpm	0	-100	100	Speed setpoint	float32		
2972 / 5020 / 7068	10	Limit	degree	30	0	170	Autocommutation: Angle error limit	float32		
2972 / 5020 / 7068	11	ActVal	degree	0	-180	180	Current angle error	float32		
2972 / 5020 / 7068	12	Frequency	Hz	0	0	1000	Measuring frequency for LHMEAS	float32		
SUBJECT AREA		Commissioning					Drive commissioning test signal generator		0	0
3070 / 5118 / 7166		SCD_State					Axis 1 / 2 / 3: Identification state		0	5
3070 / 5118 / 7166	0	State		ERROR (-1)	ERROR (-1)	RUNNING (1)	Identification state	int16		
3070 / 5118 / 7166	1	ActCmdSrv		0	0	65535	Current command server task	uint16		
2950 / 4998 / 7046	0	AddSRef	1/min	0	-3.4E+38	3.4E+38	Axis 1 / 2 / 3: Additive speed setpoint (without ramp)	float32	0	1
2954 / 5002 / 7050		AddIsRef					Axis 1 / 2 / 3: Additive current setpoint		0	2
2954 / 5002 / 7050	0	AddIsdRef	A	0	-1000	1000	Additive d-current setpoint	float32		
2954 / 5002 / 7050	1	AddIsqRef	A	0	-1000	1000	Additive q-current setpoint	float32		
2954 / 5002 / 7050	2	SetPhase	deg	0	-180	180	Set phase (V/Hz and current mode)	float32		
3052 / 5100 / 7148	0	AddTRef	Nm	0	-3.4E+38	3.4E+38	Axis 1 / 2 / 3: Additive torque setpoint (without ramp)	float32	0	1
3053 / 5101 / 7149	0	CON_TSIG_Ctrl		Off (0)	Off (0)	StopZeroCross (4)	Axis 1 / 2 / 3: Control word test signal generator	uint16	1	2
3054 / 5102 / 7150		CON_TSIG_Settings					Axis 1 / 2 / 3: Test signal generator settings		0	2
3054 / 5102 / 7150	0	OutSel		Off (0)	Off (0)	DigFil (7)	Output signal selector	uint16		
3054 / 5102 / 7150	1	Offset_0	var	0	-3.4E+38	3.4E+38	Rectangle: Offsets	float32		
3054 / 5102 / 7150	2	Offset_1	var	0	-3.4E+38	3.4E+38	Rectangle: Offsets	float32		
3054 / 5102 / 7150	3	Time_0	s	1	0	100000	Rectangle: Times	float32		
3054 / 5102 / 7150	4	Time_1	s	1	0	100000	Rectangle: Times	float32		
3054 / 5102 / 7150	5	Cycles		1	0	65535	Number of cycles	uint16		

Table 18.9: Parameter list – Control axis (continue)



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
3054 / 5102 / 7150	6	SignalType		Sine (0)	Sine (0)	Triangle (1)	Sine / triangle: Selector	uint16		
3054 / 5102 / 7150	7	Amplitude	var	0	-3.4E+38	3.4E+38	Sine / triangle: Amplitude	float32		
3054 / 5102 / 7150	8	Frequency	Hz	0	0	8000	Sine / triangle: Frequency	float32		
3054 / 5102 / 7150	9	SymVal	var	0	-3.4E+38	3.4E+38	Sine / triangle: Symmetry	float32		
3054 / 5102 / 7150	10	PRBS_Amplitude	var	0	-3.4E+38	3.4E+38	PRBS: Amplitude	float32		
3054 / 5102 / 7150	11	PRBS_Time	ms	5	0.125	1000	PBRS: min. sampling time	float32		
3054 / 5102 / 7150	12	BreakTime0	ms	0	0	100000	Pause time after a signal period (1/freq)	float32		
3054 / 5102 / 7150	13	BreakTime1	ms	0	0	100000	Pause time after a half signal period (1/freq)	float32		
3054 / 5102 / 7150	14	Frequency2		0	0	8000	2nd frequency fpor chirp signal	float32		
3056 / 5104 / 7152		CON_TSIG_Correlation					Axis 1 / 2 / 3: Test signal generator correlation		0	5
3056 / 5104 / 7152	0	CorrIp1Cos		0	-3.4E+38	3.4E+38	Result correlation: Input 1 + cos	float32		
3056 / 5104 / 7152	1	CorrIp1Sin		0	-3.4E+38	3.4E+38	Result correlation: Input 1 + sin	float32		
3056 / 5104 / 7152	2	CorrIp2Cos		0	-3.4E+38	3.4E+38	Result correlation: Input 2 + cos	float32		
3056 / 5104 / 7152	3	CorrIp2Sin		0	-3.4E+38	3.4E+38	Correlation of input signal 2 and sine	float32		
3056 / 5104 / 7152	4	Rs	Ohm	0	-3.4E+38	3.4E+38	Result correlation: Stator resistance	float32		
3056 / 5104 / 7152	5	Ls	mH	0	-3.4E+38	3.4E+38	Result correlation: Stator inductance	float32		
3058 / 5106 / 7154		SCD_SetCCON					Axis 1 / 2 / 3: Current controller control configuration		0	2
3058 / 5106 / 7154	0	Mode		STD (0)	STD (0)	DEADBEAT (2)	Calculate current control	uint8		
3058 / 5106 / 7154	1	Bandwidth	Hz	0	-3.4E+38	3.4E+38	Current control bandwidth	float32		
3059 / 5107 / 7155		SCD_SetSCON					Axis 1 / 2 / 3: Control configuration for speed / position / feed forward control		0	2
3059 / 5107 / 7155	0	Mode		STIFFNESS (0)	STIFFNESS (0)	STIFFNESS (0)	Control configuration mode	uint8		
3059 / 5107 / 7155	1	Stiffness	%	100	-3.4E+38	3.4E+38	Stiffness of distance <=> performance of speed control	float32		
3020 / 5068 / 7116		SCD_AT_JSum_Settings					Axis 1 / 2 / 3: Total moment of inertia autotuning		0	2
3020 / 5068 / 7116	0	SConHysSpeed	rpm	0	0	100000	Moment of inertia autotuning, speed limit	float32		
3020 / 5068 / 7116	1	SConHysTorq	Nm	0	0	10000	Moment of inertia autotuning, torque limit	float32		
3020 / 5068 / 7116	2	TFric	Nm	0	-3.4E+38	3.4E+38	Friction torque, calculated by autotuning	float32		
3020 / 5068 / 7116	3	TConst	Nm	0	-3.4E+38	3.4E+38	Constant torque (weight), calculated by autotuning	float32		
3068 / 5116 / 7164		SCD_MotorIdent					Axis 1 / 2 / 3: Motor identification		0	2
3068 / 5116 / 7164	0	command		IDLE (0)	STOP (-1)	MOTPHASE (16)	Motor identification	int32		
3068 / 5116 / 7164	1	settings		0	0	65535	Identification settings	uint16		

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		V/Hz control							0	0
2995 / 5043 / 7091		CON_VFC_Table					Axis 1 / 2 / 3: Table V/Hz		0	2
2995 / 5043 / 7091	0	VBoost	V	0	0	1000	Boost voltage @ 0Hz	float32		
2995 / 5043 / 7091	1	FNom	Hz	0	0	10000	Rated frequency	float32		
2995 / 5043 / 7091	2	VNom	V	0	0	1000	Nominal voltage	float32		
2995 / 5043 / 7091	3	F0	Hz	0	0	10000	Frequency @ interpolation point 0	float32		
2995 / 5043 / 7091	4	V0	V	0	0	1000	Voltage @ interpolation point 0	float32		
2995 / 5043 / 7091	5	F1	Hz	0	0	10000	Frequency @ interpolation point 1	float32		
2995 / 5043 / 7091	6	V1	V	0	0	1000	Voltage @ interpolation point 1	float32		
2995 / 5043 / 7091	7	F2	Hz	0	0	10000	Frequency @ interpolation point 2	float32		
2995 / 5043 / 7091	8	V2	V	0	0	1000	Voltage @ interpolation point 2	float32		
2995 / 5043 / 7091	9	F3	Hz	0	0	10000	Frequency @ interpolation point 3	float32		
2995 / 5043 / 7091	10	V3	V	0	0	1000	Voltage @ interpolation point 3	float32		
2995 / 5043 / 7091	11	F4	Hz	0	0	10000	Frequency @ interpolation point 4	float32		
2995 / 5043 / 7091	12	V4	V	0	0	1000	Voltage @ interpolation point 4	float32		
2995 / 5043 / 7091	13	F5	Hz	0	0	10000	Frequency @ interpolation point 5	float32		
2995 / 5043 / 7091	14	V5	V	0	0	1000	Voltage @ interpolation point 5	float32		
2996 / 5044 / 7092		CON_VFC_Settings					Axis 1 / 2 / 3: V/Hz settings		0	2
2996 / 5044 / 7092	0	URefTf	ms	0	0	1000	Setpoint voltage filter time	float32		
2996 / 5044 / 7092	1	DisableTime	ms	0	0	120000	Time in ON state after motor standstill (0 => permanent)	uint32		
2996 / 5044 / 7092	2	DemagTime	ms	100	1	4294967295	DC brakes: Demagnetisation time before current injection	uint32		
2996 / 5044 / 7092	3	LConSpeedThresh	%	100	0	3.4E+38	Load control activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	4	LConSpeedRange	%	5	0.001	10000	Transition speed range for start of load control	float32		
2996 / 5044 / 7092	5	LConKpPos	V/A	0	0	1000	Load control positive gain	float32		
2996 / 5044 / 7092	6	LConKpNeg	V/A	0	0	1000	Load control negative gain	float32		
2996 / 5044 / 7092	7	LConTf	ms	0	0	1000	Load control voltage filter time	float32		
2996 / 5044 / 7092	8	AntiOscSpeedThresh	%	100	0	10000	Oscillation damping activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	9	AntOscSpeedRange	%	5	0.001	10000	Transition speed range for start of oscillation damping	float32		
2996 / 5044 / 7092	10	AnitOscKp	Hz/A	0	-10000	10000	Oscillation damping gain	float32		
2996 / 5044 / 7092	11	AntiOscTf	ms	0	0	1000	Oscillation damping correction frequency filter time	float32		
2996 / 5044 / 7092	12	SyncCurrent	%	10	0	100	Synchronise: Search current in % of rated motor current	float32		
2996 / 5044 / 7092	13	SyncFRamp	%/s	100	1	1000	Synchronise: Frequency ramp in % of Fnom/s	float32		
2996 / 5044 / 7092	14	SyncTf	ms	1	0	1000	Synchronise: Current filter	float32		

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2996 / 5044 / 7092	15	CLimConCurrentThresh	%	100	0	1000	Current threshold in % of rated current at which ramp is scaled to 0	float32		
2996 / 5044 / 7092	16	CLimConCurrentRange	%	10	0.001	1000	Current range in % of rated motor current at which current limit value controller starts	float32		
2996 / 5044 / 7092	17	CLimConSpeedStart	%	100	0	1000	Speed at which current limit value controller starts in % of rated motor frequency	float32		
2996 / 5044 / 7092	18	CLimConSpeedMin	%	50	0	1000	Minimum speed for speed reduction in % of the rated motor frequency	float32		
2996 / 5044 / 7092	19	CLimCurrTf	ms	1	0	1000	Current filter time for current limit value controller	float32		
2997 / 5045 / 7093		CON_VFC_DCCurrent					Axis 1 / 2 / 3: Direct current functions V/Hz		0	2
2997 / 5045 / 7093	0	DCStartCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	1	DCStartTime	ms	0	0	4294967295	DC injection time before start	uint32		
2997 / 5045 / 7093	2	DCBrakeCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	3	DCBrakeTime	ms	0	0	4294967295	DC injection time before braking	uint32		
2997 / 5045 / 7093	4	DCBrakeSpeedThreshold	%	0	0	3.4E+38	DC brakes start below this speed (% of rated motor frequency)	float32		
2997 / 5045 / 7093	5	DCStopCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	6	DCStopTime	ms	0	0	4294967295	DC injection time after standstill	uint32		
2997 / 5045 / 7093	7	CCMoveCurrent	%	100	0	1000	Current setpoint in % of rated motor current (Cnom)	float32		
2997 / 5045 / 7093	8	CCMoveSpeedThreshold	%	0	0	3.4E+38	Speed range in which current is active (% of rated motor frequency)	float32		
2997 / 5045 / 7093	9	CCMoveTf	ms	10	0	1000	Filter for transition in VF table	float32		
2998 / 5046 / 7094	0	CON_VFC_Controlword		0	0	65535	Axis 1 / 2 / 3: VFC control word	uint16	0	2
2999 / 5047 / 7095	0	CON_VFC_Statusword		0	0	65535	Axis 1 / 2 / 3: VFC status word	uint16	0	5
3025 / 5073 / 7121	0	CON_VFC_ActVal		0	0	65535	Axis 1 / 2 / 3: VFC actual values	uint16	0	5
SUBJECT AREA		V/f characteristic							0	0
2995 / 5043 / 7091		CON_VFC_Table					Axis 1 / 2 / 3: Table V/Hz		0	2
2995 / 5043 / 7091	0	VBoost	V	0	0	1000	Boost voltage @ 0Hz	float32		
2995 / 5043 / 7091	1	FNom	Hz	0	0	10000	Rated frequency	float32		
2995 / 5043 / 7091	2	VNom	V	0	0	1000	Nominal voltage	float32		
2995 / 5043 / 7091	3	F0	Hz	0	0	10000	Frequency @ interpolation point 0	float32		
2995 / 5043 / 7091	4	V0	V	0	0	1000	Voltage @ interpolation point 0	float32		
2995 / 5043 / 7091	5	F1	Hz	0	0	10000	Frequency @ interpolation point 1	float32		
2995 / 5043 / 7091	6	V1	V	0	0	1000	Voltage @ interpolation point 1	float32		
2995 / 5043 / 7091	7	F2	Hz	0	0	10000	Frequency @ interpolation point 2	float32		

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2995 / 5043 / 7091	8	V2	V	0	0	1000	Voltage @ interpolation point 2	float32		
2995 / 5043 / 7091	9	F3	Hz	0	0	10000	Frequency @ interpolation point 3	float32		
2995 / 5043 / 7091	10	V3	V	0	0	1000	Voltage @ interpolation point 3	float32		
2995 / 5043 / 7091	11	F4	Hz	0	0	10000	Frequency @ interpolation point 4	float32		
2995 / 5043 / 7091	12	V4	V	0	0	1000	Voltage @ interpolation point 4	float32		
2995 / 5043 / 7091	13	F5	Hz	0	0	10000	Frequency @ interpolation point 5	float32		
2995 / 5043 / 7091	14	V5	V	0	0	1000	Voltage @ interpolation point 5	float32		
2996 / 5044 / 7092		CON_VFC_Settings					Axis 1 / 2 / 3: V/Hz settings		0	2
2996 / 5044 / 7092	0	URefTf	ms	0	0	1000	Setpoint voltage filter time	float32		
2996 / 5044 / 7092	1	DisableTime	ms	0	0	120000	Time in ON state after motor standstill (0 => permanent)	uint32		
2996 / 5044 / 7092	2	DemagTime	ms	100	1	4294967295	DC brakes: Demagnetisation time before current injection	uint32		
2996 / 5044 / 7092	3	LConSpeedThresh	%	100	0	3.4E+38	Load control activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	4	LConSpeedRange	%	5	0.001	10000	Transition speed range for start of load control	float32		
2996 / 5044 / 7092	5	LConKpPos	V/A	0	0	1000	Load control positive gain	float32		
2996 / 5044 / 7092	6	LConKpNeg	V/A	0	0	1000	Load control negative gain	float32		
2996 / 5044 / 7092	7	LConTf	ms	0	0	1000	Load control voltage filter time	float32		
2996 / 5044 / 7092	8	AntiOscSpeedThresh	%	100	0	10000	Oscillation damping activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	9	AntOscSpeedRange	%	5	0.001	10000	Transition speed range for start of oscillation damping	float32		
2996 / 5044 / 7092	10	AnitOscKp	Hz/A	0	-10000	10000	Oscillation damping gain	float32		
2996 / 5044 / 7092	11	AntiOscTf	ms	0	0	1000	Oscillation damping correction frequency filter time	float32		
2996 / 5044 / 7092	12	SyncCurrent	%	10	0	100	Synchronise: Search current in % of rated motor current	float32		
2996 / 5044 / 7092	13	SyncFRamp	%/s	100	1	1000	Synchronise: Frequency ramp in % of Fnom/s	float32		
2996 / 5044 / 7092	14	SyncTf	ms	1	0	1000	Synchronise: Current filter	float32		
2996 / 5044 / 7092	15	CLimConCurrentThresh	%	100	0	1000	Current threshold in % of rated current at which ramp is scaled to 0	float32		
2996 / 5044 / 7092	16	CLimConCurrentRange	%	10	0.001	1000	Current range in % of rated motor current at which current limit value controller starts	float32		
2996 / 5044 / 7092	17	CLimConSpeedStart	%	100	0	1000	Speed at which the current limit value controller starts in % of rated motor frequency.	float32		
2996 / 5044 / 7092	18	CLimConSpeedMin	%	50	0	1000	Minimum speed for speed reduction in % of the rated motor frequency	float32		
2996 / 5044 / 7092	19	CLimCurrTf	ms	1	0	1000	Current filter time for current limit value controller	float32		
SUBJECT AREA		DC stop							0	0

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2998 / 5046 / 7094	0	CON_VFC_Controlword		0	0	65535	Axis 1 / 2 / 3: VFC control word	uint16	0	2
2997 / 5045 / 7093		CON_VFC_DCCurrent					Axis 1 / 2 / 3: Direct current functions V/Hz		0	2
2997 / 5045 / 7093	0	DCStartCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	1	DCStartTime	ms	0	0	4294967295	DC injection time before start	uint32		
2997 / 5045 / 7093	2	DCBrakeCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	3	DCBrakeTime	ms	0	0	4294967295	DC injection time before braking	uint32		
2997 / 5045 / 7093	4	DCBrakeSpeedThreshold	%	0	0	3.4E+38	DC brakes start below this speed (% of rated motor frequency)	float32		
2997 / 5045 / 7093	5	DCStopCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	6	DCStopTime	ms	0	0	4294967295	DC injection time after standstill	uint32		
2997 / 5045 / 7093	7	CCMoveCurrent	%	100	0	1000	Current setpoint in % of rated motor current (Cnom)	float32		
2997 / 5045 / 7093	8	CCMoveSpeedThreshold	%	0	0	3.4E+38	Speed range in which current is active (% of rated motor frequency)	float32		
2997 / 5045 / 7093	9	CCMoveTf	ms	10	0	1000	Filter for transition in VF table	float32		
SUBJECT AREA		DC magnetising							0	0
2998 / 5046 / 7094	0	CON_VFC_Controlword		0	0	65535	Axis 1 / 2 / 3: VFC control word	uint16	0	2
2997 / 5045 / 7093		CON_VFC_DCCurrent					Axis 1 / 2 / 3: Direct current functions V/Hz		0	2
2997 / 5045 / 7093	0	DCStartCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	1	DCStartTime	ms	0	0	4294967295	DC injection time before start	uint32		
2997 / 5045 / 7093	2	DCBrakeCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	3	DCBrakeTime	ms	0	0	4294967295	DC injection time before braking	uint32		
2997 / 5045 / 7093	4	DCBrakeSpeedThreshold	%	0	0	3.4E+38	DC brakes start below this speed (% of rated motor frequency)	float32		
2997 / 5045 / 7093	5	DCStopCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	6	DCStopTime	ms	0	0	4294967295	DC injection time after standstill	uint32		
2997 / 5045 / 7093	7	CCMoveCurrent	%	100	0	1000	Current setpoint in % of rated motor current (Cnom)	float32		
2997 / 5045 / 7093	8	CCMoveSpeedThreshold	%	0	0	3.4E+38	Speed range in which current is active (% of rated motor frequency)	float32		
2997 / 5045 / 7093	9	CCMoveTf	ms	10	0	1000	Filter for transition in VF table	float32		
SUBJECT AREA		Speed synchronisation							0	0
2998 / 5046 / 7094	0	CON_VFC_Controlword		0	0	65535	Axis 1 / 2 / 3: VFC control word	uint16	0	2
2996 / 5044 / 7092		CON_VFC_Settings					Axis 1 / 2 / 3: V/Hz settings		0	2
2996 / 5044 / 7092	0	URefTf	ms	0	0	1000	Setpoint voltage filter time	float32		
2996 / 5044 / 7092	1	DisableTime	ms	0	0	120000	Time in ON state after motor standstill (0 => permanent)	uint32		
2996 / 5044 / 7092	2	DemagTime	ms	100	1	4294967295	DC brakes: Demagnetisation time before current injection	uint32		

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2996 / 5044 / 7092	3	LConSpeedThresh	%	100	0	3.4E+38	Load control activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	4	LConSpeedRange	%	5	0.001	10000	Transition speed range for start of load control	float32		
2996 / 5044 / 7092	5	LConKpPos	V/A	0	0	1000	Load control positive gain	float32		
2996 / 5044 / 7092	6	LConKpNeg	V/A	0	0	1000	Load control negative gain	float32		
2996 / 5044 / 7092	7	LConTf	ms	0	0	1000	Load control voltage filter time	float32		
2996 / 5044 / 7092	8	AntiOscSpeedThresh	%	100	0	10000	Oscillation damping activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	9	AntOscSpeedRange	%	5	0.001	10000	Transition speed range for start of oscillation damping	float32		
2996 / 5044 / 7092	10	AnitOscKp	Hz/A	0	-10000	10000	Oscillation damping gain	float32		
2996 / 5044 / 7092	11	AntiOscTf	ms	0	0	1000	Oscillation damping correction frequency filter time	float32		
2996 / 5044 / 7092	12	SyncCurrent	%	10	0	100	Synchronise: Search current in % of rated motor current	float32		
2996 / 5044 / 7092	13	SyncFRamp	%/s	100	1	1000	Synchronise: Frequency ramp in % of F <sub>nom</sub> /s	float32		
2996 / 5044 / 7092	14	SyncTf	ms	1	0	1000	Synchronise: Current filter	float32		
2996 / 5044 / 7092	15	CLimConCurrentThresh	%	100	0	1000	Current threshold in % of rated current at which ramp is scaled to 0	float32		
2996 / 5044 / 7092	16	CLimConCurrentRange	%	10	0.001	1000	Current range in % of rated motor current at which current limit value controller starts	float32		
2996 / 5044 / 7092	17	CLimConSpeedStart	%	100	0	1000	Speed at which current limit value controller starts in % of rated motor frequency	float32		
2996 / 5044 / 7092	18	CLimConSpeedMin	%	50	0	1000	Minimum speed for speed reduction in % of the rated motor frequency	float32		
2996 / 5044 / 7092	19	CLimCurrTf	ms	1	0	1000	Current filter time for current limit value controller	float32		
SUBJECT AREA		DC brakes							0	0
2998 / 5046 / 7094	0	CON_VFC_Controlword		0	0	65535	Axis 1 / 2 / 3: VFC control word	uint16	0	2
2997 / 5045 / 7093		CON_VFC_DCCurrent					Axis 1 / 2 / 3: Direct current functions V/Hz		0	2
2997 / 5045 / 7093	0	DCStartCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	1	DCStartTime	ms	0	0	4294967295	DC injection time before start	uint32		
2997 / 5045 / 7093	2	DCBrakeCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	3	DCBrakeTime	ms	0	0	4294967295	DC injection time before braking	uint32		
2997 / 5045 / 7093	4	DCBrakeSpeedThreshold	%	0	0	3.4E+38	DC brakes start below this speed (% of rated motor frequency)	float32		
2997 / 5045 / 7093	5	DCStopCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	6	DCStopTime	ms	0	0	4294967295	DC injection time after standstill	uint32		
2997 / 5045 / 7093	7	CCMoveCurrent	%	100	0	1000	Current setpoint in % of rated motor current (C <sub>nom</sub> )	float32		
2997 / 5045 / 7093	8	CCMoveSpeedThreshold	%	0	0	3.4E+38	Speed range in which current is active (% of rated motor frequency)	float32		

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2997 / 5045 / 7093	9	CCMoveTf	ms	10	0	1000	Filter for transition in VF table	float32		
2996 / 5044 / 7092		CON_VFC_Settings					Axis 1 / 2 / 3: V/Hz settings		0	2
2996 / 5044 / 7092	0	URefTf	ms	0	0	1000	Setpoint voltage filter time	float32		
2996 / 5044 / 7092	1	DisableTime	ms	0	0	120000	Time in ON state after motor standstill (0 => permanent)	uint32		
2996 / 5044 / 7092	2	DemagTime	ms	100	1	4294967295	DC brakes: Demagnetisation time before current injection	uint32		
2996 / 5044 / 7092	3	LConSpeedThresh	%	100	0	3.4E+38	Load control activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	4	LConSpeedRange	%	5	0.001	10000	Transition speed range for start of load control	float32		
2996 / 5044 / 7092	5	LConKpPos	V/A	0	0	1000	Load control positive gain	float32		
2996 / 5044 / 7092	6	LConKpNeg	V/A	0	0	1000	Load control negative gain	float32		
2996 / 5044 / 7092	7	LConTf	ms	0	0	1000	Load control voltage filter time	float32		
2996 / 5044 / 7092	8	AntiOscSpeedThresh	%	100	0	10000	Oscillation damping activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	9	AntOscSpeedRange	%	5	0.001	10000	Transition speed range for start of oscillation damping	float32		
2996 / 5044 / 7092	10	AnitOscKp	Hz/A	0	-10000	10000	Oscillation damping gain	float32		
2996 / 5044 / 7092	11	AntiOscTf	ms	0	0	1000	Oscillation damping correction frequency filter time	float32		
2996 / 5044 / 7092	12	SyncCurrent	%	10	0	100	Synchronise: Search current in % of rated motor current	float32		
2996 / 5044 / 7092	13	SyncFRamp	%/s	100	1	1000	Synchronise: Frequency ramp in % of Fnom/s	float32		
2996 / 5044 / 7092	14	SyncTf	ms	1	0	1000	Synchronise: Current filter	float32		
2996 / 5044 / 7092	15	CLimConCurrentThresh	%	100	0	1000	Current threshold in % of rated current at which ramp is scaled to 0	float32		
2996 / 5044 / 7092	16	CLimConCurrentRange	%	10	0.001	1000	Current range in % of rated motor current at which current limit value controller starts	float32		
2996 / 5044 / 7092	17	CLimConSpeedStart	%	100	0	1000	Speed at which the current limit value controller starts in % of rated motor frequency.	float32		
2996 / 5044 / 7092	18	CLimConSpeedMin	%	50	0	1000	Minimum speed for speed reduction in % of the rated motor frequency	float32		
2996 / 5044 / 7092	19	CLimCurrTf	ms	1	0	1000	Current filter time for current limit value controller	float32		
SUBJECT AREA		Constant current controller							0	0
2998 / 5046 / 7094	0	CON_VFC_Controlword		0	0	65535	Axis 1 / 2 / 3: VFC control word	uint16	0	2
2997 / 5045 / 7093		CON_VFC_DCCurrent					Axis 1 / 2 / 3: Direct current functions V/Hz		0	2
2997 / 5045 / 7093	0	DCStartCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	1	DCStartTime	ms	0	0	4294967295	DC injection time before start	uint32		
2997 / 5045 / 7093	2	DCBrakeCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	3	DCBrakeTime	ms	0	0	4294967295	DC injection time before braking	uint32		

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2997 / 5045 / 7093	4	DCBrakeSpeedThreshold	%	0	0	3.4E+38	DC brakes start below this speed (% of rated motor frequency)	float32		
2997 / 5045 / 7093	5	DCStopCurrent	%	100	0	1000	Current setpoint in % of rated motor current	float32		
2997 / 5045 / 7093	6	DCStopTime	ms	0	0	4294967295	DC injection time after standstill	uint32		
2997 / 5045 / 7093	7	CCMoveCurrent	%	100	0	1000	Current setpoint in % of rated motor current (Cnom)	float32		
2997 / 5045 / 7093	8	CCMoveSpeedThreshold	%	0	0	3.4E+38	Speed range in which current is active (% of rated motor frequency)	float32		
2997 / 5045 / 7093	9	CCMoveTf	ms	10	0	1000	Filter for transition in VF table	float32		
SUBJECT AREA		Current limitation controller							0	0
2998 / 5046 / 7094	0	CON_VFC_Controlword		0	0	65535	Axis 1 / 2 / 3: VFC control word	uint16	0	2
2996 / 5044 / 7092		CON_VFC_Settings					Axis 1 / 2 / 3: V/Hz settings		0	2
2996 / 5044 / 7092	0	URefTf	ms	0	0	1000	Setpoint voltage filter time	float32		
2996 / 5044 / 7092	1	DisableTime	ms	0	0	120000	Time in ON state after motor standstill (0 => permanent)	uint32		
2996 / 5044 / 7092	2	DemagTime	ms	100	1	4294967295	DC brakes: Demagnetisation time before current injection	uint32		
2996 / 5044 / 7092	3	LConSpeedThresh	%	100	0	3.4E+38	Load control activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	4	LConSpeedRange	%	5	0.001	10000	Transition speed range for start of load control	float32		
2996 / 5044 / 7092	5	LConKpPos	V/A	0	0	1000	Load control positive gain	float32		
2996 / 5044 / 7092	6	LConKpNeg	V/A	0	0	1000	Load control negative gain	float32		
2996 / 5044 / 7092	7	LConTf	ms	0	0	1000	Load control voltage filter time	float32		
2996 / 5044 / 7092	8	AntiOscSpeedThresh	%	100	0	10000	Oscillation damping activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	9	AntOscSpeedRange	%	5	0.001	10000	Transition speed range for start of oscillation damping	float32		
2996 / 5044 / 7092	10	AnitOscKp	Hz/A	0	-10000	10000	Oscillation damping gain	float32		
2996 / 5044 / 7092	11	AntiOscTf	ms	0	0	1000	Oscillation damping correction frequency filter time	float32		
2996 / 5044 / 7092	12	SyncCurrent	%	10	0	100	Synchronise: Search current in % of rated motor current	float32		
2996 / 5044 / 7092	13	SyncFRamp	%/s	100	1	1000	Synchronise: Frequency ramp in % of Fnom/s	float32		
2996 / 5044 / 7092	14	SyncTf	ms	1	0	1000	Synchronise: Current filter	float32		
2996 / 5044 / 7092	15	CLimConCurrentThresh	%	100	0	1000	Current threshold in % of rated current at which ramp is scaled to 0	float32		
2996 / 5044 / 7092	16	CLimConCurrentRange	%	10	0.001	1000	Current range in % of rated motor current at which current limit value controller starts	float32		
2996 / 5044 / 7092	17	CLimConSpeedStart	%	100	0	1000	Speed at which the current limit value controller starts in % of rated motor frequency.	float32		
2996 / 5044 / 7092	18	CLimConSpeedMin	%	50	0	1000	Minimum speed for speed reduction in % of the rated motor frequency	float32		
2996 / 5044 / 7092	19	CLimCurrTf	ms	1	0	1000	Current filter time for current limit value controller	float32		

Table 18.9: Parameter list – Control axis (continue)



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2951 / 4999 / 7047		CON_SCON_Ctrl					Axis 1 / 2 / 3: Controller settings speed control		0	2
2951 / 4999 / 7047	0	Kp	Nm/rpm	0	0	100000	Speed controller gain	float32		
2951 / 4999 / 7047	1	Tn	ms	10	0.01	10000	Speed controller integral-action time	float32		
2951 / 4999 / 7047	2	Scale	%	100	0	100000	Scale speed controller gain	float32		
SUBJECT AREA		Oscillation damping controller							0	0
2998 / 5046 / 7094	0	CON_VFC_Controlword		0	0	65535	Axis 1 / 2 / 3: VFC control word	uint16	0	2
2996 / 5044 / 7092		CON_VFC_Settings					Axis 1 / 2 / 3: V/Hz settings		0	2
2996 / 5044 / 7092	0	URefTf	ms	0	0	1000	Setpoint voltage filter time	float32		
2996 / 5044 / 7092	1	DisableTime	ms	0	0	120000	Time in ON state after motor standstill (0 => permanent)	uint32		
2996 / 5044 / 7092	2	DemagTime	ms	100	1	4294967295	DC brakes: Demagnetisation time before current injection	uint32		
2996 / 5044 / 7092	3	LConSpeedThresh	%	100	0	3.4E+38	Load control activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	4	LConSpeedRange	%	5	0.001	10000	Transition speed range for start of load control	float32		
2996 / 5044 / 7092	5	LConKpPos	V/A	0	0	1000	Load control positive gain	float32		
2996 / 5044 / 7092	6	LConKpNeg	V/A	0	0	1000	Load control negative gain	float32		
2996 / 5044 / 7092	7	LConTf	ms	0	0	1000	Load control voltage filter time	float32		
2996 / 5044 / 7092	8	AntiOscSpeedThresh	%	100	0	10000	Oscillation damping activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	9	AntOscSpeedRange	%	5	0.001	10000	Transition speed range for start of oscillation damping	float32		
2996 / 5044 / 7092	10	AnitOscKp	Hz/A	0	-10000	10000	Oscillation damping gain	float32		
2996 / 5044 / 7092	11	AntiOscTf	ms	0	0	1000	Oscillation damping correction frequency filter time	float32		
2996 / 5044 / 7092	12	SyncCurrent	%	10	0	100	Synchronise: Search current in % of rated motor current	float32		
2996 / 5044 / 7092	13	SyncFRamp	%/s	100	1	1000	Synchronise: Frequency ramp in % of Fnom/s	float32		
2996 / 5044 / 7092	14	SyncTf	ms	1	0	1000	Synchronise: Current filter	float32		
2996 / 5044 / 7092	15	CLimConCurrentThresh	%	100	0	1000	Current threshold in % of rated current at which ramp is scaled to 0	float32		
2996 / 5044 / 7092	16	CLimConCurrentRange	%	10	0.001	1000	Current range in % of rated motor current at which current limit value controller starts	float32		
2996 / 5044 / 7092	17	CLimConSpeedStart	%	100	0	1000	Speed at which the current limit value controller starts in % of rated motor frequency.	float32		
2996 / 5044 / 7092	18	CLimConSpeedMin	%	50	0	1000	Minimum speed for speed reduction in % of the rated motor frequency	float32		
2996 / 5044 / 7092	19	CLimCurrTf	ms	1	0	1000	Current filter time for current limit value controller	float32		
SUBJECT AREA		Load control							0	0
2998 / 5046 / 7094	0	CON_VFC_Controlword		0	0	65535	Axis 1 / 2 / 3: VFC control word	uint16	0	2

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2996 / 5044 / 7092		CON_VFC_Settings					Axis 1 / 2 / 3: V/Hz settings		0	2
2996 / 5044 / 7092	0	URefTf	ms	0	0	1000	Setpoint voltage filter time	float32		
2996 / 5044 / 7092	1	DisableTime	ms	0	0	120000	Time in ON state after motor standstill (0 => permanent)	uint32		
2996 / 5044 / 7092	2	DemagTime	ms	100	1	4294967295	DC brakes: Demagnetisation time before current injection	uint32		
2996 / 5044 / 7092	3	LConSpeedThresh	%	100	0	3.4E+38	Load control activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	4	LConSpeedRange	%	5	0.001	10000	Transition speed range for start of load control	float32		
2996 / 5044 / 7092	5	LConKpPos	V/A	0	0	1000	Load control positive gain	float32		
2996 / 5044 / 7092	6	LConKpNeg	V/A	0	0	1000	Load control negative gain	float32		
2996 / 5044 / 7092	7	LConTf	ms	0	0	1000	Load control voltage filter time	float32		
2996 / 5044 / 7092	8	AntiOscSpeedThresh	%	100	0	10000	Oscillation damping activation threshold in % of rated motor frequency	float32		
2996 / 5044 / 7092	9	AntOscSpeedRange	%	5	0.001	10000	Transition speed range for start of oscillation damping	float32		
2996 / 5044 / 7092	10	AnitOscKp	Hz/A	0	-10000	10000	Oscillation damping gain	float32		
2996 / 5044 / 7092	11	AntiOscTf	ms	0	0	1000	Oscillation damping correction frequency filter time	float32		
2996 / 5044 / 7092	12	SyncCurrent	%	10	0	100	Synchronise: Search current in % of rated motor current	float32		
2996 / 5044 / 7092	13	SyncFRamp	%/s	100	1	1000	Synchronise: Frequency ramp in % of Fnom/s	float32		
2996 / 5044 / 7092	14	SyncTf	ms	1	0	1000	Synchronise: Current filter	float32		
2996 / 5044 / 7092	15	CLimConCurrentThresh	%	100	0	1000	Current threshold in % of rated current at which ramp is scaled to 0	float32		
2996 / 5044 / 7092	16	CLimConCurrentRange	%	10	0.001	1000	Current range in % of rated motor current at which current limit value controller starts	float32		
2996 / 5044 / 7092	17	CLimConSpeedStart	%	100	0	1000	Speed at which the current limit value controller starts in % of rated motor frequency.	float32		
2996 / 5044 / 7092	18	CLimConSpeedMin	%	50	0	1000	Minimum speed for speed reduction in % of the rated motor frequency	float32		
2996 / 5044 / 7092	19	CLimCurrTf	ms	1	0	1000	Current filter time for current limit value controller	float32		
SUBJECT AREA		Compensation function							0	0
2985 / 5033 / 7081		CON_SCON_TFric					Axis 1 / 2 / 3: Friction torque compensation settings		0	2
2985 / 5033 / 7081	0	Torque	%	0	-1000	1000	Friction compensation torque in % of rated motor torque	float32		
2985 / 5033 / 7081	1	Speed	rpm	5	0	100000	Limit speed at which the set torque is reached	float32		
2985 / 5033 / 7081	2	Torque	%	0	-1000	1000	Friction compensation torque in % of rated motor torque	float32		
2985 / 5033 / 7081	3	Speed	rpm	5	0	100000	Limit speed at which the set torque is reached	float32		
2985 / 5033 / 7081	4	Torque	%	0	-1000	1000	Friction compensation torque in % of rated motor torque	float32		
2985 / 5033 / 7081	5	Speed	rpm	5	0	100000	Limit speed at which the set torque is reached	float32		

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2985 / 5033 / 7081	6	Torque	%	0	-1000	1000	Friction compensation torque in % of rated motor torque	float32		
2985 / 5033 / 7081	7	Speed	rpm	5	0	100000	Limit speed at which the set torque is reached	float32		
2985 / 5033 / 7081	8	Torque	%	0	-1000	1000	Friction compensation torque in % of rated motor torque	float32		
2985 / 5033 / 7081	9	Speed	rpm	5	0	100000	Limit speed at which the set torque is reached	float32		
2986 / 5034 / 7082		CON_SCON_TConst					Axis 1 / 2 / 3: Compensation for gravity		0	2
2986 / 5034 / 7082	0	Const	%	0	-100	100	Friction torque compensation: Constant (independent of direction)	float32		
2986 / 5034 / 7082	1	reserved		0	-3.4E+38	3.4E+38	reserved	float32		
3000 / 5048 / 7096		CON_COMP_1_Settings					Axis 1 / 2 / 3: Compensation function 1: Data set parameter		0	2
3000 / 5048 / 7096	0	Startup		OFF (0)	OFF (0)	ON (1)	Initialise table	uint16		
3000 / 5048 / 7096	1	FileName					Name of saved file	string		
3000 / 5048 / 7096	2	Input		EPSRS (1)	OFF (0)	ACTSPEED (6)	Input table	uint16		
3000 / 5048 / 7096	3	Output		ISQREF (4)	OFF (0)	ABSPOSACT (10)	Output value table	uint16		
3001 / 5049 / 7097		CON_COMP_1_SizeSettings					Axis 1 / 2 / 3: Compensation function 1: Table size parameter (write access triggers INIT)		0	2
3001 / 5049 / 7097	0	Length		0	0	4294967295	Table length	uint32		
3001 / 5049 / 7097	1	Dual		False (0)	False (0)	True (1)	Table double (pos. and neg.)	bool32		
3002 / 5050 / 7098		CON_COMP_1_FileSettings					Axis 1 / 2 / 3: Compensation function 1: Setting saved in table file		0	2
3002 / 5050 / 7098	0	StartVal		0	-3.4E+38	3.4E+38	Index start	float32		
3002 / 5050 / 7098	1	EndVal		0	-3.4E+38	3.4E+38	Index end	float32		
3002 / 5050 / 7098	2	Modulo		0	0	4294967295	Input periodical / modulo	uint32		
3003 / 5051 / 7099	0	CON_COMP_1_Action		READY (0)	READY (0)	DELETE (6)	Axis 1 / 2 / 3: Compensation function 1: Table/file actions	uint8	0	2
3004 / 5052 / 7100		CON_COMP_1_Tune					Axis 1 / 2 / 3: Compensation function 1: Tuning parameter		0	2
3004 / 5052 / 7100	0	Operation		OFF (0)	OFF (0)	TRACK (4)	Compensation mode	uint16		
3004 / 5052 / 7100	1	Delay	ms	0	-3.4E+38	3.4E+38	Deceleration input	float32		
3004 / 5052 / 7100	2	Shift		0	-3.4E+38	3.4E+38	Shift table	float32		
3004 / 5052 / 7100	3	Scale	%	100	-3.4E+38	3.4E+38	Scale table	float32		
3004 / 5052 / 7100	4	TeachFactor		0.01	0	1	Teach factor (update table filtering)	float32		
3004 / 5052 / 7100	5	ErrorLimit		0	0	3.4E+38	Tracking error threshold	float32		
3004 / 5052 / 7100	6	TeachMinSpeed	rpm	1	-3.4E+38	3.4E+38	No learning below this speed	float32		
3004 / 5052 / 7100	7	FadeStartSpeed	rpm	0	-3.4E+38	3.4E+38	Fade start speed	float32		

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
3004 / 5052 / 7100	8	FadeEndSpeed	rpm	0	-3.4E+38	3.4E+38	Fade end speed	float32		
3004 / 5052 / 7100	9	SignThreshSpeed	rpm	10	1	1000	Transition window for direction-dependent table	float32		
3005 / 5053 / 7101		CON_COMP_1_ActVal					Axis 1 / 2 / 3: Compensation function 2: Actual values		0	5
3005 / 5053 / 7101	0	ActVal		0	-3.4E+38	3.4E+38	Actual table value (for current position)	float32		
3005 / 5053 / 7101	1	Error		0	-3.4E+38	3.4E+38	Error update	float32		
3006 / 5054 / 7102		CON_COMP_2_Settings					Axis 1 / 2 / 3: Compensation function 2: Table size parameter (write access triggers INIT)		0	2
3006 / 5054 / 7102	0	Startup		OFF (0)	OFF (0)	ON (1)	Initialise table	uint16		
3006 / 5054 / 7102	1	FileName					Name of saved file	string		
3006 / 5054 / 7102	2	Input		ABSPOS (4)	OFF (0)	ACTSPEED (6)	Input table	uint16		
3006 / 5054 / 7102	3	Output		ABSPOSACT (10)	OFF (0)	ABSPOSACT (10)	Output value table	uint16		
3007 / 5055 / 7103		CON_COMP_2_SizeSettings					Axis 1 / 2 / 3: Compensation function 2: Setting saved in table file		0	2
3007 / 5055 / 7103	0	Length		0	0	4294967295	Table length	uint32		
3007 / 5055 / 7103	1	Dual		False (0)	False (0)	True (1)	Table double (pos. and neg.)	bool32		
3008 / 5056 / 7104		CON_COMP_2_FileSettings					Axis 1 / 2 / 3: Compensation function 2: Table/file actions		0	2
3008 / 5056 / 7104	0	StartVal		0	-3.4E+38	3.4E+38	Index start	float32		
3008 / 5056 / 7104	1	EndVal		0	-3.4E+38	3.4E+38	Index end	float32		
3008 / 5056 / 7104	2	Modulo		0	0	4294967295	Input periodical / modulo	uint32		
3009 / 5057 / 7105	0	CON_COMP_2_Action		READY (0)	READY (0)	DELETE (6)	Axis 1 / 2 / 3: Compensation function 2: Table/file actions	uint8	0	2
3010 / 5058 / 7106		CON_COMP_2_Tune					Axis 1 / 2 / 3: Compensation function 2: Tuning parameter		0	2
3010 / 5058 / 7106	0	Operation		OFF (0)	OFF (0)	TRACK (4)	Compensation mode	uint16		
3010 / 5058 / 7106	1	Delay	ms	0	-3.4E+38	3.4E+38	Deceleration input	float32		
3010 / 5058 / 7106	2	Shift		0	-3.4E+38	3.4E+38	Shift table	float32		
3010 / 5058 / 7106	3	Scale	%	100	-3.4E+38	3.4E+38	Scale table	float32		
3010 / 5058 / 7106	4	TeachFactor		0.01	0	1	Teach factor (update table filtering)	float32		
3010 / 5058 / 7106	5	ErrorLimit		0	0	3.4E+38	Tracking error threshold	float32		
3010 / 5058 / 7106	6	TeachMinSpeed	rpm	1	-3.4E+38	3.4E+38	No learning below this speed	float32		
3010 / 5058 / 7106	7	FadeStartSpeed	rpm	0	-3.4E+38	3.4E+38	Fade start speed	float32		
3010 / 5058 / 7106	8	FadeEndSpeed	rpm	0	-3.4E+38	3.4E+38	Fade end speed	float32		
3010 / 5058 / 7106	9	SignThreshSpeed	rpm	10	1	1000	Transition window for direction-dependent table	float32		
3011 / 5059 / 7107		CON_COMP_2_ActVal					Axis 1 / 2 / 3: Compensation function 2: Actual values		0	5

Table 18.9: Parameter list – Control axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
3011 / 5059 / 7107	0	ActVal		0	-3.4E+38	3.4E+38	Actual table value (for current position)	float32		
3011 / 5059 / 7107	1	Error		0	-3.4E+38	3.4E+38	Error update	float32		
SUBJECT AREA		Power failure management							0	0
3021 / 5069 / 7117		CON_POWF_Ctrl					Axis 1 / 2 / 3: VFC settings		0	2
3021 / 5069 / 7117	0	Kp	A/V	0	0	10000	Gain	float32		
3021 / 5069 / 7117	1	Tn	ms	1	0.01	1000	Voltage control: Time constant of I component	float32		
3021 / 5069 / 7117	2	SRatio		0	0	3.4E+38	Speed ratio between axes	float32		
3021 / 5069 / 7117	3	SThres	%	10	1	3.4E+38	Speed threshold at which voltage control is shut down	float32		
3021 / 5069 / 7117	4	Tf	ms	0	0	1000	Filter time for current below Sthresh	float32		
SUBJECT AREA		Check functions							0	0
3026 / 5074 / 7122	0	CON_WireTest		DISABLE (0)	DISABLE (0)	ENABLE (1)	Axis 1 / 2 / 3: Enable/disable inverter short-circuit wiring test	uint8	0	2
3027 / 5075 / 7123		CON_MPCHK					Axis 1 / 2 / 3: Motor wire break detection		0	2
3027 / 5075 / 7123	0	Mode		OFF (0)	OFF (0)	ON (1)	Inverter wiring test ON/OFF	uint16		
3027 / 5075 / 7123	1	Current	%	20	0	255	Measuring current in per cent of rated motor current	uint8		
3027 / 5075 / 7123	2	Time	ms	10	0	3.4E+38	Timeout to detect current before error state	float32		

Table 18.9: Parameter list – Control axis (continue)

## 20.5 Motion profile axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Motion profile					Motion profile		0	0
SUBJECT AREA		Basic settings							0	0
2253 / 4301 / 6349	0	MPRO_DRVCOM_AutoStart		Off (0)	Off (0)	On (1)	Axis 1 / 2 / 3: DriveCom system auto. start	uint16	0	2
2257 / 4305 / 6353	0	MPRO_DRVCOM_Init		READY (0)	READY (0)	ERRQUIT (5)	Axis 1 / 2 / 3: Initialisation	uint8	0	2
2288 / 4336 / 6384	0	MPRO_CTRL_Sel		DS402 (2)	OFF (0)	DS402 (2)	Axis 1 / 2 / 3: Control location selector	uint16	0	2
2289 / 4337 / 6385	0	MPRO_REF_Sel		DS402 (2)	OFF (0)	TAB (4)	Axis 1 / 2 / 3: Setpoint selector	uint16	0	2
2290 / 4338 / 6386	0	MPRO_REF_Override	%	100	0	100	Axis 1 / 2 / 3: Speed override	float32	0	2
2291 / 4339 / 6387	0	MPRO_REF_JTime	ms	0	0	2000	Axis 1 / 2 / 3: Smoothing time	uint16	0	2
2963 / 5011 / 7059	0	CON_REF_Mode		IP (1)	PG (0)	IP (1)	Axis 1 / 2 / 3: Profile mode	uint16	0	1
2969 / 5017 / 7065	0	CON_IP_Sel		CUBIC (1)	LIN (0)	CUBIC (1)	Axis 1 / 2 / 3: Interpolation method	uint16	0	2
SUBJECT AREA		Scaling / units					Scaling units		0	0
2301 / 4349 / 6397		MPRO_FG_Units					Axis 1 / 2 / 3: Factor Group units		0	1
2301 / 4349 / 6397	0	PosUnit		PosUnit			Units for position values	string		
2301 / 4349 / 6397	1	SpeedUnit		SpeedUnit			Unit for speed values	string		
2301 / 4349 / 6397	2	AccUnit		AccUnit			Acceleration unit	string		
2301 / 4349 / 6397	3	TorqueUnit		TorqueUnit			Unit for torque values	string		
2298 / 4346 / 6394	0	MPRO_FG_Type		DS402 (0)	DS402 (0)	User (1)	Axis 1 / 2 / 3: Factor group scaling type	uint16	0	1
2299 / 4347 / 6395		MPRO_FG_User					Axis 1 / 2 / 3: Factor group - User-specific scaling		0	1
2299 / 4347 / 6395	0	Num		1	1	4294967295	Numerator	uint32		
2299 / 4347 / 6395	1	Den		360000	1	4294967295	Denominator	uint32		
2299 / 4347 / 6395	2	SpeedFac		1	-3.4E+38	3.4E+38	Speed factor	float32		
2299 / 4347 / 6395	3	AccFac		0.016667	-3.4E+38	3.4E+38	Acceleration factor	float32		
2299 / 4347 / 6395	4	Reverse		False (0)	False (0)	True (1)	Reversing (speed and position)	bool32		
2300 / 4348 / 6396	0	MPRO_FG_PosNorm	incr/rev	1048576	0	2147483648	Axis 1 / 2 / 3: Factor group – Internal position resolution	uint32	0	1
2303 / 4351 / 6399		MPRO_FG_UserValues					Axis 1 / 2 / 3: Factor group – Actual values (user units)		0	5
2303 / 4351 / 6399	0	SpeedAct	SpeedUnit	0	-3.4E+38	3.4E+38	Actual speed value in user units	float32		
2303 / 4351 / 6399	1	SpeedRef	SpeedUnit	0	-3.4E+38	3.4E+38	Setpoint speed in user units	float32		
2303 / 4351 / 6399	2	SpeedCmd	SpeedUnit	0	-3.4E+38	3.4E+38	Speed command in user units	float32		
2303 / 4351 / 6399	3	SpeedDiff	SpeedUnit	0	-3.4E+38	3.4E+38	Speed difference in user units	float32		
2303 / 4351 / 6399	4	PosDiff	PosUnit	0	-2147483648	2147483647	Position tracking error in user units	int32		

Table 18.10: Parameter list – Motion profile axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2303 / 4351 / 6399	5	PosAct	PosUnit	0	-2147483648	2147483647	Actual position value in user units	int32		
2303 / 4351 / 6399	6	PosRef	PosUnit	0	-2147483648	2147483647	Setpoint position value in user units	int32		
24818 / 26866 / 28914	0	PositioningOC		0	0	65535	Axis 1 / 2 / 3: Option code positioning	uint16	0	1
2304 / 4352 / 6400		MPRO_FG_BackupActPos					Backup values for multiturn overflow in modulo operation		0	4
2304 / 4352 / 6400	0	ActPosMT		0	-2147483648	2147483647	Backup current multiturn position from position encoder	int32		
2304 / 4352 / 6400	1	OverflowCounter		0	-2147483648	2147483647	Number of overflows	int32		
2305 / 4353 / 6401	0	MPRO_FG_ModuloComp		OFF (0)	OFF (0)	ON (1)	Axis 1 / 2 / 3: Modulo position correction	uint8	0	2
2306 / 4354 / 6402		MPRO_FG_Settings					Axis 1 / 2 / 3: Factor group settings		0	2
2306 / 4354 / 6402	0	ActPosDelayTime	ms	0	0	8	Actual position delay sent to master (125 us scanning time)	float32		
2306 / 4354 / 6402	1	reserved		0	0	255		uint8		
SUBJECT AREA		Stop ramps / option codes					Stop ramps and option codes		0	0
24666 / 26714 / 28762	0	QuickStopOC		QuickStopRampSOD (2)	DisableDrive (0)	CurrentLimitQSA (7)	Axis 1 / 2 / 3: CiA 402 Quick stop option code	int16	0	1
24667 / 26715 / 28763	0	ShutdownOC		EqualQuickStopOC (-1)	EqualQuickStopOC (-1)	SlowDownRamp (1)	Axis 1 / 2 / 3: CiA 402 Control disable option code	int16	0	1
24668 / 26716 / 28764	0	DisableOperationOC		SlowDownRamp (1)	DisableDrive (0)	SlowDownRamp (1)	Axis 1 / 2 / 3: CiA 402 Setpoint disable option code	int16	0	1
24669 / 26717 / 28765	0	StopOC		SlowDownRamp (1)	DisableDrive (0)	CurrentLimit (3)	Axis 1 / 2 / 3: CiA 402 Stop option code	int16	0	1
24670 / 26718 / 28766	0	FaultReactionOC		QuickStopRamp (2)	DisableDrive (0)	CurrentLimit (3)	Axis 1 / 2 / 3: CiA 402 Error reaction option code	int16	0	1
24709 / 26757 / 28805	0	QuickStopDec	AccUnit	60000000	0	4294967295	Axis 1 / 2 / 3: CiA 402 Quick stop deceleration ramp	uint32	0	1
SUBJECT AREA		Homing							0	0
24700 / 26748 / 28796	0	HomeOffset	PosUnit	0	-2147483648	2147483647	Axis 1 / 2 / 3: CiA 402 Reference point shift	int32	0	2
24728 / 26776 / 28824	0	HomingMethod		Type_35 (35)	Type__11 (-11)	Type_37 (37)	Axis 1 / 2 / 3: CiA 402 Homing method	int8	0	1
24729 / 26777 / 28825		HomingSpeeds					Axis 1 / 2 / 3: CiA 402 Homing speeds		0	2
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	100	0	4294967295	Cam search speed	uint32		

Table 18.10: Parameter list – Motion profile axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	10	0	4294967295	Zero pulse search speed	uint32		
24730 / 26778 / 28826	0	HomingAcc	AccUnit	1000	0	4294967295	Axis 1 / 2 / 3: CiA 402 Homing acceleration	uint32	0	2
2279 / 4327 / 6375	0	MC_HOMING_TMaxScale	%	100	0	100	Axis 1 / 2 / 3: Torque scaling during homing	float32	0	2
2280 / 4328 / 6376	0	MC_HOMING_MaxDistance	PosUnit	0	0	2147483647	Axis 1 / 2 / 3: Max. distance during homing	int32	0	2
2281 / 4329 / 6377		MC_HOMING_Settings					Axis 1 / 2 / 3: "Homing" settings		0	2
2281 / 4329 / 6377	0	SimEnable		OFF (0)	OFF (0)	SIM_AUTO (3)	Homing simulation	uint16		
2281 / 4329 / 6377	1	EncMode		STARTUP_MT (1)	STD (0)	STARTUP_MT (1)	Homing start	uint16		
2282 / 4330 / 6378		MC_HOMING_Backup					Axis 1 / 2 / 3: Position backup		0	4
2282 / 4330 / 6378	0	HomeDiffST		0	0	4294967295	Singleturn position backup	uint32		
2282 / 4330 / 6378	1	HomeDiffMT		0	0	4294967295	Multiturn position backup	uint32		
2282 / 4330 / 6378	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
2283 / 4331 / 6379	0	MC_HOMING_Backup_User	PosUnit	0	-2147483648	2147483647	Axis 1 / 2 / 3: Position backup in user units	int32	0	5
2284 / 4332 / 6380	0	MC_HOMING_SimState		OFF (0)	OFF (0)	LOCK_MT (4)	Axis 1 / 2 / 3: Homing simulation state	uint16	0	5
SUBJECT AREA		TouchProbe					Touchprobe function settings and actual values		0	0
2338 / 4386 / 6434		TouchprobeSettings					Axis 1 / 2 / 3: Settings for all touchprobe channels		0	0
2338 / 4386 / 6434	0	SelfPosition		ACTPOS (0)	ACTPOS (0)	ENCPOS_CH2_INC (5)	Position value selection	uint16		
2338 / 4386 / 6434	1	reserved		0	0	65535	reserved for future use	uint16		
24760 / 26808 / 28856	0	TouchProbeFunction		0	0	65535	Axis 1 / 2 / 3: CiA 402 Touchprobe control bits	uint16	0	2
24761 / 26809 / 28857	0	TouchprobeStatus		0	0	65535	Axis 1 / 2 / 3: CiA 402 Touchprobe status bits	uint16	0	5
24762 / 26810 / 28858	0	Touchprobe1PosEdge		0	-2147483648	2147483647	Axis 1 / 2 / 3: CiA 402 Touchprobe 1: Position on rising edge	int32	0	5
24763 / 26811 / 28859	0	Touchprobe1NegEdge		0	-2147483648	2147483647	Axis 1 / 2 / 3: CiA 402 Touchprobe 1: Position on falling edge	int32	0	5
24764 / 26812 / 28860	0	Touchprobe2PosEdge		0	-2147483648	2147483647	Axis 1 / 2 / 3: CiA 402 Touchprobe 2: Position on rising edge	int32	0	5
24765 / 26813 / 28861	0	Touchprobe2NegEdge		0	-2147483648	2147483647	Axis 1 / 2 / 3: CiA 402 Touchprobe 2: Position on falling edge	int32	0	5
SUBJECT AREA		State machine							0	0
2248 / 4296 / 6344	0	MPRO_DRVCOM_State		Start (0)	Start (0)	Fault (8)	Axis 1 / 2 / 3: DriveCom state	uint32	0	5

Table 18.10: Parameter list – Motion profile axis (continue)



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2249 / 4297 / 6345	0	MPRO_DRVCOM_StateText					Axis 1 / 2 / 3: DriveCom state (text)	string	0	5
2250 / 4298 / 6346	0	MPRO_DRVCOM_Statusword		0	0	4294967295	Axis 1 / 2 / 3: DriveCom status word	uint32	0	5
2251 / 4299 / 6347	0	MPRO_DRVCOM_Controlword		0	0	4294967295	Axis 1 / 2 / 3: DriveCom control word	uint32	0	5
2252 / 4300 / 6348	0	MPRO_DRVCOM_FaultReset		False (0)	False (0)	True (1)	Axis 1 / 2 / 3: DriveCom fault reset	bool32	0	2
2253 / 4301 / 6349	0	MPRO_DRVCOM_AutoStart		Off (0)	Off (0)	On (1)	Axis 1 / 2 / 3: DriveCom system auto. start	uint16	0	2
2257 / 4305 / 6353	0	MPRO_DRVCOM_Init		READY (0)	READY (0)	ERRQUIT (5)	Axis 1 / 2 / 3: Initialisation	uint8	0	2
SUBJECT AREA		Configurable status word selector							0	0
2331 / 4379 / 6427		MPRO_INPUT_StatusSel					Axis 1 / 2 / 3: Configurable status word selector		0	2
2331 / 4379 / 6427	0	Source		SYSIO (0)	SYSIO (0)	PWRFAIL (5)	Source selector	uint8		
2331 / 4379 / 6427	1	BitNo		0	0	31	Bit number	uint8		
2331 / 4379 / 6427	2	Source		SYSIO (0)	SYSIO (0)	PWRFAIL (5)	Source selector	uint8		
2331 / 4379 / 6427	3	BitNo		0	0	31	Bit number	uint8		
2331 / 4379 / 6427	4	Source		SYSIO (0)	SYSIO (0)	PWRFAIL (5)	Source selector	uint8		
2331 / 4379 / 6427	5	BitNo		0	0	31	Bit number	uint8		
2331 / 4379 / 6427	6	Source		SYSIO (0)	SYSIO (0)	PWRFAIL (5)	Source selector	uint8		
2331 / 4379 / 6427	7	BitNo		0	0	31	Bit number	uint8		
2332 / 4380 / 6428	0	MPRO_INPUT_StatusWord		0	0	255	Axis 1 / 2 / 3: Configurable status word	uint8	0	5
2333 / 4381 / 6429	0	MPRO_INPUT_ControlWord		0	0	255	Axis 1 / 2 / 3: Control word for special functions	uint8	0	2
SUBJECT AREA		Table positioning							0	0
2608 / 4656 / 6704		MPRO_TAB_Trq					Axis 1 / 2 / 3: Torque mode		0	2
2608 / 4656 / 6704	0	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	1	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	2	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	3	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	4	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	5	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	6	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	7	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	8	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	9	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	10	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	11	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	12	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		

Table 18.10: Parameter list – Motion profile axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2608 / 4656 / 6704	13	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	14	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	15	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	16	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	17	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	18	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	19	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	20	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	21	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	22	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	23	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	24	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	25	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	26	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	27	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	28	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	29	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	30	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	31	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	32	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	33	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	34	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	35	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	36	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	37	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	38	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	39	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	40	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	41	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	42	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		
2608 / 4656 / 6704	43	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	44	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2608 / 4656 / 6704	45	TAcc	AccUnit	0	0	3.4E+38	Acceleration	float32		

Table 18.10: Parameter list – Motion profile axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2608 / 4656 / 6704	46	TDec	AccUnit	0	0	3.4E+38	Deceleration	float32		
2608 / 4656 / 6704	47	TRef	TorqueUnit	100	-3.4E+38	3.4E+38	Setpoint torque	float32		
2609 / 4657 / 6705		MPRO_TAB_Spd					Axis 1 / 2 / 3: Speed mode		0	2
2609 / 4657 / 6705	0	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	1	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	2	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	3	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	4	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	5	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	6	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	7	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	8	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	9	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	10	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	11	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	12	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	13	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	14	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	15	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	16	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	17	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	18	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	19	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	20	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	21	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	22	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	23	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	24	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	25	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	26	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	27	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	28	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	29	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		

Table 18.10: Parameter list – Motion profile axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2609 / 4657 / 6705	30	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	31	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	32	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	33	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	34	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	35	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	36	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	37	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	38	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	39	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	40	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	41	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	42	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	43	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	44	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2609 / 4657 / 6705	45	SAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2609 / 4657 / 6705	46	SDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2609 / 4657 / 6705	47	SRef	SpeedUnit	100	-3.4E+38	3.4E+38	Setpoint speed	float32		
2610 / 4658 / 6706		MPRO_TAB_Pos					Axis 1 / 2 / 3: Position mode		0	2
2610 / 4658 / 6706	0	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	1	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	2	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	3	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	4	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	5	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	6	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	7	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	8	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	9	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	10	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	11	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	12	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	13	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		

Table 18.10: Parameter list – Motion profile axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2610 / 4658 / 6706	14	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	15	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	16	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	17	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	18	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	19	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	20	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	21	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	22	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	23	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	24	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	25	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	26	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	27	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	28	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	29	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	30	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	31	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	32	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	33	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	34	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	35	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	36	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	37	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	38	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	39	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	40	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	41	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	42	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	43	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	44	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	45	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	46	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		

Table 18.10: Parameter list – Motion profile axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2610 / 4658 / 6706	47	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	48	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	49	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	50	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	51	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	52	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	53	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	54	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	55	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	56	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	57	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	58	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	59	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	60	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	61	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	62	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	63	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	64	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	65	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	66	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	67	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	68	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	69	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	70	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	71	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	72	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	73	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	74	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		
2610 / 4658 / 6706	75	PAcc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2610 / 4658 / 6706	76	PDec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2610 / 4658 / 6706	77	PRef	PosUnit	0	-2147483648	2147483647	Target position	int32		
2610 / 4658 / 6706	78	PMode		ABS (0)	ABS (0)	SPEED (3)	Position mode	uint16		
2610 / 4658 / 6706	79	PSpd	SpeedUnit	100	-3.4E+38	3.4E+38	Speed feed forward control	float32		

Table 18.10: Parameter list – Motion profile axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2611 / 4659 / 6707		MPRO_TAB_WaitTime					Axis 1 / 2 / 3: Maximum time for position or torque mode		0	2
2611 / 4659 / 6707	0	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	1	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	2	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	3	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	4	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	5	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	6	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	7	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	8	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	9	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	10	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	11	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	12	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	13	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	14	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2611 / 4659 / 6707	15	MPRO_TAB_WaitTime	ms	0	0	65535		uint16		
2612 / 4660 / 6708	0	MPRO_TAB_Mode		PARA (0)	PARA (0)	AUTOCMP (3)	Axis 1 / 2 / 3: Operating mode	uint16	0	2
2613 / 4661 / 6709	0	MPRO_TAB_MaxIdx		0	0	15	Axis 1 / 2 / 3: Max. index in AUTO mode	uint16	0	2
2614 / 4662 / 6710	0	MPRO_TAB_ActIdx		0	0	15	Axis 1 / 2 / 3: Current index	uint16	0	5
2615 / 4663 / 6711	0	MPRO_TAB_Ctrl		0	0	65535	Axis 1 / 2 / 3: Control word	uint16	0	2
2616 / 4664 / 6712	0	MPRO_TAB_Enable		False (0)	False (0)	True (1)	Axis 1 / 2 / 3: Activate table	bool32	0	2
SUBJECT AREA		Advanced functions of motion profile							0	0
2260 / 4308 / 6356		MPRO_DRVCOM_RetractMove					Axis 1 / 2 / 3: Retract movement data		0	2
2260 / 4308 / 6356	0	Pos	PosUnit	0	-2147483648	2147483647	Position	int32		
2260 / 4308 / 6356	1	Spd	SpeedUnit	100	0	3.4E+38	Speed feed forward control	float32		
2260 / 4308 / 6356	2	Acc	AccUnit	100	0	3.4E+38	Acceleration	float32		
2260 / 4308 / 6356	3	Dec	AccUnit	100	0	3.4E+38	Deceleration	float32		
2260 / 4308 / 6356	4	Mode		ABS (0)	ABS (0)	REL (1)	Position mode	uint16		
2262 / 4310 / 6358		MPRO_DRVCOM_Tune					Axis 1 / 2 / 3: Special DriveCom modification parameters		0	2
2262 / 4310 / 6358	0	EnOpOPC		STD	STD	MOVE	Special DriveCom modification parameters	uint8		
2262 / 4310 / 6358	1	SyncHalt		True	False	True	Re-synchronize position and speed on Halt Setting description	bool8		
2262 / 4310 / 6358	2	EnOpDistance		0	-2147483648	2147483648	Distance to check for synchronization move (0 = infinite distance allowed)	int32		

Table 18.10: Parameter list – Motion profile axis (continue)

## 20.6 Digital inputs axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Digital inputs							0	0
2329 / 4377 / 6425		MPRO_INPUT_Config					Axis 1 / 2 / 3: Dig. inputs settings		0	2
2329 / 4377 / 6425	0	Inverse		0	0	4294967295	Inversion of inputs	uint32		
2329 / 4377 / 6425	1	FilterTime_DI01	ms	0	0	65535	Filter time DI01	uint16		
2329 / 4377 / 6425	2	FilterTime_DI02	ms	0	0	65535	Filter time DI02	uint16		
2329 / 4377 / 6425	3	FilterTime_DI03	ms	0	0	65535	Filter time DI03	uint16		
2329 / 4377 / 6425	4	FuncSel_DI01		None (0)	None (0)	Halt (8)	Function selector DI01	uint16		
2329 / 4377 / 6425	5	FuncSel_DI02		None (0)	None (0)	Halt (8)	Function selector DI02	uint16		
2329 / 4377 / 6425	6	FuncSel_DI03		None (0)	None (0)	Halt (8)	Function selector DI03	uint16		
2328 / 4376 / 6424		MPRO_INPUT_State					Axis 1 / 2 / 3: State of digital inputs		0	5
2328 / 4376 / 6424	0	State		0	0	4294967295	States of the digital inputs	uint32		
2328 / 4376 / 6424	1	StateFil		0	0	4294967295	Status of digital inputs (filtered)	uint32		

Table 18.11: Parameter list – Digital inputs axis



## 20.7 Limitations / thresholds axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Limitations and Thresholds							0	0
2958 / 5006 / 7054		CON_SCON_ActMax					Axis 1 / 2 / 3: Limitation of the actual values		0	5
2958 / 5006 / 7054	0	ActMax_Speed	rpm	0	-3.4E+38	3.4E+38	Maximum speed	float32		
2958 / 5006 / 7054	1	ActMax_Current	Arms	0	-3.4E+38	3.4E+38	Maximum current	float32		
2958 / 5006 / 7054	2	ActMax_Torque	Nm	0	-3.4E+38	3.4E+38	Max. torque	float32		
2958 / 5006 / 7054	3	ActMax_UsrSpeed	SpeedUnit	0	-3.4E+38	3.4E+38	Max. speed in user units	float32		
2958 / 5006 / 7054	4	Reserved		0	-3.4E+38	3.4E+38	Reserved	float32		
2958 / 5006 / 7054	5	Reserved		0	-3.4E+38	3.4E+38	Reserved	float32		
2958 / 5006 / 7054	6	Reserved		0	-3.4E+38	3.4E+38	Reserved	float32		
2968 / 5016 / 7064		CON_SCON_LimitFactors					Axis 1 / 2 / 3: Limitations (in % of rated motor data)		0	2
2968 / 5016 / 7064	0	LimFac_Speed	%	100	0.1	1000	Speed limitation scaling factor	float32		
2968 / 5016 / 7064	1	LimFac_Current	%	200	0.01	1000	Current limitation scaling factor	float32		
2968 / 5016 / 7064	2	LimFac_Torque	%	100	0	1000	Torque unit scaling factor	float32		
2976 / 5024 / 7072		CON_SCON_ScaleLimits					Axis 1 / 2 / 3: Limitation scaling (in % of min. / max. values)		0	2
2976 / 5024 / 7072	0	TMaxPos	%	100	0	100	Pos. torque limitation scaling	float32		
2976 / 5024 / 7072	1	TMaxNeg	%	100	0	100	Neg. torque limitation scaling	float32		
2976 / 5024 / 7072	2	SMaxPos	%	100	0	100	Pos. speed limitation scaling	float32		
2976 / 5024 / 7072	3	SMaxNeg	%	100	0	100	Neg. Speed limitation	float32		
2976 / 5024 / 7072	4	ScaleTf	ms	100	0	1000	Filter time scaling	float32		
2976 / 5024 / 7072	5	TMaxScale	%	100	0	100	Scale torque limitation symmetrically	float32		
2994 / 5042 / 7090		CON_SCON_Lin_ActMax					Axis 1 / 2 / 3: Limitation of the actual values		0	5
2994 / 5042 / 7090	0	ActMax_Lin_Speed	m/s	0	-3.4E+38	3.4E+38	Maximum speed	float32		
2994 / 5042 / 7090	1	ActMax_Lin_Force	N	0	-3.4E+38	3.4E+38	Maximum force	float32		
3048 / 5096 / 7144	0	MON_State		0	0	4294967295	Axis 1 / 2 / 3: Status / device status word	uint32	0	5
3051 / 5099 / 7147		MON_MotorStatus					Axis 1 / 2 / 3: Motor status		0	2
3051 / 5099 / 7147	0	SDiffMax	%	50	0	3.4E+38	Speed difference threshold (% of Snom)	float32		
3051 / 5099 / 7147	1	StandstillWindow	%	0	0	3.4E+38	Standstill window (% of Snom)	float32		
3051 / 5099 / 7147	2	TargetReachedWindow	%	1	0	3.4E+38	TargetReached window in speed control (% of Snom)	float32		
3051 / 5099 / 7147	3	UsrPosWindow	PosUnit	100	0	4294967295	Pos. setpoint reached window	uint32		
3051 / 5099 / 7147	4	UsrPosDiffMax	PosUnit	10000	0	4294967295	Position tracking error	uint32		

Table 18.12: Parameter list – Limitations / thresholds axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
24701 / 26749 / 28797		SoftwarePositionLimit					Axis 1 / 2 / 3: Software limit switch		0	1
24701 / 26749 / 28797	0	PosLim_Min	PosUnit	0	-2147483648	2147483647	Software limit switch neg.	int32		
24701 / 26749 / 28797	1	PosLim_Max	PosUnit	0	-2147483648	2147483647	Software limit switch pos.	int32		
SUBJECT AREA		Speed feed forward control					Speed control limitations		0	0
2958 / 5006 / 7054		CON_SCON_ActMax					Axis 1 / 2 / 3: Limitation of the actual values		0	5
2958 / 5006 / 7054	0	ActMax_Speed	rpm	0	-3.4E+38	3.4E+38	Maximum speed	float32		
2958 / 5006 / 7054	1	ActMax_Current	Arms	0	-3.4E+38	3.4E+38	Maximum current	float32		
2958 / 5006 / 7054	2	ActMax_Torque	Nm	0	-3.4E+38	3.4E+38	Max. torque	float32		
2958 / 5006 / 7054	3	ActMax_UsrSpeed	SpeedUnit	0	-3.4E+38	3.4E+38	Max. speed in user units	float32		
2958 / 5006 / 7054	4	Reserved		0	-3.4E+38	3.4E+38	Reserved	float32		
2958 / 5006 / 7054	5	Reserved		0	-3.4E+38	3.4E+38	Reserved	float32		
2958 / 5006 / 7054	6	Reserved		0	-3.4E+38	3.4E+38	Reserved	float32		
2968 / 5016 / 7064		CON_SCON_LimitFactors					Axis 1 / 2 / 3: Limitations (in % of rated motor data)		0	2
2968 / 5016 / 7064	0	LimFac_Speed	%	100	0.1	1000	Speed limitation scaling factor	float32		
2968 / 5016 / 7064	1	LimFac_Current	%	200	0.01	1000	Current limitation scaling factor	float32		
2968 / 5016 / 7064	2	LimFac_Torque	%	100	0	1000	Torque unit scaling factor	float32		
2976 / 5024 / 7072		CON_SCON_ScaleLimits					Axis 1 / 2 / 3: Limitation scaling (in % of min. / max. values)		0	2
2976 / 5024 / 7072	0	TMaxPos	%	100	0	100	Pos. torque limitation scaling	float32		
2976 / 5024 / 7072	1	TMaxNeg	%	100	0	100	Neg. torque limitation scaling	float32		
2976 / 5024 / 7072	2	SMaxPos	%	100	0	100	Pos. speed limitation scaling	float32		
2976 / 5024 / 7072	3	SMaxNeg	%	100	0	100	Neg. Speed limitation	float32		
2976 / 5024 / 7072	4	ScaleTf	ms	100	0	1000	Filter time scaling	float32		
2976 / 5024 / 7072	5	TMaxScale	%	100	0	100	Scale torque limitation symmetrically	float32		
3051 / 5099 / 7147		MON_MotorStatus					Axis 1 / 2 / 3: Motor status		0	2
3051 / 5099 / 7147	0	SDiffMax	%	50	0	3.4E+38	Speed difference threshold (% of Snom)	float32		
3051 / 5099 / 7147	1	StandstillWindow	%	0	0	3.4E+38	Standstill window (% of Snom)	float32		
3051 / 5099 / 7147	2	TargetReachedWindow	%	1	0	3.4E+38	TargetReached window in speed control (% of Snom)	float32		
3051 / 5099 / 7147	3	UsrPosWindow	PosUnit	100	0	4294967295	Pos. setpoint reached window	uint32		
3051 / 5099 / 7147	4	UsrPosDiffMax	PosUnit	10000	0	4294967295	Position tracking error	uint32		
SUBJECT AREA		Torque / current					Torque / current control limitations		0	0

Table 18.12: Parameter list – Limitations / thresholds axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2958 / 5006 / 7054		CON_SCON_ActMax					Axis 1 / 2 / 3: Limitation of the actual values		0	5
2958 / 5006 / 7054	0	ActMax_Speed	rpm	0	-3.4E+38	3.4E+38	Maximum speed	float32		
2958 / 5006 / 7054	1	ActMax_Current	Arms	0	-3.4E+38	3.4E+38	Maximum current	float32		
2958 / 5006 / 7054	2	ActMax_Torque	Nm	0	-3.4E+38	3.4E+38	Max. torque	float32		
2958 / 5006 / 7054	3	ActMax_UsrSpeed	SpeedUnit	0	-3.4E+38	3.4E+38	Max. speed in user units	float32		
2958 / 5006 / 7054	4	Reserved		0	-3.4E+38	3.4E+38	Reserved	float32		
2958 / 5006 / 7054	5	Reserved		0	-3.4E+38	3.4E+38	Reserved	float32		
2958 / 5006 / 7054	6	Reserved		0	-3.4E+38	3.4E+38	Reserved	float32		
2968 / 5016 / 7064		CON_SCON_LimitFactors					Axis 1 / 2 / 3: Limitations (in % of rated motor data)		0	2
2968 / 5016 / 7064	0	LimFac_Speed	%	100	0.1	1000	Speed limitation scaling factor	float32		
2968 / 5016 / 7064	1	LimFac_Current	%	200	0.01	1000	Current limitation scaling factor	float32		
2968 / 5016 / 7064	2	LimFac_Torque	%	100	0	1000	Torque unit scaling factor	float32		
2976 / 5024 / 7072		CON_SCON_ScaleLimits					Axis 1 / 2 / 3: Limitation scaling (in % of min. / max. values)		0	2
2976 / 5024 / 7072	0	TMaxPos	%	100	0	100	Pos. torque limitation scaling	float32		
2976 / 5024 / 7072	1	TMaxNeg	%	100	0	100	Neg. torque limitation scaling	float32		
2976 / 5024 / 7072	2	SMaxPos	%	100	0	100	Pos. speed limitation scaling	float32		
2976 / 5024 / 7072	3	SMaxNeg	%	100	0	100	Neg. Speed limitation	float32		
2976 / 5024 / 7072	4	ScaleTf	ms	100	0	1000	Filter time scaling	float32		
2976 / 5024 / 7072	5	TMaxScale	%	100	0	100	Scale torque limitation symmetrically	float32		
3051 / 5099 / 7147		MON_MotorStatus					Axis 1 / 2 / 3: Motor status		0	2
3051 / 5099 / 7147	0	SDiffMax	%	50	0	3.4E+38	Speed difference threshold (% of Snom)	float32		
3051 / 5099 / 7147	1	StandstillWindow	%	0	0	3.4E+38	Standstill window (% of Snom)	float32		
3051 / 5099 / 7147	2	TargetReachedWindow	%	1	0	3.4E+38	TargetReached window in speed control (% of Snom)	float32		
3051 / 5099 / 7147	3	UsrPosWindow	PosUnit	100	0	4294967295	Pos. setpoint reached window	uint32		
3051 / 5099 / 7147	4	UsrPosDiffMax	PosUnit	10000	0	4294967295	Position tracking error	uint32		
SUBJECT AREA		Position					Position control limitations		0	0
3051 / 5099 / 7147		MON_MotorStatus					Axis 1 / 2 / 3: Motor status		0	2
3051 / 5099 / 7147	0	SDiffMax	%	50	0	3.4E+38	Speed difference threshold (% of Snom)	float32		
3051 / 5099 / 7147	1	StandstillWindow	%	0	0	3.4E+38	Standstill window (% of Snom)	float32		
3051 / 5099 / 7147	2	TargetReachedWindow	%	1	0	3.4E+38	TargetReached window in speed control (% of Snom)	float32		
3051 / 5099 / 7147	3	UsrPosWindow	PosUnit	100	0	4294967295	Pos. setpoint reached window	uint32		
3051 / 5099 / 7147	4	UsrPosDiffMax	PosUnit	10000	0	4294967295	Position tracking error	uint32		
SUBJECT AREA		Axis thresholds					Thresholds of the current axis		0	0

Table 18.12: Parameter list – Limitations / thresholds axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
3071 / 5119 / 7167		MON_WarningLevels					Axis 1 / 2 / 3: Warning thresholds		0	2
3071 / 5119 / 7167	0	I_ON	A	1000	0	1000	Motor current	float32		
3071 / 5119 / 7167	1	I_OFF	A	1000	0	1000	Motor current	float32		
3071 / 5119 / 7167	2	DeviceI2t_ON	%	110	0	110	I2t device protection	float32		
3071 / 5119 / 7167	3	DeviceI2t_OFF	%	110	0	110	I2t device protection	float32		
3071 / 5119 / 7167	4	MotorI2t_ON	%	110	0	110	I2t motor protection	float32		
3071 / 5119 / 7167	5	MotorI2t_OFF	%	110	0	110	I2t motor protection	float32		
3071 / 5119 / 7167	6	Torque_ON	Nm	1000	0	10000	Torque	float32		
3071 / 5119 / 7167	7	Torque_OFF	Nm	1000	0	10000	Torque	float32		
3071 / 5119 / 7167	8	Speed_ON	rpm	10000	0	200000	Speed	float32		
3071 / 5119 / 7167	9	Speed_OFF	rpm	10000	0	200000	Speed	float32		
3071 / 5119 / 7167	10	TC_ON	degC	200	0	200	Heat sink temperature (power electronics)	float32		
3071 / 5119 / 7167	11	TC_OFF	degC	200	0	200	Heat sink temperature (power electronics)	float32		
3071 / 5119 / 7167	12	MotorTemp_On	degC	200	0	200	Motor temperature sensor	float32		
3071 / 5119 / 7167	13	MotorTemp_Off	degC	200	0	200	Motor temperature sensor	float32		

Table 18.12: Parameter list – Limitations / thresholds axis (continue)

## 20.8 Alarms / Warnings axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Alarms / Warnings					Alarm / warning history		0	0
2148 / 4196 / 6244		ERR_Actual					Axis 1 / 2 / 3: Error status		0	5
2148 / 4196 / 6244	0	Cause					Text	string		
2148 / 4196 / 6244	1	Remedy					Remedy	string		
2148 / 4196 / 6244	2	ID		0	0	65535	ID	uint16		
2148 / 4196 / 6244	3	Location		0	0	65535	Location	uint16		
2148 / 4196 / 6244	4	CommentID		0	-2147483648	2147483647	Additional ID	int32		
2148 / 4196 / 6244	5	CommentText					Additional text	string		
2148 / 4196 / 6244	6	SourceLine		0	0	4294967295	Source line	uint32		
2148 / 4196 / 6244	7	SourceFile					Name of source	string		
2148 / 4196 / 6244	8	TimeString					Time stamp	string		
2149 / 4197 / 6245		ERR_Actual_SysState					Axis 1 / 2 / 3: System status		0	5
2149 / 4197 / 6245	0	Templnt	°C	0	-32768	32767	Interior temperature	int16		
2149 / 4197 / 6245	1	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
2149 / 4197 / 6245	2	OperationTime	s	0	0	4294967295	Time	uint32		
2149 / 4197 / 6245	3	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
2149 / 4197 / 6245	4	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
2149 / 4197 / 6245	5	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
2149 / 4197 / 6245	6	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
2149 / 4197 / 6245	7	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
2150 / 4198 / 6246		ERR_Actual_AxisState					Axis 1 / 2 / 3: Axis state		0	5
2150 / 4198 / 6246	0	Speed	SpeedUnit	0	-3.4E+38	3.4E+38	Speed	float32		
2150 / 4198 / 6246	1	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
2150 / 4198 / 6246	2	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
2150 / 4198 / 6246	3	DriveCom		0	0	65535	Device status	uint16		
2151 / 4199 / 6247	0	ERR_WRN_State		0	0	4294967295	Axis 1 / 2 / 3: Warning state	uint32	0	5
2152 / 4200 / 6248		ERR_AbsoluteCount					Axis 1 / 2 / 3: Error counter		0	4
2152 / 4200 / 6248	0	RunTime		0	0	4294967295	Runtime	uint32		
2152 / 4200 / 6248	1	ParaList		0	0	4294967295	Parameter list	uint32		
2152 / 4200 / 6248	2	ObjList		0	0	4294967295	Object list	uint32		

Table 18.13: Parameter list – Alarms / warnings axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2152 / 4200 / 6248	3	EtherCAT		0	0	4294967295	EtherCAT	uint32		
2152 / 4200 / 6248	4	Ethernet		0	0	4294967295	Ethernet	uint32		
2152 / 4200 / 6248	5	Fatal		0	0	4294967295	Fatal error	uint32		
2152 / 4200 / 6248	6	Parameters		0	0	4294967295	Parameters	uint32		
2152 / 4200 / 6248	7	EncoderInit		0	0	4294967295	Encoder initialisation	uint32		
2152 / 4200 / 6248	8	Timing		0	0	4294967295	Timing	uint32		
2152 / 4200 / 6248	9	OverCurrent		0	0	4294967295	Overcurrent	uint32		
2152 / 4200 / 6248	10	I2tPowerAmplifier		0	0	4294967295	I2T power stage	uint32		
2152 / 4200 / 6248	11	I2tMotor		0	0	4294967295	I2T motor	uint32		
2152 / 4200 / 6248	12	MotionControl		0	0	4294967295	Motion control	uint32		
2152 / 4200 / 6248	13	OverVoltage		0	0	4294967295	Overvoltage	uint32		
2152 / 4200 / 6248	14	Off		0	0	4294967295	Off (undervoltage)	uint32		
2152 / 4200 / 6248	15	SpeedDiff		0	0	4294967295	Speed difference	uint32		
2152 / 4200 / 6248	16	PositionDiff		0	0	4294967295	Position difference	uint32		
2152 / 4200 / 6248	17	DeviceTemp		0	0	4294967295	Device temperature	uint32		
2152 / 4200 / 6248	18	CrossComm		0	0	4294967295	Cross communication	uint32		
2152 / 4200 / 6248	19	CommonSys		0	0	4294967295	CommonSys	uint32		
2152 / 4200 / 6248	20	MotorBrake		0	0	4294967295	Motor brake	uint32		
2152 / 4200 / 6248	21	EncoderCyclic		0	0	4294967295	Encoder (cyclic)	uint32		
2152 / 4200 / 6248	22	Homing		0	0	4294967295	Homing	uint32		
2152 / 4200 / 6248	23	Supply		0	0	4294967295	Supply	uint32		
2152 / 4200 / 6248	24	MotorTemp		0	0	4294967295	Motor temperature	uint32		
2152 / 4200 / 6248	25	Calib		0	0	4294967295	Calibration	uint32		
2152 / 4200 / 6248	26	HardLimitSwitch		0	0	4294967295	Hardware limit switch	uint32		
2152 / 4200 / 6248	27	PositionLimit		0	0	4294967295	Software limit switch	uint32		
2152 / 4200 / 6248	28	LockViolate		0	0	4294967295	Setpoint exceeded	uint32		
SUBJECT AREA		Error reactions					Error reaction settings		0	0
2153 / 4201 / 6249		ERR_Reaction_Axis					Custom programmable error reaction for all axis errors		0	2
2153 / 4201 / 6249	0	NoError		ServoHalt (4)	Ignore (0)	Specific2 (8)	no error	uint16		
2153 / 4201 / 6249	1	Fatal		WaitERSAndReset (6)	WaitERSAndReset (6)	WaitERSAndReset (6)	Fatal error	uint16		

Table 18.13: Parameter list – Alarms / warnings axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2153 / 4201 / 6249	2	Parameters		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Parameter error	uint16		
2153 / 4201 / 6249	3	Encoder		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Encoder	uint16		
2153 / 4201 / 6249	4	Timing		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Timing	uint16		
2153 / 4201 / 6249	5	OverCurrent		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Overcurrent	uint16		
2153 / 4201 / 6249	6	I2tPowerAmplifier		FaultReactionOptionCode (1)	FaultReactionOptionCode (1)	Specific2 (8)	I2T power stage	uint16		
2153 / 4201 / 6249	7	I2tMotor		FaultReactionOptionCode (1)	Ignore (0)	Specific2 (8)	I2T motor	uint16		
2153 / 4201 / 6249	8	MotionControl		FaultReactionOptionCode (1)	FaultReactionOptionCode (1)	Specific2 (8)	Motion control	uint16		
2153 / 4201 / 6249	9	UnderVoltage		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Undervoltage	uint16		
2153 / 4201 / 6249	10	SpeedDiff		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Speed tracking error	uint16		
2153 / 4201 / 6249	11	PositionDiff		FaultReactionOptionCode (1)	Ignore (0)	Specific2 (8)	Position tracking error	uint16		
2153 / 4201 / 6249	12	DeviceTemp		FaultReactionOptionCode (1)	FaultReactionOptionCode (1)	Specific2 (8)	Reaction to error 18 'Overtemperature of power stage'	uint16		
2153 / 4201 / 6249	13	MotorBrake		FaultReactionOptionCode (1)	FaultReactionOptionCode (1)	Specific2 (8)	Holding brake	uint16		
2153 / 4201 / 6249	14	EncoderCyclic		FaultReactionOptionCode (1)	FaultReactionOptionCode (1)	Specific2 (8)	Encoder cycle	uint16		
2153 / 4201 / 6249	15	Homing		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Homing	uint16		
2153 / 4201 / 6249	16	MotorTemp		FaultReactionOptionCode (1)	Ignore (0)	Specific2 (8)	Motor temperature	uint16		
2153 / 4201 / 6249	17	Calib		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Calibration	uint16		
2153 / 4201 / 6249	18	HWLimitSwitch		FaultReactionOptionCode (1)	FaultReactionOptionCode (1)	Specific2 (8)	Hardware limit switch	uint16		
2153 / 4201 / 6249	19	PositionLimit		FaultReactionOptionCode (1)	FaultReactionOptionCode (1)	Specific2 (8)	Position limit	uint16		

Table 18.13: Parameter list – Alarms / warnings axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2153 / 4201 / 6249	20	LockViolate		FaultReactionOptionCode (1)	FaultReactionOptionCode (1)	Specific2 (8)	Setpoint exceeded	uint16		
2153 / 4201 / 6249	21	EncoderHW		FaultReactionOptionCode (1)	Ignore (0)	Specific2 (8)	Encoder hardware	uint16		
2153 / 4201 / 6249	22	CompTracking		FaultReactionOptionCode (1)	Ignore (0)	Specific2 (8)	Reaction to error 31 'Compensation table tracking error'	uint16		
2153 / 4201 / 6249	23	InitCon		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Reaction to error 32 'Control initialisation'	uint16		
2153 / 4201 / 6249	24	EncoderIdle		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Reaction to error 36 'Encoder error while in idle state'			
3071 / 5119 / 7167		MON_WarningLevels					Axis 1 / 2 / 3: Warning thresholds		0	2
3071 / 5119 / 7167	0	I_ON	A	1000	0	1000	Motor current	float32		
3071 / 5119 / 7167	1	I_OFF	A	1000	0	1000	Motor current	float32		
3071 / 5119 / 7167	2	DeviceI2t_ON	%	110	0	110	I2t device protection	float32		
3071 / 5119 / 7167	3	DeviceI2t_OFF	%	110	0	110	I2t device protection	float32		
3071 / 5119 / 7167	4	MotorI2t_ON	%	110	0	110	I2t motor protection	float32		
3071 / 5119 / 7167	5	MotorI2t_OFF	%	110	0	110	I2t motor protection	float32		
3071 / 5119 / 7167	6	Torque_ON	Nm	1000	0	10000	Torque	float32		
3071 / 5119 / 7167	7	Torque_OFF	Nm	1000	0	10000	Torque	float32		
3071 / 5119 / 7167	8	Speed_ON	rpm	10000	0	200000	Speed	float32		
3071 / 5119 / 7167	9	Speed_OFF	rpm	10000	0	200000	Speed	float32		
3071 / 5119 / 7167	10	TC_ON	degC	200	0	200	Heat sink temperature (power electronics)	float32		
3071 / 5119 / 7167	11	TC_OFF	degC	200	0	200	Heat sink temperature (power electronics)	float32		
3071 / 5119 / 7167	12	MotorTemp_On	degC	200	0	200	Motor temperature sensor	float32		
3071 / 5119 / 7167	13	MotorTemp_Off	degC	200	0	200	Motor temperature sensor	float32		

Table 18.13: Parameter list – Alarms / warnings axis (continue)



## 20.9 EtherCAT® axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		EtherCAT					EtherCAT settings (DS301 / 402)		0	0
SUBJECT AREA		Basic settings							0	0
24640 / 26688 / 28736	0	Control word		0	0	65535	Axis 1 / 2 / 3: DS402 control word	uint16	0	1
24641 / 26689 / 28737	0	Status word		0	0	65535	Axis 1 / 2 / 3: DS402 status word	uint16	0	5
24672 / 26720 / 28768	0	ModesOfOperation		None (0)	None (0)	CycSync_TM (10)	Axis 1 / 2 / 3: DS402 Modes of operation selector	int8	0	1
24673 / 26721 / 28769	0	ModesOfOperationDisplay		None (0)	None (0)	CycSync_TM (10)	Axis 1 / 2 / 3: DS402 Modes of operation display	int8	0	5
25858 / 27906 / 29954	0	SupDriveModes		935	0	4294967295	Axis 1 / 2 / 3: Operation modes supported by DS402	uint32	0	5
SUBJECT AREA		Scaling / units							0	0
24699 / 26747 / 28795		PositionRangeLimit					Axis 1 / 2 / 3: DS402 Modulo range limit		0	1
24699 / 26747 / 28795	0	PositionRangeLimit_Min	PosUnit	0	-2147483648	2147483647	Position limitation neg.	int32		
24699 / 26747 / 28795	1	PositionRangeLimit_Max	PosUnit	0	-2147483648	2147483647	Position limitation pos.	int32		
24702 / 26750 / 28798	0	Polarity		0	0	255	Axis 1 / 2 / 3: DS402 polarity	uint8	0	2
24719 / 26767 / 28815		PosEncRes					Axis 1 / 2 / 3: DS402 Position encoder resolution		0	2
24719 / 26767 / 28815	0	PosEncRes		1048576	0	4294967295	Encoder increments singleturn	uint32		
24719 / 26767 / 28815	1	PosEncRes		1	0	4294967295	Multiturn motor revolutions	uint32		
24720 / 26768 / 28816		VelEncRes					Axis 1 / 2 / 3: DS402 Speed encoder resolution		0	2
24720 / 26768 / 28816	0	VelEncRes		1048576	0	4294967295	Encoder increments per second	uint32		
24720 / 26768 / 28816	1	VelEncRes		1	0	4294967295	Motor revolutions per second	uint32		

Table 18.14: Parameter list – EtherCAT axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
24721 / 26769 / 28817		GearRatio					Axis 1 / 2 / 3: DS402 Gear unit gear ratio		0	2
24721 / 26769 / 28817	0	GearRatio		1	1	4294967295	Multiturn motor revolutions	uint32		
24721 / 26769 / 28817	1	GearRatio		1	1	4294967295	Shaft revolutions	uint32		
24722 / 26770 / 28818		FeedConst					Axis 1 / 2 / 3: DS402 feed constant		0	2
24722 / 26770 / 28818	0	Feed		360000	1	4294967295	Feed	uint32		
24722 / 26770 / 28818	1	ShaftRev		1	1	4294967295	Shaft revolutions	uint32		
24723 / 26771 / 28819		PosFactor					Axis 1 / 2 / 3: DS402 Position factor		0	5
24723 / 26771 / 28819	0	PosFactor		0	0	4294967295	Resulting numerator	uint32		
24723 / 26771 / 28819	1	PosFactor		0	0	4294967295	Resulting denominator	uint32		
24724 / 26772 / 28820		VelFactor					Axis 1 / 2 / 3: DS402 Speed factor		0	5
24724 / 26772 / 28820	0	VelFactorNumerator		1	1	4294967295	Resulting numerator	uint32		
24724 / 26772 / 28820	1	VelFactorDenominator		1	1	4294967295	Resulting denominator	uint32		
24818 / 26866 / 28914	0	PositioningOC		0	0	65535	Axis 1 / 2 / 3: Option code positioning	uint16	0	1
2298 / 4346 / 6394	0	MPRO_FG_Type		DS402 (0)	DS402 (0)	User (1)	Axis 1 / 2 / 3: Factor group scaling type	uint16	0	1
2300 / 4348 / 6396	0	MPRO_FG_PosNorm	incr/rev	1048576	0	2147483648	Axis 1 / 2 / 3: Factor group – Internal position resolution	uint32	0	1
2301 / 4349 / 6397		MPRO_FG_Units					Axis 1 / 2 / 3: Factor Group units		0	1
2301 / 4349 / 6397	0	PosUnit		PosUnit			Units for position values	string		
2301 / 4349 / 6397	1	SpeedUnit		SpeedUnit			Unit for speed values	string		

Table 18.14: Parameter list – EtherCAT axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2301 / 4349 / 6397	2	AccUnit		AccUnit			Acceleration unit	string		
2301 / 4349 / 6397	3	TorqueUnit		TorqueUnit			Unit for torque values	string		
2258 / 4306 / 6354		MPRO_402_VelEncRes2					Axis 1: DS402 Velocity encoder resolution multiplier		0	2
2258 / 4306 / 6354	0	VelEncRes2		1	0	4294967295	Encoder increments per second	uint32		
2258 / 4306 / 6354	1	VelEncRes2		1	0	4294967295	Motor revolutions per second	uint32		
SUBJECT AREA		Setpoint / actual values							0	0
24676 / 26724 / 28772	0	PositionActualValue	PosUnit	0	-2147483648	2147483647	Axis 1 / 2 / 3: DS402 Actual position value	int32	0	5
24684 / 26732 / 28780	0	VelocityActualValue	SpeedUnit	0	-2147483648	2147483647	Axis 1 / 2 / 3: DS402 Actual speed value	int32	0	5
24689 / 26737 / 28785	0	TargetTorque	0/00	0	-32768	32767	Axis 1 / 2 / 3: DS402 Target torque	int16	0	2
24694 / 26742 / 28790	0	MotorRatedTorque	mNm	500	0	4294967295	Axis 1 / 2 / 3: DS402 Rated motor torque	uint32	0	2
24695 / 26743 / 28791	0	TorqueActualValue	0/00	0	-32768	32767	Axis 1 / 2 / 3: DS402 Actual torque value	int16	0	5
24698 / 26746 / 28794	0	TargetPosition	PosUnit	0	-2147483648	2147483647	Axis 1 / 2 / 3: DS402 Target position	int32	0	2
24753 / 26801 / 28849	0	VelocityOffset	SpeedUnit	0	-2147483648	2147483647	Axis 1 / 2 / 3: DS402 Speed feed forward control setpoint	int32	0	2
24754 / 26802 / 28850	0	TorqueOffset	0/00	0	-32768	32767	Axis 1 / 2 / 3: DS402 Torque feed forward control setpoint	int16	0	2
24831 / 26879 / 28927	0	TargetVelocity	SpeedUnit	0	-2147483648	2147483647	Axis 1 / 2 / 3: DS402 Target speed	int32	0	1
24642 / 26690 / 28738	0	vITargetVelocity	SpeedUnit	0	-32768	32767	Axis 1 / 2 / 3: DS402 vI target velocity	int16	0	1
24643 / 26691 / 28739	0	vIVelocityDemand	SpeedUnit	0	-32768	32767	Axis 1 / 2 / 3: DS402 velocity demand	int16	0	5
24644 / 26692 / 28740	0	vIVelocityActual	SpeedUnit	0	-32768	32767	Axis 1 / 2 / 3: DS402 Actual speed value	int16	0	5

Table 18.14: Parameter list – EtherCAT axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
24648 / 26696 / 28744		vVelocityAcceleration					Axis 1 / 2 / 3: Velocity mode acceleration		0	2
24648 / 26696 / 28744	0	DeltaSpeed	SpeedUnit	0	0	4294967295	Delta speed for acceleration slope	uint32		
24648 / 26696 / 28744	1	DeltaTime	s	1	1	65535	Velocity mode delta time for acceleration slope	uint16		
24649 / 26697 / 28745		vVelocityDeceleration					Axis 1 / 2 / 3: Velocity mode deceleration		0	2
24649 / 26697 / 28745	0	DeltaSpeed	SpeedUnit	0	0	4294967295	Delta speed for deceleration slope	uint32		
24649 / 26697 / 28745	1	DeltaTime	s	1	1	65535	Velocity mode delta time for deceleration slope	uint16		
SUBJECT AREA		Profile settings					Profile settings		0	0
24705 / 26753 / 28801	0	ProfileVelocity	SpeedUnit	0	0	4294967295	Axis 1 / 2 / 3: Profile speed	uint32	0	2
24707 / 26755 / 28803	0	ProfileAcceleration	AccUnit	0	0	4294967295	Axis 1 / 2 / 3: Profile acceleration	uint32	0	2
24708 / 26756 / 28804	0	ProfileDeceleration	AccUnit	1000	0	4294967295	Axis 1 / 2 / 3: Deceleration profile	uint32	0	2
SUBJECT AREA		Homing							0	0
24700 / 26748 / 28796	0	HomeOffset	PosUnit	0	-2147483648	2147483647	Axis 1 / 2 / 3: DS402 Reference point shift	int32	0	2
24728 / 26776 / 28824	0	HomingMethod		Type_35 (35)	Type__11 (-11)	Type_37 (37)	Axis 1 / 2 / 3: DS402 Homing method	int8	0	1
24729 / 26777 / 28825		HomingSpeeds					Axis 1 / 2 / 3: DS402 Homing speeds		0	2
24729 / 26777 / 28825	0	SpeedSwitch	SpeedUnit	100	0	4294967295	Cam search speed	uint32		
24729 / 26777 / 28825	1	SpeedZero	SpeedUnit	10	0	4294967295	Zero pulse search speed	uint32		
24730 / 26778 / 28826	0	HomingAcc	AccUnit	1000	0	4294967295	Axis 1 / 2 / 3: DS402 Homing acceleration	uint32	0	2
SUBJECT AREA		Stop ramps / option codes							0	0
24666 / 26714 / 28762	0	QuickStopOC		QuickStopRampSOD (2)	DisableDrive (0)	CurrentLimitQSA (7)	Axis 1 / 2 / 3: DS402 Quick stop option code	int16	0	1
24667 / 26715 / 28763	0	ShutdownOC		EqualQuickStopOC (-1)	EqualQuickStopOC (-1)	SlowDownRamp (1)	Axis 1 / 2 / 3: DS402 Control disable option code	int16	0	1

Table 18.14: Parameter list – EtherCAT axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
24668 / 26716 / 28764	0	DisableOperationOC		SlowDownRamp (1)	DisableDrive (0)	SlowDownRamp (1)	Axis 1 / 2 / 3: DS402 Setpoint disable option code	int16	0	1
24669 / 26717 / 28765	0	StopOC		SlowDownRamp (1)	DisableDrive (0)	CurrentLimit (3)	Axis 1 / 2 / 3: DS402 Stop option code	int16	0	1
24670 / 26718 / 28766	0	FaultReactionOC		QuickStopRamp (2)	DisableDrive (0)	CurrentLimit (3)	Axis 1 / 2 / 3: DS402 Error reaction option code	int16	0	1
24709 / 26757 / 28805	0	QuickStopDec	AccUnit	6000000	0	4294967295	Axis 1 / 2 / 3: DS402 Quick stop deceleration ramp	uint32	0	1
SUBJECT AREA		Limitations and Thresholds							0	0
24699 / 26747 / 28795		PositionRangeLimit					Axis 1 / 2 / 3: DS402 Modulo range limit		0	1
24699 / 26747 / 28795	0	PositionRangeLimit_Min	PosUnit	0	-2147483648	2147483647	Position limitation neg.	int32		
24699 / 26747 / 28795	1	PositionRangeLimit_Max	PosUnit	0	-2147483648	2147483647	Position limitation pos.	int32		
24701 / 26749 / 28797		SoftwarePositionLimit					Axis 1 / 2 / 3: Software limit switch		0	1
24701 / 26749 / 28797	0	PosLim_Min	PosUnit	0	-2147483648	2147483647	Software limit switch neg.	int32		
24701 / 26749 / 28797	1	PosLim_Max	PosUnit	0	-2147483648	2147483647	Software limit switch pos.	int32		
24703 / 26751 / 28799	0	MaxProfileVelocity	SpeedUnit	0	0	4294967295	Axis 1 / 2 / 3: Max. speed (both directions)	uint32	0	2
24646 / 26694 / 28742		vIVelocityMinMaxAmount					Axis 1: Velocity min and max amount		0	2
24646 / 26694 / 28742	0	VelMinAmount	SpeedUnit	0	0	4294967295	velocity mode, velocity min amount	uint32		
24646 / 26694 / 28742	1	VelMaxAmount	SpeedUnit	0	0	4294967295	velocity mode, velocity max amount	uint32		

Table 18.14: Parameter list – EtherCAT axis (continue)

## 20.10 Manual mode axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Manual mode					Drive control in manual mode		0	0
2268 / 4316 / 6364	0	MPRO_PARA_Ctrl		0	0	4294967295	Axis 1 / 2 / 3: Device commissioning control word	uint32	0	1
2269 / 4317 / 6365		MPRO_PARA_Data					Axis 1 / 2 / 3: Device commissioning setpoint speed		1	1
2269 / 4317 / 6365	0	TRef	TorqueUnit	1	-3.4E+38	3.4E+38	Device commissioning: Torque setpoint	float32		
2269 / 4317 / 6365	1	SRef	SpeedUnit	60	-3.4E+38	3.4E+38		float32		
2269 / 4317 / 6365	2	PRef	PosUnit	1000	-2147483648	2147483647	Device commissioning: Position setpoint	int32		
2269 / 4317 / 6365	3	Acc	AccUnit	1000	0	3.4E+38	Device commissioning: Acceleration	float32		
2269 / 4317 / 6365	4	Dec	AccUnit	1000	0	3.4E+38	Device commissioning: Deceleration	float32		
2269 / 4317 / 6365	5	JogSpdFast	SpeedUnit	100	0	4294967295	Fast jog speed	uint32		
2269 / 4317 / 6365	6	JogSpdSlow	SpeedUnit	10	0	4294967295	Slow jog speed	uint32		
2270 / 4318 / 6366		MPRO_PARA_Settings					Axis 1 / 2 / 3: Device commissioning settings (test signal / monitoring)		0	1
2270 / 4318 / 6366	0	Frequency	Hz	1	0.0000019	8000	Device commissioning: Test signal frequency	float32		
2270 / 4318 / 6366	1	SignalType		SINE (1)	LINEAR (0)	PRBS (3)	Device commissioning: Test signal type	uint32		
2270 / 4318 / 6366	2	Time	ms	100	0	2147483647	Timer	int32		
2270 / 4318 / 6366	3	Watchdog	ms	-1	-1	2147483647	Watchdog	int32		

Table 18.15: Parameter list – Manual mode axis

## 20.11 Status axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		State							0	0
2248 / 4296 / 6344	0	MPRO_DRVCOM_State		Start (0)	Start (0)	Fault (8)	Axis 1 / 2 / 3: DriveCom state	uint32	0	5
2249 / 4297 / 6345	0	MPRO_DRVCOM_StateText					Axis 1 / 2 / 3: DriveCom state (text)	string	0	5
2250 / 4298 / 6346	0	MPRO_DRVCOM_Statusword		0	0	4294967295	Axis 1 / 2 / 3: DriveCom status word	uint32	0	5
2251 / 4299 / 6347	0	MPRO_DRVCOM_Controlword		0	0	4294967295	Axis 1 / 2 / 3: DriveCom control word	uint32	0	5
2252 / 4300 / 6348	0	MPRO_DRVCOM_FaultReset		False (0)	False (0)	True (1)	Axis 1 / 2 / 3: DriveCom fault reset	bool32	0	2

Table 18.16: Parameter list – Status axis

## 20.12 Actual values axis

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Actual values					Selection of axis states and actual values		0	0
2955 / 5003 / 7051	0	CON_PCON_ActPosition	incr	0	-2147483648	2147483647	Axis 1 / 2 / 3: Actual position	int32	0	5
2967 / 5015 / 7063		CON_FM_ActValues					Axis 1 / 2 / 3: Control of actual values		0	5
2967 / 5015 / 7063	0	isq	A	0	-3.4E+38	3.4E+38	Actual q-current value	float32		
2967 / 5015 / 7063	1	isd	A	0	-3.4E+38	3.4E+38	Actual d-current value	float32		
2967 / 5015 / 7063	2	iphasor	A	0	-3.4E+38	3.4E+38	Actual motor current value (amplitude/filtered)	float32		
2967 / 5015 / 7063	3	usq	V	0	-3.4E+38	3.4E+38	Actual q-voltage value	float32		
2967 / 5015 / 7063	4	usd	V	0	-3.4E+38	3.4E+38	Actual d-voltage value	float32		
2967 / 5015 / 7063	5	vmot	V	0	-3.4E+38	3.4E+38	Motor voltage	float32		
2967 / 5015 / 7063	6	pmot	kW	0	-3.4E+38	3.4E+38	Effective power	float32		
2967 / 5015 / 7063	7	smot	kVA	0	-3.4E+38	3.4E+38	Apparent power	float32		
3016 / 5064 / 7112		CON_SCON_ActValues					Axis 1 / 2 / 3: Actual values (in system units)		0	5
3016 / 5064 / 7112	0	RefSpeed	rpm	0	-3.4E+38	3.4E+38	Rated speed	float32		
3016 / 5064 / 7112	1	ActSpeed	rpm	0	-3.4E+38	3.4E+38	Actual speed	float32		
3016 / 5064 / 7112	2	RefTorque	Nm	0	-3.4E+38	3.4E+38		float32		
3016 / 5064 / 7112	3	ActTorque	Nm	0	-3.4E+38	3.4E+38	Actual torque	float32		
3049 / 5097 / 7145		MON_ActValues					Axis 1 / 2 / 3: Actual values		0	5
3049 / 5097 / 7145	0	I2t_Motor	%	0	-3.4E+38	3.4E+38	I2T integrator for motor	float32		
3049 / 5097 / 7145	1	I2t_Inverter	%	0	-3.4E+38	3.4E+38	I2T integrator for device	float32		
3049 / 5097 / 7145	2	I2t_Fast	%	0	-3.4E+38	3.4E+38	I2T integrator high overload	float32		
3049 / 5097 / 7145	3	I2tMax	A2s	0	-3.4E+38	3.4E+38	Max. I2T integral	float32		
3049 / 5097 / 7145	4	IMaxDC	A	0	-3.4E+38	3.4E+38	Max. DC current	float32		
3049 / 5097 / 7145	5	IMaxDC_sum	%	0	-3.4E+38	3.4E+38	Integral DC protection	float32		
3049 / 5097 / 7145	6	InRot	A	0	-3.4E+38	3.4E+38	Rated current at current switching frequency / voltage	float32		
3049 / 5097 / 7145	7	iphasor	A	0	-3.4E+38	3.4E+38	Actual motor current value (amplitude, filtered)	float32		
3049 / 5097 / 7145	8	UsrPosDiffHistory	PosUnit	0	0	4294967295	Position tracking error monitoring	uint32		
3049 / 5097 / 7145	9	Temp_Motor	degC	0	-3.4E+38	3.4E+38	Motor temperature	float32		
3049 / 5097 / 7145	10	Temp_Motor_R	Ohm	0	-3.4E+38	3.4E+38	Temperature sensor resistance (power stage)	float32		
3049 / 5097 / 7145	11	SwitchFreqSelState		NONE (0)	NONE (0)	OCD (5)	Switching frequency switchover state	uint16		

Table 18.17: Parameter list – Actual values axis



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
3049 / 5097 / 7145	12	SwitchFreqSelAct		2kHz (0)	2kHz (0)	16kHz (4)	Switching frequency switchover: Actual switching frequency value	uint16		
3049 / 5097 / 7145	13	Irms	A	0	-3.4E+38	3.4E+38	Effective motor current value	float32		
3049 / 5097 / 7145	14	Tth_Motor	%	0	-3.4E+38	3.4E+38	Actual motor protection value with thermal model	float32		
24676 / 26724 / 28772	0	PositionActualValue	PosUnit	0	-	2147483647	Axis 1 / 2 / 3: DS402 Actual position value	int32	0	5
24684 / 26732 / 28780	0	VelocityActualValue	SpeedUnit	0	-	2147483647	Axis 1 / 2 / 3: DS402 Actual speed value	int32	0	5
3019 / 5067 / 7115	0	MOT_Km_adapt	Nm/A	0	-3.4E+38	3.4E+38	Axis 1 / 2 / 3: Actual motor constant value (peak)	float32	0	5
3017 / 5065 / 7113		CON_SystemPara					Axis 1 / 2 / 3: Actual control values		0	5
3017 / 5065 / 7113	0	JSUM	kgm2	0	-3.4E+38	3.4E+38	System moment of inertia	float32		
3017 / 5065 / 7113	1	TE_I	ms	0	-3.4E+38	3.4E+38	Current controller replacement time constant	float32		
3017 / 5065 / 7113	2	T_Filter	ms	0	-3.4E+38	3.4E+38	Speed filter / observer replacement time constant	float32		
3017 / 5065 / 7113	3	TE_S	ms	0	-3.4E+38	3.4E+38	Speed control replacement time constant	float32		
3017 / 5065 / 7113	4	Tdelay_S	ms	0	-3.4E+38	3.4E+38	Internal delay of speed encoder	float32		
3017 / 5065 / 7113	5	Tdelay_P	ms	0	-3.4E+38	3.4E+38	Internal delay of position encoder	float32		
2303 / 4351 / 6399		MPRO_FG_UserValues					Axis 1 / 2 / 3: Factor group – Actual values (user units)		0	5
2303 / 4351 / 6399	0	SpeedAct	SpeedUnit	0	-3.4E+38	3.4E+38	Actual speed value in user units	float32		
2303 / 4351 / 6399	1	SpeedRef	SpeedUnit	0	-3.4E+38	3.4E+38	Setpoint speed in user units	float32		
2303 / 4351 / 6399	2	SpeedCmd	SpeedUnit	0	-3.4E+38	3.4E+38	Speed command in user units	float32		
2303 / 4351 / 6399	3	SpeedDiff	SpeedUnit	0	-3.4E+38	3.4E+38	Speed difference in user units	float32		
2303 / 4351 / 6399	4	PosDiff	PosUnit	0	-	2147483647	Position tracking error in user units	int32		
2303 / 4351 / 6399	5	PosAct	PosUnit	0	-	2147483647	Actual position value in user units	int32		
2303 / 4351 / 6399	6	PosRef	PosUnit	0	-	2147483647	Setpoint position value in user units	int32		
2259 / 4307 / 6355		MPRO_402_RampTime					Axis 1 / 2 / 3: Times for configured ramps		0	5
2259 / 4307 / 6355	0	MPRO_402_RampTime	s	0	-3.4E+38	3.4E+38	Time for profile acceleration	float32		
2259 / 4307 / 6355	1	MPRO_402_RampTime	s	0	-3.4E+38	3.4E+38	Time for profile deceleration	float32		
2259 / 4307 / 6355	2	MPRO_402_RampTime	s	0	-3.4E+38	3.4E+38	Quick stop time	float32		
SUBJECT AREA		Cockpit							0	0
2948 / 4996 / 7044	0	ActSpeed	1/min	0	-3.4E+38	3.4E+38	Axis 1 / 2 / 3: Actual speed value	float32	0	5
3049 / 5097 / 7145		MON_ActValues					Axis 1 / 2 / 3: Actual values		0	5
3049 / 5097 / 7145	0	I2t_Motor	%	0	-3.4E+38	3.4E+38	I2T integrator for motor	float32		

Table 18.17: Parameter list – Actual values axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
3049 / 5097 / 7145	1	I2t_Inverter	%	0	-3.4E+38	3.4E+38	I2T integrator for device	float32		
3049 / 5097 / 7145	2	I2t_Fast	%	0	-3.4E+38	3.4E+38	I2T integrator high overload	float32		
3049 / 5097 / 7145	3	I2tMax	A2s	0	-3.4E+38	3.4E+38	Max. I2T integral	float32		
3049 / 5097 / 7145	4	IMaxDC	A	0	-3.4E+38	3.4E+38	Max. DC current	float32		
3049 / 5097 / 7145	5	IMaxDC_sum	%	0	-3.4E+38	3.4E+38	Integral DC protection	float32		
3049 / 5097 / 7145	6	InRot	A	0	-3.4E+38	3.4E+38	Rated current at current switching frequency / voltage	float32		
3049 / 5097 / 7145	7	iphasor	A	0	-3.4E+38	3.4E+38	Actual motor current value (amplitude, filtered)	float32		
3049 / 5097 / 7145	8	UsrPosDiffHistory	PosUnit	0	0	4294967295	Position tracking error monitoring	uint32		
3049 / 5097 / 7145	9	Temp_Motor	degC	0	-3.4E+38	3.4E+38	Motor temperature	float32		
3049 / 5097 / 7145	10	Temp_Motor_R	Ohm	0	-3.4E+38	3.4E+38	Temperature sensor resistance (power stage)	float32		
3049 / 5097 / 7145	11	SwitchFreqSelState		NONE (0)	NONE (0)	OCD (5)	Switching frequency switchover state	uint16		
3049 / 5097 / 7145	12	SwitchFreqSelAct		2kHz (0)	2kHz (0)	16kHz (4)	Switching frequency switchover: Actual switching frequency value	uint16		
3049 / 5097 / 7145	13	Irms	A	0	-3.4E+38	3.4E+38	Effective motor current value	float32		
3049 / 5097 / 7145	14	Tth_Motor	%	0	-3.4E+38	3.4E+38	Actual motor protection value with thermal model	float32		
2303 / 4351 / 6399		MPRO_FG_UserValues					Axis 1 / 2 / 3: Factor group – Actual values (user units)		0	5
2303 / 4351 / 6399	0	SpeedAct	SpeedUnit	0	-3.4E+38	3.4E+38	Actual speed value in user units	float32		
2303 / 4351 / 6399	1	SpeedRef	SpeedUnit	0	-3.4E+38	3.4E+38	Setpoint speed in user units	float32		
2303 / 4351 / 6399	2	SpeedCmd	SpeedUnit	0	-3.4E+38	3.4E+38	Speed command in user units	float32		
2303 / 4351 / 6399	3	SpeedDiff	SpeedUnit	0	-3.4E+38	3.4E+38	Speed difference in user units	float32		
2303 / 4351 / 6399	4	PosDiff	PosUnit	0	-	2147483647	Position tracking error in user units	int32		
2303 / 4351 / 6399	5	PosAct	PosUnit	0	-	2147483648	Actual position value in user units	int32		
2303 / 4351 / 6399	6	PosRef	PosUnit	0	-	2147483648	Setpoint position value in user units	int32		
3016 / 5064 / 7112		CON_SCON_ActValues					Axis 1 / 2 / 3: Actual values (in system units)		0	5
3016 / 5064 / 7112	0	RefSpeed	rpm	0	-3.4E+38	3.4E+38	Rated speed	float32		
3016 / 5064 / 7112	1	ActSpeed	rpm	0	-3.4E+38	3.4E+38	Actual speed	float32		
3016 / 5064 / 7112	2	RefTorque	Nm	0	-3.4E+38	3.4E+38	Actual torque	float32		
3016 / 5064 / 7112	3	ActTorque	Nm	0	-3.4E+38	3.4E+38	Actual torque	float32		
2967 / 5015 / 7063		CON_FM_ActValues					Axis 1 / 2 / 3: Control of actual values		0	5
2967 / 5015 / 7063	0	isq	A	0	-3.4E+38	3.4E+38	Actual q-current value	float32		
2967 / 5015 / 7063	1	isd	A	0	-3.4E+38	3.4E+38	Actual d-current value	float32		

Table 18.17: Parameter list – Actual values axis (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
2967 / 5015 / 7063	2	iphasor	A	0	-3.4E+38	3.4E+38	Actual motor current value (amplitude/filtered)	float32		
2967 / 5015 / 7063	3	usq	V	0	-3.4E+38	3.4E+38	Actual q-voltage value	float32		
2967 / 5015 / 7063	4	usd	V	0	-3.4E+38	3.4E+38	Actual d-voltage value	float32		
2967 / 5015 / 7063	5	vmot	V	0	-3.4E+38	3.4E+38	Motor voltage	float32		
2967 / 5015 / 7063	6	pmot	kW	0	-3.4E+38	3.4E+38	Effective power	float32		
2967 / 5015 / 7063	7	smot	kVA	0	-3.4E+38	3.4E+38	Apparent power	float32		
1000 / 3048 / 5096		MON_ActSystemValues					Monitoring: Actual values		0	5
1000 / 3048 / 5096	0	InteriorTemp	degC	0	-3.4E+38	3.4E+38	Device interior temperature	float32		
1000 / 3048 / 5096	1	VDC	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
1000 / 3048 / 5096	2	VDC_SYMM		0	-3.4E+38	3.4E+38	DC link symmetry value (0.5 = ideal)	float32		
1000 / 3048 / 5096	3	InverterTemp1	degC	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
1000 / 3048 / 5096	4	InverterTemp2	degC	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
1000 / 3048 / 5096	5	InverterTemp3	degC	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
SUBJECT AREA		Digital inputs					Status of the digital inputs		0	0
2328 / 4376 / 6424		MPRO_INPUT_State					Axis 1 / 2 / 3: State of digital inputs		0	5
2328 / 4376 / 6424	0	State		0	0	4294967295	Status of digital inputs	uint32		
2328 / 4376 / 6424	1	StateFil		0	0	4294967295	Status of digital inputs (filtered)	uint32		

Table 18.17: Parameter list – Actual values axis (continue)

## 20.13 Axis monitoring

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	Value range	EtherCAT object ID	Index
3049 / 5097 / 7145		MON_ActValues					Axis 1/2/3: Actual values		0	5		2BE9	
3049 / 5097 / 7145	0	I2t_Motor	%	0	-3.4E+38	3.4E+38	I2T integrator for motor	float32			-3.4E+38 - 3.4E+38	2BE9	0001
3049 / 5097 / 7145	1	I2t_Inverter	%	0	-3.4E+38	3.4E+38	I2T integrator for device	float32			-3.4E+38 - 3.4E+38	2BE9	0002
3049 / 5097 / 7145	2	I2t_Fast	%	0	-3.4E+38	3.4E+38	I2T integrator high overload	float32			-3.4E+38 - 3.4E+38	2BE9	0003
3049 / 5097 / 7145	3	I2tMax	A2s	0	-3.4E+38	3.4E+38	Max. I2T integral	float32			-3.4E+38 - 3.4E+38	2BE9	0004
3049 / 5097 / 7145	4	IMaxDC	A	0	-3.4E+38	3.4E+38	Max. DC current	float32			-3.4E+38 - 3.4E+38	2BE9	0005
3049 / 5097 / 7145	5	IMaxDC_sum	%	0	-3.4E+38	3.4E+38	Integral DC protection	float32			-3.4E+38 - 3.4E+38	2BE9	0006
3049 / 5097 / 7145	6	InRot	A	0	-3.4E+38	3.4E+38	Rated current at current switching frequency / voltage	float32			-3.4E+38 - 3.4E+38	2BE9	0007
3049 / 5097 / 7145	7	iphasor	A	0	-3.4E+38	3.4E+38	Actual motor current value (amplitude, filtered)	float32			-3.4E+38 - 3.4E+38	2BE9	0008
3049 / 5097 / 7145	8	UsrPosDiffHistory	PosUnit	0	0	4294967295	Position tracking error monitoring	uint32			0 - 4294967295	2BE9	0009
3049 / 5097 / 7145	9	Temp_Motor	degC	0	-3.4E+38	3.4E+38	Motor temperature	float32			-3.4E+38 - 3.4E+38	2BE9	000A
3049 / 5097 / 7145	10	Temp_Motor_R	Ohm	0	-3.4E+38	3.4E+38	Temperature sensor resistance (power stage)	float32			-3.4E+38 - 3.4E+38	2BE9	000B
3049 / 5097 / 7145	11	SwitchFreqSelState		NONE (0)	NONE (0)	OCDC (5)	Switching frequency switchover state	uint16				2BE9	000C
		NONE (0)					Current switching frequency not changed						
		MANUAL (1)					Current switching frequency changed manually						
		I2T (2)					Current switching frequency changed by I2t						
		FASTI2T (3)					Current switching frequency changed by fast IxT						
		OCSW (4)					Current switching frequency changed by software overcurrent						
		OCDC (5)					Current switching frequency changed by DC overcurrent						

Table 18.18: Parameter list – Axis monitoring

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	Value range	EtherCAT object ID	Index
3049 / 5097 / 7145	12	SwitchFreqSelAct		2kHz (0)	2kHz (0)	16kHz (4)	Switching frequency switchover: Actual switching frequency value	uint16				2BE9	000D
		2kHz (0)											
		4kHz (1)											
		8kHz (2)											
		12kHz (3)											
		16kHz (4)											
3049 / 5097 / 7145	13	Irms	A	0	-3.4E+38	3.4E+38	Effective motor current value	float32			-3.4E+38 - 3.4E+38	2BE9	000E
3049 / 5097 / 7145	14	Tth_Motor	%	0	-3.4E+38	3.4E+38	Actual motor protection value with thermal model	float32			-3.4E+38 - 3.4E+38	2BE9	000F
3074 / 5122 / 7170		MON_Load_Axis					Axis 1: Motor protection settings		0	2		2C02	
3074 / 5122 / 7170	0	ThermalLoadMotor	%	0	0	65535	Thermal load of the motor. motor current to i2t motor limit current over on workload cycle	uint16			0 - 65535	2C02	0001
3074 / 5122 / 7170	1	ThermalLoadDevice	%	0	0	65535	Thermal load of the power stage. motor current to i2t device limit current over on workload cycle	uint16			0 - 65535	2C02	0002
3074 / 5122 / 7170	2	I2tUsageMotor	%	0	-3.4E+38	3.4E+38	Maximum I2t of the motor. maximum motor i2t value over on workload cycle	float32			-3.4E+38 - 3.4E+38	2C02	0003
3074 / 5122 / 7170	3	I2tUsageDevice	%	0	-3.4E+38	3.4E+38	Maximum I2t of the power stage. maximum device i2t value over on workload cycle	float32			-3.4E+38 - 3.4E+38	2C02	0004
3074 / 5122 / 7170	4	PeakLoadMotor	%	0	0	65535	Max. motor current in relation to MOT_Cmax. maximum motor current to MOT_CMax current over on workload cycle	uint16			0 - 65535	2C02	0005
3074 / 5122 / 7170	5	PeakLoadDevice	%	0	0	65535	Thermal load of the power stage. maximum motor current to i2t device current over on workload cycle	uint16			0 - 65535	2C02	0006
3074 / 5122 / 7170	6	EffectiveTorque	Nm	0	-3.4E+38	3.4E+38	Effective torque. rms torque over one workload cycle	float32			-3.4E+38 - 3.4E+38	2C02	0007
3074 / 5122 / 7170	7	AverageSpeed	rpm	0	-3.4E+38	3.4E+38	Average speed. Average Speed over one workload cycle	float32			-3.4E+38 - 3.4E+38	2C02	0008
3074 / 5122 / 7170	8	MaxMotorCurrent	A	0	-3.4E+38	3.4E+38	Max. motor current. Maximum Motor current over one cycle	float32			-3.4E+38 - 3.4E+38	2C02	0009
3074 / 5122 / 7170	9	MaxMotorTorque	Nm	0	-3.4E+38	3.4E+38	Max. motor torque. Maximum Motor torque over one cycle	float32			-3.4E+38 - 3.4E+38	2C02	000A
3074 / 5122 / 7170	10	MaxMotorSpeed	rpm	0	-3.4E+38	3.4E+38	Max. speed. Maximum Motor speed over one cycle	float32			-3.4E+38 - 3.4E+38	2C02	000B

Table 18.18: Parameter list – Axis monitoring (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	Value range	EtherCAT object ID	Index
3074 / 5122 / 7170	11	NoLoadSpeed	rpm	0	-3.4E+38	3.4E+38	Idle speed (from rating plate).	float32			-3.4E+38 - 3.4E+38	2C02	000C
3074 / 5122 / 7170	12	StandStillTorque	Nm	0	-3.4E+38	3.4E+38	maximum standstill torque (from rating plate)	float32			-3.4E+38 - 3.4E+38	2C02	000D
3074 / 5122 / 7170	13	DebugInput	A	0	-3.4E+38	3.4E+38	Test value used by CurrentFormSelect as maximum	float32			-3.4E+38 - 3.4E+38	2C02	000E
3074 / 5122 / 7170	14	CurrentFormSelect		NONE (0)	NONE (0)	VIRTEL (3)	debug, selects the form of current speed torque for test signals	uint16				2C02	000F
		NONE (0)					Normal operation with original signals						
		SAME (1)					always input * 1						
		REECK (2)					half cycle off, input * 2						
		VIRTEL (3)					3/4 off, 1/4 input * 4 on						

Table 18.18: Parameter list – Axis monitoring (continue)

## 20.14 System device

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		System					Internal settings		0	0
14	0	DV_AxisCount		0	0	3	Number of power stages (per axis module)	uint16	0	5
SUBJECT AREA		Data set							0	0
28	0	PARA_SetCmdAxis		0	-1	2	Axis index used for axis commands on parameter PARA_SetCmd	int32	0	1
SUBJECT AREA		Debug							0	0
23	0	LU_Debug_Message					Debug message	string	1	5
24	0	LU_Debug_InfoSelect		0	0	4294967295	Debug information	uint32	0	2
303		LU_DebugVar					Debug variables (do not use!)		0	2
303	0	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	1	U32		0	0	4294967295	integer debug var.	uint32		
303	2	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	3	U32		0	0	4294967295	integer debug var.	uint32		
303	4	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	5	U32		0	0	4294967295	integer debug var.	uint32		
303	6	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	7	U32		0	0	4294967295	integer debug var.	uint32		
303	8	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	9	U32		0	0	4294967295	integer debug var.	uint32		
303	10	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	11	U32		0	0	4294967295	integer debug var.	uint32		
303	12	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	13	U32		0	0	4294967295	integer debug var.	uint32		
303	14	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	15	U32		0	0	4294967295	integer debug var.	uint32		
303	16	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	17	U32		0	0	4294967295	integer debug var.	uint32		
303	18	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	19	U32		0	0	4294967295	integer debug var.	uint32		
303	20	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	21	U32		0	0	4294967295	integer debug var.	uint32		

Table 18.19: Parameter list – System device

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
303	22	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	23	U32		0	0	4294967295	integer debug var.	uint32		
303	24	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	25	U32		0	0	4294967295	integer debug var.	uint32		
303	26	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	27	U32		0	0	4294967295	integer debug var.	uint32		
303	28	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	29	U32		0	0	4294967295	integer debug var.	uint32		
303	30	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	31	U32		0	0	4294967295	integer debug var.	uint32		
303	32	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	33	U32		0	0	4294967295	integer debug var.	uint32		
303	34	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	35	U32		0	0	4294967295	integer debug var.	uint32		
303	36	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	37	U32		0	0	4294967295	integer debug var.	uint32		
303	38	F32		0	-3.4E+38	3.4E+38	float debug var.	float32		
303	39	U32		0	0	4294967295	integer debug var.	uint32		
1001		CC_Stats					Cross communication statistics		0	5
1001	0	Address		0	0	255	Device address	uint8		
1001	1	TaskTime_CIRQ		0	-3.4E+38	3.4E+38	Task time IRQ execution	float32		
1001	2	BytesIn		0	0	65535	Received Bytes	uint16		
1001	3	BytesOut		0	0	65535	Bytes sent	uint16		
1001	4	TelegramsProcessed		0	0	65535	Number of processed telegrams	uint16		
1001	5	MagicNumberErrors		0	0	65535	Number of received telegrams with a wrong magic number.	uint16		
1001	6	TelegramCRCErrors		0	0	65535	Number of received telegrams with failed crc.	uint16		
1001	7	MultiMasterErrors		0	0	65535	Number of possible multi master errors.	uint16		
1001	8	FramingErrors		0	0	65535	Low level framing errors.	uint16		
1001	9	BytesOutOfSync		0	0	65535	Number of bytes which where received during telegram pauses	uint16		
1001	10	Timeouts		0	0	65535	Number of slave / master timeouts	uint16		
1001	11	HeaderWrong		0	0	65535	Number of wrong headers	uint16		
1001	12	TailWrong		0	0	65535	Number of wrong tails	uint16		
1001	13	MasterAliveTelegrams		0	0	65535	Received Master telegrams	uint16		

Table 18.19: Parameter list – System device (continue)



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
1001	14	Slave0AliveTelegrams		0	0	65535	Received Telegrams received from slave 0 (VSE)	uint16		
1001	15	Slave1AliveTelegrams		0	0	65535	Received Telegrams received from slave 1 (master)	uint16		
1001	16	Slave2AliveTelegrams		0	0	65535	Received Telegrams received from slave 2	uint16		
1001	17	Slave3AliveTelegrams		0	0	65535	Received Telegrams received from slave 3	uint16		
1001	18	Slave4AliveTelegrams		0	0	65535	Received Telegrams received from slave 4	uint16		
1001	19	Slave5AliveTelegrams		0	0	65535	Received Telegrams received from slave 5	uint16		
1001	20	Slave6AliveTelegrams		0	0	65535	Received Telegrams received from slave 6	uint16		
1001	21	Slave7AliveTelegrams		0	0	65535	Received Telegrams received from slave 7	uint16		
1001	22	Slave8AliveTelegrams		0	0	65535	Received Telegrams received from slave 8	uint16		
1001	23	Slave9AliveTelegrams		0	0	65535	Received Telegrams received from slave 9	uint16		
1001	24	Slave10AliveTelegrams		0	0	65535	Received Telegrams received from slave 10	uint16		
1001	25	NoOfScopeTelegrams		0	0	65535	Number of VSE telegrams (scope variable description)	uint16		
1001	26	ChannelNo		0	0	65535	Number of VSE scope channels	uint16		
1001	27	VsuSignal0		0	0	65535	VSE scope signal 0	uint16		
1001	28	VsuSignal1		0	0	65535	VSE scope signal 1	uint16		
1001	29	VsuSignal2		0	0	65535	VSE scope signal 2	uint16		
1001	30	VsuSignal3		0	0	65535	VSE scope signal 3	uint16		
1001	31	VsuSignal4		0	0	65535	VSE scope signal 4	uint16		
1001	32	VsuSignal5		0	0	65535	VSE scope signal 5	uint16		
1001	33	QueueOverrun		0	0	65535	Telegram rejected, queue overrun	uint16		
1001	34	TypeOfScopeVariableNotValid		0	0	65535	Type of this Scope Value not supported	uint16		
1001	35	TryToConfigVsuWithNoConnection		0	0	65535	Access to VsU via Q-Comm with no connection	uint16		
1001	36	ScopeConfigOnWayToVsu		False (0)	False (0)	True (1)	Transmission from Axis to VsU in progress	bool32		
1001	37	LastTeleOnWayToAxis		False (0)	False (0)	True (1)	Last telegram VsU to axis with old scope datas in progress	bool32		
1001	38	DsStrtDelayMainLoopTicks		0	0	65535	Delay time in main loop ticks for VsU Scope initialisation	uint16		
1001	39	DsWaitConnectMainLoopTicks		0	0	65535	Main loop calls until q com connection is established	uint16		
1001	40	DefautSwitch1		0	0	65535	Failure diagnostics	uint16		
1001	41	DefautSwitch2		0	0	65535	Failure diagnostics	uint16		
1001	42	norms_eseCurr		0	-3.4E+38	3.4E+38	Multiplier of current scope values from VsU	float32		
1001	43	norms_eseVolt		0	-3.4E+38	3.4E+38	Multipler of voltage scope values from VsU	float32		
1001	44	norms_esePow		0	-3.4E+38	3.4E+38	Multiplier of power scope values from VsU	float32		
1472		StkRtlInfo					State and runtime information of EtherCAT - stack		2	5
1472	0	StkRtlInfo		0	-3.4E+38	3.4E+38	EOE states	float32		

Table 18.19: Parameter list – System device (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
1472	1	StkRtInfo		0	-3.4E+38	3.4E+38	Mailbox states	float32		
1472	2	StkRtInfo		0	-3.4E+38	3.4E+38	Main loop	float32		
1472	3	StkRtInfo		0	-3.4E+38	3.4E+38	Mailbox copy	float32		
1472	4	StkRtInfo		0	-3.4E+38	3.4E+38	EoE fragment errors	float32		
1472	5	StkRtInfo		0	-3.4E+38	3.4E+38	EoE size errors	float32		
1471		SyncRtInfo					Runtime measurement of internal communication related functions		2	5
1471	0	RtSm2		0	-3.4E+38	3.4E+38	SM2 output copy in SYNC0	float32		
1471	1	RtSm3		0	-3.4E+38	3.4E+38	SM3 input copy in SYNC0	float32		
1471	2	RtOutMap		0	-3.4E+38	3.4E+38	Output mapping	float32		
1471	3	RtInMap		0	-3.4E+38	3.4E+38	Input mapping	float32		
1471	4	RtDIRQ		0	-3.4E+38	3.4E+38	DIRQ	float32		
1471	5	RtDC0		0	-3.4E+38	3.4E+38	DC0	float32		
1471	6	RtTimer		0	-3.4E+38	3.4E+38	Stopwatch	float32		
1471	7	RtOutValid		0	-3.4E+38	3.4E+38	Output valid time	float32		
1471	8	RtInLatch		0	-3.4E+38	3.4E+38	Input latch time	float32		
1471	9	RtNDK		0	-3.4E+38	3.4E+38	ndk response time	float32		
1471	10	RtTotal		0	-3.4E+38	3.4E+38	Control task total	float32		
1471	11	RtSm4		0	-3.4E+38	3.4E+38	SM4 output copy in SYNC01	float32		
1471	12	RtSm2		0	-3.4E+38	3.4E+38	SM2 output copy in SYNC01	float32		
1471	13	RtAfterCon		0	-3.4E+38	3.4E+38	After Control (less critical)	float32		
1471	14	RtControl		0	-3.4E+38	3.4E+38	Control	float32		
1471	15	RtCommon		0	-3.4E+38	3.4E+38	Common control	float32		
1471	16	Debug0Ax0		0	-3.4E+38	3.4E+38	Debug0Ax0	float32		
1471	17	Debug0Ax1		0	-3.4E+38	3.4E+38	Debug0Ax1	float32		
1471	18	Debug0Ax2		0	-3.4E+38	3.4E+38	Debug0Ax2	float32		
1471	19	Debug1Ax0		0	-3.4E+38	3.4E+38	Debug1Ax0	float32		
1471	20	Debug1Ax1		0	-3.4E+38	3.4E+38	Debug1Ax1	float32		
1471	21	Debug1Ax2		0	-3.4E+38	3.4E+38	Debug1Ax2	float32		
1471	22	Debug2Ax0		0	-3.4E+38	3.4E+38	Debug2Ax0	float32		
1471	23	Debug2Ax1		0	-3.4E+38	3.4E+38	Debug2Ax1	float32		
1471	24	Debug2Ax2		0	-3.4E+38	3.4E+38	Debug2Ax2	float32		
1471	25	RtWrong		0	-3.4E+38	3.4E+38	Wrong output data counter	float32		
1471	26	RtSyncIsr		0	-3.4E+38	3.4E+38	Runtime Sync ISR	float32		

Table 18.19: Parameter list – System device (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
1471	27	RtSemaphore		0	-3.4E+38	3.4E+38	Spoiled time control semaphore	float32		
1471	28	RtMotionTask		0	-3.4E+38	3.4E+38	Runtime 1ms task	float32		
1471	29	RtSlowTask		0	-3.4E+38	3.4E+38	Runtime 10ms task	float32		
1471	30	RtMainLoop		0	-3.4E+38	3.4E+38	Runtime main loop	float32		
530		LU_WatchPtr					Pointer to watch memory value		2	2
530	0	LU_WatchPtr		0	0	4294967295		uint32		
530	1	LU_WatchPtr		0	0	4294967295		uint32		
530	2	LU_WatchPtr		0	0	4294967295		uint32		
530	3	LU_WatchPtr		0	0	4294967295		uint32		
530	4	LU_WatchPtr		0	0	4294967295		uint32		
530	5	LU_WatchPtr		0	0	4294967295		uint32		
530	6	LU_WatchPtr		0	0	4294967295		uint32		
530	7	LU_WatchPtr		0	0	4294967295		uint32		
530	8	LU_WatchPtr		0	0	4294967295		uint32		
530	9	LU_WatchPtr		0	0	4294967295		uint32		
530	10	LU_WatchPtr		0	0	4294967295		uint32		
530	11	LU_WatchPtr		0	0	4294967295		uint32		
530	12	LU_WatchPtr		0	0	4294967295		uint32		
530	13	LU_WatchPtr		0	0	4294967295		uint32		
530	14	LU_WatchPtr		0	0	4294967295		uint32		
530	15	LU_WatchPtr		0	0	4294967295		uint32		
530	16	LU_WatchPtr		0	0	4294967295		uint32		
531		LU_WatchVal					Memory values addressed by LU_WatchPtr		2	3
531	0	F32		0	-3.4E+38	3.4E+38		float32		
531	1	U32		0	0	4294967295		uint32		
531	2	F32		0	-3.4E+38	3.4E+38		float32		
531	3	U32		0	0	4294967295		uint32		
531	4	F32		0	-3.4E+38	3.4E+38		float32		
531	5	U32		0	0	4294967295		uint32		
531	6	F32		0	-3.4E+38	3.4E+38		float32		
531	7	U32		0	0	4294967295		uint32		
531	8	F32		0	-3.4E+38	3.4E+38		float32		
531	9	U32		0	0	4294967295		uint32		

Table 18.19: Parameter list – System device (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
531	10	F32		0	-3.4E+38	3.4E+38		float32		
531	11	U32		0	0	4294967295		uint32		
531	12	F32		0	-3.4E+38	3.4E+38		float32		
531	13	U32		0	0	4294967295		uint32		
531	14	F32		0	-3.4E+38	3.4E+38		float32		
531	15	U32		0	0	4294967295		uint32		
531	16	F32		0	-3.4E+38	3.4E+38		float32		
531	17	U32		0	0	4294967295		uint32		
531	18	F32		0	-3.4E+38	3.4E+38		float32		
531	19	U32		0	0	4294967295		uint32		
531	20	F32		0	-3.4E+38	3.4E+38		float32		
531	21	U32		0	0	4294967295		uint32		
531	22	F32		0	-3.4E+38	3.4E+38		float32		
531	23	U32		0	0	4294967295		uint32		
531	24	F32		0	-3.4E+38	3.4E+38		float32		
531	25	U32		0	0	4294967295		uint32		
531	26	F32		0	-3.4E+38	3.4E+38		float32		
531	27	U32		0	0	4294967295		uint32		
531	28	F32		0	-3.4E+38	3.4E+38		float32		
531	29	U32		0	0	4294967295		uint32		
531	30	F32		0	-3.4E+38	3.4E+38		float32		
531	31	U32		0	0	4294967295		uint32		
301	0	LU_DSP_Timing_Total	%	0	-3.4E+38	3.4E+38	Last DSP	float32	1	5
302	0	LU_ARM_Timing_Total	%	0	-3.4E+38	3.4E+38	Last ARM	float32	1	5
27	0	LU_Test_Select		0	0	4294967295	Spec. test bits	uint32	2	2
305	0	LU_RestartDelay	ms	5000	-3.4E+38	5000	Delay for reset / restart	float32	0	2

Table 18.19: Parameter list – System device (continue)

## 20.15 Device encoder

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Encoder							0	0
SUBJECT AREA		Basic settings							0	0
815		ENC_EC_Action					Field bus encoder backup values control word		0	2
815	0	BackupLatch		OFF (0)	OFF (0)	RESET_EC3 (6)		uint8		
815	1	MtBase		OFF (0)	OFF (0)	ZERO_EC3 (9)	Set overflow point based on current position	uint8		
SUBJECT AREA		EtherCAT channel 1							0	0
800		ENC_EC1_Settings					EtherCAT encoder 1: Settings		0	2
800	0	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		
800	1	Multiturn		12	0	32	Number of multiturn bits	uint16		
800	2	Singleturn		16	0	32	Number of singleturn bits	uint16		
800	3	Delay	ms	0.125	-3.4E+38	3.4E+38	Compensation of the field bus delay	float32		
800	4	Numerator		1	-2147483648	2147483647	Encoder gearing numerator	int32		
800	5	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		
800	6	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
800	7	OffsetST	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
800	8	OffsetMT	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
800	9	MTBase		2147483648	0	4294967295	Multiturn zero point shift	uint32		
800	10	StatusCheck		ON (1)	OFF (0)	ON (1)	Status bit check on/off	uint8		
800	11	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
800	12	EncVal_Enable		224	0	65535	Encoder validation	uint16		
800	13	EncVal_PosDiffLim	POS	100	0	4294967295	Max. encoder validation position	uint32		
800	14	EncoderType		NONE (0)	NONE (0)	ENDAT (2)	Type of remote encoder	uint8		
800	15	TemperatureLimit	degC	0	0	3.4E+38	Encoder temperature error threshold (0 = no function)	float32		
800	16	TemperatureWarning	degC	0	0	3.4E+38	Encoder temperature warning threshold (0 = no function)	float32		
800	17	ErrorTol		0	0	255	Tolerate small number of errors in digital protocol	uint8		
801		ENC_EC1_ActVal					EtherCAT encoder 1: Actual values		0	2
801	0	ActPosST		0	0	4294967295	Current singleturn position	uint32		

Table 18.20: Parameter list – Encoder device

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
801	1	ActPosMT		0	0	4294967295	Current multiturn position	uint32		
801	2	InitPosST		0	0	4294967295	Singleturn init position	uint32		
801	3	InitPosMT		0	0	4294967295	Multiturn init position	uint32		
801	4	RawDataLow		0	0	4294967295	Encoder raw data: Low-word	uint32		
801	5	RawDataHigh		0	0	4294967295	Encoder raw data: High-word	uint32		
801	6	Speed	RPM	0	-3.4E+38	3.4E+38	Speed from encoder module unfiltered	float32		
801	7	MotorTempRaw		0	-2147483648	2147483647	Raw value of motor temperature (written by master)	int32		
801	8	EncoderTempRaw		0	-32768	32767	Raw value of encoder temperature (written by master)	int16		
801	9	MotorTempR	Ohm	0	-3.4E+38	3.4E+38	Temperature sensor resistance (power stage)	float32		
801	10	EncoderTemp	degC	0	-3.4E+38	3.4E+38	Encoder temperature	float32		
806		ENC_EC1_Backup					Field bus encoder #1 backup values		0	4
806	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
806	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
806	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
806	3	EncSerialNum					Encoder serial number	string		
809		ENC_EC1_Backup_User					Field bus encoder #1 backup values in user units		0	5
809	0	Pos	POS	0	-2147483648	2147483647	Backup position in user units	int32		
809	1	EncVal_PosDiff	POS	0	-2147483648	2147483647	Validation of position difference	int32		
812		ENC_EC1_Info					Encoder information of field bus encoder #1		0	2
812	0	SerialNumber					Serial number	string		
812	1	FirmwareVersion					Firmware version	string		
812	2	EncoderType					Encoder type	string		
812	3	Flags		0	0	4294967295	Encoder information	uint32		
SUBJECT AREA		EtherCAT channel 2							0	0
802		ENC_EC2_Settings					EtherCAT encoder 2: Settings		0	2
802	0	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		
802	1	Multiturn		12	0	32	Number of multiturn bits	uint16		
802	2	Singleturn		16	0	32	Number of singleturn bits	uint16		
802	3	Delay	ms	0.125	-3.4E+38	3.4E+38	Compensation of the field bus delay	float32		

Table 18.20: Parameter list – Encoder device (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
802	4	Numerator		1	- 2147483648	2147483647	Encoder gearing numerator	int32		
802	5	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		
802	6	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
802	7	OffsetST	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
802	8	OffsetMT	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
802	9	MTBase		2147483648	0	4294967295	Multiturn zero point shift	uint32		
802	10	StatusCheck		ON (1)	OFF (0)	ON (1)	Status bit check	uint8		
802	11	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
802	12	EncVal_Enable		224	0	65535	Encoder validation	uint16		
802	13	EncVal_PosDiffLim	POS	100	0	4294967295	Max. encoder validation position	uint32		
802	14	EncoderType		NONE (0)	NONE (0)	ENDAT (2)	Type of remote encoder	uint8		
802	15	TemperatureLimit	degC	0	0	3.4E+38	Encoder temperature error threshold (0 = no function)	float32		
802	16	TemperatureWarning	degC	0	0	3.4E+38	Encoder temperature warning threshold (0 = no function)	float32		
802	17	ErrorTol		0	0	255	Tolerate small number of errors in digital protocol	uint8		
803		ENC_EC2_ActVal					EtherCAT encoder 2: Actual values		0	2
803	0	ActPosST		0	0	4294967295	Current singleturn position	uint32		
803	1	ActPosMT		0	0	4294967295	Current multiturn position	uint32		
803	2	InitPosST		0	0	4294967295	Singleturn init position	uint32		
803	3	InitPosMT		0	0	4294967295	Multiturn init position	uint32		
803	4	RawDataLow		0	0	4294967295	Encoder raw data: Low-word	uint32		
803	5	RawDataHigh		0	0	4294967295	Encoder raw data: High-word	uint32		
803	6	Speed	RPM	0	-3.4E+38	3.4E+38	Speed from encoder module unfiltered	float32		
803	7	MotorTempRaw		0	- 2147483648	2147483647	Raw value of motor temperature (written by master)	int32		
803	8	EncoderTempRaw		0	-32768	32767	Raw value of encoder temperature (written by master)	int16		
803	9	MotorTempR	Ohm	0	-3.4E+38	3.4E+38	Temperature sensor resistance (power stage)	float32		
803	10	EncoderTemp	degC	0	-3.4E+38	3.4E+38	Encoder temperature	float32		
807		ENC_EC2_Backup					Field bus encoder #2 backup values		0	4
807	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
807	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
807	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		

Table 18.20: Parameter list – Encoder device (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
807	3	EncSerialNum					Encoder serial number	string		
810		ENC_EC2_Backup_User					Field bus encoder #2 backup values in user units		0	5
810	0	Pos	POS	0	-2147483648	2147483647	Backup position in user units	int32		
810	1	EncVal_PosDiff	POS	0	-2147483648	2147483647	Validation of position difference	int32		
813		ENC_EC2_Info					Encoder information of field bus encoder #1		0	2
813	0	SerialNumber					Serial number	string		
813	1	FirmwareVersion					Firmware version	string		
813	2	EncoderType					Encoder type	string		
813	3	Flags		0	0	4294967295	Encoder information flags	uint32		
SUBJECT AREA		EtherCAT channel 3							0	0
804		ENC_EC3_Settings					EtherCAT encoder 3: Settings		0	2
804	0	IsLinear		False (0)	False (0)	True (1)	Linear encoder yes/no	bool32		
804	1	Multiturn		12	0	32	Number of multiturn bits	uint16		
804	2	Singleturn		16	0	32	Number of singleturn bits	uint16		
804	3	Delay	ms	0.125	-3.4E+38	3.4E+38	Compensation of the field bus delay	float32		
804	4	Numerator		1	-2147483648	2147483647	Encoder gearing numerator	int32		
804	5	Denominator		1	0	4294967295	Encoder gearing denominator	uint32		
804	6	DigitalResolution	nm	0	0	4294967295	Dig. increment (linear encoder)	uint32		
804	7	OffsetST	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
804	8	OffsetMT	incr	0	0	4294967295	Multiturn offset at original encoder position	uint32		
804	9	MTBase		2147483648	0	4294967295	Multiturn zero point shift	uint32		
804	10	StatusCheck		ON (1)	OFF (0)	ON (1)	Activate status bit check	uint8		
804	11	AbsSim_Enable		OFF (0)	OFF (0)	SIM_ENC (1)	Absolute encoder simulation	uint16		
804	12	EncVal_Enable		224	0	65535	Encoder validation	uint16		
804	13	EncVal_PosDiffLim	POS	100	0	4294967295	Max. encoder validation position	uint32		
804	14	EncoderType		NONE (0)	NONE (0)	ENDAT (2)	Type of remote encoder	uint8		
804	15	TemperatureLimit	degC	0	0	3.4E+38	Encoder temperature error threshold (0 = no function)	float32		
804	16	TemperatureWarning	degC	0	0	3.4E+38	Encoder temperature warning threshold (0 = no function)	float32		
804	17	ErrorTol		0	0	255	Tolerate small number of errors in digital protocol	uint8		

Table 18.20: Parameter list – Encoder device (continue)



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
805		ENC_EC3_ActVal					EtherCAT encoder 3: Actual values		0	2
805	0	ActPosST		0	0	4294967295	Current singleturn position	uint32		
805	1	ActPosMT		0	0	4294967295	Current multiturn position	uint32		
805	2	InitPosST		0	0	4294967295	Singleturn init position	uint32		
805	3	InitPosMT		0	0	4294967295	Multiturn init position	uint32		
805	4	RawDataLow		0	0	4294967295	Encoder raw data: Low-word	uint32		
805	5	RawDataHigh		0	0	4294967295	Encoder raw data: High-word	uint32		
805	6	Speed	RPM	0	-3.4E+38	3.4E+38	Speed from encoder module unfiltered	float32		
805	7	MotorTempRaw		0	-2147483648	2147483647	Raw value of motor temperature (written by master)	int32		
805	8	EncoderTempRaw		0	-32768	32767	Raw value of encoder temperature (written by master)	int16		
805	9	MotorTempR	Ohm	0	-3.4E+38	3.4E+38	Temperature sensor resistance (power stage)	float32		
805	10	EncoderTemp	degC	0	-3.4E+38	3.4E+38	Encoder temperature	float32		
808		ENC_EC3_Backup					Field bus encoder #3 backup values		0	4
808	0	PosST		0	0	4294967295	Singleturn backup position	uint32		
808	1	PosMT		0	0	4294967295	Multiturn backup position	uint32		
808	2	Valid		False (0)	False (0)	True (1)	Backup	bool32		
808	3	EncSerialNum					Encoder serial number	string		
811		ENC_EC3_Backup_User					Field bus encoder #3 backup values in user units		0	5
811	0	Pos	POS	0	-2147483648	2147483647	Backup position in user units	int32		
811	1	EncVal_PosDiff	POS	0	-2147483648	2147483647	Validation of position difference	int32		
814		ENC_EC3_Info					Encoder information of field bus encoder #1		0	2
814	0	SerialNumber					Serial number	string		
814	1	FirmwareVersion					Firmware version	string		
814	2	EncoderType					Encoder type	string		
814	3	Flags		0	0	4294967295	Encoder information bits	uint32		
SUBJECT AREA		Electronic rating plate							0	0
816		ENC_ENP_Mode					Parameters for block access		0	2
816	0	AxisID		0	0	2	Axis ID (0..2)	uint32		
816	1	BlockID		0	0	4294967295	ID of block addressed by ENC ENP_Block	uint32		
816	2	FileSize	Byte	0	0	5120	Size of file on RAM disk	uint32		
817		ENC_ENP_Block					Addressed file block on rating plate		0	2
817	0 to 127	ENC_ENP_Block		0	0	4294967295	Addressed file block on rating plate	uint32		

Table 18.20: Parameter list – Encoder device (continue)

## 20.16 EtherCAT® device

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		EtherCAT					EtherCAT settings (DS301 / 402)		0	0
SUBJECT AREA		Basic settings							0	0
61440		ModularDeviceProfile					ETG 1000 RPDO1 Axis 1 parameter mapping		0	5
61440	0	IndexDistance		2048	0	65535		uint16		
61440	1	MaxModules		0	0	65535	Max. number of axis modules	uint16		
8017	0	ProgCtrl		0	0	255	Program Control	uint8	0	2
4120		IdentityObject					ETG 1000 Identification object		0	5
4120	0	VendorID		0	0	4294967295	Assigned uniquely by ETG	uint32		
4120	1	ProductCode		0	0	4294967295	Assigned uniquely by Vendor	uint32		
4120	2	RevisionNumber		0	0	4294967295	Assigned uniquely by Vendor	uint32		
4120	3	SerialNumber		0	0	4294967295	Assigned uniquely by Vendor	uint32		
4097	0	ErrorRegister		0	0	255	ETG 1000 Error register	uint8	0	5
4096	0	DeviceType		131474	0	4294967295	ETG 1000 Device type	uint32	0	5
136		EoESettings					EoE settings (conf. by master)		0	5
136	0	MAC		MAC address				string		
136	1	Ip		192.168.38.5				string		
136	2	SubNetMask		255.255.255.0			Subnet mask, configured by master	string		
136	3	DefaultGateway		192.168.38.255			Default gateway, configured by master	string		
136	4	DNSServer		xxx.xxx.xxx.xxx			DNS server, configured by master	string		
136	5	DNSName		DNS Server			DSN server name, configured by master	string		
1471		SyncRtInfo					Runtime measurement of internal communication related functions		2	5
1471	0	RtSm2		0	-3.4E+38	3.4E+38	SM2 output copy in SYNC0	float32		
1471	1	RtSm3		0	-3.4E+38	3.4E+38	SM3 input copy in SYNC0	float32		
1471	2	RtOutMap		0	-3.4E+38	3.4E+38	Output mapping	float32		
1471	3	RtInMap		0	-3.4E+38	3.4E+38	Input mapping	float32		
1471	4	RtDIRQ		0	-3.4E+38	3.4E+38	DIRQ	float32		
1471	5	RtDC0		0	-3.4E+38	3.4E+38	DC0	float32		
1471	6	RtTimer		0	-3.4E+38	3.4E+38	Stopwatch	float32		
1471	7	RtOutValid		0	-3.4E+38	3.4E+38	Output valid time	float32		

Table 18.21: Parameter list – EtherCAT device

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
1471	8	RtInLatch		0	-3.4E+38	3.4E+38	Input latch time	float32		
1471	9	RtNDK		0	-3.4E+38	3.4E+38	ndk response time	float32		
1471	10	RtTotal		0	-3.4E+38	3.4E+38	Control task total	float32		
1471	11	RtSm4		0	-3.4E+38	3.4E+38	SM4 output copy in SYNC01	float32		
1471	12	RtSm2		0	-3.4E+38	3.4E+38	SM2 output copy in SYNC01	float32		
1471	13	RtAfterCon		0	-3.4E+38	3.4E+38	After Control (less critical)	float32		
1471	14	RtControl		0	-3.4E+38	3.4E+38	Control	float32		
1471	15	RtCommon		0	-3.4E+38	3.4E+38	Common control	float32		
1471	16	Debug0Ax0		0	-3.4E+38	3.4E+38	Debug0Ax0	float32		
1471	17	Debug0Ax1		0	-3.4E+38	3.4E+38	Debug0Ax1	float32		
1471	18	Debug0Ax2		0	-3.4E+38	3.4E+38	Debug0Ax2	float32		
1471	19	Debug1Ax0		0	-3.4E+38	3.4E+38	Debug1Ax0	float32		
1471	20	Debug1Ax1		0	-3.4E+38	3.4E+38	Debug1Ax1	float32		
1471	21	Debug1Ax2		0	-3.4E+38	3.4E+38	Debug1Ax2	float32		
1471	22	Debug2Ax0		0	-3.4E+38	3.4E+38	Debug2Ax0	float32		
1471	23	Debug2Ax1		0	-3.4E+38	3.4E+38	Debug2Ax1	float32		
1471	24	Debug2Ax2		0	-3.4E+38	3.4E+38	Debug2Ax2	float32		
1471	25	RtWrong		0	-3.4E+38	3.4E+38	Wrong output data counter	float32		
1471	26	RtSyncIsr		0	-3.4E+38	3.4E+38	Runtime Sync ISR	float32		
1471	27	RtSemaphore		0	-3.4E+38	3.4E+38	Spoiled time control semaphore	float32		
1471	28	RtMotionTask		0	-3.4E+38	3.4E+38	Runtime 1ms task	float32		
1471	29	RtSlowTask		0	-3.4E+38	3.4E+38	Runtime 10ms task	float32		
1471	30	RtMainLoop		0	-3.4E+38	3.4E+38	Runtime main loop	float32		
1472		StkRtInfo					State and runtime information of EtherCAT - stack		2	5
1472	0	StkRtInfo		0	-3.4E+38	3.4E+38	EoE states	float32		
1472	1	StkRtInfo		0	-3.4E+38	3.4E+38	Mailbox states	float32		
1472	2	StkRtInfo		0	-3.4E+38	3.4E+38	Main loop	float32		
1472	3	StkRtInfo		0	-3.4E+38	3.4E+38	Mailbox copy	float32		
1472	4	StkRtInfo		0	-3.4E+38	3.4E+38	EoE fragment errors	float32		
1472	5	StkRtInfo		0	-3.4E+38	3.4E+38	EoE size errors	float32		
SUBJECT AREA		Mapping							0	0
5632		RPDO1_Axis1					ETG 1000 RPDO1 Axis 1 parameter mapping		0	2
5632	0	PDO_Sub0		3	0	8	PDO mapping parameter	uint8		

Table 18.21: Parameter list – EtherCAT device (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
5632	1	PDO_Sub1		1616904200	0	4294967295		uint32		
5632	2	PDO_Sub2		1614807056	0	4294967295		uint32		
5632	3	PDO_Sub3		1627324448	0	4294967295		uint32		
5632	4	PDO_Sub4		0	0	4294967295		uint32		
5632	5	PDO_Sub5		0	0	4294967295		uint32		
5632	6	PDO_Sub6		0	0	4294967295		uint32		
5632	7	PDO_Sub7		0	0	4294967295		uint32		
5632	8	PDO_Sub8		0	0	4294967295		uint32		
5648		RPDO1_Axis2					ETG 1000 RPDO1 Axis 2 parameter mapping		0	2
5648	0	PDO_Sub0		3	0	8	PDO mapping parameter	uint8		
5648	1	PDO_Sub1		1751121928	0	4294967295		uint32		
5648	2	PDO_Sub2		1749024784	0	4294967295		uint32		
5648	3	PDO_Sub3		1761542176	0	4294967295		uint32		
5648	4	PDO_Sub4		0	0	4294967295		uint32		
5648	5	PDO_Sub5		0	0	4294967295		uint32		
5648	6	PDO_Sub6		0	0	4294967295		uint32		
5648	7	PDO_Sub7		0	0	4294967295		uint32		
5648	8	PDO_Sub8		0	0	4294967295		uint32		
5664		RPDO1_Axis3					ETG 1000 RPDO1 Axis 3 parameter mapping		0	2
5664	0	PDO_Sub0		3	0	8	PDO mapping parameter	uint8		
5664	1	PDO_Sub1		1885339656	0	4294967295		uint32		
5664	2	PDO_Sub2		1883242512	0	4294967295		uint32		
5664	3	PDO_Sub3		1895759904	0	4294967295		uint32		
5664	4	PDO_Sub4		0	0	4294967295		uint32		
5664	5	PDO_Sub5		0	0	4294967295		uint32		
5664	6	PDO_Sub6		0	0	4294967295		uint32		
5664	7	PDO_Sub7		0	0	4294967295		uint32		
5664	8	PDO_Sub8		0	0	4294967295		uint32		
6656		TPDO1_Axis1					ETG 1000 TPDO1 Axis 1 parameter mapping		0	2
6656	0	PDO_Sub0		3	0	8	PDO mapping parameter	uint8		
6656	1	PDO_Sub1		1616969736	0	4294967295		uint32		
6656	2	PDO_Sub2		1614872592	0	4294967295		uint32		
6656	3	PDO_Sub3		1617690656	0	4294967295		uint32		

Table 18.21: Parameter list – EtherCAT device (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
6656	4	PDO_Sub4		0	0	4294967295		uint32		
6656	5	PDO_Sub5		0	0	4294967295		uint32		
6656	6	PDO_Sub6		0	0	4294967295		uint32		
6656	7	PDO_Sub7		0	0	4294967295		uint32		
6656	8	PDO_Sub8		0	0	4294967295		uint32		
6672		TPDO1_Axis2					ETG 1000 TPDO1 Axis 2 parameter mapping		0	2
6672	0	PDO_Sub0		3	0	8	PDO mapping parameter	uint8		
6672	1	PDO_Sub1		1751187464	0	4294967295		uint32		
6672	2	PDO_Sub2		1749090320	0	4294967295		uint32		
6672	3	PDO_Sub3		1751908384	0	4294967295		uint32		
6672	4	PDO_Sub4		0	0	4294967295		uint32		
6672	5	PDO_Sub5		0	0	4294967295		uint32		
6672	6	PDO_Sub6		0	0	4294967295		uint32		
6672	7	PDO_Sub7		0	0	4294967295		uint32		
6672	8	PDO_Sub8		0	0	4294967295		uint32		
6688		TPDO1_Axis3					ETG 1000 TPDO1 Axis 3 parameter mapping		0	2
6688	0	PDO_Sub0		3	0	8	PDO mapping parameter	uint8		
6688	1	PDO_Sub1		1885405192	0	4294967295		uint32		
6688	2	PDO_Sub2		1883308048	0	4294967295		uint32		
6688	3	PDO_Sub3		1886126112	0	4294967295		uint32		
6688	4	PDO_Sub4		0	0	4294967295		uint32		
6688	5	PDO_Sub5		0	0	4294967295		uint32		
6688	6	PDO_Sub6		0	0	4294967295		uint32		
6688	7	PDO_Sub7		0	0	4294967295		uint32		
6688	8	PDO_Sub8		0	0	4294967295		uint32		
7168		SyncManComType					ETG 1000 Sync manager communication type		0	5
7168	0	NumOfSyncManCh		5	0	255	1C00H Sub 0: Number of Sync Manager channels	uint8		
7168	1	SyncManComType0		1	0	255	1C00H Sub1: Communication Type Sync Manager 0	uint8		
7168	2	SyncManComType1		2	0	255	1C00H Sub2: Communication Type Sync Manager 1	uint8		
7168	3	SyncManComType2		3	0	255	1C00H Sub3: Communication Type Sync Manager 2	uint8		
7168	4	SyncManComType3		4	0	255	1C00H Sub4: Communication Type Sync Manager 3	uint8		
7168	5	SyncManComType4		3	0	255	1C00H Sub5: Communication Type Sync Manager 4	uint8		
7186		SyncMan2Assign					ETG 1000 Sync Manager 2 PDO instruction		0	2

Table 18.21: Parameter list – EtherCAT device (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
7186	0	SyncMan2Assign		1	0	3	1C12H Sub 0 Number of assigned RxPDOs	uint8		
7186	1	SyncMan2PdoAssign_1		5632	5632	5664	1C12H Sub1 PDO index of assigned RxPDO	uint16		
7186	2	SyncMan2PdoAssign_2		5648	5632	5664	1C12H Sub2 PDO index of assigned RxPDO	uint16		
7186	3	SyncMan2PdoAssign_3		5664	5632	5664	1C12H Sub3 PDO index of assigned RxPDO	uint16		
7187		SyncMan3Assign					ETG 1000 Sync-Manager 3 PDO instruction		0	2
7187	0	SyncMan3Assign		1	0	3	1C13H Sub0 Number of assigned TxPDOs	uint8		
7187	1	SyncMan3PdoAssign_1		6656	6656	6688	1C13H Sub1 Pdo index of assigned TxPDO	uint16		
7187	2	SyncMan3PdoAssign_2		6672	6656	6688	1C13H Sub2 Pdo index of assigned TxPDO	uint16		
7187	3	SyncMan3PdoAssign_3		6688	6656	6688	1C13H Sub3 Pdo index of assigned TxPDO	uint16		
7188		SyncMan4Assign					ETG 1000 Sync-Manager 3 PDO instruction		0	2
7188	0	SyncMan4Assign		0	0	3	1C13H Sub0 Number of assigned TxPDOs	uint8		
7188	1	SyncMan4PdoAssign_1		6128	6128	6128	1C14H Sub1 Pdo index of assigned TxPDO	uint16		
7188	2	SyncMan4PdoAssign_2		0	0	0	1C14H Sub2 Pdo index of assigned TxPDO	uint16		
7188	3	SyncMan4PdoAssign_3		0	0	0	1C14H Sub3 Pdo index of assigned TxPDO	uint16		
7218		SM2SyncObject					ETG 1000 Sync Manager sync. object		0	5
7218	0	SyncType		0	0	65535		uint16		
7218	1	CycleTime		0	0	4294967295		uint32		
7218	2	ShiftTime		0	0	4294967295	Time between sync0 event and outputs valid	uint32		
7218	3	SupSyncTypes		0	0	65535	Supported synchronization types	uint16		
7218	4	MinCycleTime		0	0	4294967295	Minimum cycle time	uint32		
7218	5	CalcAndCopyTime		0	0	4294967295	Calc and copy time	uint32		
7218	6	MinDelayTime		0	0	4294967295	Minimum delay time	uint32		
7218	7	GetCycleTime		0	0	65535	WR Bit 0: 0:Measurement of local cycle time stopped 1: Measurement of local cycle time started.	uint16		
7218	8	DelayTime		0	0	4294967295	Hardware delay time of the slave	uint32		
7218	9	Sync0CycleTime		0	0	4294967295	Time between two sync0 signals	uint32		
7218	10	SMEEventMissed		0	0	65535	This error counter is incremented when the cycle time is too small	uint16		
7218	11	CycleTimeTooSmall		0	0	65535		uint16		
7218	12	ShiftTimeTooShort		0	0	65535		uint16		
7218	13	RxPDOToggleFailed		0	0	65535		uint16		
7218	14	MinCycleDistance		0	0	4294967295		uint32		
7218	15	MaxCycleDistance		0	0	65535		uint16		

Table 18.21: Parameter list – EtherCAT device (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
7218	16	MinSMSyncDistance		0	0	4294967295		uint32		
7218	17	MaxSMSyncDistance		0	0	4294967295		uint32		
7218	18	Res19		0	0	4294967295		uint32		
7218	19	Res20		0	0	4294967295		uint32		
7218	20	Res21		0	0	4294967295		uint32		
7218	21	Res22		0	0	4294967295		uint32		
7218	22	Res23		0	0	4294967295		uint32		
7218	23	Res24		0	0	4294967295		uint32		
7218	24	Res25		0	0	4294967295		uint32		
7218	25	Res26		0	0	4294967295		uint32		
7218	26	Res27		0	0	4294967295		uint32		
7218	27	Res28		0	0	4294967295		uint32		
7218	28	Res29		0	0	4294967295		uint32		
7218	29	Res30		0	0	4294967295		uint32		
7218	30	Res31		0	0	4294967295		uint32		
7218	31	SyncError		False (0)	False (0)	True (1)		bool32		
7219		SM3SyncObject					ETG 1000 Sync Manager sync. object		0	5
7219	0	SyncType		0	0	65535		uint16		
7219	1	CycleTime		0	0	4294967295		uint32		
7219	2	ShiftTime		0	0	4294967295	Time between sync0 event and outputs valid	uint32		
7219	3	SupSyncTypes		0	0	65535	Supported synchronization types	uint16		
7219	4	MinCycleTime		0	0	4294967295	Minimum cycle time	uint32		
7219	5	CalcAndCopyTime		0	0	4294967295	Calc and copy time	uint32		
7219	6	MinDelayTime		0	0	4294967295	Minimum delay time	uint32		
7219	7	GetCycleTime		0	0	65535	WR Bit 0: 0: Measurement of local cycle time stopped 1: Measurement of local cycle time started.	uint16		
7219	8	DelayTime		0	0	4294967295	Hardware delay time of the slave	uint32		
7219	9	Sync0CycleTime		0	0	4294967295	Time between two sync0 signals	uint32		
7219	10	SMEventMissed		0	0	65535	This error counter is incremented when the cycle time is too small	uint16		
7219	11	CycleTimeTooSmall		0	0	65535		uint16		
7219	12	ShiftTimeTooShort		0	0	65535		uint16		
7219	13	RxPDOToggleFailed		0	0	65535		uint16		

Table 18.21: Parameter list – EtherCAT device (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
7219	14	MinCycleDistance		0	0	4294967295		uint32		
7219	15	MaxCycleDistance		0	0	65535		uint16		
7219	16	MinSMSyncDistance		0	0	4294967295		uint32		
7219	17	MaxSMSyncDistance		0	0	4294967295		uint32		
7219	18	Res19		0	0	4294967295		uint32		
7219	19	Res20		0	0	4294967295		uint32		
7219	20	Res21		0	0	4294967295		uint32		
7219	21	Res22		0	0	4294967295		uint32		
7219	22	Res23		0	0	4294967295		uint32		
7219	23	Res24		0	0	4294967295		uint32		
7219	24	Res25		0	0	4294967295		uint32		
7219	25	Res26		0	0	4294967295		uint32		
7219	26	Res27		0	0	4294967295		uint32		
7219	27	Res28		0	0	4294967295		uint32		
7219	28	Res29		0	0	4294967295		uint32		
7219	29	Res30		0	0	4294967295		uint32		
7219	30	Res31		0	0	4294967295		uint32		
7219	31	SyncError		False (0)	False (0)	True (1)		bool32		
6128		RPDO1_System					ETG 1000 RPDO1 System objects parameter mapping		0	2
6128	0	PDO_Sub0		0	0	8	PDO mapping parameter	uint8		
6128	1	PDO_Sub1		0	0	4294967295		uint32		
6128	2	PDO_Sub2		0	0	4294967295		uint32		
6128	3	PDO_Sub3		0	0	4294967295		uint32		
6128	4	PDO_Sub4		0	0	4294967295		uint32		
6128	5	PDO_Sub5		0	0	4294967295		uint32		
6128	6	PDO_Sub6		0	0	4294967295		uint32		
6128	7	PDO_Sub7		0	0	4294967295		uint32		
6128	8	PDO_Sub8		0	0	4294967295		uint32		
SUBJECT AREA		Drive data							0	0
4106	0	ManSoftVersion					ETG 1000 Manufacturer-spec. Software version	string	0	5
4105	0	ManHardVersion					ETG 1000 Manufacturer-spec. Hardware version	string	0	5
4104	0	ManDeviceName					ETG 1000 Manufacturer-spec. Device name	string	0	5
4098	0	ManStateRegister		0	0	4294967295	Manufacturer-specific status register	uint32	0	5

Table 18.21: Parameter list – EtherCAT device (continue)



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Advanced functions							0	0
69872		BackupParameterCrc					Backup parameter checksum		0	2
69872	0	Checksum		0	0	4294967295		uint32		
69872	1	Changed		False (0)	False (0)	True (1)	Backup parameter changed	bool32		
SUBJECT AREA		Debug					Do not use		0	0
137		SIISimulation					SII simulation of EtherCAT controller		0	3
137	0	Reserved0		0	0	65535	Reserved for further use	uint16		
137	1	Reserved1		0	0	65535	Reserved for further use	uint16		
137	2	Reserved2		0	0	65535	Reserved for further use	uint16		
137	3	Reserved3		0	0	65535	Reserved for further use	uint16		
137	4	ConfiguredStationAlias		0	0	65535	Alias address (SII register: 0x0004 )	uint16		
SUBJECT AREA		Synchronization								

Table 18.21: Parameter list – EtherCAT device (continue)

## 20.17 Device alarms / warnings

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Alarms / Warnings					Alarm / warning history		0	0
100		ERR_Stack					Error stack		0	4
100	0	Cause					Text	string		
100	1	Remedy					Remedy	string		
100	2	ID		0	0	65535	ID	uint16		
100	3	Location		0	0	65535	Location	uint16		
100	4	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	5	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	6	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	7	CommentText					Additional text	string		
100	8	SourceLine		0	0	4294967295	Source line	uint32		
100	9	SourceFile					Name of source	string		
100	10	TimeString					Error time	string		
100	11	Cause					Text	string		
100	12	Remedy					Remedy	string		
100	13	ID		0	0	65535	ID	uint16		
100	14	Location		0	0	65535	Location	uint16		
100	15	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	16	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	17	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	18	CommentText					Additional text	string		
100	19	SourceLine		0	0	4294967295	Source line	uint32		
100	20	SourceFile					Name of source	string		
100	21	TimeString					Error time	string		
100	22	Cause					Text	string		
100	23	Remedy					Remedy	string		
100	24	ID		0	0	65535	ID	uint16		
100	25	Location		0	0	65535	Location	uint16		

Table 18.22: Parameter list – Device alarms / warnings

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
100	26	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	27	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	28	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	29	CommentText					Additional text	string		
100	30	SourceLine		0	0	4294967295	Source line	uint32		
100	31	SourceFile					Name of source	string		
100	32	TimeString					Error time	string		
100	33	Cause					Text	string		
100	34	Remedy					Remedy	string		
100	35	ID		0	0	65535	ID	uint16		
100	36	Location		0	0	65535	Location	uint16		
100	37	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	38	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	39	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	40	CommentText					Additional text	string		
100	41	SourceLine		0	0	4294967295	Source line	uint32		
100	42	SourceFile					Name of source	string		
100	43	TimeString					Error time	string		
100	44	Cause					Text	string		
100	45	Remedy					Remedy	string		
100	46	ID		0	0	65535	ID	uint16		
100	47	Location		0	0	65535	Location	uint16		
100	48	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	49	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	50	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	51	CommentText					Additional text	string		
100	52	SourceLine		0	0	4294967295	Source line	uint32		
100	53	SourceFile					Name of source	string		
100	54	TimeString					Error time	string		
100	55	Cause					Text	string		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
100	56	Remedy					Remedy	string		
100	57	ID		0	0	65535	ID	uint16		
100	58	Location		0	0	65535	Location	uint16		
100	59	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	60	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	61	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	62	CommentText					Additional text	string		
100	63	SourceLine		0	0	4294967295	Source line	uint32		
100	64	SourceFile					Name of source	string		
100	65	TimeString					Error time	string		
100	66	Cause					Text	string		
100	67	Remedy					Remedy	string		
100	68	ID		0	0	65535	ID	uint16		
100	69	Location		0	0	65535	Location	uint16		
100	70	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	71	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	72	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	73	CommentText					Additional text	string		
100	74	SourceLine		0	0	4294967295	Source line	uint32		
100	75	SourceFile					Name of source	string		
100	76	TimeString					Error time	string		
100	77	Cause					Text	string		
100	78	Remedy					Remedy	string		
100	79	ID		0	0	65535	ID	uint16		
100	80	Location		0	0	65535	Location	uint16		
100	81	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	82	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	83	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	84	CommentText					Additional text	string		
100	85	SourceLine		0	0	4294967295	Source line	uint32		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
100	86	SourceFile					Name of source	string		
100	87	TimeString					Error time	string		
100	88	Cause					Text	string		
100	89	Remedy					Remedy	string		
100	90	ID		0	0	65535	ID	uint16		
100	91	Location		0	0	65535	Location	uint16		
100	92	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	93	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	94	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	95	CommentText					Additional text	string		
100	96	SourceLine		0	0	4294967295	Source line	uint32		
100	97	SourceFile					Name of source	string		
100	98	TimeString					Error time	string		
100	99	Cause					Text	string		
100	100	Remedy					Remedy	string		
100	101	ID		0	0	65535	ID	uint16		
100	102	Location		0	0	65535	Location	uint16		
100	103	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	104	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	105	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	106	CommentText					Additional text	string		
100	107	SourceLine		0	0	4294967295	Source line	uint32		
100	108	SourceFile					Name of source	string		
100	109	TimeString					Error time	string		
100	110	Cause					Text	string		
100	111	Remedy					Remedy	string		
100	112	ID		0	0	65535	ID	uint16		
100	113	Location		0	0	65535	Location	uint16		
100	114	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	115	Repetitions		0	0	4294967295	Number of error repetitions	uint32		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
100	116	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	117	CommentText					Additional text	string		
100	118	SourceLine		0	0	4294967295	Source line	uint32		
100	119	SourceFile					Name of source	string		
100	120	TimeString					Error time	string		
100	121	Cause					Text	string		
100	122	Remedy					Remedy	string		
100	123	ID		0	0	65535	ID	uint16		
100	124	Location		0	0	65535	Location	uint16		
100	125	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	126	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	127	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	128	CommentText					Additional text	string		
100	129	SourceLine		0	0	4294967295	Source line	uint32		
100	130	SourceFile					Name of source	string		
100	131	TimeString					Error time	string		
100	132	Cause					Text	string		
100	133	Remedy					Remedy	string		
100	134	ID		0	0	65535	ID	uint16		
100	135	Location		0	0	65535	Location	uint16		
100	136	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	137	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	138	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	139	CommentText					Additional text	string		
100	140	SourceLine		0	0	4294967295	Source line	uint32		
100	141	SourceFile					Name of source	string		
100	142	TimeString					Error time	string		
100	143	Cause					Text	string		
100	144	Remedy					Remedy	string		
100	145	ID		0	0	65535	ID	uint16		
100	146	Location		0	0	65535	Location	uint16		
100	147	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent	int16		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
							system error			
100	148	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	149	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	150	CommentText					Additional text	string		
100	151	SourceLine		0	0	4294967295	Source line	uint32		
100	152	SourceFile					Name of source	string		
100	153	TimeString					Error time	string		
100	154	Cause					Text	string		
100	155	Remedy					Remedy	string		
100	156	ID		0	0	65535	ID	uint16		
100	157	Location		0	0	65535	Location	uint16		
100	158	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	159	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	160	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	161	CommentText					Additional text	string		
100	162	SourceLine		0	0	4294967295	Source line	uint32		
100	163	SourceFile					Name of source	string		
100	164	TimeString					Error time	string		
100	165	Cause					Text	string		
100	166	Remedy					Remedy	string		
100	167	ID		0	0	65535	ID	uint16		
100	168	Location		0	0	65535	Location	uint16		
100	169	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	170	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	171	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	172	CommentText					Additional text	string		
100	173	SourceLine		0	0	4294967295	Source line	uint32		
100	174	SourceFile					Name of source	string		
100	175	TimeString					Error time	string		
100	176	Cause					Text	string		
100	177	Remedy					Remedy	string		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
100	178	ID		0	0	65535	ID	uint16		
100	179	Location		0	0	65535	Location	uint16		
100	180	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	181	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	182	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	183	CommentText					Additional text	string		
100	184	SourceLine		0	0	4294967295	Source line	uint32		
100	185	SourceFile					Name of source	string		
100	186	TimeString					Error time	string		
100	187	Cause					Text	string		
100	188	Remedy					Remedy	string		
100	189	ID		0	0	65535	ID	uint16		
100	190	Location		0	0	65535	Location	uint16		
100	191	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	192	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	193	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	194	CommentText					Additional text	string		
100	195	SourceLine		0	0	4294967295	Source line	uint32		
100	196	SourceFile					Name of source	string		
100	197	TimeString					Error time	string		
100	198	Cause					Text	string		
100	199	Remedy					Remedy	string		
100	200	ID		0	0	65535	ID	uint16		
100	201	Location		0	0	65535	Location	uint16		
100	202	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	203	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	204	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	205	CommentText					Additional text	string		
100	206	SourceLine		0	0	4294967295	Source line	uint32		
100	207	SourceFile					Name of source	string		

Table 18.22: Parameter list – Device alarms / warnings (continue)



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
100	208	TimeString					Error time	string		
100	209	Cause					Text	string		
100	210	Remedy					Remedy	string		
100	211	ID		0	0	65535	ID	uint16		
100	212	Location		0	0	65535	Location	uint16		
100	213	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	214	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	215	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	216	CommentText					Additional text	string		
100	217	SourceLine		0	0	4294967295	Source line	uint32		
100	218	SourceFile					Name of source	string		
100	219	TimeString					Error time	string		
100	220	Cause					Text	string		
100	221	Remedy					Remedy	string		
100	222	ID		0	0	65535	ID	uint16		
100	223	Location		0	0	65535	Location	uint16		
100	224	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	225	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	226	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	227	CommentText					Additional text	string		
100	228	SourceLine		0	0	4294967295	Source line	uint32		
100	229	SourceFile					Name of source	string		
100	230	TimeString					Error time	string		
100	231	Cause					Text	string		
100	232	Remedy					Remedy	string		
100	233	ID		0	0	65535	ID	uint16		
100	234	Location		0	0	65535	Location	uint16		
100	235	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	236	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	237	CommentID		0	-2147483648	2147483647	Additional ID	int32		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
100	238	CommentText					Additional text	string		
100	239	SourceLine		0	0	4294967295	Source line	uint32		
100	240	SourceFile					Name of source	string		
100	241	TimeString					Error time	string		
100	242	Cause					Text	string		
100	243	Remedy					Remedy	string		
100	244	ID		0	0	65535	ID	uint16		
100	245	Location		0	0	65535	Location	uint16		
100	246	AxisIndex		0	-32768	32767	Axis index, in error state - 1 = axis-independent system error	int16		
100	247	Repetitions		0	0	4294967295	Number of error repetitions	uint32		
100	248	CommentID		0	-2147483648	2147483647	Additional ID	int32		
100	249	CommentText					Additional text	string		
100	250	SourceLine		0	0	4294967295	Source line	uint32		
100	251	SourceFile					Name of source	string		
100	252	TimeString					Error time	string		
105	0	ERR_StackPtr		0	0	255	Error stack index	uint8	0	4
107	0	ERR_SwVersionID		2	0	4294967295	Software module ID	uint32	0	3
101		ERR_Stack_SysState					System states at last error		0	4
101	0	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	1	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	2	OperationTime	s	0	0	4294967295	Time	uint32		
101	3	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	4	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	5	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	6	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	7	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	8	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	9	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	10	OperationTime	s	0	0	4294967295	Time	uint32		
101	11	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	12	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	13	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	14	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
101	15	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	16	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	17	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	18	OperationTime	s	0	0	4294967295	Time	uint32		
101	19	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	20	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	21	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	22	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	23	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	24	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	25	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	26	OperationTime	s	0	0	4294967295	Time	uint32		
101	27	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	28	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	29	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	30	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	31	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	32	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	33	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	34	OperationTime	s	0	0	4294967295	Time	uint32		
101	35	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	36	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	37	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	38	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	39	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	40	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	41	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	42	OperationTime	s	0	0	4294967295	Time	uint32		
101	43	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	44	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	45	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	46	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	47	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
101	48	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	49	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	50	OperationTime	s	0	0	4294967295	Time	uint32		
101	51	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	52	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	53	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	54	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	55	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	56	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	57	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	58	OperationTime	s	0	0	4294967295	Time	uint32		
101	59	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	60	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	61	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	62	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	63	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	64	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	65	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	66	OperationTime	s	0	0	4294967295	Time	uint32		
101	67	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	68	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	69	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	70	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	71	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	72	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	73	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	74	OperationTime	s	0	0	4294967295	Time	uint32		
101	75	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	76	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	77	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	78	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	79	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	80	Templnt	°C	0	-32768	32767	Interior temperature	int16		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
101	81	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	82	OperationTime	s	0	0	4294967295	Time	uint32		
101	83	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	84	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	85	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	86	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	87	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	88	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	89	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	90	OperationTime	s	0	0	4294967295	Time	uint32		
101	91	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	92	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	93	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	94	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	95	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	96	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	97	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	98	OperationTime	s	0	0	4294967295	Time	uint32		
101	99	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	100	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	101	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	102	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	103	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	104	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	105	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	106	OperationTime	s	0	0	4294967295	Time	uint32		
101	107	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	108	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	109	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	110	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	111	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	112	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	113	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
101	114	OperationTime	s	0	0	4294967295	Time	uint32		
101	115	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	116	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	117	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	118	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	119	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	120	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	121	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	122	OperationTime	s	0	0	4294967295	Time	uint32		
101	123	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	124	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	125	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	126	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	127	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	128	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	129	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	130	OperationTime	s	0	0	4294967295	Time	uint32		
101	131	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	132	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	133	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	134	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	135	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	136	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	137	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	138	OperationTime	s	0	0	4294967295	Time	uint32		
101	139	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	140	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	141	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	142	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	143	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	144	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	145	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	146	OperationTime	s	0	0	4294967295	Time	uint32		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
101	147	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	148	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	149	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	150	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	151	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	152	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	153	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	154	OperationTime	s	0	0	4294967295	Time	uint32		
101	155	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	156	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	157	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	158	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	159	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	160	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	161	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	162	OperationTime	s	0	0	4294967295	Time	uint32		
101	163	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	164	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	165	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	166	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	167	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	168	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	169	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	170	OperationTime	s	0	0	4294967295	Time	uint32		
101	171	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
101	172	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	173	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	174	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	175	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
101	176	Templnt	°C	0	-32768	32767	Interior temperature	int16		
101	177	Voltage	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
101	178	OperationTime	s	0	0	4294967295	Time	uint32		
101	179	Templnv1	°C	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
101	180	Templnv2	°C	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
101	181	Templnv3	°C	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		
101	182	ETCSysTimeLow		0	0	4294967295	EtherCAT system time low word	uint32		
101	183	ETCSysTimeHigh		0	0	4294967295	EtherCAT system time high word	uint32		
102		ERR_Stack_AxisState					Axis states at last error		0	4
102	0	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	1	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	2	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	3	DriveCom		0	0	65535	DriveCom state	uint16		
102	4	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	5	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	6	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	7	DriveCom		0	0	65535	DriveCom state	uint16		
102	8	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	9	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	10	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	11	DriveCom		0	0	65535	DriveCom state	uint16		
102	12	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	13	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	14	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	15	DriveCom		0	0	65535	DriveCom state	uint16		
102	16	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	17	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	18	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	19	DriveCom		0	0	65535	DriveCom state	uint16		
102	20	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	21	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	22	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	23	DriveCom		0	0	65535	DriveCom state	uint16		
102	24	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	25	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	26	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	27	DriveCom		0	0	65535	DriveCom state	uint16		

Table 18.22: Parameter list – Device alarms / warnings (continue)



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
102	28	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	29	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	30	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	31	DriveCom		0	0	65535	DriveCom state	uint16		
102	32	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	33	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	34	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	35	DriveCom		0	0	65535	DriveCom state	uint16		
102	36	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	37	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	38	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	39	DriveCom		0	0	65535	DriveCom state	uint16		
102	40	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	41	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	42	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	43	DriveCom		0	0	65535	DriveCom state	uint16		
102	44	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	45	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	46	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	47	DriveCom		0	0	65535	DriveCom state	uint16		
102	48	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	49	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	50	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	51	DriveCom		0	0	65535	DriveCom state	uint16		
102	52	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	53	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	54	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	55	DriveCom		0	0	65535	DriveCom state	uint16		
102	56	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	57	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	58	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	59	DriveCom		0	0	65535	DriveCom state	uint16		
102	60	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
102	61	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	62	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	63	DriveCom		0	0	65535	DriveCom state	uint16		
102	64	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	65	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	66	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	67	DriveCom		0	0	65535	DriveCom state	uint16		
102	68	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	69	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	70	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	71	DriveCom		0	0	65535	DriveCom state	uint16		
102	72	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	73	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	74	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	75	DriveCom		0	0	65535	DriveCom state	uint16		
102	76	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	77	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	78	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	79	DriveCom		0	0	65535	DriveCom state	uint16		
102	80	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	81	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	82	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	83	DriveCom		0	0	65535	DriveCom state	uint16		
102	84	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	85	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	86	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	87	DriveCom		0	0	65535	DriveCom state	uint16		
102	88	Speed	SPEED	0	-3.4E+38	3.4E+38	Speed	float32		
102	89	Current	A	0	-3.4E+38	3.4E+38	Effective current	float32		
102	90	TimePowerStage	s	0	0	4294967295	Power stage active (hours)	uint32		
102	91	DriveCom		0	0	65535	DriveCom state	uint16		
SUBJECT AREA		Error reactions					Error reaction settings		0	0
103		ERR_Reaction_System					Custom programmable error reaction for all system errors		0	2

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
103	0	NoError		ServoHalt (4)	Ignore (0)	Specific2 (8)	no error	uint16		
103	1	Runtime		FaultReactionOptionCode (1)	Ignore (0)	Specific2 (8)	Reaction to error 1 'Runtime error'	uint16		
103	2	ParameterList		WaitERSAndReset (6)	WaitERSAndReset (6)	WaitERSAndReset (6)	Reaction to error 2 'Error in parameter list'	uint16		
103	3	ObjectList		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Reaction to error 3 'Error in object list'	uint16		
103	4	EtherCAT		FaultReactionOptionCode (1)	FaultReactionOptionCode (1)	Specific2 (8)	Reaction to error 4 'EtherCAT error'	uint16		
103	5	Ethernet		FaultReactionOptionCode (1)	FaultReactionOptionCode (1)	Specific2 (8)	Reaction to error 5 'Ethernet error'	uint16		
103	6	Fatal		WaitERSAndReset (6)	WaitERSAndReset (6)	WaitERSAndReset (6)	Reaction to error 6 'Fatal error'	uint16		
103	7	Parameters		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Reaction to error 7 'Parameter error'	uint16		
103	8	Timing		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Reaction to error 9 'Timing error'	uint16		
103	9	OverVoltage		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Reaction to error 14 'Overcurrent error'	uint16		
103	10	DeviceTemp		FaultReactionOptionCode (1)	FaultReactionOptionCode (1)	Specific2 (8)	Reaction to error 18 'Overtemperature of device electronics'	uint16		
103	11	CrossCom		FaultReactionOptionCode (1)	FaultReactionOptionCode (1)	Specific2 (8)	Reaction to error 19 'Error in cross-communication'	uint16		
103	12	CommonSys		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Reaction to error 20 'Error in shared system'	uint16		
103	13	Supply_1		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Reaction to error 24 'Error in supply unit 1'	uint16		
103	14	SafetyQuit		ServoHalt (4)	ServoHalt (4)	WaitERSAndReset (6)	Reaction to error 34 'Non-fatal safety error'	uint16		
103	15	SafetySysReset		WaitERSAndReset (6)	WaitERSAndReset (6)	WaitERSAndReset (6)	Reaction to error 35 'Fatal safety error'	uint16		
103	16	SPI_SDC		ServoHalt (4)	Ignore (0)	Specific2 (8)	Reaction on Error 37 'Safety SDC communication error'	uint16		
103	17	IO-Expd		ServoHalt (4)	Ignore (0)	Specific2 (8)	Reaction on Error 38 'Safety IO-Expander error'	uint16		
103	18	SDC_Option		ServoHalt (4)	Ignore (0)	Specific2 (8)	Reaction on Error 39 'Safety SDC error'	uint16		
103	19	Sys_Reset		ServoHalt (4)	Ignore (0)	Specific2 (8)	Reaction on Error 40 'System Reset error'	uint16		
103	20	ExpansionModule		ServoHalt (4)	Ignore (0)	Specific2 (8)	Reaction on Error 41 'Expansion-module error'	uint16		

Table 18.22: Parameter list – Device alarms / warnings (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
103	21	CapacityModule		ServoHalt (4)	Ignore (0)	Specific2 (8)	Reaction on Error 42 'Capacity-module error'	uint16		
103	22	IxT_Device		FaultReactionOptionCode (1)	FaultReactionOptionCode (1)	Specific2 (8)	Reaction on Error 43 'Device IxT'	uint16		
SUBJECT AREA		Warning threshold					Warning thresholds		0	0
1002		MON_DeviceWarningLevels					Warning thresholds of the device		0	2
1002	0	Undervoltage_ON	V	0	0	1000	DC-link undervoltage	float32		
1002	1	Undervoltage_OFF	V	0	0	10000	DC-link undervoltage	float32		
1002	2	OverVoltage_ON	V	1000	0	1000	DC-link overvoltage	float32		
1002	3	OverVoltage_OFF	V	1000	0	1000	DC-link overvoltage	float32		
1002	4	Tint_ON	degC	200	0	200	Interior temperature	float32		
1002	5	Tint_OFF	degC	200	0	200	Interior temperature	float32		

Table 18.22: Parameter list – Device alarms / warnings (continue)

## 20.18 Device administration

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Administration					Device settings (administration)		0	0
SUBJECT AREA		Passwords							1	1
90	0	PARA_PSW_Level1					Password user level 1 (Setter)	string	1	1
91	0	PARA_PSW_Level2					Password user level 1 (Local Administrator)	string	2	2
94	0	PARA_PSW_Setting					Password for data set handling	string	2	2
95	0	PARA_PSW_ManualMode					Password for manual mode	string	2	2
SUBJECT AREA		Service interface							0	0
130		SB_TCPIP_Monitor					Monitor of TCP/IP service channel		2	2
130	0	Reset		0	0	4294967295	Reset monitor data	uint32		
130	1	State		0	0	4294967295	Actual scanner status ID	uint32		
130	2	BytesIn		0	0	4294967295	Count of incoming bytes	uint32		
130	3	OutOfRecordBytes		0	0	4294967295	Count of bytes outside valid service frame, that means before receiving magic number	uint32		
130	4	BytesDiscarded		0	0	4294967295	Count of bytes discarded after start of service frame detected	uint32		
130	5	BytesOut		0	0	4294967295	Count of transmitted bytes	uint32		
130	6	BytesProceeded		0	0	4294967295	Count of bytes inside valid service frame	uint32		
130	7	DataBytesProceeded		0	0	4294967295	Count of valid service content bytes	uint32		
130	8	RecordStartDetected		0	0	4294967295	Count of detected magic numbers	uint32		
130	9	TelegramCheckFailed		0	0	4294967295	Count of aborted service telegrams	uint32		
130	10	TelegramsScanned		0	0	4294967295	Count of valid incoming service telegrams	uint32		
130	11	TelegramsProcessed		0	0	4294967295	Count of processed valid service telegrams	uint32		
130	12	TelegramsReplied		0	0	4294967295	Count of replied service telegrams	uint32		
130	13	TelegramsOut		0	0	4294967295	Count of transmitted reply service telegrams	uint32		
130	14	SystemError		0	0	4294967295	Count of fatal errors	uint32		
130	15	TelegramsDiscarded		0	0	4294967295	Count of discarded incoming service telegrams with correct frame	uint32		
130	16	HeaderFramesDetected		0	0	4294967295	Count of detected telegram header frames	uint32		
131	0	SB_StatusMonitor		True (1)	False (0)	True (1)	Switch on/off monitoring of status of service bus interface via log function	bool32	2	2
132		SB_TCPIP_MultiService					Switch on/off management for handling service requests from more than one socket.		2	2
132	0	SB_TCPIP_MultiService		False (0)	False (0)	True (1)		bool32		

Table 18.23: Parameter list – Device administration

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
132	1	ReplyDelay	ms	0	0	65535	Delay time for service reply telegram	uint16		
133	0	SB_TCPIP_ChannelTimeout	ms	240000	3000	3600000	Timeout after that socket is closed, if there is no incoming or outgoing data	uint32	2	2
134	0	SB_TCPIP_Connections		0	0	1	Ethernet communication counter	uint8	0	5
135	0	SB_TCPIP_BufferSize		1452	350	8000	TCPIP service bus buffer size. Changes take effect after restart.	uint32	2	2
SUBJECT AREA		IP address					IP address		0	0
544		DV_CAL_MAC					MAC address		0	4
544	0	DV_CAL_MAC		0	0	255	Byte 0 (LSB)	uint8		
544	1	DV_CAL_MAC		20	0	255	Byte 1	uint8		
544	2	DV_CAL_MAC		29	0	255	Byte 2	uint8		
544	3	DV_CAL_MAC		0	0	255	Byte 3	uint8		
544	4	DV_CAL_MAC		0	0	255	Byte 4	uint8		
544	5	DV_CAL_MAC		1	0	255	Byte 5 (MSB)	uint8		
15		DV_Network					Network configuration		0	2
15	0	IpAddress		3232245509	0	4294967295		uint32		
15	1	SubNetMask		4294967040	0	4294967295	Subnet mask for standard Ethernet mode	uint32		
15	2	DefGateway		0	0	4294967295		uint32		

Table 18.23: Parameter list – Device administration (continue)

## 20.19 Device drive data

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Drive data					Electronic drive controller rating plate		0	0
21	0	DV_BiosVersion					BIOS version	string	0	5
22	0	DV_BiosVersionId		0	0	128	BIOS version ID	uint32	1	5
1	0	DV_DeviceId		0	0	4294967295	Device ID	uint32	0	5
2	0	DV_DeviceName		SO_CM_X.xxxx.xxxx			Device name	string	0	4
3	0	DV_DeviceAliasName					Device name alias	string	2	2
4	0	DV_SwVersion					Firmware version	string	0	5
5	0	DV_DeviceFamilyName		SystemOne CM			Device series name	string	0	5
6	0	DV_SwVersionId		0	0	128	Software version number	uint32	1	5
7		DV_SwModulVersion					Software versions of the individual modules		0	5
7	0	Device		13558	0	4294967295	Software version of the entire device	uint32		
7	1	Parameter meta data		12000	0	4294967295	Software version of metadata exchange of parameters	uint32		
7	2	Digital scope		11000	0	4294967295	Software version of Scope interface	uint32		
7	3	File system		20000	0	4294967295	Software version of the internal file system	uint32		
8	0	DV_VendorName		KEBA			Name of device manufacturer	string	0	5
9	0	DV_SerialNumber					Device (int.) Serial number	string	0	4
10	0	DV_OEM_SerialNumber					Device OEM serial number	string	0	4
11	0	DV_ArticleNumber					Device part number	string	0	4
12		DV_AxisAlias					Name of individual axis		2	2
12	0	DV_AxisAlias						string		
12	1	DV_AxisAlias						string		
12	2	DV_AxisAlias						string		
17		DV_HwVersion					Hardware version		0	5
17	0	Revision		UNKNOWN (0)	UNKNOWN (0)	REV_3 (4)		uint8		
17	1	Variant		0	0	4294967295		uint32		
17	2	Partnumber					Control board part number	string		
19		DV_HMI					LED control word		0	2
19	0	KeyPad		0	0	65535	Yellow LED	uint16		
19	1	LedCtrl		0	0	65535	LED on axis flashing	uint16		

Table 18.24: Parameter list – Device drive data

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
50		DV_PSTC_Info					Power stage controller information		0	5
50	0	C0_ID		0	0	65535	Controller #0 Silicon ID	uint16		
50	1	C0_SW		0	0	65535	Controller #0 Software Version	uint16		
50	2	C0_CHK		0	0	65535	Controller #0 Software Checksum	uint16		
50	3	C1_ID		0	0	65535	Controller #1 Silicon ID	uint16		
50	4	C1_SW		0	0	65535	Controller #1 Software Version	uint16		
50	5	C1_CHK		0	0	65535	Controller #1 Software Checksum	uint16		
51		DV_IdentVal					Hardware identification		0	5
51	0	PST0	V	0	-3.4E+38	3.4E+38	Power stage 0 identification	float32		
51	1	PST1	V	0	-3.4E+38	3.4E+38	Power stage 1 identification	float32		
546	0	DV_OEM_VendorId		52922	0	4294967295	Customer-spec. Vendor ID	uint32	0	5
547		DV_OEM_ProductCode					Customer-spec. Product-Code		0	5
547	0	DV_OEM_ProductCode		92719	0	4294967295		uint32		
547	1	DV_OEM_ProductCode		93285	0	4294967295		uint32		
547	2	DV_OEM_ProductCode		92717	0	4294967295		uint32		
550	0	DV_OEM_RevisionNumber		65536	0	4294967295	Customer specific revision number (part of OEM-dataset)	uint32	0	5
551		DV_CAL_ProdData					Production data – for internal use only		0	4
551	0	Bits		0	0	4294967295		uint32		
551	1	Info						string		

Table 18.24: Parameter list – Device drive data (continue)



## 20.20 Device status

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Device status					Current drive status		0	0
280	0	MPRO_INPUT_SysState		0	0	4294967295	Status of digital inputs	uint32	0	5
200	0	MPRO_DRVCOM_SystemState		0	0	4294967295	DriveCom: System state	uint32	0	5
281	0	MPRO_INPUT_SysAllStatus		0	0	4294967295	DriveCom system status	uint32	0	5

Table 18.25: Parameter list – Device status

## 20.21 Device actual values

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Actual values					Status / values selection		0	0
280	0	MPRO_INPUT_SysState		0	0	4294967295	Status of digital inputs	uint32	0	5
46	0	MON_OperationTime	s	0	0	4294967295	Time	uint32	0	4
47		MON_HostTime					Localised system time. Must be set by host after every device restart		0	1
47	0	CUT_Seconds		0	0	4294967295	Writeable localised time which represents the number of seconds elapsed since 00:00:00 on January 1, 1900	uint32		
47	1	LongDateTimeString					Print out of date and time in the standard format	string		
47	2	CUT_ActSeconds		0	0	4294967295	Actual localised time which represents the number of seconds elapsed since 00:00:00 on January 1, 1900	uint32		
900		CON_TS					Control of sampling times		0	5
900	0	CCON_TS	ms	0.0625	-3.4E+38	3.4E+38	Current control scanning time	float32		
900	1	SCON_TS	ms	0.125	-3.4E+38	3.4E+38	Speed control scanning time	float32		
900	2	PCON_TS	ms	0.125	-3.4E+38	3.4E+38	Position control scanning time	float32		
900	3	IP_REF_TS	ms	1	-3.4E+38	3.4E+38	NC cycle time (setpoint)	float32		
900	4	RAMP_REF_TS	ms	1	-3.4E+38	3.4E+38	Scanning time in ramp mode	float32		
1000		MON_ActSystemValues					Monitoring: Actual values		0	5
1000	0	InteriorTemp	degC	0	-3.4E+38	3.4E+38	Device interior temperature	float32		
1000	1	VDC	V	0	-3.4E+38	3.4E+38	DC link voltage	float32		
1000	2	VDC_SYMM		0	-3.4E+38	3.4E+38	DC link symmetry value (0.5 = ideal)	float32		
1000	3	InverterTemp1	degC	0	-3.4E+38	3.4E+38	Temperature power stage 1	float32		
1000	4	InverterTemp2	degC	0	-3.4E+38	3.4E+38	Temperature power stage 2	float32		
1000	5	InverterTemp3	degC	0	-3.4E+38	3.4E+38	Temperature power stage 3	float32		

Table 18.26: Parameter list – Device actual values

## 20.22 Device supply

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Supply					Supply settings and status		0	0
SUBJECT AREA		Output							0	0
271	0	MPRO_OUTPUT_CT		0	0	65535	Supply unit: Control relay	uint16	0	2
270		MPRO_OUTPUT_FS					Supply unit: Relay selector		0	2
270	0	OUTPUT_X5		CT271 (18)	OFF (0)	_CT271 (19)	Supply unit: Relay X5 settings	uint16		
270	1	OUTPUT_X6		ERR (2)	OFF (0)	_CT271 (19)	Supply unit: Relay X6 settings	uint16		
SUBJECT AREA		DC link					Settings and actual values for DC voltage, DC switching, brake circuit, and axis readiness. Read the operating instructions.		0	0
713		SUPPLY_BrakeChopperGlobal					Braking resistor protection function settings		0	2
713	0	ExtIntSel		INT (0)	INT (0)	EXT_NOPROT (4)		uint16		
713	1	pxtlv	%	80	0	255	Braking resistor pxt: Warning threshold	uint8		
712		SUPPLY_BrakeChopperExternData					Description of external braking resistor		0	2
712	0	r_bce	Ohm	39	-3.4E+38	3.4E+38	Value of external braking resistor	float32		
712	1	pwste	W	150	-3.4E+38	3.4E+38	Rated power of braking resistor	float32		
712	2	pw1se	Ws	8000	-3.4E+38	3.4E+38	Maximum braking energy in short time	float32		
711	0	SUPPLY_DcLinkCoupling		NOCPL (0)	NOCPL (0)	CPLDIR (3)	DC-link coupling setting	uint8	0	2
602		PST_VoltageSupply					Voltage supply data		0	2
602	0	NomVoltage	Vdc	565	0	3.4E+38	Nominal voltage	float32		
602	1	SupplySel		User (0)	User (0)	3x480 (4)	Voltage supply selection	uint16		
602	2	Phase		three-phase (1)	single-phase (0)	three-phase (1)	Number of phases	uint8		
602	3	WideRange		OFF (0)	OFF (0)	ON (1)	Enables autodetection of mains voltage in range 380 to 480V	uint8		
201	0	MPRO_DRVCOM_Supply		STD (0)	STD (0)	ALONE (1)	DriveCom: Supply unit	uint16	2	2
200	0	MPRO_DRVCOM_SystemState		0	0	4294967295	DriveCom: System state	uint32	0	5
653		SUPPLY_BrakeChopperInternData					Description of internal braking resistor.		0	4
653	0	r_bci	Ohm	0	-3.4E+38	3.4E+38	Value of internal braking resistor	float32		
653	1	pwsti	W	0	-3.4E+38	3.4E+38	Rated power of braking resistor	float32		
653	2	pw1si	Ws	0	-3.4E+38	3.4E+38	Maximum braking resistor energy (power * time)	float32		

Table 18.27: Parameter list – Device supply

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Debug					Do not use		0	0
705		SUPPLY_WritePara					Supply unit control values		0	2
705	0	para1		1	0	65535	Number of read accesses	uint16		
705	1	para2		0	0	65535	Number of write accesses	uint16		
705	2	estatW		0	0	65535	Warning bitmask	uint16		
705	3	estatF		0	0	65535	Bitmask error, in case of matching with corresponding status Bit, error is generated	uint16		
705	4	estatV		0	0	65535	Bitmask precharging, in case of matching with corresponding status Bit, precharging relays are released	uint16		
705	5	astatW		0	0	65535	Bitmask warning, in case of matching with corresponding status Bit, warning is generated	uint16		
705	6	astatF		0	0	65535	Bitmask error	uint16		
705	7	astatV		0	0	65535	Bitmask precharging	uint16		
705	8	tstatW		0	0	65535	Bitmask warning, in case of matching with corresponding status Bit, warning is generated	uint16		
705	9	tstatF		0	0	65535	Bitmask error, in case of matching with corresponding status Bit, error is generated	uint16		
705	10	tstatV		0	0	65535	Bitmask precharging, in case of matching with corresponding status Bit, precharging relays are released	uint16		
705	11	twvse	deg c	0	-32768	32767	VSE interior temperature warning threshold	int16		
705	12	twcnt	deg c	0	-32768	32767	24V supply interior temperature warning threshold	int16		
705	13	tw_kk	deg c	0	-32768	32767	24V supply HS temperature warning threshold	int16		
705	14	rese		0	0	255	VSE error reset	uint8		
705	15	seven		0	0	65535	Password	uint16		
1003	0	MON_UnderVoltTime	ms	0	0	2000	Delay from undervoltage to shutdown of the controller	uint32	0	2
704		SUPPLY_SlowPara					Supply unit actual values (slow)		0	5
704	0	para1		0	0	65535	Number of read accesses	uint16		
704	1	ErPar		0	0	65535	Extended error information	uint16		
704	2	t_vse	deg c	0	-32768	32767	VSE temperature	int16		
704	3	t_snt	deg c	0	-32768	32767	24V supply temperature	int16		
704	4	t_kk	deg c	0	-32768	32767	Power stage temperature	int16		
704	5	u_24v	10 mV	0	0	65535	24V voltage (10mV resolution)	uint16		
704	6	U_EffU	V	0	-32768	32767	Eff. voltage L1 - L2	int16		
704	7	U_EffV	V	0	-32768	32767	Eff. voltage L2 - L3	int16		
704	8	U_EffW	V	0	-32768	32767	Eff. voltage L3 - L1	int16		

Table 18.27: Parameter list – Device supply (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
704	9	I_EffU	10 mArms	0	-32768	32767	Mains current in L1 (10mA resolution)	int16		
704	10	I_EffV	10 mArms	0	-32768	32767	Mains current in L2 (10mA resolution)	int16		
704	11	I_EffW	10 mArms	0	-32768	32767	Mains current in phase L3 (10mArms resolution)	int16		
704	12	Zk_M	V	0	-32768	32767	DC link voltage	int16		
704	13	I_Lade	10 mA	0	-32768	32767	DC-link charging current (10mA resolution)	int16		
704	14	i2tdv	%	0	0	65535	Current level (in % of rated current)	uint16		
704	15	tebci	deg c	0	-32768	32767	Not used	int16		
704	16	MaxPdV_L1	V	0	-32768	32767	Max. voltage in L1 (last mains period)	int16		
704	17	MaxPdV_L2	V	0	-32768	32767	Max. voltage in L2 (last mains period)	int16		
704	18	MaxPdV_L3	V	0	-32768	32767	Max. voltage in L3 (last mains period)	int16		
704	19	MaxPhSpg	V	0	-32768	32767	Max. voltage in L1 / 2 / 3 (last mains period)	int16		
704	20	ptime	us	0	0	65535	Mains period time (in microseconds)	uint16		
704	21	I_EffZk	10 mArms	0	0	65535	DC-link current (10mA resolution)	uint16		
704	22	DC_Pow	W	0	0	65535	VSE power	uint16		
704	23	BcPower	W	0	0	65535	Current power loss in braking resistor	uint16		
704	24	I_BW	10 mA	0	-32768	32767	Braking resistor current (10mA resolution)	int16		
704	25	R_BrC	Ohm	0	0	65535	Value of internal braking resistor measured during precharging time	uint16		
704	26	tscur	us	0	0	65535	Time shift between mains voltage and current phase	uint16		
704	27	oczkt	us	0	0	65535	Time until overcurrent causes error	uint16		
704	28	ErrNum		0	0	255	VSE error number (internal)	uint8		
704	29	ErrLoc		0	0	255	VSE error location (internal)	uint8		
704	30	sntzk		No_DC_Link (0)	No_DC_Link (0)	NoSNT (8)	DC-link 24V supply identification	uint8		
704	31	VsuConfig		0	0	255	Configuration of supply unit, as configured in EEPROM	uint8		
704	32	i2tl1	%	0	-3.4E+38	3.4E+38	I2T L1 current level	float32		
704	33	i2tl2	%	0	-3.4E+38	3.4E+38	I2T L2 current level	float32		
704	34	i2tl3	%	0	-3.4E+38	3.4E+38	I2T L3 current level	float32		
704	35	pxtbc	%	0	0	255	Actual pxt level of brake chopper overload	uint8		

Table 18.27: Parameter list – Device supply (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
704	36	EepSize		INVALID (0)	INVALID (0)	EEP256 (2)	Vsu Eeprom size, 128 or 256 Byte	uint8		
704	37	VsuCap	F	0	-3.4E+38	3.4E+38	DC link capacity of the group, measured in the pre-charging phase	float32		
704	38	PowArith	W	0	0	65535	average dc - link power consumption over one slowPara Cycle	uint16		
704	39	sernr					Serial number of the VSU	string		
704	40	top	h	0	0	4294967295	Operating time of the VSU	uint32		
703		SUPPLY_FastPara					Supply unit parameter (fast!)		0	5
703	0	para1		0	0	65535	Number of read accesses	uint16		
703	1	para2		0	0	65535	reserved	uint16		
703	2	Wrm		0	0	65535	Warning / error bits	uint16		
703	3	estatS		0	0	65535	Status bits: Internal information	uint16		
703	4	astatS		0	0	65535	Status bits: Mains voltage / DC-link / precharging / braking resistor	uint16		
703	5	tstatS		0	0	65535	Status bits: Temperatures / I2T / auxiliary voltages	uint16		
701		SUPPLY_Status					Supply unit status		0	5
701	0	Connected		0	0	255	Supply unit controlled by axis..	uint8		
701	1	SlaveQuantity		0	0	65535	Number of connected slave devices	uint16		
700		SUPPLY_Control					Basic supply unit functions		2	2
700	0	General		None (0)	None (0)	reserved (16)	Control word: Gen. functions	uint8		
700	1	FwDownload		None (0)	None (0)	LoadCrc (5)	Control word: Firmware download to supply unit	uint8		
700	2	DataDownload		None (0)	None (0)	reserved (4)	Control word: Data download to supply unit	uint8		
700	3	State		None (0)	Error3 (-3)	WaitCyclicRestarted (7)	Status word: Control functions	int8		
613		PST_VoltageLevels					Axis module voltage level		0	5
613	0	DCUV	V	0	0	10000	DC-link undervoltage	float32		
613	1	DCOK	V	0	0	10000	DC-link OK	float32		
613	2	DCOV	V	0	0	10000	DC-link overvoltage	float32		
613	3	CHOP	V	0	0	10000	Braking chopper threshold	float32		
613	4	RELAY	V	0	0	10000	Relay	float32		
702		SUPPLY_Information					Supply unit version		0	5
702	0	SwVersion					Software version number	string		
702	1	BsCrc		0	0	65535	BIOS checksum	uint16		

Table 18.27: Parameter list – Device supply (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
702	2	PgCrc		0	0	65535	Program checksum	uint16		
702	3	pwrgrp		BG1_10KW (0)	BG1_10KW (0)	Value_255 (255)	Rated power	uint8		
702	4	revve		145x_810_0 (0)	145x_810_0 (0)	Value_255 (255)	Control hardware version	uint8		
702	5	revsn		1451_820_0 (0)	1451_820_0 (0)	Value_255 (255)	24V supply hardware version	uint8		
702	6	typcd		0	- 2147483648	2147483647	Type coding	int32		

Table 18.27: Parameter list – Device supply (continue)

## 20.23 Device safety

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
150		DV_SAFETY_Channel1					Values of safety controller D8027		0	5	2096	
150	0	CH1_STO1_state		RESET (0)	RESET (0)	ERSTAT15 (15)	STO1 Status info	uint8			2096	0001
150	1	CH1_STO2_state		RESET (0)	RESET (0)	ERSTAT15 (15)	STO2 Status info	uint8			2096	0002
150	2	CH1_SBC_state		RESET (0)	RESET (0)	ERSTAT15 (15)	Brake status	uint8			2096	0003
150	3	CH1_STO1_fail		NOERR (0)	NOERR (0)	UNUSED15 (15)	Error status STO1	uint8			2096	0004
150	4	CH1_STO2_fail		NOERR (0)	NOERR (0)	UNUSED15 (15)	Error status STO2	uint8			2096	0005
150	5	CH1_SBC_fail		NOERR (0)	NOERR (0)	WTG (15)	Brake error status	uint8			2096	0006
150	6	CH1_global_fail		0	0	255	Gen. error register	uint8			2096	0007
150	7	CH1_hw_chan		0	0	255	Channel number	uint8			2096	0008
150	8	CH1_rst_reg		0	0	255	Reset register	uint8			2096	0009
150	9	CH1_mode		0	0	255	Mode	uint8			2096	000A
150	10	CH1_chks1		0	0	65535	Controller 1 checksum	uint16			2096	000B
150	11	CH1_chks2		0	0	65535	Controller 2 checksum	uint16			2096	000C
150	12	CH1_cdate		0	0	4294967295	Compilation date	uint32			2096	000D
150	13	CH1_hdate		0	0	4294967295	Hex file date	uint32			2096	000E
150	14	CH1_version		0	0	4294967295	FW version	uint32			2096	000F
150	15	CH1_feature		0	0	255	FW status	uint8			2096	0010
151		DV_SAFETY_Channel2					Values of safety controller D8026		0	5	2097	
151	0	CH2_STO1_state		RESET (0)	RESET (0)	ERSTAT15 (15)	STO1 Status info	uint8			2097	0001
151	1	CH2_STO2_state		RESET (0)	RESET (0)	ERSTAT15 (15)	STO2 Status info	uint8			2097	0002
151	2	CH2_SBC_state		RESET (0)	RESET (0)	ERSTAT15 (15)	Brake status	uint8			2097	0003
151	3	CH2_STO1_fail		NOERR (0)	NOERR (0)	UNUSED15 (15)	Error status STO1	uint8			2097	0004

Table 18.28: Parameter list – Device safety



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
151	4	CH2_STO2_fail		NOERR (0)	NOERR (0)	UNUSED15 (15)	Error status STO2	uint8			2097	0005
151	5	CH2_SBC_fail		NOERR (0)	NOERR (0)	WTG (15)	Brake error status	uint8			2097	0006
151	6	CH2_global_fail		0	0	255	Gen. error register	uint8			2097	0007
151	7	CH2_hw_chan		0	0	255	Channel number	uint8			2097	0008
151	8	CH2_rst_reg		0	0	255	Reset register	uint8			2097	0009
151	9	CH2_mode		0	0	255	Mode	uint8			2097	000A
151	10	CH2_chks1		0	0	65535	Controller 1 checksum	uint16			2097	000B
151	11	CH2_chks2		0	0	65535	Controller 2 checksum	uint16			2097	000C
151	12	CH2_cdate		0	0	4294967295	Compilation date	uint32			2097	000D
151	13	CH2_hdate		0	0	4294967295	Hex file date	uint32			2097	000E
151	14	CH2_version		0	0	4294967295	Firmware version, bit 8..15->patchlevel, bit 16..23->minor version, bit 24..31 major version number	uint32			2097	000F
151	15	CH2_feature		0	0	255	FW status	uint8			2097	0010
155		DV_SAFETY_Error_Info_SR1					Error information from safety controller SR1		0	5	209B	
155	0	DV_SAFETY_Error_Info_SR1		0	- 2147483648	2147483647	Error code	int32			209B	0001
155	1	DV_SAFETY_Error_Info_SR1		0	- 2147483648	2147483647	Row	int32			209B	0002
155	2	DV_SAFETY_Error_Info_SR1		0	- 2147483648	2147483647	File ID	int32			209B	0003
155	3	DV_SAFETY_Error_Info_SR1		0	- 2147483648	2147483647	Additional information	int32			209B	0004
156		DV_SAFETY_Error_Info_SR2					Error information from safety controller SR2		0	5	209C	
156	0	DV_SAFETY_Error_Info_SR2		0	- 2147483648	2147483647	Error code	int32			209C	0001
156	1	DV_SAFETY_Error_Info_SR2		0	- 2147483648	2147483647	Row	int32			209C	0002
156	2	DV_SAFETY_Error_Info_SR2		0	- 2147483648	2147483647	File ID	int32			209C	0003
156	3	DV_SAFETY_Error_Info_SR2		0	- 2147483648	2147483647	Additional information	int32			209C	0004
183		SDC_DiagData					SDC option diagnostics data		0	5	20B7	
183	0	SDC_State		Undefined (0)	Undefined (0)	Undefined4 (15)	State of SDC option	uint16			20B7	0001

Table 18.28: Parameter list – Device safety (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
183	1	SDC_AliveCnt		0	0	65535	Alive counter of SDC option	uint16			20B7	0002
129408		DeviceSafetyAddress					Safe device addresses		0	5	F980	
129408	0	NumberOfEntries		3	0	255	Number of subindices	uint8			F980	0001
129408	1	FSoE_AddressInst1		0	0	65535	FSoE address Instance 1	uint16			F980	0002
129408	2	FSoE_AddressInst2		0	0	65535	FSoE address Instance 2	uint16			F980	0003
129408	3	FSoE_AddressInst3		0	0	65535	FSoE address Instance 3	uint16			F980	0004
129408	4	FSoE_AddressInst4		0	0	65535	FSoE address Instance 4	uint16			F980	0005
132608	0	OperationStatusSDC		0	0	65535	SDC option operation status	uint16	0	5	22600	0000
132609	0	ErrorCodeSDC		0	0	65535	SDC option error code	uint16	0	5	22601	0000
SUBJECT AREA		State					State		0	0		
150		DV_SAFETY_Channel1					Values of safety controller D8027		0	5	2096	
150	0	CH1_STO1_state		RESET0 (0)	RESET0 (0)	ERSTAT15 (15)	STO1 Status info	uint8			2096	0001
150	1	CH1_STO2_state		RESET0 (0)	RESET0 (0)	ERSTAT15 (15)	STO2 Status info	uint8			2096	0002
150	2	CH1_SBC_state		RESET0 (0)	RESET0 (0)	ERSTAT15 (15)	Brake status	uint8			2096	0003
150	3	CH1_STO1_fail		NOERR0 (0)	NOERR0 (0)	UNUSED15 (15)	Error status STO1	uint8			2096	0004
150	4	CH1_STO2_fail		NOERR0 (0)	NOERR0 (0)	UNUSED15 (15)	Error status STO2	uint8			2096	0005
150	5	CH1_SBC_fail		NOERR0 (0)	NOERR0 (0)	WTG15 (15)	Brake error status	uint8			2096	0006
150	6	CH1_global_fail		0	0	255	Gen. error register	uint8			2096	0007
150	7	CH1_hw_chan		0	0	255	Channel number	uint8			2096	0008
150	8	CH1_rst_reg		0	0	255	Reset register	uint8			2096	0009
150	9	CH1_mode		0	0	255	Mode	uint8			2096	000A
150	10	CH1_chks1		0	0	65535	Controller 1 checksum	uint16			2096	000B
150	11	CH1_chks2		0	0	65535	Controller 2 checksum	uint16			2096	000C
150	12	CH1_cdate		0	0	4294967295	Compilation date	uint32			2096	000D
150	13	CH1_hdate		0	0	4294967295	Hex file date	uint32			2096	000E
150	14	CH1_version		0	0	4294967295	FW version	uint32			2096	000F
150	15	CH1_feature		0	0	255	FW status	uint8			2096	0010
152		DV_SAFETY_Status					Contains status information about STO and SBC		2	5	2098	
152	0	StateSTO		0	0	255	Safety torque off state of 3 axis	uint8			2098	0001

Table 18.28: Parameter list – Device safety (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
152	1	StateBrakeAllAxis		0	0	255	Brake status of all axes in one byte	uint8			2098	0002
152	2	StateDiag		0	0	255	failure state	uint8			2098	0003
183		SDC_DiagData					SDC option diagnostics data		0	5	20B7	
183	0	SDC_State		Undefined (0)	Undefined (0)	Undefined4 (15)	State of SDC option	uint16			20B7	0001
183	1	SDC_AliveCnt		0	0	65535	SDC option alive counter	uint16			20B7	0002
280	0	MPRO_INPUT_SysState		0	0	4294967295	Status of digital inputs	uint32	0	5	2118	0000
2310	0	MPRO_BRK_Lock_AX1		Off (0)	Off (0)	Open (2)	Axis 1: Vent brake man.	uint16	0	2	2906	0000
2313	0	MPRO_BRK_Status_AX1		0	0	4294967295	Axis 1: Motor brake status	uint32	0	5	2909	0000
2318	0	MPRO_OUTPUT_FS_MOTBRK_AX1		NONE (0)	NONE (0)	SDC (5)	Axis 1: Motor brake selector	uint16	0	2	290E	0000
4358	0	MPRO_BRK_Lock_AX2		Off (0)	Off (0)	Open (2)	Axis 2: Vent brake man.	uint16	0	2	3106	0000
4361	0	MPRO_BRK_Status_AX2		0	0	4294967295	Axis 2: Motor brake status	uint32	0	5	3109	0000
4366	0	MPRO_OUTPUT_FS_MOTBRK_AX2		NONE (0)	NONE (0)	SDC (5)	Axis 2: Motor brake selector	uint16	0	2	310E	0000
6406	0	MPRO_BRK_Lock_AX3		Off (0)	Off (0)	Open (2)	Axis 3: Vent brake man.	uint16	0	2	3906	0000
6409	0	MPRO_BRK_Status_AX3		0	0	4294967295	Axis 3: Motor brake status	uint32	0	5	3909	0000
6414	0	MPRO_OUTPUT_FS_MOTBRK_AX3		NONE (0)	NONE (0)	SDC (5)	Axis 3: Motor brake selector	uint16	0	2	390E	0000
129408		DeviceSafetyAddress					DeviceSafetyAddress		0	5	F980	
129408	0	NumberOfEntries		3	0	255	Number of subindices	uint8			F980	0001
129408	1	FSoE_AddressInst1		0	0	65535	FSoE address Instance 1	uint16			F980	0002
129408	2	FSoE_AddressInst2		0	0	65535	FSoE address Instance 2	uint16			F980	0003
129408	3	FSoE_AddressInst3		0	0	65535	FSoE address Instance 3	uint16			F980	0004
129408	4	FSoE_AddressInst4		0	0	65535	FSoE address Instance 4	uint16			F980	0005
132609	0	ErrorCodeSDC		0	0	65535	SDC option error code	uint16	0	5	22601	0000
SUBJECT AREA		Device encoder (redundant)							0	0		
3073	0	ENC_CH_SDCSel		CH1 (0)	CH1 (0)	CH3 (2)	Axis 1: Encoder channel selection for safe SDC position	uint16	0	2	2C01	0000
5121	0	ENC_CH_SDCSel		CH1 (0)	CH1 (0)	CH3 (2)	Axis 2: Encoder channel selection for safe SDC position	uint16	0	2	3401	0000
7169	0	ENC_CH_SDCSel		CH1 (0)	CH1 (0)	CH3 (2)	Axis 3: Encoder channel selection for safe SDC position	uint16	0	2	3C01	0000
SUBJECT AREA		Functional Input							0	0		
180		FunctionalInputs					Functional inputs of SafePLC		0	2	20B4	
180	0	FunctionalInputs0		0	0	255	Functional inputs (bits: 1...8) of SafePLC	uint8			20B4	0001
180	1	FunctionalInputs1		0	0	255	Functional inputs (bits: 9...16) of SafePLC	uint8			20B4	0002
180	2	FunctionalInputs2		0	0	255	Functional inputs (bits: 17...24) of SafePLC	uint8			20B4	0003
180	3	FunctionalInputs3		0	0	255	Functional inputs (bits: 25...32) of SafePLC	uint8			20B4	0004
193		FunctionalInputSelect					Special function for SDC bit Functional Input		0	2	20C1	

Table 18.28: Parameter list – Device safety (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
193	0	FunctionalInputSelect_1		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 1	uint8			20C1	0001
193	1	FunctionalInputSelect_2		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 2	uint8			20C1	0002
193	2	FunctionalInputSelect_3		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 3	uint8			20C1	0003
193	3	FunctionalInputSelect_4		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 4	uint8			20C1	0004
193	4	FunctionalInputSelect_5		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 5	uint8			20C1	0005
193	5	FunctionalInputSelect_6		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 6	uint8			20C1	0006
193	6	FunctionalInputSelect_7		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 7	uint8			20C1	0007
193	7	FunctionalInputSelect_8		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 8	uint8			20C1	0008
193	8	FunctionalInputSelect_9		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 9	uint8			20C1	0009
193	9	FunctionalInputSelect_10		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 10	uint8			20C1	000A
193	10	FunctionalInputSelect_11		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 11	uint8			20C1	000B
193	11	FunctionalInputSelect_12		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 12	uint8			20C1	000C
193	12	FunctionalInputSelect_13		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 13	uint8			20C1	000D
193	13	FunctionalInputSelect_14		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 14	uint8			20C1	000E
193	14	FunctionalInputSelect_15		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 15	uint8			20C1	000F
193	15	FunctionalInputSelect_16		OFF (0)	OFF (0)	AXIS3_WARN (23)	Special function for SDC bit Functional Input 16	uint8			20C1	0010
SUBJECT AREA		Functional Output							0	0		
181		FunctionalOutputs					Functional outputs of SafePLC		0	5	20B5	
181	0	FunctionalOutput0		0	0	255	Functional inputs (bits: 1...8) of SafePLC	uint8			20B5	0001
181	1	FunctionalOutput1		0	0	255	Functional inputs (bits: 9...16) of SafePLC	uint8			20B5	0002
181	2	FunctionalOutput2		0	0	255	Functional inputs (bits: 17...24) of SafePLC	uint8			20B5	0003

Table 18.28: Parameter list – Device safety (continue)

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
181	3	FunctionalOutput3		0	0	255	Functional inputs (bits: 25...32) of SafePLC	uint8			20B5	0004
181	4	FunctionalOutput4		0	0	255	Functional inputs (bits: 33...40) of SafePLC	uint8			20B5	0005
181	5	FunctionalOutput5		0	0	255	Functional inputs (bits: 41...48) of SafePLC	uint8			20B5	0006
181	6	FunctionalOutput6		0	0	255	Functional inputs (bits: 49...56) of SafePLC	uint8			20B5	0007
194		FunctionalOutputSelect					Special function for SDC bit Functional Output		0	2	20C2	
194	0	FunctionalOutputSelect_1		OFF (0)	OFF (0)	AXIS3_Halt (6)	Special function for SDC bit Functional Output bit 1	uint8			20C2	0001
194	1	FunctionalOutputSelect_2		OFF (0)	OFF (0)	AXIS3_Halt (6)	Special function for SDC bit Functional Output bit 2	uint8			20C2	0002
194	2	FunctionalOutputSelect_3		OFF (0)	OFF (0)	AXIS3_Halt (6)	Special function for SDC bit Functional Output bit 3	uint8			20C2	0003
194	3	FunctionalOutputSelect_4		OFF (0)	OFF (0)	AXIS3_Halt (6)	Special function for SDC bit Functional Output bit 4	uint8			20C2	0004
194	4	FunctionalOutputSelect_5		OFF (0)	OFF (0)	AXIS3_Halt (6)	Special function for SDC bit Functional Output bit 5	uint8			20C2	0005
194	5	FunctionalOutputSelect_6		OFF (0)	OFF (0)	AXIS3_Halt (6)	Special function for SDC bit Functional Output bit 6	uint8			20C2	0006
194	6	FunctionalOutputSelect_7		OFF (0)	OFF (0)	AXIS3_Halt (6)	Special function for SDC bit Functional Output bit 7	uint8			20C2	0007
194	7	FunctionalOutputSelect_8		OFF (0)	OFF (0)	AXIS3_Halt (6)	Special function for SDC bit Functional Output bit 8	uint8			20C2	0008

Table 18.28: Parameter list – Device safety (continue)

## 20.24 Device monitoring

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level	EtherCAT object ID	Index
1004	0	MON_Load_Device_CycleTime	s	0	0	600	Cycle time for workload analysis, 0 -> not active	uint32			23EC	0001
1005		MON_Load_Device_Values					actual device values of load monitoring		0	5	23ED	
1005	0	ThermalLoadVsu	%	0	0	65535	vsu rms grid max current (scope id 1937) over one period to vsu i2t current (see para 652-1) ratio	uint16			23ED	0001
1005	1	I2tUsageVsu	%	0	0	65535	maximum calculated rectifier temperature over ambient to rectifier max temperature	uint16			23ED	0002
1005	2	PeakLoadVsu	%	0	0	65535	vsu calculated rectifier temperature to max rectifier temperature ratio	uint16			23ED	0003
1005	3	VsuChopperLoadRatio	%	0	0	65535	"vsu avg chopper power (scope id 1935 or para 704-23) over one period to chopper pxt power (see para 712-1 or 653-1) ratio	uint16			23ED	0004
1005	4	VsuMaxChopperLoadRatio	%	0	0	65535	"vsu maximum chopper power (scope id 1935 or para 704-23) in one period to chopper pxt power (see para 712-1 or 653-1) ratio	uint16			23ED	0005
1005	5	PowToCap	%	0	0	65535	vsu rms load Current (scope id 1911 or para 704-21) at 560V to capacity (see para 704-34) ratio, 1kW / 100uF is 100%	uint16			23ED	0006
1005	6	ActualCycleTime	s	0	-3.4E+38	3.4E+38	Current measurement cycle	float32			23ED	0007

Table 18.29: Parameter list – Device monitoring

## 20.25 Digital oscilloscope device

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
SUBJECT AREA		Digital oscilloscope							2	2
508		DS_Settings					Digital scope settings		2	2
508	0	SamplingTime	ms	0	-3.4E+38	3.4E+38	Digital scope sampling time	float32		
508	1	RecordTime	ms	0	-3.4E+38	3.4E+38	Scope record time	float32		
508	2	RecordSize		4096	1024	32768	Number of recorded values	uint32		
508	3	AutoStartup		False (0)	False (0)	True (1)	Start scope on system startup	bool32		
508	4	SaveToFile		False (0)	False (0)	True (1)	Save scope record to CSV file	bool32		
509		DS_ChannelWhat					Digital scope: Signal selection		2	2
509	0	DS_ChannelWhat		0	0	32767		int16		
509	1	DS_ChannelWhat		0	0	32767		int16		
509	2	DS_ChannelWhat		0	0	32767		int16		
509	3	DS_ChannelWhat		0	0	32767		int16		
509	4	DS_ChannelWhat		0	0	32767		int16		
509	5	DS_ChannelWhat		0	0	32767		int16		
510		DS_ChannelID					Digital scope: Channel / signal ID		2	2
510	0	DS_ChannelID		0	0	32767		int16		
510	1	DS_ChannelID		0	0	32767		int16		
510	2	DS_ChannelID		0	0	32767		int16		
510	3	DS_ChannelID		0	0	32767		int16		
510	4	DS_ChannelID		0	0	32767		int16		
510	5	DS_ChannelID		0	0	32767		int16		
511		DS_State					Digital scope: state and command parameters		2	5
511	0	ScopeState		Off (0)	Off (0)	Ready (7)	Digital scope: state and command parameters	int16		
511	1	RecDataState		Ready (0)	Ready (0)	Updating (1)	Update record data state	uint16		
512	0	DS_ScopeTS	ms	0.0625	-3.4E+38	3.4E+38	Digital scope: Sampling time	float32	2	5
513	0	DS_RecordSize	Samples	0	0	4294967295	Digital scope: Recording time	uint32	2	5
514		DS_RecAddress					Select recorded data block for reading in DS_RecData		2	2
514	0	Channel		0	0	4294967295	Channel selection	uint32		
514	1	Block		0	0	4294967295	Block selection	uint32		
515		DS_RecData					Digital scope: Read data		2	5

Table 18.30: Parameter list – Digital oscilloscope device

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
515	0 to 127	DS_RecData		0	-2147483648	2147483647		int32		
518	0	DS_TrigMode		0	0	7	Digital scope: Trigger mode	int16	2	2
516	0	DS_TrigWhat		0	0	32767	Digital scope: Signal type	int16	2	2
517	0	DS_TrigID		0	0	32767	Digital scope: Signal type	int16	2	2
519	0	DS_TrigLevel		0	-3.4E+38	3.4E+38	Digital scope: Trigger level	float32	2	2
520	0	DS_PreTrig	%	10	-99	99	Digital scope: Pre-Trigger (negative=Post-Trigger)	float32	2	2
521	0	DS_TrigBit		-1	-1	31	Digital scope: Bit trigger	int16	2	2
522		DS_ChannelVal					Digital scope: Channel actual value		2	5
522	0	DS_ChannelVal		0	-3.4E+38	3.4E+38		float32		
522	1	DS_ChannelVal		0	-3.4E+38	3.4E+38		float32		
522	2	DS_ChannelVal		0	-3.4E+38	3.4E+38		float32		
522	3	DS_ChannelVal		0	-3.4E+38	3.4E+38		float32		
522	4	DS_ChannelVal		0	-3.4E+38	3.4E+38		float32		
522	5	DS_ChannelVal		0	-3.4E+38	3.4E+38		float32		
523	0	DS_Control		0	0	65535	Digital scope: Control word	uint16	2	2
524	0	DS_TrigBitEn		0	0	1	Digital scope: Bit trigger ON	int16	2	2
525		DS_ChannelSubID					Digital scope: Channel / signal ID		2	2
525	0	DS_ChannelSubID		0	0	32767		int16		
525	1	DS_ChannelSubID		0	0	32767		int16		
525	2	DS_ChannelSubID		0	0	32767		int16		
525	3	DS_ChannelSubID		0	0	32767		int16		
525	4	DS_ChannelSubID		0	0	32767		int16		
525	5	DS_ChannelSubID		0	0	32767		int16		
526	0	DS_TrigSubID		0	0	32767	Digital scope: Signal type	int16	2	2
527		DS_ChannelEn					Digital scope: Channel ON		2	2
527	0	DS_ChannelEn		0	0	1		int16		
527	1	DS_ChannelEn		0	0	1		int16		
527	2	DS_ChannelEn		0	0	1		int16		
527	3	DS_ChannelEn		0	0	1		int16		
527	4	DS_ChannelEn		0	0	1		int16		
527	5	DS_ChannelEn		0	0	1		int16		
528		DS_yAxis					Digital scope: Name of Y axis (in plot)		2	2
528	0	DS_yAxis		0	0	1		uint16		

Table 18.30: Parameter list – Digital oscilloscope device (continue)



P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
528	1	DS_yAxis		0	0	1		uint16		
528	2	DS_yAxis		0	0	1		uint16		
528	3	DS_yAxis		0	0	1		uint16		
528	4	DS_yAxis		0	0	1		uint16		
528	5	DS_yAxis		0	0	1		uint16		
507	0	DS_NumScopeVals		0	0	65535	Number of valid entries in ScopeVals	uint16	2	5

Table 18.30: Parameter list – Digital oscilloscope device (continue)

Table 18.31: Parameter list – Device control

P No.	Index	Name	Unit	Factory setting	Minimum	Maximum	Description	Data type	Read level	Write level
910	1	SpeedLimit	rpm	1	0	10000	Speed threshold for scaling	float32		
910	2	FilterZero	ms	10	0	100	Filter time for change from high to low speed	float32		
910	3	FilterHigh	ms	0	0	100	Filter time for change from low to high speed	float32		
910	4	KpScalePcon	%	100	0	1000	Position controller gain scaling	float32		
910	5	KpScaleSconConst	%	100	0	100000	Scale speed control mode permanently (e.g. adaptation to moment of inertia)	float32		
911		GANTRY_RefVal					Cyclical reference values for gantry mode		0	2
911	0	ScaleAxis1	%	100	0	65535	Scale torque for axis 1	uint16		
911	1	ScaleAxis2	%	100	0	65535	Scale torque for axis 2	uint16		

Table 18.31: Parameter list – Device control (continue)

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