



Automation by innovation.

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

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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.

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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 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) | HANDLING INSTRUCTIONS 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
Gewerbestr. 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



NOTE

- For detailed information on our services, please visit our website, 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. | Precautions to avoid injury and damage to property 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.

| WARNING! | Risk of injury posed by uncontrolled rotation! |
|-----------------|---|
| | Improper conduct can lead to serious injury or death. <ul style="list-style-type: none">• 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. |

| 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. <ul style="list-style-type: none">• 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. |

| | |
|---|--|
| CAUTION! | Damage to the device as a result of incorrect operation! |
|  | <p>Failure to exercise caution or follow proper working procedures may result in damage to the device.</p> <ul style="list-style-type: none"> 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). |

- 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

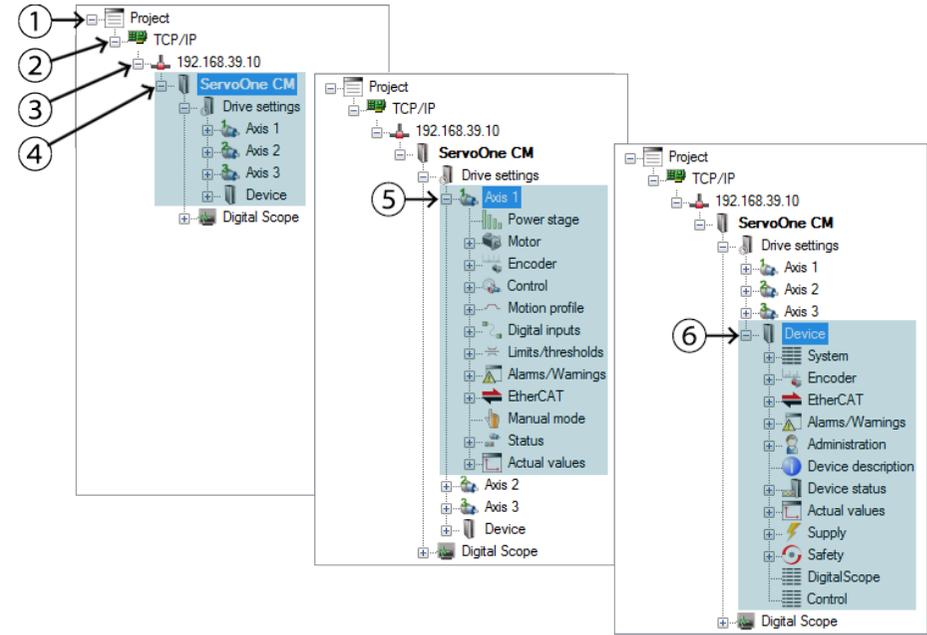
This chapter describes the basic procedure for parametrization of the Axis Controller ServoOne CM.

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 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.

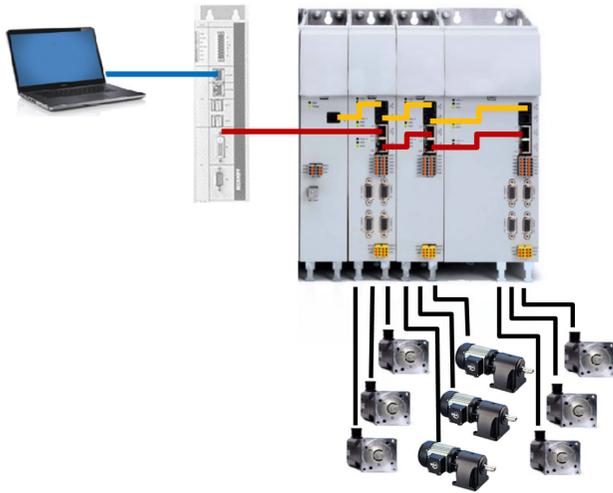


Fig. 3.1: EtherCAT Mode

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.

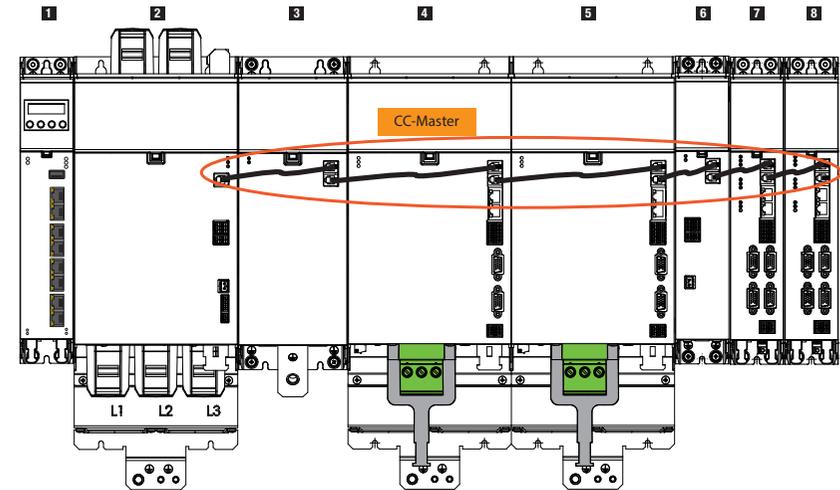
The EtherCAT® interfaces of the axis controllers must be set to the "service and diagnostics mode" in order to be able to establish a connection to the axis controllers via this interface using the PC and the installed DriveManager 5 even without a controller.



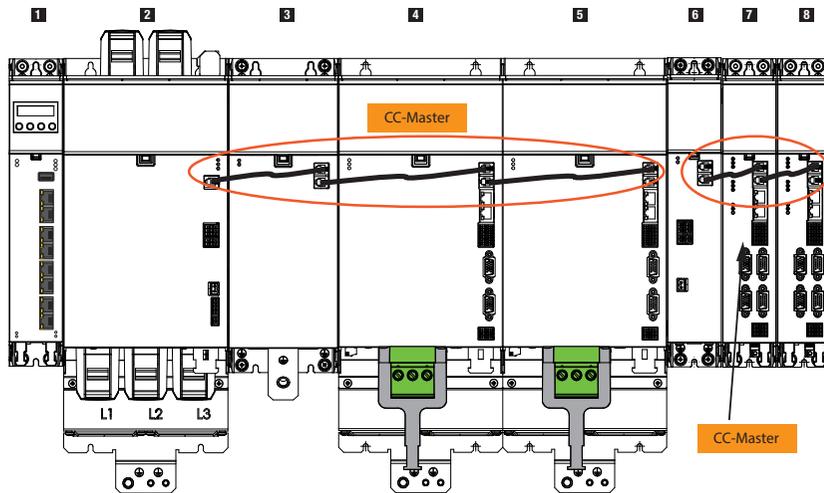
NOTE In order to activate the “service and diagnostics mode”, the first axis controller (cross communication master) on the right side of the power supply within the cross communication must be identified. Depending on the combination of with or without expansion or capacity modules and the necessary 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

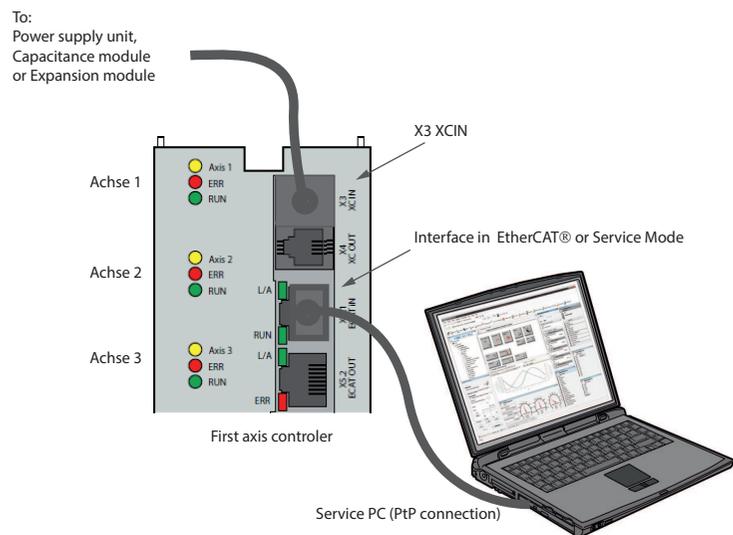
a one-time delay of the start-up operation by about 2 minutes. The loading of the firmware for the supply unit is indicated by the two supply unit LEDs blinking (0.5s/0.5s).

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 DriveManager:

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

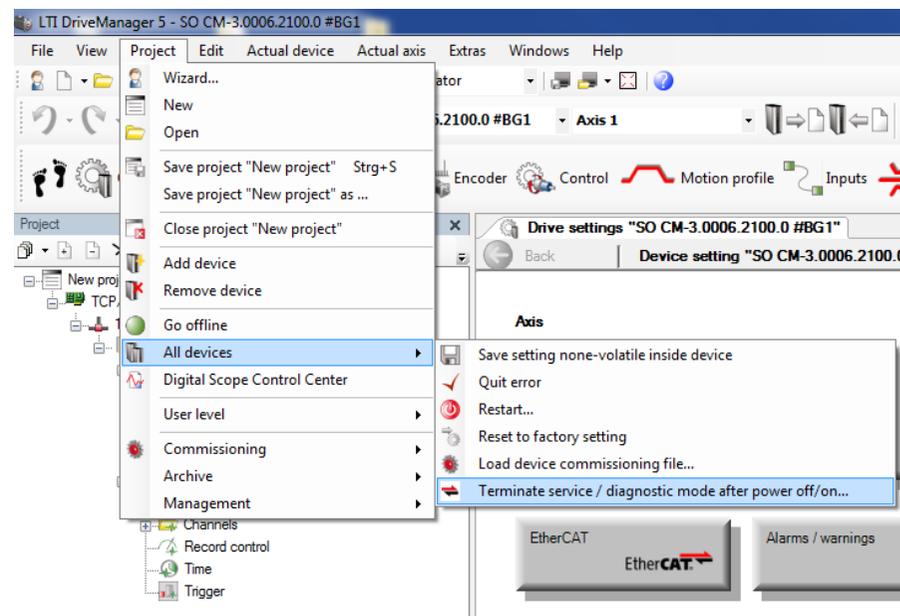


Fig. 3.2: Exiting the Service and Diagnostics mode

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.

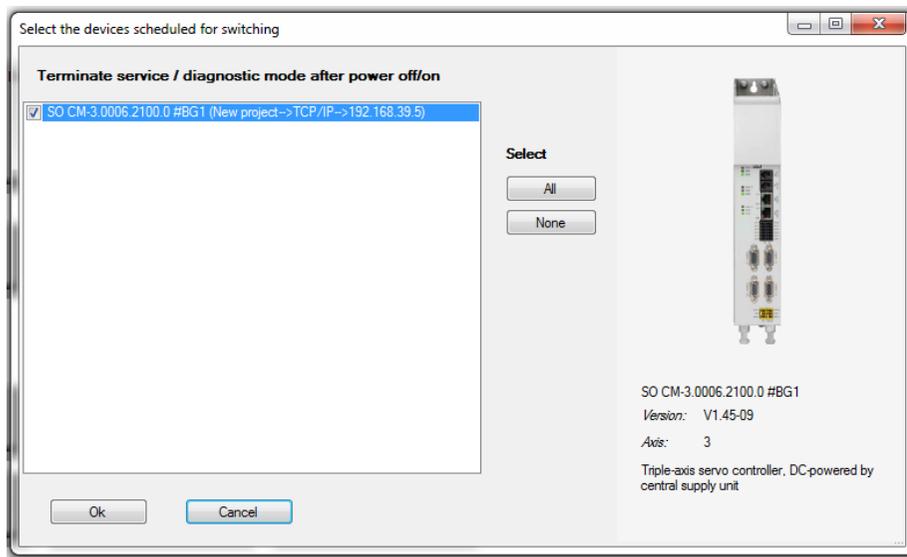


Fig. 3.3: Selection of the axes to be switched over

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.

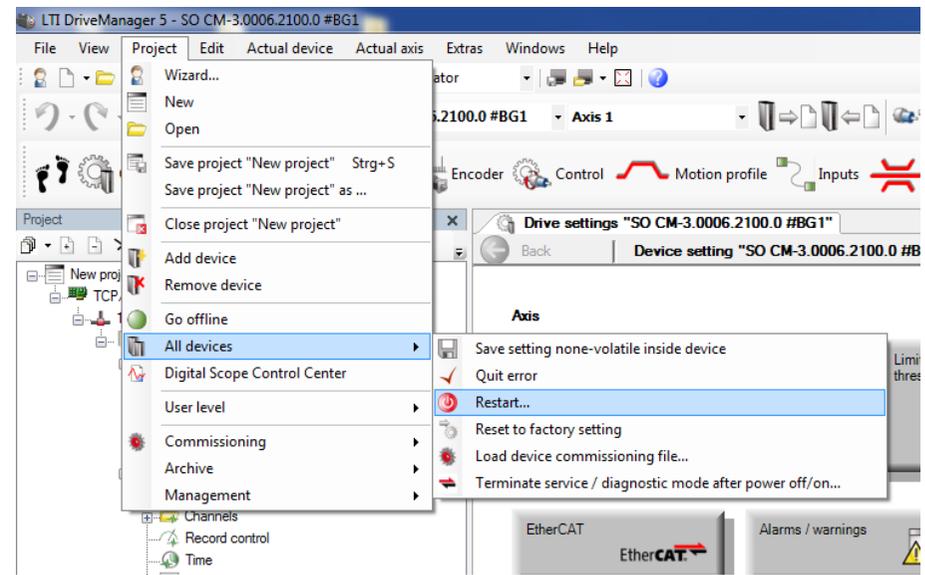


Fig. 3.4: Restart after selected switchover

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. | <ul style="list-style-type: none"> ►Menu ►Active device ►Reset to factory setting 1. Clicking ►Yes without ticking the checkbox resets the device to the factory settings without resetting the network settings. 2. Clicking ►Yes with the checkbox ticked resets the device to the factory settings including the network settings. 3. Clicking on ►No closes the window without a reset. |

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.

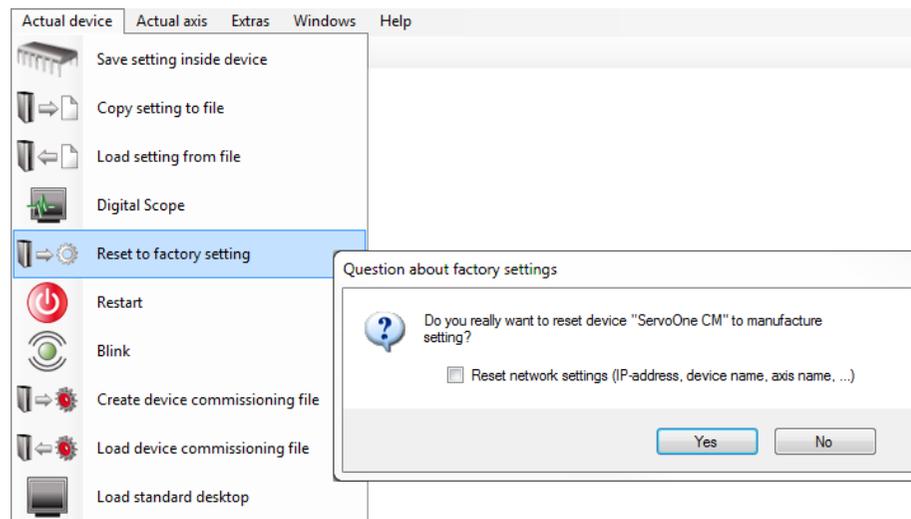


Fig. 3.5: Menu: Reset to factory settings

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 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.

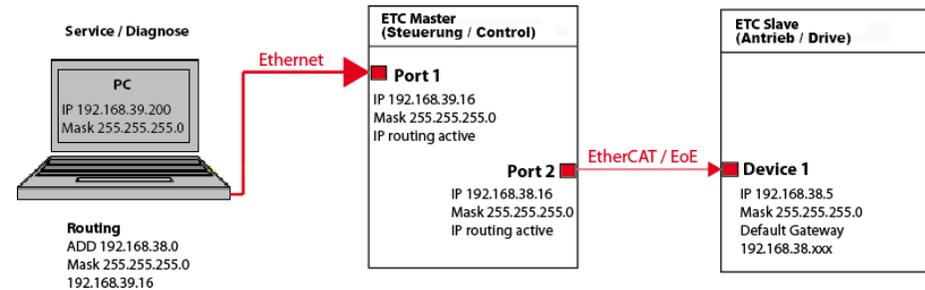


Fig. 3.6: EoE Routing configuration

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

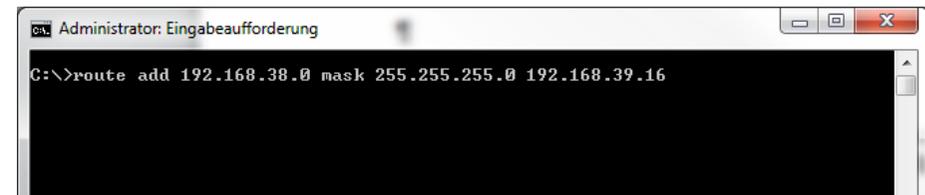


Fig. 3.7: Input prompt in cmd window

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.

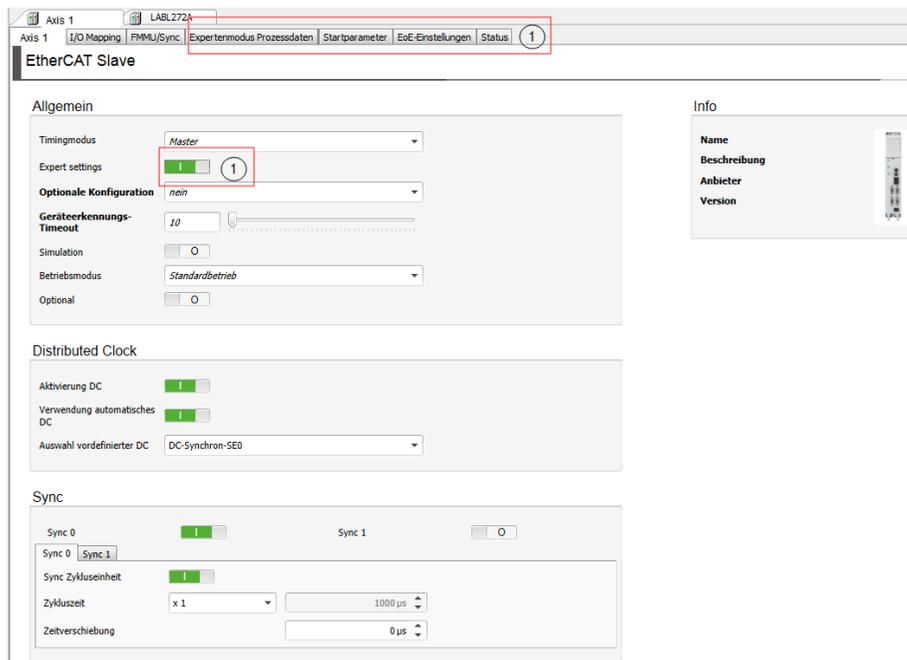
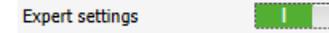


Fig. 3.8: "Expert setting"

- 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

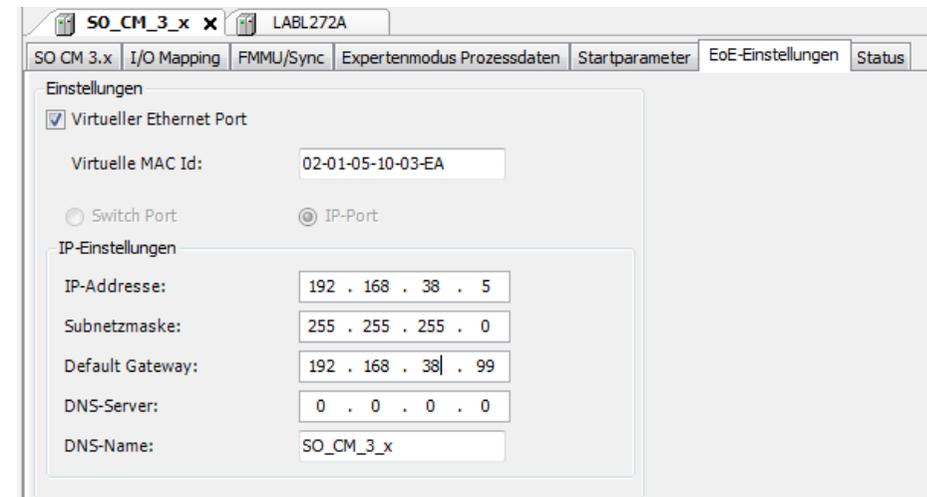


Fig. 3.9: Example for EoE settings

- **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.

3.5.4 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.

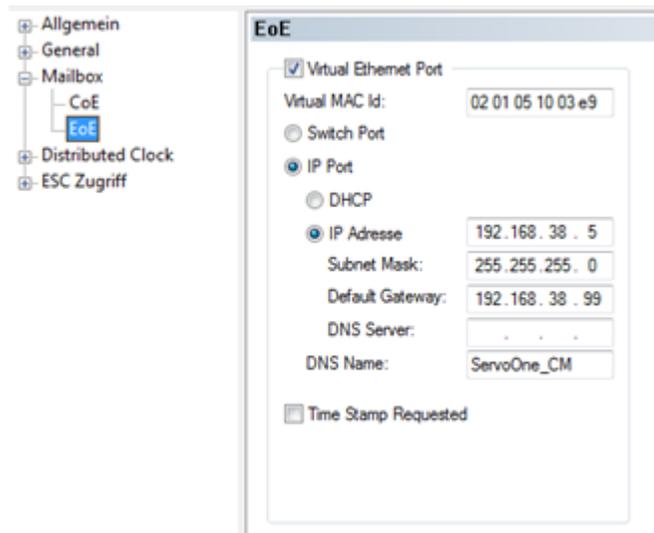


Fig. 3.10: Example: "Configuration of virtual Ethernet port" with a Beckhoff industrial PC.

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

| | | | |
|--------------------------|-------------------|-------------------|------|
| Device: | | Axis 1: | |
| Type: | SO_CM_X:xxxx:xxxx | Control mode: | PCON |
| Number of axis: | 3 | Operational mode: | None |
| Serial number: | | Motor: | |
| Device family: | ServoOne | Encoder: Torque | CH1 |
| Manufacturer: | | Speed | CH1 |
| | | Position | CH1 |
| Hardware: | | Axis 2: | |
| Control card Id: | SD0_REV_1 | Control mode: | PCON |
| | | Operational mode: | None |
| Software: | | Motor: | |
| SW-version: | V1.40-11 | Encoder: Torque | CH1 |
| BIOS version: | V10.25-03 | Speed | CH1 |
| | | Position | CH1 |
| Operational time: | | Axis 3: | |
| 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 unit36

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 connections Supply 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 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 | <input type="text" value="0"/> ms |
| 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 | <input type="text" value="56"/> | Ohm | Chopper efficiency: |
| Continuous power | <input type="text" value="75"/> | W | Actual value |
| Peak power for one second | <input type="text" value="1500"/> | Ws | <input type="text" value="0"/> % |
| | | | Prewarming threshold |
| | | | <input type="text" value="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 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 | A |
| 2. | 1911 | RmsCurrent | DC link average current | A |
| 2. | 1912 | i16Filter_ZK_ME | Rms current over one period | A |
| 2. | 1919 | I_LADE | DC Link voltage | V |
| 2. | 1920 | VsuPower | dc link current VsU | A |
| 3. | 1918 | i16Filter_I_BW | Power consumption on DC link | kW |
| 3. | 1933 | pxtbc_ram | Brake chopper current | A |
| 3. | 1907 | BcPower | Overload counter, brake chopper overload counter | % |
| 3. | 1935 | BcPowerFilter | brake chopper power | kW |
| 3. | | | 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.

Contents 5.1 Setting for the switching frequency42

5.1 Setting for the switching frequency

Selection of available switch frequencies

- 2 kHz
- 4 kHz
- 8 kHz
- 12 kHz
- 16 kHz

Settings for switching frequencies: 8kHz(2) = 8kHz switching frequency

Set mode for online switching frequency selection: ON(1) = Automatic switching frequency selection on

Characteristics of power stage:

| | |
|-------------------------------|----------------|
| Rated current of powerstage | 6 A |
| Maximal current of powerstage | 18 A for 0.5 s |

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 | $I_{Phasor} > 110\% I_{Max}$ | switch down to next possible switching frequency |
| | $I_{Phasor} < 110\% I_{Max}$ | switch up step by step after 2 s |
| Actual value monitoring of the current phasor < 5 Hz | $I_{Phasor} > I_{maxDC}$ | switch down to next possible switching frequency |
| | $I_{Phasor} < I_{maxDC}$ | switch up step by step after 2 s |
| $I^*t < 5 \text{ Hz}$ 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^*t 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 | 0 | CON_SwitchFreq | | Axis 1 / 2 / 3: Switching frequency setting |
| | | Mode | | Factory setting: ON |
| | | (0) OFF (1) ON | | Function not active Automatic Switching frequency switchover active. |
| 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) |
| | | 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) |
| 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) |
| 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 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

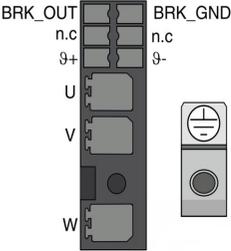
| | X12 X13 X14 | Function | Specification |
|--|--------------------------------|---|--|
| X12/X13/X14  | 1 (9+ / DSL-) 2 (9- / DSL+) | Motor temperature sensor connection or Hiperface DSL one-cable solution | Cross-section: 0.14 - 1.5 mm ² AWG 24-16 |
| | 3 (BRK_OUT) 4 (BRK_GND) | Connection of motor holding brake I _{br} = max. 2A | |
| | U / V / W | Motor phases connection | Cross-section: 6 mm ² 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: PSM(1) = Synchronous motor

Linear motor:

Calculate control settings subject to motor data sheet: Calculation

Calculate control settings subject to motor data identification: Identification

Further settings

Motor protection:

Motor brake:

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

Rated torque Nm OR Rated power kW

Motor inertia kg m*m Total inertia kg m*m

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

Stator resistance Ohm Lsd mH

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 (L_d) and the inductance of the cross axis (L_q) 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.

- a. Calculation
- b. 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"/> Vrms |

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 | Stator inductance ▶ See note! | |
| | | Lsd | <input type="text" value="10"/> mH <input type="button" value="Info ..."/> |
| Encoder | | 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 P 2991[3] - Mot_Lin_M and total weight of motor in P 2993[0] - SCD_MSum . |
| 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 inductance**

Stator resistance Ohm Lsd mH Info ...
 Encoder Lsq mH
 Encoder period nm

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 P 2991[3] - Mot_Lin_M and total weight of motor in P 2993[0] - SCD_MSum . |
| 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 m*m | 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: Ams Maximal current: Ams
 Rated speed: rpm Maximal speed: rpm
 Rated voltage: Vrms Rated frequency: Hz

Rated torque: Nm **OR** Rated power: kW

Motor inertia: kg m²m Total inertia: kg m²m

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 m*m | 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**.

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

| 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 | kgm ² | 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

Source

Maximum temperature (X5) (only KTY 84) degC

I²t monitoring

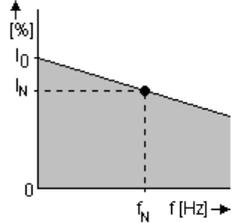
I²t type

Permitted continuous current:

Rated motor current (I_N) %

Rated motor frequency (f_N) Hz

1. current interpol. point (I₀) %



Point of switch off:

% I_N for s

Thermal time constant s

Fig. 6.7: Synchronous motor protection dialog box

Temperature monitoring:

Type:

Source:

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

It monitoring

It type:

Permitted continuous current:

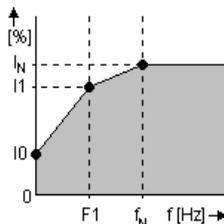
Rated motor current (IN): %

Rated motor frequency (fN): 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 | NOT for devices with the version Hiperface® DSL |
| 2 | Via digital protocol Hiperface® DSL (Channel 3 = Motor plug) | (0) MOTCON or (2) ENC_MCON * | ONLY for devices with the version Hiperface® 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

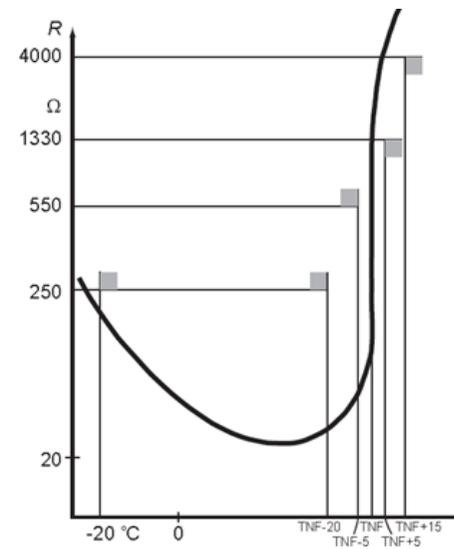


Fig. 6.9: Resistance diagram as function of the temperature of a DIN PTC

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

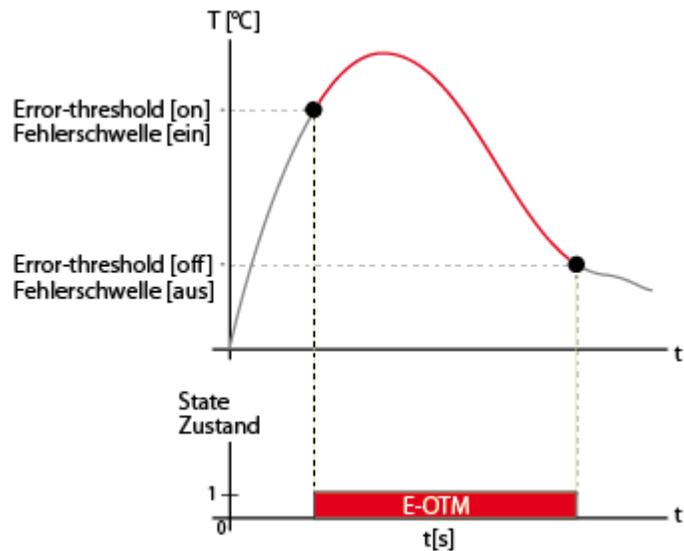


Fig. 6.10: Trigger diagram for the PTC evaluation (E-OTM = Error Overtemperature Motor)

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**.

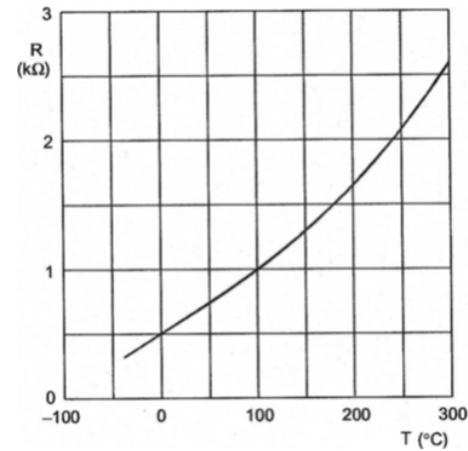


Fig. 6.11: Temperature curve KTY

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**

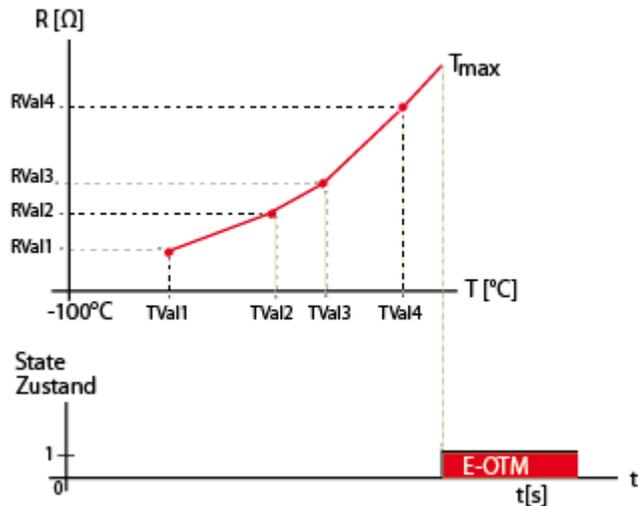


Fig. 6.12: Temperature curve "user" (E-OTM = Error Overtemperature Motor)

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 – I²t 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 – I²t characteristic curve (continue)

| | |
|-----------------|---|
| CAUTION! | Your system/motor may be damaged if put into operation in an uncontrolled or inappropriate manner. |
| | <p>Improper conduct can cause damage to your system / machine.</p> <ul style="list-style-type: none"> Motor protection can be parametrized. The user is responsible for adequate motor protection at all working points. 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. 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! |

6.7.2.1 I²t monitoring

Classical I²t 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] - IO**, **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] - MOT_CNom * 3050[1] INom * 3050[2] IO * 110 % |
| 2. | 3050.4 F1 | 2964[5] - MOT_CNom * 3050[1] INom * 3050[3] I1 * 110 % |
| 3. | 3050.5 FNom | 2964[5] - MOT_CNom * 3050[1] 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 KEBA motor data sets

in such a way that $I_0 > 100\%$. 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 $I_0 = 50\%$, $I_1 = 80\%$, $F1 = FNom/2$

The error reaction of the I²t monitoring system can be parametrized to a stop ramp.

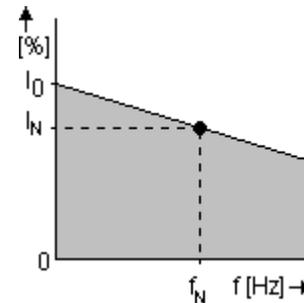


Fig. 6.13: I²t characteristic curve synchronous motor

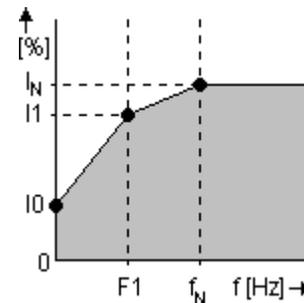


Fig. 6.14: I²t characteristic curve asynchronous motor



NOTE

- I²t 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_{act} represents the actual motor current, $i_{\text{nom}}(f)$ the characteristic curve value at the momentary rotational frequency; if $S(t)$ exceeds S_{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 – I²t 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 I²t. See Fig. 6.14: I²t 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 (I²t + Thermal)

The combination of I²t 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 I²t 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 I²t monitoring

The temperature-dependent I²t 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 I²t 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_{Max}** 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_{Max2}** 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 I²t motor protection apply. See Section "I²t monitoring" on page 63.

NOTE



- Above T2, the temperature characteristic of the motor protection can reach zero so that even without any current, an I²t 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] - Tmax** (see temperature sensor) to create properly defined conditions.

6.7.2.5 Combined model (temperature-dependent I²t+ thermal)

The combination of the temperature-dependent I²t 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_CMax**). The current motor current (**P 2967[2] - iphasor**) is compared with **MOT_CMax**.

As soon as **iphasor** exceeds 120 % of **MOT_CMax**, 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_Cmax** 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 in the DOCU-PORTAL.

| | |
|-----------------|--|
| CAUTION! | Your system/motor may be damaged if put into operation in an uncontrolled or inappropriate manner. |
| | <p>Improper conduct can cause damage to your system / machine.</p> <ul style="list-style-type: none"> • 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. |



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 is able to be moved.
 Ensure, that drive and motor don't make hazard before you continue operation!

Motor brake details

Torque rise time: ms (a)

Brake lift time: ms (b)

Brake close time: ms (c)

Torque fade time: ms (d)

Torque bias:

Constant start value: Nm

Factor (last torque bias): %

Last saved bias: Nm

$M(\text{soll}) = \text{Last saved bias} \times \text{Factor (last torque bias)} + \text{Constant start value}$
 $t(1), t(3) = \text{apply brake}$
 $t(2) = \text{release brake}$

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 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! |
|  | <p>Improper conduct can lead to serious injury or death.</p> <ul style="list-style-type: none"> 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. |

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.

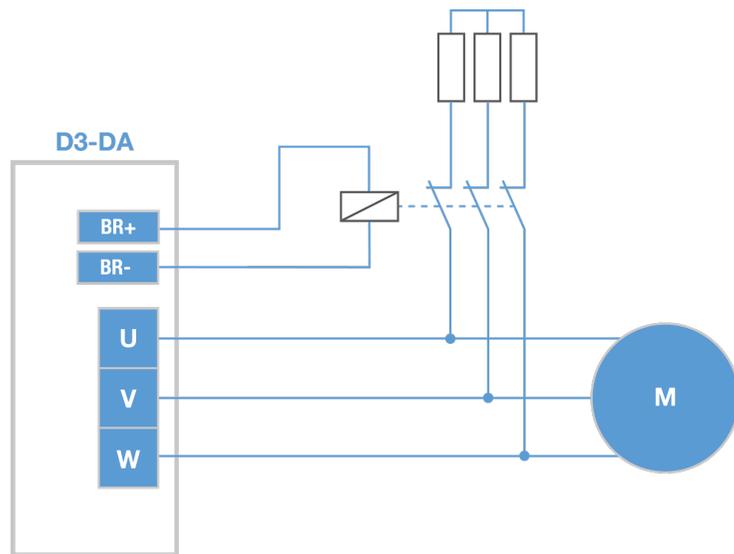


Fig. 6.16: Brake contactor

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.

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

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.

7.1.1 Single-axis controller

| Fig. | X7 Pin | SinCos and TTL | EnDat / SSI | HIPERFACE® | BISS ⁵⁾ | Resolver |
|-----------|--------|--------------------------------|-------------|-----------------------------|--------------------------------|------------------------|
| X7 | 1 | A- | | REFCOS | - | S3 / COS- (A-) |
| | 2 | A+ | | +COS | - | S1 / COS+ (A+) |
| | 3 | +5 V ³⁾ | | (+5 V ^{3) 4)} | +5 V ³⁾ | - |
| | 4 | R+ | | Data + | SL+ | - |
| | 5 | R- | | Data - | SL- | - |
| | 6 | B- | | REFSIN | - | S4 / SIN-(B-) |
| | 7 | (10 V / 110 mA ⁴⁾) | | 10 V / 110 mA | (10 V / 110 mA ⁴⁾) | |
| | 8 | GND | | | | - |
| | 9 | - | - | - | | R2 (Resolver excit.-) |
| | 10 | - | - | - | | R1 (Resolver excit. +) |
| | 11 | B+ | | +SIN | | S2 / SIN+ (B+) |
| | 12 | | | nc / Temp+ ^{1) 2)} | | |
| | 13 | | | nc / Temp- ^{1) 2)} | | |
| | 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 ⁶⁾ |
|-----------|--------|---------------------------------|------------------------|
| X8 | 1 | A- | S3 / COS- (A-) |
| | 2 | A+ | S1 / COS+ (A+) |
| | 3 | +5 V ³⁾ | - |
| | 4 | R+ | - |
| | 5 | R- | - |
| | 6 | B- | S4 / SIN-(B-) |
| | 7 | (10 V / 110 mA ^{4) 7)} | |
| | 8 | GND | |
| | 9 | - | R2 (Resolver excit.-) |
| | 10 | - | R1 (Resolver excit. +) |
| | 11 | B+ | S2 / SIN+ (B+) |
| | 12 | nc / Temp+ ^{1) 2)} | |
| | 13 | nc / Temp- ^{1) 2)} | |
| | 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 ⁵⁾ | Resolver | |
|-----------|--------|--------------------------------|-------------|-----------------------------|--------------------------------|----------------|------------------------|
| X7 | 1 | A- | | REFCOS | - | S3 / COS- (A-) | |
| | 2 | A+ | | +COS | - | S1 / COS+ (A+) | |
| | 3 | +5 V ³⁾ | | (+5 V ^{3) 4)} | +5 V ³⁾ | - | |
| | 4 | R+ | | Data + | SL+ | - | |
| | 5 | R- | | Data - | SL- | - | |
| | 6 | B- | | REFSIN | - | S4 / SIN-(B-) | |
| | 7 | (10 V / 110 mA ⁴⁾) | | 10 V / 110 mA | (10 V / 110 mA ⁴⁾) | | |
| | 8 | GND | | | | | - |
| | 9 | - | - | - | | | R2 (Resolver excit.-) |
| | 10 | - | - | - | | | R1 (Resolver excit. +) |
| | 11 | B+ | | +SIN | | | S2 / SIN+ (B+) |
| | 12 | | | nc / Temp+ ^{1) 2)} | | | |
| | 13 | | | nc / Temp- ^{1) 2)} | | | |
| | 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 ⁶⁾ | |
|-----------|--------|---------------------------------|------------------------|---|
| X8 | 1 | A- | S3 / COS- (A-) | |
| | 2 | A+ | S1 / COS+ (A+) | |
| | 3 | +5 V ³⁾ | - | |
| | 4 | R+ | - | |
| | 5 | R- | - | |
| | 6 | B- | S4 / SIN-(B-) | |
| | 7 | (10 V / 110 mA ^{4) 7)} | | |
| | 8 | GND | | - |
| | 9 | - | R2 (Resolver excit.-) | |
| | 10 | - | R1 (Resolver excit. +) | |
| | 11 | B+ | S2 / SIN+ (B+) | |
| | 12 | nc / Temp+ ^{1) 2)} | | |
| | 13 | nc / Temp- ^{1) 2)} | | |
| | 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 ⁵⁾ | Resolver | |
|-----------|--------|--------------------------------|-------------|------------------------|--------------------------------|----------------|------------------------|
| X9 | 1 | A- | | REFCOS | - | S3 / COS- (A-) | |
| | 2 | A+ | | +COS | - | S1 / COS+ (A+) | |
| | 3 | +5 V ³⁾ | | (+5 V ^{3) 4)} | +5 V ³⁾ | - | |
| | 4 | R+ | | Data + | SL+ | - | |
| | 5 | R- | | Data - | SL- | - | |
| | 6 | B- | | REFSIN | - | S4 / SIN-(B-) | |
| | 7 | (10 V / 110 mA ⁴⁾) | | 10 V / 110 mA | (10 V / 110 mA ⁴⁾) | | |
| | 8 | GND | | | | | - |
| | 9 | - | - | - | - | | R2 (Resolver excit.-) |
| | 10 | - | - | - | - | | R1 (Resolver excit. +) |
| | 11 | B+ | | +SIN | | | S2 / SIN+ (B+) |
| | 12 | nc / Temp+ ^{1) 2)} | | | | | |
| | 13 | nc / Temp- ^{1) 2)} | | | | | |
| | 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 7.5: Pin assignment of connector X9 (Enc1) **double-axis controller Axis 2**

| Fig. | X10 Pin | SinCos and TTL | Resolver ⁶⁾ | |
|------------|---------|--------------------------------|-----------------------------------|---|
| X10 | 1 | A- | S3 / COS- (A-) | |
| | 2 | A+ | S1 / COS+ (A+) | |
| | 3 | +5 V ³⁾ | - | |
| | 4 | R+ | - | |
| | 5 | R- | - | |
| | 6 | B- | S4 / SIN-(B-) | |
| | 7 | (10 V / 110 mA ⁴⁾) | (10 V / 110 mA ^{4) 7)}) | |
| | 8 | GND | | - |
| | 9 | - | R2 (Resolver excit.-) | |
| | 10 | - | R1 (Resolver excit. +) | |
| | 11 | B+ | S2 / SIN+ (B+) | |
| | 12 | nc / Temp+ ^{1) 2)} | | |
| | 13 | nc / Temp- ^{1) 2)} | | |
| | 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 ⁵⁾ | Resolver | |
|-----------|--------|--------------------------------|-------------|------------------------|--------------------------------|----------------|------------------------|
| X7 | 1 | A- | | REFCOS | - | S3 / COS- (A-) | |
| | 2 | A+ | | +COS | - | S1 / COS+ (A+) | |
| | 3 | +5 V ³⁾ | | (+5 V ^{3) 4)} | +5 V ³⁾ | - | |
| | 4 | R+ | | Data + | SL+ | - | |
| | 5 | R- | | Data - | SL- | - | |
| | 6 | B- | | REFSIN | - | S4 / SIN-(B-) | |
| | 7 | (10 V / 110 mA ⁴⁾) | | 10 V / 110 mA | (10 V / 110 mA ⁴⁾) | | |
| | 8 | GND | | | | | - |
| | 9 | - | | - | | | R2 (Resolver excit.-) |
| | 10 | - | | - | | | R1 (Resolver excit. +) |
| | 11 | B+ | | +SIN | | | S2 / SIN+ (B+) |
| | 12 | nc / Temp+ ^{1) 2)} | | | | | |
| | 13 | nc / Temp- ^{1) 2)} | | | | | |
| | 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 7.7: Pin assignment of connector X7 (Enc1) **three-axis controller Axis 1**

| Fig. | X8 Pin | SinCos and TTL | Resolver ⁶⁾ | |
|-----------|--------|-----------------------------------|------------------------|---|
| X8 | 1 | A- | S3 / COS- (A-) | |
| | 2 | A+ | S1 / COS+ (A+) | |
| | 3 | +5 V ³⁾ | - | |
| | 4 | R+ | - | |
| | 5 | R- | - | |
| | 6 | B- | S4 / SIN-(B-) | |
| | 7 | (10 V / 110 mA ^{4) 7)}) | | |
| | 8 | GND | | - |
| | 9 | - | R2 (Resolver excit.-) | |
| | 10 | - | R1 (Resolver excit. +) | |
| | 11 | B+ | S2 / SIN+ (B+) | |
| | 12 | nc / Temp+ ^{1) 2)} | | |
| | 13 | nc / Temp- ^{1) 2)} | | |
| | 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 ⁵⁾ | Resolver |
|-----------|--------|--------------------------------|-------------|------------------------|--------------------------------|------------------------|
| X9 | 1 | A- | | REFCOS | - | S3 / COS- (A-) |
| | 2 | A+ | | +COS | - | S1 / COS+ (A+) |
| | 3 | +5 V ³⁾ | | (+5 V ^{3) 4)} | +5 V ³⁾ | - |
| | 4 | R+ | | Data + | SL+ | - |
| | 5 | R- | | Data - | SL- | - |
| | 6 | B- | | REFSIN | - | S4 / SIN-(B-) |
| | 7 | (10 V / 110 mA ⁴⁾) | | 10 V / 110 mA | (10 V / 110 mA ⁴⁾) | |
| | 8 | GND | | | | - |
| | 9 | - | - | - | - | R2 (Resolver excit.-) |
| | 10 | - | - | - | - | R1 (Resolver excit. +) |
| | 11 | B+ | | +SIN | | S2 / SIN+ (B+) |
| | 12 | nc / Temp+ ^{1) 2)} | | | | |
| | 13 | nc / Temp- ^{1) 2)} | | | | |
| | 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 ⁵⁾ | Resolver |
|------------|---------|--------------------------------|-------------|------------------------|--------------------------------|------------------------|
| X10 | 1 | A- | | REFCOS | - | S3 / COS- (A-) |
| | 2 | A+ | | +COS | - | S1 / COS+ (A+) |
| | 3 | +5 V ³⁾ | | (+5 V ^{3) 4)} | +5 V ³⁾ | - |
| | 4 | R+ | | Data + | SL+ | - |
| | 5 | R- | | Data - | SL- | - |
| | 6 | B- | | REFSIN | - | S4 / SIN-(B-) |
| | 7 | (10 V / 110 mA ⁴⁾) | | 10 V / 110 mA | (10 V / 110 mA ⁴⁾) | |
| | 8 | GND | | | | - |
| | 9 | - | - | - | - | R2 (Resolver excit.-) |
| | 10 | - | - | - | - | R1 (Resolver excit. +) |
| | 11 | B+ | | +SIN | | S2 / SIN+ (B+) |
| | 12 | nc / Temp+ ^{1) 2)} | | | | |
| | 13 | nc / Temp- ^{1) 2)} | | | | |
| | 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

Selection of absolut value information: NONE(0) =

rotative linear

Sine/Cosine - motor and position encoder

Line count: 1

Encoder offset: 0 deg

Commutation setting

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

Gear ratio:

n1: 1

n2: 1

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

Selection of absolut value information: NONE(0) =

rotative linear

Sine/Cosine - motor and position encoder

Encoder offset: 0 deg

Commutation setting

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

Configuration linear encoder

period length: 20000 nm

digital resolution: 0 nm

gear ratio numerator: 1

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"> • Resolver • SinCos • EnDAT • HIPERFACE® • TTL • SSI | 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"> • SINCOS • TTL • Resolver ²⁾ • HTL for axis 1 ³⁾ | X8 | - | - |
| 2-axis module | | X8 | X10 | - |
| 3-axis module | | X8 | - | - |

²⁾ as of controller card ID SDC_REV02, FW V2.20. Only one resolver per axis.
³⁾ 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"> • HIPERFACE® DSL | - | - | - |
| 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_{SS}
- 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.

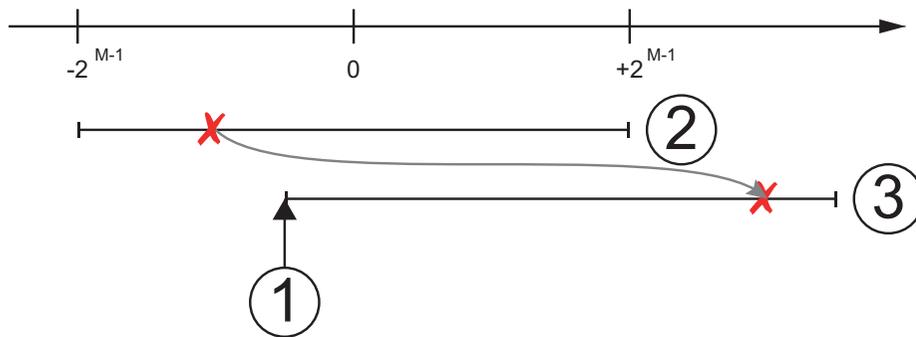


Fig. 7.3: Representation MTBase

- 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 ² +b ²) |
| 2848 / 4896 / 6944 | 34 | EncObsTf | ms | Filter time constant of signal sqrt(a ² +b ²) 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 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_{SS}). 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. CAUTION: 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_{SS} 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 (≤ 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 $1 V_{SS}$, 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.

| | |
|---|---|
| WARNING! | Damage to the device and hazards to persons as a result of incorrect operation! |
|  | <p>Improper conduct can lead to the destruction of the system and serious injury or death.</p> <ul style="list-style-type: none"> 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. |

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**.

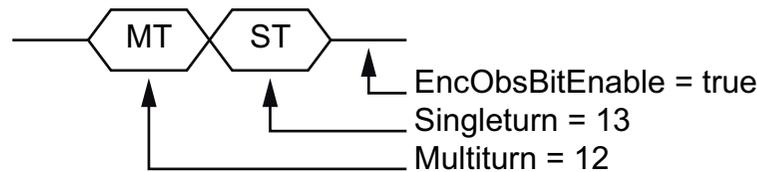
The evaluation of an encoder monitoring bit in the PostBits or an encoder error bit in the PreBits can also be activated to trigger an error reaction of the drive controller. To do so, **Parameters P 2848[21] - EncObsbitEnable** and **P 2848[25] - PostEncObsPosition** for the encoder monitoring bit or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

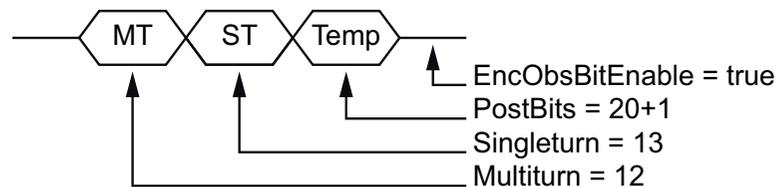
7.5.5.1 Example 1 (rotative SSI encoder):

- 12 bit multeturn information
- 13 bit singleturn information



7.5.5.2 Example 2 (rotative SSI encoder with additional information)

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

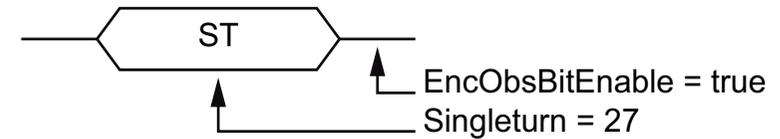


NOTE

- 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



- DigitalResolution = 100 nm
- IsLinear = true

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.

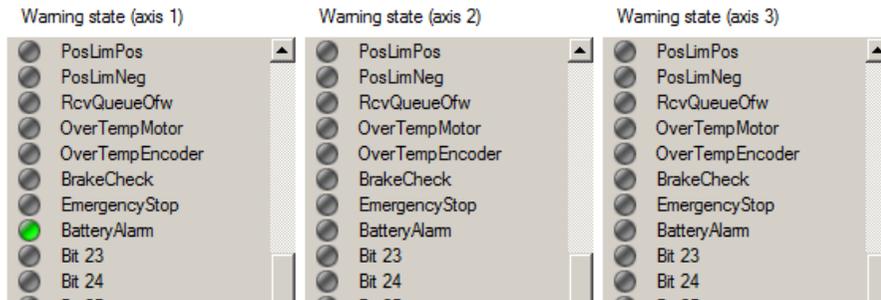


Fig. 7.4: Warning, battery alarm

7.5.6.1 Encoder GUI

Encoder settings:

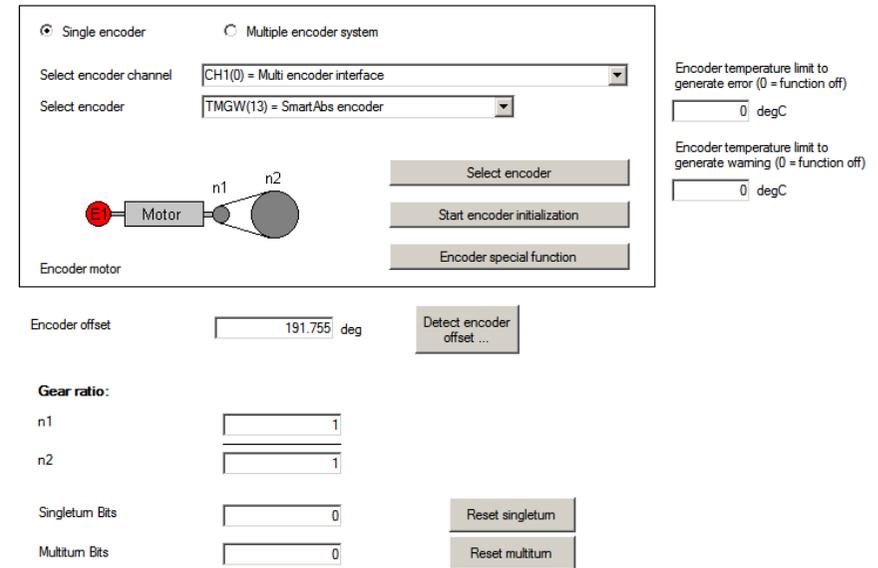


Fig. 7.5: Encoder settings dialog box, Tamagawa encoder

7.5.7.1 Encoder GUI

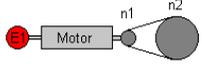
Encoder settings:

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 motor: 

Encoder offset: 0.384693 deg

rotative linear

Gear ratio:
 n1: -1
 n2: 1
 Singletum Bits: 20
 Multitum Bits: 16

Protocol settings:
 Protocol type: BISS_C_UNI(3) = Use BISS C (unidirectional) Protocol Type
 CRC polynom: 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] - Multitum(4)** and ENC_CH1_Settings **P 2848[5] -Singletum(5)** are used.

If a unidirectional BiSS_C encoder is connected, the settings for **P 2848[42] - BISS_CRC_Polynom** 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_Polynom** 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 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)²⁾

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

²⁾ 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 ¹⁾ |
| 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 PBRBS 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 P 3057[2] - MCon 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 (P 2884[0] - Select) 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" (P 2949[0] - CON_SCALC_Tf) to 10 ms. |
| 6 | In the same dialog box, set P 3059[1] - Stiffness to 10% in "Control adaptation of rigidity" and press the "Activate" button (sets P 3068[0] - command to CALC_SCON (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 (P 2992[0] - SCD_JSum). 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 KEBA.

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 | ENCSN (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 **ENCSN** 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 yyyyymmdd. 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.

| | |
|---|---|
| CAUTION! | Damage to the device as a result of incorrect operation! |
|  | <p>Failure to exercise caution or follow proper working procedures may result in damage to the device.</p> <ul style="list-style-type: none"> 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". |

NOTE

 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.

| 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>Improper conduct can lead to serious injury or death.</p> <ul style="list-style-type: none"> 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. |



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)

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

OFF(0) = Encoder simulation inactive Activate absolute-encoder simulation

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 Activate persistent homing

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

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 | AbsIntfMode | | 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 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) |
| 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 OperationEnabled . |
| 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>Improper conduct can lead to serious injury or death.</p> <ul style="list-style-type: none"> • 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 AutoPosST and AutoEncSN are set. • Use the PowerOff (PowOff) validation function to protect against the use case "Switching off operating voltage". This is activated automatically if the AutoPowOff bit is set. • 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. • Use this function only on axes with a holding brake. |

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! |
| | <p>Improper conduct can lead to serious injury or death.</p> <ul style="list-style-type: none"> • 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 AutoEncSN bit is set. |

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^N (N = 1, 2, 3...). For a 1:2^N 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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| 8.13 Test functions | 178 |
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8.1 Overview of control structure

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

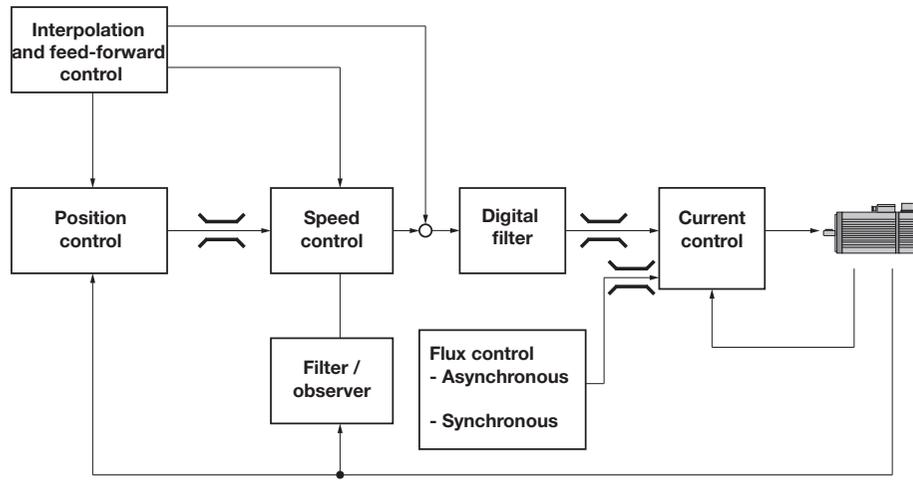


Fig. 8.1: Control structure

| 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 μ s
- Speed controller = 125 μ s
- Position controller = 125 μ s



NOTE

- Feed forward control (nref_FF and isq_FF) is only active in position control mode.

8.2 Operating concept and motor control

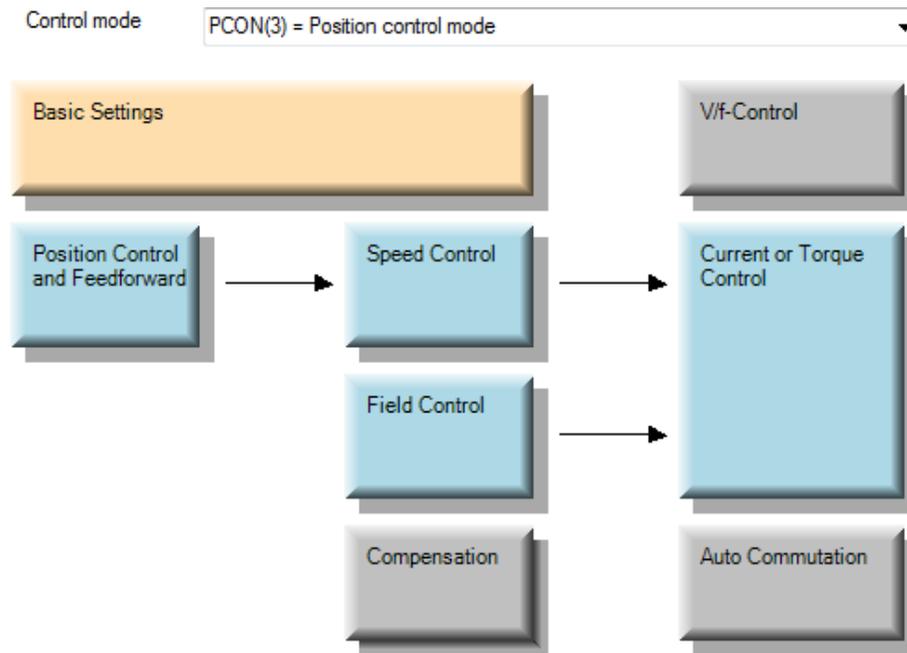


Fig. 8.2: Control dialog box

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).

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

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

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

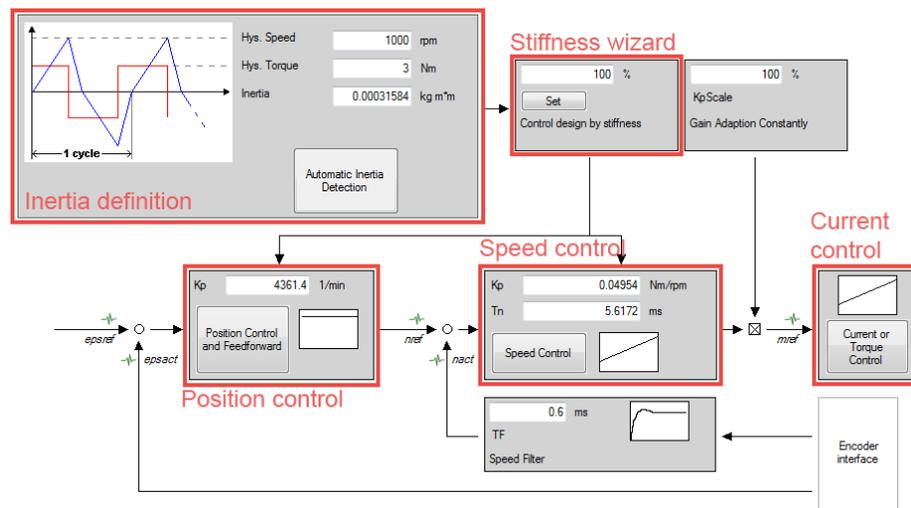


Fig. 8.3: Basic control setting dialog box

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

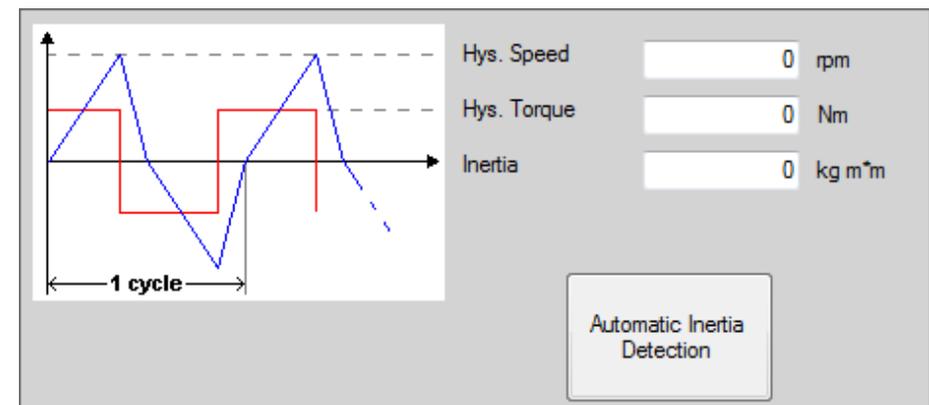


Fig. 8.4: Mass inertia definition dialog box

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).

| | |
|--|--|
| CAUTION! | Damage to your system/machine caused by uncontrolled or non-customized commissioning. |
|  | <p>Improper conduct can cause damage to your system / machine.</p> <ul style="list-style-type: none"> • 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. • 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. |



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 m*m | Total mass inertia |

Table 8.1: Mass inertia definition parameters

8.2.3 Rigidity wizard

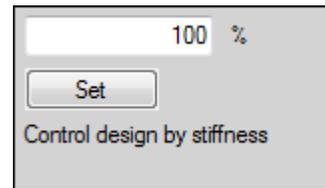


Fig. 8.5: Rigidity wizard dialog box

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

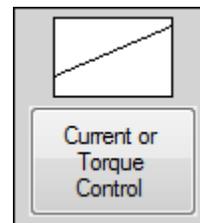


Fig. 8.7: Current and torque control button

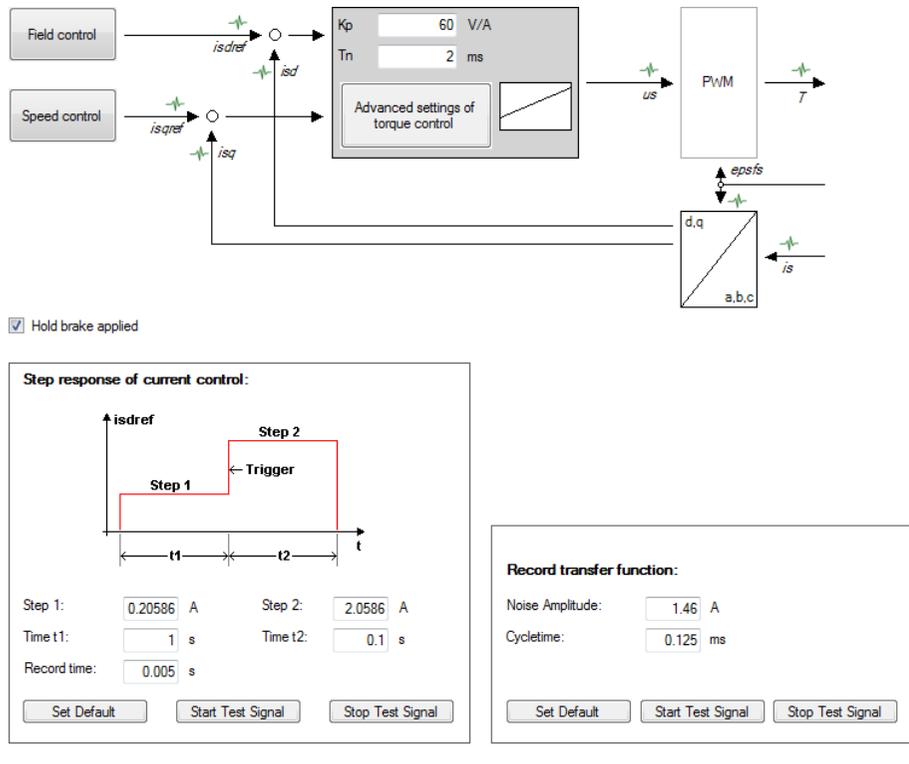


Fig. 8.8: Current and torque control dialog box

The current controller is a PI controller. Gain (Kp) can be configured via **P 2952[0] - CON_CCON_Kp**, integral-action time (Tn) 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.

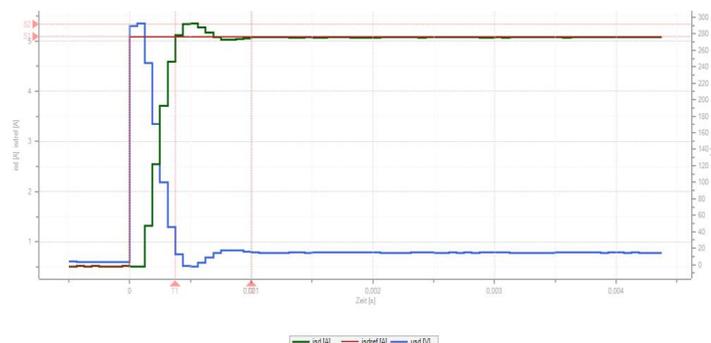
Optimisation with step response

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 μ 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

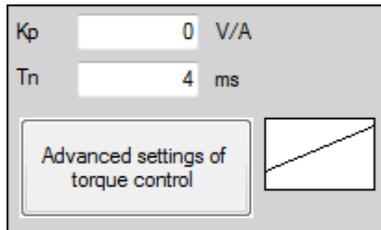


Fig. 8.9: Button: Advanced settings for torque control

| 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

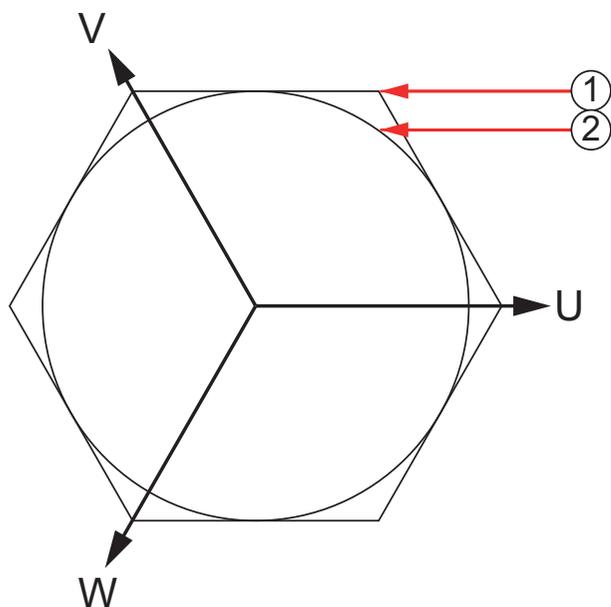


Fig. 8.10: Vector diagram of available voltage

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*.

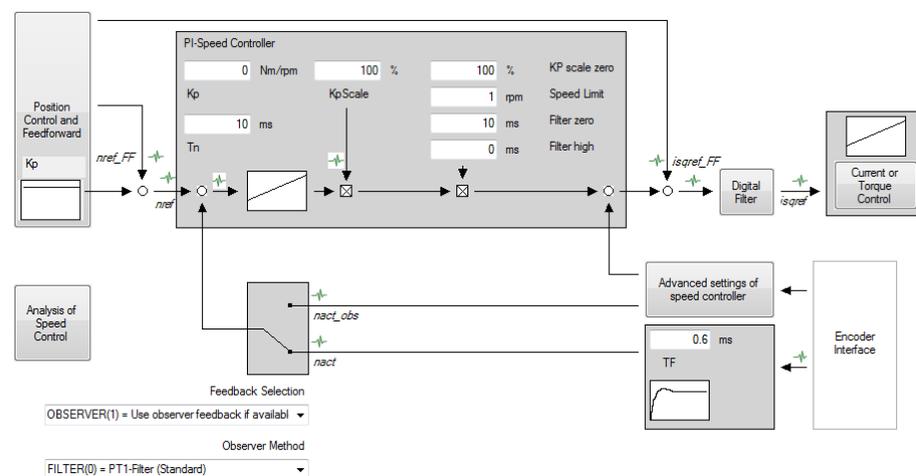


Fig. 8.11: Speed control dialog box

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).

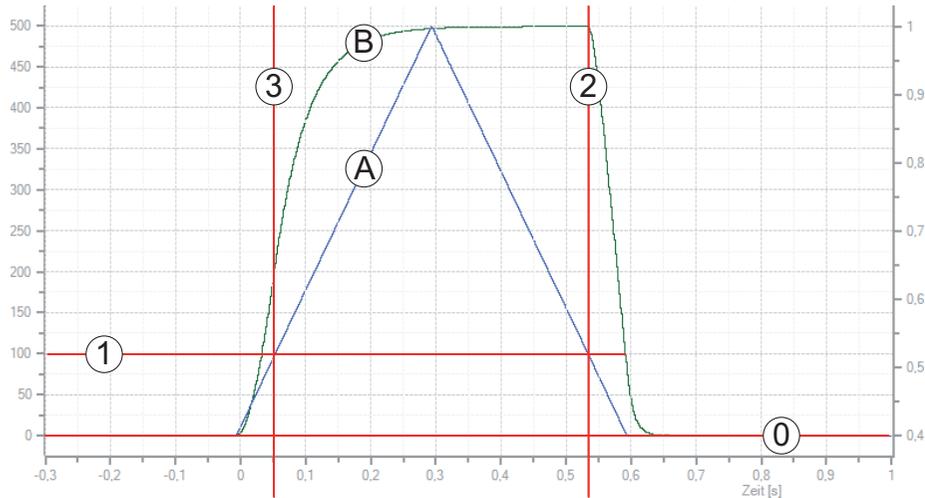


Fig. 8.12: Reduction of the speed gain at low speed

| P No. | Index | Name | Unit | Description | Value in diagram | Name in diagram |
|--------------------|-------|-------------|------|---|------------------|-----------------|
| 2983 / 5031 / 7079 | 0 | KpScaleScon | % | Scaling of speed control gain | 40 | Ⓐ |
| 2983 / 5031 / 7079 | 1 | SpeedLimit | rpm | Speed threshold for scaling | 100 | Ⓐ |
| 2983 / 5031 / 7079 | 2 | FilterZero | ms | Filter time for change from high to low speed | 10 | Ⓐ |

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 | Ⓑ |
| 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 | | Ⓐ |
| Scope signal 1077 | | KpScaleScon | | Speed Control Scaling | | Ⓑ |

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 $\text{Nm} / (1/\text{min})$.

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^2 .

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

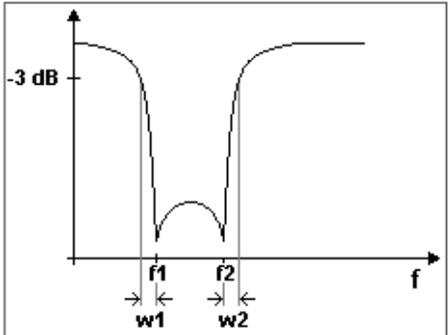
center / cut off (f1) Hz

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 μ 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!

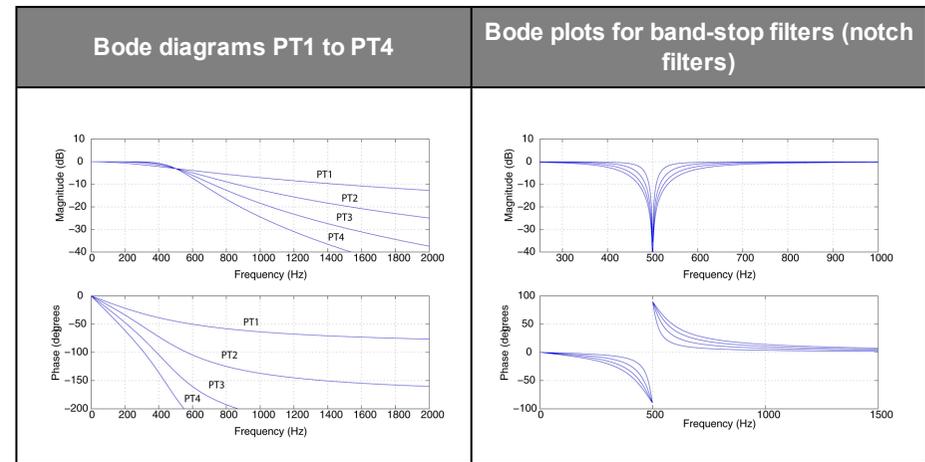


Table 8.10: Bode diagrams of filters

| 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.

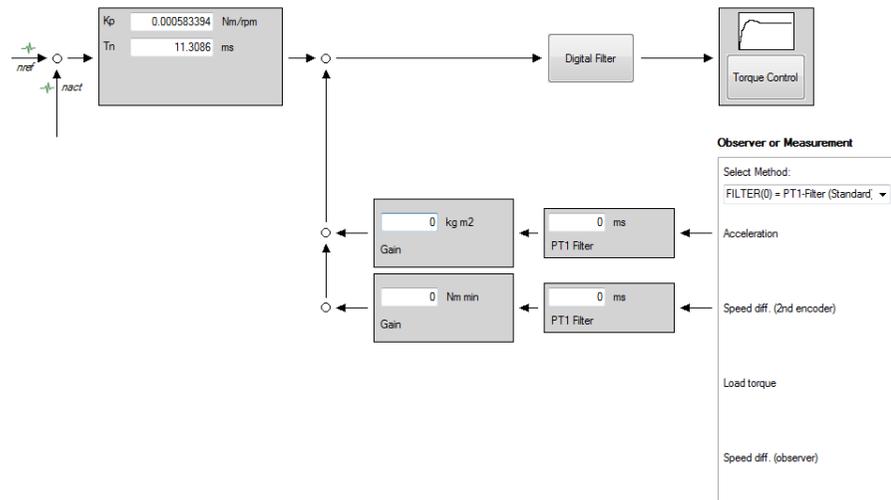


Fig. 8.14: Advanced Speed Control dialog box

| 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.

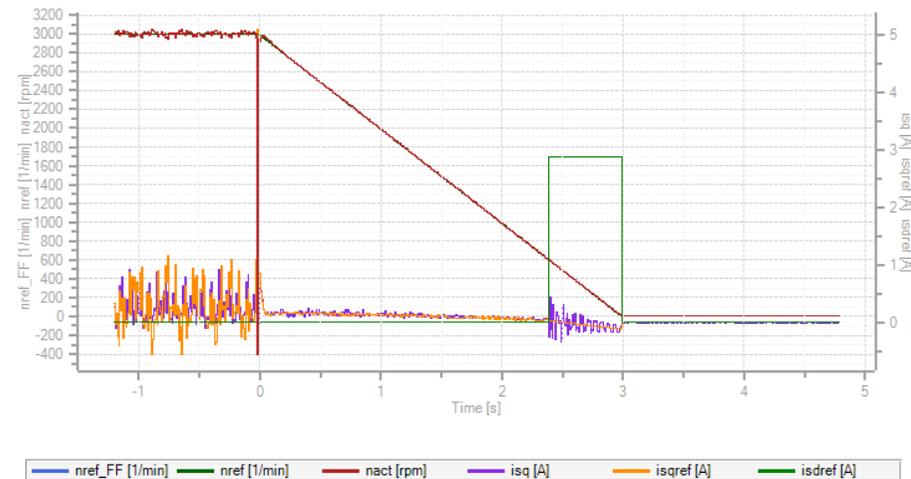


Fig. 8.16: Quick stop without sensor

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.

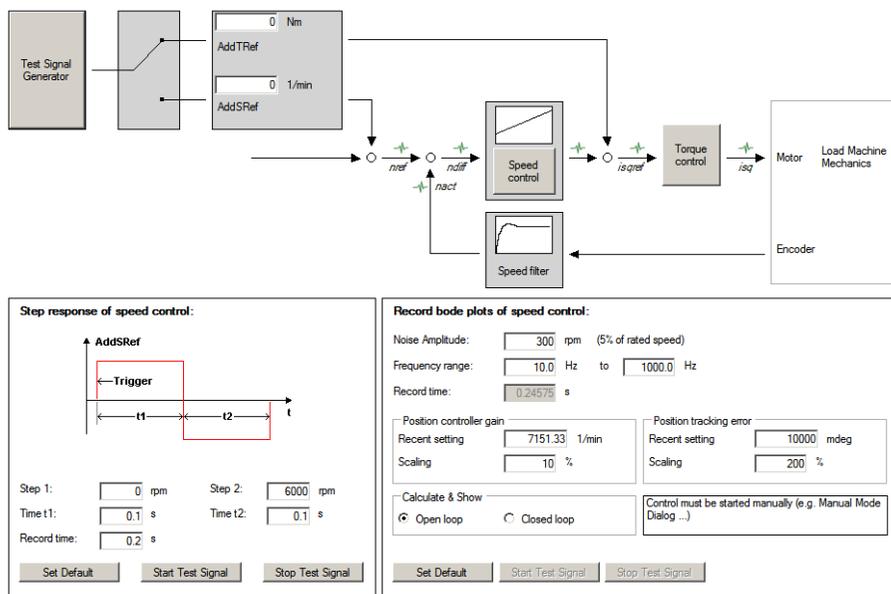


Fig. 8.17: Speed control analysis dialog box

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

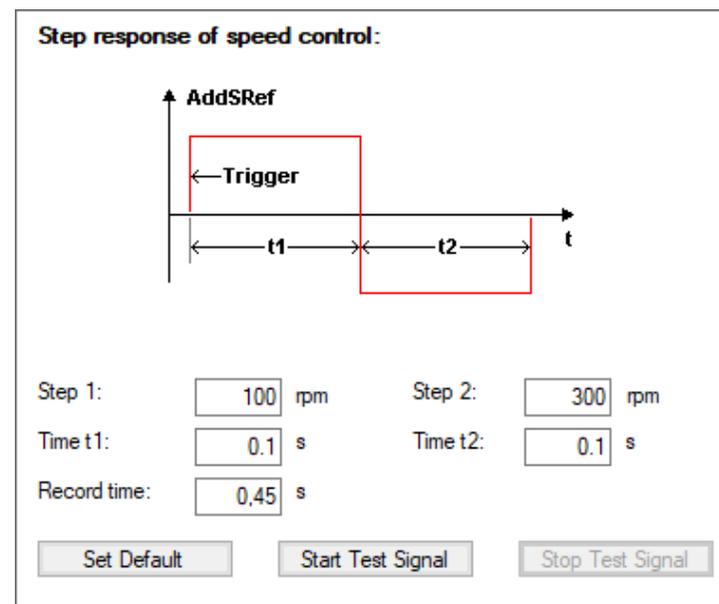


Fig. 8.18: Step response of the speed control

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.

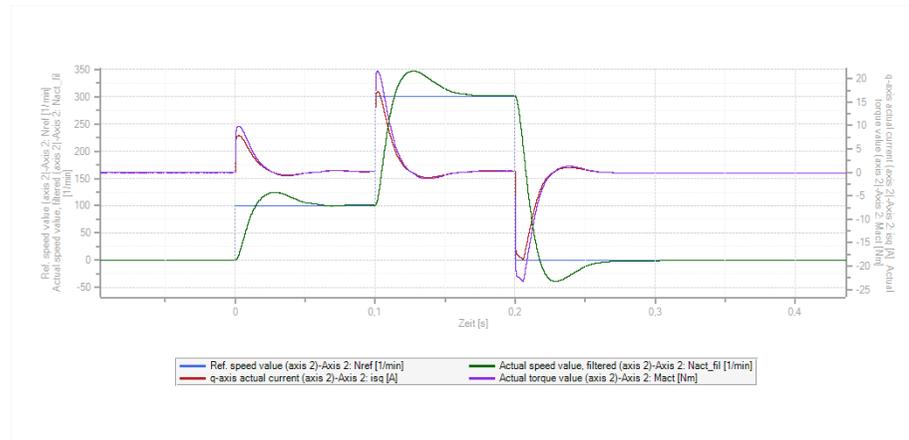


Fig. 8.19: Example step response

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

| | |
|--|--|
| <p>Position controller gain</p> <p>Actual setting <input type="text" value="1000"/> 1/min</p> <p>Scaling <input type="text" value="10"/> %</p> | <p>Position tracking error</p> <p>Actual setting <input type="text" value="10000"/> mdeg</p> <p>Scaling <input type="text" value="200"/> %</p> |
|--|--|

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.

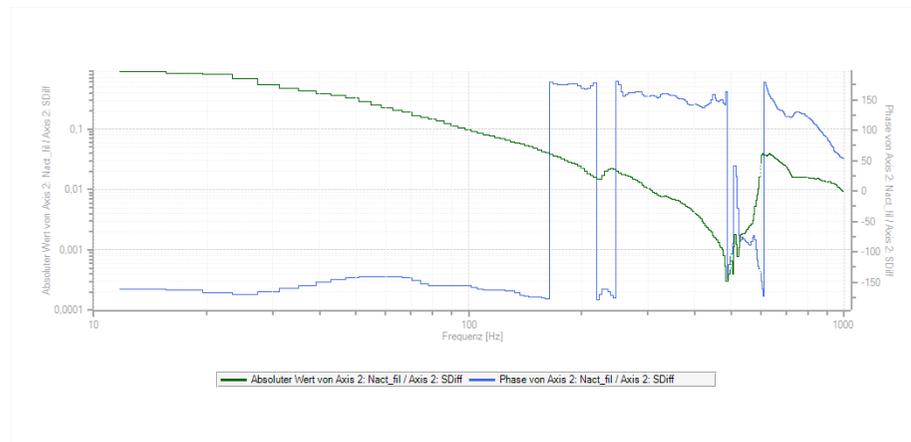


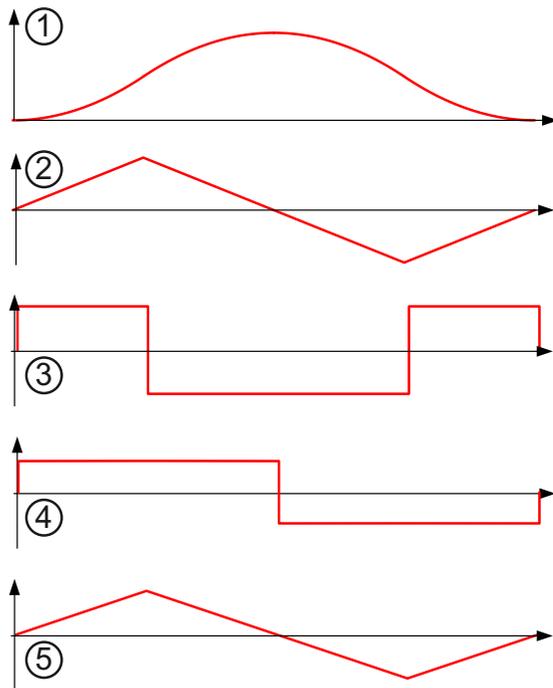
Fig. 8.21: Example Bode plot for open loop

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° .

The point of intersection with 0dB is also referred to as the bandwidth of the control loop. The distance above -180° 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).

8.5.2 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 |
| P 2303[4] | PosDiff | 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 multi-axis 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:

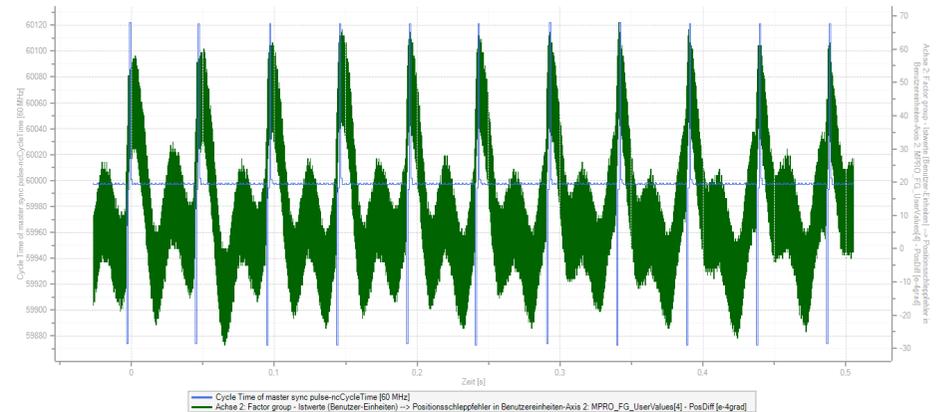


Fig. 8.23: Synchronisation without compensation measures

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.

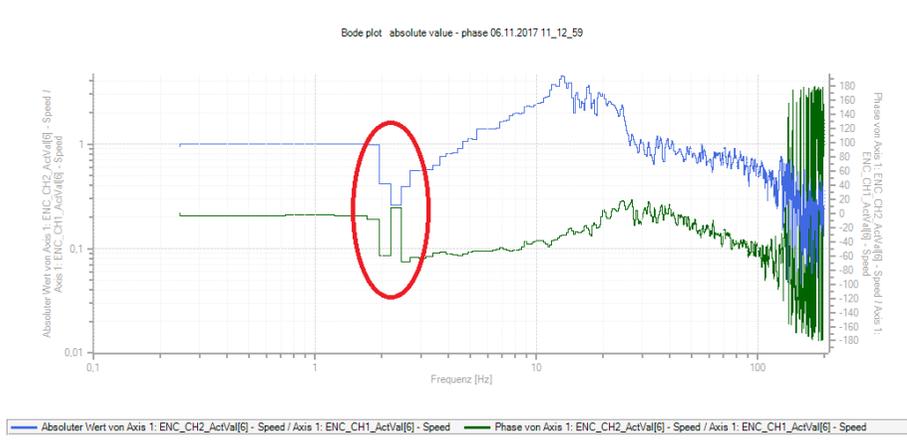


Fig. 8.24: Example: Bode plot of a transfer function

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.

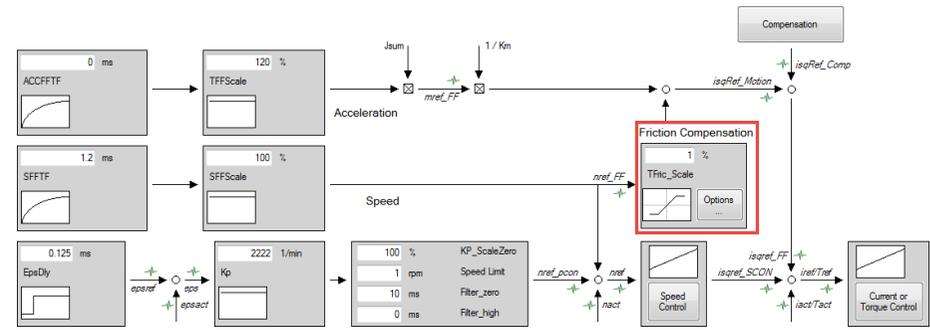


Fig. 8.25: Position control dialog box

| 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

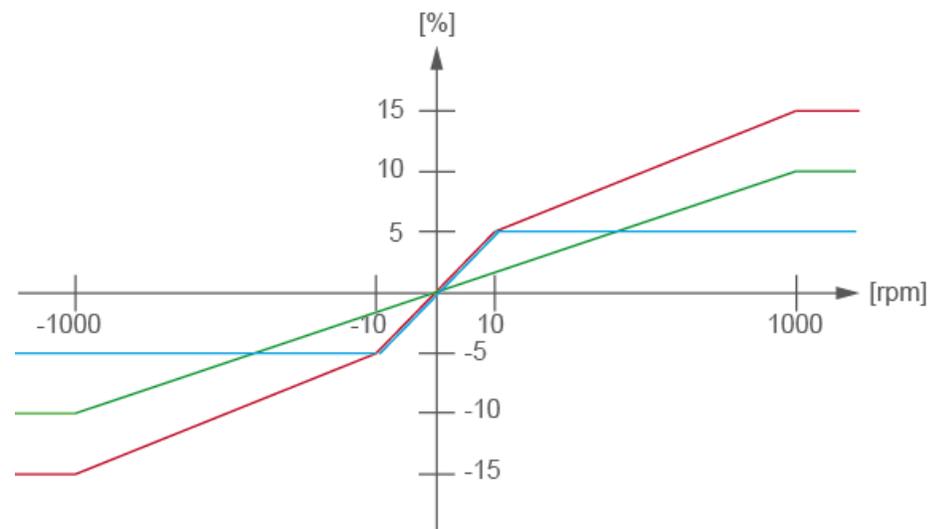


Fig. 8.26: Friction torque compensation for position control

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 |
| P 2303[4] | PosDiff | 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

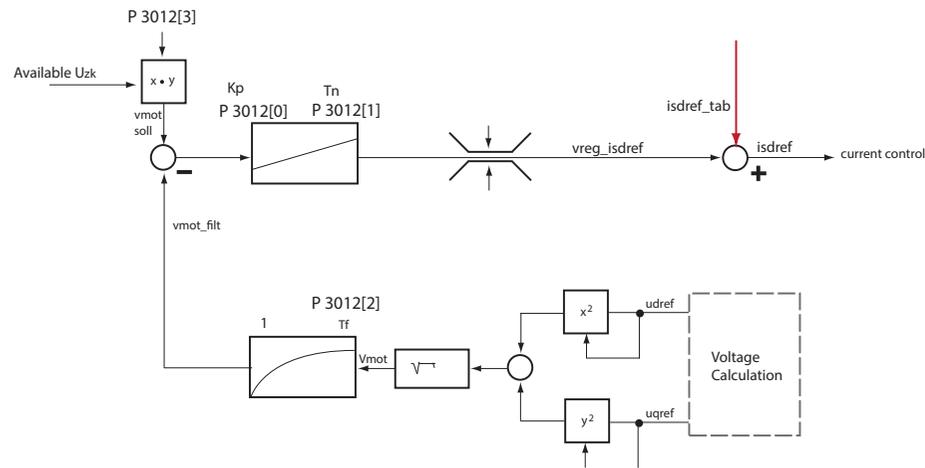


Fig. 8.27: Structure of the voltage controller

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>Failure to exercise caution or follow proper working procedures may result in damage to the device.</p> <ul style="list-style-type: none"> • 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. P 2964[12] - MOT_Ke * P 2968[0] - LimFac_Speed * P 2964[2] - MOT_SNom * $\sqrt{2}$ < 800 V • Use an external brake chopper on the Supply unit. This reduces voltage in the event of an error. • 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 P 3013[0] - IMag to this limit value. |

There are two methods available for field weakening that can be selected via **P 3014 [0] - SelMode**.

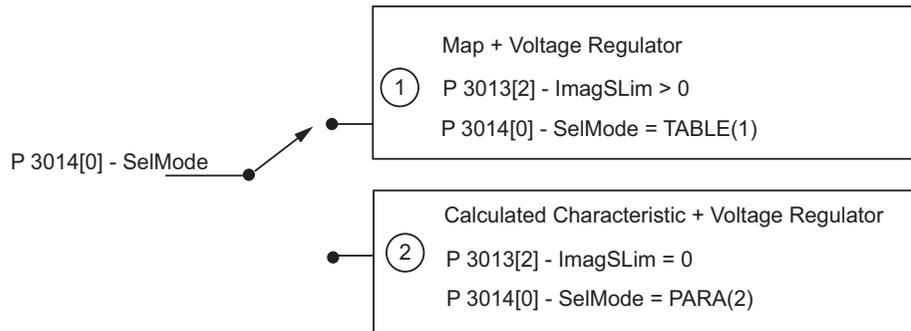


Fig. 8.28: Methods of field weakening

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 $-\text{Imag} * \sqrt{2}$, 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] - IImag**. 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 | KImTime | 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>Failure to exercise caution or follow proper working procedures may result in damage to the device.</p> <ul style="list-style-type: none"> • The motor can move suddenly during the auto commutation. The mechanism coupled must be designed for this movement. • 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. • 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. • Enable speed tracking error monitoring (P 2972[0] - SDiffMax, Section "Limitations" on page 214). This monitoring function provides extensive protection against uncontrolled movement. |

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**.

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).

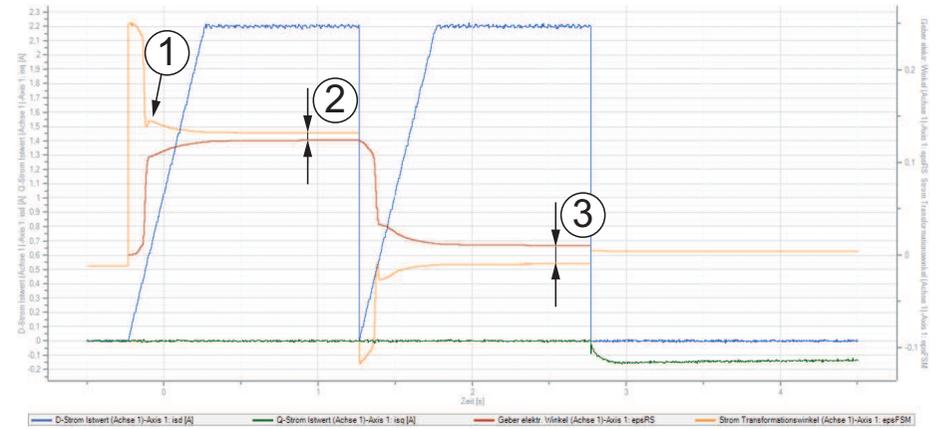


Fig. 8.31: Autocommutation analysis IECON

- 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>Failure to exercise caution or follow proper working procedures may result in damage to the device.</p> <ul style="list-style-type: none"> The motor can move suddenly during the auto commutation. The mechanism coupled must be designed for this movement. 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! |

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 | KImTime | 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 * (Time0 + 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**.

Mode: LHMEAS(3) = saturation of inductance evaluated Options ...

Scaling factor: 20 %

Measurement frequency: 0 Hz

Speed reference value: 0 rpm

Current I0: 1.62 A Time t0: 1000 ms

Current I1: 1.62 A Time t1: 1000 ms

Time t2: 1000 ms

Time t3: 1000 ms

Reset

When all values are 0 (zero) automatic settings on the basis of motor parameter.

Verification

Limit angle for error detection: 30 degree

Actual commutation angle error: 0 degree

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**.

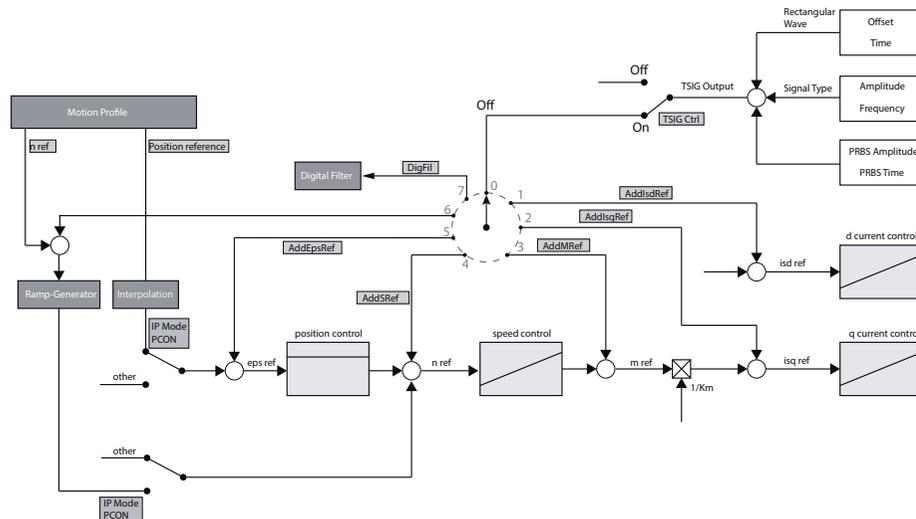


Fig. 8.33: Diagram of the test signal generator

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 | Corrp1Cos | | Result correlation: Input 1 + cos |
| 3056 / 5104 / 7152 | 1 | Corrp1Sin | | Result correlation: Input 1 + sin |
| 3056 / 5104 / 7152 | 2 | Corrp2Cos | | Result correlation: Input 2 + cos |
| 3056 / 5104 / 7152 | 3 | Corrp2Sin | | 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.

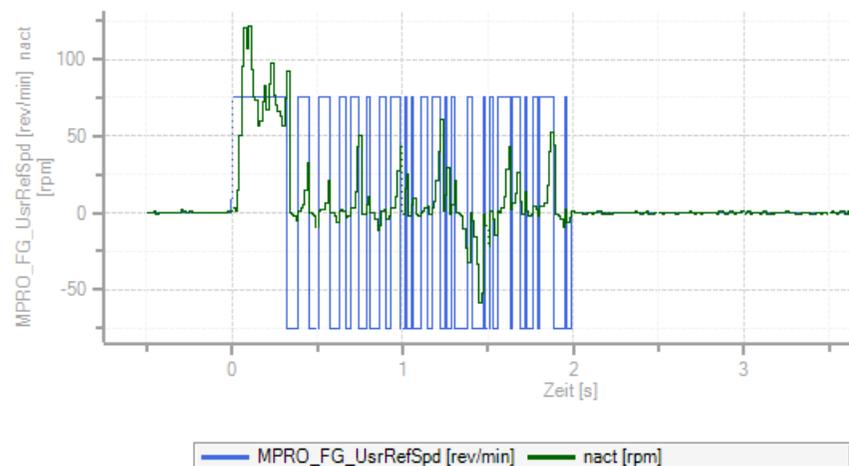


Fig. 8.34: PRBS-Signal: Amplitude = 150 rpm, Time = 20 ms

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"> Gain is set to 60 degrees phase reserve. Integration time is set to compensation of stator time constants, i.e. $T_n = L_{sig} / R_{stat}$. |
| BW | <ul style="list-style-type: none"> Gain is set to the bandwidth set in P 3058[1] - Bandwidth. Integration time is set to compensation of stator time constants. |
| DEADBEAT | <ul style="list-style-type: none"> The current observer is activated. Gain is configured so that a pending control error is compensated in 62.5 μs. Integration time is set to compensation of stator time constants. |

8.9.2.2 Configuration of speed and position control (CALC_SCN)

The rating plate parameters and electrical parameters of the motor must be set. Then 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 % $T_{sum} =$ (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 P 2996[0] - URefTf 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 P 2997[2] Amplitude DCBrakeCurrent is injected. The braking time must be set in P 2998[2] DCBrake in order to brake the machine. If the speed threshold is P 299[4] = 0 Hz , the current is injected directly during braking. After the configurable time P 2998[2] , 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 P 2997[7] DCMoveCurrent is injected over a defined speed range P 2997[8] DCMoveSpeedThreshold . The filter time P 2997[9] - DCMoveTf 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 P 2997[5] - DCStopCurrent is injected for a time of P 2997[6] - DCStopTime . |
| 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"> Boost voltage (V_{Boost}) at $f = 0$, this value is preset during motor identification |
| Interpolation points | <ul style="list-style-type: none"> 6 interpolation points, ($V_0/F_0, V_1/F_1, \dots, V_5/F_5$) |
| Motor nominal point | <ul style="list-style-type: none"> V_{Nom} and F_{Nom} The values are preset during the motor identification. 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. |
| 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] - UR_{eff}f**. 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.

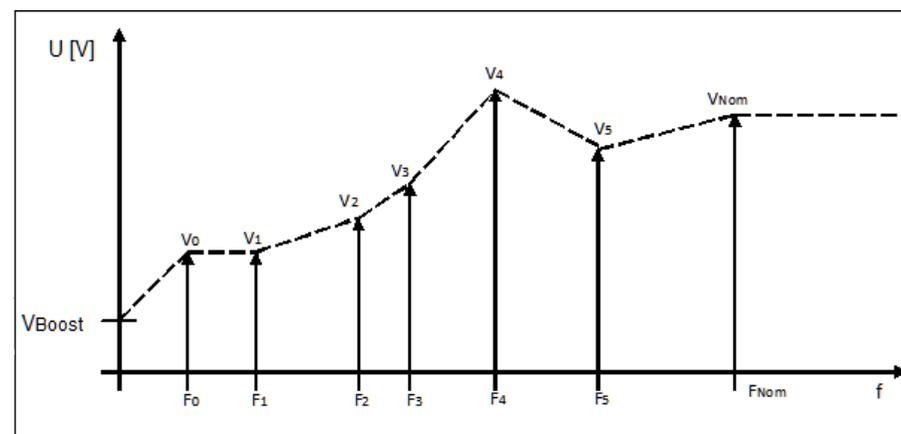


Fig. 8.35: VFC characteristic curve with 6 interpolation points

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

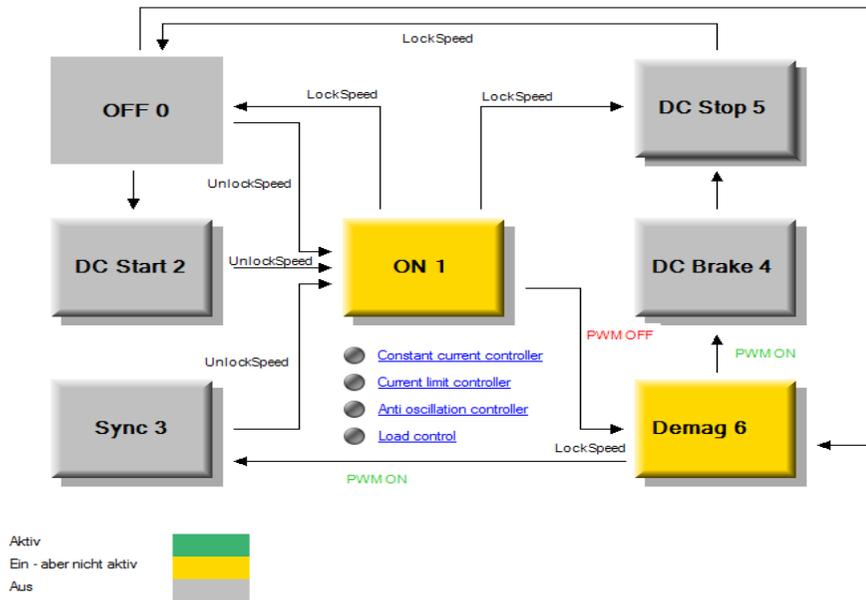


Fig. 8.36: State machine V/Hz mode

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**).

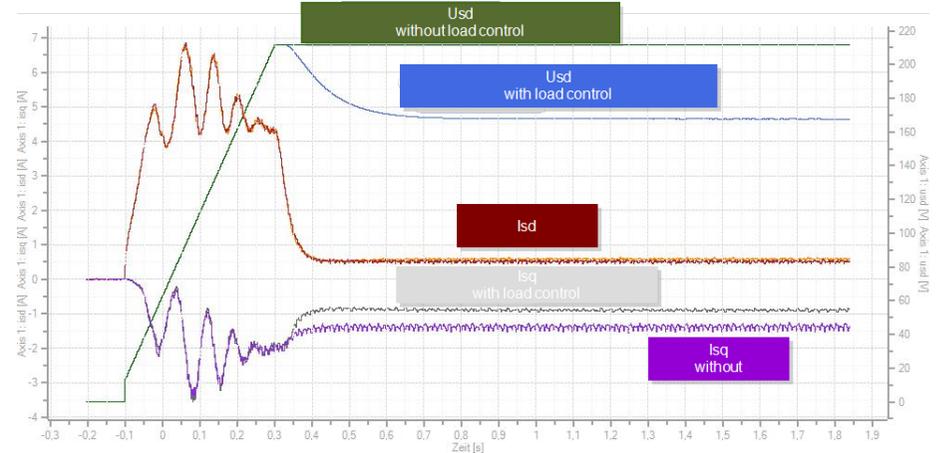


Fig. 8.37: i_{sd} and i_{sq} with and without load control (0 Hz to 40 Hz)

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.

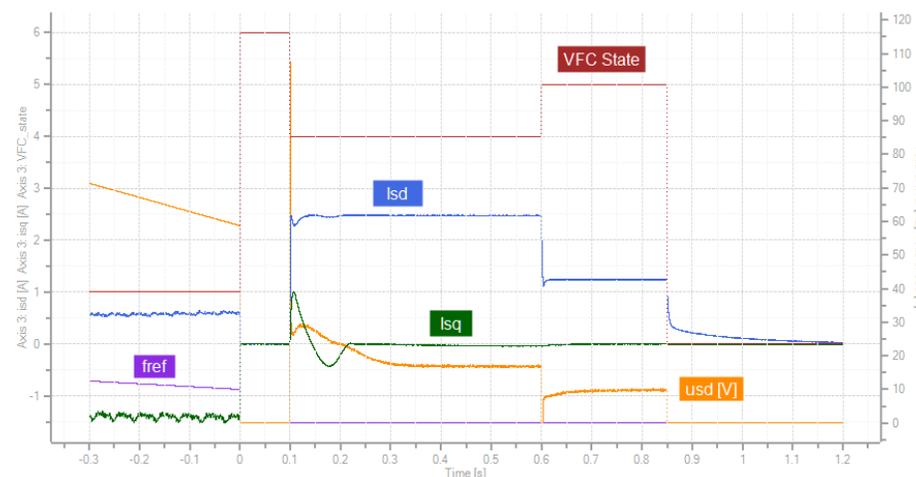


Fig. 8.38: Braking operation via DCBrake and DCStop (current injection)

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.

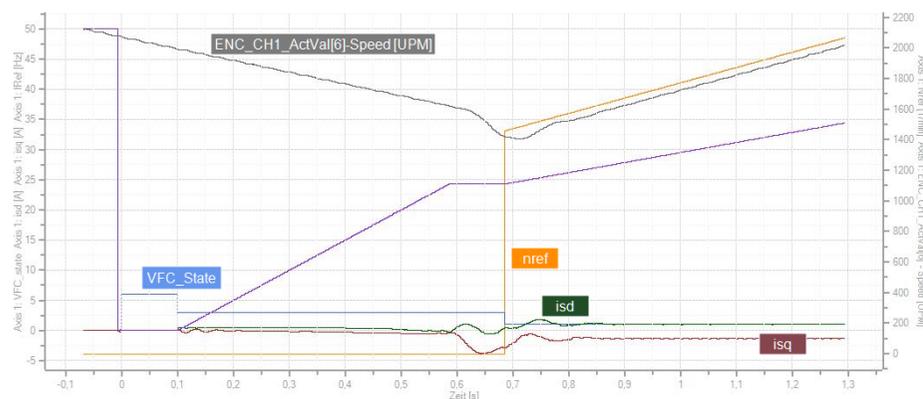


Fig. 8.39: Asynchronous motor synchronisation (status: 0, 6, 3, 1)

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.

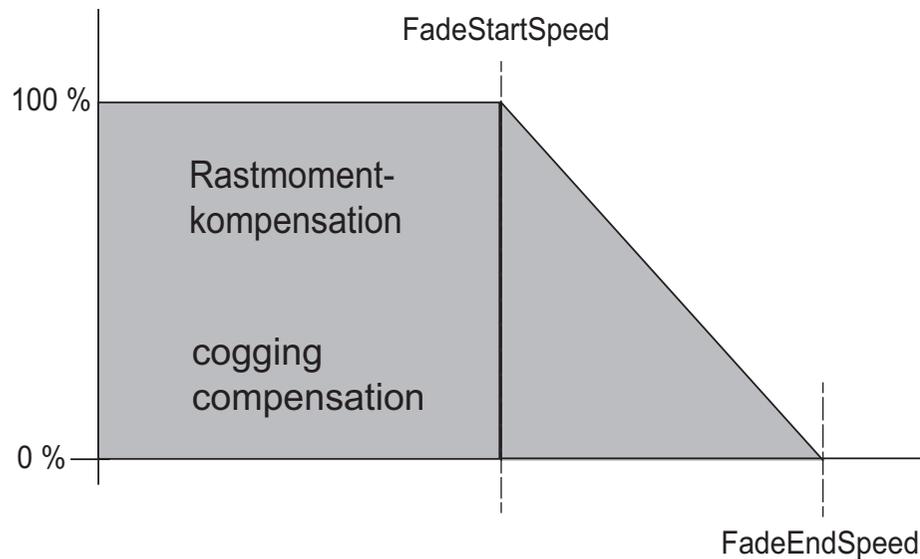


Fig. 8.40: FadeStartSpeed and FadeEndSpeed

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:

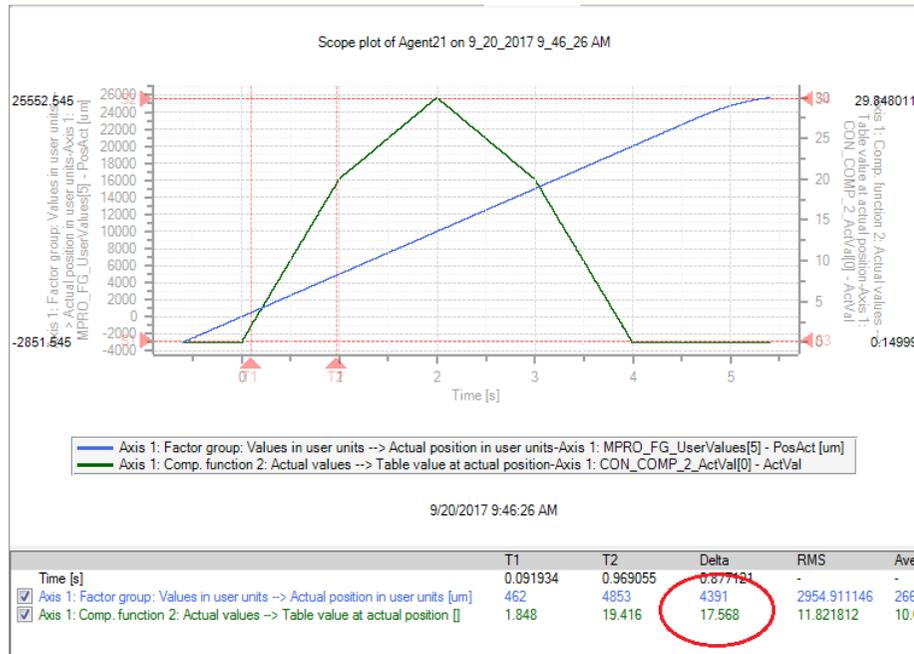


Fig. 8.42: Example scope view



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!

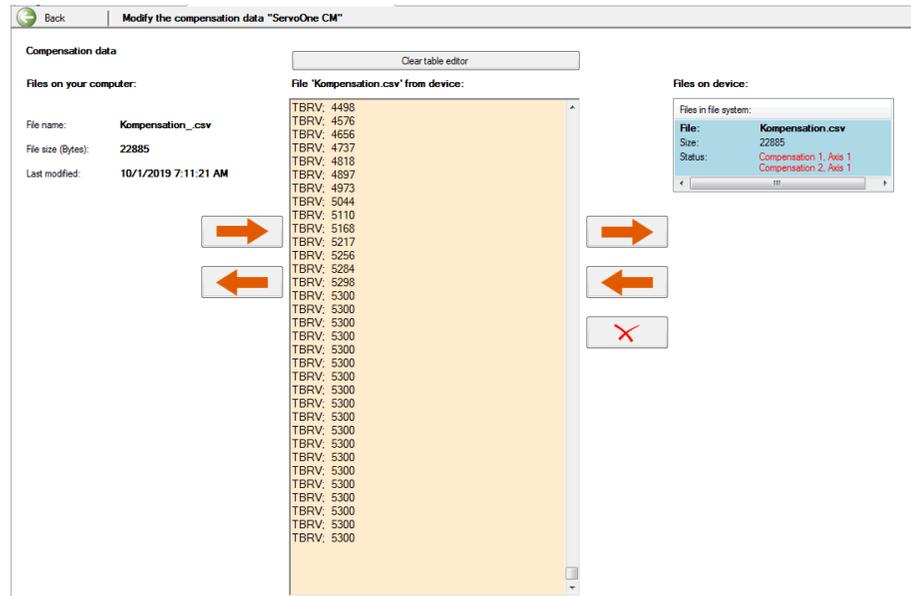
The output variable is not modified by the table but rather compared with the table value. The error is cumulated. If it exceeds a monitoring limit, the error message is output.

- 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.



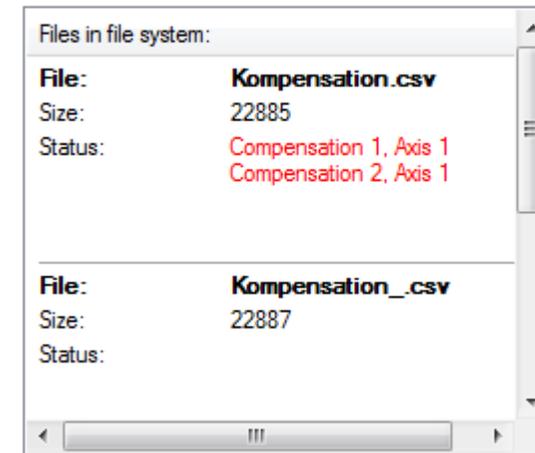
Data on your computer:

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.

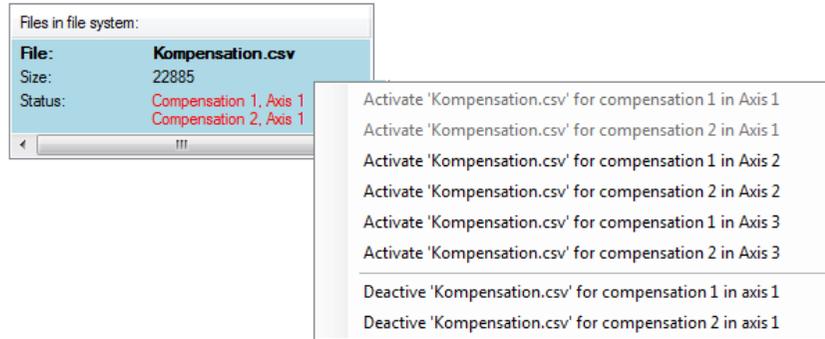
The name of the csv file, the file size and the status are displayed. The status indicates for which compensation (1 or 2) and axis (1, 2, 3) the csv file is activated.

| | |
|--|--|
| | 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. |

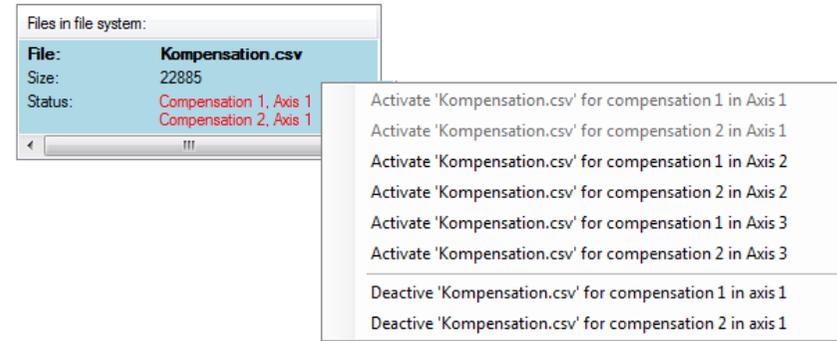
Activating a csv file

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.

| | |
|-----------------|---|
| CAUTION! | Your system/motor may be damaged if put into operation in an uncontrolled or inappropriate manner. |
| | <p>Improper conduct can cause damage to your system / machine.</p> <ul style="list-style-type: none"> 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. |

| 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

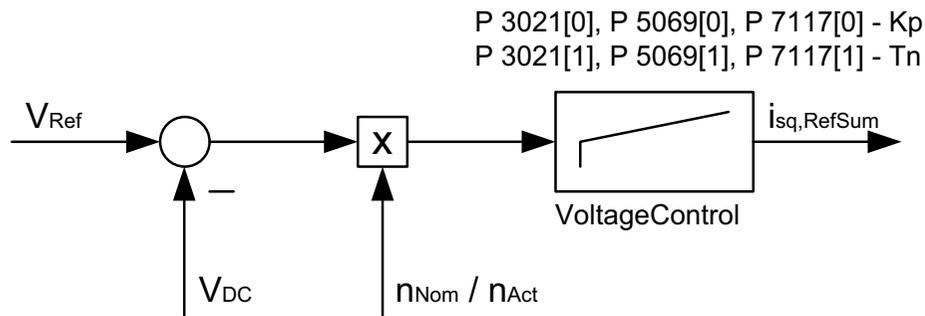
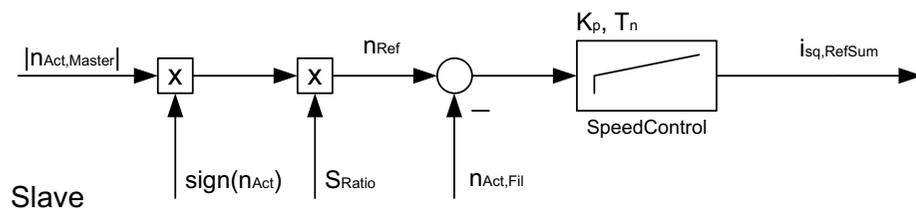


Fig. 8.43: Master axis structure

The master axis is controlled by a PI voltage controller. The parameters can be preset axis-specifically **P 3021 - CON_POWER_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.



Slave

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_POWER_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 | Bit word 00 : Each axis brakes individually. |
| 4 | SetMasterBit1 | 01 : Axis 1 is master axis 10 : Axis 2 is master axis 11 : Axis 3 is master axis |

| 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

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 (P 2308[0]). 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, P 2314[3] HoldMaxDelta 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"> the desired distance (path of travel) for grinding (P 2314[6] - GrindDist), the desired speed (P 2314[7] - GrindSpeed), the desired acceleration (P 2314[8] - GrindAcc), maximum available time (P 2314[9] - GrindTO). |
| 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 (P 2316[0] , bit 2 and 15). |
| 4 | The distance covered is stored in P 2316[5] - DistancePos or P 2316[6] - DistanceNeg (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" (P 2316[0] , 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" (P 2316[0] , 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"> • “Required holding torque” (P 2314[2] - HoldTorque) • “Hold time” (P 2314[14] - VerMaxTorqHoldTime) • “Torque ramp” (P 2314[5] - TorqueRamp) and • “Max. position difference” (P 2314[3] - HoldMaxDelta). |
| 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 (P 2316[0], bit 0 and 15). |
| 4 | The torque is increased based on the configured ramp (P 2314[5] - TorqueRamp) up to the configured rated torque (P 2314[0 and 2]). Meanwhile, the position is monitored for exceeding the configured maximum position difference (P 2314[3] - VerMaxDelta). |
| 5 | If the maximum position difference is exceeded, the test is aborted and “Status” displays “Test failed” (P 2316[0], bit 1) and “Positive slip” (P 2316[0], bit 3) or “Negative slip” (P 2316[0], bit 4) (depending on the direction of movement selected). |
| 6 | If the test is successful, it is displayed in “Status” as “Test completed successfully” (P 2316[0], bit 0) and “Positive holding torque” (P 2316[0], bit 5) or “Negative holding torque” (P 2316[0], 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"> • "Maximum test torque" (P 2314[4] - MeasTorque) and • "Torque ramp" (P 2314[5] - TorqueRamp). |
| 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 (P 2316[0] , bit 1 and 15). |
| 4 | The torque is increased based on the configured ramp (P 2314[5] - TorqueRamp) up to the configured torque (P 2314[0+4]). Meanwhile, the speed is monitored for exceeding the configured maximum speed (P 2314[12] - StickSpeed). |
| 5 | If maximum speed is exceeded, the current actual torque value in P 2316[1] - SlipTorquePos or P 2316[2] - SlipTorqueNeg (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 P 2316[3] - StickTorquePos or P 2316[4] - StickTorqueNeg (depending on the direction of movement selected) is recorded. |
| 8 | If the test is successful, it is displayed in "Status" as "Test completed successfully" (P 2316[0] , bit 0) and "Positive slip" (P 2316[0] , bit 3) or "Negative slip" (P 2316[0] , bit 4) and "Positive holding torque" (P 2316[0] , bit 5) or "Negative holding torque" (P 2316[0] , 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" (P 2316[0] , 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"> “Required holding torque” (P 2314[2] - HoldTorque) “Hold time” (P 2314[14] - VerMaxTorqHoldTime) “Torque ramp” (P 2314[5] - TorqueRamp). Activate/deactivate "Test of two brakes" (P 2316[0] - Bit 12 SBT_2BRK_Test) |
| 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 (P 2316[0], bit 5 and 15). |
| 5 | The torque is increased based on the configured ramp (P 2314[5] - TorqueRamp) up to the configured rated torque (P 2314[0 and 2]). 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” (P 2316[0], bit 1) and “Positive slip” (P 2316[0], bit 3) or “Negative slip” (P 2316[0], bit 4) (depending on the direction of movement selected) and/or the corresponding status bit of the SBT function “SBT slip” (P 2316[0], bit 7), “SBT Torque” (P 2316[0], bit 8) or “SBT Time” (P 2316[0], bit 9). |
| 7 | If the test is successful, it is displayed in “Status” as “Test completed successfully” (P 2316[0], bit 0) and “Positive holding torque” (P 2316[0], bit 5) or “Negative holding torque” (P 2316[0], 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” (P 2314[10] - TestPeriod). Entering a value of 0 disables monitoring. |
| 2 | Activate function with “Activate duration for brake test” (P 2315[0], bit 14). |
| 3 | P 2316[9] - OperationTime displays the time that has elapsed since the last brake test. |
| 4 | P 2317[0] - TestSchedule stores the time in absolute operating hours (also refer to P 3064[0] - MON_OperationEnTime in Section "Setting for the switching frequency" on page 42) when the next brake test is due. |
| 5 | Any changes to P 2314[10] - TestPeriod 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" (P 2314[11] - EmcyStopThresh) 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" (P 2314[13] - AllwEmergcStp). |
| 3 | Activate function with "Activate emergency stop counter" (P 2315[0] , bit 13). |
| 4 | If P 2317[1] - EmcyStopCount exceeds the value of P 2314[13] - AllwEmergcStp , bit 21 (EmergencyStop) is set in P 2151[0] - ERR_WRN_State (cf. Section "Warnings" on page 221). |
| 5 | The warning can be reset with P 2315[0] - MPRO_BRK_CK_Control , 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.

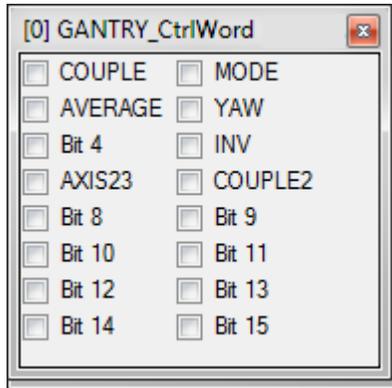


Fig. 8.46: GANTRY_CtrlWord

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:

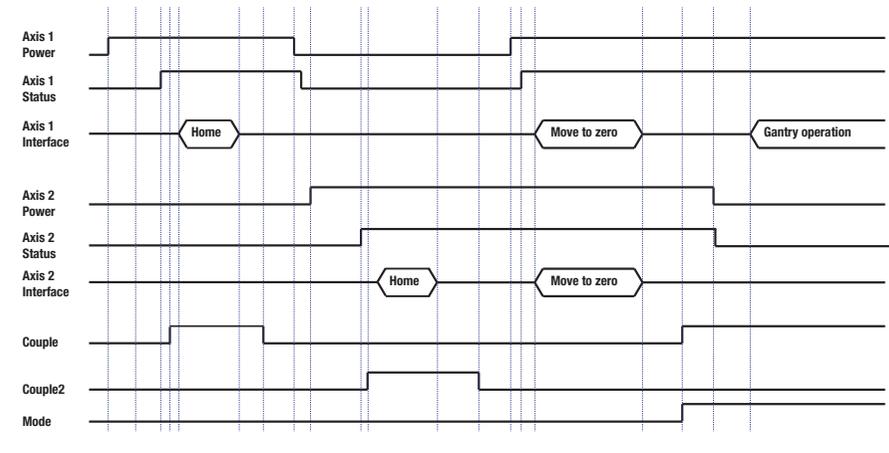


Fig. 8.47: Gantry for axes with incremental encoders

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:

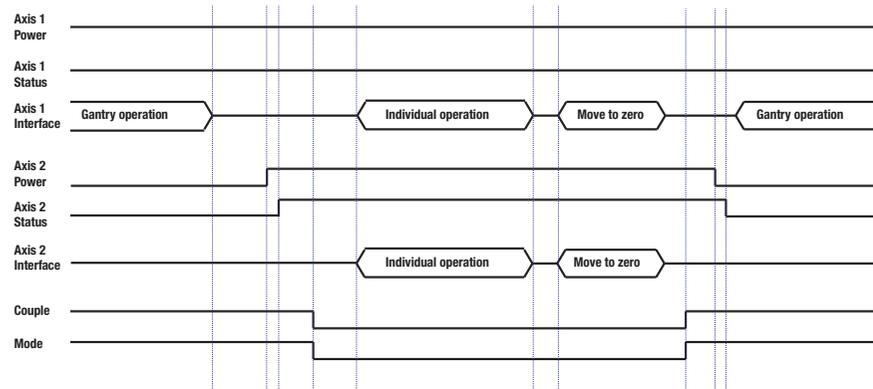


Fig. 8.48: Decoupling and coupling with control switched on

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.

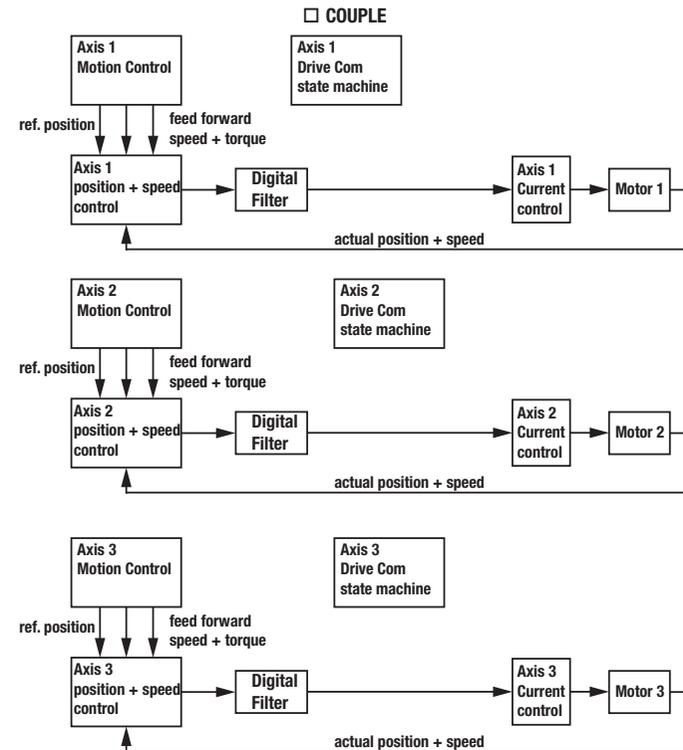


Fig. 8.49: Standard control structure

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.

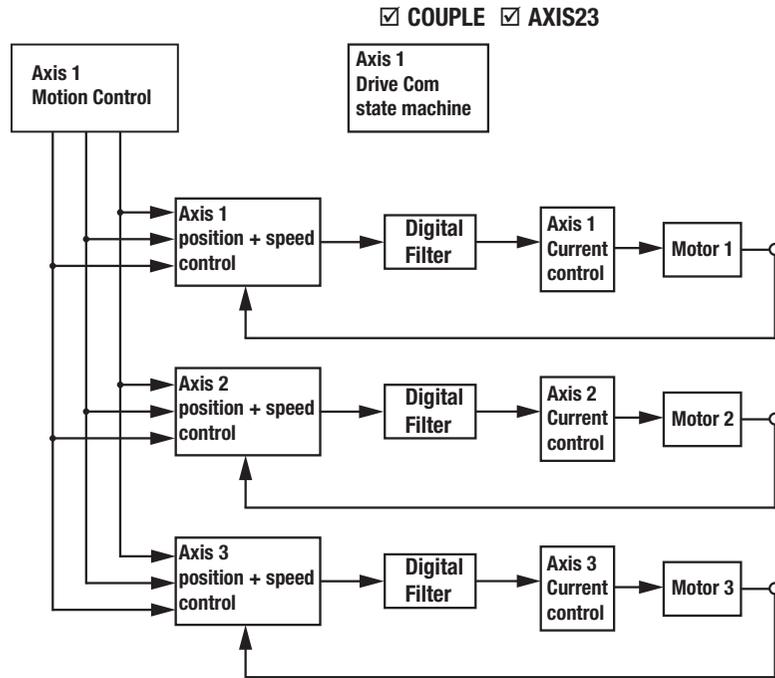


Fig. 8.50: Control structure with axis coupling (axes 1, 2 and 3)

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).

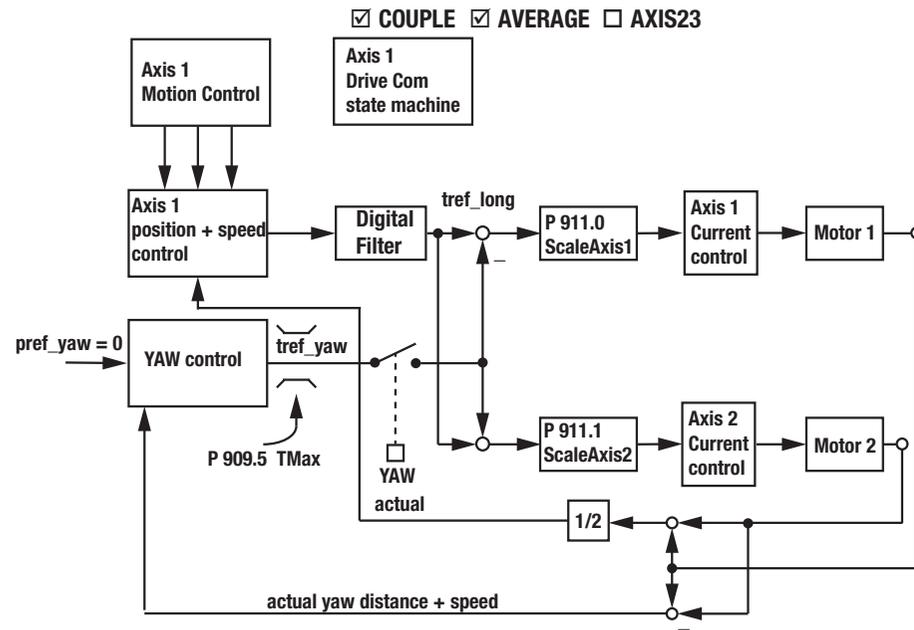


Fig. 8.51: Enhanced gantry control structure



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

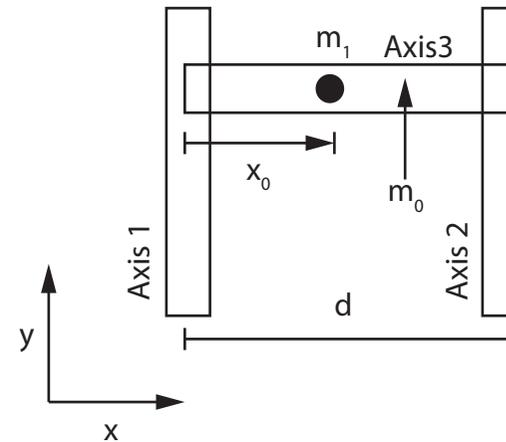


Fig. 8.52: Adaptation to the mass distribution

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:

$$\text{Virtual mass in the axis 1 control circuit: } m_{v1} = m_0/2 + m_1(d - x_0)/d$$

$$\text{Virtual mass in the axis 2 control circuit: } m_{v2} = m_0/2 + m_1x_0/d$$

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"> Determine the inertia. Divide the inertia by two Set the control to 100% and move the y-axis via axis 1 for test purposes. |
| 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.

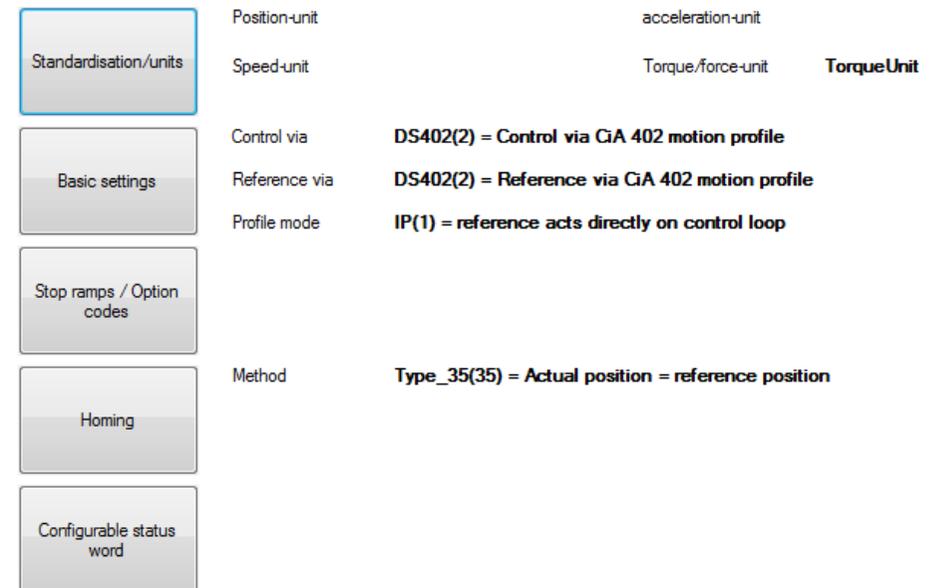


Fig. 9.1: Main Motion profile dialog box

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 “**D**raft **S**tandard 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 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:

Reference via:

Motor control start condition:

Profile

Profile mode:

Jerk time: ms

Interpolation

Interpolation type: Cycle time: ms

Limit

Speed override: %

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 $125 \mu\text{s} = 8 \text{ kHz}$ (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.

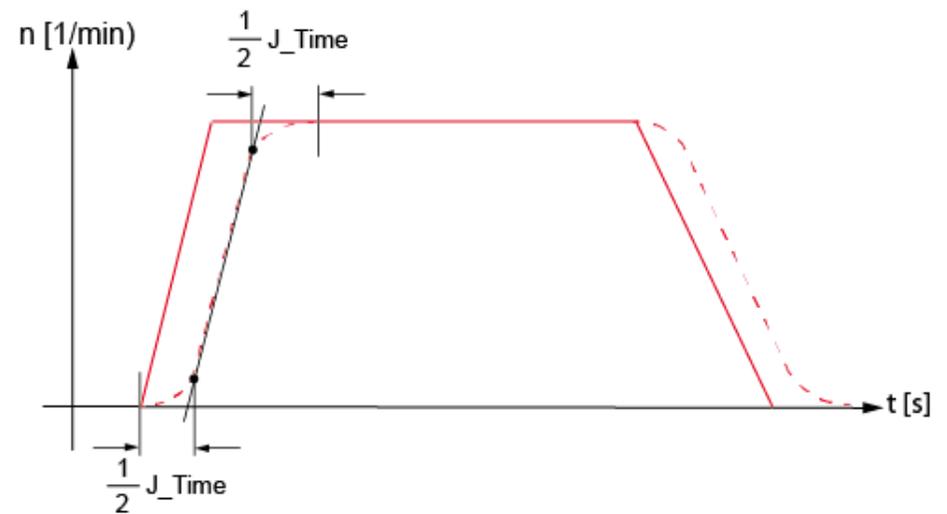


Fig. 9.3: Smoothing time in travel profile

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:
 Maximum deceleration time: 0.3 s

Gear ratio (if available):
 Input revolutions (motor shaft): 1
 Output revolutions (driving shaft): 1

Position encoder resolution:
 1048576 = 2²⁰ (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

Apply normalizations

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

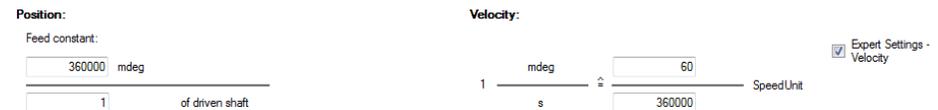


Fig. 9.5: Example 1: Unit [mdeg] for position and unit [rpm] for speed

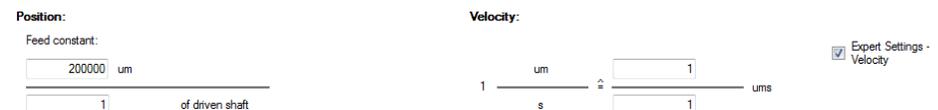


Fig. 9.6: Example 2: Unit [µm] for position and unit [µm/s] for speed

Fig. 9.7: Example 3: Unit [μm] for position and unit [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.

Fig. 9.8: Parameter for round table mode

In round table mode, the position is interpreted by default from 0° to 360° 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 |

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].

Expert Settings - MT Base

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".

Homing method: Type_35(35) = Actual position = reference position

Speed during search for switch (V1): 100 mms

Speed during search for zero (V2): 10 mms

Homing acceleration: 1000 AccUnit

Homing offset: 0 um

Max. distance during homing: 0 um

Home position = Actual position

Homing special function

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). 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"> • STD (0) = Standard mode • SH1F (1) = Input shaping for one frequency without damping" | 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 inputs208

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 |

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

Open the panel "Bits" with a double click on status word.

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 MPRO_BRK_Lock . 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 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 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 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.



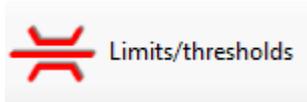
NOTE

- 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 enabled on input | |
| | Test pulse monitoring is disabled 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 | <ul style="list-style-type: none"> 11.1 Limitations214 11.2 Thresholds217 11.3 Parameters 219 |

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.

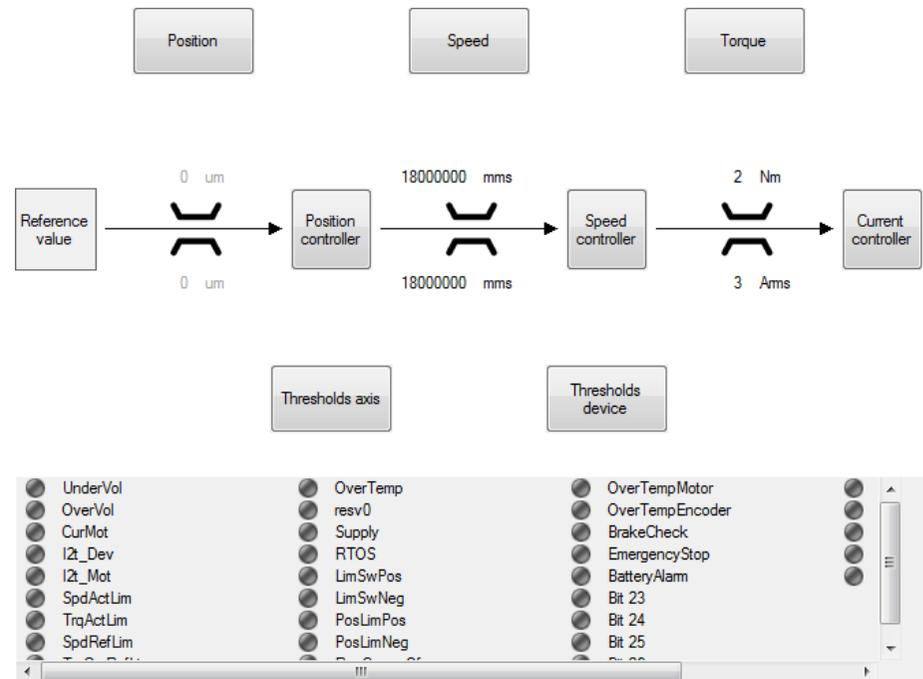


Fig. 11.1: "Limitations, thresholds settings" dialog box

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

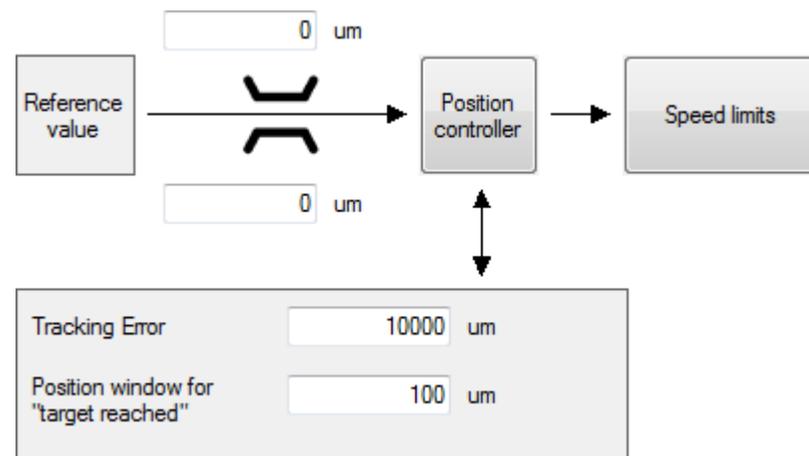


Fig. 11.2: Dialog box for "Position control limitations"

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

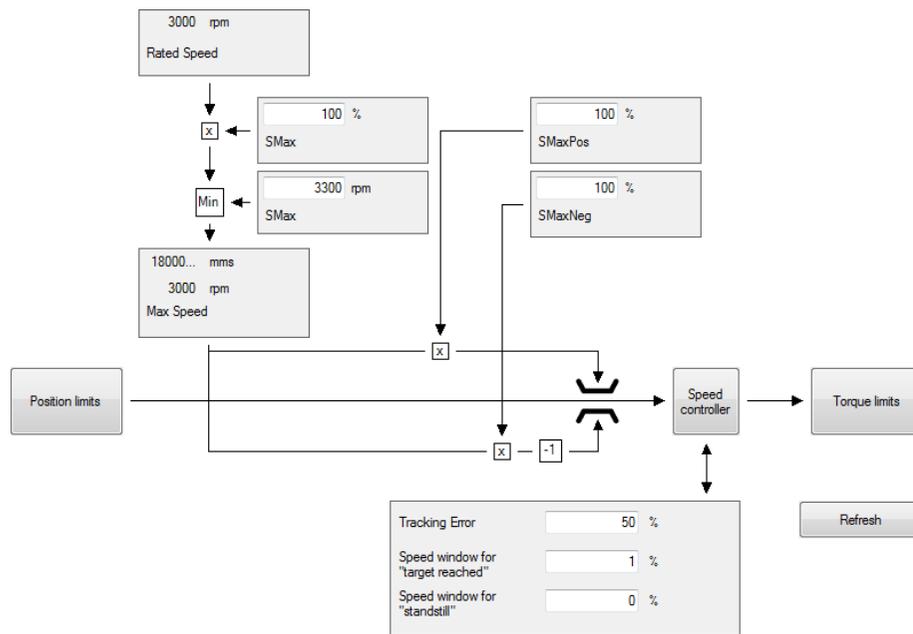


Fig. 11.3: Dialog box for "speed control limitations"

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

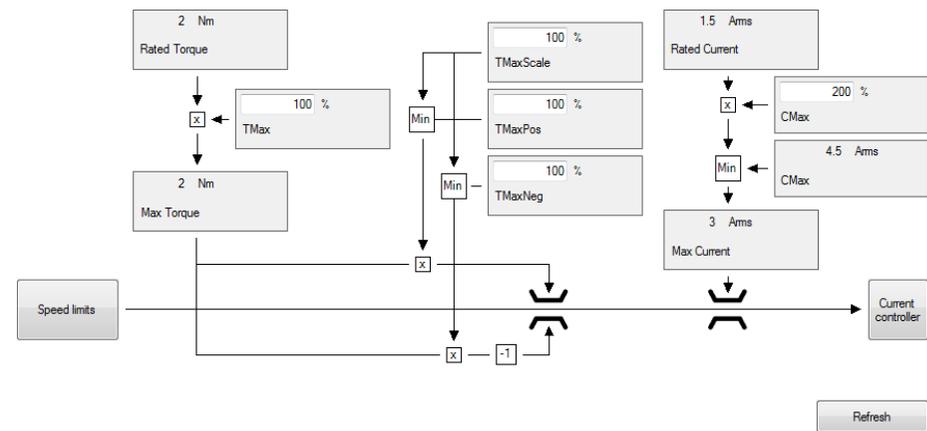


Fig. 11.4: "Torque / current control limitations" dialog box

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 ² t device protection (on) | <input type="text" value="110"/> | % |
| I ² t device protection (off) | <input type="text" value="110"/> | % |
| I ² t motor protection (on) | <input type="text" value="110"/> | % |
| I ² 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

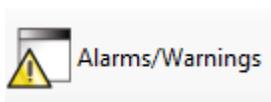
| P No. | Index | Name | Unit | Description |
|-------|-------|-----------------------------|------|----------------------------------|
| 1002 | | MON_ DeviceWarningLevels | | Warning thresholds of the device |
| 1002 | 0 | Undervoltage_ON | V | DC-link undervoltage |
| 1002 | 1 | Undervoltage_OFF | 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**:

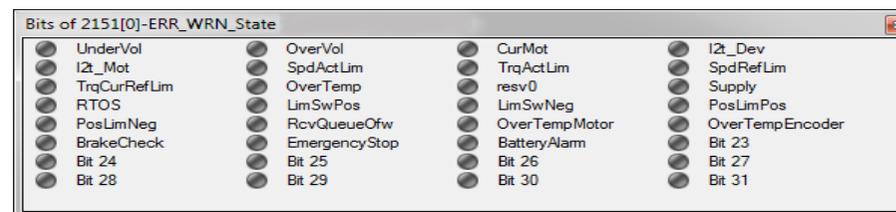


Fig. 12.1: ERR_WRN_State status word

| Bit | Name | Function | Reference | Parameter for threshold(s) |
|-----|-----------|--------------------------------------|-----------|--|
| 0 | UnderVol | Undervoltage detected | Device | P 1002 0 Undervoltage_ON, P 1002 1 Undervoltage_OFF |
| 1 | OverVol | Overvoltage detected | Device | P 1002 2 OverVoltage_ON, P 1002 3 OverVoltage_OFF |
| 2 | IMon | Motor current greater than threshold | Axis | P 3071 0 I_ON, P 3071 1 I_OFF |
| 3 | I2t_Dev | Overload Axis Controller detected | Axis | P 3071 2 DeviceI2t_ON, P 3071 3 DeviceI2t_OFF |
| 4 | I2t_Mot | Motor overload detected | Axis | P 3071 4 MotorI2t_ON, P 3071 5 MotorI2t_OFF |
| 5 | SpdActLim | Speed limitation active | Axis | P 3071 8 Speed_ON, P 3071 9 Speed_OFF |

Table 12.1: ERR_WRN_State status word

| Bit | Name | Function | Reference | Parameter for threshold(s) |
|-----|-------------|--|---------------|---|
| 6 | TrqActLim | Torque limitation active | Axis | P 3071 6 Torque_ON, P 3071 7 Torque_OFF |
| 7 | SpdRefLim | Speed setpoint limitation active | Axis | -- |
| 8 | CurRefLim | Current setpoint limitation active | Axis | -- |
| 9 | OverTemp | Overtemperature detected | Device / axis | P 1002 4 Tint_ON, P 1002 5 Tint_OFF (Device temperature) P 3071 10 TC_ON, P 3071 11 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: P 703[3] bit 5 P 703[4] bit 0, 2, 3 P 703[5] bit 4 - 9, 12, 14 However, these bits only lead to a warning if they were activated for this purpose with mask parameters. P 705[2] as a mask for P 703[3] P 705[5] as a mask for P 703[4] P 705[8] as a mask for P 703[5] |
| 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 | P 24701 1 PosLim_Max |
| 16 | PosLimNeg | Negative position limit reached | Axis | P 24701 0 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 | P 3071 12 MotorTemp_On, P 3071 13 MotorTemp_Off |
| 19 | OverTempEncoder | Ovetemperature encoder (on this axis) | Axis | P 2874 31 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 P 703-3 estatS | | | | |
| 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 | P 711-0 = 2: 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 | P 705-11: PSU interior temperature warning threshold. |
| 5 | T_KK_W | If the PSU heat sink temperature rises above the set warning threshold. | Supply unit | P 705-13: 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 | P 705-12: 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 P 651-5 tmx_u . | Supply unit | P 651-5 tmx_u: 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 P 651-4 tmn_u . | Supply unit | P 651-4 tmn_u: Minimum 24V output voltage. |
| 12 | T_BR_WRN | Overtemperature threshold, brake chopper, exceeded due to P*t monitoring. If the Pxt counter in P 704-35 pxtbc exceeds the value in P 713-1 pxtlv . | Supply unit | P 704-35 pxtbc: actual pxt level of brake chopper overload. [%] P 713-1: 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)

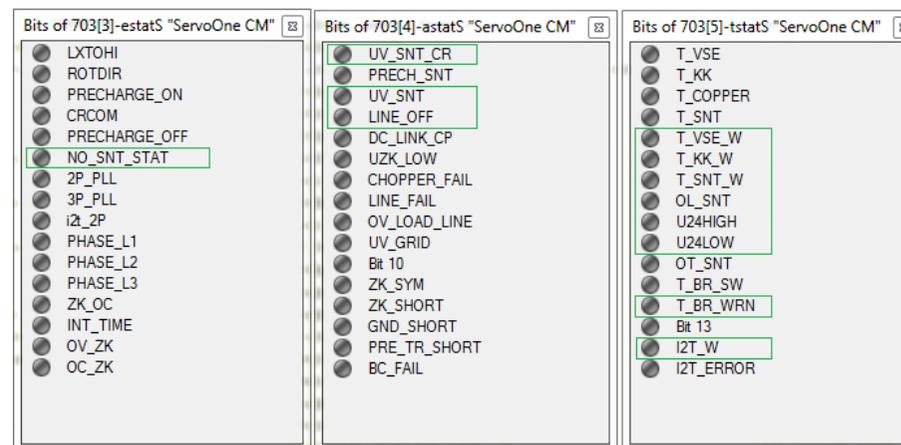


Fig. 12.2: Supply unit Warnings

12.1.1 Parameter warnings/errors

| P No. | Index | Name | Unit | Description |
|------------------------|-------|----------------------|-----------|--------------------------------|
| Status warnings | | | | |
| 2151 / 4199 / 6247 | 0 | ERR_WRN_State | | Axis 1 / 2 / 3: Warning state |
| Error status | | | | |
| 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 |
| System status | | | | |
| 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 |
| Axis state | | | | |
| 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 |
| Warning state | | | | |
| 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 |
| Current error | | | | |
| 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 | Devicel2t_ON | % | I2t device protection |
| 3071 / 5119 / 7167 | 3 | Devicel2t_OFF | % | I2t device protection |
| 3071 / 5119 / 7167 | 4 | Motorl2t_ON | % | I2t motor protection |
| 3071 / 5119 / 7167 | 5 | Motorl2t_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.

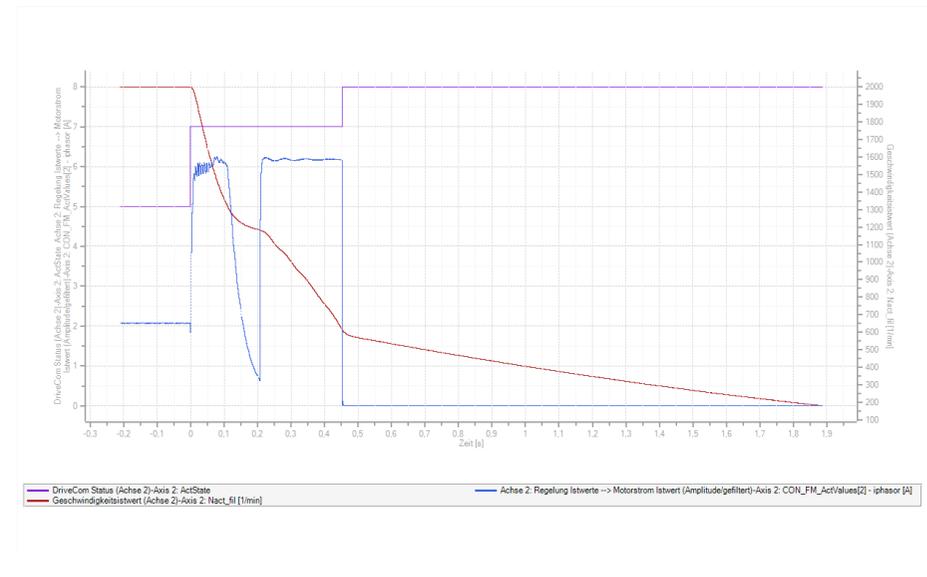


Fig. 12.5: Procedure for an asynchronous machine (example)

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

| Error source | Axis 1 | Axis 1 |
|--|----------------------------------|---|
| Counter | 4 | 3 |
| Label | Error 8-90 | Error 25-1 |
| Cause | Encoder #1 lost connection | Motor temperature reached TMax value |
| Remedy | Please check encoder wiring | Let motor cool down. If temperature is not plausible, check cables. |
| Time of error occurrence | Tuesday, 26. April 2016 12:06:47 | Monday, 25. April 2016 14:30:08 |
| EtherCAT system time | 0 | 0 |
| Info | Drive processor #0, 0 | Motor temperature too high, 329 |
| Source | unknown, line 392 | MON c, line 1914 |
| DriveCom state | Not ready to switch on | Not ready to switch on |
| Operating hours (power stage) [hh:mm:ss] | 0 | 0 |
| Actual Current [A] | 0.0032793 | 0.0030642 |
| Actual voltage [V] | 5.95219 | 5.95219 |
| Actual speed [SPEED] | 0 | 0 |
| Temp. heat sink modul 1 [°C] | 27.377 | 27.5298 |
| Temp. heat sink modul 2 [°C] | 27.3591 | 27.5297 |
| Temp. heat sink modul 3 [°C] | 27.3662 | 27.5298 |
| Temp. interior [°C] | 50 | 50 |

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"> False(0)= False True(1)= True |
| 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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
| This is probably a software issue. | <ul style="list-style-type: none">• Please try to switch to a different version of device firmware.• 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. |

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |
| 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"> • Please report this error to your service partner. • Please check with your service partner how to generate an image file of the drive. • Please provide the KeStudio DriveManager message log. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |

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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
| This is probably a software issue. | <ul style="list-style-type: none">• Please try to switch to a different version of device firmware.• 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. |

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">• Please report this error to your service partner.• Please check with your service partner how to generate an image file of the drive.• Please provide the KeStudio DriveManager message log. |
| This is probably a software issue. | <ul style="list-style-type: none">• Please try to switch to a different version of device firmware.• 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. |

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

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"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |
| 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"> • Please check the device cabling for proper 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. |

12.5.4.4 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">• Please check the EtherCAT connection. Try to replace the cables.• Please try to reduce computational load on the master.• Try to increase the master cycle time. |
| 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">• Please check the device cabling for proper 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. |

12.5.4.5 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">• Please check the EtherCAT connection. Try to replace the cables.• Please try to reduce computational load on the master.• Try to increase the master cycle time. |
| 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">• Please check the device cabling for proper 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. |

12.5.4.6 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">• Please check the EtherCAT connection. Try to replace the cables.• Please try to reduce computational load on the master.• Try to increase the master cycle time. |
|---|--|

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">• Please check the EtherCAT connection. Try to replace the cables.• Please try to reduce computational load on the master.• Try to increase the master cycle time. |
|---|--|

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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. |
|-------------|---|

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"> • Please restart application (24V reset). • If the error occurs again, switch device to service mode. Try to save a device commissioning file with your settings. • Please re-view ethernet over EtherCAT (EoE) settings on the master. |
| 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"> • Please restart application (24V reset). • If the error occurs again, switch device to service mode. Try to save a device commissioning file with your settings. • Please re-view ethernet over EtherCAT (EoE) settings on the master. |
| 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"> • Please restart application (24V reset). • If the error occurs again, switch device to service mode. Try to save a device commissioning file with your settings. • Please re-view ethernet over EtherCAT (EoE) settings on the master. |
| 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"> • Please restart application (24V reset). • If the error occurs again, switch device to service mode. Try to save a device commissioning file with your settings. • Please re-view ethernet over EtherCAT (EoE) settings on the master. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please report this error to your service partner. • Please check with your service partner how to generate an image file of the drive. • Please provide the KeStudio DriveManager message log. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please report this error to your service partner. • Please check with your service partner how to generate an image file of the drive. • Please provide the KeStudio DriveManager message log. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |

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"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |

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"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
| This is probably a software issue. | <ul style="list-style-type: none">• Please try to switch to a different version of device firmware.• 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. |

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|---|---|

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|---|---|

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|---|---|

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
| This is probably a software issue. | <ul style="list-style-type: none">• Please try to switch to a different version of device firmware.• 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. |

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please check the encoder speed and direction, and motor pole pairs.• Check auto commutation parameters.• Make a scope record with scope values 24, 25, 21, 1009. |
|---|--|

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please try to switch to a different version of device firmware.• 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. |

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please check the encoder speed and direction, and motor pole pairs.• Check auto commutation parameters.• Make a scope record with scope values 24, 25, 21, 1009. |
|---|--|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.8 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.9 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.10 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.15 Error 8-61 (emergency code 230607h)

Cause: Encoder #2: A/B pattern error, probably EMC problem

Suggested steps:

| | |
|---|---|
| <p>The encoder is not connected or not working properly.</p> | <ul style="list-style-type: none"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| <p>Analog encoder: Amplitude check failed</p> | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| <p>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.</p> | <ul style="list-style-type: none"> • Please check the device cabling for proper 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. |

12.5.8.16 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.

| | |
|---|---|
| <p>The encoder is not connected or not working properly.</p> | <ul style="list-style-type: none"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| <p>Analog encoder: Amplitude check failed</p> | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| <p>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.</p> | <ul style="list-style-type: none"> • Please check the device cabling for proper 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. |

12.5.8.24 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.25 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.26 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.27 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.28 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.29 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.30 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.31 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.32 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.33 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|---|---|

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|---|---|

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. |
|-----------------------------------|--|

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. |
|-----------------------------------|--|

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. |
|-----------------------------------|--|

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.

| | |
|--|---|
| <p>The device was probably disconnected from the master controller, or the master is overloaded.</p> | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |
| <p>This issue is probably caused by an unsuitable parameter setting.</p> | <ul style="list-style-type: none"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |

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.

| | |
|--|---|
| <p>The device was probably disconnected from the master controller, or the master is overloaded.</p> | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |
| <p>This issue is probably caused by an unsuitable parameter setting.</p> | <ul style="list-style-type: none"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |

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.

| | |
|--|---|
| <p>The device was probably disconnected from the master controller, or the master is overloaded.</p> | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |
| <p>This issue is probably caused by an unsuitable parameter setting.</p> | <ul style="list-style-type: none"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |

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.

| | |
|--|--|
| <p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p> | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|--|--|

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.

| | |
|--|--|
| <p>The encoder special function (persistent homing and multiturn simulation) has reported an error</p> | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|--|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.76 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.77 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.78 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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
|---|---|

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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
|---|---|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
|---|--|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.8.82 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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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">• Please check the device cabling for proper 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. |

12.5.8.87 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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please reduce computational load by removing parameters from mapping. • De-activate features of control system or motion control. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |

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"> • Please reduce computational load by removing parameters from mapping. • De-activate features of control system or motion control. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |

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"> • Please reduce computational load by removing parameters from mapping. • De-activate features of control system or motion control. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |

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"> • Please reduce computational load by removing parameters from mapping. • De-activate features of control system or motion control. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |

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"> • Please reduce computational load by removing parameters from mapping. • De-activate features of control system or motion control. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |

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"> • Please reduce computational load by removing parameters from mapping. • De-activate features of control system or motion control. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |

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"> • Please reduce computational load by removing parameters from mapping. • De-activate features of control system or motion control. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |

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"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| 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">• Please check current control settings and step response.• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.• If possible, reduce the needed current, especially in low-frequency range.• If possible, lower the switching frequency or enable automatic frequency selection.• Check if the encoder offset is set properly.• Consider using an axis module with higher current rating. |

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">• Please check current control settings and step response.• Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually.• If possible, reduce the needed current, especially in low-frequency range.• If possible, lower the switching frequency or enable automatic frequency selection.• Check if the encoder offset is set properly.• Consider using an axis module with higher current rating. |

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"> • Please let the motor cool down. • Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet. |
| An overcurrent was detected. | <ul style="list-style-type: none"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |

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"> • Please let the motor cool down. • Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet. |
| An overcurrent was detected. | <ul style="list-style-type: none"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |

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"> • Please let the motor cool down. • Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet. |
| An overcurrent was detected. | <ul style="list-style-type: none"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |

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"> • Please let the motor cool down. • Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet. |
| An overcurrent was detected. | <ul style="list-style-type: none"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |

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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

12.5.13.2 Error 13-1 (emergency code FF0207h)

Cause: Set of set points: Stack overflow, to 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"> • Please check the encoder speed and direction, and motor pole pairs. • Check auto commutation parameters. • Make a scope record with scope values 24, 25, 21, 1009. |
| The control system failed to track the reference value | <ul style="list-style-type: none"> • Please check if the axis is blocked. • Try to reduce acceleration or deceleration. • 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. |

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">• Please check if the actual grid voltage matches the supply setting (parameter PST_VoltageSupply)• Over-voltage may be caused by a decelerating axis, possibly with high inertia. Reduce deceleration ramp.• Consider using a braking resistor with higher power. If the supply unit has an internal braking resistor, please contact your service partner. |
|---------------------------|--|

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">• Please check if the actual grid voltage matches the supply setting (parameter PST_VoltageSupply)• Over-voltage may be caused by a decelerating axis, possibly with high inertia. Reduce deceleration ramp.• Consider using a braking resistor with higher power. If the supply unit has an internal braking resistor, please contact your service partner. |
|---------------------------|--|

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. |
|-----------------------------------|--|

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"> • Power supply was possibly switched off. • Please check if the actual grid voltage matches the supply setting (parameter PST_VoltageSupply) • Verify that the grid is stable under load condition. |
|---|---|

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"> • Power supply was possibly switched off. • Please check if the actual grid voltage matches the supply setting (parameter PST_VoltageSupply) • Verify that the grid is stable under load condition. |
|---|---|

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"> • Please check if the axis is blocked. • Try to reduce acceleration or deceleration. • 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. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |
| 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"> • Please check the device cabling for proper 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. |

12.5.16.2 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"> • Please check if the axis is blocked. • Try to reduce acceleration or deceleration. • 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. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |
| 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"> • Please check the device cabling for proper 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. |

12.5.16.3 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"> • Please check if the axis is blocked. • Try to reduce acceleration or deceleration. • 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. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |
| 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"> • Please check the device cabling for proper 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. |

12.5.16.4 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"> • Please check if the axis is blocked. • Try to reduce acceleration or deceleration. • 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. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |
| 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"> • Please check the device cabling for proper 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. |

12.5.17.1 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"> • Please check if the axis is blocked. • Try to reduce acceleration or deceleration. • 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. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |
| 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"> • Please check the device cabling for proper 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. |

12.5.17 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"> • Please check if the axis is blocked. • Try to reduce acceleration or deceleration. • 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. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |
| 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"> • Please check the device cabling for proper 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. |

12.5.17.3 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"> • Please check if the axis is blocked. • Try to reduce acceleration or deceleration. • 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. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |
| 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"> • Please check the device cabling for proper 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. |

12.5.18 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"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| 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"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| 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"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| 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"> • Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies). • Cross communication must not be connected across different power supplies. • The last axis module's X4 or X40B connector (whichever applies) must remain open. • All axis modules on a cross communication should run the same firmware • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies). • Cross communication must not be connected across different power supplies. • The last axis module's X4 or X40B connector (whichever applies) must remain open. • All axis modules on a cross communication should run the same firmware • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies). • Cross communication must not be connected across different power supplies. • The last axis module's X4 or X40B connector (whichever applies) must remain open. • All axis modules on a cross communication should run the same firmware • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies). • Cross communication must not be connected across different power supplies. • The last axis module's X4 or X40B connector (whichever applies) must remain open. • All axis modules on a cross communication should run the same firmware • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please check the device cabling for proper 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. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please check the device cabling for proper 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. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |
| 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">• Please check the device cabling for proper 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. |
| This is probably a software issue. | <ul style="list-style-type: none">• Please try to switch to a different version of device firmware.• 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. |
| 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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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"> • Please check the device cabling for proper 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. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |
| 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. |
|-----------------------------------|--|

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please check the encoder speed and direction, and motor pole pairs.• Check auto commutation parameters.• Make a scope record with scope values 24, 25, 21, 1009. |
|---|--|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.22.8 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.22.9 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.22.10 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.22.15 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.22.16 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.

| | |
|--|---|
| <p>The encoder is not connected or not working properly.</p> | <ul style="list-style-type: none"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| <p>Analog encoder: Amplitude check failed</p> | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| <p>This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC</p> | <ul style="list-style-type: none"> • Please check the device cabling for proper connection. • Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

link power supply.

- Check motor grounding and motor cable length.

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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none">• Please scope the signal amplitude, and compare to parameter EncObsMin• 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.• See detailed error information (>>) for a more detailed description. |
| 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">• Please check the device cabling for proper connection.• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

| | |
|--------------------|---|
| link power supply. | <ul style="list-style-type: none"> • Check motor grounding and motor cable length. |
|--------------------|---|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper connection. • Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

link power supply.

- Check motor grounding and motor cable length.

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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none">• Please scope the signal amplitude, and compare to parameter EncObsMin• 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.• See detailed error information (>>) for a more detailed description. |
| 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">• Please check the device cabling for proper connection.• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

| | |
|--------------------|---|
| link power supply. | <ul style="list-style-type: none"> • Check motor grounding and motor cable length. |
|--------------------|---|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper connection. • Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

link power supply.

- Check motor grounding and motor cable length.

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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none">• Please scope the signal amplitude, and compare to parameter EncObsMin• 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.• See detailed error information (>>) for a more detailed description. |
| 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">• Please check the device cabling for proper connection.• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

| | |
|--------------------|---|
| link power supply. | <ul style="list-style-type: none"> • Check motor grounding and motor cable length. |
|--------------------|---|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper connection. • Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

link power supply.

- Check motor grounding and motor cable length.

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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none">• Please scope the signal amplitude, and compare to parameter EncObsMin• 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.• See detailed error information (>>) for a more detailed description. |
| 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">• Please check the device cabling for proper 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. |

12.5.22.31 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.22.32 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.22.33 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |

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"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |
|---|---|

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|---|---|

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. |
|-----------------------------------|--|

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. |
|-----------------------------------|--|

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. |
|-----------------------------------|--|

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"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |
| <p>This issue is probably caused by an unsuitable parameter setting.</p> | <ul style="list-style-type: none"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |

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">• Please check the EtherCAT connection. Try to replace the cables.• Please try to reduce computational load on the master.• Try to increase the master cycle time. |
| This issue is probably caused by an unsuitable parameter setting. | <ul style="list-style-type: none">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |

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">• Please check the EtherCAT connection. Try to replace the cables.• Please try to reduce computational load on the master.• Try to increase the master cycle time. |
| This issue is probably caused by an unsuitable parameter setting. | <ul style="list-style-type: none">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.22.76 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.22.77 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.22.78 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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
|---|---|

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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
|---|---|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
|---|--|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.22.82 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:

| | |
|---|--|
| <p>The encoder is not connected or not working properly.</p> | <ul style="list-style-type: none"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| <p>Digital encoder: protocol error or problem reported by encoder</p> | <p>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.</p> |
| <p>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.</p> | <ul style="list-style-type: none"> • Please check the device cabling for proper 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. |

12.5.22.87 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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 24V I/O wiring, function assignment and inversion parameters.• Please check connected switches for chattering. Consider using the input filter. |
| 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">• Please check the device cabling for proper 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. |

12.5.23.2 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">• Please check the 24V I/O wiring, function assignment and inversion parameters.• Please check connected switches for chattering. Consider using the input filter. |
| 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">• Please check the device cabling for proper 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. |

12.5.23.3 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"> • Please check the 24V I/O wiring, function assignment and inversion parameters. • Please check connected switches for chattering. Consider using the input filter. |
| 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"> • Please check the device cabling for proper 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. |

12.5.23.4 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"> • Please check the 24V I/O wiring, function assignment and inversion parameters. • Please check connected switches for chattering. Consider using the input filter. |
| 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"> • Please check the device cabling for proper 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. |

12.5.23.5 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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies). • Cross communication must not be connected across different power supplies. • The last axis module's X4 or X40B connector (whichever applies) must remain open. • All axis modules on a cross communication should run the same firmware • 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. |
| 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"> • Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies). • Cross communication must not be connected across different power supplies. • The last axis module's X4 or X40B connector (whichever applies) must remain open. • All axis modules on a cross communication should run the same firmware • 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. |
| 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"> • Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies). • Cross communication must not be connected across different power supplies. • The last axis module's X4 or X40B connector (whichever applies) must remain open. • All axis modules on a cross communication should run the same firmware • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Check the source of the 24V supply. • Measure the exact voltage, and check limits in the instruction manual. • Check the supply voltage when switching on the system. • Check the supply voltage in special situations, esp. when the motor brakes are opening |
| 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"> • Please check the device cabling for proper 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. |
| 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. |
|-----------------------------------|--|

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"> • Please try to switch to a different version of device firmware. • 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. |
| 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">• Please check if the actual grid voltage matches the supply setting (parameter PST_VoltageSupply)• Over-voltage may be caused by a decelerating axis, possibly with high inertia. Reduce deceleration ramp.• Consider using a braking resistor with higher power. If the supply unit has an internal braking resistor, please contact your service partner. |
|---------------------------|--|

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. |
|---|---|

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.

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.

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.

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">• 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. |
|---|--|

12.5.24.26 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">• Please check the emergency line requirements in the instruction manual• Check errors on other modules connected to the emergency line• Check if any axis module in the system reports a critical error |
|--|--|

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">• 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. |
|---|--|

12.5.25 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"> • Please let the motor cool down. • Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet. |
| The motor temperature is too high. | <ul style="list-style-type: none"> • 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. • If you are not using a system motor, please check with the motor manufacturer if the motor can stand a higher temperature |
| An overcurrent was detected. | <ul style="list-style-type: none"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| This is possibly an EMC | <ul style="list-style-type: none"> • Please check the device cabling for proper |

| | |
|--|---|
| 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"> • 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"> • Please let the motor cool down. • Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet. |
| The motor temperature is too high. | <ul style="list-style-type: none"> • 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. • If you are not using a system motor, please check with the motor manufacturer if the motor can stand a higher temperature |
| An overcurrent was detected. | <ul style="list-style-type: none"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| This is possibly an EMC | <ul style="list-style-type: none"> • Please check the device cabling for proper |

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"> • Please let the motor cool down. • Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet. |
| The motor temperature is too high. | <ul style="list-style-type: none"> • 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. • If you are not using a system motor, please check with the motor manufacturer if the motor can stand a higher temperature |
| An overcurrent was detected. | <ul style="list-style-type: none"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| This is possibly an EMC | <ul style="list-style-type: none"> • Please check the device cabling for proper |

| | |
|--|---|
| 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"> • 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"> • Please let the motor cool down. • Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet. |
| The motor temperature is too high. | <ul style="list-style-type: none"> • 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. • If you are not using a system motor, please check with the motor manufacturer if the motor can stand a higher temperature |
| An overcurrent was detected. | <ul style="list-style-type: none"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. |

| | |
|--|--|
| | <ul style="list-style-type: none"> • Consider using an axis module with higher current rating. |
| 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"> • Please check the device cabling for proper 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. |

12.5.25.5 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"> • Please let the motor cool down. • Reduce load or consider using a larger motor. Check parameters of motor protection against motor datasheet. |
| The motor temperature is too high. | <ul style="list-style-type: none"> • 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. • If you are not using a system motor, please check with the motor manufacturer if the motor can stand a higher temperature |
| An overcurrent was detected. | <ul style="list-style-type: none"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| This is possibly an EMC | <ul style="list-style-type: none"> • Please check the device cabling for proper |

| | |
|--|---|
| 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"> • Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. • Check motor grounding and motor cable length. |
|--|---|

12.5.25.6 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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

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"> • Please check factor group setting and position command • Take a scope record to determine if the position control overshoots. |
| There is a problem with the digital inputs | <ul style="list-style-type: none"> • Please check the 24V I/O wiring, function assignment and inversion parameters. • Please check connected switches for chattering. Consider using the input filter. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |

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"> • Please check factor group setting and position command • Take a scope record to determine if the position control overshoots. |
| There is a problem with the digital inputs | <ul style="list-style-type: none"> • Please check the 24V I/O wiring, function assignment and inversion parameters. • Please check connected switches for chattering. Consider using the input filter. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |

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"> • Please check factor group setting and position command • Take a scope record to determine if the position control overshoots. |
| There is a problem with the digital inputs | <ul style="list-style-type: none"> • Please check the 24V I/O wiring, function assignment and inversion parameters. • Please check connected switches for chattering. Consider using the input filter. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |

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"> • Please check factor group setting and position command • Take a scope record to determine if the position control overshoots. |
| There is a problem with the digital inputs | <ul style="list-style-type: none"> • Please check the 24V I/O wiring, function assignment and inversion parameters. • Please check connected switches for chattering. Consider using the input filter. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |

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"> • Please check factor group setting and position command • Take a scope record to determine if the position control overshoots. |
| There is a problem with the digital inputs | <ul style="list-style-type: none"> • Please check the 24V I/O wiring, function assignment and inversion parameters. • Please check connected switches for chattering. Consider using the input filter. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |

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">• Please check factor group setting and position command• Take a scope record to determine if the position control overshoots. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none">• Please check that the encoder offset is set properly.• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |

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">• Please check factor group setting and position command• Take a scope record to determine if the position control overshoots. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none">• Please check that the encoder offset is set properly.• If auto commutation is used, re-view the auto commutation setting and test under all possible conditions.• If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |

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"> • Please check factor group setting and position command • Take a scope record to determine if the position control overshoots. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |

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"> • Please check factor group setting and position command • Take a scope record to determine if the position control overshoots. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |

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"> • Please check reference values. If this axis is working in cyclic synchronous mode, make a scope record. • Check factor group settings. • Check mode of operation. |
|--|---|

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">• Please check reference values. If this axis is working in cyclic synchronous mode, make a scope record.• Check factor group settings.• Check mode of operation. |
|--|---|

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">• Please check reference values. If this axis is working in cyclic synchronous mode, make a scope record.• Check factor group settings.• Check mode of operation. |
|--|---|

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">• Please check reference values. If this axis is working in cyclic synchronous mode, make a scope record.• Check factor group settings.• Check mode of operation. |
|--|---|

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">• Please check reference values. If this axis is working in cyclic synchronous mode, make a scope record.• Check factor group settings.• Check mode of operation. |
|--|---|

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"> • Please check reference values. If this axis is working in cyclic synchronous mode, make a scope record. • Check factor group settings. • Check mode of operation. |
|--|---|

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"> • Please check message log for further information. • Restart application (24V reset) and see if the error occurs again. • Please view encoder documentation or contact motor manufacturer • If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore' |
|---|--|

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"> • Please check message log for further information. • Restart application (24V reset) and see if the error occurs again. • Please view encoder documentation or contact motor manufacturer • If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore' |
|---|--|

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"> • Please check message log for further information. • Restart application (24V reset) and see if the error occurs again. • Please view encoder documentation or contact motor manufacturer • If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore' |
|---|--|

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">• Please check message log for further information.• Restart application (24V reset) and see if the error occurs again.• Please view encoder documentation or contact motor manufacturer• If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore' |
|---|---|

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">• Please check message log for further information.• Restart application (24V reset) and see if the error occurs again.• Please view encoder documentation or contact motor manufacturer• If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore' |
|---|---|

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">• Please check message log for further information.• Restart application (24V reset) and see if the error occurs again.• Please view encoder documentation or contact motor manufacturer• If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore' |
|---|---|

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">• Please check message log for further information.• Restart application (24V reset) and see if the error occurs again.• Please view encoder documentation or contact motor manufacturer• If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore' |
|---|---|

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"> • Please check message log for further information. • Restart application (24V reset) and see if the error occurs again. • Please view encoder documentation or contact motor manufacturer • If encoder message guarding is not intended, please set the corresponding reaction parameter to 'Ignore' |
|---|--|

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"> • Please check axis for mechanical problems • Please check setting of the tracking function. |
|--|---|

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"> • Please check axis for mechanical problems • Please check setting of the tracking function. |
|--|---|

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"> • Please check axis for mechanical problems • Please check setting of the tracking function. |
|--|---|

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
| This is probably a software issue. | <ul style="list-style-type: none">• Please try to switch to a different version of device firmware.• 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. |

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|---|---|

12.5.32.3 Error 32-2 (emergency code 632007h)

Cause: Error in motor parameters/ asynchronous 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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|--|---|

12.5.32.4 Error 32-3 (emergency code 632007h)

Cause: Error in motor parameters

Suggested steps:

Check motor electrical parameters

| | |
|--|---|
| <p>This issue is probably caused by an unsuitable parameter setting.</p> | <ul style="list-style-type: none">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|--|---|

12.5.32.5 Error 32-4 (emergency code 632007h)

Cause: No motor type was specified

Suggested steps:

Check motor parameters

| | |
|--|---|
| <p>This issue is probably caused by an unsuitable parameter setting.</p> | <ul style="list-style-type: none">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|--|---|

12.5.32.6 Error 32-5 (emergency code 632007h)

Cause: Error initializing motor simulation

Suggested steps:

Check motor parameters

| | |
|--|---|
| <p>This issue is probably caused by an unsuitable parameter setting.</p> | <ul style="list-style-type: none">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|--|---|

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|--|---|

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|--|---|

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"> • Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies). • Cross communication must not be connected across different power supplies. • The last axis module's X4 or X40B connector (whichever applies) must remain open. • All axis modules on a cross communication should run the same firmware • 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. |
| 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"> • Please check the device cabling for proper 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. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |

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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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">• To quit this error, it is necessary to restart the application (24V reset).• Please check the DIP switch setting.• Check the external STO cabling and safety master configuration.• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.• An external relay in the safety circuit might chatter. |
| 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">• To quit this error, it is necessary to restart the application (24V reset).• Please check the DIP switch setting.• Check the external STO cabling and safety master configuration.• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.• An external relay in the safety circuit might chatter. |
| 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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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">• To quit this error, it is necessary to restart the application (24V reset).• Please check the DIP switch setting.• Check the external STO cabling and safety master configuration.• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.• An external relay in the safety circuit might chatter. |
| 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">• To quit this error, it is necessary to restart the application (24V reset).• Please check the DIP switch setting.• Check the external STO cabling and safety master configuration.• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.• An external relay in the safety circuit might chatter. |
| 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.

| | |
|--|--|
| <p>A diagnostic error occurred in the safety module.</p> | <ul style="list-style-type: none"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| <p>This is possibly a hardware issue</p> | <p>If other measures fail to solve the problem, please replace the axis module.</p> |

12.5.35.7 Error 35-6 (emergency code FF0C07h)

Cause: STO diagnostic error

Suggested steps:

| | |
|--|--|
| <p>A diagnostic error occurred in the safety module.</p> | <ul style="list-style-type: none"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| <p>This is possibly a hardware issue</p> | <p>If other measures fail to solve the problem, please replace the axis module.</p> |

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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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:

| | |
|--|--|
| <p>A diagnostic error occurred in the safety module.</p> | <ul style="list-style-type: none"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| <p>This is possibly a hardware issue</p> | <p>If other measures fail to solve the problem, please replace the axis module.</p> |

12.5.35.11 Error 35-10 (emergency code FF0C07h)

Cause: STO SF OV: internal supply out of range

Suggested steps:

| | |
|--|--|
| <p>A diagnostic error occurred in the safety module.</p> | <ul style="list-style-type: none"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| <p>This is possibly a hardware issue</p> | <p>If other measures fail to solve the problem, please replace the axis module.</p> |

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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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:

| | |
|--|--|
| <p>A diagnostic error occurred in the safety module.</p> | <ul style="list-style-type: none"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| <p>This is possibly a hardware issue</p> | <p>If other measures fail to solve the problem, please replace the axis module.</p> |

12.5.35.15 Error 35-14 (emergency code FF0C07h)

Cause: SBC Master switch failure

Suggested steps:

| | |
|--|--|
| <p>A diagnostic error occurred in the safety module.</p> | <ul style="list-style-type: none"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| <p>This is possibly a hardware issue</p> | <p>If other measures fail to solve the problem, please replace the axis module.</p> |

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.

| | |
|---|--|
| <p>A diagnostic error occurred in the safety module.</p> | <ul style="list-style-type: none"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| <p>An error concerning 24V supply was reported</p> | <ul style="list-style-type: none"> • Check the source of the 24V supply. • Measure the exact voltage, and check limits in the instruction manual. • Check the supply voltage when switching on the system. • Check the supply voltage in special situations, esp. when the motor brakes are opening |
| <p>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.</p> | <ul style="list-style-type: none"> • Please check the device cabling for proper 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. |
| 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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| An error concerning 24V supply was reported | <ul style="list-style-type: none"> • Check the source of the 24V supply. • Measure the exact voltage, and check limits in the instruction manual. • Check the supply voltage when switching on the system. • Check the supply voltage in special situations, esp. when the motor brakes are opening |
| 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"> • Please check the device cabling for proper connection. • Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

| | |
|-----------------------------------|---|
| | <ul style="list-style-type: none"> • Check motor grounding and motor cable length. |
| 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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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">• To quit this error, it is necessary to restart the application (24V reset).• Please check the DIP switch setting.• Check the external STO cabling and safety master configuration.• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.• An external relay in the safety circuit might chatter. |
| 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">• To quit this error, it is necessary to restart the application (24V reset).• Please check the DIP switch setting.• Check the external STO cabling and safety master configuration.• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.• An external relay in the safety circuit might chatter. |
| 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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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"> • To quit this error, it is necessary to restart the application (24V reset). • Please check the DIP switch setting. • Check the external STO cabling and safety master configuration. • Especially check if the test pulses of the external master matches the axis module's DIP switch setting. • An external relay in the safety circuit might chatter. |
| 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">• To quit this error, it is necessary to restart the application (24V reset).• Please check the DIP switch setting.• Check the external STO cabling and safety master configuration.• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.• An external relay in the safety circuit might chatter. |
| 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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please check the encoder speed and direction, and motor pole pairs.• Check auto commutation parameters.• Make a scope record with scope values 24, 25, 21, 1009. |
|---|--|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.36.8 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.36.9 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.36.10 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.36.15 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.36.16 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.

| | |
|--|---|
| <p>The encoder is not connected or not working properly.</p> | <ul style="list-style-type: none"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| <p>Analog encoder: Amplitude check failed</p> | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| <p>This is possibly an EMC issue. This is very likely if the problem occurs when switching on motor control and/ or when connecting DC</p> | <ul style="list-style-type: none"> • Please check the device cabling for proper connection. • Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

link power supply.

- Check motor grounding and motor cable length.

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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none">• Please scope the signal amplitude, and compare to parameter EncObsMin• 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.• See detailed error information (>>) for a more detailed description. |
| 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">• Please check the device cabling for proper connection.• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

| | |
|--------------------|---|
| link power supply. | <ul style="list-style-type: none"> • Check motor grounding and motor cable length. |
|--------------------|---|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper connection. • Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

link power supply.

- Check motor grounding and motor cable length.

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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none">• Please scope the signal amplitude, and compare to parameter EncObsMin• 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.• See detailed error information (>>) for a more detailed description. |
| 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">• Please check the device cabling for proper connection.• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

| | |
|--------------------|---|
| link power supply. | <ul style="list-style-type: none"> • Check motor grounding and motor cable length. |
|--------------------|---|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper connection. • Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

link power supply.

- Check motor grounding and motor cable length.

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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none">• Please scope the signal amplitude, and compare to parameter EncObsMin• 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.• See detailed error information (>>) for a more detailed description. |
| 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">• Please check the device cabling for proper connection.• Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

| | |
|--------------------|---|
| link power supply. | <ul style="list-style-type: none"> • Check motor grounding and motor cable length. |
|--------------------|---|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper connection. • Please check device grounding, i. e. the connection to a metal backplane and cabinet connection to earth. |

link power supply.

- Check motor grounding and motor cable length.

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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none">• Please scope the signal amplitude, and compare to parameter EncObsMin• 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.• See detailed error information (>>) for a more detailed description. |
| 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">• Please check the device cabling for proper 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. |

12.5.36.31 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.36.32 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| Analog encoder: Amplitude check failed | <ul style="list-style-type: none"> • Please scope the signal amplitude, and compare to parameter EncObsMin • 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. • See detailed error information (>>) for a more detailed description. |
| 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"> • Please check the device cabling for proper 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. |

12.5.36.33 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |

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"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |
|---|---|

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">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |
|---|---|

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. |
|-----------------------------------|--|

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. |
|-----------------------------------|--|

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. |
|-----------------------------------|--|

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"> • Please check the EtherCAT connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |
| <p>This issue is probably caused by an unsuitable parameter setting.</p> | <ul style="list-style-type: none"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |

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">• Please check the EtherCAT connection. Try to replace the cables.• Please try to reduce computational load on the master.• Try to increase the master cycle time. |
| This issue is probably caused by an unsuitable parameter setting. | <ul style="list-style-type: none">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |

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">• Please check the EtherCAT connection. Try to replace the cables.• Please try to reduce computational load on the master.• Try to increase the master cycle time. |
| This issue is probably caused by an unsuitable parameter setting. | <ul style="list-style-type: none">• Save your parameter set for a later restore.• See 'history of parameter changes' and undo the latest changes.• Please check your parameter set for implausible settings.• Please set device to factory setting, restart, and see if the error occurs again.• When reporting this error to your service partner, please include your device's parameter setting. |

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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.

| | |
|---|--|
| The encoder special function (persistent homing and multiturn simulation) has reported an error | <ul style="list-style-type: none"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Please check the 'encoder special function' dialog and the message log for current state. • Please read documentation of 'encoder special function' • When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.36.76 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.36.77 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.36.78 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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
|---|---|

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">• Check cabling. If available, please try another encoder and cable.• See detailed error information (>>) for a more detailed description.• The problem may be caused by mechanical shock• In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
|---|---|

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

| | |
|--|--|
| <p>The encoder is not connected or not working properly.</p> | <ul style="list-style-type: none"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
|--|--|

12.5.36.81 Error 36-230 (emergency code 230507h)

Cause: Encoder #1: SmartAbs encoder error (Encoder error while switched off)

Suggested steps:

| | |
|---|--|
| <p>The encoder is not connected or not working properly.</p> | <ul style="list-style-type: none"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| <p>Digital encoder: protocol error or problem reported by encoder</p> | <p>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.</p> |
| <p>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.</p> | <ul style="list-style-type: none"> • Please check the device cabling for proper 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. |

12.5.36.82 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:

| | |
|---|--|
| <p>The encoder is not connected or not working properly.</p> | <ul style="list-style-type: none"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| <p>Digital encoder: protocol error or problem reported by encoder</p> | <p>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.</p> |
| <p>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.</p> | <ul style="list-style-type: none"> • Please check the device cabling for proper 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. |

12.5.36.87 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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the 'encoder special function' dialog and the message log for current state.• Please read documentation of 'encoder special function'• When reporting this error to your service partner, please attach the current project file and message log. |
|---|--|

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">• Please check the wiring of the device• If this error occurs in a SDC application, check for errors on SDC system and try to solve this errors first.• To quit this error, it is necessary to restart the application (24V reset).• If error still applies after restart, it's probably an hardware issue. Please replace the axis module and contact your service partner |
|---|--|

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">• Please check the wiring of the device• If this error occurs in a SDC application, check for errors on SDC system and try to solve this errors first.• To quit this error, it is necessary to restart the application (24V reset).• If error still applies after restart, it's probably an hardware issue. Please replace the axis module and contact your service partner |
|---|--|

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. |
|-----------------------------------|--|

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. |
|-----------------------------------|--|

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">• Please check the wiring the safe inputs.• Please check the DIP switch setting.• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.• An external relay in the safety circuit might chatter.• Please check the wiring of the motor brake• If this error occurs in a SDC application, check for errors on SDC system and try to solve these errors first. |
|---|---|

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">• Please check the wiring the safe inputs.• Please check the DIP switch setting.• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.• An external relay in the safety circuit might chatter.• Please check the wiring of the motor brake• If this error occurs in a SDC application, check for errors on SDC system and try to solve these errors first. |
|---|---|

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">• Please check the wiring of the device• If this error occurs in a SDC application, check for errors on SDC system and try to solve this errors first.• To quit this error, it is necessary to restart the application (24V reset).• If error still applies after restart, it's probably an hardware issue. Please replace the axis module and contact your service partner |
|---|--|

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">• Please check the wiring of the device• If this error occurs in a SDC application, check for errors on SDC system and try to solve this errors first.• To quit this error, it is necessary to restart the application (24V reset).• If error still applies after restart, it's probably an hardware issue. Please replace the axis module and contact your service partner |
|---|--|

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. |
|-----------------------------------|--|

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">• Please check the wiring of the device• If this error occurs in a SDC application, check for errors on SDC system and try to solve this errors first.• To quit this error, it is necessary to restart the application (24V reset).• If error still applies after restart, it's probably an hardware issue. Please replace the axis module and contact your service partner |
|---|--|

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">• Please check the wiring the safe inputs.• Please check the DIP switch setting.• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.• An external relay in the safety circuit might chatter.• Please check the wiring of the motor brake• If this error occurs in a SDC application, check for errors on SDC system and try to solve these errors first. |
|---|---|

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">• Please check the wiring the safe inputs.• Please check the DIP switch setting.• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.• An external relay in the safety circuit might chatter.• Please check the wiring of the motor brake• If this error occurs in a SDC application, check for errors on SDC system and try to solve these errors first. |
|---|---|

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">• Please check the wiring the safe inputs.• Please check the DIP switch setting.• Especially check if the test pulses of the external master matches the axis module's DIP switch setting.• An external relay in the safety circuit might chatter.• Please check the wiring of the motor brake• If this error occurs in a SDC application, check for errors on SDC system and try to solve these errors first. |
|---|---|

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">• Please check the extended error code in the message window• For more detailed error information please refer to document "ServoOne CM ErrorList SDC Option"• To quit this error please STOP/START the safePLC or restart the complete device |
|--|--|

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">• Please check the extended error code in the message window• For more detailed error information please refer to the SDC programming manual |
|---|---|

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"> • Please check the encoder hardware and the wiring. • Please check the encoder settings in SafetyManager and KeStudio DriveManager. Encoder must be configured correctly in both the functional and safety part |
| An alarm occurred in the safety module SDC | <ul style="list-style-type: none"> • Please check the extended error code in the message window • For more detailed error information please refer to the SDC programming manual |

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"> • Please check the encoder hardware and the wiring. • Please check the encoder settings in SafetyManager and KeStudio DriveManager. Encoder must be configured correctly in both the functional and safety part |
| An alarm occurred in the safety module SDC | <ul style="list-style-type: none"> • Please check the extended error code in the message window • For more detailed error information please refer to the SDC programming manual |

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"> • Please check the encoder hardware and the wiring. • Please check the encoder settings in SafetyManager and KeStudio DriveManager. Encoder must be configured correctly in both the functional and safety part |
| An alarm occurred in the safety module SDC | <ul style="list-style-type: none"> • Please check the extended error code in the message window • For more detailed error information please refer to the SDC programming manual |

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"> • Please check the encoder hardware and the wiring. • Please check the encoder settings in SafetyManager and KeStudio DriveManager. Encoder must be configured correctly in both the functional and safety part |
| An alarm occurred in the safety module SDC | <ul style="list-style-type: none"> • Please check the extended error code in the message window • For more detailed error information please refer to the SDC programming manual |

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">• Please check the encoder hardware and the wiring.• Please check the encoder settings in SafetyManager and KeStudio DriveManager. Encoder must be configured correctly in both the functional and safety part |
| An alarm occurred in the safety module SDC | <ul style="list-style-type: none">• Please check the extended error code in the message window• For more detailed error information please refer to the SDC programming manual |

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">• Please check the extended error code in the message window• For more detailed error information please refer to the SDC programming manual |
|--|---|

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">• Please check the extended error code in the message window• For more detailed error information please refer to the SDC programming manual |
|--|---|

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">• Please check the extended error code in the message window• For more detailed error information please refer to the SDC programming manual |
|--|---|

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"> • Please check the extended error code in the message window • For more detailed error information please refer to document "ServoOne CM ErrorList SDC Option" • To quit this error please STOP/START the safePLC or restart the complete device |
|---|--|

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"> • Please check the extended error code in the message window • For more detailed error information please refer to document "ServoOne CM ErrorList SDC Option" • To quit this error please STOP/START the safePLC or restart the complete device |
|---|--|

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"> • Please check the extended error code in the message window • For more detailed error information please refer to document "ServoOne CM ErrorList SDC Option" • To quit this error please STOP/START the safePLC or restart the complete device |
|---|--|

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"> • Please check the extended error code in the message window • For more detailed error information please refer to document "ServoOne CM ErrorList SDC Option" • To quit this error please STOP/START the safePLC or restart the complete device |
| 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 occured in the safety module SDC. | <ul style="list-style-type: none"> • Please check the extended error code in the message window • For more detailed error information please refer to document "ServoOne CM ErrorList SDC Option" • To quit this error please STOP/START the safePLC or restart the complete device |
| 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"> • Check cabling. If available, please try another encoder and cable. • See detailed error information (>>) for a more detailed description. • The problem may be caused by mechanical shock • In case of a linear encoder, the problem may be caused by imprecise encoder mounting. |
| 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"> • Please check the device cabling for proper 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. |

12.5.39 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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please check the emergency line requirements in the instruction manual• Check errors on other modules connected to the emergency line• Check if any axis module in the system reports a critical error |
|--|--|

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">• Please check the emergency line requirements in the instruction manual• Check errors on other modules connected to the emergency line• Check if any axis module in the system reports a critical error |
|--|--|

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"> • Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies). • Cross communication must not be connected across different power supplies. • The last axis module's X4 or X40B connector (whichever applies) must remain open. • All axis modules on a cross communication should run the same firmware • 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. |
|--|---|

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"> • 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. |

12.5.39.6 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"> • 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. |

12.5.39.7 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. |
|-----------------------------------|--|

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"> • Please try to switch to a different version of device firmware. • 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. |
| 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"> • 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. |
|---|---|

12.5.39.10 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"> • 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. |
|---|---|

12.5.39.11 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"> • 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. |
|---|---|

12.5.39.12 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">• Check the source of the 24V supply.• Measure the exact voltage, and check limits in the instruction manual.• Check the supply voltage when switching on the system.• Check the supply voltage in special situations, esp. when the motor brakes are opening |
| 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">• Please check the device cabling for proper 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. |

12.5.39.13 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">• Check the source of the 24V supply.• Measure the exact voltage, and check limits in the instruction manual.• Check the supply voltage when switching on the system.• Check the supply voltage in special situations, esp. when the motor brakes are opening |
| 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">• Please check the device cabling for proper 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. |

12.5.39.14 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"> • Check the source of the 24V supply. • Measure the exact voltage, and check limits in the instruction manual. • Check the supply voltage when switching on the system. • Check the supply voltage in special situations, esp. when the motor brakes are opening |
| 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"> • Please check the device cabling for proper 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. |

12.5.39.15 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"> • 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. |
|---|---|

12.5.40 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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

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">• Please check the emergency line requirements in the instruction manual• Check errors on other modules connected to the emergency line• Check if any axis module in the system reports a critical error |
|--|--|

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">• Please check the emergency line requirements in the instruction manual• Check errors on other modules connected to the emergency line• Check if any axis module in the system reports a critical error |
|--|--|

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. |
|-----------------------------------|--|

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">• Please try to switch to a different version of device firmware.• 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. |
| 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"> • 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. |
|---|---|

12.5.40.8 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"> • 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. |
|---|---|

12.5.40.9 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"> • 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. |
|---|---|

12.5.41 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"> • Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies). • Cross communication must not be connected across different power supplies. • The last axis module's X4 or X40B connector (whichever applies) must remain open. • All axis modules on a cross communication should run the same firmware • 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. |
| 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"> • Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies). • Cross communication must not be connected across different power supplies. • The last axis module's X4 or X40B connector (whichever applies) must remain open. • All axis modules on a cross communication should run the same firmware • 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. |
| 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"> • Please check cross communication cabling (X3/X4 or X40A/X40B, whichever applies). • Cross communication must not be connected across different power supplies. • The last axis module's X4 or X40B connector (whichever applies) must remain open. • All axis modules on a cross communication should run the same firmware • 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. |
| 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"> • Please check the device cabling for proper 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. |
| 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"> • Check the source of the 24V supply. • Measure the exact voltage, and check limits in the instruction manual. • Check the supply voltage when switching on the system. • Check the supply voltage in special situations, esp. when the motor brakes are opening |
| 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"> • Please check the device cabling for proper 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. |
| 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. |
|-----------------------------------|--|

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">• Please try to switch to a different version of device firmware.• 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. |
| 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">• Please check if the actual grid voltage matches the supply setting (parameter PST_VoltageSupply)• Over-voltage may be caused by a decelerating axis, possibly with high inertia. Reduce deceleration ramp.• Consider using a braking resistor with higher power. If the supply unit has an internal braking resistor, please contact your service partner. |
|---------------------------|--|

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. |
|---|---|

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. |
|---|---|

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. |
|---|---|

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. |
|---|---|

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">• 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. |
|---|--|

12.5.42.26 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">• Please check the emergency line requirements in the instruction manual• Check errors on other modules connected to the emergency line• Check if any axis module in the system reports a critical error |
|--|--|

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">• 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. |
|---|--|

12.5.43 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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please check the emergency line requirements in the instruction manual• Check errors on other modules connected to the emergency line• Check if any axis module in the system reports a critical error |
|--|--|

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">• Please check the emergency line requirements in the instruction manual• Check errors on other modules connected to the emergency line• Check if any axis module in the system reports a critical error |
|--|--|

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. |
|-----------------------------------|--|

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"> • Please try to switch to a different version of device firmware. • 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. |
| 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. |
|--|--|

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"> • 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. |
|---|---|

12.5.43.8 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">• 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. |
|---|--|

12.5.43.9 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">• 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. |
|---|--|

12.5.44 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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please check the emergency line requirements in the instruction manual• Check errors on other modules connected to the emergency line• Check if any axis module in the system reports a critical error |
|--|--|

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"> • Please check the emergency line requirements in the instruction manual • Check errors on other modules connected to the emergency line • Check if any axis module in the system reports a critical error |
|--|--|

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"> • Please try to switch to a different version of device firmware. • 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. |
| 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">• 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. |
|---|--|

12.5.44.8 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">• 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. |
|---|--|

12.5.44.9 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">• 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. |
|---|--|

12.5.45 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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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"> • Please check the emergency line requirements in the instruction manual • Check errors on other modules connected to the emergency line • Check if any axis module in the system reports a critical error |
|--|--|

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"> • Please check the emergency line requirements in the instruction manual • Check errors on other modules connected to the emergency line • Check if any axis module in the system reports a critical error |
|--|--|

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"> • Please try to switch to a different version of device firmware. • 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. |
| 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">• 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. |
|---|--|

12.5.45.8 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">• 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. |
|---|--|

12.5.45.9 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">• 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. |
|---|--|

12.5.46 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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

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"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |
| This is probably a software issue. | <ul style="list-style-type: none"> • Please try to switch to a different version of device firmware. • 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. |

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"> • Please try to switch to a different version of device firmware. • 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. |

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"> • Please check the POWERLINK connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |
| 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"> • Please check the device cabling for proper 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. |

12.5.46.5 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"> • Please try to switch to a different version of device firmware. • 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. |
|------------------------------------|---|

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"> • Save your parameter set for a later restore. • See 'history of parameter changes' and undo the latest changes. • Please check your parameter set for implausible settings. • Please set device to factory setting, restart, and see if the error occurs again. • When reporting this error to your service partner, please include your device's parameter setting. |
| The device was probably disconnected from the master controller, or the master is overloaded. | <ul style="list-style-type: none"> • Please check the POWERLINK connection. Try to replace the cables. • Please try to reduce computational load on the master. • Try to increase the master cycle time. |
| 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"> • Please check the device cabling for proper 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. |

12.5.46.7 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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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">• Please try to switch to a different version of device firmware.• 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. |
|------------------------------------|--|

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"> • Please check current control settings and step response. • Check the motor's saturation settings (parameter MOT_LSigDiff). If the error occurred in high-current range, lower saturation values manually. • If possible, reduce the needed current, especially in low-frequency range. • If possible, lower the switching frequency or enable automatic frequency selection. • Check if the encoder offset is set properly. • Consider using an axis module with higher current rating. |
| The control system failed to track the reference value | <ul style="list-style-type: none"> • Please check if the axis is blocked. • Try to reduce acceleration or deceleration. • 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. |

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"> • Please check if the axis is blocked. • Try to reduce acceleration or deceleration. • 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. |
| The speed control might run away, most likely due to a wrong encoder offset. | <ul style="list-style-type: none"> • Please check that the encoder offset is set properly. • If auto commutation is used, re-view the auto commutation setting and test under all possible conditions. • If torque mode is used, reduce torque, ensure external speed limitation, or increase speed control gain for stronger limitation. |

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
- 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

| | | | | | | | | | | | | |
|-----------------------|------------|-----|-----|-----|----|----|---|----|----|----|-----|---|
| 31 | 15 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Manufacturer-specific | r(eserved) | cst | csv | csp | ip | hm | r | tq | pv | vl | pp | |
| MSB | | | | | | | | | | | LSB | |

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 |
| pv | Profile velocity mode (PV) | Yes |
| vl | Velocity mode (VM) | Yes |
| pp | Profile position mode (PP) | Yes |

Table 13.4: Functions supported

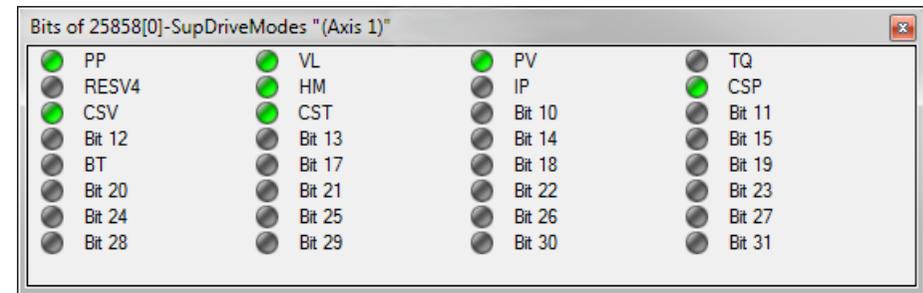


Fig. 13.1: Functions supported

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 DCO 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.

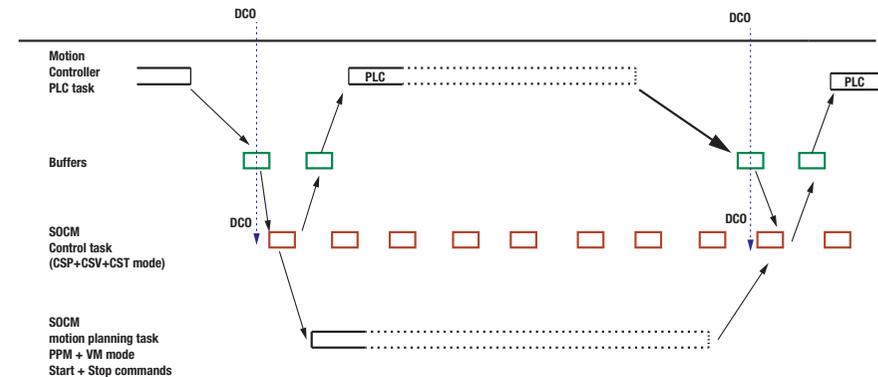


Fig. 13.2: Modes of operation - Timing

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

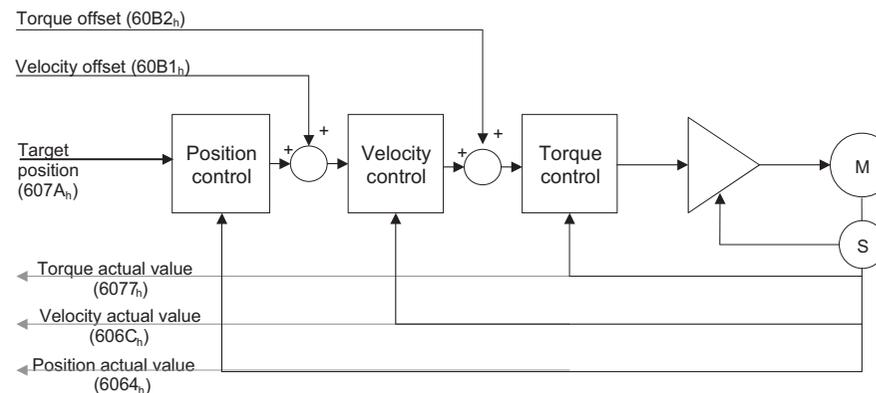


Fig. 13.3: Structure model CSP

| 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

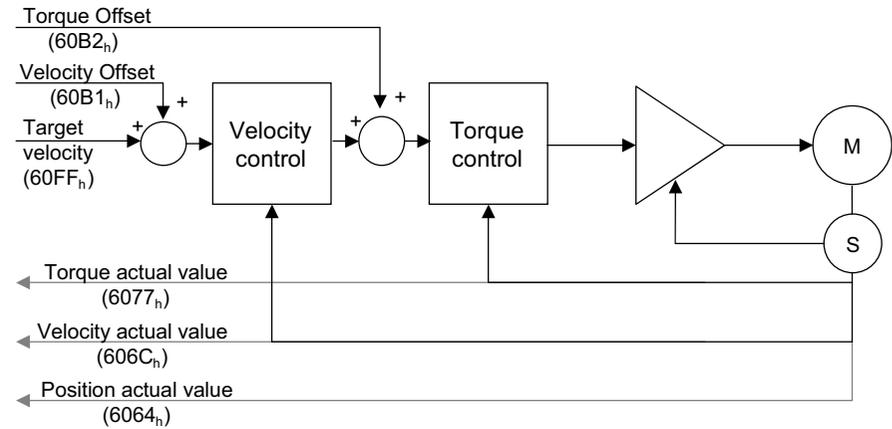


Fig. 13.4: Structure model CSV

| 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 (0x6076) - motor rated torque . | 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

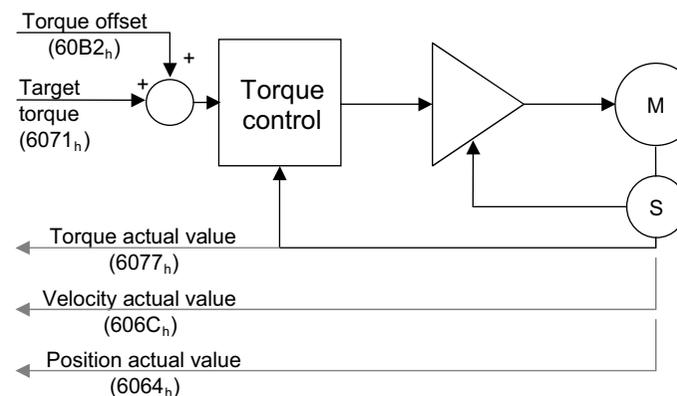


Fig. 13.5: Structure CST

| 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.

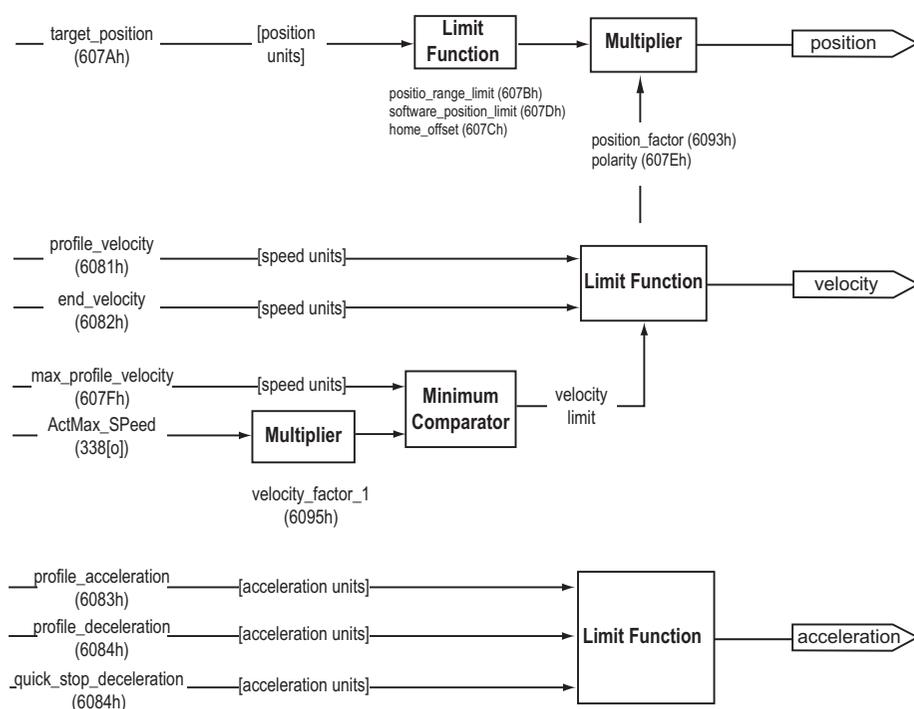


Fig. 13.6: Structure model of the Profile position mode

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 | uint32 |
| 0x607D | | Software position limit | | Axis 1: Software limit switch | uint32 |
| 0x607D | 0001 | PosLim_Min | PosUnit | Software limit switch neg. | uint32 |
| 0x607D | 0002 | PosLim_Max | PosUnit | Software limit switch pos. | uint32 |
| 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:

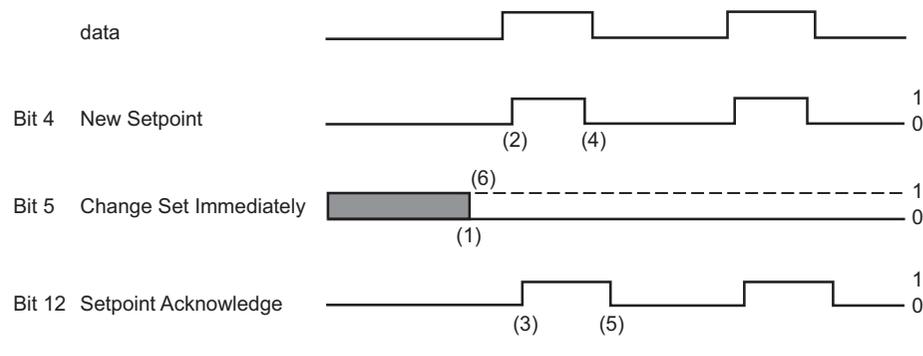
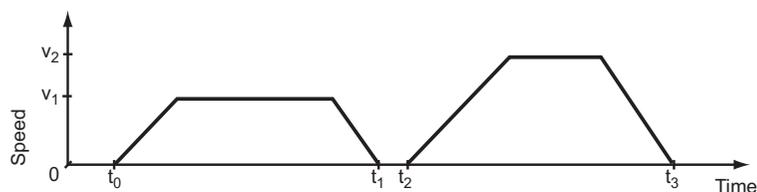


Fig. 13.7: Setpoint transmission from a master

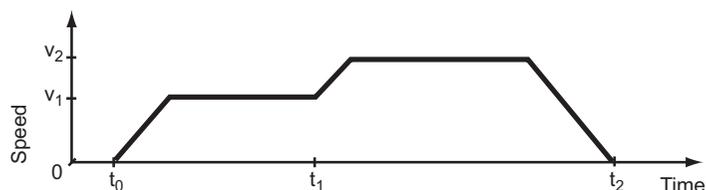
- (1) If bit 5, "Change Set Immediately" equals "0" (solid line in the figure above), the drive expects a "Single setpoint".
- (2) When the setpoint has been transmitted to the drive, the master activates the positioning by setting bit 4 "New Setpoint" in the control word.
- (3) When the new data has 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

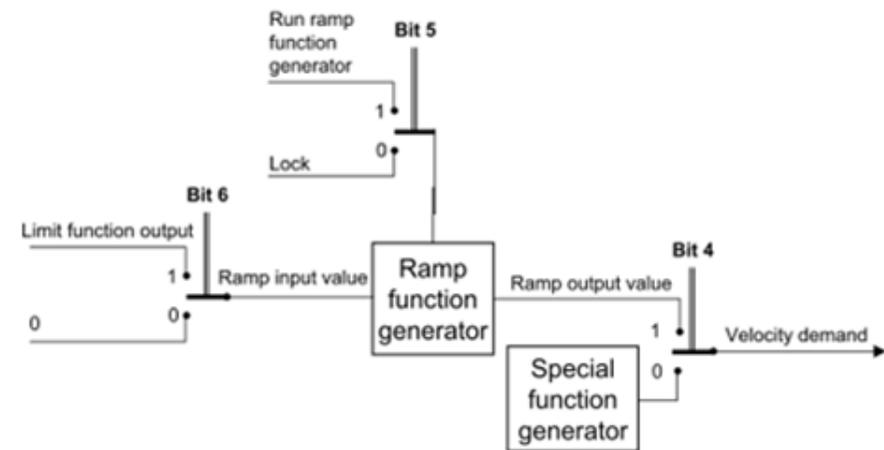


Fig. 13.8: Structure model of control word bits for profile velocity mode

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".

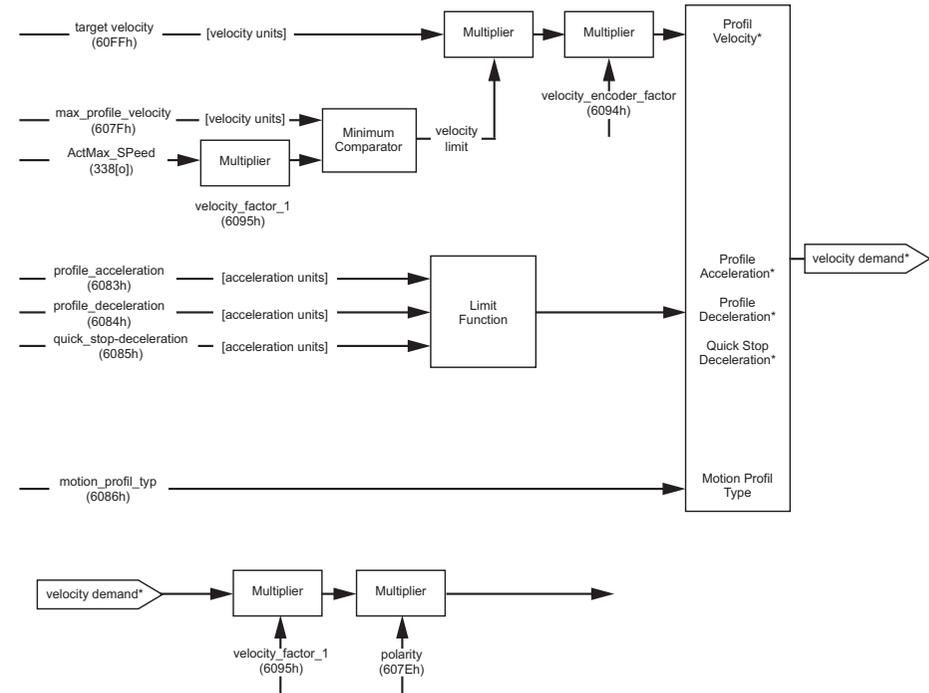


Fig. 13.9: Structure model of the Profile velocity mode

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: Axle 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

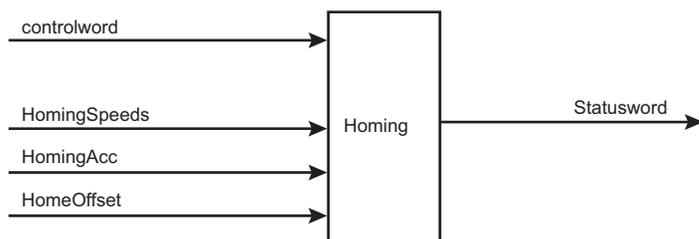


Fig. 13.10: Homing mode structure model

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 P 3051 [1] - StandstillWindow |

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 <i>PositionEncoderResolution</i> = $\frac{\text{Encoder increments}}{\text{Motor revolutions}}$ | uint32 |
| [0001] | PosEncRes | Encoder increments singleturn | |
| [0002] | PosEncRes | Multiturn motor revolutions | |
| 0x6090 | VelEncRes | CiA402 Velocity encoder resolution <i>VelocityEncoderResolution</i> = $\frac{\text{Encoder} \frac{\text{Increments}}{\text{Second}}}{\text{Motor} \frac{\text{Revolutions}}{\text{Second}}}$ | uint32 |
| [0001] | | Encoder increments per second | |
| [0002] | | Motor revolutions per second | |
| 0x6091 | GearRatio | CiA402 gear ratio <i>GearRatio</i> = $\frac{\text{Revolutions of motor shaft}}{\text{Revolutions of drive shaft}}$ | uint32 |
| [0001] | GearRatio | Multiturn motor revolutions | |
| [0002] | GearRatio | Shaft revolutions | |
| 0x6092 | FeedConst | CiA402 Feed constant <i>feedconstant</i> = $\frac{\text{Feed}}{\text{Revolutions of drive shaft}}$ | 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 <i>PositionFactor</i> = $\frac{\text{PositionEncoderResolution} \cdot \text{Gear ratio}}{\text{Feed constant}}$ | uint32 |
| [0001] | PosFactor | Resulting numerator | |
| [0002] | PosFactor | Resulting denominator | |
| 0x6094 | VelFactor | CiA402 Velocity encoder factor <i>VelocityEncoderFactor</i> = $\frac{\text{VelocityEncoderResolution} \cdot \text{Gear ratio} \cdot \text{Position unit} \cdot F_{\text{Speed (notation index)}}}{\text{Feed constant} \cdot \text{Speed unit} \cdot \text{Second} \cdot F_{\text{Position (notation index)}}$ 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 | ProfileDecelaration | 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).

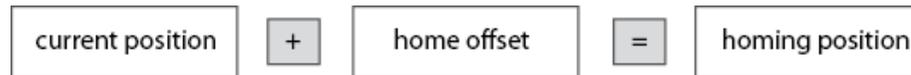


Fig. 13.11: Definition "homing position"

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

The following homing methods are available

| | |
|---|-----|
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| 13.13.2 Movement after homing | 474 |
| 13.13.3 Method (-12) homing mode: Homing to raw data | 474 |
| 13.13.4 Method (-10) and Method (-11): Move to block in negative / positive direction of movement with zero pulse | 475 |

| | | | |
|---|-----|--|-----|
| 13.13.5 Method (-8) and Method (-9): Move to block in negative / positive direction of movement | 476 | 13.13.22 Method (12): Negative limit switch, right homing edge, zero pulse while homing cam is active | 487 |
| 13.13.6 Method (-6) and Method (-7): Homing to encoders with distance-coded zero pulses in the negative direction | 477 | 13.13.23 Method (13): Negative limit switch, left homing edge, zero pulse while homing cam is inactive | 487 |
| 13.13.7 Method (-5): Current position + zero point offset | 479 | 13.13.24 Method (14): Negative limit switch, left homing edge, zero pulse while homing cam is inactive | 488 |
| 13.13.8 Method (-3) and method (-4): Not implemented | 479 | 13.13.25 Method (15) and method (16): Not implemented | 488 |
| 13.13.9 Method (-2): no homing | 480 | 13.13.26 Method (17): Negative limit switch | 489 |
| 13.13.10 Method (-1): Homing position = offset | 480 | 13.13.27 Method (18): Positive limit switch | 489 |
| 13.13.11 Method (0): Homing point reached | 481 | 13.13.28 Method (19): Positive homing cam, falling edge | 490 |
| 13.13.12 Method (1) and Method (2): limit switch and zero pulse | 481 | 13.13.29 Method (20): Positive homing cam, rising edge | 490 |
| 13.13.13 Method (3): Positive reference cam and zero pulse | 482 | 13.13.30 Method (21): Negative homing cam, falling edge | 491 |
| 13.13.14 Method (4): Positive reference cam and zero pulse | 483 | 13.13.31 Method (22): Negative homing cam, rising edge | 491 |
| 13.13.15 Method (5): Negative reference cam and zero pulse | 483 | 13.13.32 Method (23): Positive limit switch, left homing edge, falling edge | 492 |
| 13.13.16 Method (6): Negative reference cam and zero pulse | 484 | 13.13.33 Method (24): Positive limit switch, left homing edge, rising edge | 492 |
| 13.13.17 Method (7): Positive limit switch, left homing edge, zero pulse while homing cam is active | 484 | 13.13.34 Method (25): Positive limit switch, right homing edge, rising edge | 493 |
| 13.13.18 Method (8): Positive limit switch, left homing edge, zero pulse while homing cam is active | 485 | 13.13.35 Method (26): Positive limit switch, right homing edge, falling edge | 493 |
| 13.13.19 Method (9): Positive limit switch, right homing edge, zero pulse while homing cam is active | 485 | 13.13.36 Method (27): Negative limit switch, right homing edge, falling edge | 494 |
| 13.13.20 Method (10): Positive limit switch, right homing edge, zero pulse while homing cam is inactive | 486 | 13.13.37 Method (28): Negative limit switch, right homing edge, rising edge | 494 |
| 13.13.21 Method (11): Negative limit switch, right homing edge, zero pulse while homing cam is active | 486 | 13.13.38 Method (29): Negative limit switch, left homing edge, rising edge | 495 |
| | | 13.13.39 Method (30): Negative limit switch, left homing edge, falling edge | 495 |
| | | 13.13.40 Method (31) and method (32): Not implemented | 496 |

| | |
|---|-----|
| 13.13.41 Method (33): Next left zero pulse | 496 |
| 13.13.42 Method (34): Next right zero pulse | 497 |
| 13.13.43 Method (35): Current position | 497 |
| 13.13.44 Method (36): Not implemented | 498 |
| 13.13.45 Method (37): Set the homing point for absolute value encoder | 498 |

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 " halt option code " 0x605D |

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 (P 3051[1] – standstill window). |
| 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.

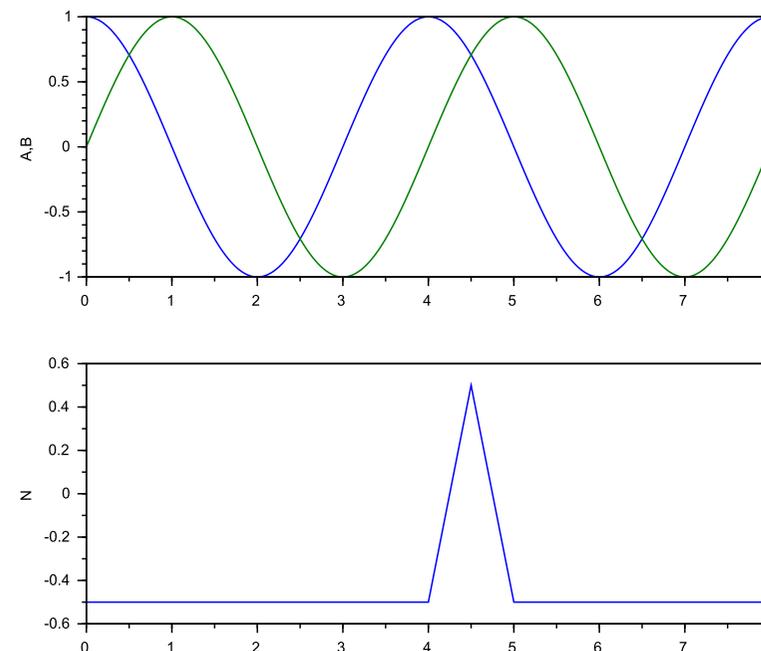
Zero pulses are in principle susceptible to interference. If necessary, connect an oscilloscope via an adapter plug and check the analogue signals. The threshold for detecting a zero pulse is 0 V differentially. Also take note of the information on signal adaptation (common mode) in (see 7.5.1 TTL encoder 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.

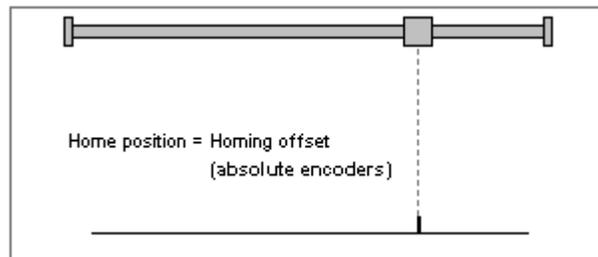


Fig. 13.12: Method (-12) Homing to raw data

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 $> 0.5 \times \mathbf{P\ 2280[0] - MC_HOMING_MaxDistance}$.
- 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**.

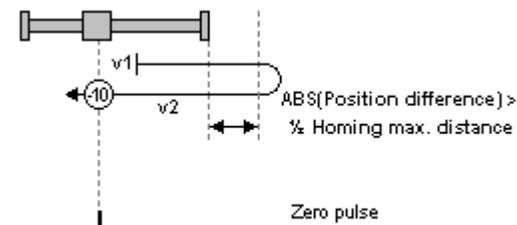


Fig. 13.13: Method (-10): Move to block in negative direction of movement with zero pulse

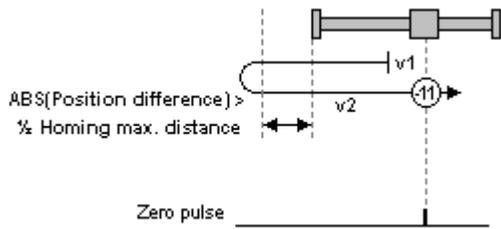


Fig. 13.14: Method (-11): Move to block in positive direction of movement with zero pulse

| 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.

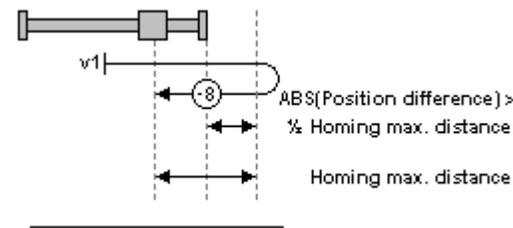


Fig. 13.15: Method (-8): Move to block in negative direction of movement

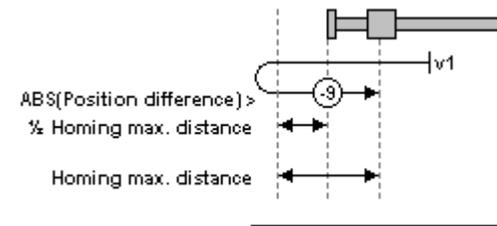


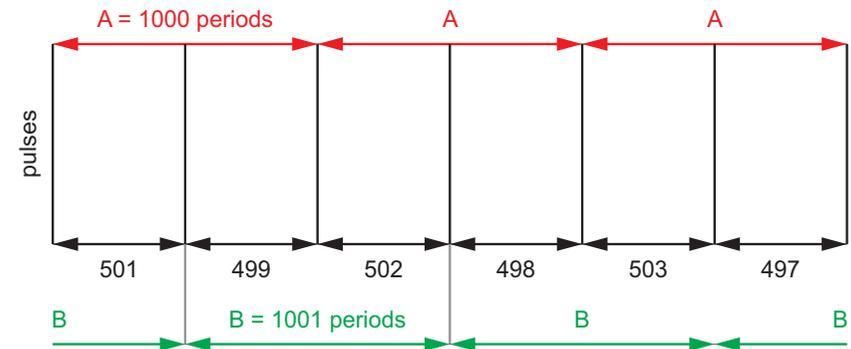
Fig. 13.16: Method (-9): Move to block in positive direction of movement

| 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.

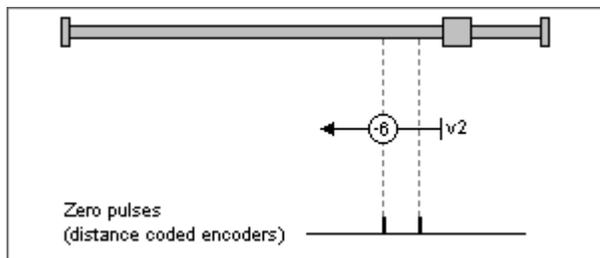


Fig. 13.17: Method (-6): Homing to encoders with distance-coded zero pulses in the negative direction

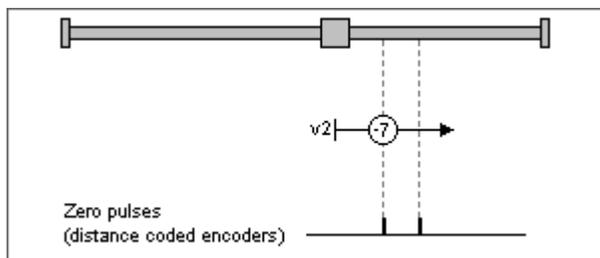


Fig. 13.18: Method (-7): Homing to encoders with distance-coded zero pulses in the positive direction

| 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.

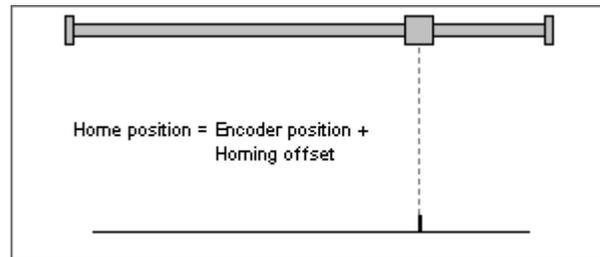


Fig. 13.19: Method (-5): Current position + zero point offset



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

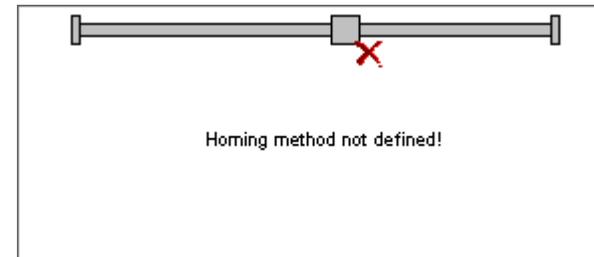


Fig. 13.20: Method (-3) and (-4): Not implemented

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).

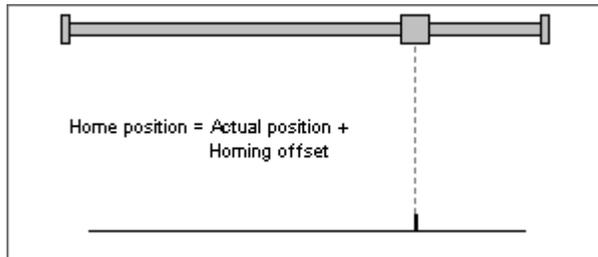


Fig. 13.21: Method (-2): No homing

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.

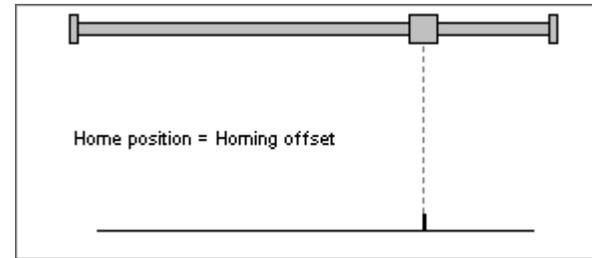


Fig. 13.22: Method (-1): Homing position = zero point offset

13.13.11 Method (0): Homing point reached

- The current actual position value of the position encoder is used as home position.

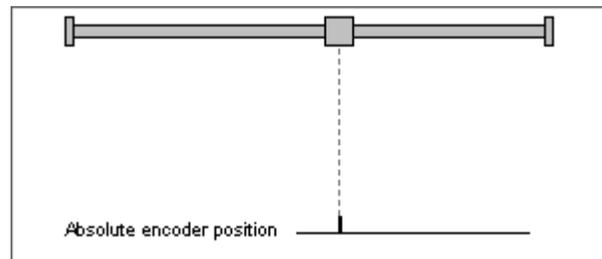


Fig. 13.23: Method (0): Homing position reached

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.

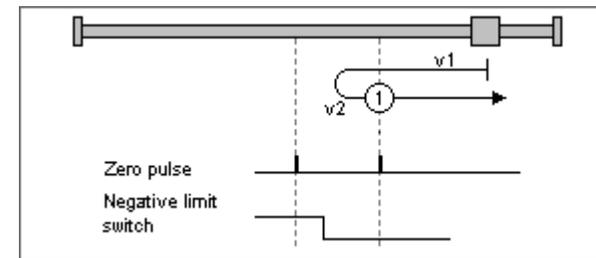


Fig. 13.24: Negative limit switch and zero pulse

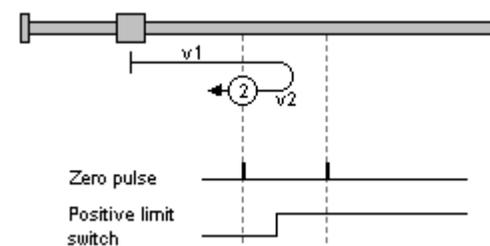


Fig. 13.25: Positive limit switch and zero pulse

| 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.

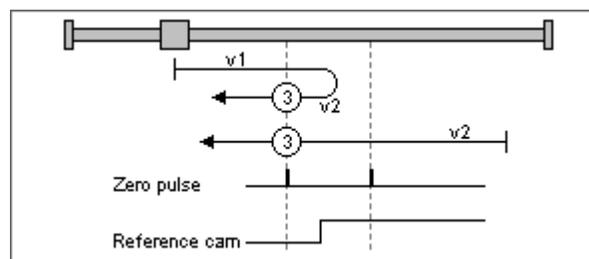


Fig. 13.26: Method (3): Positive homing cam and negative zero pulse

| 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.

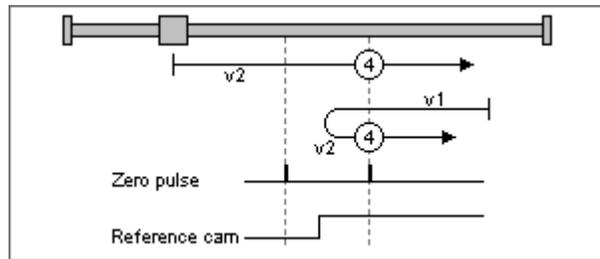


Fig. 13.27: Method (4): Positive homing cam and positive zero pulse

| 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.

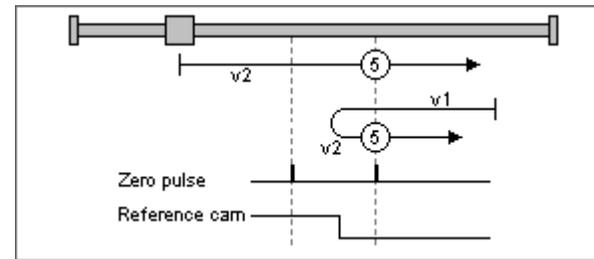


Fig. 13.28: Method (5): Negative reference mark and zero pulse

| 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.

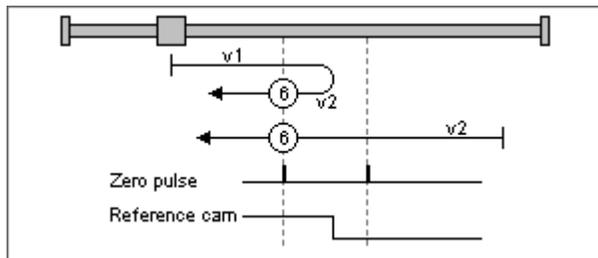


Fig. 13.29: Method (6): Negative reference cam and zero pulse

| 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.

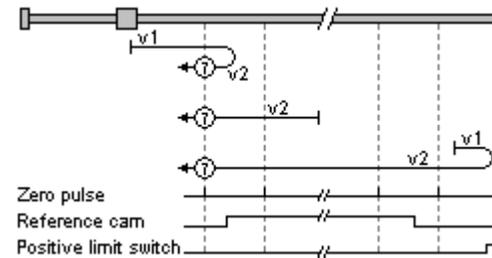


Fig. 13.30: Method (7): Positive limit switch, left homing edge, zero pulse while homing cam is active

| 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.

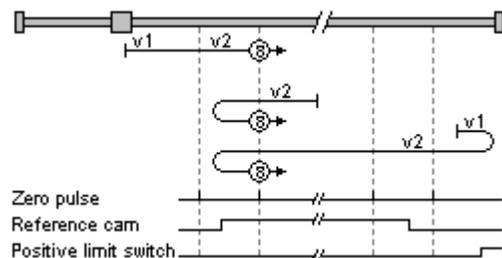


Fig. 13.31: Method (8): Positive limit switch, left homing edge, zero pulse while homing cam is active

| 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.

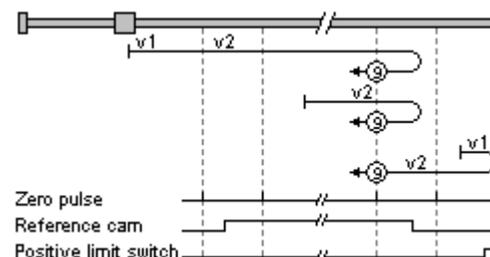


Fig. 13.32: Method (9): Positive limit switch, right homing edge, zero pulse while homing cam is active

| 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.

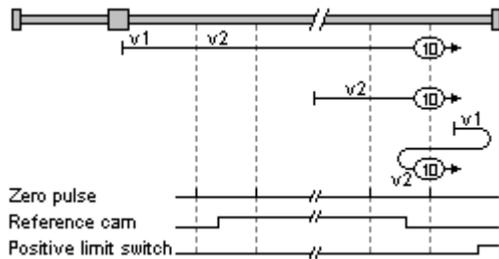


Fig. 13.33: Method (10): Positive limit switch, right homing edge, zero pulse while homing cam is inactive

| 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.

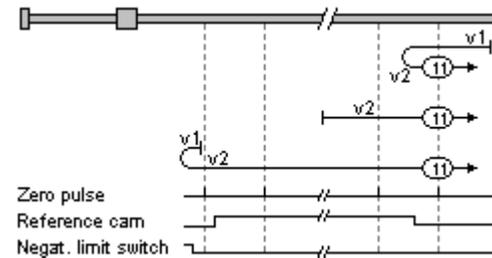


Fig. 13.34: Method (11): Negative limit switch, right homing edge, zero pulse while homing cam is active

| 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.

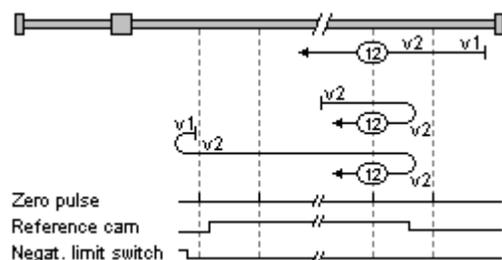


Fig. 13.35: Method (12): Negative limit switch, right homing edge, zero pulse while homing cam is active

| 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.

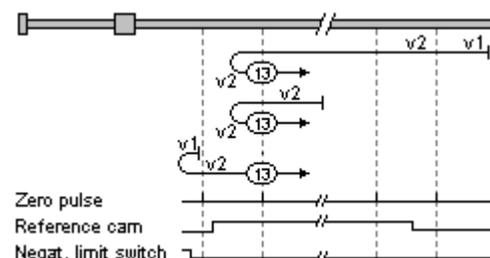


Fig. 13.36: Method (13): Negative limit switch, left homing edge, zero pulse while homing cam is inactive

| 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.

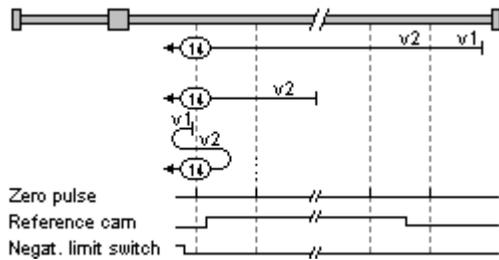


Fig. 13.37: Method (14): Negative limit switch, left homing edge, zero pulse while homing cam is inactive

| 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

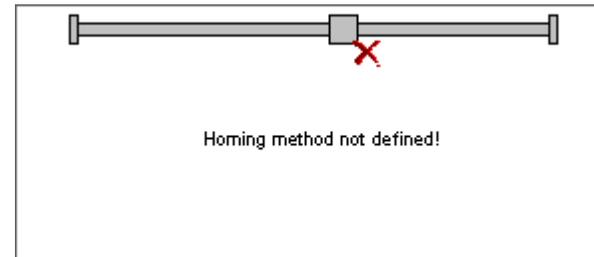


Fig. 13.38: Method (15) and (16): Not implemented

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.

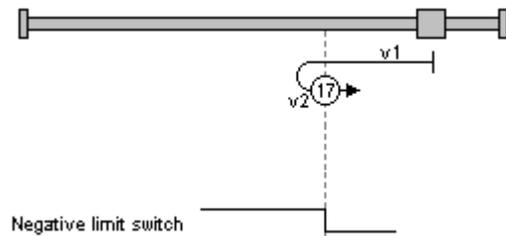


Fig. 13.39: Negative limit switch

| 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.

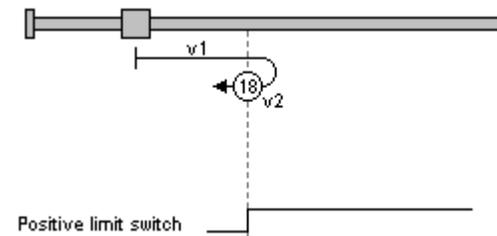


Fig. 13.40: Positive limit switch

| 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.

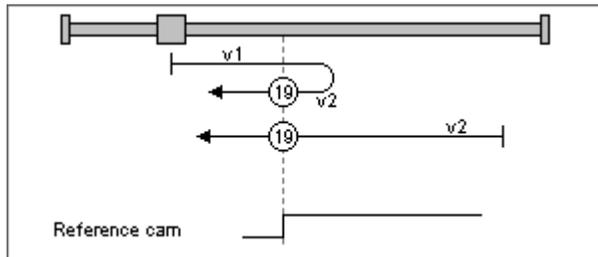


Fig. 13.41: Method (19): Positive homing cam, falling edge

| 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. 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 active. 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 rising edge.

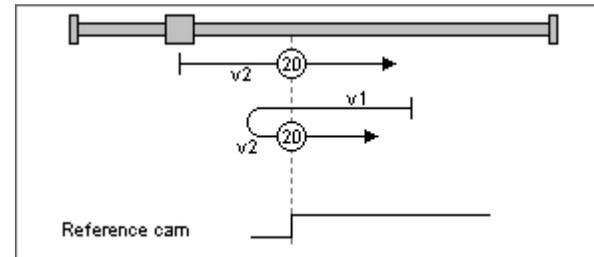


Fig. 13.42: Method (20): Positive homing cam, rising edge

| 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.

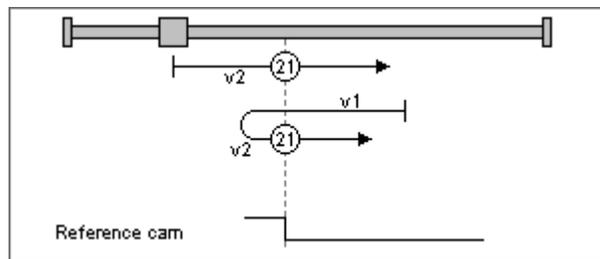


Fig. 13.43: Method (21): Negative homing cam, falling edge

| 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.

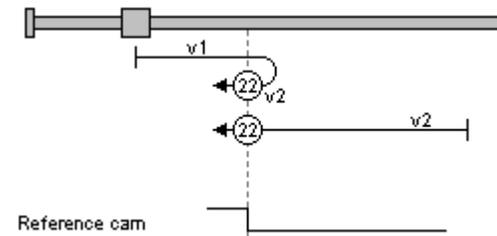


Fig. 13.44: Method (22): Negative homing cam, rising edge

| 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.

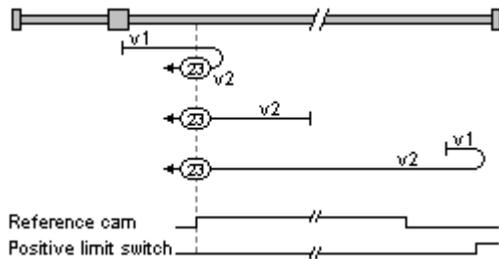


Fig. 13.45: Method (23): Positive limit switch, left homing edge, falling edge

| 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.

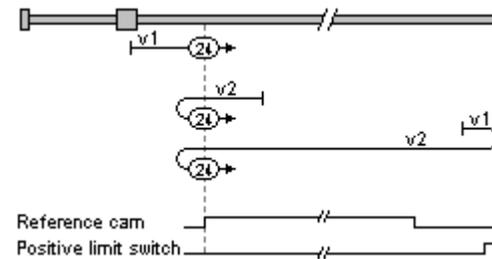


Fig. 13.46: Method (24): Positive limit switch, left homing edge, rising edge

| 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.

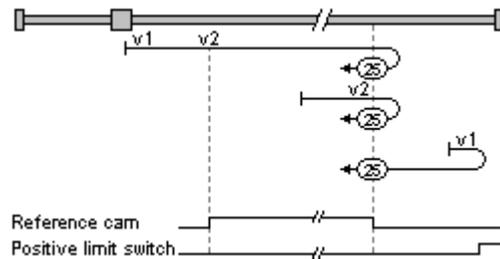


Fig. 13.47: Method (25): Positive limit switch, right homing edge, rising edge

| 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.

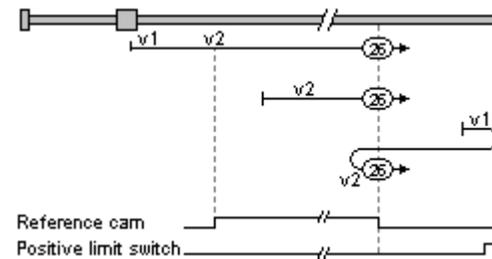


Fig. 13.48: Method (26): Positive limit switch, right homing edge, falling edge

| 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.

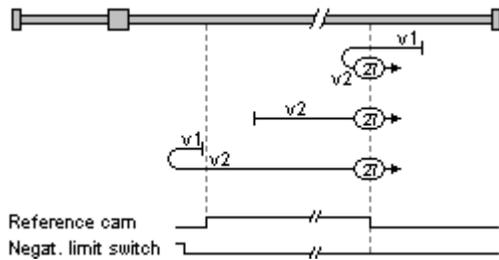


Fig. 13.49: Method (27): Negative limit switch, right homing edge, falling edge

| 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.

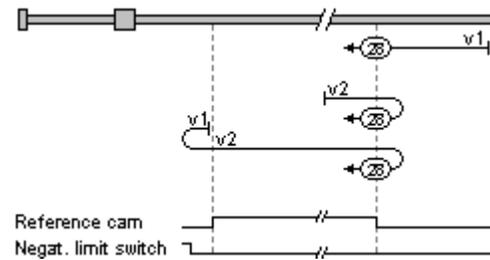


Fig. 13.50: Method (28): Negative limit switch, right homing edge, rising edge

| 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.

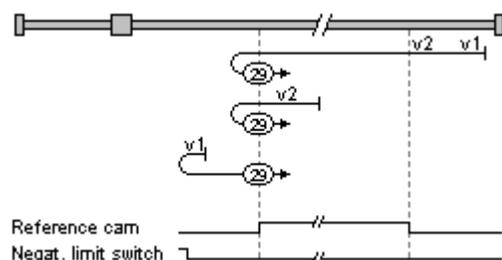


Fig. 13.51: Method (29): Negative limit switch, left homing edge, rising edge

| 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.

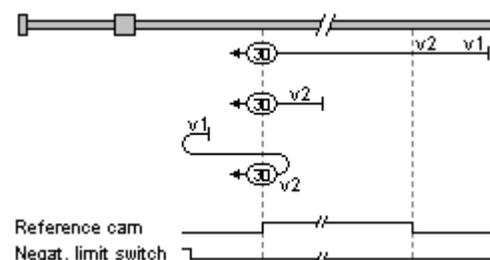


Fig. 13.52: Method (30): Negative limit switch, left homing edge, falling edge

| 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

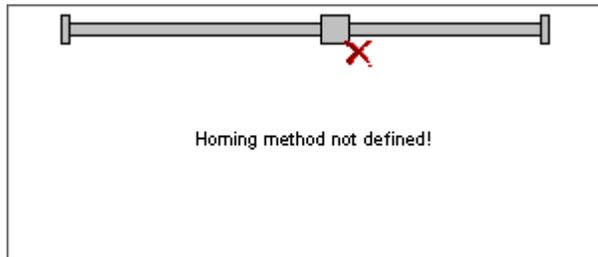


Fig. 13.53: Method (31) and (32): Not implemented

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.

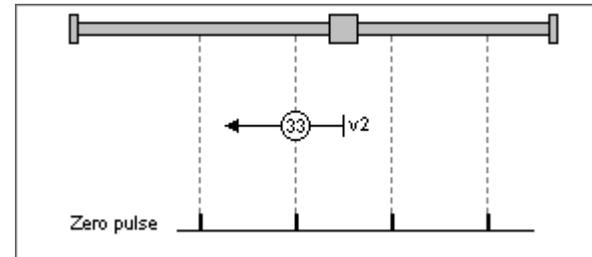


Fig. 13.54: Method (33): Next left zero pulse

| 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.

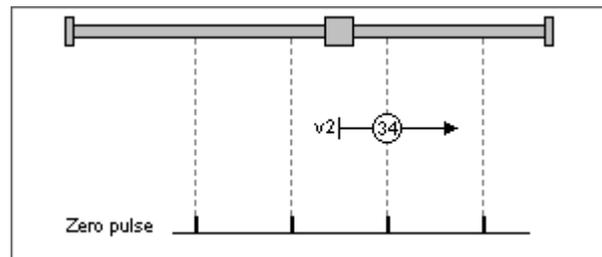


Fig. 13.55: Method (34): Next right zero pulse

| 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.

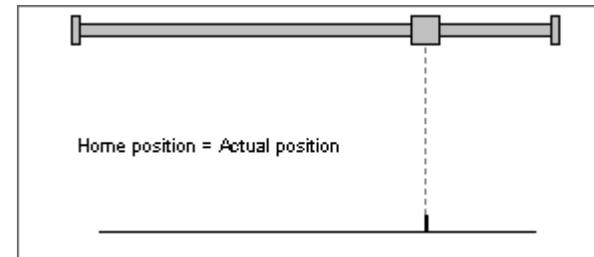


Fig. 13.56: Method (35): Zero point / homing point = current position

13.13.44 Method (36): Not implemented

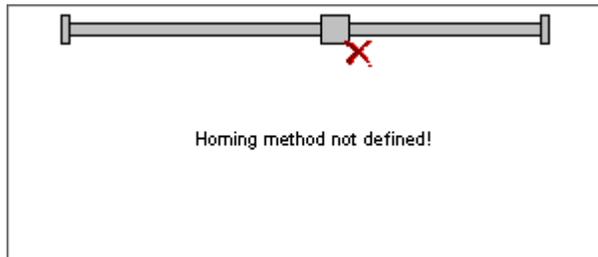


Fig. 13.57: Method (36): Not implemented

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.

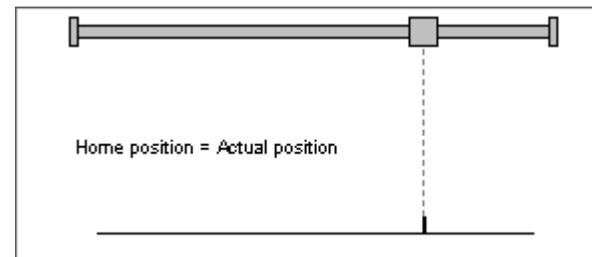


Fig. 13.58: Method (37): Zero point / homing point = offset



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

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. 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 [0000] | ENC_BackupLatch | Manual initialisation (saving) of the backup data |
| | (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 |
| 0x2B48 [0001] [0002] | ENC_CH1_Backup_User | Axis 1: CH1 position backup in user units |
| | Pos | Backup singleturn encoder position in user units |
| | 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 | <input type="text" value="30000000"/> Maximum deceleration time: <input type="text" value="0.3"/> s |
| Quick stop time out | <input type="text" value="100"/> ms |
| Reaction at fault (fault reaction) | DisableDrive(0) = Disable drive function, motor is free to rotate |
| <input type="button" value="Error reactions (axis)"/> <input type="button" value="Error reactions (device)"/> | |

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 |
|---------------|------------------------|---|-----------|
| 0x28CF | MPRO_DRVCOM_ROT0_Time | Timeout until motor standstill | uint32 |
| 0x6085 | QuickStopDec | Setting for the quick-stop ramp | uint32 |
| 0x605B | 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. | |
| 0x605C | 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. | |
| 0x605D | 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 |
|---------------|-----------------|------------------------------------|-----------|
| 0x605E | 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 |
|---------------|--------------------------|---|-----------|
| 0x605A | 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. ¹⁾ | |
| -3 | RampAndCurrentLimit | Braking with the quick-stop ramp and current limit, with smoothing, change to the "Switch On Disabled" state. ¹⁾ | |
| -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. | |

1) 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 |
|---------------|--------------------|---|-----------|
| 0x605C | 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 (P 2308.0 CloseTime + P 2308.2 FadeTime) 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

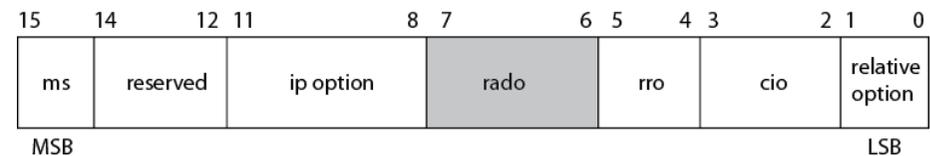


Fig. 13.61: Object structure 0x60F2 Positioning option code

- 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 (0x607B) 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

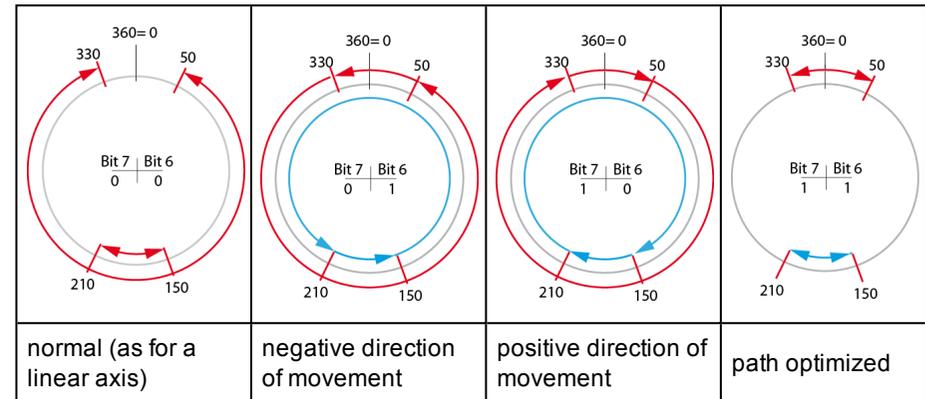


Table 13.72: Movement options for bits 6 and 7

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.

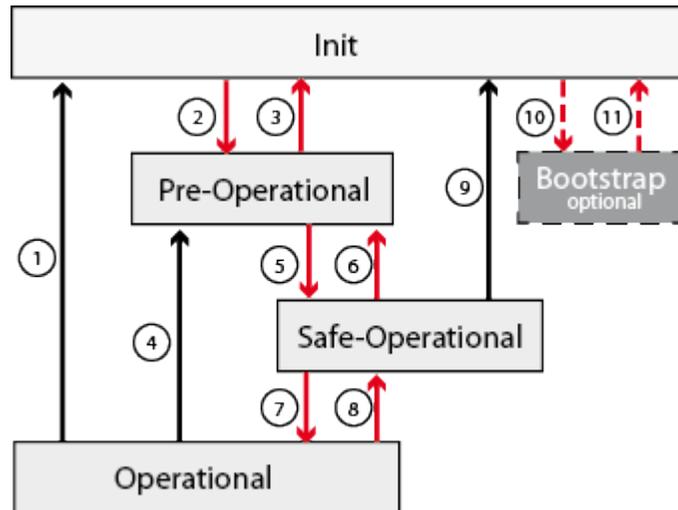


Fig. 13.62: Overview of NMT status

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"> The slave firmware can be updated in the bootstrap state. The bootstrap state can only be accessed via the init state. 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. |

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.

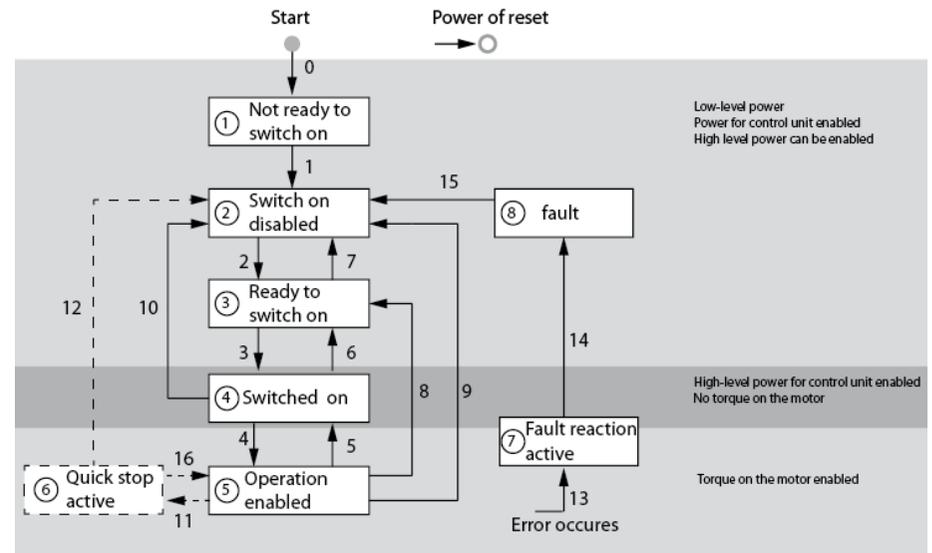


Fig. 13.63: EtherCAT® state machine

| State | Description |
|-------|--|
| ① | <p>Not ready to switch on</p> <ul style="list-style-type: none"> • Boot process active, Initialisation, Self test • Drive function is switched off • Power section is inhibited • Control voltage available • No error |
| ② | <p>Switch on disabled</p> <ul style="list-style-type: none"> • Initialisation completed • Parametrization completed • Power section is switched off (for safety reasons) • Drive function is switched off "STO (Safe Torque Off)" stop and/or ENPO not active • No error |
| ③ | <p>Ready to switch on</p> <ul style="list-style-type: none"> • Power supply available • Drive function switched off • Drive parameters have been changed • No error |

Table 13.75: Device states

| State | Description |
|-------|---|
| ④ | <p>Switched on</p> <ul style="list-style-type: none"> • Power supply available • Power stage is ready • Drive parameters have been changed • The drive function is switched off • No error • Brake applied |
| ⑤ | <p>Operation enable (drive is energized and ready for setpoint to be specified)</p> <ul style="list-style-type: none"> • Power supply available • Power section is switched on • Operation is enabled, processing setpoints • No error • Brake vented |

| State | Description |
|-------|--|
| ⑥ | Quick stop active <ul style="list-style-type: none"> Power supply available Drive function is enabled Quick-stop reaction is implemented as per quick stop option code No error Brake vented 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. |
| ⑦ | Fault reaction active <ul style="list-style-type: none"> An error has occurred Power supply available The drive function is enabled Error reaction is implemented as per "Fault Reaction", then change to "Fault" state. |
| ⑧ | Fault <ul style="list-style-type: none"> An error has occurred, the error reaction has been implemented. The shutdown and application of power depend on the application. The drive function is switched off. |

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. 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 |
| INT8 | -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).

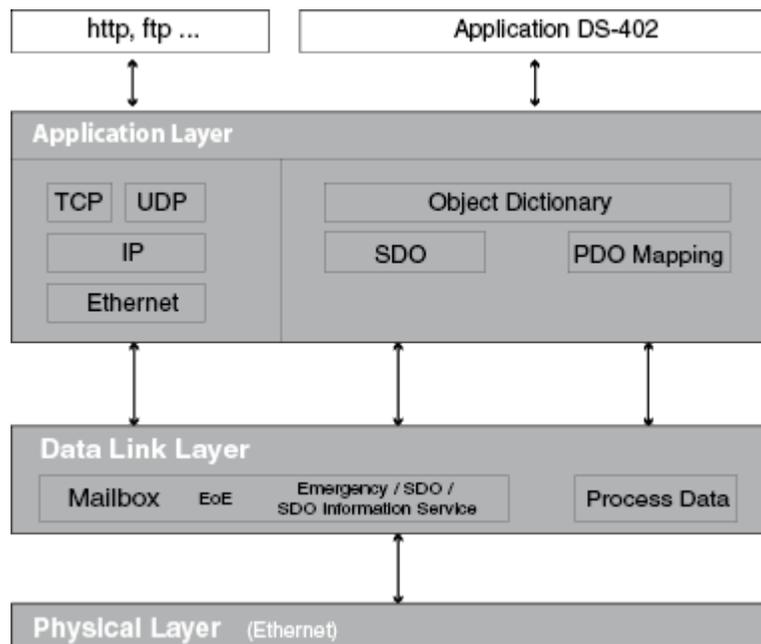


Fig. 13.64: OSI layer model

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.

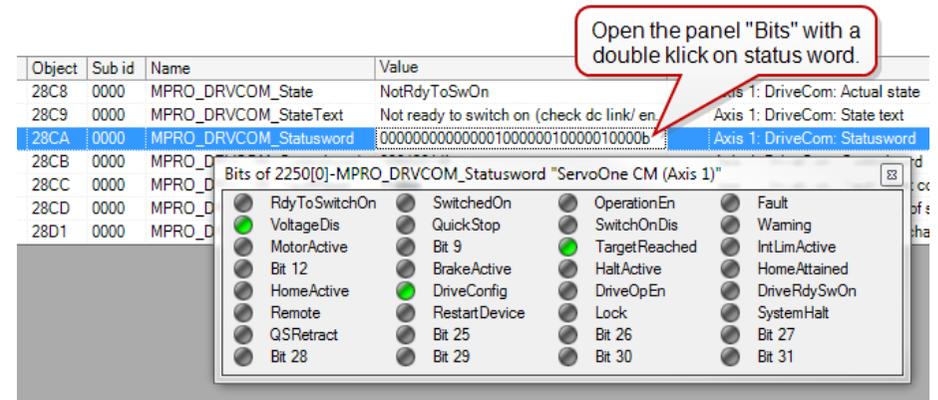


Fig. 13.65: Example for opening a bit window (2250)

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"> "Quick stop" state after conclusion of the "Quick stop" "Stop" state if the drive is at a standstill Homing mode (see also section "Homing / homing mode" on page 470) |
| 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 | | |

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 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)

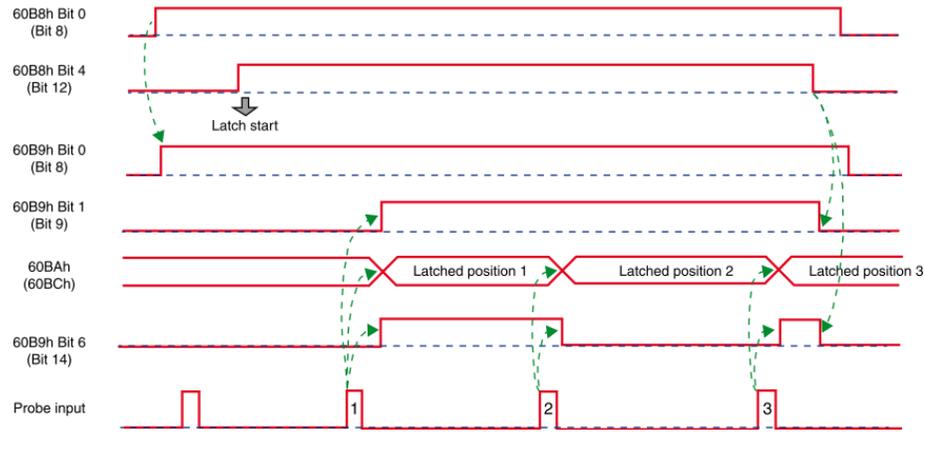


Fig. 13.66: Timing sequence of a measurement in Single Trigger Mode and in Continuous Trigger Mode.

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 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"> • OFF = no link • ON = Link Link stable, no data exchange • Blinking: Data exchange active |
| | RUN green Device / EtherCAT RUN | <ul style="list-style-type: none"> • OFF = Initialisation • Flashing = Pre-Operational • Blinks once = Safe-Operational • ON = Operational Device ready for operation |
| ECAT OUT X5.2 | L/A green Port1 Link / Activity | <ul style="list-style-type: none"> • OFF = no link • ON = Link Link stable, no data exchange • Blinking: Data exchange active |
| | ERR red Device / EtherCAT ERROR | <ul style="list-style-type: none"> • ON = Error |

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 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"> • - = off • X on • Yx number of pulses | | | |

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\lo\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

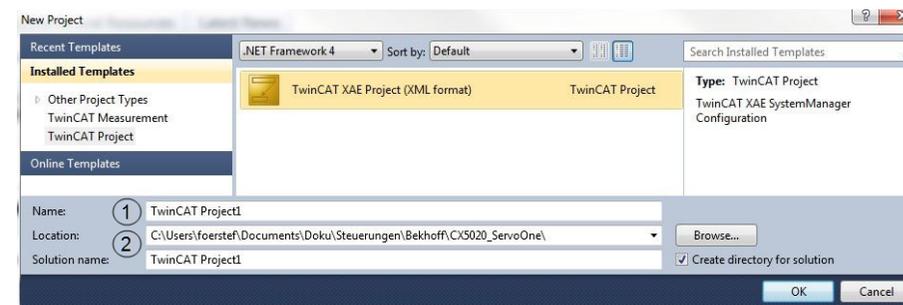


Fig. 13.67: Screenshot "New Project"

- Enter the name of the project
- Enter the location (path)

Legend for Screenshot "New Project"

13.28.3 Select target system

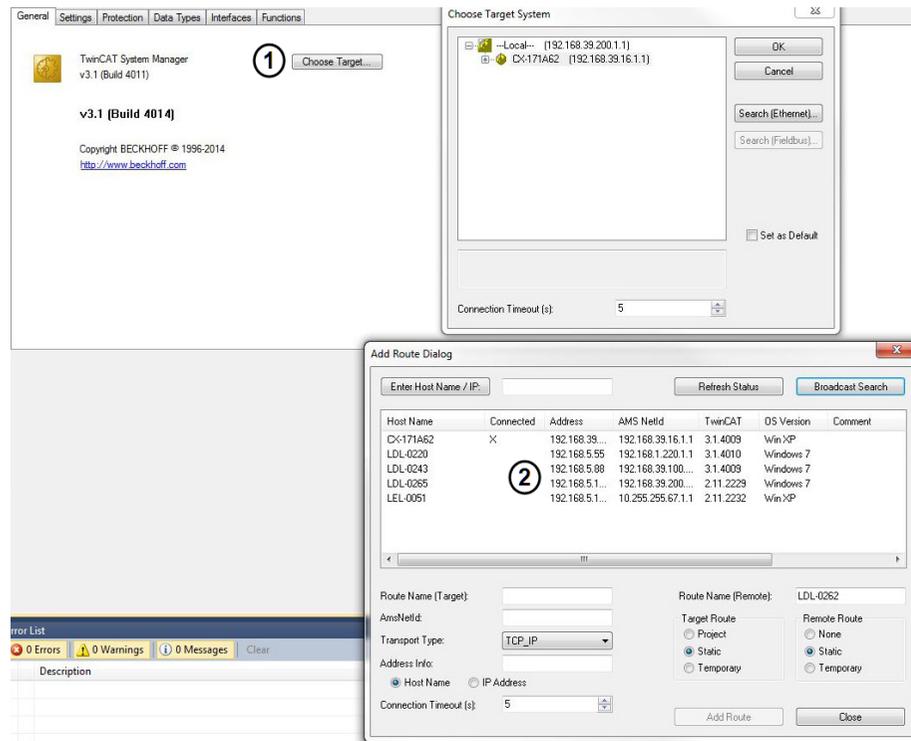


Fig. 13.68: Select target system

- 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).

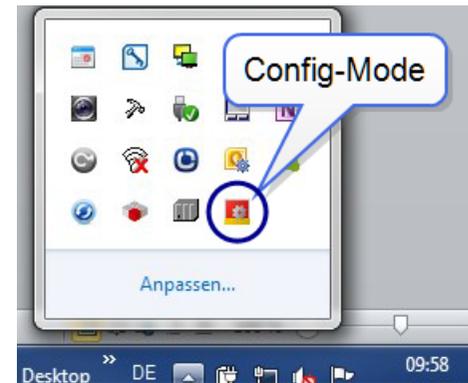


Fig. 13.69: "Config Mode" button on the taskbar

►Menu ►TwinCAT ►Restart TwinCAT (Config-mode)

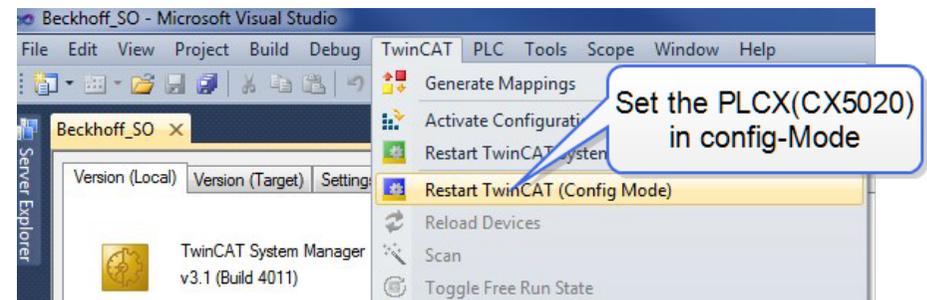
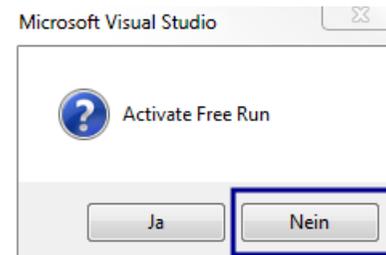
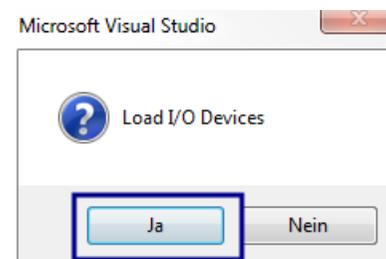
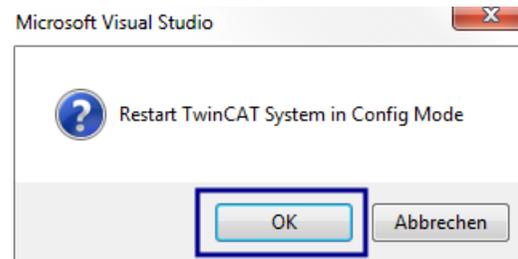


Fig. 13.70: Menu item "Restart TwinCAT (Config-Mode)"

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

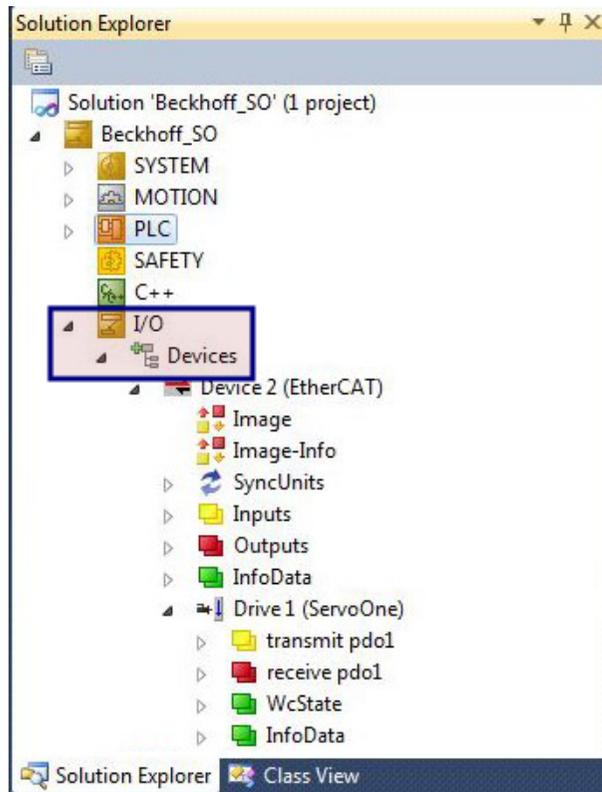
| CPU | RT-CPU | Base Time | CPU Limit | Latency Warning |
|-----|-----------|-----------|-----------|-----------------|
| 0 | ✓ Default | 125 µs | 80 % | (none) |

| 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 |

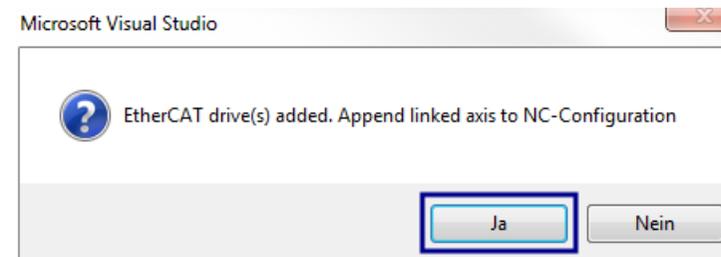
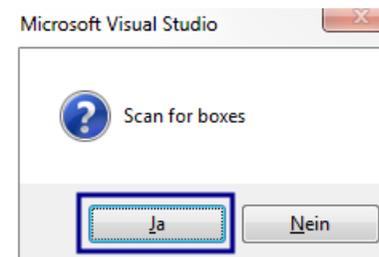
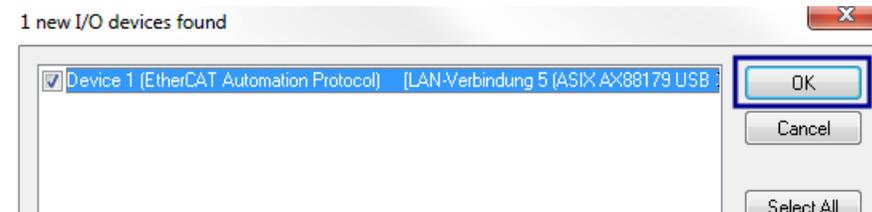
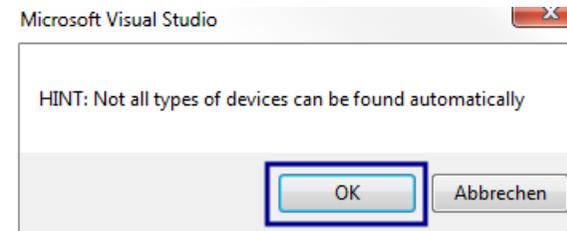
Fig. 13.71: Setting the system time

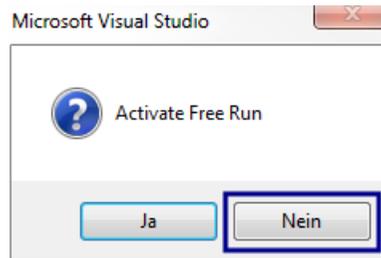
13.28.5 Detecting the nodes (EtherCAT® slaves) via the scan function:

- 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.

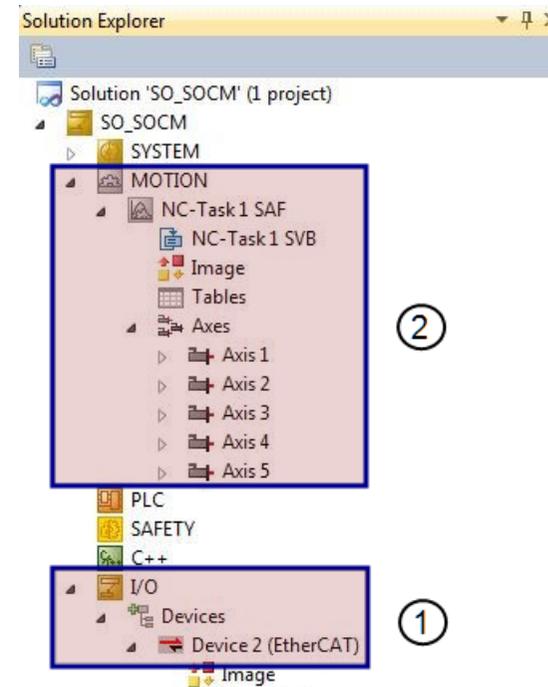


Fig. 13.72: Project tree after a successful scan

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

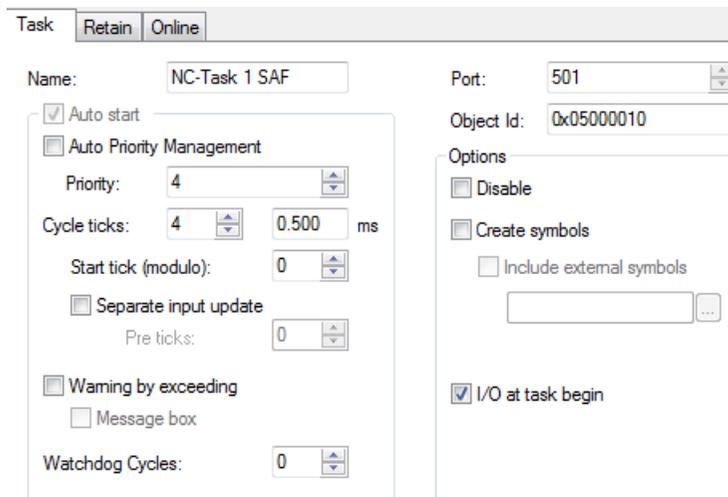
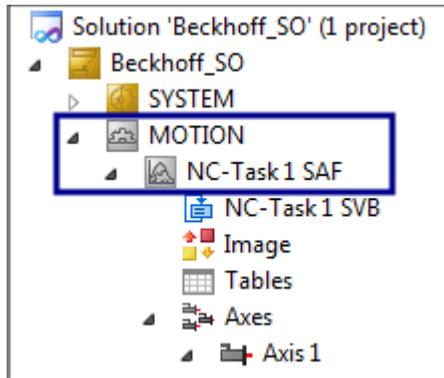
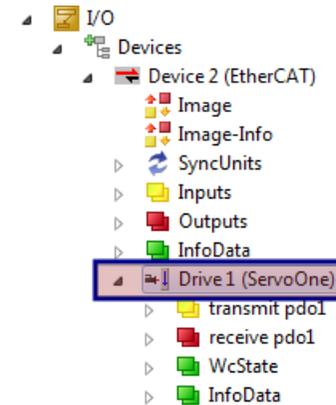


Fig. 13.73: Setting the cycle time

13.28.7 Setting and handling the EtherCAT® slave process data



| Index | Size | Name | Flags | SM | SU |
|--------|------|---------------|-------|----|----|
| 0x1A00 | 6.0 | transmit pdo1 | | 3 | 0 |
| 0x1600 | 6.0 | receive pdo1 | | 2 | 0 |

| 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 | | | |

| Name | Online | Type | Size | > Addr... | In/Out | User ID | Linked to |
|----------------------|--------|---------|------|-----------|--------|---------|-------------------------------|
| statusword | X | UINT | 2.0 | 71.0 | Input | 0 | nState1, nState2 |
| position actual v... | X | DINT | 4.0 | 73.0 | Input | 0 | nDataIn1 . In . Inputs . E... |
| WcState | X | BIT | 0.1 | 1522.3 | Input | 0 | nState4, nState4 |
| InputToggle | X | BIT | 0.1 | 1524.3 | Input | 0 | nState4, nState4 |
| State | X | UINT | 2.0 | 1548.0 | Input | 0 | |
| AdsAddr | X | AMSADDR | 8.0 | 1550.0 | Input | 0 | |
| Chn0 | X | USINT | 1.0 | 1558.0 | Input | 0 | |
| DcOutputShift | X | DINT | 4.0 | 1559.0 | Input | 0 | nDcOutputTime . In . In... |
| DcInputShift | X | DINT | 4.0 | 1563.0 | Input | 0 | nDcInputTime . In . Inpu... |
| controlword | X | UINT | 2.0 | 71.0 | Output | 0 | nCtrl2, nCtrl1 |
| target position | X | DINT | 4.0 | 73.0 | Output | 0 | nDataOut1 . Out . Outpu... |

Fig. 13.74: Setting and handling of the process data

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.

| 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 | nDcInpuTime, 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

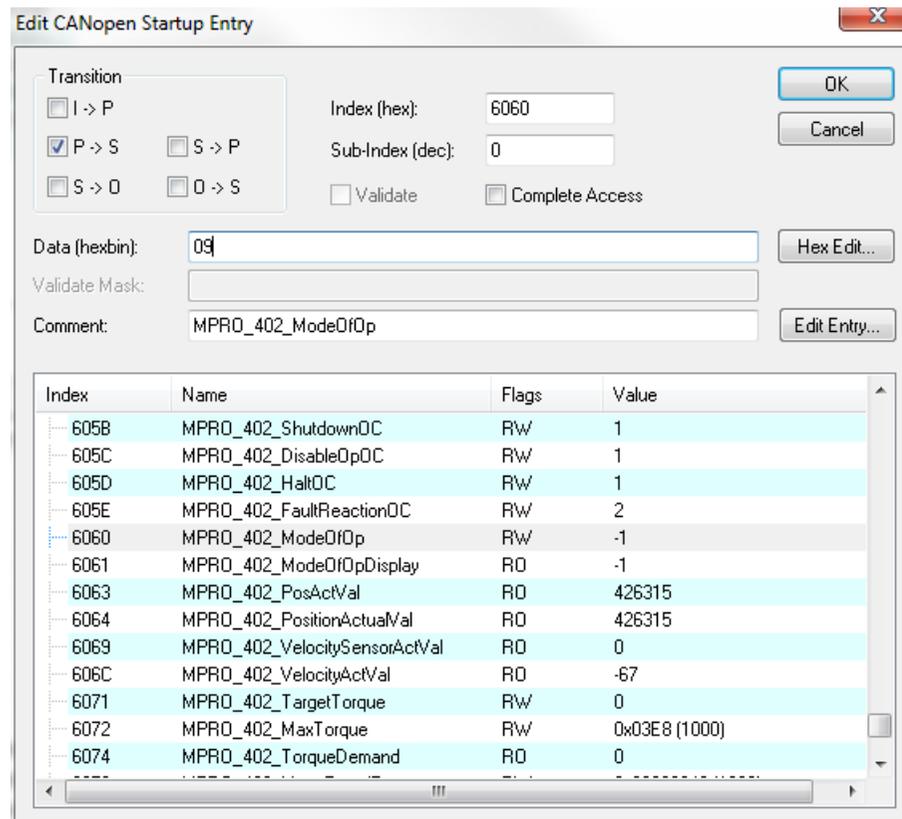
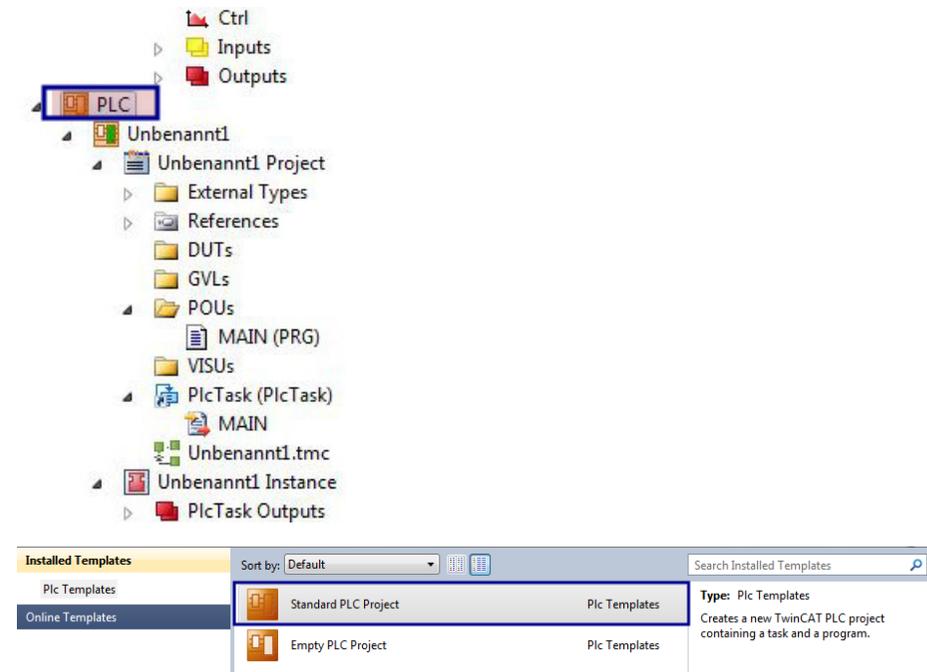


Fig. 13.76: Startup entries

13.28.9 Creating a PLC program

- Path ► PLC ► right-click ► Open dialog “Add New Item”



```

MAIN x SO_SOCM
1 PROGRAM MAIN
2 VAR
3     ModesOfOperation_SO          AT %Q* : SINT;
4     ModesOfOperation_SOCM_Achse_1 AT %Q* : SINT;
5     ModesOfOperation_SOCM_Achse_2 AT %Q* : SINT;
6     ModesOfOperation_SOCM_Achse_3 AT %Q* : SINT;
7 END_VAR
8
1 ModesOfOperation_SO:=9;
2 ModesOfOperation_SOCM_Achse_1:=8;
3 ModesOfOperation_SOCM_Achse_2:=8;
4 ModesOfOperation_SOCM_Achse_3:=8;

```

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.

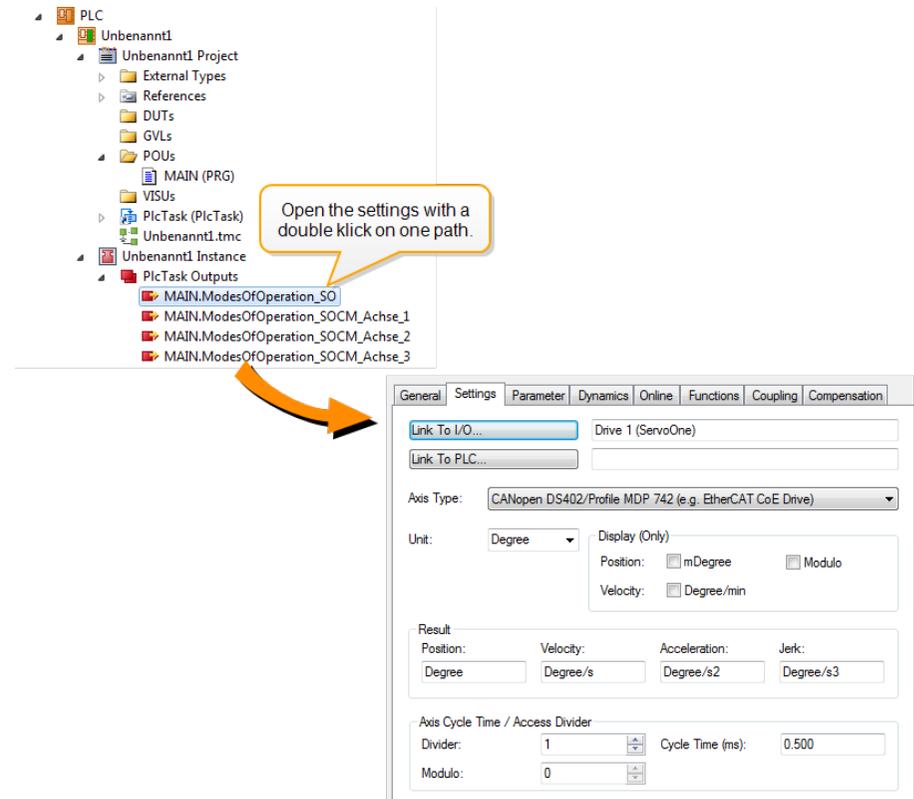


Fig. 13.78: Selection of the PLC variables

- Path ► Motion ► NC-Task1 SAF ► Axis ► Axis1

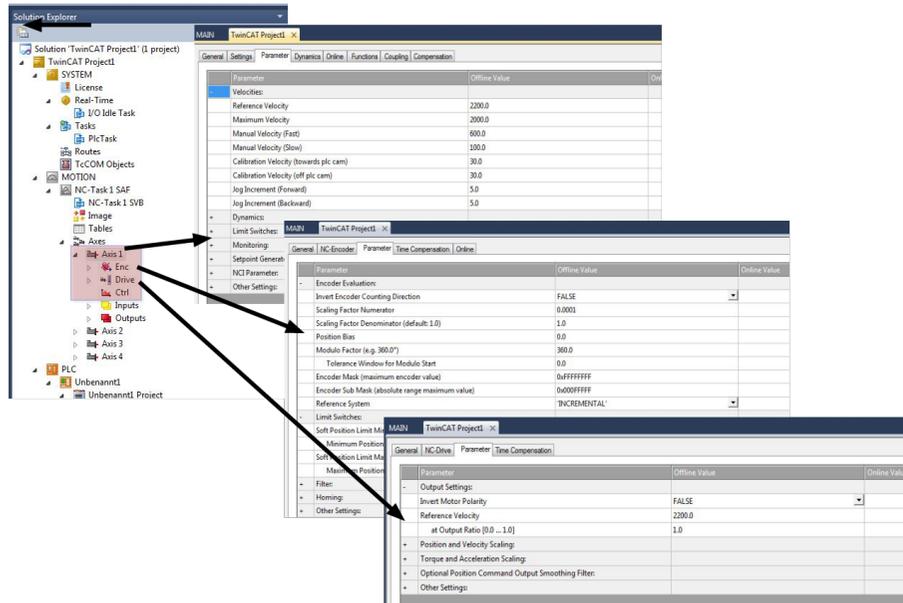


Fig. 13.79: Parameter editor for Axis1 (encoder, drive)

| 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:



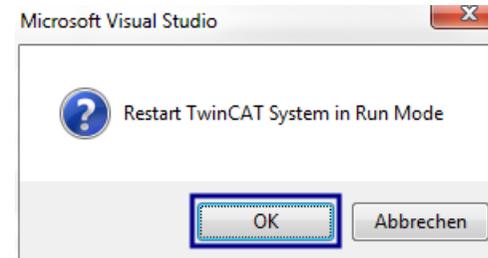
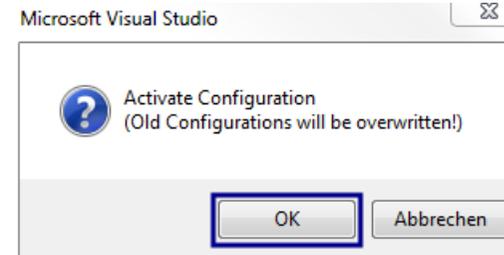
NOTE

- 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: $360 \text{ degrees} / 1048576 \text{ Inc} = 0.00034322 \text{ degrees} / \text{Inc}$.

13.28.10 Activating the configuration

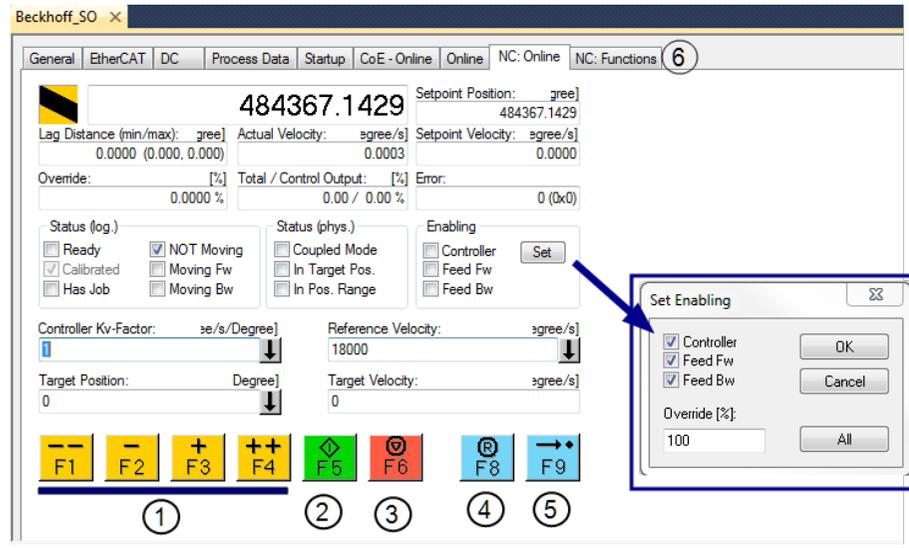
- Path ► Menu ► TwinCAT ► Activate Configuration

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.

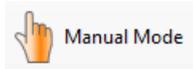
Parameter **P 69872.1 Changed** provides information as to whether the setting was changed intentionally. It is set to **true** when the function "Save in the device" is activated.

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.

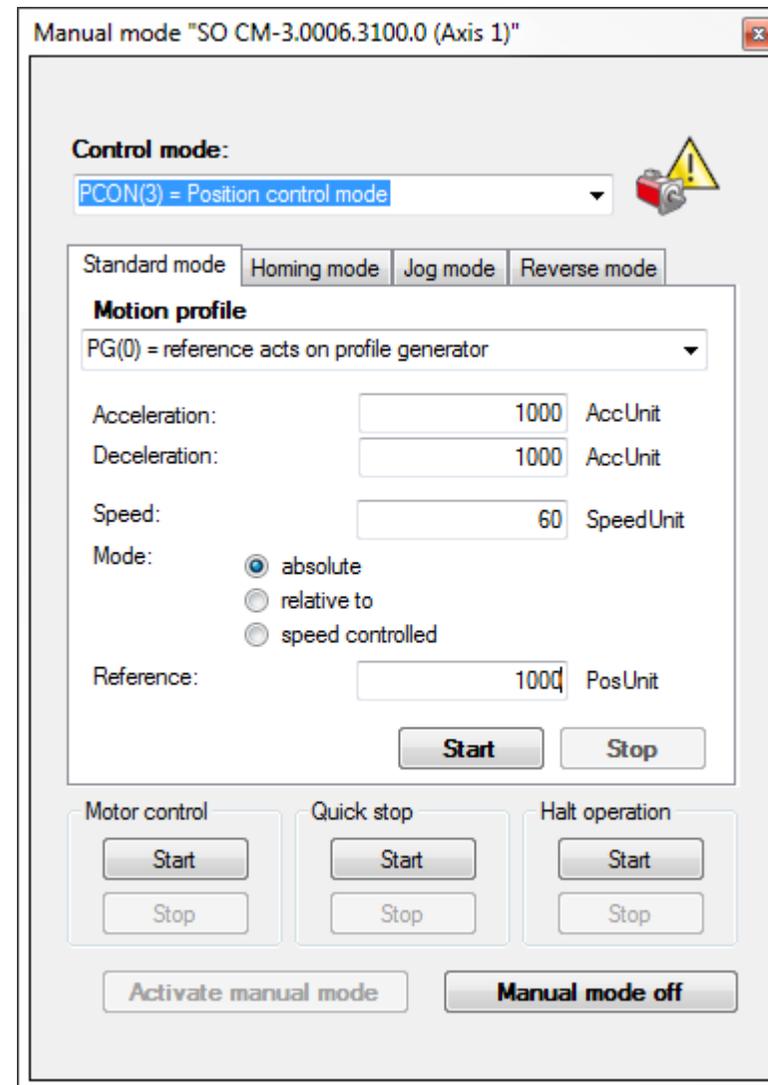


Fig. 14.2: Manual mode window (active) – Control mode tab

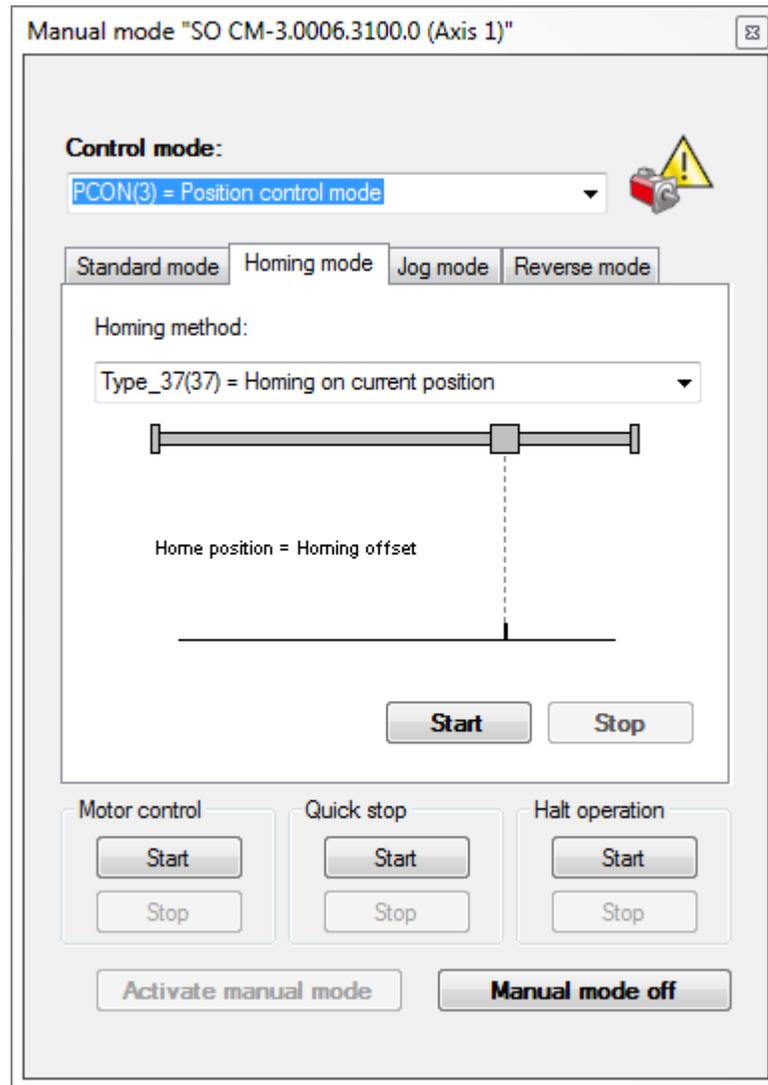


Fig. 14.3: Manual mode window (active) – Homing tab

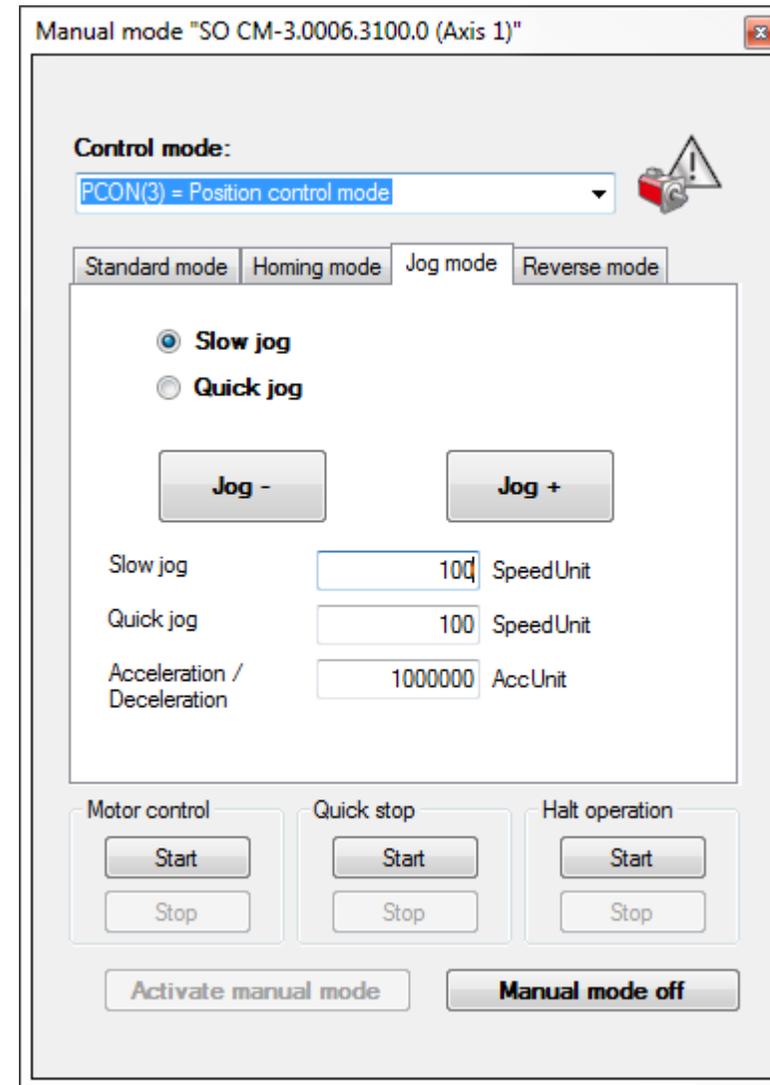


Fig. 14.4: Manual mode window (active) – Jog mode tab

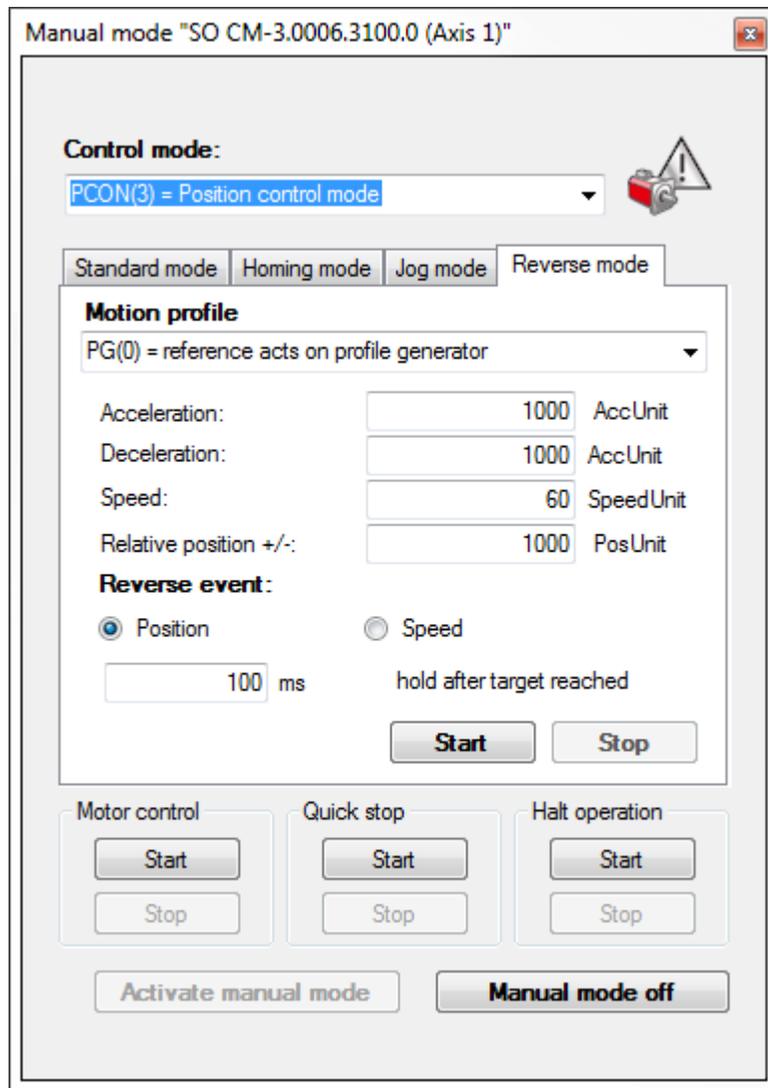


Fig. 14.5: Manual mode window (active) – Reversing PG(0) tab

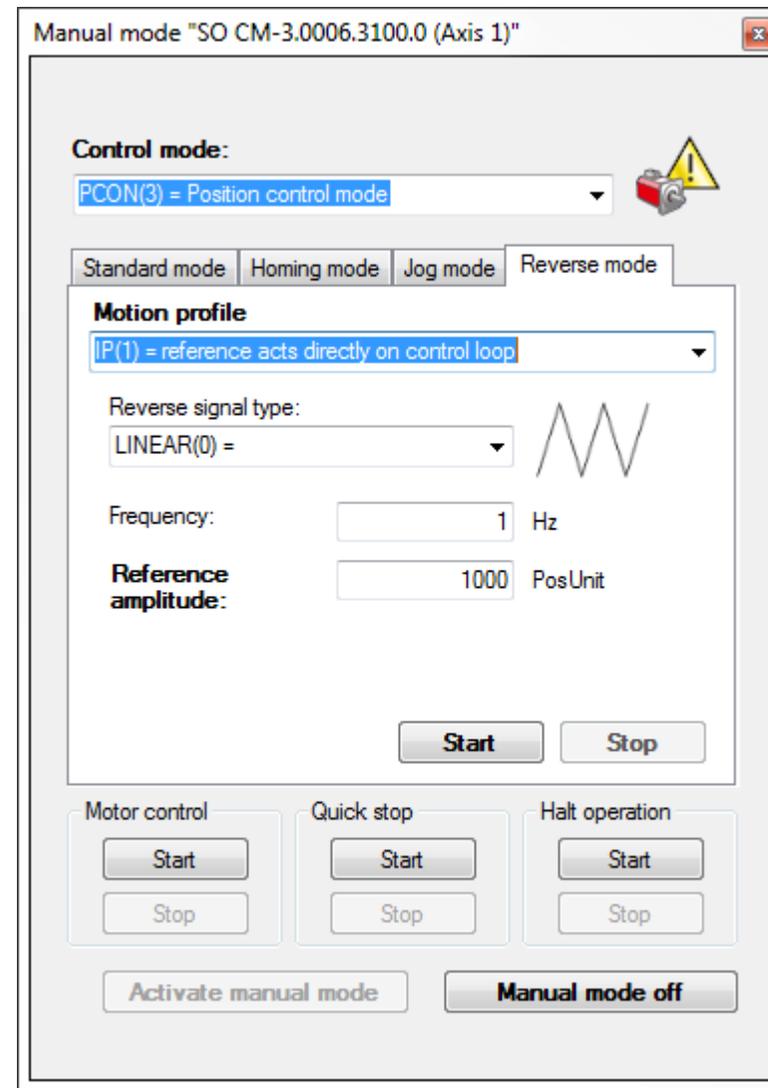
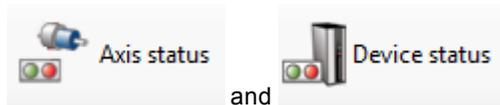


Fig. 14.6: Manual mode window (active) – Reversing IP(1) tab

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

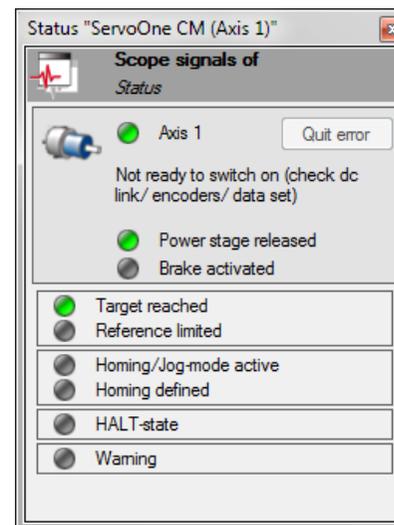


Fig. 15.2: "Axis status" window

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

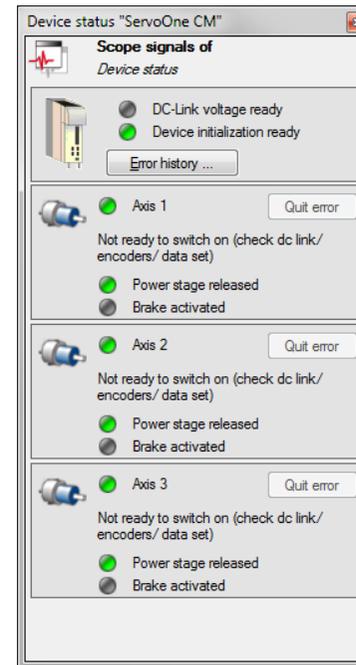


Fig. 15.4: “Device status” window for a three-axis controller

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

Pictogram



Navigation

- ▶ Project tree ▶ Axis adjustment ▶ X axis ▶ Actual values
- ▶ Project tree ▶ Axis adjustment ▶ Device ▶ Actual values

Brief description

The following chapter describes options for displaying various actual values and states of each individual axis and of the device.

Contents

| | |
|---------------------------|-----|
| 16.1 Overview | 548 |
| 16.2 Cockpit | 550 |
| 16.3 Digital inputs | 552 |

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

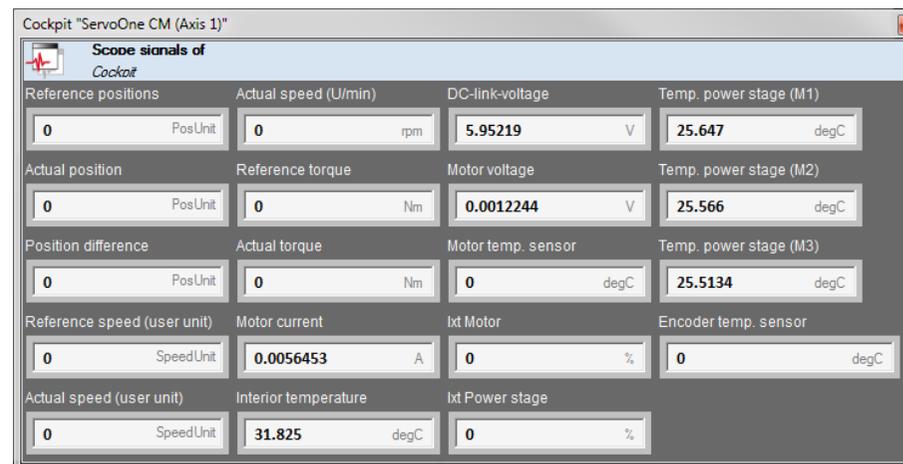


Fig. 16.1: "Cockpit" window

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

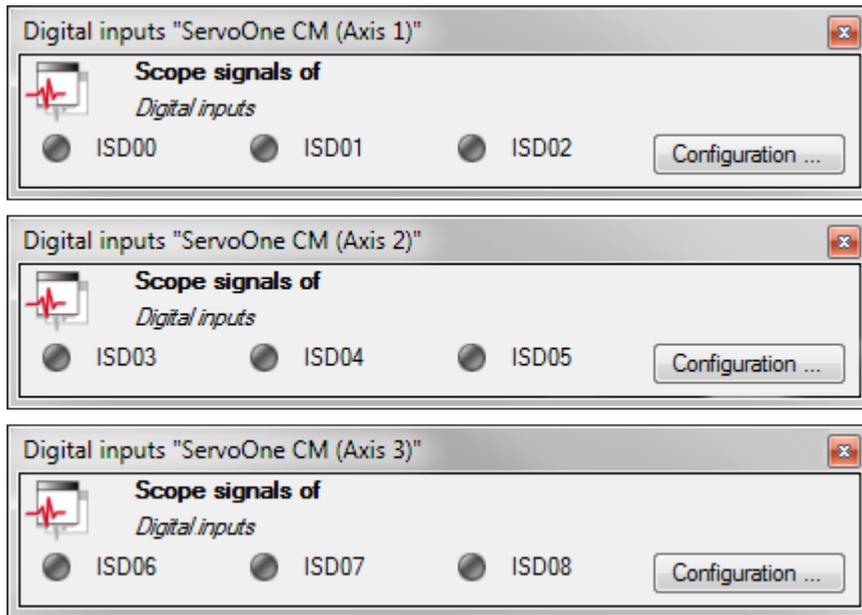


Fig. 16.2: “Digital inputs (axes 1–3)” window

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

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| 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 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 |

Table 17.1: "Status and diagnostics SDO" 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 SDO" parameters (continue)

| ID | Index | Name / Setting | Unit | Description |
|-----|-------|-------------------|------|---|
| | | | | supply line to brake 3. |
| | | SWOFCHK1FAIL (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. |
| | | SWOFCHK2FAIL (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. |
| | | SWOFCHK3FAIL (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) | | - |
| | | 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) | | - |
| 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. |
| | | SWOFCHK1FAIL (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. |
| | | SWOFCHK2FAIL (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. |
| | | SWOFCHK3FAIL (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 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 |
| ENC_CH3_Settings | | | | |
| 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 |

| 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 ¹⁾ | | SRA-CRC as transmitted from SafetyMaster. (Only if SRA-Parameter method is used) |
| 132613 | | LDV_CRC ¹⁾ | | LDV CRC (PLC Program Data) (Only with FSoE) |
| 132614 | | PDV_CRC ¹⁾ | | PDV CRC (Configuration Parameter Data) (Only with FSoE) |
| 132615 | | PEV_CRC ¹⁾ | | PEV CRC (Parameter List) (Only with FSoE) |

Table 17.2: "Status and diagnostics (SDC)" parameters (continue)

| 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 |

¹⁾ 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 SDO (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 |
| 5121 | 0 | CH3 (2) encoder via motor cable | | Send nonsafe Position from Encoder Ch3 to SDCSDC |
| | | ENC_CH_SDCSel | | Axis 2: Encoder channel selection for safe SDC position |
| | | CH1 (0) Multi-Encoder Interface | | Multi-Encoder Interface |
| 7169 | 0 | CH2 (1) Single Encoder Interface | | Single Encoder Interface |
| | | CH3 (2) Encoder via motor cable | | Encoder via motor cable |
| | | ENC_CH_SDCSel | | Axis 3: Encoder channel selection for safe SDC position |
| | | CH1 (0) Multi-Encoder Interface | | Multi-Encoder Interface |
| | | CH2 (1) Single Encoder Interface | | Single Encoder Interface |
| | | CH3 (2) Encoder via motor cable | | 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)

| | | |
|-----|---------------------------------------|---|
| 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 FE1 to FE8

(Byte 2)

Status of byte 2

Functional selection for functional inputs (Byte 1)

| | | |
|------|---------------------------------------|---|
| 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 FE9 to FE16

(Byte 3)

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)

| | | |
|-----|--|---|
| FA1 | OFF(0) = no special function triggered | ● |
| FA2 | OFF(0) = no special function triggered | ● |
| FA3 | OFF(0) = no special function triggered | ● |
| 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 | ● |

Status FA1 to FA8

(Byte 1)

Status of byte 1

(Byte 4)

Status of byte 4

(Byte 2)

Status of byte 2

(Byte 5)

Status of byte 5

(Byte 3)

Status of byte 3

(Byte 6)

Status of byte 6

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 SDO (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 |
|----------------|----------|----------|
| Axis 1: | | |
| Safe position | 249998 | 249998 |
| Safe speed | 0 | 0 |
| Axis 2: | | |
| Safe position | 250 | 248 |
| Safe speed | 0 | 0 |
| Axis 3: | | |
| 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"> ▶ Project tree ▶ Device ▶ Utilization monitor ▶ Project tree ▶ Axis adjustment ▶ X axis ▶ Utilization monitor |
| 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"> 18.1 System utilization monitor 571 18.2 Axis 574 |

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 _{2t}) | 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 ¹⁾ | % | Supply unit thermal load, vsu rms grid max current (scope id 1937) over one period to vsu i2t current (see P 652-1) ratio. | 23ED | 0001 |
| 1005 | 1 | I2tUsageVsu ¹⁾ | % | Maximum I2t usage of supply unit, maximum value of i2t counter (scope id 1934). | 23ED | 0002 |
| 1005 | 2 | PeakLoadVsu ¹⁾ | % | Maximum overload of supply unit, maximum vsu rms grid current (scope id 1937) over one period to vsu i2ts current (see P 652-2) ratio. | 23ED | 0003 |
| 1005 | 3 | VsuChopperLoadRatio ¹⁾ | % | Average chopper power, vsu avg chopper power (scope id 1935 or P 704-23) over one period to chopper pxt power (see P 712-1 or P 653-1) ratio. | 23ED | 0004 |
| 1005 | 4 | VsuMaxChopperLoadRatio ¹⁾ | % | Max. chopper power, vsu maximum chopper power (scope id 1935 or P 704-23) in one period to chopper pxt power (see P 712-2 or P 653-2) 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 P 704-21) at 560 V to capacity (see P 704-34) 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)

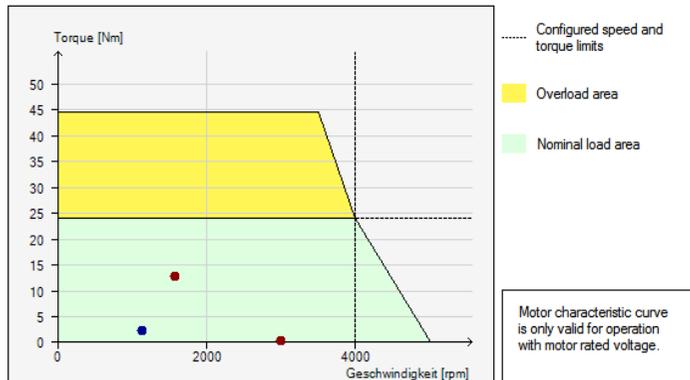
18.2 Axis

Axis utilization

| | Power stage | Motor |
|-----------------------------|--------------------|--------------------|
| Nominal load | 0 % | 0 % |
| Short time overload (I2t) | 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 (I2t) | Maximum value of the I2t 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. Rectification: 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.

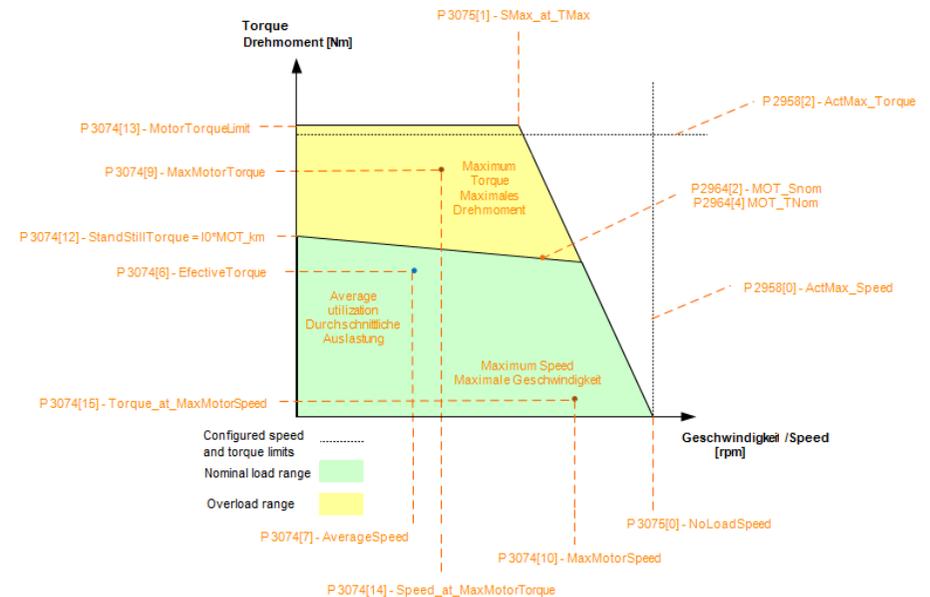


Fig. 18.3: Example of a motor characteristic curve



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 |
|--------------------|-------|----------------------|------|--|--------------------|-------|
| | | OCDG (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

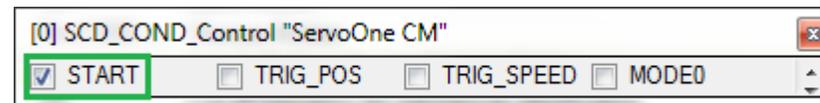
Many errors affecting bearings or gearing cause vibrations at certain frequencies. Even without knowing all possible error modes in advance, it makes sense to monitor the drive behaviour in the frequency range. The monitoring function in ServoOne CM groups the frequency range into 6 feature values.



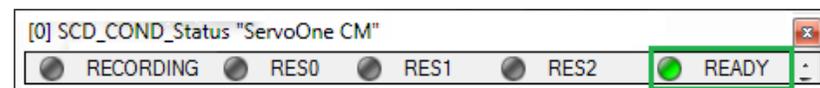
NOTE

- In order to obtain measurements that are useful for comparison purposes, the measurement should be made at a constant, defined speed.

- Once the axis has reached a constant speed, set **bit 0** of **P 3039 - SCD_COND_Control** to start the measurement.



- Wait until **bit 4** of **P 3040 - SCD_COND_Status** indicates that the measurement is ready.



- 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

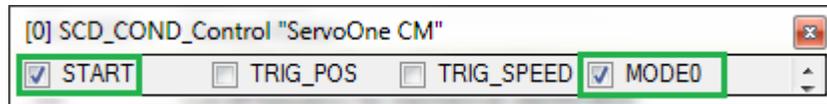
This function is for trying to identify mechanical parameters of the system. In doing so, inertia and constant torque as well as static and viscous friction are taken into account. Many long-term errors, for example, cause increased friction.



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 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 | | | | |
| 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 | | | 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 | | | | | |
| 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 | TTherm | 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 | | 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) | 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 | | |

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 | HdsIfilter | 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 yyyymmdd. 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 ² +b ²) | 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 ² +b ²) 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 | | PRI0 (0) | PRI0 (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 | $a_2 * x(k-2)$ | float32 | | |
| 2982 / 5030 / 7078 | 7 | a3 | | 0 | -3.4E+38 | 3.4E+38 | $a_3 * x(k-3)$ | float32 | | |
| 2982 / 5030 / 7078 | 8 | a4 | | 0 | -3.4E+38 | 3.4E+38 | $a_4 * x(k-4)$ | 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 S _{nom}) | float32 | | |
| 2974 / 5022 / 7070 | 1 | LowSpeedCurrent | % | 50 | 0 | 200 | D-current for IF control (in % of I _{Nom}) | 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 | kgm ² | 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_I_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 |
| SUBJECT AREA | | 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 | Corrp1Cos | | 0 | -3.4E+38 | 3.4E+38 | Result correlation: Input 1 + cos | float32 | | |
| 3056 / 5104 / 7152 | 1 | Corrp1Sin | | 0 | -3.4E+38 | 3.4E+38 | Result correlation: Input 1 + sin | float32 | | |
| 3056 / 5104 / 7152 | 2 | Corrp2Cos | | 0 | -3.4E+38 | 3.4E+38 | Result correlation: Input 2 + cos | float32 | | |
| 3056 / 5104 / 7152 | 3 | Corrp2Sin | | 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 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 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 (Cnom) | 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 | | | | | | | | | |
| 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 | | | | | | | | |
| 2958 / 5006 / 7054 | | CON_SCON_ActMax | | | | | Axis 1 / 2 / 3: Limitation of the actual values | | 0 | 0 |
| 2958 / 5006 / 7054 | 0 | ActMax_Speed | rpm | 0 | -3.4E+38 | 3.4E+38 | Maximum speed | float32 | 0 | 5 |
| 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 | Devicel2t_ON | % | 110 | 0 | 110 | I2t device protection | float32 | | |
| 3071 / 5119 / 7167 | 3 | Devicel2t_OFF | % | 110 | 0 | 110 | I2t device protection | float32 | | |
| 3071 / 5119 / 7167 | 4 | Motorl2t_ON | % | 110 | 0 | 110 | I2t motor protection | float32 | | |
| 3071 / 5119 / 7167 | 5 | Motorl2t_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 | 10000 | 0 | 10000 | Torque | float32 | | |
| 3071 / 5119 / 7167 | 7 | Torque_OFF | Nm | 10000 | 0 | 10000 | Torque | float32 | | |
| 3071 / 5119 / 7167 | 8 | Speed_ON | rpm | 200000 | 0 | 200000 | Speed | float32 | | |
| 3071 / 5119 / 7167 | 9 | Speed_OFF | rpm | 200000 | 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 | | vVelocityMinMaxAmount | | | | | 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 | | | | | | | | | | |
| 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) | OCDC (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 | -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 |
| 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 | -2147483648 | 2147483647 | Position tracking error in user units | int32 | | |
| 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 | | |
| 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 | | |
| | | | | | 2147483648 | | | | | |
| 2303 / 4351 / 6399 | 5 | PosAct | PosUnit | 0 | - | 2147483647 | Actual position value in user units | int32 | | |
| | | | | | 2147483648 | | | | | |
| 2303 / 4351 / 6399 | 6 | PosRef | PosUnit | 0 | - | 2147483647 | Setpoint position value in user units | int32 | | |
| | | | | | 2147483648 | | | | | |
| 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 | EfectiveTorque | 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 | NoOfScopeTelegramms | | 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 telegramm 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 | Multipier 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 | RtSynclsr | | 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 | - | 2147483647 | Raw value of motor temperature (written by master) | int32 | | |
| | | | | | 2147483648 | | | | | |
| 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 | - | 2147483647 | Backup position in user units | int32 | | |
| | | | | | 2147483648 | | | | | |
| 809 | 1 | EncVal_PosDiff | POS | 0 | - | 2147483647 | Validation of position difference | int32 | | |
| | | | | | 2147483648 | | | | | |
| 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 | RtSynclsr | | 0 | -3.4E+38 | 3.4E+38 | Runtime Sync ISR | float32 | | |
| 1471 | 27 | RtSemafore | | 0 | -3.4E+38 | 3.4E+38 | Spoiled time control semafore | 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 | SMEventMissed | | 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 | TempInt | °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 | TempInv1 | °C | 0 | -3.4E+38 | 3.4E+38 | Temperature power stage 1 | float32 | | |
| 101 | 4 | TempInv2 | °C | 0 | -3.4E+38 | 3.4E+38 | Temperature power stage 2 | float32 | | |
| 101 | 5 | TempInv3 | °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 | TempInt | °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 | TempInv1 | °C | 0 | -3.4E+38 | 3.4E+38 | Temperature power stage 1 | float32 | | |
| 101 | 12 | TempInv2 | °C | 0 | -3.4E+38 | 3.4E+38 | Temperature power stage 2 | float32 | | |
| 101 | 13 | TempInv3 | °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 | TempInt | °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 | TempInv1 | °C | 0 | -3.4E+38 | 3.4E+38 | Temperature power stage 1 | float32 | | |
| 101 | 52 | TempInv2 | °C | 0 | -3.4E+38 | 3.4E+38 | Temperature power stage 2 | float32 | | |
| 101 | 53 | TempInv3 | °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 | TempInt | °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 | TempInv1 | °C | 0 | -3.4E+38 | 3.4E+38 | Temperature power stage 1 | float32 | | |
| 101 | 60 | TempInv2 | °C | 0 | -3.4E+38 | 3.4E+38 | Temperature power stage 2 | float32 | | |
| 101 | 61 | TempInv3 | °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 | TempInt | °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 | TempInv1 | °C | 0 | -3.4E+38 | 3.4E+38 | Temperature power stage 1 | float32 | | |
| 101 | 68 | TempInv2 | °C | 0 | -3.4E+38 | 3.4E+38 | Temperature power stage 2 | float32 | | |
| 101 | 69 | TempInv3 | °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 | TempInt | °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 | TempInv1 | °C | 0 | -3.4E+38 | 3.4E+38 | Temperature power stage 1 | float32 | | |
| 101 | 76 | TempInv2 | °C | 0 | -3.4E+38 | 3.4E+38 | Temperature power stage 2 | float32 | | |
| 101 | 77 | TempInv3 | °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 | TempInt | °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 | twsnt | 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 | i2tI1 | % | 0 | -3.4E+38 | 3.4E+38 | I2T L1 current level | float32 | | |
| 704 | 33 | i2tI2 | % | 0 | -3.4E+38 | 3.4E+38 | I2T L2 current level | float32 | | |
| 704 | 34 | i2tI3 | % | 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 | semr | | | | | 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 | Wrn | | 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 | - | 2147483647 | Error code | int32 | | | 209B | 0001 |
| 155 | 1 | DV_SAFETY_Error_Info_SR1 | | 0 | - | 2147483647 | Row | int32 | | | 209B | 0002 |
| 155 | 2 | DV_SAFETY_Error_Info_SR1 | | 0 | - | 2147483647 | File ID | int32 | | | 209B | 0003 |
| 155 | 3 | DV_SAFETY_Error_Info_SR1 | | 0 | - | 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 | - | 2147483647 | Error code | int32 | | | 209C | 0001 |
| 156 | 1 | DV_SAFETY_Error_Info_SR2 | | 0 | - | 2147483647 | Row | int32 | | | 209C | 0002 |
| 156 | 2 | DV_SAFETY_Error_Info_SR2 | | 0 | - | 2147483647 | File ID | int32 | | | 209C | 0003 |
| 156 | 3 | DV_SAFETY_Error_Info_SR2 | | 0 | - | 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) | | | | | | | | | | |
| 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 | | | | | | | | | | |
| 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)

| 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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